12.0 Air Quality and Climate

12.1 Introduction

AWN Consulting Limited has been commissioned to conduct an assessment of the likely impact on air quality and climate associated with the development of the new National Maternity Hospital on St. Vincent's University Hospital Campus, Merrion Road, Dublin 4. This EIS chapter also outlines the methodology be used to assess the air quality & climate impacts of the proposed development. The assessment takes the worst case scenario with respect to traffic impacts, assuming that all granted permissions will be built between 2020 and 2030.

The proposed development comprises the redevelopment of The National Maternity Hospital at St. Vincent's University Hospital campus, Elm Park, Dublin 4. The proposed new National Maternity Hospital building will be located at the eastern side of the hospital campus and comprises the construction of a building that rises to 5 and 6 storeys above ground level, with one partial basement level, plus additional ancillary plant areas at the roof level. The proposed development also includes an extension to the existing multi-storey car park at the north of the campus. The proposed development will be constructed in a sequential manner that allows for the continual operation of the hospital campus and, as such, includes the phased demolition of existing buildings at St. Vincent's University Hospital campus to facilitate clearing the site for the proposed development and the construction of temporary accommodation to facilitate construction sequencing (including a single storey temporary canteen, catering staff changing facilities, household services store and carpenters workshop). The full detail of the nature and extent of the proposed development is set out in Chapter 2 of this EIS and the Draft Construction Management Plan is appended to same.

12.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 12.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the *Air*

Quality Standards Regulations 2011, which incorporate *European Commission Directive 2008/50/EC* which has set limit values for the pollutants SO_2, NO_2, PM_{10}, benzene and CO (see Table 12.1). *Council Directive 2008/50/EC* combines the previous *Air Quality Framework Directive (96/62/EC)* and its subsequent daughter directives (including *1999/30/EC* and *2000/69/EC*). Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$ (see Appendix 12.1).

Table 12.1: Air Quality Standards Regulations 2011 (based on EU Council Directive 2008/50/EC)

Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 µg/m³ NO_2
		Annual limit for protection of human health	None	40 µg/m³ NO_2
		Annual limit for protection of vegetation	None	30 µg/m³ NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	100% Note 2	0.5 µg/m³
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 µg/m³	350 µg/m³
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 µg/m³
		Annual & Winter limit for the protection of ecosystems	None	20 µg/m³
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m³ PM_{10}
		Annual limit for protection of human health	20%	40 µg/m³ PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m³ $PM_{2.5}$
$PM_{2.5}$ (Stage 2)	-	Annual limit for protection of human health	None	20 µg/m³ $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 µg/m³
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m³ (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFE) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - '*Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'*.

12.1.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change in April 1994 and the *Kyoto Protocol* in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012 (Environmental Resources Management, 1998). The United Nations Framework Convention on Climate Change is continuing detailed negotiations in relation to Greenhouse Gases' reductions and in relation to technical issues such as emissions trading and burden sharing. The EU has published the "20-20-20 Climate and Energy Package" which calls for a 20% reduction in greenhouse gas emissions, a 20% share of renewable energy and 20% energy efficiency improvements by 2020.

12.1.3 Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. COM (2013) 917 Final is the "*Proposal for a Council Decision for the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone*" which sets out the initial objectives of the Protocol to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% below 2005 levels), 65 kt for NO_X (49% reduction), 43 kt for VOCs (25% reduction), 108 kt for NH3 (1% reduction) and 10 kt for $PM_{2.5}$ (18% reduction).

European Commission Directive 2001/81/EC and the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National

Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (Department of the Environment, Community and Local Government, 2004). The Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X (European Economic Area, 2011). COM (2013) 920 Final is the *"Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC",* which will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (83% below 2005 levels), for NO_X (75% reduction), for VOCs (32% reduction), for NH_3 (7% reduction), for $PM_{2.5}$ (35% reduction) and for CH_4 (7% reduction).

12.2 Methodology

12.2.1 Local Air Quality Assessment

The air quality assessment was carried out following procedures described in the publications by the EPA (EPA 2002, 2003, 2015) and using the methodology outlined in the policy and technical guidance notes, LAQM.PG(09) and LAQM.TG(09), issued by UK Department for Environment, Food and Rural Affairs (UK DEFRA 2001, 2009a, 2009b; UK Department of the Environment, Transport and Roads 1998, UK Highways Agency 2007). The assessment of air quality is carried out using a phased approach as recommended by the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2009a). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of key pollutants will be carried out at sensitive receptors. These sensitive receptors have the potential to have an impact on the concentration of key pollutants due to the proposed development. An examination of recent EPA and Local Authority data in Ireland (EPA 2015a, 2015b), has indicated that SO_2 and smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres (EPA 2015a, 2015b). Benzene, although previously reported at quite high levels in urban centres (EPA 2015a, 2015b), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2015a, 2015b). Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres (EPA 2015a, 2015b). The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5}$, benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations were predicted for nearby sensitive receptors for the following seven scenarios:

- The Existing scenario (2014), for model verification;
- Opening Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place (2020);
- Opening Year Do-Something scenario (DS), which assumes the proposed development in place (2020);
- Design Year Do-Nothing scenario (DN), which assumes the proposed development in place (2030); and
- Design Year of the Do-Something scenario (DS), which assumes the proposed development plus all other current planning permission for the site are in place (2030).

The assessment methodology involved air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (UK Highways Agency 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK Department for Environment, Food and Rural Affairs, 2014) (Version 4.1), and following guidance issued by the National Roads Authority (NRA 2011), UK Highways Agency (UK Highways Agency 2007), UK Department for Environment, Food and Rural Affairs (UK DEFRA 2009a) and the EPA (EPA 2002, 2003).

The National Roads Authority guidance states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK Design Manual for Roads and Bridges guidance (UK Highways Agency 2007), on which the National Roads Authority guidance was based, states that road links meeting one or more of the following criteria can be defined as being ‘affected’ by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors which have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200 m of the chosen sensitive receptors inputs to the air dispersion model these consist of; road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles, annual average traffic speeds and background concentrations.

The UK Design Manual for Roads and Bridges guidance states that road links at a distance of greater than 200 m from a sensitive receptor will not influence pollutant concentrations at the receptor. Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The Design Manual for Roads and Bridges model uses conservative emission factors, the formulae for which are outlined in the Design Manual for Roads and Bridges Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the Proposed Scheme with these ambient air quality standards. The National Roads Authority *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (NRA 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. The National Roads Authority significance criteria have been adopted for the Proposed Scheme and are detailed in Table 12.2 to Table 12.4. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

Table 12.2: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 50 µg/m³	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥4 µg/m³	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m³
Medium	Increase / decrease 2 - <4 µg/m³	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m³
Small	Increase / decrease 0.4 - <2 µg/m³	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase / decrease <0.4 µg/m³	Increase / decrease <1 day	Increase / decrease <0.25 µg/m³

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

Table 12.3: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Moderate	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well Below Objective/Limit Value With Scheme (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

Table 12.4: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

12.2.2 Regional Impact Assessment (Including Climate)

The impact of the Proposed Scheme at a national / international level has been determined using the procedures given by the National Roads Authority (NRA 2011) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges (UK Highways Agency 2007). The assessment focused on determining the resulting change in emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) and carbon dioxide (CO_2). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

12.2.3 Conversion of NO_x to NO_2

NO_x ($NO + NO_2$) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGV's the proportion of NO_x emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

The National Roads Authority states the recommended method for the conversion of NO_x to NO_2 in *"Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes"* (NRA, 2011). The National Roads Authority guidelines recommend the use of the UK Department for Environment, Food and Rural Affairs NO_x to NO_2 calculator (UK DEFRA, 2014) which was originally published in 2009 and is currently on version 4.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NO_x emitted as NO for each Local Authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and the National Roads Authority guidance recommends the use of Craigavon as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO_2 and NO_x for Ireland. The "All other Urban UK Traffic" traffic mix option was used.

12.2.4 Ecological Sites

For routes which pass within 2 km of a designated area of conservation (either Irish or European designation) the National Roads Authority requires consultation with an Ecologist (NRA 2011). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed scheme and when significant changes in AADT (>5%) occur.

The National Roads Authority's *Guidelines for Assessment of Ecological Impacts of National Road Scheme*s (Rev. 2, National Roads Authority, 2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of the Environment, Heritage and Local Government, 2010) provide details regarding the legal protection of designated conservation areas.

If the assessment criteria, of a designated area of conservation within 200 m of the proposed development and a significant change in AADT flows, are met an assessment of the potential for impact due to nitrogen deposition should be assessed. While there is a Special Area of Conservation (South Dublin Bay SAC) and a Special Protected Area (South Dublin Bay and River Tolka) near to the site, they are no roads impacted with a 5% or greater increase in AADT within 200m of the Special Area of Conservation.

Where the proposed development is predicted to adversely impact concentrations by 2 $\mu g/m^3$ or more and causing overall concentrations to be within 10% of the 30 $\mu g/m^3$ limit, then the sensitivity of the habitat to NO_x should be assessed by the project Ecologist.

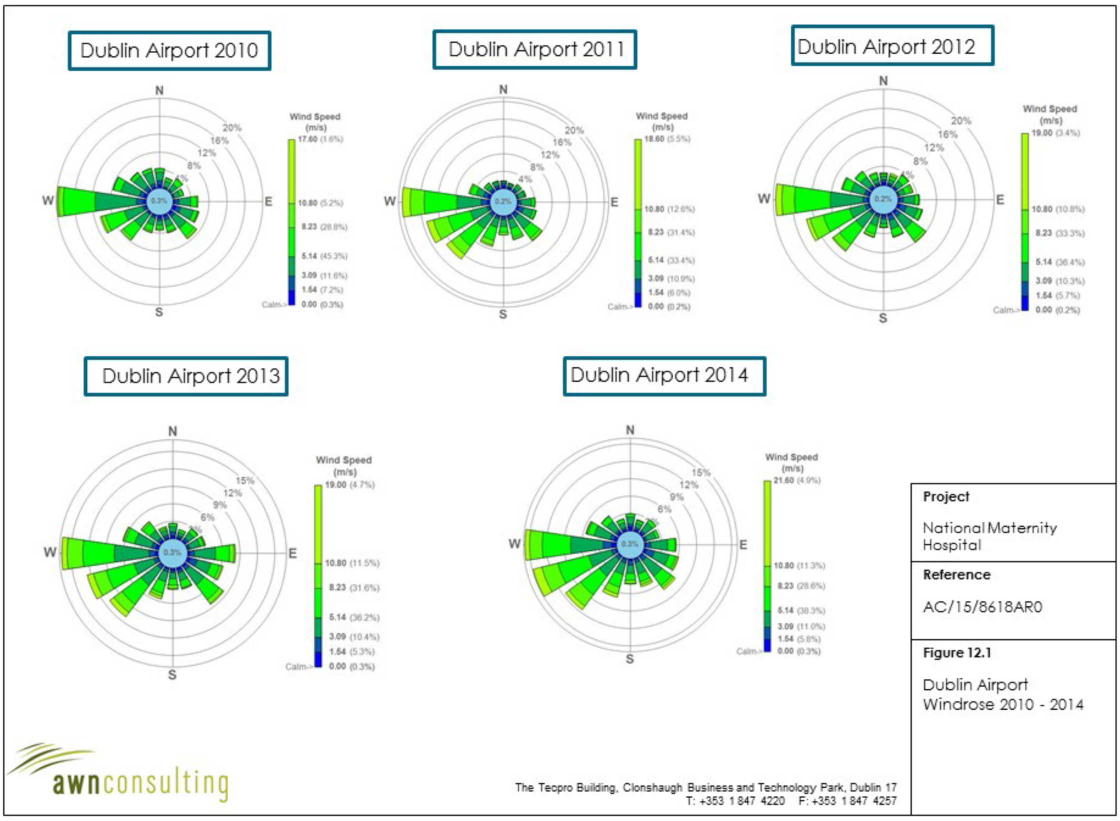
12.3 Receiving Environment

12.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (World Health Organisation, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 12 km north of the site. Dublin Airport Met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 12.1) For data collated during five representative years (2010-2014), the predominant wind direction is south-westerly. The average wind speed over the period 1981 – 2010 is approximately 5.3 m/s.

Figure 12.1: Dublin Airport Windroses 2010-2014



12.3.2 Trends In Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources (UK Highways Agency 2007). Thus, residential exposure is determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In 2011 the UK Department for Environment, Food and Rural Affairs published research (UK DEFRA 2011) on the long term trends in NO_2 and NO_x for roadside monitoring sites in the UK. This Study found a marked decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this study is that there now exists a gap between projected NO_2 concentrations which UK Department for Environment, Food and Rural Affairs previously published and monitored concentrations. The impact of this 'gap' is that the Design Manual for Roads and Bridges screening model can under-predict NO_2 concentrations predicted for future years. Subsequently, the UK Highways Agency published an Interim advice note (IAN 170/12) in order to correct the Design Manual for Roads and Bridges results for future years.

12.3.3 EPA Monitoring Data and Background Concentrations

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "*Air Quality Monitoring Annual Report 2014*" (EPA, 2015a), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2015b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, St. Vincent's University Hospital is within Zone A Dublin region (EPA, 2015a). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA at urban and suburban locations in Rathmines, Coleraine Street, Dun Laoghaire and Winetavern Street show that current levels of NO_2 are below both the annual and 1-hour limit values (see Table 12.5), with average long term annual mean concentrations ranging from 15 – 31 µg/m^3 in 2014. Sufficient data is available for the urban station at Rathmines to observe a downward trend over the period 2010-2014. This urban background station is located roughly 3.5 km from the site and therefore can provide a good indication of current background concentrations. The station has an average annual mean NO_2 concentrations of 20 µg/m^3 over the period of 2010-2014, with 2014 concentrations of 17 µg/m^3. Based on these results, a conservative estimate of the background NO_2 concentration in the region of St. Vincent's University Hospital in 2014 is 19 µg/m^3.

Table 12.5: Trends In Dublin City Air Quality - Nitrogen Dioxide (NO_2)

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year				
			2010	2011	2012	2013	2014
Rathmines	Urban Background	Annual Mean NO_2 ($\mu g/m^3$)Note 1	25	20	21	19	17
	Distance From Road = 3 m	Max 1-hr NO_2 ($\mu g/m^3$)Notes 2,3	[139]	[118]	[138]	[107]	[165]
Coleraine Street	Urban Traffic	Annual Mean NO_2 ($\mu g/m^3$)	33	26	26	26	25
	Distance From Road = 3 m	Max 1-hr NO_2 ($\mu g/m^3$)	[168]	[167]	[142]	[118]	[127]
Ringsend	Urban Traffic	Annual Mean NO_2 ($\mu g/m^3$)	29	32	25	-	-
		Max 1-hr NO_2 ($\mu g/m^3$)	[151]	[202]	[122]	-	-
Dun Laoghaire	suburban Background	Annual Mean NO_2 ($\mu g/m^3$)	23	18	18	16	15
		Max 1-hr NO_2 ($\mu g/m^3$)	[154]	[127]	[136]	[123]	
Wood Quay / Winetavern Street	Urban Traffic	Annual Mean NO_2 ($\mu g/m^3$)	35	34	29	31	31
	Distance From Road = 7 m	Max 1-hr NO_2 ($\mu g/m^3$)	[148]	[181]	[136]	[158]	[123]

Note 1 Annual average limit value - 40 $\mu g/m^3$ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 1-hour limit value - 200 $\mu g/m^3$ as a 99.8th%ile, i.e. not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 3 [ ]: represents the 99.8th%ile of maximum 1-hour concentrations.

Continuous PM_{10} monitoring carried out at the urban locations of Rathmines, Wood Quay and Ringsend showed average annual mean concentrations of 12 – 23 $\mu g/m^3$ over the 2010-2014 period, with at most 8 exceedances (in Rathmines) of the 24-hour limit value of 50 $\mu g/m^3$ (36 exceedances are permitted per year)(EPA, 2015a). The average annual mean concentration at Rathmines from 2010-2014 was 16 $\mu g/m^3$, based on the EPA data (Table 12.6). A conservative estimate of the background PM_{10} concentration in the region of St. Vincent's University Hospital in 2014 is 17 $\mu g/m^3$.

Table 12.6: Trends In Trends In Dublin City Air Quality - PM_{10}

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year				
			2010	2011	2012	2013	2014
Rathmines	Urban Background Distance From Road = 3 m	Annual Mean (µg/m³) Note 1	18	16	14	17	14
		24-hr Mean > 50 µg/m³ Note 2 (days)	10	2	8	8	3
Wood Quay / Winetavern St	Urban Traffic Distance From Road = 7 m	Annual Mean PM_{10} (µg/m³)	19	14	13	14	14
		24-hr Mean > 50 µg/m³ (days)	7	7	0	3	1
Ringsend	Urban Traffic	Annual Mean PM_{10} (µg/m³)	23	20	20	-	-
		24-hr Mean > 50 µg/m³ (days)	10	17	1	-	-
Phoenix Park	Suburban Background Distance From Road = 250m	Annual Mean PM_{10} (µg/m³)	11	12	11	14	12
		24-hr Mean > 50 µg/m³ (days)	1	3	0	3	0
Dun Laoghaire	Suburban Background	Annual Mean PM_{10} (µg/m³)	15	15	12	17	14
		24-hr Mean > 50 µg/m³ (days)	5	11	1	5	2

Note 1 Annual average limit value - 40 µg/m³ (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 24-hour limit value - 50 µg/m³ as a 90.4th%ile, i.e. not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

Continuous $PM_{2.5}$ monitoring carried out at the Zone A locations of Coleraine Street, Rathmines and Marino showed average levels of 7 - 9 µg/m³ respectively in 2014. The annual average level measured in Rathmines in 2014 was 9 µg/m³, with an average $PM_{2.5}/PM_{10}$ ratio of 0.64. Based on this information, a ratio of 0.64 was used to generate a background $PM_{2.5}$ concentration in the region of St. Vincent's University Hospital in 2014 of 11.0 µg/m³.

In terms of benzene, the annual mean concentration in Rathmines for 2014 was 0.94 µg/m^3. This is well below the limit value of 5 µg/m^3 (EPA, 2015a, 2015b). 2006 to 2014 annual mean concentrations ranged from 0.8 - 2.8 µg/m^3. Based on this EPA data, a conservative estimate of the background benzene concentration in St. Vincent's University Hospital in 2014 is 0.94 µg/m^3.

Background concentrations for Opening Year 2020 and Design Years 2030 have been calculated. These have used 2014 background concentrations and the year on year reduction factors provided by National Roads Authority in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* and the UK Department for Environment, Food and Rural Affairs LAQM.TG(09).

12.4 Characteristics of the Proposed Development

The proposed development will involve the development of the new National Maternity Hospital on St. Vincent's University Hospital Campus. The development has an opening year of 2020. When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

A. construction phase, and;
B. operational phase.

The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows or congestion in the local area which are associated with the development. The energy requirements of the site from boilers and generators may also give rise to some air emissions.

The construction phase will involve the demolition of a number of existing buildings and construction of the new hospital buildings, which has the potential to impact on St. Vincent's University Hospital. There will also be an extension to the St. Vincent's University Hospital multi-storey car park which will result in a net increase of 277 spaces on the campus, bringing the total number of spaces in the multi-storey car park to 922.

During the operational phase of the development there will be different sources of potential air quality impacts. The following describes the primary sources of potential air quality impacts which are deemed long term and which have been assessed in detail as part of this EIS.

12.5 Potential Impact of the Proposed Development

12.5.1 Construction Phase

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and PM_{10}/$PM_{2.5}$ emissions (Table 12.7). While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. As the development is on the grounds of St. Vincent's University Hospital Campus there are highly sensitive receptors within the immediate boundary of the site. In addition to construction dust, there is the potential for *Aspergillus* and asbestos impacts to occur.

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

Table 12.7: Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place (NRA 2011)

Source		Potential Distance for Significant Effects (Distance From Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads	25m	10m	10m

12.5.2 Operational Phase

12.5.2.1 Air Quality

There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}. The energy requirements of the site from boilers and generators may also give rise to some air emissions such as nitrogen dioxide and sulphur dioxide.

12.5.2.2 Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the development. Road traffic and space heating of buildings may give rise to CO_2 and N_2O emissions. There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO.

12.6 Mitigation Measures

In order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and operational phases associated with the proposed development.

12.6.1 Construction Phase

12.6.1.1Air Quality

The greatest potential impact on air quality during the construction phase is from construction dust emissions, PM_{10}/$PM_{2.5}$ emissions and the potential for nuisance dust, asbestos and aspergillus.

An Asbestos Report published in 2013 by About Safety Ltd. on behalf of St. Vincent's University Hospital found significant amounts of asbestos containing materials across the hospital including in the blocks which will be demolished as part of the enabling works for the proposed development. A Refurbishment and Demolition Survey of these buildings will be required prior to commencement the demolition phase. This is a fully intrusive asbestos containing materials survey which will involve destructive inspection. Prior to commencement of the demolition works, all asbestos containing materials identified by the Management Asbestos Survey and Refurbishment and Demolition Survey will be removed by a suitably trained and competent person. Asbestos containing materials will only be removed from site by a suitably permitted/licensed waste contractor and will be brought to a suitably licensed facility. The Health and Safety Authority should be contacted in relation to the handling of asbestos and material should be dealt with in accordance with the Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006, as amended and associated approved Codes of Practice.

In relation to aspergillus, prevention works will take place before construction commences. The prevention works will involve sealing the windows to the facades of the east side of the Dermatology Unit, Our Ladys and Herbert Wing block and the catering block. These works will form part of an Aspergillus Prevention Plan and will ensure the prevention of Aspergillus spores spreading.

In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Due to the sensitivity of St. Vincent's University Hospital, additional mitigation measures recommended in the Institute of Air Quality Management *Guidance on the Assessment of Dust from Demolition and Construction* (2014) for sensitive receptors have been included. Provided the dust minimisation measures outlined in the Plan (see Appendix 12.3) and construction management plan are adhered to, the air quality impacts during the construction phase should be not be significant.

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

12.6.1.2 Climate

Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works the impact on climate will not be significant.

12.6.2 Operational Phase

12.6.2.1 Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (REGULATION (EC) No 715/2007) for passenger cars to be complied with in 2009 (Euro V) and 2014 (Euro VI). With regard to heavy duty vehicles, EU Directive 2005/78/EC defines the emission standard currently in force, Euro IV, as well as the next stage (Euro V) which has entered into force since October 2009. In addition, it defines a non-binding standard called Enhanced Environmentally-friendly Vehicle (EEV). In relation to fuel quality, SI No. 407 of 1999 and SI No. 72 of 2000 have introduced significant reductions in both sulphur and benzene content of fuels.

Emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems (UK Department for Environment, Food and Rural Affairs, 2009b).

12.6.2.2 Climate

Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fueled vehicles and the introduction of cleaner fuels.

CO_2 emissions for the average new car fleet were reduced to 120 g/km by 2012 through EU legislation on improvements in vehicle motor technology and by an increased use of biofuels. This measure has reduced CO_2 emissions from new cars by an average of 25% in the period from 1995 to 2008/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU has been met by this measure alone (Department of Environment, Heritage and Local Government, 2000).

Additional measures included in the National Climate Change Strategy (Department of Environment, Heritage and Local Government, 2006, 2007) include: (1) VRT and Motor Tax rebalancing to favour the purchase of more fuel-efficient vehicles with lower CO_2 emissions; (2) continuing the Mineral Oils Tax Relief II Scheme and introduction of a biofuels obligation scheme; (3) implementation of a national efficient driving awareness campaign, to promote smooth and safe driving at lower engine revolutions; and (4) enhancing the existing mandatory vehicle labelling system to provide more information on CO_2 emission levels and on fuel economy.

12.7 Predicted Impacts of the Proposed Development

12.7.1 Construction Phase

12.7.1.1 Air Quality

When the dust minimisation measures detailed in the mitigation section of this Chapter and construction management plan as shown in the appendix of Chapter 2 are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Chapter 13 discusses the impact of wind on St. Vincent’s University Hospital Campus and found that as construction progresses, that wind conditions will remain the same or become calmer at the majority of areas, a small number of areas will become one category windier. Once the mitigation measures discussed in Appendix 12.3 and the construction management plan are put in place it is predicted that the dust impact on any areas which experience increased wind will be imperceptible.

12.7.1.2 Climate

Due to the size and nature of the construction activities with appropriate mitigation measures, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

12.7.2 Operational Phase

12.7.2.1 Local Air Quality

The results of the air dispersion modelling study indicate that the residual impacts of the proposed development on air quality and climate are predicted to be imperceptible with respect to the operational phase local air quality assessment for the long and short term.

The receptors modelled represent the worst-case locations close to the proposed development and were chosen due to their close proximity (within 200 m) to the road links impacted by proposed development. The worst case traffic data from a October 2014 assessment used in this assessment is shown in Table 12.8, with the percentage of HGV's shown in parenthesis below the AADT. A subsequent assessment in January 2017 shows that traffic volumes had decreased by 3 - 4% at peak times at the junction since the original surveys, indicating that the 2014 surveys remain valid, worst-cast and offer a robust assessment.

Sensitive receptors in the vicinity of the proposed development are predominately residential. Seven sensitive receptors have been chosen as they have the potential to be adversely impacted by the development, these receptors are shown in Table 12.9 and Figure 12.2.

Table 12.8: Traffic Data used in this Assessment

Link	Road Name	Base Year	Do-Nothing		Do-Something	
		2014	2020	2030	2020	2030
1	Merrion Road (north of Merrion Road/ Ailsebury Rd junction)	22756 (2.9%)	22756 (2.8%)	22756 (2.8%)	23303 (2.8%)	23303 (2.8%)
2	Merrion Road (south of Merrion Road/ Ailsebury Rd junction)	25556 (3%)	25556 (2.9%)	25556 (2.9%)	26219 (2.9%)	26219 (2.9%)
3	Merrion Road (north of Merrion Road/ Nutley Lane junction)	25238 (3.1%)	25238 (3%)	25238 (0%)	25901 (3%)	25901 (3%)
4	Merrion Road (south of Merrion Road/ Nutley Lane junction)	20365 (3.2%)	20365 (3.1%)	20365 (0%)	20800 (3.1%)	20800 (3.1%)
5	Merrion Road (south of Merrion Road/ SVUH Access junction)	20358 (3.5%)	20358 (3.4%)	20358 (0%)	20918 (3.4%)	20918 (3.4%)
6	Merrion Road (north of Merrion Road/ Strand Rd junction)	19841 (3.2%)	19841 (3.1%)	19841 (0%)	20401 (3.1%)	20401 (3.1%)
7	Merrion Road (south of Merrion Road/ Strand Rd junction)	32454 (3.2%)	32454 (3.1%)	32454 (3.1%)	32992 (3.1%)	32992 (3.1%)
8	Nutley Lane (east of Nutley Lane/Tesco Access Junction)	12015 (2.4%)	12015 (2.3%)	12015 (2.3%)	12335 (2.3%)	12335 (2.3%)
9	Nutley Lane (east of Nutley Lane/Nutley	11495	11495	11495	11815	11815

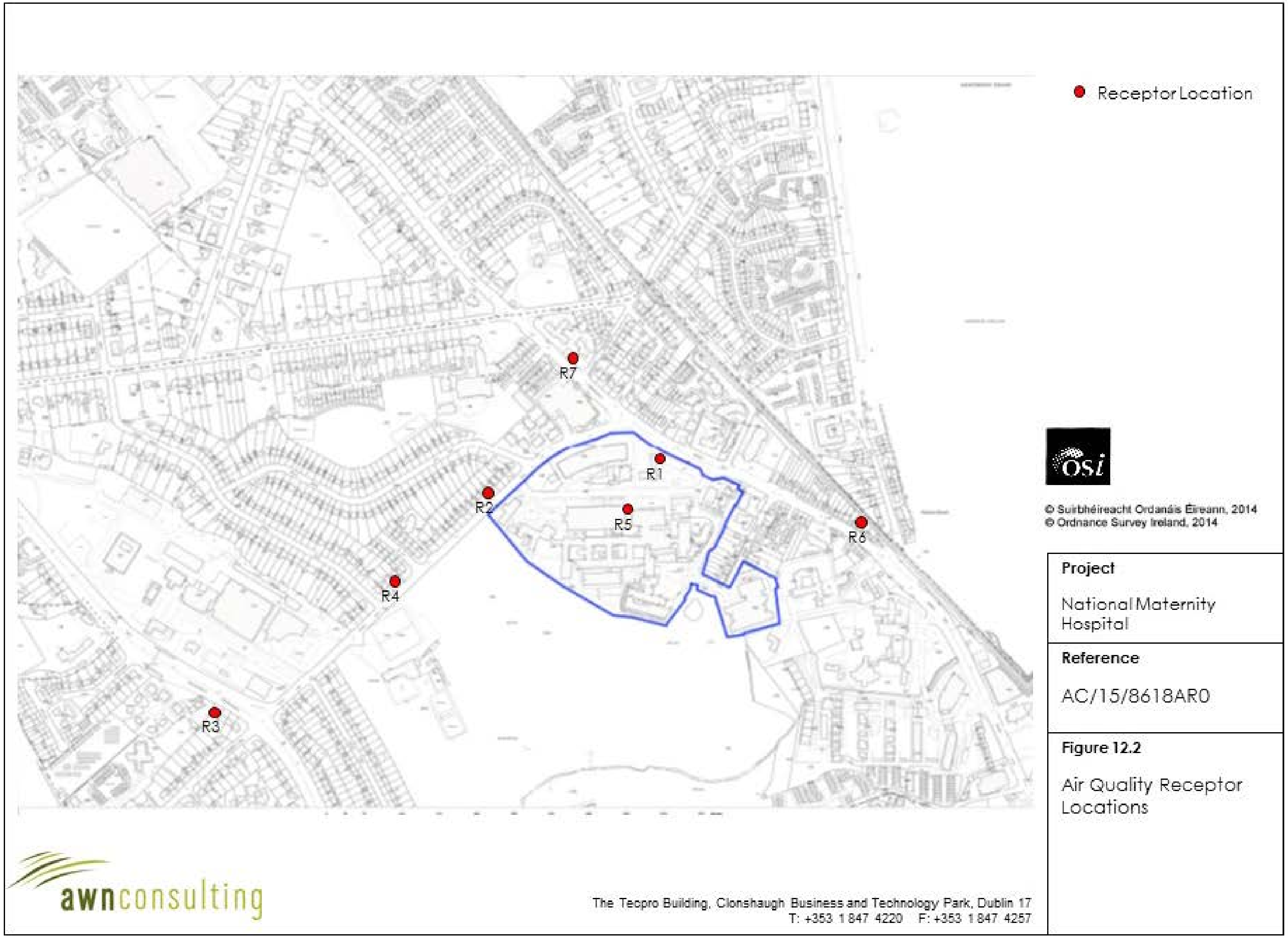
Link	Road Name	Base Year	Do-Nothing		Do-Something	
		2014	2020	2030	2020	2030
	Avenue Junction)	(2.4%)	(2.4%)	(2.4%)	(2.4%)	(2.4%)
10	Nutley Lane (east of Nutley Lane/SVUH Access Junction)	12164 (2.3%)	12164 (2.2%)	12164 (2.2%)	12485 (2.2%)	12485 (2.2%)
11	Nutley Lane (east of Nutley Lane/Nutley Rd Junction)	16400 (1.9%)	16400 (1.7%)	16400 (1.7%)	17583 (1.7%)	17583 (1.7%)
12	Nutley Lane (east of N11/Nutley Lane Junction)	18889 (2%)	18889 (1.9%)	18889 (1.9%)	20012 (1.9%)	20012 (1.9%)
13	N11 (north of N11/Nutley Lane Junction)	39708 (4.8%)	39708 (4.7%)	39708 (4.7%)	39953 (4.7%)	39953 (4.7%)
14	N11 (south of N11/Nutley Lane Junction)	50370 (4.2%)	50370 (4.1%)	50370 (4.1%)	51226 (4.1%)	51226 (4.1%)

Note: Traffic data expressed in AADT, percentage HGV shown in parenthesis

Table 12.9: Description of Sensitive Receptors (UTM Co-ordinates)

Name	Receptor Type	X	Y
R1	St Rita's	685732	5911275
R2	Residential	685425	5911208
R3	Residential	684916	5910786
R4	Residential	685240	5911022
R5	Hospital	685670	5911179
R6	Residential	686124	5911133
R7	Residential	685565	5911454

Figure 12.2: Sensitive Receptors Location Map



12.7.2.2 "Do Something' Modelling Assessment'

The National Roads Authority Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. Therefore, in order to assess the impact of the scheme using the 'Do Something' modelling scenario, the 'Do Nothing' modelling scenario must first be assessed.

"Do Nothing" Scenario

CO and Benzene

The results of the "do nothing" modelling assessment for CO and benzene in the opening and design years are shown in Table 12.10 and Table 12.11. Concentrations are well within the limit values at all worst-case receptors. Levels of both pollutants are at maximum 25% and 5% of the respective limit values in 2020, and 20% and 4% in 2030.

PM_{10}

The results of the "do nothing" modelling assessment for PM_{10} in the opening and design years are shown in Table 12.12. Concentrations are well within the annual limit value at all worst-case receptors. In addition, the 24-hour PM_{10} concentration of 50 μg/m^3, which can only be exceeded 35 times per year within the limit, is found to be in compliance at all receptors (Table 12.13). There is only one day of exceedance predicted at any of the seven receptors. Annual average PM_{10} concentrations are 45% of the limit value in 2020 and 44% in 2030.

$PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ in the opening and design years are shown in Table 12.14. The predicted concentrations at all worst-case receptors are well below the $PM_{2.5}$ limit value of 25 μg/m^3. The annual average $PM_{2.5}$ concentration peaks at 47% of the limit value in 2020 and 46% in 2030.

NO_2

The results of the “do nothing” assessment of annual average NO_2 concentrations in the opening and design years are shown in Table 12.15 for the Highways Agency IAN 170/12 and Table 12.16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The purpose of IAN 170/12 was to account for the conclusions of UK’s Department for Environment, Food and Rural Affairs advice on long term trends that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in UK Department for Environment, Food and Rural Affairs technical guidance and observed trends. Hence the projections calculated via the IAN 170/12 technique show a slower than previously predicted reduction between the base year and future year predictions. The concentrations are below the limit value at all locations, with levels ranging up to 63% of the limit value in 2020 and 57% in 2030, using the more conservative IAN prediction.

The hourly limit value for NO_2 is 200 $\mu g/m^3$ is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the “do nothing” scenario is not predicted to be exceeded in either 2020 or 2030 (Table 12.17).

“Do Something” Scenario

CO and Benzene

The results of the modelled impact of the scheme for CO and benzene in the opening and design years are shown in Table 12.10 and Table 12.11 respectively. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of both pollutants range from 25% to 5% of the respective limit values in 2020, for 2030 the predicted concentrations are 20% and 4% of the limit values respectively. Future trends indicate similarly low levels of CO and benzene. There are some increases in traffic flows between 2020 and 2030, therefore any reduction in concentrations is due to reduced background concentrations and greater efficiencies predicted in engines.

The impact of the proposed development can be assessed relative to “Do nothing” levels in 2020 and 2030. Relative to baseline levels, some imperceptible increases in pollutant levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on CO and benzene concentrations in either 2020 or 2030 will be an increase of 0.078% of their respective limit values at Receptor 6. Thus, using the assessment criteria for NO_2 and PM_{10} and applying these criteria to CO and benzene, the impact of the proposed development in terms of CO and benzene is negligible.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} in the opening and design years are shown in Table 12.12. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors with levels 45% of the limit value in 2020. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year within the limit, is found to be in compliance at all receptors. It is predicted that the worst case receptors will have one exceedance of the 50 µg/m^3 24-hour mean value in 2020 and 2030 (Table 12.13). Future trends with the proposed development in place indicate similarly low levels of PM_{10}. Annual average PM_{10} concentrations are 44% of the limit in 2030.

The impact of the proposed development can be assessed relative to “Do nothing” levels in 2020 and 2030. Relative to baseline levels, some imperceptible increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed development. With regard to impacts at individual receptors, none of the seven receptors assessed will experience an increase in concentrations of over 0.035% of the limit value in 2020 and 2030. Thus the magnitude of the changes in air quality are imperceptible at all receptors based on the criteria outlined in Table 12.2 to Table 12.4.

The greatest impact on PM_{10} concentrations in the region of the proposed development in either 2020 or 2030 will be an increase of 0.035% of the annual limit value at Receptor 4. Thus, using the assessment criteria outlined in Table 12.2 and Table 12.3, the impact of the proposed development with regard to PM_{10} is negligible at all seven of the receptors assessed.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ in the opening and design years are shown in Table 12.14. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors, with levels of 47% of the limit value in 2020. Future trends with the proposed development in place indicate similarly low levels of $PM_{2.5}$. Annual average $PM_{2.5}$ concentrations are also 46% of the limit in 2030.

The impact of the proposed development can be assessed relative to “Do nothing” levels in 2020 and 2030. Relative to baseline levels, imperceptible increases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed development. None of the seven receptors assessed will experience an increase or decrease in concentrations of over 0.037% of the limit value in 2020 and 2030. Thus, the magnitude of the changes in air is negligible at all receptors based on the criteria outlined in Table 12.2 and Table 12.3.

NO_2

The result of the assessment of the impact of the proposed development for NO_2 in the opening and design years are shown in Table 12.15 for the Highways Agency IAN 170/12 and Table 12.16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The annual average concentration is within the limit value at all worst-case receptors using both the UK Department for Environment, Food and Rural Affairs and more conservative IAN technique. Levels of NO_2 are 62% and 57% of the annual limit value in 2020 and 2030 using the IAN technique, while concentrations are 49% and 41% of the annual limit value in 2020 and 2030 using the UK Department for Environment, Food and Rural Affairs technique. Maximum one-hour NO_2 levels with the proposed development in place are not predicted to exceed using either technique. The impact of the proposed development on annual mean NO_2 levels can be assessed relative to “Do nothing” levels in 2020 and 2030. Relative to baseline levels, some imperceptible increases in pollutant levels are predicted as a result of the proposed development. With regard to impacts at individual receptors, none of the seven receptors assessed will experience an increase in concentrations of over 0.19% of the limit value in 2020 and 2030. Thus, using the assessment criteria outlined in Table 12.2 to Table 12.3, the impact of the proposed development in terms of NO_2 is negligible at all seven of the receptors assessed.

The hourly limit value for NO_2 is 200 μg/m^3 is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the “do nothing” scenario is not predicted to be exceeded in either 2020 or 2030 (Table 12.17).

Table 12.10: Maximum 8-hour CO Concentrations (mg/m³)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	2.27	2.27	0.003	Imperceptible	Negligible Increase	2.25	2.25	0.003	Imperceptible	Negligible Increase
2	2.18	2.18	0.005	Imperceptible	Negligible Increase	2.18	2.18	0.005	Imperceptible	Negligible Increase
3	2.31	2.31	0.002	Imperceptible	Negligible Increase	2.26	2.26	0.002	Imperceptible	Negligible Increase
4	2.18	2.18	0.005	Imperceptible	Negligible Increase	2.18	2.18	0.005	Imperceptible	Negligible Increase
5	2.04	2.04	0.001	Imperceptible	Negligible Increase	2.04	2.04	0.001	Imperceptible	Negligible Increase
6	2.54	2.54	0.005	Imperceptible	Negligible Increase	2.42	2.43	0.004	Imperceptible	Negligible Increase
7	2.38	2.39	0.004	Imperceptible	Negligible Increase	2.38	2.39	0.004	Imperceptible	Negligible Increase

Table 12.11: Annual Mean Benzene Concentrations (µg/m³)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	0.16	0.16	0.002	Imperceptible	Negligible Increase	0.16	0.16	0.001	Imperceptible	Negligible Increase
2	0.13	0.13	0.001	Imperceptible	Negligible Increase	0.13	0.13	0.001	Imperceptible	Negligible Increase
3	0.21	0.21	0.002	Imperceptible	Negligible Increase	0.19	0.19	0.001	Imperceptible	Negligible Increase
4	0.13	0.13	0.001	Imperceptible	Negligible Increase	0.13	0.13	0.001	Imperceptible	Negligible Increase
5	0.10	0.10	0.000	Imperceptible	Negligible Increase	0.10	0.10	0.000	Imperceptible	Negligible Increase
6	0.25	0.26	0.004	Imperceptible	Negligible Increase	0.22	0.22	0.003	Imperceptible	Negligible Increase
7	0.21	0.22	0.003	Imperceptible	Negligible Increase	0.21	0.21	0.003	Imperceptible	Negligible Increase

Table 12.12: Annual Mean PM_{10} Concentrations (µg/m³)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	17.2	17.2	0.01	Imperceptible	Negligible Increase	17.2	17.2	0.01	Imperceptible	Negligible Increase
2	16.9	16.9	0.01	Imperceptible	Negligible Increase	16.9	17.0	0.01	Imperceptible	Negligible Increase
3	17.4	17.4	0.01	Imperceptible	Negligible Increase	17.3	17.3	0.01	Imperceptible	Negligible Increase
4	16.9	16.9	0.01	Imperceptible	Negligible Increase	16.9	17.0	0.01	Imperceptible	Negligible Increase
5	16.5	16.5	0.00	Imperceptible	Negligible Increase	16.5	16.5	0.00	Imperceptible	Negligible Increase
6	18.0	18.0	0.01	Imperceptible	Negligible Increase	17.7	17.7	0.01	Imperceptible	Negligible Increase
7	17.6	17.6	0.01	Imperceptible	Negligible Increase	17.6	17.6	0.01	Imperceptible	Negligible Increase

Table 12.13: Number of days with PM_{10} concentration > 50 µg/m³

Receptor	Opening Year (2020)		Design Year (2030)	
	DM	DS	DM	DS
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1

Table 12.14: $PM_{2.5}$ Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	11.2	11.2	0.01	Imperceptible	Negligible Increase	11.2	11.2	0.01	Imperceptible	Negligible Increase
2	11.0	11.0	0.01	Imperceptible	Negligible Increase	11.0	11.0	0.01	Imperceptible	Negligible Increase
3	11.3	11.3	0.00	Imperceptible	Negligible Increase	11.2	11.2	0.00	Imperceptible	Negligible Increase
4	11.0	11.0	0.01	Imperceptible	Negligible Increase	11.0	11.0	0.01	Imperceptible	Negligible Increase
5	10.7	10.7	0.00	Imperceptible	Negligible Increase	10.7	10.7	0.00	Imperceptible	Negligible Increase
6	11.7	11.7	0.01	Imperceptible	Negligible Increase	11.5	11.5	0.01	Imperceptible	Negligible Increase
7	11.4	11.4	0.01	Imperceptible	Negligible Increase	11.4	11.4	0.01	Imperceptible	Negligible Increase

Table 12.15: Annual Mean NO_2 Concentrations (µg/m³) (using Interim advice note 170/12 V3 Long Term NO_2 Trend Projections)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	22.2	22.2	0.03	Imperceptible	Negligible Increase	20.4	20.5	0.06	Imperceptible	Negligible Increase
2	20.8	20.9	0.07	Imperceptible	Negligible Increase	19.3	19.4	0.09	Imperceptible	Negligible Increase
3	23.2	23.2	0.01	Imperceptible	Negligible Increase	21.3	21.4	0.04	Imperceptible	Negligible Increase
4	20.8	20.9	0.07	Imperceptible	Negligible Increase	19.3	19.4	0.09	Imperceptible	Negligible Increase
5	18.9	18.9	0.01	Imperceptible	Negligible Increase	17.5	17.5	0.02	Imperceptible	Negligible Increase
6	25.1	25.1	0.03	Imperceptible	Negligible Increase	22.8	22.9	0.08	Imperceptible	Negligible Increase
7	24.1	24.1	0.04	Imperceptible	Negligible Increase	22.2	22.3	0.07	Imperceptible	Negligible Increase

Table 12.16: Annual Mean NO_2 Concentrations ($\mu g/m^3$) (using UK Department for Environment, Food and Rural Affairs Technical Guidance)

Receptor	Impact Opening Year (2020)					Impact Design Year (2030)				
	DM	DS	DS-DM	Magnitude	Description	DM	DS	DS-DM	Magnitude	Description
1	17.0	17.0	0.02	Imperceptible	Negligible Increase	13.9	13.9	0.04	Imperceptible	Negligible Increase
2	15.8	15.9	0.05	Imperceptible	Negligible Increase	12.8	12.8	0.06	Imperceptible	Negligible Increase
3	17.9	17.9	0.01	Imperceptible	Negligible Increase	14.6	14.7	0.03	Imperceptible	Negligible Increase
4	15.8	15.9	0.05	Imperceptible	Negligible Increase	12.8	12.8	0.06	Imperceptible	Negligible Increase
5	14.0	14.0	0.01	Imperceptible	Negligible Increase	11.0	11.0	0.01	Imperceptible	Negligible Increase
6	19.7	19.7	0.02	Imperceptible	Negligible Increase	16.2	16.2	0.06	Imperceptible	Negligible Increase
7	18.8	18.8	0.03	Imperceptible	Negligible Increase	15.6	15.6	0.05	Imperceptible	Negligible Increase

Table 12.17: 99.8th percentile of daily maximum 1-hour for NO_2 concentrations ($\mu g/m^3$)

Receptor	IAN 170/12 V3 Long Term NO_2 Trend Projections Technique				Defra's Technical Guidance Technique			
	Opening Year (2020)		Design Year (2030)		Opening Year (2020)		Design Year (2030)	
	DM	DS	DM	DS	DM	DS	DM	DS
1	77.6	77.6	71.6	71.8	77.6	77.6	71.6	71.8
2	72.9	73.1	67.5	67.8	72.9	73.1	67.5	67.8
3	81	81.1	74.7	74.8	81	81.1	74.7	74.8
4	72.9	73.1	67.5	67.8	72.9	73.1	67.5	67.8
5	66	66	61.1	61.2	66	66	61.1	61.2
6	87.8	87.8	79.9	80.2	87.8	87.8	79.9	80.2
7	84.2	84.3	77.9	78.1	84.2	84.3	77.9	78.1

12.7.2.3 Regional Air Quality Impacts

The regional impact of the development of the new National Maternity Hospital on emissions of NO_x and VOCs has been assessed using the procedures of the National Roads Authority (NRA, 2011) and the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2007). The results (see Table 12.18) indicate that the impact of the proposed development on Ireland's obligations under the Targets set out by "*Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*" are negligible. For the assessment year of 2020, the predicted impact of the changes in AADT is to decrease NO_x levels by 0.000466% of the NO_x emissions ceiling and decrease VOC levels by 0.000187% of the VOC emissions ceiling to be complied with in 2020. For the assessment year of 2030, the predicted impact of the changes in AADT is to decrease NOx levels by 0.000937% of the NO_x emissions ceiling and decrease VOC levels by 0. 0002025% of the VOC emissions ceiling to be complied with in 2030.

12.7.2.4 Regional Climate Impacts

The impact of the development of the new National Maternity Hospital on emissions of CO_2 were also assessed using the Design Manual for Roads and Bridges screening model (see Table 12.18). The results show that the impact of the proposed road in 2020 will be to decrease CO_2 emissions by 0.0000003642% of Ireland's EU 2020 Target. In the design year of 2030, the proposed road will decrease CO_2 emissions by 0.0000003644% of EU 2020 Target. Thus, the impact of the proposed road development on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the EU 2020 Target (EPA, 2013).

Table 12.18: Regional Air Quality Assessment.

Year	Scenario	VOC (kg/annum)	NO_X (kg/annum)	CO_2 (tonnes/annum)
2020	Do Nothing	13556	13556	7720
	Do Something	13818	13818	7874
2030	Do Nothing	13346	13346	7725
	Do Something	13603	13603	7879
Increment in 2020		87 kg	261.3 kg	153.3 Tonnes
Increment in 2030		86.5 kg	257.7 kg	15 3.4 Tonnes
Emission Ceiling (kilo Tonnes) 2020		46.5 Note 1	56.1 Note 1	42,100 Note 2
Emission Ceiling (kilo Tonnes) 2030		42.2 Note 1	27.5 Note 1	42,100 Note 2
Impact in 2020 (%)		0.000187 %	0.000466 %	0.0000003642 %
Impact in 2030 (%)		0.0002053 %	0.000937 %	0.0000003644 %

Note 1 Targets under the "*Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*"

Note 2 20-20-20 Climate and Energy Package

12.7.2.5 Impacts due to Energy Requirements of Site

There is the potential for air emissions as a result of the energy requirements of the proposed development. Boilers, generators and CHP engines are likely to emit Nitrogen Oxides (NOx) when in operation. The heat and energy requirements on site are proposed to be provided by the installation of a 500kW gas fired combined heat and power plant.

The EPA's "*Integrated Pollution Prevention and Control Licensing Application Guidance Notes*" (EPA, 2012) state that as a rule, gas boilers over 5MW are to be regarded as significant. Boilers below these sizes are classified as minor emissions. Therefore, the proposed 500kW combined heat and power plant is a minor emission point and does not require detailed assessment. However, this CHP will be combined with the five boilers which will be required for The St. Vincent's University Campus, therefore, a conservative screening modelling assessment has been conducted.

Air emissions from the energy center have been modelled using the United States Environmental Protection Agency approved AERSCREEN air dispersion model (United States Environmental Protection Agency, 2011). AERSCREEN is an approved regulatory screening model which uses a full set of meteorological conditions including all stability classes and wind speeds to find the maximum short-term impact. Screening models are usually applied before a refined air quality model to determine if more detailed modelling is needed. Thus AERSCREEN is designed to be conservative in its prediction of ambient pollutant concentrations.

The AERSCREEN model requires a number of site specific stack input parameters in order to carry out the dispersion modelling predictions. In this assessment the five boilers and CHP have been combined into one emission point (stack), with a worst-case approach taken to input parameters. These site specific stack input parameters include the following and are outlined below.

- NO_x Emission rate (g/sec) – 0.91 g/sec;
- Stack height (m) – 43.3 m;
- Stack diameter (m) – 0.4 m;
- Stack exit velocity (m/s) – 10 m/s;
- Stack gas temperature (K) – 383 K.

Buildings can influence the passage of airflow over the emission point and draw plumes down towards the ground (termed building downwash). Information on building dimensions was also input into the model in order to calculate building downwash effects.

- Building Height (m) – 38.13 m;
- Minimum Horizontal Building Diameter (m) – 54 m;
- Maximum Horizontal Building Diameter (m) – 133 m.

The modelling results for release of NO_2 from the facility lead to an ambient NO_2 annual mean contribution of 8.5 µg/m^3 and a maximum predicted 1-hour concentration of 85.1 µg/m^3, which peaks at a distance of 125 m from the stack. With shorter and longer distance from this peak location contributions drop significantly. Combining the stack contribution with the maximum predicted 1- hour results at Receptor 1, located 185 m from the stack, leads to a worst case maximum predicted 1-hour concentration of 162.7 µg/m^3 and annual mean concentration of 30.7 µg/m^3 (Table 12.19).

The conservative model results show that predicted ambient concentrations of NO_2 are below the short term and long term limit values at a stack height of 47.3 m. Thus, the impact of the energy center facility on ambient air quality in the region will not require further detailed modelling to be carried out to confirm whether the emissions from these stacks will lead to a breach of the ambient air quality standards.

Table 12.19: NO_2 Concentration Contributions at Worst Case Receptor

Contribution at Receptor 1	1 Hour 99.8th%ile NO_2 Concentrations ($\mu g/m^3$)				IAN 170/12 V3 Long Term NO2 Trend Projections Technique			
	Opening Year (2020)		Design Year (2030)		Opening Year (2020)		Design Year (2030)	
	DM	DS	DM	DS	DM	DS	DM	DS
Background (NO_2)	47.1	47.1	36.8	36.8	13.5	13.5	10.5	10.5
DMRB (including background)	77.6	77.6	71.6	71.8	22.2	22.2	20.4	20.5
Energy Centre(NO_2)	85.1	85.1	85.1	85.1	8.5	8.5	8.5	8.5
Total Concentration (NO_2)	162.7	162.7	156.7	156.9	30.7	30.7	29.0	29.0

12.7.3 'Do Nothing' Scenario

12.7.3.1 'Do Nothing' Modelling Assessment

The do-nothing modeling assessment has been assessed under the section 12.7.2. The assessment in this order was completed to facilitate calculation of the local air quality impact in accordance with the UK Design Manual for Roads and Bridges Methodology. It was found that all assessed pollutant concentrations were between 4% and 76% of their respective ambient air quality standards.

12.7.4 'Worst Case Scenario

Due to the sensitive nature of St. Vincent's University Hospital Campus, worst case construction and operational phase impacts have been assumed to be worst case throughout the assessment.

Potential construction phase impacts have been taken to be worst case and therefore strict mitigation measures have been outlined in a dust minimisation plan (Appendix 13.3) and construction management plan. The mitigation measures for dust are designed with a number of layers of protocol, therefore if one fails in the short-term it, should, be eliminated by the next. Construction dust monitoring should be put in place to ensure should mitigation measures fail and construction dust impacts occur they will be short term in nature.

As stated in the previous sections, worst case receptors and traffic data have been chosen when modelling air quality impacts in the operational phase. These receptors are located on road links which will experience traffic impacts due to the development of the new National Maternity Hospital. Therefore, it is assumed that the predicted impact discussed in Section 12.7.2 is the worst case operational impact.

12.8 Monitoring

AWN recommend that monitoring of dust deposition levels (via the Bergerhoff method) takes place at a number of locations at the site boundary of the proposed development to ensure that dust nuisance is not occurring at nearby sensitive receptors. This methodology will ensure that the dust mitigation measures outlined in the dust minimisation plan (Appendix 12.3) remain effective.

12.9 Reinstatement

This is not applicable to the air quality & climate assessment.

12.10 Interactions and Potential Cumulative Impacts

This section considers the interactions between air quality with other specialties reviewed within the EIS. The cumulative impacts between the development of the new National Maternity Hospital on the St. Vincent’s University Campus and other developments which have been granted planning permission in the area have also been considered.

12.10.1 Interactions

Air Quality does not have a significant number of interactions with other chapters. The most significant interactions are between Human Beings and Air Quality. An adverse impact due to air quality in either the construction or operational phase has the potential to cause health and dust nuisance issues.

The mitigation measures that will be put in place at the development of the new National Maternity Hospital will ensure that the impact of the development complies with all ambient air quality legislative limits and therefore the predicted impact is long term and neutral with respect to human beings.

Interactions between Air Quality and Traffic are significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The development of the new National Maternity Hospital impact on air quality is assessed by reviewing the change in annual average daily traffic on roads close to St. Vincent's University Hospital Campus. In this assessment the impact of the interactions between traffic and air quality are not significant.

The construction and operation of the proposed development will lead to emissions to atmosphere which have the potential to impact on sensitive fora, fauna and water. However, the effect of these emissions is predicted to be neutral for both the construction and operational phase. Construction phase mitigation measures will minimise dust emissions which have the potential to impacts on flora, fauna and water. In the operational phase, impacts meet the criteria set down for ecological sensitive site as discussed in Section 12.2.4 and therefore the interactions between air quality and flora, fauna and water are neutral for both the construction and operational phase.

The change in the microclimate during the construction phase has the potential to impact air flows, and therefore dust dispersion in the area surrounding the building. However, the impact is predicated to be neutral once mitigation measures as discussed in Appendix 12.3 and are put in place.

With the appropriate mitigation measures in place for the can It is predicted that any interactions on Soil, Geology and Noise are neutral.

12.10.2 Potential Cumulative Impacts

There are a number of other significant developments in the vicinity of the proposed subject development which have been granted planning permission. These include the construction of sheltered housing on Park Avenue (c. 3,341sq.m gross floor space, area does not include floor area to be demolished: c.1,360sq.m) (Reg. Ref: 3034/13), a c. 3,146sqm gross floor space extension of a nursing home on the Merrion Road (Reg. Ref: 3704/14), a new broadcasting facility at RTE with permission for c. 103,553 sq.m gross floor space and demolition of: c.13,640sq.m (Reg. Ref: 4057/09) and alterations of office space of c. 11,305 gross floor space - offices (area does not include floor area to be demolished: c. 2,923sq.m) on RDS lands (Reg. Ref: 2876/15).

Only one (the new broadcasting facility at RTE) of these schemes conducted an air quality impact assessment as part of planning permission. The results of this assessment were that, with appropriate mitigation measures, the impact is predicted to be negligible during the construction and operational phases.

Should the construction phases of the development of the new National Maternity Hospital and the above permitted developments coincide, it is predicted that once appropriate mitigations are put in place during the construction for the above schemes, impacts will not be significant. The cumulative impact of the permitted developments and the development of the new National Maternity Hospital are also predicted to cause insignificant impacts during the operational phase with respect to local air quality for the long and short term.

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