Atmospheric Dispersion Modelling Report, PB Gelatins, Pontypridd

Report: 300104898-011

Version: 3

Date: 23 August 2017

Report:	Ref. No: 300104898-011 Version: 3 Date: 23 August 2017
Prepared for:	Delphine Canning Veolia Energy & Utility Services UK PLC Kingswood House Kingswood Crescent Cannock WS11 8JP

Prepared by:	James McKinstry-West
Telephone:	01925 741301
Email:	james.mckinstry-west@gb.abb.com

ABB Limited
Daresbury Park
Daresbury
Warrington
Cheshire
WA4 4BT
United Kingdom
Tel: +44 (0)1925 741111
Fax: +44 (0)1925 741212
Email: contact@gb.abb.com

Contents

1 Introduction

ABB Ltd (ABB) was commissioned by Veolia Energy & Utility Services UK PLC (Veolia) to carry out an air emissions risk assessment including a site receptor survey for three emission points at the PB Gelatins, Pontypridd Site ("the Site"; grid ref: 310191, 186865).

The work was carried out in accordance with the terms and conditions of the ABB proposal ref: 300104898-004 (dated 13 December 2016).

1.1 Background

PB Gelatins have been requested by Natural Resources Wales (NRW) to include the operations of boilers and the associated stacks within the site permit. Subsequently, the atmospheric dispersion of nitrogen oxides (NO_x), carbon monoxide (CO) and sulphur oxides (SO_x) emitted from the three boiler stacks at the site are required to be assessed. This shall be undertaken using the designated H1 Assessment Tool and following the Environment Agency (EA) and DEFRA *Air Emissions Risk Assessment* guidance (Ref 1).

ABB have been commissioned by Veolia to complete the assessment initially through preliminary screening using the H1 Assessment Tool and through more detailed dispersion modelling where necessary based on the emission and Site data provided by Veolia.

This report presents the findings of the H1 screening, a site receptor survey and of the detailed air dispersion modelling.

1.2 Reliability of Information/Limitations

ABB has prepared this report with all reasonable skill, care and diligence, within the terms of the contract with Veolia Energy & Utility Services UK PLC ("the Client"), in the acquisition of information upon which the report is based. The information provided reflects the best judgement of ABB in the light of the data available at the time of the preparation of the report.

The current report has been prepared under the terms of the contract with the Client for the use of Veolia Energy & Utility Services UK PLC. The contents of the report may not

be used or relied upon by any person other than this party without the express written consent and authorisation of ABB.

ABB assumes the correctness and completeness of, and shall have no liability in respect to any inaccuracy, defect or omission in any information or materials provided by third parties to ABB. ABB does not assume any liability for misrepresentation of information or for items not visible, accessible, present or supplied at the time of the study.

2 Site Setting and Supporting Information

2.1 Veolia Data

The data used in this report have been provided by Veolia unless otherwise stated. This includes building and stack dimensions, source locations, and emission rates

The key pollutants considered in this report are nitrogen oxides (NO_x), carbon monoxide (CO) and sulphur oxides (namely sulphur dioxide; SO_2). NO_x is of particular interest here due to the proximity of an Air Quality Monitoring Area (AQMA) to the Site. To assess the potential impacts of the pollutant emissions to the surrounding areas there are a number of factors which must be considered such as sensitive receptors, source emission locations, local meteorological conditions and the background concentrations. These factors are described in more detail in the following sections.

2.2 ADMS

ADMS (Atmospheric Dispersion Modelling System) v5.1 (Ref 2) was used to undertake the detailed dispersion assessment. ADMS is the most widely used dispersion model in the UK and is accepted by industry, consultancies and regulators. It was developed by Cambridge Environmental Research Consultants (CERC) on behalf of a consortium of organisations originally including National Power, PowerGen, The Environment Agency, The Health and Safety Executive, ICI and Zeneca.

2.3 Toxicity of Discharged Pollutants

2.3.1 Nitrogen Oxides (NOx)

Nitrogen oxides (also known as oxides of nitrogen, and abbreviated as NO_x) is a collective term used to refer to two species of oxides of nitrogen: nitrogen monoxide (NO) and nitrogen dioxide (NO_2). Nitrogen monoxide is a colourless, flammable gas with a slight odour. Although somewhat toxic, its odour is insufficient to provide warning. Nitrogen dioxide is a reddish brown, non-flammable, gas with a detectable smell. In significant concentrations it is highly toxic, causing serious lung damage with a delayed effect. Nitrogen dioxide is a strong oxidising agent that reacts in the air to form corrosive nitric

acid as well as toxic organic nitrates. It also plays a major role in the atmospheric reactions that produce ground-level ozone or photochemical smog.

Nitrogen monoxide oxidises rapidly to form nitrogen dioxide. For this study, it has been assumed that NO_x emissions from the stacks result in a conversion rate to NO_2 of 70% in the Long Term (LT) and of 35% in the Short Term (ST). This rate generally accepted as it is deemed conservative and therefore considered appropriate for this investigation.

The environmental standards (Ref 3) for NO_2 for Human Health are:

- 200 µg/m^3 (105 ppb) as a 1-hour mean level with a maximum of 18 exceedances per year. This is equivalent to a 99.8th percentile; and
- 40 µg/m^3 (21 ppb) as an annual mean.

The limit values for protection of vegetation and ecosystems is applied as total NO_x:

- 30 µg/m^3 as an annual mean.
- 75 µg/m^3 as a daily mean target.

Conversion factor (NO_2): 1 $\mu g/m^3$ = 0.52 ppb

2.3.2 Carbon Monoxide (CO)

Carbon monoxide (CO) is a product of the incomplete combustion of carbon-containing fuels and is also produced by natural processes within the human body. With external exposure to additional carbon monoxide, subtle effects can begin to occur and exposure to higher levels can result in death. The health effects of carbon monoxide are largely the result of the formation of carboxyhaemoglobin (COHb), which impairs the oxygen carrying capacity of the blood. Carbon monoxide is absorbed through the lungs, and the concentration of carboxyhaemoglobin will depend mainly on the concentrations of inspired carbon monoxide and oxygen and will also depend on the duration of exposure, pulmonary ventilation, and the concentration of carboxyhaemoglobin originally present. Occupational or accidental exposure to the products of combustion and pyrolysis, particularly indoors, may lead to acute decrements in lung function if the carboxyhaemoglobin levels are high. It is difficult, however, to separate the potential effects of carbon monoxide from those due to other respiratory irritants in the smoke and exhaust. The odour threshold for carbon monoxide is approximately 10% in air and is greater than the lethal concentration.

The environmental standard for CO is:

- 10,000 μg/m^3 (8,600 ppb), as measured by a maximum daily running 8-hour mean.

Conversion factor (CO): 1 μg/m^3 = 0.86 ppb

2.3.3 Sulphur Dioxide (SO_2)

Sulphur dioxide is a non-combustible colourless gas at ambient temperatures with a characteristic, strong, suffocating odour. The odour level for sulphur dioxide is approximately 8000 μg/m^3 and the level for irritant effects is approximately 21000 μg/m^3. Inhalation of sulphur dioxide causes irritation of the eyes, nose, and throat in the short term. Levels greater than 1000 mg/m^3 can cause swelling and accumulation of fluid in throat and lungs (pulmonary oedema). Sulphur dioxide is also a key component of smog formation and can result in the creation of acidic compounds which can cause harm to soils, vegetation and buildings (including the creation of acid rain).

There is wide variation in the sensitivity of individuals to sulphur dioxide concentrations. The UK Sulphur Dioxide Air Quality Objectives are defined to protect asthmatics, who are particularly vulnerable to sulphur dioxide concentrations.

The environmental standards for SO_2 are:

- 350 μg/m^3 (132 ppb) as a 1 hour mean not to be exceeded more than 24 times a year. This is equivalent to a 99.7th percentile;
- 266 μg/m^3 (100 ppb) as a 15 min mean not to be exceeded more than 35 times a year. This is equivalent to a 99.9th percentile; and
- 125 μg/m^3 (47ppb) as a 24-hour mean not to be exceeded more than 3 times a year. This is equivalent to a 99.2th percentile.

DEFRA guidance Local Air Quality Management Technical Guidance 2009 states “elevated point sources will have little impact upon the annual mean concentration, and the assessment should focus upon an accurate prediction of the shorter-term”. In addition, the World Health Organisation notes that studies on the human health effects of acute SO_2 exposure suggest that responses to exposure occur very rapidly from the first few

minutes of inhalation and further exposure often does not increase the effects. However, by Veolia's request all three environmental standard criteria will be considered in this modelling. The long-term Environmental Assessment Level (EAL) for the protection of vegetation and ecosystem receptors for SO_2 is:

- 20 µg/m^3 as an annual mean.

Conversion factor (SO_2): 1 µg/m^3 = 0.35 ppb

2.4 Site Location

The Site is located South East of Pontypridd in the Treforest Industrial estate, it is surrounded by other commercial and industrial buildings and backs on to a National Grid transformer station to the west. The location is shown in Figure 2-1.

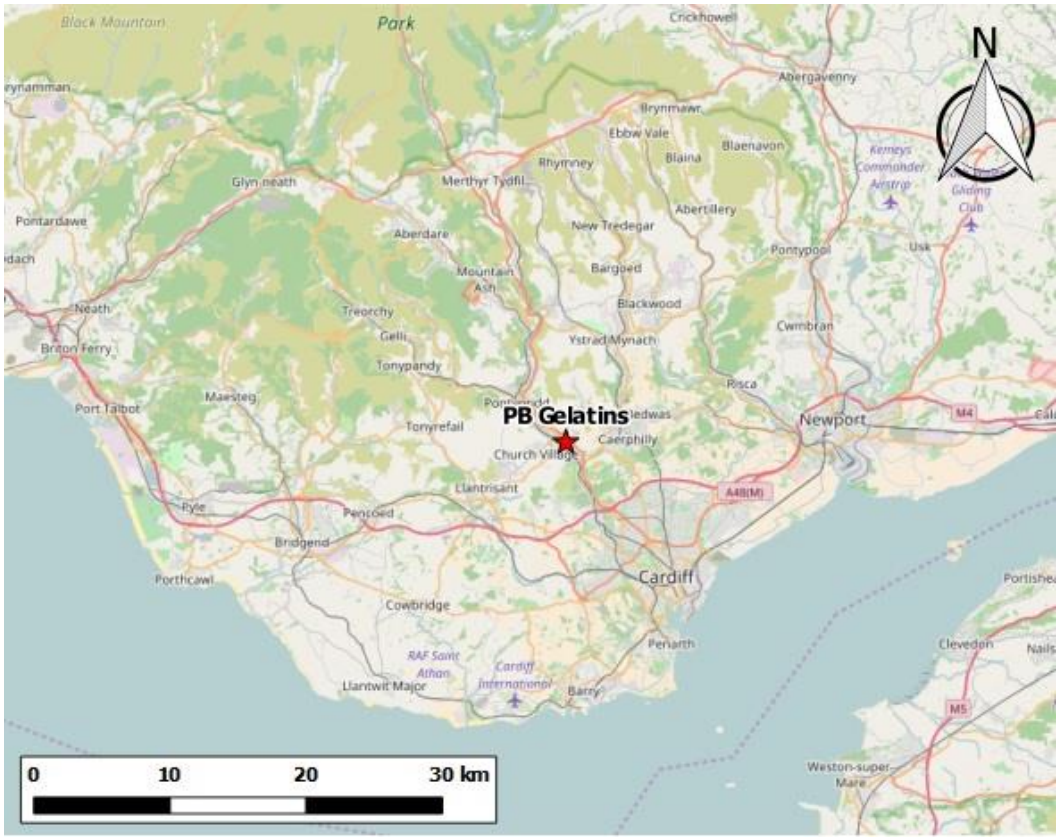


Figure 2-1: Site location plan

2.5 Source Emission Locations

The approximate Site boundaries are shown in Figure 2-2 along with the location of the stacks used in the modelling, taken from plans provided by Veolia. The source coordinates and locations are described in Table 2-1.

Table 2-1: Source location and details

Name	Easting	Northing	Height (m)	Diameter
Boiler Stack 1 (A1)	310083	186859	23.8	1.0
Boiler Stack 2 (A2)	310080	186854	23.8	1.0
Boiler Stack 3 (A3)	310070	186850	23.8	0.6

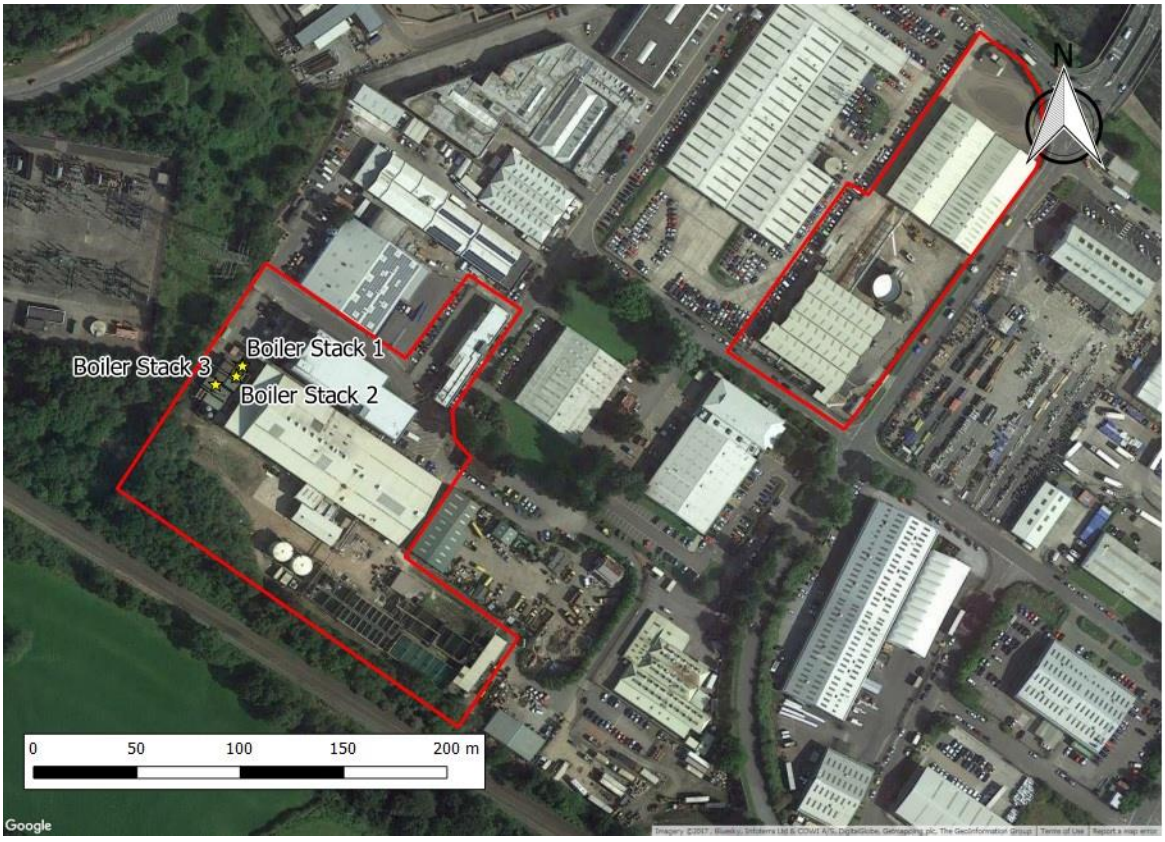


Figure 2-2: Source Location Plan

2.6 Meteorology

Hourly sequential meteorological (Met.) data recorded at Cardiff Airport between the years 2012 and 2016 have been used in the assessment, provided by ADM Ltd (Ref 4). This data has been selected as it was the most recent, proximal and consecutive set of data available for the Site. A wind rose showing the average wind conditions for the 5 years is present in Figure 2-3.

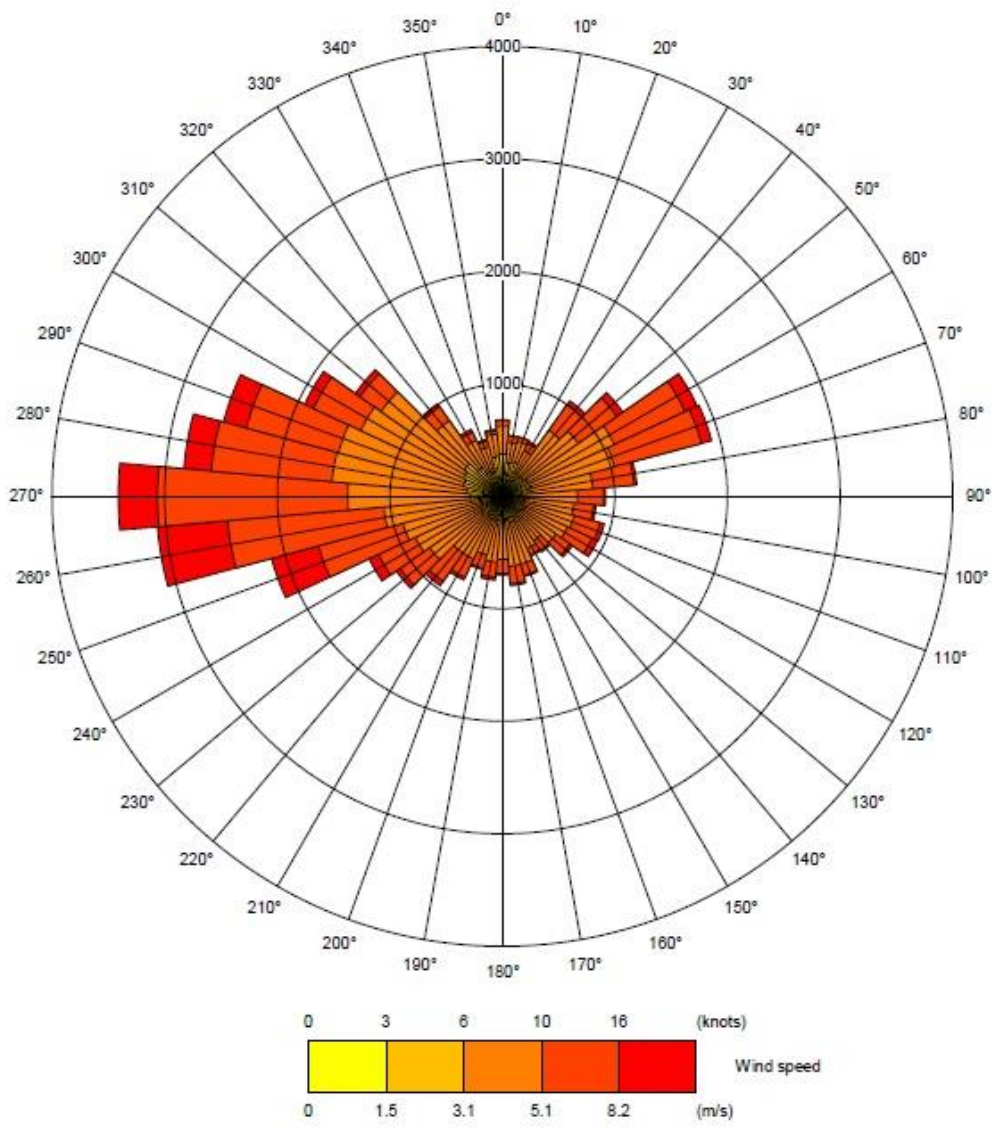


Figure 2-3: Composite wind rose for Cardiff Airport (Rhoose) for 2012-2016

2.7 Background Concentrations

Data from DEFRA's Air Information Resource (UK-AIR; Ref 3) has been used to gather background concentrations for the assessment area. This has been established by taking the average of the annual mean concentrations for the 1km quadrant within which the Site is located over a 5 year period. Nitrogen dioxide and sulphur dioxide background data for 2016 was not available at the time of writing so the most recent range of 2011–2015 has been used. It is assumed that these data are annual averages of hourly data. As the data also overlap the meteorological data for the area it is considered suitable for use as the underlying background concentration. As per the Environment Agency (EA) and DEFRA *Air Emissions Risk Assessment* guidance short-term (ST) background concentrations of each substance is assumed to be twice its long-term (LT) concentration

2.7.1 NO_2

The average of the annual values was chosen due to an observable decreasing trend of NO_2 over time and thus presents both a conservative and environmentally applicable value. Due to the presence of a local AQMA (designated for NO_2 only) the relevant background concentration at that location is also considered. The average LT NO_2 background concentrations are as follows:

- Site quadrant ($1km^2$) – 16.3 $\mu g/m^3$
- Church Village AQMA – 13.9 $\mu g/m^3$

The higher, and thus more conservative, background value (16.3 $\mu g/m^3$) shall be used in this assessment to analyse the relative impact of the site emissions as the background NO_2 concentration recorded at the AQMA is less than that of the Site quadrant. The objective for the protection of vegetation and ecosystems is detailed for nitrogen oxides (NO_x) only, therefore the background level used for this analysis is 22.9 $\mu g/m^3$ (derived from DEFRA's NO_x as NO_2 figures for the area).

2.7.2 SO_2

The average of the annual values was again chosen due to an observable decreasing trend in SO_2 over the period. The average LT SO_2 background concentration for the 1km quadrant of the Site is 3.04 $\mu g/m^3$.

2.7.3 CO

Background carbon monoxide concentrations were only available for 2006-2010. For conservatism and due to the age and varying trend of the data the maximum value observed in the dataset shall be used as the reference LT background concentration recorded for the quadrant. This value is 230 µg/m^3.

3 Receptors

As part of the air emissions risk assessment it is necessary to screen the local area surrounding the Site for ecological receptors and AQMAs. The following conservation areas are relevant within 10km of the site:

- Special Protection Areas (SPAs)
- Special Areas of Conservation (SACs)
- Ramsar sites

And 2km of the site:

- Sites of Special Scientific Interest (SSSIs)
- Local nature sites

3.1 Ecological Receptors

The details of conservation areas identified through a site receptor survey are displayed in Table 3-1 and Table 3-2.

Table 3-1: Identified protected conservation areas from receptor survey within 10km radius

Within 10km of site		
Receptor Type	**Approx. Location**	**Description**
Special Protection Areas (SPAs):	-	N/A
Special Areas of Conservation (SACs):	4.3km SE	Cardiff Beech Woods: Approximately 115ha in size it is one of the largest concentrations of *Asperulo-Fagetum* beech forests in Wales. Characteristic and notable species in the ground flora include ramsons *Allium ursinum*, sanicle *Sanicula europaea*, bird's-nest orchid *Neottia nidus-avis* and yellow bird's-nest *Monotropa hypopitys*.
Ramsar sites (protected wetlands):	-	N/A

Table 3-2: Identified protected conservation areas from receptor survey within 2km radius

Within 2km of site		
Receptor Type	**Approx. Location**	**Description**
Local Wildlife Sites	1.7km ENE	Mynydd Meio: Approximately 115ha in size it is an extensive area of open countryside. It comprises acid grasslands, heathland and mires.
Ancient Woodlands	-	There are 57 areas of designated Ancient woodland of varying size within 2km of the site.

3.2 Air Quality Management Areas (AQMAs)

To ensure that the national air quality objectives are being achieved Local Authorities must measure air pollution to protect human health and the environment. Local Authorities must identify areas where the objectives are not likely to be achieved and declare them Air Quality Management Areas. As part of the sensitive receptor survey AQMAs within 10km and 2km of the site were identified and are presented in Table 3-3.

Table 3-3: Identified AQMAs from receptor survey

Within 10km of site			
AQMA Reference	**Approx. Location**	**Substance**	**Description**
623	8.7km NW	Annual NO_2	Cymmer AQMA: Including all roadside properties from 30 High Street and 227 High Street, Porth via High Street and Trebanog Road to 37 Trebanog Road and 247 Trebanog Road, Trebanog.
532	7km SW	Annual and 1hr NO_2	Mwyndy AQMA: An area surrounding Lakeside Court, Penstowe.
569	5.3km E	Annual NO_2	Caerphilly Town Centre AQMA: An area encompassing a number of properties along Clifton Street, Whilte Street, Bartlett Street, Nantgarw Road and Ton-Y-Felin Road in Caerphilly.
531	4.7km NW	Annual and 1hr NO_2	Cilfynydd AQMA: An area encompassing properties along Belgrave Terrace, Coronation Terrace, Evans Square, Merthyr Road and Pontshonnorton Road in Cilfynydd.
534	4.4km NW	Annual and 1hr NO_2	Pontypridd Town Centre AQMA: An area in Pontypridd Town Centre encompassing properties along Broadway and the High Street, and extended in 2009 to include Taff Street down to Sardis Road.
622	3.5km NW	Annual NO_2	Nightingales Bush AQMA: An area encompassing all roadside properties from 5 Nightingales Bush to 46 Pentrebach Road (alongside the A470).
1604	3.4km SW	Annual NO_2	Llantwit Fardre AQMA: All roadside properties form 2 Balmoral Cottages east to Bryn House within the township of Llantwit Fardre.

Within 10km of site			
AQMA Reference	**Approx. Location**	**Substance**	**Description**
530	3.2km NW	Annual NO_2	Broadway AQMA: An area encompassing roadside properties along Broadway, Fothergill Street and Park Street.
533	2.9km SE	Annual and 1hr NO_2	Nantgarw AQMA: An area in Nantgarw encompassing the properties at Graig View along the western edge of the A468.
Within 2km of site			
AQMA Reference	**Approx. Location**	**Substance**	**Description**
1608	1.8km SW	Annual NO_2	Church Village AQMA: All roadside properties from 9 Dyffryn Terrace east to 5b Main Road within the township of Church Village.

3.3 Selected Receptors

Due to the range of the Cardiff Beech Woods SAC it has been split into three point locations for modelling purposes: CBW West, Centre and East. The approximate centre-points of the various ancient woodlands sites within 2km of the Site have been selected for inclusion in the model to give a representative view of the emissions impact. The most proximal point of the ancient woodland located on-Site has been selected for modelling, this is in addition to the centre-point (AW 15). The closest points of two nearby public footpaths identified in local maps have also been included in the modelling, as well as the most proximal point of the sports field north of the Site. Only one AQMA has been identified within 2km of the site (Church Village) this is therefore included in the assessment.

Two residential areas are included which represent the two further human health receptors, these are Cheriton Grove and Heol Ty Maen. Four site boundary locations are also included in the assessment. The coordinates of the receptors is presented in Table 3-4 and they are displayed in Figure 3-1 and Figure 3-2.

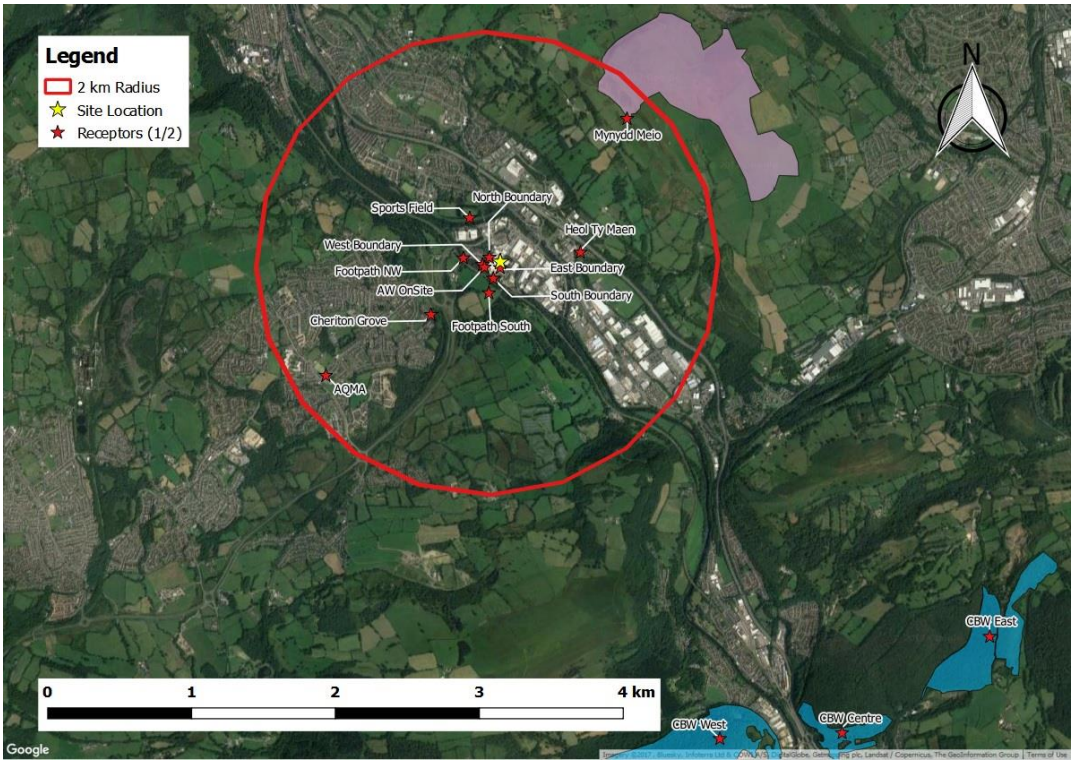


Figure 3-1: Receptor Location Plan (1 of 2) – excluding ancient woodlands

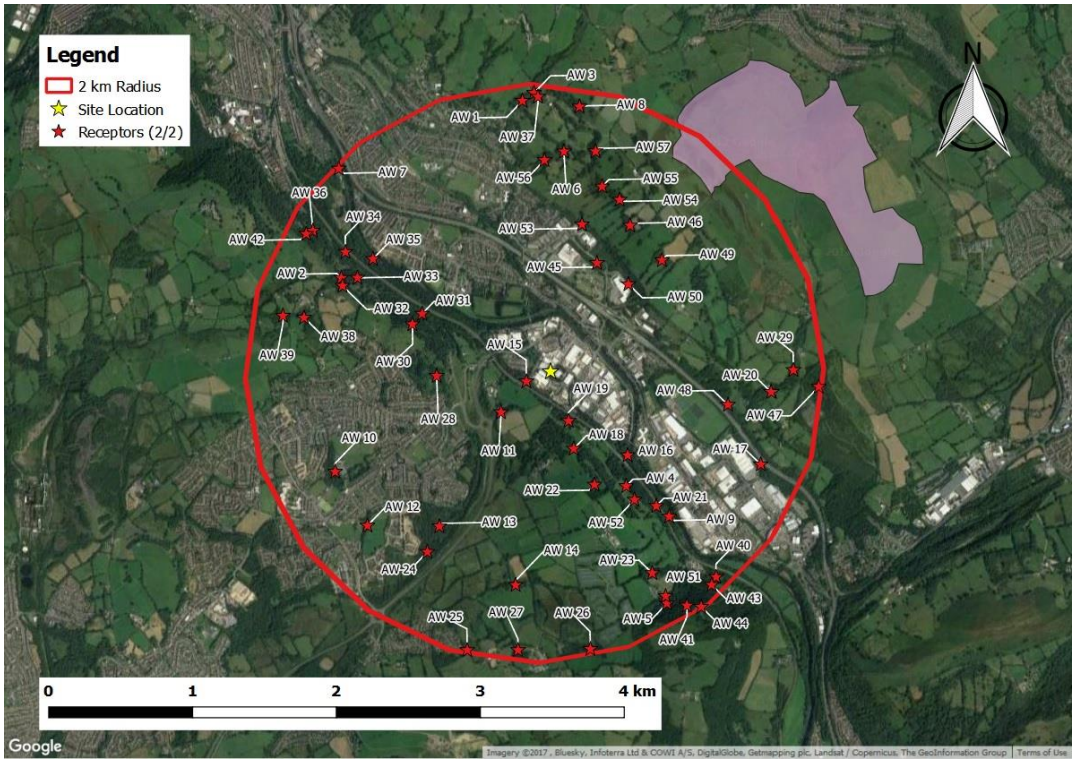


Figure 3-2: Receptor Location Plan (2 of 2) - ancient woodland sites only

Table 3-4: Receptor coordinates

Receptor Name	Easting (X)	Northing (y)
North Boundary	310098	186904
East Boundary	310189	186813
West Boundary	310037	186843
South Boundary	310128	186722
Cheriton Grove	309583	186419
Heol Ty Maen	310886	186934
Footpath NW	309872	186903
Footpath South	310087	186597
Sports Field	309933	187248
AQMA	308664	185910
Mynydd Meio	311310	188082
CBW Centre	313072	182744

Receptor Name	Easting (X)	Northing (y)
AW 22	310482	186078
AW 23	310871	185460
AW 24	309316	185634
AW 25	309580	184950
AW 26	310433	184942
AW 27	309932	184944
AW 28	309402	186849
AW 29	311867	186846
AW 30	309240	187209
AW 31	309309	187280
AW 32	308761	187483
AW 33	308866	187537

Receptor Name	Easting (X)	Northing (y)
CBW West	312020	182711
CBW East	314365	183554
AW Onsite	310054	186820
AW 1	310030	188739
AW 2	308754	187538
AW 3	310111	188792
AW 4	310701	186064
AW 5	310969	185248
AW 6	310311	188384
AW 7	308750	188293
AW 8	310424	188692
AW 9	310995	185848
AW 10	308687	186199
AW 11	309843	186590
AW 12	308904	185823
AW 13	309402	185809
AW 14	309923	185394
AW 15	310023	186800
AW 16	310715	186277
AW 17	311636	186198
AW 18	310342	186329
AW 19	310310	186522
AW 20	311716	186697
AW 21	310907	185923

Receptor Name	Easting (X)	Northing (y)
AW 34	308786	187716
AW 35	308975	187665
AW 36	308563	187867
AW 37	310138	188765
AW 38	308491	187268
AW 39	308345	187284
AW 40	311313	185425
AW 41	311107	185231
AW 42	308516	187846
AW 43	311281	185371
AW 44	311206	185220
AW 45	310526	187609
AW 46	310760	187864
AW 47	312040	186727
AW 48	311416	186614
AW 49	310976	187621
AW 50	310741	187459
AW 51	310961	185299
AW 52	310757	185969
AW 53	310427	187878
AW 54	310691	188043
AW 55	310571	188137
AW 56	310175	188326
AW 57	310530	188381

4 H1 Assessment

An initial assessment of the emission data was carried out using the Environment Agency's H1 calculation method. The following two scenarios based on two available fuel types for the boiler operations were modelled using the software:

1. Boilers running on Gas
2. Boilers running on Oil

4.1.1 Test of Significance

In general terms, the significance of atmospheric emissions are assessed by comparison of the predicted ground level concentrations (GLCs) of the specific pollutant to published Environmental Assessment Levels (EALs), atmospheric EALs typically comprise Air Quality Standards (AQS) and Ambient Air Directive Limit Values (AADLV).

EALs provide a means of defining acceptable air quality on a long-term basis where the effects of pollutants are cumulative (or 'chronic') e.g. annual average concentrations, and on a short-term basis, where the effects of pollutants are considered 'acute', e.g. 15 minute or hourly peak concentrations. EALs provide a basis for assessment of potential impacts of emissions on human health receptors and ecologically sensitive receptors.

In general terms, the assessment criteria employed by the Regulator to assess the significance of emissions is to compare the predicted maximum GLC of pollutants associated with emissions from the site (termed the Process Contribution, PC) to short term and long term EALs.

The environmental impact may be considered significant where greater than:

- 1% of the AQS/EAL for the long-term average calculations; and
- 10% of the AQS/EAL for the short-term calculations.

Where the PC exceeds this significance threshold then the total Predicted Environmental Concentration (PEC) of that substance is calculated by summing the background concentration and the process contributions. The PEC may then be compared to the relevant environmental standard. It should be noted that the background concentrations

used will often already include contributions from existing site sources and is therefore a pessimistic approach.

The next stage of the screening determines if further, more detailed modelling is required (i.e. ADMS). This is necessary if the following requirements are not met:

- The LT PEC is <70% of the long-term environmental standards; and
- The ST PC is <20% of the short-term environmental standards minus twice the long-term background concentration (i.e. 'headroom').

Criteria for secondary screening of the impacts for protected conservation areas differ slightly from human health receptors. For SPAs, SACs, Ramsars and SSSIs where the ST PC exceeds the first screening stage then detailed modelling is required. Further modelling is required for the long-term emissions only if the LT PEC exceeds 70% of the long term environmental standard. Local nature sites (e.g. ancient woodlands) require detailed modelling if the LT or ST PC exceed 100% of the respective LT or ST environmental standards.

The above secondary screening thresholds may also be used as a metric by which to review the significance of results from detailed modelling.

4.2 H1 Assessment Results

The results of the H1 Assessment are presented in Tables Table 4-1 to Table 4-4 and the H1 model input tables are included in Appendix A.

Table 4-1: H1 Results for Gas fired boilers (Long-term)

Gas Long-term Impacts							
Substance	**Background Contribution (BG) µg/m³**	**EAL µg/m³**	**PC µg/m³**	**%PC of EAL**	**% PEC of EAL**	**%PC >1% of EAL**	**%PEC >70% of EAL**
Sulphur Dioxide (15 min mean)	3.04	-	0.05	-	-	-	-
Sulphur Dioxide (Other Ecological)	3.04	20	0.05	0.26	16.5	No	No
Nitrogen Dioxide	16.3	40	2.43	6.08	46.8	**Yes**	No
Carbon Monoxide	230	-	0.11	-	-	-	-

Table 4-2: H1 Results for Gas fired boilers (Short-term)

Gas Short-term Impacts								
Substance	**Adjusted background contribution (ABG) µg/m³**	**EAL µg/m³**	**PC µg/m³**	**PEC µg/m³**	**%PC of EAL-ABG**	**% PEC of EAL**	**%PC >10% of EAL**	**%PC >20% of EAL-ABG**
Sulphur Dioxide (15 min mean)	6.07	266	1.92	7.99	0.738	3.00	No	No
Nitrogen Dioxide	32.5	200	89.7	122	53.5	61.1	**Yes**	**Yes**
Carbon Monoxide	460	10,000	3.87	463	0.0405	4.64	No	No

Table 4-3: H1 Results for Oil fired boilers (Long-term)

Oil Long-term Impacts							
Substance	**Background Contribution (BG) µg/m³**	**EAL µg/m³**	**PC µg/m³**	**%PC of EAL**	**% PEC of EAL**	**%PC >1% of EAL**	**%PEC >70% of EAL**
Sulphur Dioxide (15 min mean)	3.04	-	3.55	-	-	-	-
Sulphur Dioxide (Other Ecological)	3.04	20	3.55	17.8	33.0	**Yes**	No
Nitrogen Dioxide	16.3	40	3.12	7.80	48.5	**Yes**	No
Carbon Monoxide	230	-	0.01	-	-	-	-

Table 4-4: H1 Results for Oil fired boilers (Short-term)

Oil Short-term Impacts								
Substance	**Adjusted background contribution (ABG) µg/m³**	**EAL µg/m³**	**PC µg/m³**	**PEC µg/m³**	**%PC of EAL-ABG**	**% PEC of EAL**	**%PC >10% of EAL**	**%PC >20% of EAL-ABG**
Sulphur Dioxide (15 min mean)	6.07	266	131	137	50.3	51.5	**Yes**	**Yes**
Nitrogen Dioxide	32.5	200	115	148	68.6	73.8	**Yes**	**Yes**
Carbon Monoxide	460	10,000	3.18	463	0.0333	4.63	No	No

The Environment Agency (EA) and DEFRA *Air Emissions Risk Assessment* guidance requires that detailed dispersion modelling is undertaken where the long-term PEC >70% of the EAL and/or if the short-term PC >20% of EAL–2*background concentration (presented here as the adjusted background concentration 'ABG'). Based on the guidance, detailed modelling of atmospheric dispersion is considered necessary for nitrogen dioxide (for both long and short-term impacts) in both scenarios and sulphur dioxide (short-term only) for the oil fuel scenario. At the request of NRW the impact of emissions on ecological receptors will be considered for NO_x in both scenarios and SO_2 in only the oil scenario as for the gas fuelled scenario site emissions fall below all H1 screening thresholds and may be considered insignificant.

5 ADMS Modelling

ADMS (Atmospheric Dispersion Modelling System) v5.1 was used to undertake the detailed dispersion assessment. The analysis has been undertaken using the two fuel scenarios (Gas fuelled and Oil fuelled boilers) described earlier in Section 3.3.

Predicted NO_x concentrations have been calculated assuming that 70% of NO_x is converted to NO_2 for the long-term (annual) average. The short-term 99.8th percentile (hourly mean) was derived assuming a 35% conversion of NO_x to NO_2.

Detailed modelling was completed for the two emissions scenarios as described above and the results are presented in Section 6. The substances modelled were those not screened out in the above H1 assessment.

5.1 Buildings

Buildings and structures located close to emission sources can impact on the dispersion of pollutants though the wake effect, which may result in increased retention nearby the source.

There are a number of proximal buildings to the various sources at the Site which have been included in the assessment. Only buildings considered large and/or close enough to significantly affect dispersion were entered into the model.

An ADMS Mapper view of the structures included in the modelling is shown in Figure 5-1 where the red points are source locations.

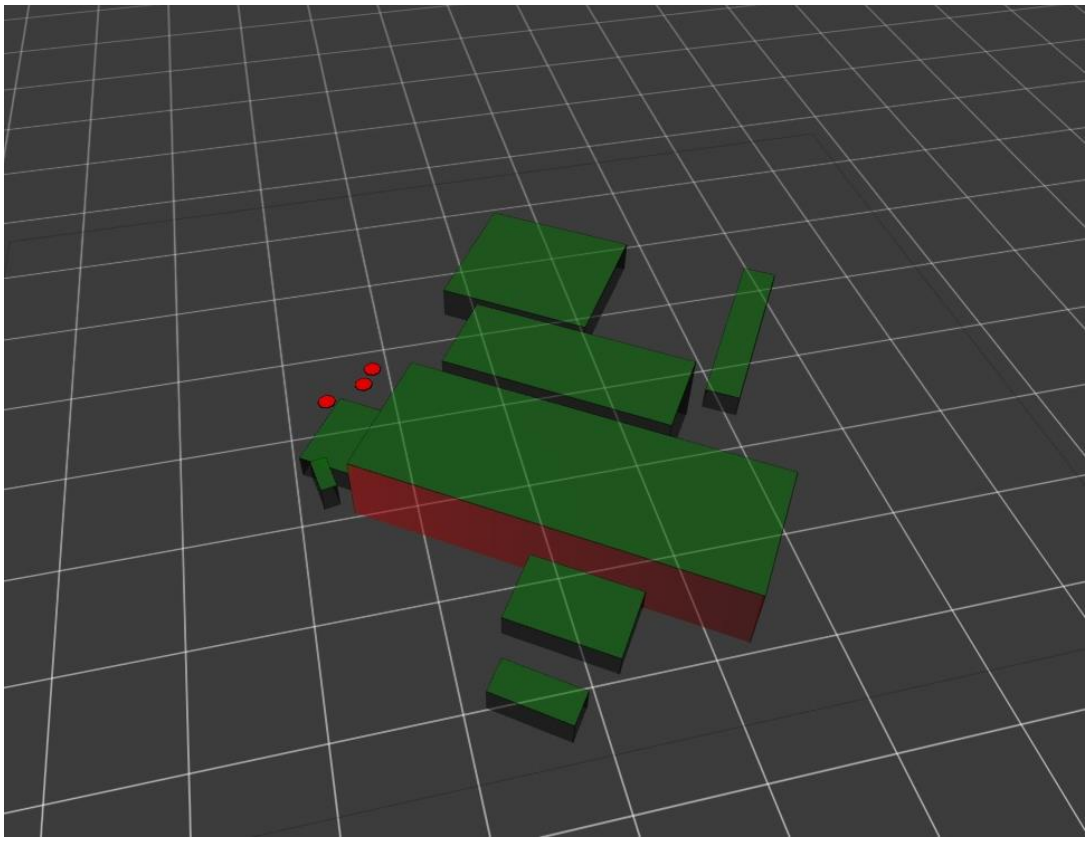


Figure 5-1: Modelled buildings plan

6 ADMS Results

Each scenario (Gas fuelled and Oil fuelled) has been modelled for each of the yearly meteorological datasets giving 5 sets of GLCs. The maximum pollutant concentration modelled at each identified receptor from all 5 years of Met. data has been calculated to give worst case annual concentrations. This provides a conservative overview of the predicted dispersion characteristics for the Site based on emissions and typical weather conditions.

The results of the ADMS modelling are presented in Table 6-1 to Table 6-3, which show maximum predicted GLC for each receptor. In addition the percentage contributions corresponding to the significance thresholds as described in Section 4.1.1 are displayed. PCs and PECs which may not be deemed insignificant are highlighted in bold. The average concentrations from the 5 years of met. data is utilised for comparison of annual means against vegetation and ecosystem objectives.

The ADMS software models the dispersion of a parcel of gas emitted from a source as it undergoes numerous physical and physio-chemical interactions. Meteorological factors such as wind direction and boundary layer height play a large role on the mixing and dispersion of pollutants from a source. Using 5 years of historical Met. data allows assumptions to be made of the expected weather conditions at the site, which facilitates an estimation of typical future conditions. The values presented are theoretical and conservative but appropriately serve to predict detailed environmental concentrations.

Site emission parameters (as provided by Veolia) are included in Appendix A. Contour plots showing predicted NO_2, NO_x and SO_2 dispersion patterns are included in Appendix B.

Table 6-1: Gas - NO_2 & NO_x ADMS results

Gas – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
North Boundary	0.44	-	-	0.44	-	-	0.41	**1.03%**	42%	7.26	3.63%	4.3%
East Boundary	3.94	-	-	3.93	-	-	3.10	**7.75%**	48%	12.30	6.15%	7.3%
West Boundary	3.21	-	-	3.20	-	-	2.96	**7.40%**	48%	14.33	7.17%	8.6%
South Boundary	0.73	-	-	0.73	-	-	0.67	**1.68%**	42%	11.35	5.67%	6.8%
Cheriton Grove	0.31	-	-	0.31	-	-	0.23	0.57%	41%	2.82	1.41%	1.7%
Heol Ty Maen	0.31	-	-	0.31	-	-	0.25	0.62%	41%	1.63	0.81%	1.0%
Footpath NW	1.51	-	-	1.52	-	-	1.22	**3.04%**	44%	10.85	5.43%	6.5%
Footpath South	0.46	-	-	0.46	-	-	0.40	**1.01%**	42%	5.89	2.95%	3.5%
Sports Field	0.39	-	-	0.39	-	-	0.35	0.87%	42%	4.58	2.29%	2.7%
AQMA	0.08	-	-	0.08	-	-	0.06	0.15%	41%	0.85	0.42%	0.51%
Mynydd Meio	0.06	0.19%	76%	0.06	0.08%	31%	0.07	-	-	2.31	-	-
CBW Centre (SAC)	0.02	0.05%	76%	0.02	0.02%	30%	0.02	-	-	1.37	-	-
CBW West (SAC)	0.01	0.05%	76%	0.01	0.02%	30%	0.02	-	-	1.37	-	-
CBW East (SAC)	0.02	0.08%	76%	0.02	0.03%	31%	0.03	-	-	1.39	-	-
AW Onsite	3.29	10.97%	87%	3.27	4.37%	35%	4.36	-	-	40.96	-	-
AW 1	0.04	0.12%	76%	0.04	0.05%	31%	0.05	-	-	1.91	-	-
AW 2	0.07	0.23%	76%	0.07	0.09%	31%	0.08	-	-	5.23	-	-
AW 3	0.03	0.12%	76%	0.03	0.05%	31%	0.05	-	-	1.80	-	-
AW 4	0.17	0.57%	77%	0.17	0.23%	31%	0.20	-	-	6.52	-	-

Gas – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 5	0.05	0.17%	76%	0.05	0.07%	31%	0.06	-	-	2.88	-	-
AW 6	0.05	0.16%	76%	0.05	0.06%	31%	0.06	-	-	2.58	-	-
AW 7	0.03	0.12%	76%	0.04	0.05%	31%	0.04	-	-	2.80	-	-
AW 8	0.04	0.12%	76%	0.04	0.05%	31%	0.05	-	-	1.92	-	-
AW 9	0.13	0.43%	77%	0.13	0.17%	31%	0.15	-	-	4.71	-	-
AW 10	0.10	0.33%	77%	0.10	0.13%	31%	0.11	-	-	3.91	-	-
AW 11	0.72	2.40%	79%	0.72	0.96%	31%	0.76	-	-	13.21	-	-
AW 12	0.09	0.29%	76%	0.09	0.12%	31%	0.10	-	-	3.57	-	-
AW 13	0.07	0.25%	76%	0.07	0.10%	31%	0.08	-	-	3.38	-	-
AW 14	0.06	0.19%	76%	0.06	0.07%	31%	0.07	-	-	3.56	-	-
AW 15	1.50	5.00%	81%	1.49	1.99%	32%	1.79	-	-	27.96	-	-
AW 16	0.30	1.01%	77%	0.30	0.40%	31%	0.35	-	-	11.27	-	-
AW 17	0.15	0.51%	77%	0.15	0.20%	31%	0.17	-	-	5.20	-	-
AW 18	0.24	0.81%	77%	0.24	0.32%	31%	0.29	-	-	11.44	-	-
AW 19	0.55	1.83%	78%	0.55	0.73%	31%	0.67	-	-	16.61	-	-
AW 20	0.14	0.48%	77%	0.14	0.19%	31%	0.16	-	-	3.18	-	-
AW 21	0.14	0.48%	77%	0.14	0.19%	31%	0.17	-	-	4.91	-	-
AW 22	0.14	0.46%	77%	0.14	0.18%	31%	0.16	-	-	7.47	-	-
AW 23	0.06	0.21%	76%	0.06	0.08%	31%	0.07	-	-	3.47	-	-
AW 24	0.06	0.19%	76%	0.06	0.08%	31%	0.07	-	-	2.95	-	-
AW 25	0.04	0.12%	76%	0.04	0.05%	31%	0.04	-	-	2.21	-	-
AW 26	0.05	0.15%	76%	0.05	0.06%	31%	0.06	-	-	4.22	-	-

Gas – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 27	0.04	0.14%	76%	0.04	0.06%	31%	0.06	-	-	3.33	-	-
AW 28	0.19	0.64%	77%	0.19	0.26%	31%	0.23	-	-	5.85	-	-
AW 29	0.11	0.37%	77%	0.11	0.15%	31%	0.13	-	-	2.45	-	-
AW 30	0.15	0.49%	77%	0.15	0.20%	31%	0.18	-	-	6.76	-	-
AW 31	0.15	0.49%	77%	0.15	0.20%	31%	0.17	-	-	7.62	-	-
AW 32	0.07	0.24%	76%	0.07	0.10%	31%	0.09	-	-	5.18	-	-
AW 33	0.07	0.24%	76%	0.07	0.10%	31%	0.09	-	-	5.45	-	-
AW 34	0.06	0.20%	76%	0.06	0.08%	31%	0.07	-	-	4.64	-	-
AW 35	0.07	0.23%	76%	0.07	0.09%	31%	0.08	-	-	4.63	-	-
AW 36	0.05	0.16%	76%	0.05	0.06%	31%	0.06	-	-	3.93	-	-
AW 37	0.04	0.12%	76%	0.04	0.05%	31%	0.05	-	-	1.96	-	-
AW 38	0.06	0.20%	76%	0.06	0.08%	31%	0.08	-	-	5.03	-	-
AW 39	0.05	0.17%	76%	0.05	0.07%	31%	0.07	-	-	4.58	-	-
AW 40	0.08	0.25%	76%	0.08	0.10%	31%	0.09	-	-	2.84	-	-
AW 41	0.05	0.18%	76%	0.05	0.07%	31%	0.06	-	-	3.01	-	-
AW 42	0.05	0.15%	76%	0.05	0.06%	31%	0.06	-	-	3.95	-	-
AW 43	0.07	0.23%	76%	0.07	0.09%	31%	0.08	-	-	2.80	-	-
AW 44	0.06	0.18%	76%	0.06	0.07%	31%	0.06	-	-	3.69	-	-
AW 45	0.14	0.47%	77%	0.14	0.19%	31%	0.17	-	-	5.69	-	-
AW 46	0.09	0.30%	76%	0.09	0.12%	31%	0.10	-	-	3.62	-	-
AW 47	0.10	0.35%	77%	0.10	0.14%	31%	0.12	-	-	2.56	-	-
AW 48	0.22	0.74%	77%	0.22	0.30%	31%	0.25	-	-	4.78	-	-

Gas – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 49	0.11	0.38%	77%	0.11	0.15%	31%	0.14	-	-	3.85	-	-
AW 50	0.17	0.58%	77%	0.17	0.23%	31%	0.21	-	-	4.94	-	-
AW 51	0.05	0.18%	76%	0.05	0.07%	31%	0.06	-	-	3.00	-	-
AW 52	0.14	0.47%	77%	0.14	0.19%	31%	0.17	-	-	5.59	-	-
AW 53	0.08	0.26%	76%	0.08	0.11%	31%	0.10	-	-	2.75	-	-
AW 54	0.07	0.23%	76%	0.07	0.09%	31%	0.08	-	-	3.23	-	-
AW 55	0.06	0.19%	76%	0.06	0.08%	31%	0.07	-	-	2.22	-	-
AW 56	0.05	0.18%	76%	0.05	0.07%	31%	0.07	-	-	3.05	-	-
AW 57	0.04	0.14%	76%	0.04	0.06%	31%	0.05	-	-	2.20	-	-

Table 6-2: Oil - NO_2 & NO_x ADMS results

Oil – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
North Boundary	0.76	-	-	0.81	-	-	0.71	**1.78%**	42%	12.33	6.17%	7.4%
East Boundary	5.51	-	-	5.97	-	-	4.34	**10.84%**	52%	17.29	8.64%	10.3%
West Boundary	5.43	-	-	5.68	-	-	4.94	**12.36%**	53%	23.31	**11.65%**	13.9%
South Boundary	1.06	-	-	1.14	-	-	0.97	**2.43%**	43%	16.47	8.23%	9.8%
Cheriton Grove	0.43	-	-	0.46	-	-	0.31	0.78%	41%	4.00	2.00%	2.4%
Heol Ty Maen	0.42	-	-	0.46	-	-	0.33	0.83%	42%	2.35	1.18%	1.4%
Footpath NW	2.03	-	-	2.24	-	-	1.64	**4.10%**	45%	14.92	7.46%	8.9%
Footpath South	0.63	-	-	0.69	-	-	0.56	**1.40%**	42%	8.11	4.05%	4.8%
Sports Field	0.52	-	-	0.57	-	-	0.47	**1.18%**	42%	6.23	3.12%	3.7%
AQMA	0.11	-	-	0.12	-	-	0.08	0.21%	41%	1.17	0.58%	0.70%
Mynydd Meio	0.08	0.26%	76%	0.08	0.10%	31%	0.06	-	-	1.14	-	-
CBW Centre (SAC)	0.02	0.08%	76%	0.03	0.03%	31%	0.02	-	-	0.66	-	-
CBW West (SAC)	0.02	0.07%	76%	0.02	0.03%	31%	0.02	-	-	0.68	-	-
CBW East (SAC)	0.03	0.11%	76%	0.04	0.04%	31%	0.03	-	-	0.66	-	-
AW Onsite	5.46	18.18%	94%	5.74	7.24%	38%	4.98	-	-	23.31	-	-
AW 1	0.05	0.16%	76%	0.05	0.07%	31%	0.04	-	-	0.93	-	-
AW 2	0.09	0.31%	77%	0.10	0.12%	31%	0.08	-	-	2.65	-	-
AW 3	0.05	0.16%	76%	0.05	0.06%	31%	0.04	-	-	0.96	-	-

Oil – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 4	0.23	0.77%	77%	0.25	0.31%	31%	0.19	-	-	3.06	-	-
AW 5	0.07	0.23%	76%	0.08	0.09%	31%	0.06	-	-	1.35	-	-
AW 6	0.06	0.21%	76%	0.07	0.08%	31%	0.06	-	-	1.18	-	-
AW 7	0.05	0.16%	76%	0.05	0.06%	31%	0.04	-	-	1.36	-	-
AW 8	0.05	0.16%	76%	0.05	0.06%	31%	0.04	-	-	0.89	-	-
AW 9	0.18	0.59%	77%	0.19	0.24%	31%	0.14	-	-	2.31	-	-
AW 10	0.14	0.45%	77%	0.15	0.18%	31%	0.11	-	-	1.80	-	-
AW 11	0.98	3.26%	79%	1.07	1.30%	32%	0.72	-	-	6.45	-	-
AW 12	0.12	0.40%	77%	0.13	0.16%	31%	0.09	-	-	1.70	-	-
AW 13	0.10	0.34%	77%	0.11	0.14%	31%	0.08	-	-	1.61	-	-
AW 14	0.08	0.26%	76%	0.09	0.11%	31%	0.07	-	-	1.77	-	-
AW 15	2.13	7.10%	83%	2.30	2.82%	33%	1.77	-	-	13.83	-	-
AW 16	0.41	1.38%	78%	0.45	0.55%	31%	0.33	-	-	5.39	-	-
AW 17	0.21	0.69%	77%	0.23	0.28%	31%	0.16	-	-	2.71	-	-
AW 18	0.33	1.11%	77%	0.36	0.44%	31%	0.28	-	-	5.51	-	-
AW 19	0.75	2.49%	79%	0.82	1.00%	31%	0.64	-	-	8.13	-	-
AW 20	0.19	0.65%	77%	0.21	0.26%	31%	0.15	-	-	1.63	-	-
AW 21	0.20	0.65%	77%	0.21	0.26%	31%	0.16	-	-	2.30	-	-
AW 22	0.19	0.63%	77%	0.21	0.25%	31%	0.16	-	-	3.53	-	-
AW 23	0.09	0.29%	76%	0.09	0.11%	31%	0.07	-	-	1.63	-	-
AW 24	0.08	0.27%	76%	0.09	0.11%	31%	0.06	-	-	1.42	-	-
AW 25	0.05	0.17%	76%	0.05	0.07%	31%	0.04	-	-	1.15	-	-

Oil – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 26	0.06	0.22%	76%	0.07	0.09%	31%	0.06	-	-	2.05	-	-
AW 27	0.06	0.20%	76%	0.07	0.08%	31%	0.06	-	-	1.60	-	-
AW 28	0.26	0.86%	77%	0.28	0.34%	31%	0.22	-	-	2.79	-	-
AW 29	0.15	0.50%	77%	0.16	0.20%	31%	0.12	-	-	1.17	-	-
AW 30	0.20	0.66%	77%	0.22	0.27%	31%	0.17	-	-	3.40	-	-
AW 31	0.20	0.67%	77%	0.22	0.27%	31%	0.17	-	-	4.29	-	-
AW 32	0.10	0.32%	77%	0.11	0.13%	31%	0.08	-	-	2.79	-	-
AW 33	0.10	0.34%	77%	0.11	0.14%	31%	0.09	-	-	2.76	-	-
AW 34	0.08	0.27%	76%	0.09	0.11%	31%	0.07	-	-	2.37	-	-
AW 35	0.10	0.32%	77%	0.11	0.13%	31%	0.08	-	-	2.55	-	-
AW 36	0.06	0.21%	76%	0.07	0.09%	31%	0.05	-	-	2.06	-	-
AW 37	0.05	0.16%	76%	0.05	0.06%	31%	0.04	-	-	0.98	-	-
AW 38	0.08	0.27%	76%	0.09	0.11%	31%	0.07	-	-	2.38	-	-
AW 39	0.07	0.23%	76%	0.08	0.10%	31%	0.06	-	-	2.16	-	-
AW 40	0.10	0.35%	77%	0.11	0.14%	31%	0.08	-	-	1.59	-	-
AW 41	0.07	0.25%	76%	0.08	0.10%	31%	0.06	-	-	1.48	-	-
AW 42	0.06	0.21%	76%	0.07	0.09%	31%	0.05	-	-	1.85	-	-
AW 43	0.10	0.32%	77%	0.10	0.13%	31%	0.08	-	-	1.58	-	-
AW 44	0.08	0.26%	76%	0.08	0.10%	31%	0.06	-	-	1.82	-	-
AW 45	0.19	0.64%	77%	0.21	0.26%	31%	0.16	-	-	2.72	-	-
AW 46	0.12	0.40%	77%	0.13	0.16%	31%	0.10	-	-	1.74	-	-
AW 47	0.14	0.47%	77%	0.15	0.19%	31%	0.11	-	-	1.34	-	-

Oil – NO_2 & NO_x	Ecological						Human Health					
							Long Term			Short Term		
Receptor	NO_x Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_x Daily Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Annual Mean PC µg/m³	%PC of EAL	%PEC of EAL	NO_2 Hourly Mean 99.8 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 48	0.30	1.00%	77%	0.33	0.40%	31%	0.23	-	-	2.24	-	-
AW 49	0.15	0.52%	77%	0.17	0.21%	31%	0.13	-	-	1.81	-	-
AW 50	0.23	0.78%	77%	0.26	0.31%	31%	0.20	-	-	2.36	-	-
AW 51	0.07	0.25%	76%	0.08	0.10%	31%	0.06	-	-	1.41	-	-
AW 52	0.19	0.65%	77%	0.21	0.26%	31%	0.16	-	-	2.63	-	-
AW 53	0.11	0.35%	77%	0.12	0.14%	31%	0.09	-	-	1.29	-	-
AW 54	0.09	0.31%	76%	0.10	0.12%	31%	0.08	-	-	1.53	-	-
AW 55	0.08	0.26%	76%	0.09	0.10%	31%	0.07	-	-	1.04	-	-
AW 56	0.07	0.24%	76%	0.08	0.09%	31%	0.07	-	-	1.47	-	-
AW 57	0.06	0.19%	76%	0.06	0.08%	31%	0.05	-	-	1.02	-	-

Table 6-3: Oil - SO_2 ADMS results

Oil – SO_2	Ecological			Human Health								
				24 Hour Mean			Hourly mean			15 Minute Mean		
Receptor	SO_2 Annual Average Mean PC µg/m³	%PC of EAL	%PEC of EAL	SO_2 24 Hour Mean 99.2 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 Hourly Mean 99.7 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 15min Mean 99.9 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
North Boundary	0.81	-	-	10.20	8.16%	4%	35.01	**10.00%**	13%	41.04	**15.43%**	16%
East Boundary	5.97	-	-	29.86	**23.89%**	11%	53.31	**15.23%**	**21%**	56.81	**21.36%**	**22%**
West Boundary	5.68	-	-	57.48	**45.98%**	**22%**	69.52	**19.86%**	**27%**	73.27	**27.54%**	**28%**
South Boundary	1.14	-	-	17.54	**14.03%**	7%	47.18	**13.48%**	18%	60.60	**22.78%**	**23%**
Cheriton Grove	0.46	-	-	4.71	3.76%	2%	11.55	3.30%	4%	17.35	6.52%	7%
Heol Ty Maen	0.46	-	-	1.99	1.59%	1%	5.91	1.69%	2%	13.30	5.00%	5%
Footpath NW	2.24	-	-	19.50	**15.60%**	8%	45.34	**12.95%**	17%	54.92	**20.65%**	**21%**
Footpath South	0.69	-	-	11.71	9.37%	5%	24.84	7.10%	10%	28.43	**10.69%**	11%
Sports Field	0.57	-	-	6.22	4.98%	2%	18.37	5.25%	7%	29.30	**11.01%**	11%
AQMA	0.12	-	-	1.10	0.88%	0%	3.36	0.96%	1%	6.17	2.32%	2%
Mynydd Meio	0.08	0.42%	16%	0.92	-	-	2.86	-	-	1.14	-	-
CBW Centre (SAC)	0.03	0.13%	15%	0.27	-	-	1.82	-	-	0.66	-	-
CBW West (SAC)	0.02	0.11%	15%	0.25	-	-	1.99	-	-	0.68	-	-
CBW East (SAC)	0.04	0.18%	15%	0.32	-	-	1.72	-	-	0.66	-	-
AW Onsite	5.74	28.69%	44%	55.09	-	-	69.52	-	-	23.31	-	-
AW 1	0.05	0.27%	15%	0.59	-	-	2.68	-	-	0.93	-	-
AW 2	0.10	0.51%	16%	1.58	-	-	7.04	-	-	2.65	-	-
AW 3	0.05	0.26%	15%	0.57	-	-	2.64	-	-	0.96	-	-
AW 4	0.25	1.27%	16%	2.10	-	-	9.36	-	-	3.06	-	-

Oil – SO_2	Ecological			Human Health								
				24 Hour Mean			Hourly mean			15 Minute Mean		
Receptor	SO_2 Annual Average Mean PC µg/m³	%PC of EAL	%PEC of EAL	SO_2 24 Hour Mean 99.2 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 Hourly Mean 99.7 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 15min Mean 99.9 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 5	0.08	0.38%	16%	0.86	-	-	3.55	-	-	1.35	-	-
AW 6	0.07	0.35%	16%	0.65	-	-	3.45	-	-	1.18	-	-
AW 7	0.05	0.26%	15%	0.77	-	-	3.00	-	-	1.36	-	-
AW 8	0.05	0.26%	15%	0.48	-	-	2.64	-	-	0.89	-	-
AW 9	0.19	0.97%	16%	1.42	-	-	6.98	-	-	2.31	-	-
AW 10	0.15	0.74%	16%	1.46	-	-	4.33	-	-	1.80	-	-
AW 11	1.07	5.33%	21%	10.60	-	-	19.92	-	-	6.45	-	-
AW 12	0.13	0.65%	16%	1.27	-	-	4.92	-	-	1.70	-	-
AW 13	0.11	0.55%	16%	1.63	-	-	4.95	-	-	1.61	-	-
AW 14	0.09	0.43%	16%	1.43	-	-	5.34	-	-	1.77	-	-
AW 15	2.30	11.52%	27%	21.37	-	-	37.74	-	-	13.83	-	-
AW 16	0.45	2.26%	17%	3.10	-	-	12.01	-	-	5.39	-	-
AW 17	0.23	1.13%	16%	1.33	-	-	7.41	-	-	2.71	-	-
AW 18	0.36	1.81%	17%	4.18	-	-	15.77	-	-	5.51	-	-
AW 19	0.82	4.08%	19%	7.71	-	-	24.86	-	-	8.13	-	-
AW 20	0.21	1.07%	16%	1.06	-	-	4.60	-	-	1.63	-	-
AW 21	0.21	1.07%	16%	1.51	-	-	7.01	-	-	2.30	-	-
AW 22	0.21	1.03%	16%	2.28	-	-	9.31	-	-	3.53	-	-
AW 23	0.09	0.47%	16%	1.05	-	-	3.99	-	-	1.63	-	-
AW 24	0.09	0.44%	16%	1.25	-	-	4.24	-	-	1.42	-	-
AW 25	0.05	0.27%	15%	0.81	-	-	3.25	-	-	1.15	-	-
AW 26	0.07	0.35%	16%	1.15	-	-	3.90	-	-	2.05	-	-

Oil – SO_2	Ecological			Human Health								
				24 Hour Mean			Hourly mean			15 Minute Mean		
Receptor	SO_2 Annual Average Mean PC µg/m³	%PC of EAL	%PEC of EAL	SO_2 24 Hour Mean 99.2 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 Hourly Mean 99.7 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 15min Mean 99.9 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 27	0.07	0.34%	16%	1.15	-	-	4.84	-	-	1.60	-	-
AW 28	0.28	1.42%	17%	2.41	-	-	8.50	-	-	2.79	-	-
AW 29	0.16	0.82%	16%	0.72	-	-	3.00	-	-	1.17	-	-
AW 30	0.22	1.10%	16%	2.68	-	-	9.89	-	-	3.40	-	-
AW 31	0.22	1.12%	16%	2.57	-	-	11.22	-	-	4.29	-	-
AW 32	0.11	0.53%	16%	1.61	-	-	7.84	-	-	2.79	-	-
AW 33	0.11	0.56%	16%	1.58	-	-	6.50	-	-	2.76	-	-
AW 34	0.09	0.45%	16%	1.27	-	-	6.53	-	-	2.37	-	-
AW 35	0.11	0.53%	16%	1.36	-	-	7.61	-	-	2.55	-	-
AW 36	0.07	0.35%	16%	1.06	-	-	5.37	-	-	2.06	-	-
AW 37	0.05	0.26%	15%	0.61	-	-	2.73	-	-	0.98	-	-
AW 38	0.09	0.44%	16%	1.31	-	-	6.14	-	-	2.38	-	-
AW 39	0.08	0.39%	16%	1.19	-	-	5.67	-	-	2.16	-	-
AW 40	0.11	0.57%	16%	0.90	-	-	4.37	-	-	1.59	-	-
AW 41	0.08	0.40%	16%	0.80	-	-	4.08	-	-	1.48	-	-
AW 42	0.07	0.35%	16%	1.13	-	-	4.50	-	-	1.85	-	-
AW 43	0.10	0.52%	16%	0.88	-	-	4.29	-	-	1.58	-	-
AW 44	0.08	0.42%	16%	0.85	-	-	4.56	-	-	1.82	-	-
AW 45	0.21	1.05%	16%	2.24	-	-	7.59	-	-	2.72	-	-
AW 46	0.13	0.66%	16%	1.42	-	-	5.00	-	-	1.74	-	-
AW 47	0.15	0.77%	16%	0.78	-	-	3.57	-	-	1.34	-	-
AW 48	0.33	1.65%	17%	1.59	-	-	6.40	-	-	2.24	-	-

Oil – SO_2	Ecological			Human Health								
				24 Hour Mean			Hourly mean			15 Minute Mean		
Receptor	SO_2 Annual Average Mean PC µg/m³	%PC of EAL	%PEC of EAL	SO_2 24 Hour Mean 99.2 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 Hourly Mean 99.7 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG	SO_2 15min Mean 99.9 %ile PC µg/m³	%PC of EAL	%PC of EAL-ABG
AW 49	0.17	0.85%	16%	1.53	-	-	5.31	-	-	1.81	-	-
AW 50	0.26	1.28%	16%	2.40	-	-	7.18	-	-	2.36	-	-
AW 51	0.08	0.40%	16%	0.90	-	-	3.60	-	-	1.41	-	-
AW 52	0.21	1.06%	16%	1.82	-	-	8.04	-	-	2.63	-	-
AW 53	0.12	0.58%	16%	1.19	-	-	3.88	-	-	1.29	-	-
AW 54	0.10	0.50%	16%	1.08	-	-	4.16	-	-	1.53	-	-
AW 55	0.09	0.43%	16%	0.87	-	-	3.11	-	-	1.04	-	-
AW 56	0.08	0.39%	16%	0.89	-	-	3.68	-	-	1.47	-	-
AW 57	0.06	0.31%	15%	0.64	-	-	2.84	-	-	1.02	-	-

7 Discussion

The results for the Gas fuelled scenario indicate that all modelled boundary receptor locations are receiving LT NO_2 PCs which cannot be deemed insignificant. However, with further screening (of PECs, and of ST PCs against 'headroom') no exceedances of the significance thresholds are observed in the ADMS results (including identified receptors). Thus, the environmental concentrations for both long and short-term NO_2 emissions from the stacks may be considered insignificant.

The modelled concentrations in the Oil fuelled scenario are seen to be higher than those for the Gas fuelled scenario across the board. The boundary receptors are again observed to receive LT NO_2 PCs in excess of the significance threshold, however only the West Boundary is modelled to receive ST PCs above the threshold. Further screening of PECs and of PCs against 'headroom' does not present any NO_2 concentrations above the secondary significance thresholds and as such the site NO_2 emissions may be viewed as insignificant.

Human health receptors represented by the Cheriton Grove, Heol Ty Maen, Sports Field, Footpath NW and Footpath South model receptors are generally seen to receive insignificant potential impacts from the Site emissions in both scenarios with GLCs falling well below EALs. However, when emitting under Oil-fuelled operations the Footpath NW receptor is predicted to receive SO_2 GLCs which are marginally above the insignificance threshold (21.13% versus 20%) for a 15 minute mean but again this remains well below the EAL. Given the marginal exceedance in the area, the conservatism inherent in the model and the expected short residence time of user of the footpath staying in the affected area the real-world potential for exposure is likely to be much reduced.

Sulphur dioxide PCs (derived for the 24 hour mean, hourly mean and 15min mean) are seen to exceed the initial significance threshold at all boundary receptors except the north boundary for the 24 hour mean. Screening of the PCs against 'headroom' continues to identify concentrations marginally above the 20% of EAL-Background secondary screening thresholds at several boundary locations across the three ST averaging periods. Ground level concentrations at these locations cannot therefore be ruled out as insignificant. The maximum modelled SO_2 concentration (93.6 $\mu g/m^3$ which equates to 36% of EAL-background as a 15min mean value) is therefore also above this threshold.

The location of this observed concentration is off-site immediately North West of the site boundary, roughly in the location of the National Grid transformer site.

Analysis of NO_x and SO_2 impacts to the identified vegetation and ecosystem receptors from the site (namely ancient woodland areas, Cardiff Beech Woods SAC and Mynydd Meio LWS) indicates that these may be considered insignificant. Indeed, at all SAC receptors modelled the long-term PCs are well below 1% of the relevant EALs and at all receptors representative of the Mynydd Meio local wildlife site and ancient woodlands the PCs are below EALs.

No exceedance of EALs is presented anywhere in the modelling although raised NO_x concentrations are observed, predominantly due to the background concentration contributing 76% of the ambient level in the modelling. The maximum NO_x PC at an ecological receptor is 18.2% (excluding background) which occurs at the closest point of the ancient woodland located within the site boundary.

The raised GLCs observed at a number of boundary receptors seem to be a result of the clustered sources at the western extent of the Site. Surrounding these sources are a number of large structures which appear to result in the increased proximal retention and subsequently reduced dispersion in the area.

The nature of the modelling approach is inherently conservative through the selection of the maximum observed concentrations over the 5 years of modelled Met data. Therefore the marginal SO_2 exceedances modelled at the boundary receptors (0.5 - 8.2% above the significance threshold) represent worst case concentrations, thus the actual contributions from the Site would generally be expected to be lower.

8 Summary

Following the air emission dispersion assessment, the analysis that has been undertaken for Veolia in regards to the PB Gelatins Site demonstrates that predicted emissions of NO_2 and SO_2 at all modelled off-site receptors do not contribute to concentrations in excess of air quality standards.

The results of the modelling indicate that the Church Village AQMA located 1.8km south west of the Site is not expected to be significantly affected by any air emissions from the boiler stacks in either the Gas fuelled or Oil fuelled scenario.

In the Oil-fuelled scenario marginal exceedances of the SO_2 significance thresholds are observed at several of the identified Site boundary receptors and also off-site in the area immediately north west of the Site. As such SO_2 emissions from the Site in these areas cannot be viewed as insignificant but they appear considerably below the relevant environmental standards. However, it should be noted, that currently given the very low likelihood of oil being used to fuel the boilers for either short or long periods that the results offer a pessimistic account of actual site operations.

No exceedances of EALs for ecological receptors receiving GLCs from site emissions are observed in the modelling. Emissions from the Site may therefore be considered insignificant in terms of the impact in these areas. Raised background levels of NO_x in the local area (as evidenced by the incidence of a nearby AQMA) are seen to dominate over any respective contributions from the Site.

While operation of the boilers using gas indicates sufficient air dispersion to present insignificant concentrations at the identified receptors, consideration could be given regarding the potential for higher ground level SO_2 and NO_x concentrations in certain areas if fuelling the boilers on oil. However, based on the modelling undertaken here no exceedance of any environmental standard is expected as a result of air emissions from the Site.

9 References

1. Department for Environment, Food and Rural Affairs (DEFRA) and Environment Agency (EA): Air Emissions Risk Assessment Guidance. Available at: www.gov.uk
2. ADMS version 5.1.2.0, Cambridge Environmental Research Consultants Ltd.
3. Department for Environment, Food and Rural Affairs (DEFRA), UK-AIR: Air Information Resource. Available at: http://uk-air.defra.gov.uk
4. ADM Ltd, Old Chambers, 93-94 West Street, Farnham, Surrey, GU9 7EB.

Appendix A ADMS Data

Appendix A - ADMS Input Data

	Boiler 1		Boiler 2		Boiler 3	
Emission point	A1		A2		A3	
Diameter	1		1		0.6	
stack height (m)	23.8		23.8		23.8	
	Natural gas					
	g/s	**mg/m3**	**g/s**	**mg/m3**	**g/s**	**mg/m3**
NO2 (g/s)	0.17944	116.68	0.24333	126.32	0.26944	162.13
SO2 (g/s)	0.005	3.08	0.006	3.35	0.004	2.15
CO (g/s)	0.007	4.67	0.011	5.87	0.011	6.86
velocity (m/s, ref T, P, dry, 3% O2)	1.96		2.46		5.89	
Flow (m3/s, ref T, P, dry, 3% O2)	1.54	5544	1.93	6948	1.67	6012
Exit temperatures for the stacks (°C)	114		198		146	
	Gas Oil					
	g/s	**mg/m3**	**g/s**	**mg/m3**	**g/s**	**mg/m3**
NO2 (g/s)	0.30028	207.67	0.30194	213.31	0.31972	171.21
SO2 (g/s)	0.30250	209.15	0.32833	232.07	0.37917	226.88
CO (g/s)	0.006	4.05	0.008	5.20	0.011	6.73
velocity (m/s, ref T, P, dry, 3% O2)	1.84	-	1.81	-	5.93	-
Flow (m3/s, ref T, P, dry, 3% O2)	1.45	5220	1.42	5112	1.68	6048
Exit temperatures for the stacks (°C)	121	-	197	-	149	-

Modelling Assumptions

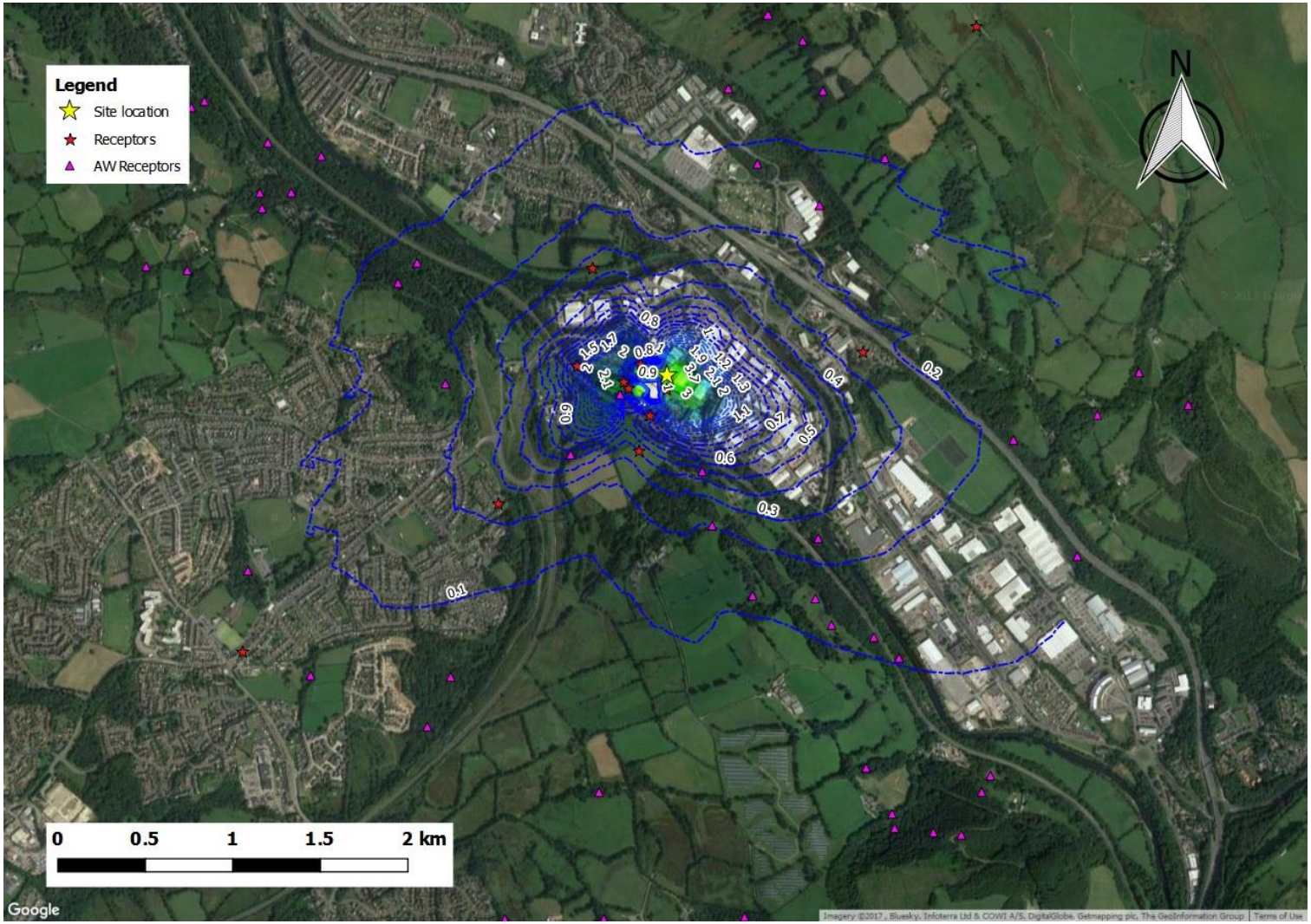
Roughness Length: 0.5 - Parkland and Open Suburbia

Meteorological Data from Cardiff Airport (Rhoose)

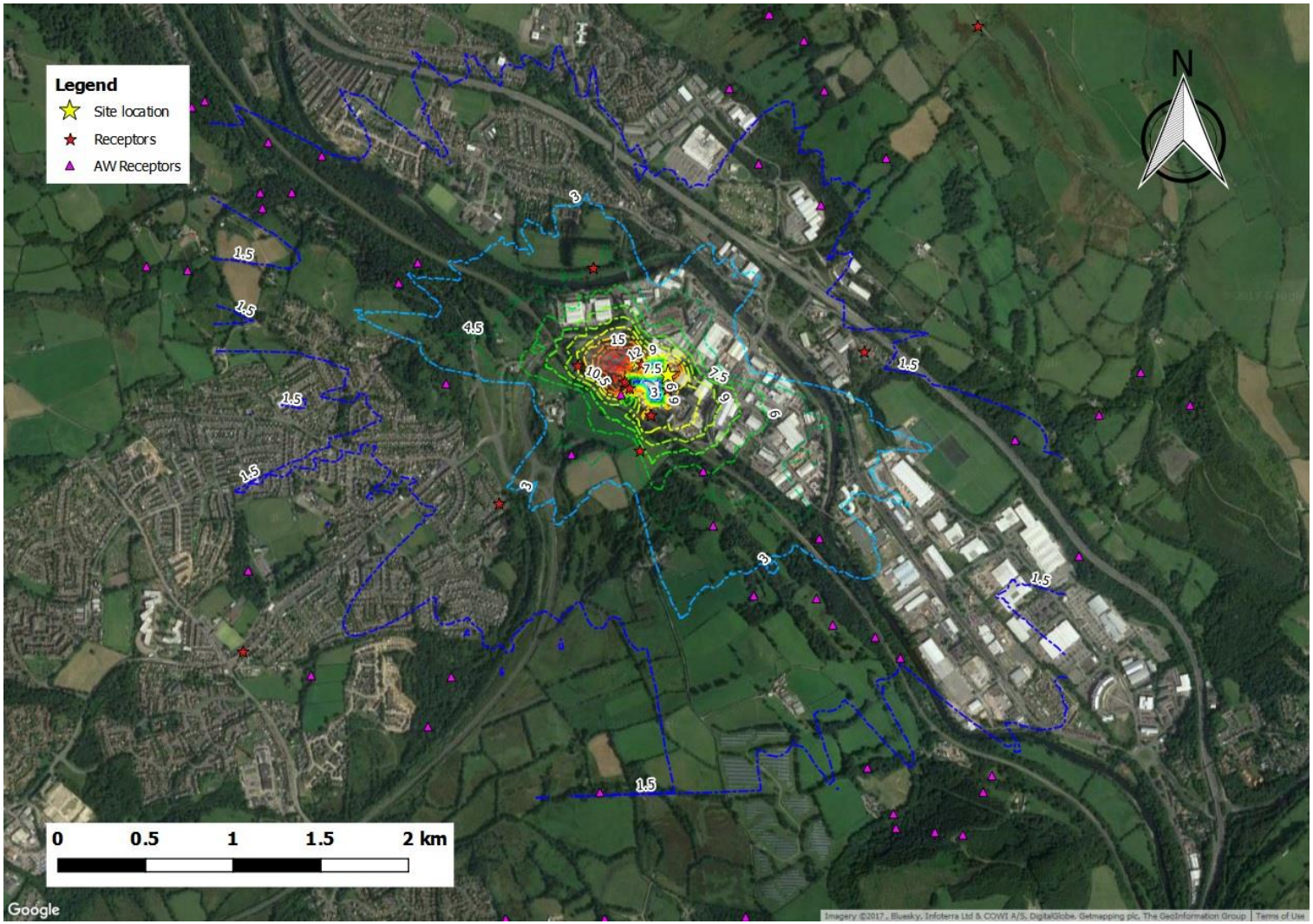
Flat terrain

Appendix B Contour Plots

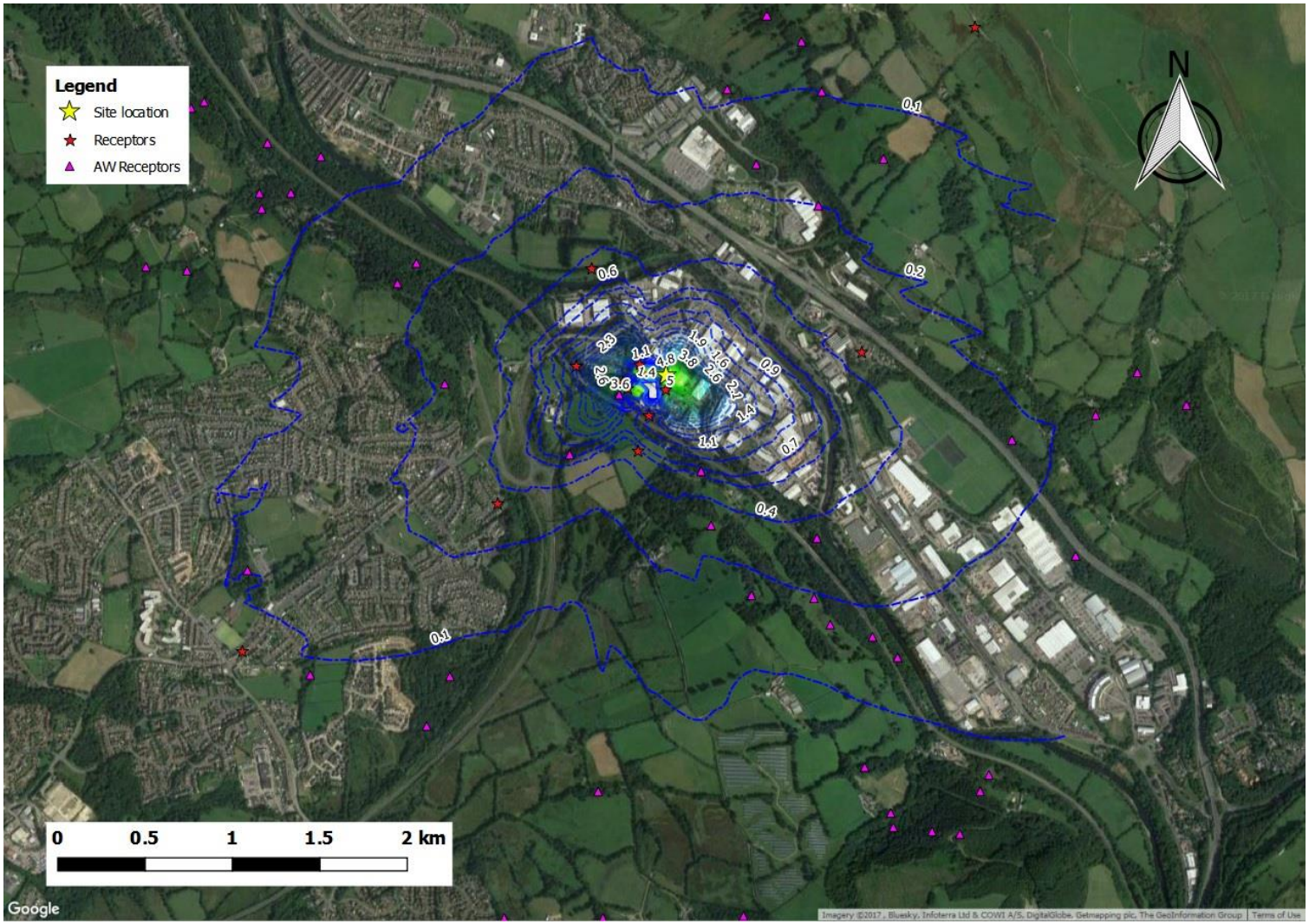
ADMS Contour Plots



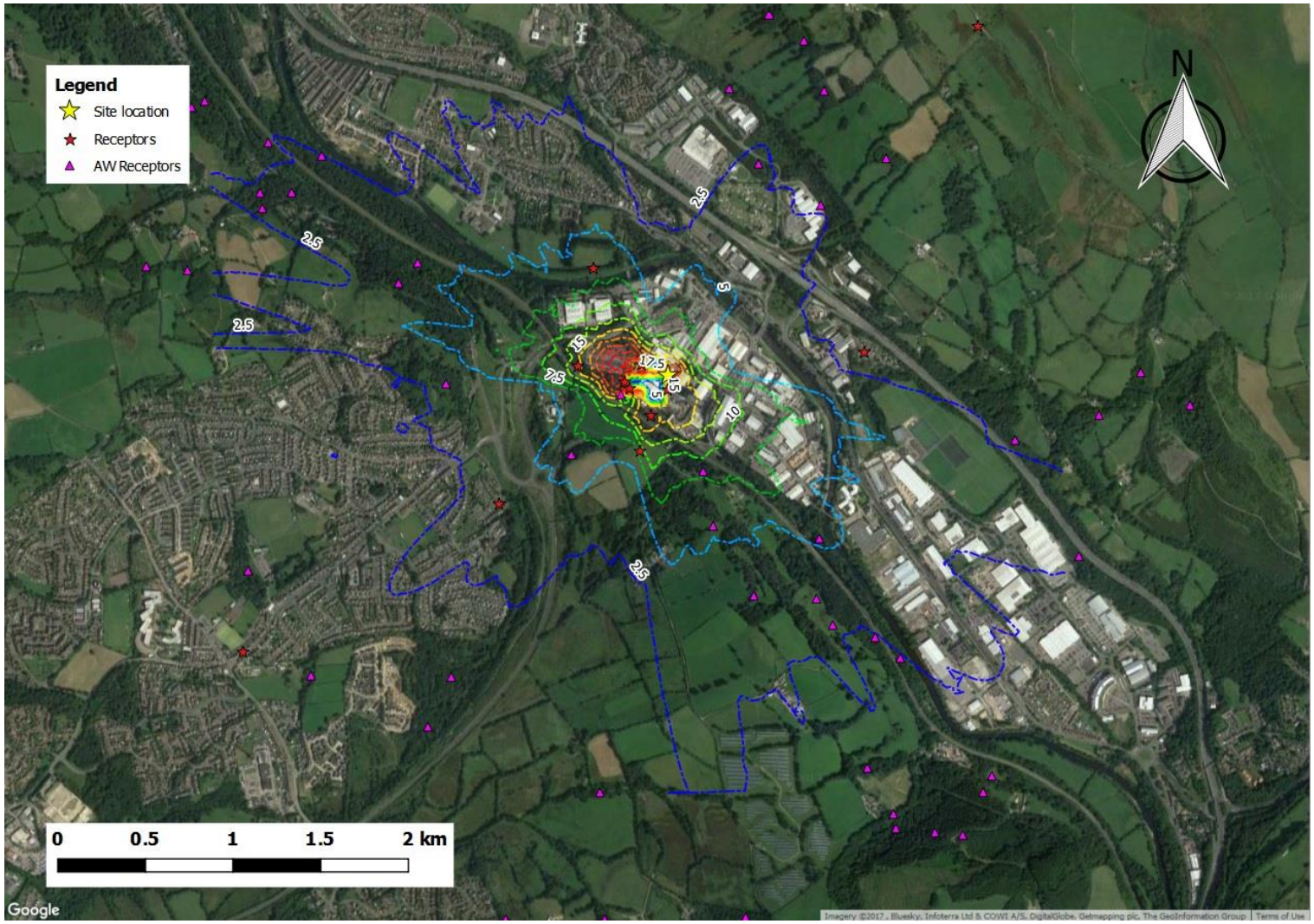
Gas Scenario: Long-term NO_2 Concentrations, 2012-2016 Maximums (µg/m^3)



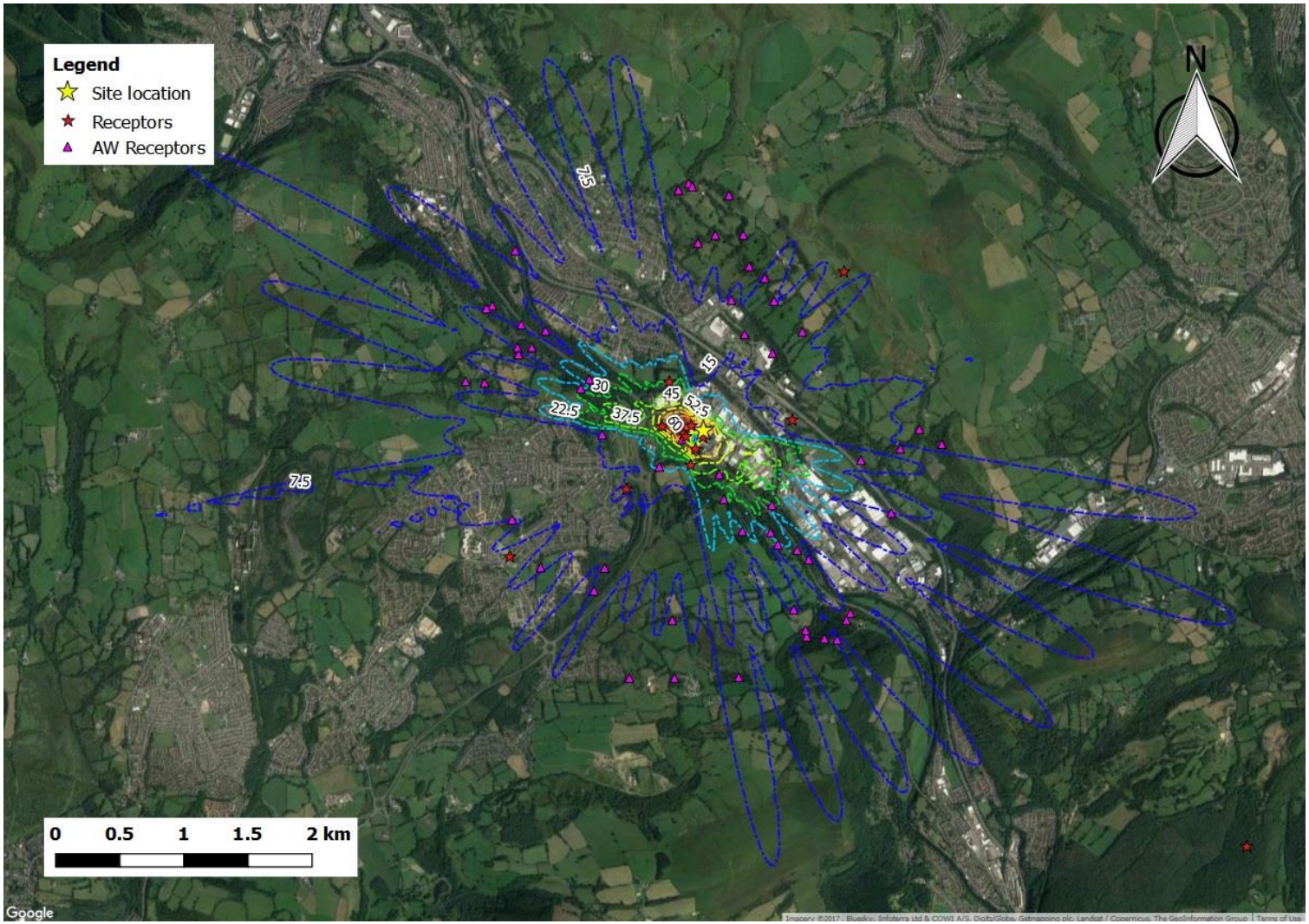
Gas Scenario: Short-term NO_2 Concentrations, 2012-2016 Maximums (µg/m^3)



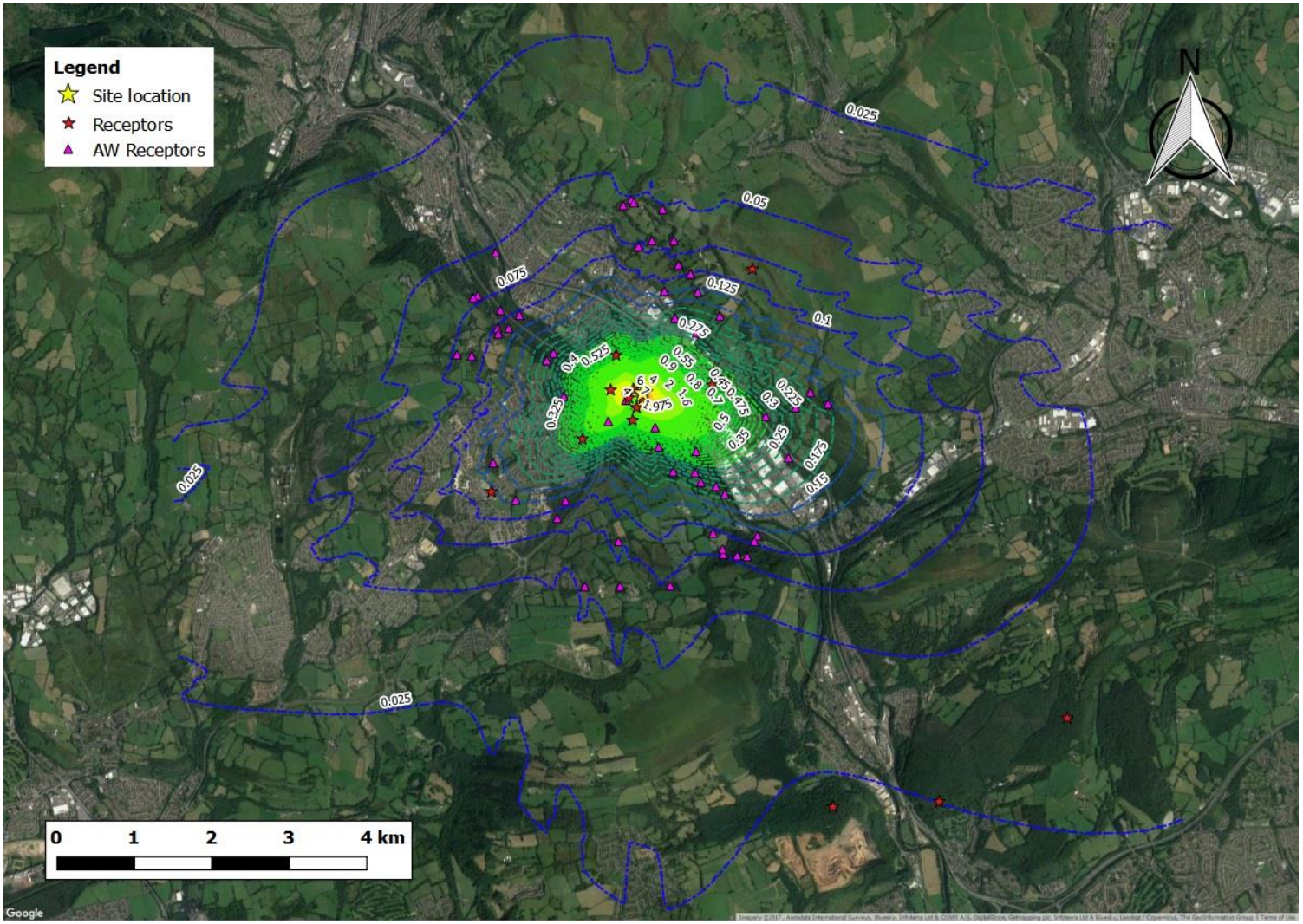
Oil Scenario: Long-term NO_2 Concentrations, 2012-2016 Maximums (µg/m^3)



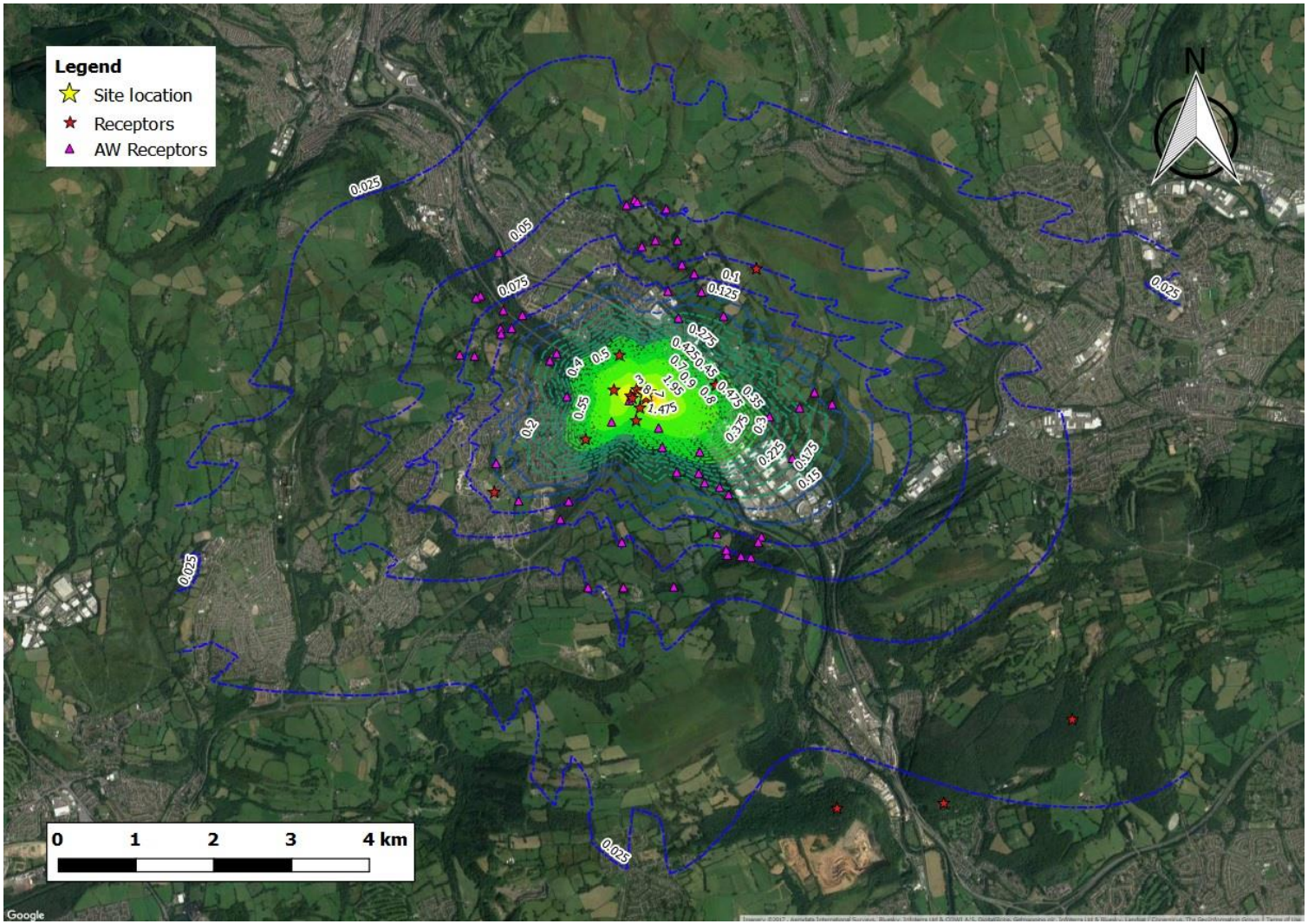
Oil Scenario: Short-term NO_2 Concentrations, 2012-2016 Maximums (µg/m^3)



Oil Scenario: 15 min mean SO_2 Concentrations, 2012-2016 Maximums (µg/m^3)



Oil Scenario: Annual SO_2 Concentrations, 2012-2016 Averages (µg/m^3)



Oil Scenario: Annual NO_x Concentrations, 2012-2016 Averages (µg/m^3)