The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.

T: + 353 1 847 4220
F: + 353 1 847 4257
E: info@awnconsulting.com
W: www.awnconsulting.com

AIR QUALITY IMPACT ASSESSMENT FOR DOLCAIN HOUSE, CLONDALKIN, DUBLIN 22

Technical Report Prepared For

Randelswood Holdings Ltd.,
36 Mount Street Upper,
Dublin 2.

Technical Report Prepared By

Niamh Nolan BSocSci AMIAQM

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Dublin Office
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.
T: + 353 1 847 4220
F: + 353 1 847 4257

AWN Consulting Limited
Registered in Ireland No. 319812
Directors: F Callaghan, C Dilworth,
T Donnelly, T Hayes, D Kelly, E Porter

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EXECUTIVE SUMMARY

AWN Consulting Ltd. were commissioned to investigate the potential air quality impacts associated with the proposed development at the Dolcain House site, Clondalkin, Dublin 22. The potential impacts and the outcome of the assessment are summarised below.

Impacts to air quality can occur during both the construction and operational phases of the proposed development. With regard to the construction stage the greatest potential for air quality impacts is from fugitive dust emissions impacting nearby sensitive receptors. Construction plant and traffic can emit air pollutants which can also impact air quality. In terms of the operational stage, impacts to air quality will be as a result of traffic emissions due to an increased number of vehicles and a change in traffic flows on nearby roads as a result of the proposed development.

Any potential construction dust impacts can be mitigated through the use of best practice and minimisation measures which are outlined in this report. Dust impacts will be short-term and imperceptible at all nearby sensitive receptors once the mitigation measures are implemented. Once works are completed dust levels will return to baseline conditions. Emissions from traffic have been scoped out of a detailed air quality assessment as the proposed development is not predicted to significantly change the traffic on the local road network. Therefore, the operational stage impact to air quality is considered long-term, neutral and imperceptible.

No significant impacts to air quality are predicted during the construction or operational phases of the proposed development.

A detailed baseline assessment for NO_2, SO_2, benzene, and PM_{10}/$PM_{2.5}$ (particulate matter <10 μm and <2.5μm) was undertaken on the site of the proposed development to ensure the works undertaken at the adjoining site of SIAC BP Construction will not impact on the air quality of the potential residents. Monitoring was conducted for a two-month period, from June 2021 – August 2021.

The NO_2 monitoring was carried out using passive diffusion tubes. The bias adjusted average NO_2 concentration measured over the two months at each of the diffusion tube monitoring locations ranged from 10.17 – 14.23 $\mu g/m^3$ which is between 25% - 36% of the EU annual limit value of 40 $\mu g/m^3$.

The SO_2 diffusion tube concentrations measured over the two month survey period are below the annual EU limit value of 20 $\mu g/m^3$ for the protection of vegetation. The average SO_2 concentration measured over the two month period at each location ranged from <1.32 - <1.45 $\mu g/m^3$ which is between 6% – 7% of the EU annual limit value of 20 $\mu g/m^3$.

The Benzene diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 5 $\mu g/m^3$ for the protection of human health. The average benzene concentrations measured over the two month period at each location were all <0.27 $\mu g/m^3$ which is 5% of the EU annual limit value of 5 $\mu g/m^3$.

Daily concentrations of PM_{10} were measured using a continuous Osiris light scattering monitor. Despite there being some gap in data obtained for the Osiris monitor, there were no exceedances recorded over the two months of monitoring, it is extremely unlikely that 35 exceedances would occur over 365 days at the current location. The average PM_{10} concentration measured over the two-month period is 8.8 $\mu g/m^3$ which is only 22% of the EU annual limit value of 40 $\mu g/m^3$.

Monitoring for $PM_{2.5}$ was also conducted using the continuous Osiris light scattering monitor. The average $PM_{2.5}$ concentration measured over the two-month period is 4.5 $\mu g/m^3$ which is below the annual average EU limit value of 25 $\mu g/m^3$.

In summary, existing baseline levels of NO_2, SO_2, Benzene, PM_{10}, and $PM_{2.5}$ are low and are within the applicable ambient air quality standards in the region of Dolcain House, Clondalkin. It can therefore be concluded that operations at the adjoining SIAC BP site are not currently causing a deleterious impact to the local ambient air quality and are unlikely to negatively impact the air quality for potential future residents.

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1.0 INTRODUCTION

AWN Consulting Ltd. has been commissioned to carry out an assessment of the potential air quality impacts as a result of the proposed development at the Dolcain House site, Clondalkin, Dublin 22. A focus has been placed on the adjoining site of SIAC BP Construction and the impacts these works could have for prospective residents of the proposed scheme.

2.0 ASSESSMENT CRITERIA

2.1 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.

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 a number of pollutants with the limit values for NO_2, PM_{10} and $PM_{2.5}$ being relevant to this assessment (see Table 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).

Pollutant	Regulation Note 1	Limit Type	Value
Dust Deposition	TA Luft (German VDI 2002)	Annual average limit for nuisance dust	350 mg/(m^2*day)
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
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 µg/m^3 PM_{10}
		Annual limit for protection of human health	40 µg/m^3 PM_{10}
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3 $PM_{2.5}$

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

Table 1 Ambient Air Quality Standards

2.2 Dust Deposition Guidelines

The concern from a health perspective is focused on particles of dust which are less than 10 microns and the EU ambient air quality standards outlined in section 2.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regard to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland.

However, guidelines for dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled 'Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006). The document recommends that the Bergerhoff limit of 350 mg/(m^2*day) be applied to the site boundary of quarries. This limit value can be implemented with regard to dust impacts from construction of the proposed development.

3.0 METHODOLOGY

3.1 Construction Phase

The Institute of Air Quality Management in the UK (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014) outlines an assessment method for predicting the impact of dust emissions from demolition, earthworks, construction and haulage activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this development in order to predict the likely risk of dust impacts in the absence of mitigation measures and to determine the level of site specific mitigation required. The use of UK guidance is considered best practice in the absence of applicable Irish guidance.

Construction phase traffic also has the potential to impact air quality. The UK Highways Agency Design Manual for Roads and Bridges (DMRB) guidance (UK Highways Agency, 2019a), 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. The use of the UK guidance is recommended by the TII (2011) in the absence of specific Irish guidance, this approach is considered best practice and can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band;
- A change in carriageway alignment by 5m or greater.

The construction stage traffic does not meet the above scoping criteria. Therefore, a detailed air quality modelling assessment has been scoped out as there is no potential for significant impacts to air quality during construction as a result of traffic emissions.

3.2 Operational Phase

Operational phase traffic has the potential to impact local air quality as a result of increased vehicle movements associated with the proposed development. The UK Highways Agency DMRB scoping criteria detailed in Section 3.1 was used to determine if any road links are affected by the proposed development and require inclusion in a detailed air dispersion modelling assessment. The proposed development will not increase traffic more than the screening criteria and therefore, none of the local road links can be classed as ‘affected’ and detailed air dispersion modelling of operational phase traffic emissions is not required as there is no potential for significant impacts to air quality.

4.0 BASELINE ENVIRONMENT

4.1 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) (WHO, 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 Casement Aerodrome meteorological station, which is located approximately 4.1 km west of the site. Casement Aerodrome met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 1). For data collated during five representative years (2016 - 2020), the predominant wind direction is south-westerly (Met Eireann, 2021).

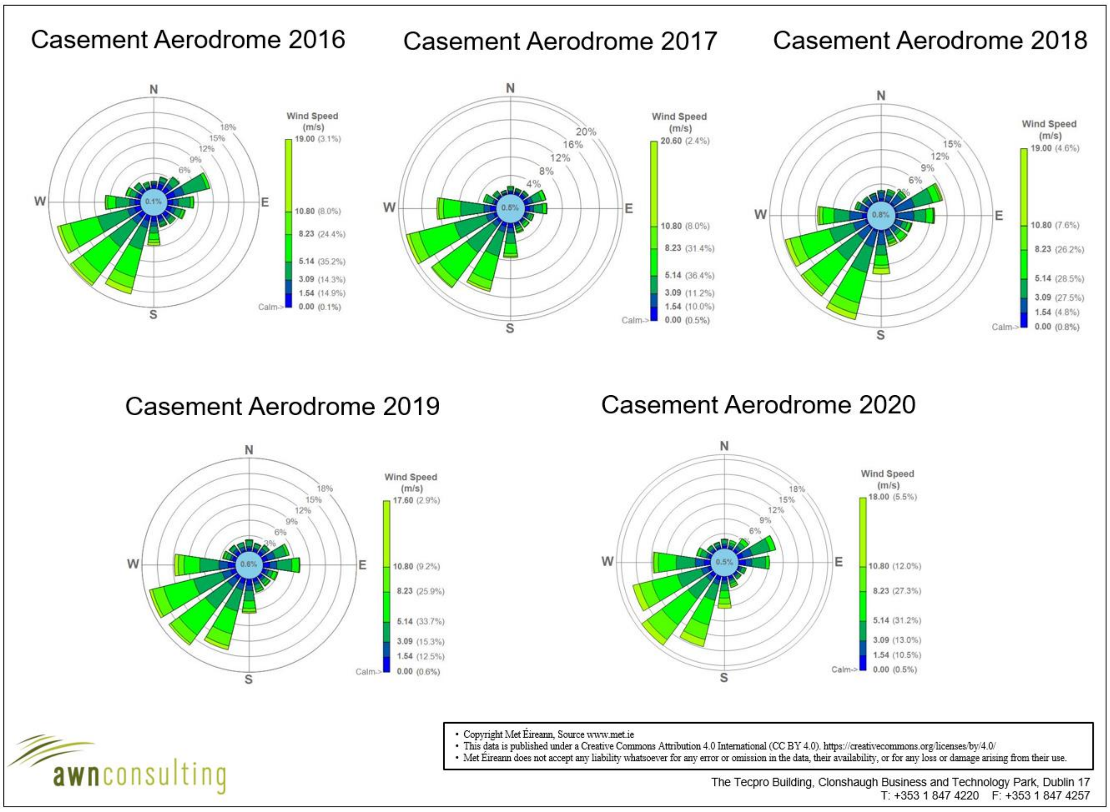

Figure 1 Casement Aerodrome Met Station Windrose 2016 – 2020 (Met Eireann, 2021)

4.2 Baseline Air Quality – Review of EPA Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent EPA published annual report on air quality "*Air Quality In Ireland 2020*" (EPA 2021) details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes as outlined within the EPA document titled 'Air Quality In Ireland 2020' (EPA 2021). 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, the area of the proposed development is categorised as Zone A.

In 2020 the EPA reported (EPA 2021) that Ireland was compliant with EU legal limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA report details the effect that the Covid-19 restrictions had on stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason, they have not been included in the baseline section.

NO_2

With regard to NO_2, continuous monitoring data from the EPA (EPA, 2020) at suburban Zone A locations in Ballyfermot, Dun Laoghaire, Swords and Rathmines show that current levels of NO_2 are below both the annual and 1-hour limit values, with annual average levels ranging from 15 – 22 µg/m^3 in 2019 (see Table 2). Sufficient data is available for all stations to observe the long-term trend since 2015 (EPA, 2020) (see Table 2), with results ranging from 13 – 22 µg/m^3 and few exceedances of the one-hour limit value. The station in Ballyfermot is approximately 3 km north-east of the proposed development site and monitored background concentrations would be representative of the site location. Concentrations of NO_2 at the Ballyfermot site over the period 2015 – 2019 ranged from 16 - 20 µg/m^3. Based on the above information, an estimate of the background NO_2 concentration in the region of the proposed development is 20 µg/m^3.

Station	**Averaging Period** Note 1,2	**Year**				
		2015	**2016**	**2017**	**2018**	**2019**
Rathmines	Annual Mean NO_2 (µg/m^3)	18	20	17	20	22
	Max 1-hr NO_2 (µg/m^3)	106	102	116	138	183
Dún Laoghaire	Annual Mean NO_2 (µg/m^3)	16	19	17	19	15
	Max 1-hr NO_2 (µg/m^3)	103	142	153	135	104
Swords	Annual Mean NO_2 (µg/m^3)	13	16	14	16	15
	Max 1-hr NO_2 (µg/m^3)	170	206	107	112	108
Ballyfermot	Annual Mean NO_2 (µg/m^3)	16	17	17	17	20
	Max 1-hr NO_2 (µg/m^3)	142	127	148	217	124

Note 1 Annual average limit value of 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 1-hour limit value - 200 µg/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).

Table 2 Background NO_2 Concentrations In Zone A Locations (µg/m^3)

PM_{10}

Continuous PM_{10} monitoring carried out at the Zone A locations of Tallaght, Rathmines, Phoenix Park and Dún Laoghaire showed 2015 – 2019 annual mean concentrations ranging from 9 – 16 µg/m^3 (Table 3), with at most 9 exceedances (in Rathmines) of the 24-hour limit value of 50 µg/m^3 (35 exceedances are permitted per year). The most representative location is Tallaght which had an average annual mean concentration of 13.8 µg/m^3 over the five year period. Based on the EPA data (Table 3) a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 14 µg/m^3.

Station	Averaging Period Notes 1, 2	Year				
		2015	2016	2017	2018	2019
Tallaght	Annual Mean PM_{10} (µg/m^3)	14	14	12	15	12
	24-hr Mean > 50 µg/m^3 (days)	4	0	2	1	3
Rathmines	Annual Mean PM_{10} (µg/m^3)	15	15	13	15	15
	24-hr Mean > 50 µg/m^3 (days)	5	3	5	2	9
Phoenix Park	Annual Mean PM_{10} (µg/m^3)	12	11	9	11	11
	24-hr Mean > 50 µg/m^3 (days)	2	0	1	0	2
Dún Laoghaire	Annual Mean PM_{10} (µg/m^3)	13	13	12	13	12
	24-hr Mean > 50 µg/m^3 (days)	3	0	2	0	2

Note 1 Annual average limit value of 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 24-hour limit value - 50 µg/m^3 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).

Table 3 Background PM_{10} Concentrations In Zone A Locations (µg/m^3)

$PM_{2.5}$

Monitoring for both PM_{10} and $PM_{2.5}$ is carried out at the Rathmines monitoring station which allows the $PM_{2.5}/PM_{10}$ ratio to be calculated. Continuous $PM_{2.5}$ monitoring carried out at the Zone A location of Rathmines showed $PM_{2.5}/PM_{10}$ ratios ranging from 0.60 – 0.68 over the period 2015 – 2019. Based on this information, a conservative ratio of 0.7 was used to generate a background $PM_{2.5}$ concentration in the region of the proposed development of 9.8 µg/m^3.

4.2.1 Baseline Monitoring

A detailed baseline assessment for NO_2, SO_2, benzene, and $PM_{10}/PM_{2.5}$ (particulate matter <10 µm and <2.5µm) was carried out at the proposed site to ensure baseline levels were in compliance with human health levels (see Appendix 1). Particular focus was placed on the boundary of the site with SIAC BP Construction with the Osiris monitor used being placed close to the adjoining site. Monitoring was conducted for 2 a two-month period, from June 2021 – August 2021.

The NO_2 monitoring was carried out using passive diffusion tubes. The bias adjusted average NO_2 concentration measured over the two months at each of the diffusion tube monitoring locations ranged from 10.17 – 14.23 µg/m^3 which is between 25% - 36% of the EU annual limit value of 40 µg/m^3.

The SO_2 diffusion tube concentrations measured over the two month survey period are below the annual EU limit value of 20 µg/m^3 for the protection of vegetation. The average SO_2 concentration measured over the two month period at each location ranged from <1.32 - <1.45 µg/m^3 which is between 6% – 7% of the EU annual limit value of 20 µg/m^3.

The Benzene diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 5 µg/m^3 for the protection of human health. The average benzene concentrations measured over the two month period at each location were all <0.27 µg/m^3 which is 5% of the EU annual limit value of 5 µg/m^3.

Daily concentrations of PM_{10} were measured using a continuous Osiris light scattering monitor. Despite there being some gap in data obtained for the Osiris monitor, there were no exceedances recorded over the two months of monitoring, it is extremely unlikely that 35 exceedances would occur over 365 days at the current location. The average PM_{10} concentration measured over the two-month period is 8.8 $\mu g/m^3$ which is only 22% of the EU annual limit value of 40 $\mu g/m^3$.

Monitoring for $PM_{2.5}$ was also conducted using the continuous Osiris light scattering monitor. The average $PM_{2.5}$ concentration measured over the two-month period is 4.5 $\mu g/m^3$ which is below the annual average EU limit value of 25 $\mu g/m^3$.

The NO_2 monitoring was carried out using passive diffusion tubes. The bias adjusted average NO_2 concentration measured over the two months at each of the diffusion tube monitoring locations ranged from 10.17 – 14.23 $\mu g/m^3$ which is between 25% - 36% of the EU annual limit value of 40 $\mu g/m^3$.

The SO_2 diffusion tube concentrations measured over the two month survey period are below the annual EU limit value of 20 $\mu g/m^3$ for the protection of vegetation. The average SO_2 concentration measured over the two month period at each location ranged from <1.32 - <1.45 $\mu g/m^3$ which is between 6% – 7% of the EU annual limit value of 20 $\mu g/m^3$.

The Benzene diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 5 $\mu g/m^3$ for the protection of human health. The average benzene concentrations measured over the two month period at each location were all <0.27 $\mu g/m^3$ which is 5% of the EU annual limit value of 5 $\mu g/m^3$.

Daily concentrations of PM_{10} were measured using a continuous Osiris light scattering monitor. Despite there being some gap in data obtained for the Osiris monitor, there were no exceedances recorded over the two months of monitoring, it is extremely unlikely that 35 exceedances would occur over 365 days at the current location. The average PM_{10} concentration measured over the two-month period is 8.8 $\mu g/m^3$ which is only 22% of the EU annual limit value of 40 $\mu g/m^3$.

Monitoring for $PM_{2.5}$ was also conducted using the continuous Osiris light scattering monitor. The average $PM_{2.5}$ concentration measured over the two-month period is 4.5 $\mu g/m^3$ which is below the annual average EU limit value of 25 $\mu g/m^3$. The existing baseline levels of NO_2, SO_2, Benzene, PM_{10}, and $PM_{2.5}$ are low and are within the applicable ambient air quality standards in the region of Dolcain House, Clondalkin.

4.3 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction'* (2014) prior to assessing the impact of dust from a proposed development the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, there are approximately 10 residential premises within 50m of the proposed development site, these are considered high sensitivity receptors in terms of dust soiling. Therefore, the overall sensitivity of the area to dust soiling impacts is considered low based on the IAQM criteria outlined in Table 4.

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	**Low**	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Source: IAQM (2014) *Guidance on the Assessment of Dust from Demolition and Construction*
Table 4 Sensitivity of the Area to Dust Soiling Effects on People and Property

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity based on type (residential receptors are classified as high sensitivity) and the number of receptors affected within various distance bands from the construction works. As per Section 4.2.1 the baseline levels surrounding the site are not exceeding human health levels, even during SIAC BP Construction operating hours.

A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the proposed development is 14 µg/m^3 and there are approximately 10 high sensitivity residential receptors within 50m of the proposed site area. Based on the IAQM criteria outlined in Table 5, the worst case sensitivity of the area to human health is considered low.

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number Of Receptors	Distance from source (m)				
			<20	<50	<100	<200	<350
High	< 24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	**Low**	Low	Low	Low
Medium	< 24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	< 24 µg/m^3	>1	Low	Low	Low	Low	Low

Source: IAQM (2014) *Guidance on the Assessment of Dust from Demolition and Construction*
Table 5 Sensitivity of the Area to Human Health Impacts

5.0 IMPACT ASSESSMENT

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. While construction dust tends to be deposited within 350 m of a construction site, the majority of the deposition occurs within the first 50 m. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. A review of Casement Aerodrome meteorological data (see Section 4.1) indicates that the prevailing wind direction is south-westerly and wind speeds are generally moderate in nature.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 4.3). The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (movement of heavy vehicles).

Demolition

Demolition will primarily involve the removal of buildings or structures currently on the site in a potentially dusty manner. This may also involve dust generation at heights. Dust emission magnitude from demolition can be classified as small, medium and large and are described below.

- **Large**: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;

- **Medium**: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and

- **Small**: Total building volume less than 20,000 m^3.

As per the above criteria the dust emission magnitude for the proposed demolition activities can be classified as medium as a worst case as the total building volume to be demolished will be between 20,000 – 50,000 m^3. As the overall sensitivity of the area to dust soiling impacts is low there is a low risk of dust soiling impacts from the proposed demolition activities according to the IAQM guidance (see Table 6). There is an overall low risk of human health impacts as a result of the demolition activities as the overall sensitivity of the area to human health impacts is low (Section 4.3).

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 6 Risk of Dust Impacts – Demolition

Earthworks

Earthworks primarily involve excavating material, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. The dust emission magnitude from earthworks can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes;
- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The dust emission magnitude for the proposed earthwork activities can be classified as large as the site area is greater than 2,500 m^2 and there is to be a large amount of material involved in excavation works. However, a large portion of this material will be kept on site and re-used.

The sensitivity of the area, as determined in Section 4.4, is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 7, this results in an overall low risk of short-term dust soiling impacts and short-term human health impacts as a result of the proposed earthworks activities.

Sensitivity of Area	**Dust Emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 7 Risk of Dust Impacts – Earthworks

Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;
- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching;
- **Small:** Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as large as worst case as the total building volume to be constructed will be greater than 100,000 m^3.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 8, this results in an overall low risk of short-term dust soiling impacts and short-term human health impacts as a result of the proposed construction activities.

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8 Risk of Dust Impacts – Construction

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface material and duration of movement. Dust emission magnitude from trackout can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** > 50 HGV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium:** 10 - 50 HGV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m;
- **Small:** < 10 HGV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

The dust emission magnitude for the proposed trackout can be classified as large, as at worst-case scenario.

As outlined in Table 9, this results in an overall low risk of short-term dust soiling and human health impacts as a result of the proposed trackout activities.

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 9 Risk of Dust Impacts – Trackout

Summary of Dust Emission Risk

The risk of dust impacts as a result of the proposed development are summarised in Table 10 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

While there is an overall low risk of dust soiling and human health impacts as result of the proposed construction works, best practice dust mitigation measures will be implemented on site to prevent potential dust emissions. These mitigation measures will be incorporated into the construction environmental management plan (CEMP) for the site. Provided the dust mitigation measures outlined in the plan (see Section 6.1) are adhered to, the air quality impacts during the construction phase will be short-term, negative, localised and imperceptible.

Table 10 Summary of Dust Impact Risk used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Low Risk	Low Risk	Low Risk	Low Risk
Human Health	Low Risk	Low Risk	Low Risk	Low Risk

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. The construction stage traffic has been reviewed and a detailed air quality assessment has been scoped out as none of the road links impacted by the proposed development satisfy the DMRB assessment criteria in Section 3.1. It can therefore be determined that the construction stage traffic will have an imperceptible, neutral and short-term impact on air quality.

5.2 Operational Phase

Operational phase traffic has the potential to impact local air quality as a result of increased vehicle movements associated with the proposed development. However, the proposed development it is not predicted to significantly change the existing traffic on the nearby road links. Therefore, according to the DMRB scoping criteria in section 3.1 none of the local road links can be classed as 'affected'. The potential impact to air quality during the operational phase is considered long-term, neutral and imperceptible.

6.0 MITIGATION MEASURES

6.1 Construction Phase

The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the Dust Management Plan. The key aspects of controlling dust are listed below. These measures will be incorporated into the overall construction environmental management plan (CEMP) for the site in order to prevent significant dust emissions from site. The main measures are summarized below:

- 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.

- Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.

- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Public roads and footpaths outside the site will be regularly inspected for cleanliness and cleaned as necessary. If sweeping using a road sweeper is not possible due to the nature of the surrounding area then a suitable smaller scale street cleaning vacuum will be used.
- 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.
- Prior to demolition blocks shall be soft striped inside buildings (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).

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 will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

6.2 Operational Phase

The impact of the proposed development on air quality is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no site specific mitigation measures are required.

7.0 CONCLUSION

No significant impacts to air quality are predicted during the construction or operational phases of the proposed development. Once the best practice dust minimisation measures outlined in Section 6.1 are implemented, fugitive emissions of dust from the site during construction will be insignificant and pose no nuisance to nearby receptors. Following the assessment of traffic during the operational phase of the development the impact on ambient air quality in the operational stage is considered long-term, localised, neutral and imperceptible. The adjoining site of SIAC BP Construction and the impacts these works could have for prospective residents of the proposed scheme was analysed in a detailed baseline assessment for NO_2, SO_2, benzene, and $PM_{10}/PM_{2.5}$ (particulate matter <10 μm and <2.5μm) undertaken by AWN Consulting. The accompanying monitoring that was conducted for a two-month period, from June 2021 – August 2021 confirms the existing baseline levels of analysed pollutants are low and are within the applicable ambient air quality standards in the region.

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APPENDIX 1 – BASELINE AIR QUALITY MONITORING

INTRODUCTION

AWN Consulting was requested by McGrath Group to perform a detailed baseline assessment for NO_2, SO_2, benzene, and PM_{10}/$PM_{2.5}$ (particulate matter <10 µm and <2.5µm) as part of the air quality assessment for the proposed development at Dolcain House, Clondalkin, Dublin 22. Monitoring was conducted for 2 a two-month period, from June 2021 – August 2021 this report presents the results of the monitoring.

SAMPLING DETAILS

Monitoring for NO_2, SO_2, benzene, PM_{10} and $PM_{2.5}$, was undertaken at Dolcain House. Monitoring for all parameters was conducted over the period June 2021 – August 2021.

METHODOLOGY

Nitrogen Dioxide - NO_2

Monitoring of nitrogen dioxide in the vicinity of Dolcain House was carried out using passive diffusion. The spatial variation in NO_2 levels away from sources is particularly important, as a complex relationship exists between NO, NO_2 and O_3 leading to a non-linear variation of NO_2 concentrations with distance from sources. In order to assess the spatial variation in NO_2 levels in the region around Dolcain House, NO_2 was monitored using passive diffusion tubes over two one-month periods (15th June 2021 – 13th July 2021 and 13th July 2021 – 10th August 2021) at 4 locations in the area (see Locations 1 – 4 in Figure A.1). Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following sampling, the tubes were analysed using UV spectrophotometry, at a UKAS accredited laboratory (GRADKO laboratories, Winchester). The diffusion tube locations were strategically positioned to allow an assessment of both background levels and typical exposure of the population. The passive diffusion tube results allow an indicative comparison with the annual average limit value.

Studies in the UK have shown that diffusion tube monitoring results generally have a positive or negative bias when compared to continuous analysers. This bias is laboratory specific and is dependent on the specific analysis procedures at each laboratory. A diffusion tube bias of 0.81 was obtained for the GRADKO laboratory (which analysed the diffusion tubes) from the UK DEFRA website (UK DEFRA, 2021).

Sulphur Dioxide - SO_2

In order to assess the spatial variation in sulphur dioxide levels in the area, SO_2 was monitored using passive diffusion tubes over two one-month periods (15th June 2021 – 13th July 2021 and 13th July 2021 – 10th August 2021) at 4 locations (see locations 1 – 4 in Figure A.1). Passive sampling of SO_2 involves the molecular diffusion of SO_2 molecules through a tube fabricated of PTFE and their subsequent adsorption onto a stainless steel gauze coated with sodium carbonate. Following sampling, the adsorbed sulphate is removed from the tubes with deionised water and analysed using ion chromatography. Analysis was carried out by GRADKO laboratories, Winchester.

Benzene

In order to assess the spatial variation in benzene levels in the area, benzene was monitored using BTEX Ethyl Benzene tubes over two one-month periods (15th June 2021 – 13th July 2021 and 13th July 2021 – 10th August 2021) at 4 locations (see Location 1 – 4 in Figure A.1). Passive sampling of benzene involves the molecular diffusion of benzene molecules through a stainless steel tube and their subsequent adsorption onto a stainless steel gauze coated with Tenax. Following sampling, the tubes were analysed using Gas Chromatography – Mass Spectrometry (GC-MS), by GRADKO laboratories, Winchester.

Particulate Matter - PM_{10} and $PM_{2.5}$

In order to determine the average $PM_{2.5}$ and PM_{10} concnetrations at the static monitoring location (see Figure A.1), a Turnkey Instruments Osiris Environmental Dust Monitor was used to monitor both $PM_{2.5}$ and PM_{10} over an approximate 60-day period during June 2021 – August 2021.

The Osiris instrument is a light scattering device capable of continuous measurement of PM_{10} and $PM_{2.5}$. The air sample was continuously drawn into the instrument by a pump through a heated inlet at a flow rate of 600 ml/min. The incoming air passed through a laser beam in a photometer. The light scattered by the individual particles of dust was measured by the photometer and this information used to measure the size and concentration of the dust particles.

AMBIENT AIR QUALITY COMPLIANCE CRITERIA

NO_2, SO_2, PM_{10}, $PM_{2.5}$, Benzene

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. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC (see Table A.1). The ambient air quality standards applicable for NO_2, SO_2, Benzene, PM_{10} and $PM_{2.5}$ are outlined in this Directive.

Pollutant	Limit Type	Value
Nitrogen Dioxide (NO_2)	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 μg/m^3
	Annual limit for protection of human health	40 μg/m^3
NO_X	Critical level for protection of vegetation	30 μg/m^3 NO + NO_2
Sulphur dioxide (SO_2)	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 μg/m^3
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 μg/m^3
	Critical limit for the protection of ecosystems	20 μg/m^3
Particulate Matter (as PM_{10})	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 μg/m^3
	Annual limit for protection of human health	40 μg/m^3
Particulate Matter (as $PM_{2.5}$)	Annual limit for protection of human health	25 μg/m^3
Benzene	Annual limit for protection of human health	5 μg/m^3

Table A.1 Ambient Air Quality Standards 2011 (Based on EU Directive 2008/50/EC)

RESULTS AND DISCUSSION

<u>NO_2</u>

Nitrogen dioxide (NO_2) results are presented in Table A.2. The NO_2 diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 40 μg/m^3 for the protection of human health. The bias adjusted average NO_2 concentration measured over the two month period at each location ranged from 10.17 – 14.23 μg/m^3 which is between 25% - 36% of the EU annual limit value of 40 μg/m^3.

<u>SO_2</u>

Sulphur dioxide (SO_2) results are presented in Table A.3. The SO_2 diffusion tube concentrations measured over the two-month survey period are well below the annual EU limit value of 20 μg/m^3 for the protection of vegetation. The average SO_2 concentration measured over the two month period at each location ranged from <1.32 - <1.45 μg/m^3 which is between 6% – 7% of the EU annual limit value of 20 μg/m^3.

Benzene

Benzene results are presented in Table A.4. The Benzene diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 5 $\mu g/m^3$ for the protection of human health. The average benzene concentrations measured over the two month period at each location were all <0.27 $\mu g/m^3$ which is 5% of the EU annual limit value of 5 $\mu g/m^3$.

PM_{10}

Daily concentrations of PM_{10} were measured using a continuous Osiris light scattering monitor. This gave an average PM_{10} concentration over the 2-month period of 8.8 $\mu g/m^3$ which is 22% of the annual limit value of 40 $\mu g/m^3$. There were no exceedances of the daily limit value of 50 $\mu g/m^3$ over the 2-month period (see Table A.5 and Figure A.2). There are some gaps in the data presented due to technical difficulties encountered with the Osiris monitor during the monitoring period. However, since there were no exceedances recorded over the two months of monitoring, it is extremely unlikely that 35 exceedances would occur over 365 days at the current location.

$PM_{2.5}$

Daily concentrations of $PM_{2.5}$ measured using the Osiris continuous $PM_{2.5}$ monitor are shown in Table A.5 and Figure A.3. The average $PM_{2.5}$ concentration measured over the two-month period is 4.5 $\mu g/m^3$ which is below the annual average EU limit value of 25 $\mu g/m^3$. A $PM_{2.5}/PM_{10}$ ratio for the monitoring period of 0.51 has been calculated using the Osiris monitoring data.

SUMMARY

Ambient NO_2, SO_2, Benzene, PM_{10}, and $PM_{2.5}$ concentrations were measured two months (June 2021 – August 2021).

The NO_2 monitoring was carried out using passive diffusion tubes. The bias adjusted average NO_2 concentration measured over the two months at each of the diffusion tube monitoring locations ranged from 10.17 – 14.23 $\mu g/m^3$ which is between 25% - 36% of the EU annual limit value of 40 $\mu g/m^3$.

The SO_2 diffusion tube concentrations measured over the two month survey period are below the annual EU limit value of 20 $\mu g/m^3$ for the protection of vegetation. The average SO_2 concentration measured over the two month period at each location ranged from <1.32 - <1.45 $\mu g/m^3$ which is between 6% – 7% of the EU annual limit value of 20 $\mu g/m^3$.

The Benzene diffusion tube concentrations measured over the two-month survey period are below the annual EU limit value of 5 $\mu g/m^3$ for the protection of human health. The average benzene concentrations measured over the two month period at each location were all <0.27 $\mu g/m^3$ which is 5% of the EU annual limit value of 5 $\mu g/m^3$.

Daily concentrations of PM_{10} were measured using a continuous Osiris light scattering monitor. Despite there being some gap in data obtained for the Osiris monitor, there were no exceedances recorded over the two months of monitoring, it is extremely unlikely that 35 exceedances would occur over 365 days at the current location. The average PM_{10} concentration measured over the two-month period is 8.8 $\mu g/m^3$ which is only 22% of the EU annual limit value of 40 $\mu g/m^3$.

Monitoring for $PM_{2.5}$ was also conducted using the continuous Osiris light scattering monitor. The average $PM_{2.5}$ concentration measured over the two-month period is 4.5 $\mu g/m^3$ which is below the annual average EU limit value of 25 $\mu g/m^3$.

In summary, existing baseline levels of NO_2, SO_2, Benzene, PM_{10}, and $PM_{2.5}$ are low and are within the applicable ambient air quality standards in the region of Dolcain House, Clondalkin.

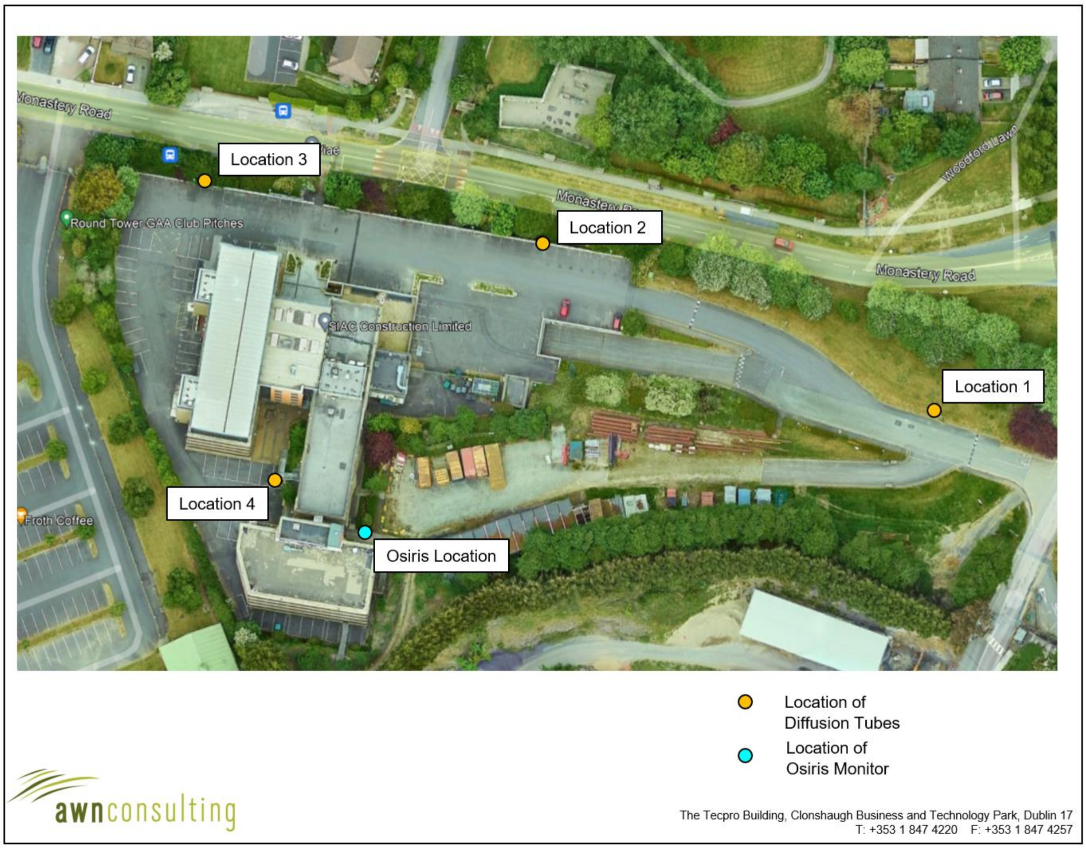

Figure A.1 Passive Diffusion Tube Locations and Osiris Monitor Location Dolcain House, Clondalkin.

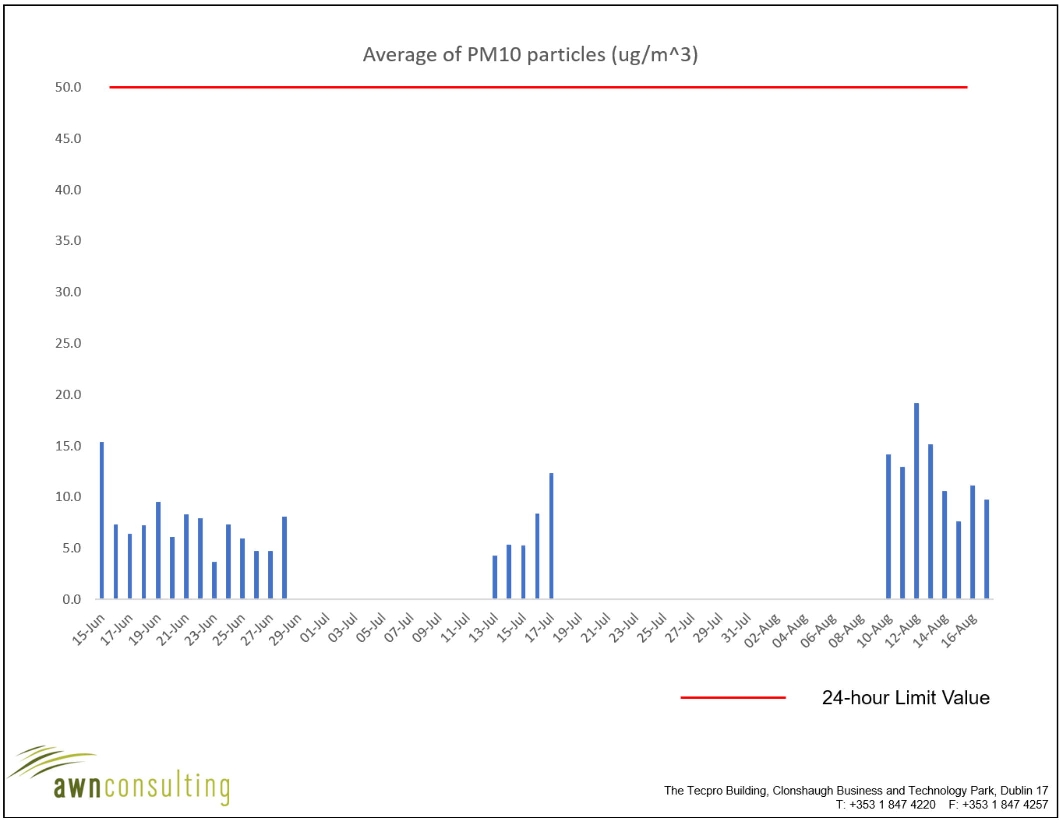

Figure A.2 Daily Average PM_{10} Concentration Over Monitoring Period (June 2021 – August 2021)

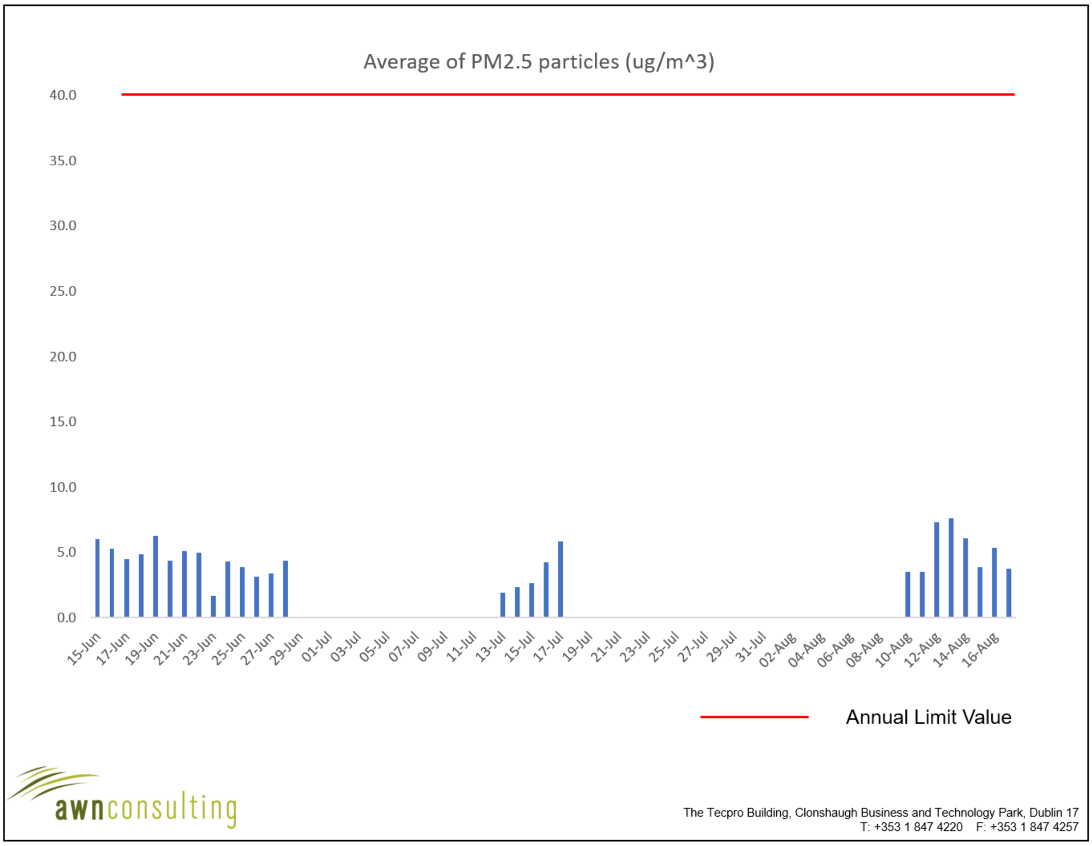

Figure A.3 Daily Average $PM_{2.5}$ Concentration Over Monitoring Period (June 2021 – August 2021)

Location	Location 1	Location 2	Location 3	Location 4
NO_2 (µg/m^3) **15/06/21 – 13/07/21**	15.9	17.14	13.71	11.58
NO_2 (µg/m^3) **13/07/21 – 10/08/21**	16.51	17.99	15.65	13.54
NO_2 Average (µg/m^3)	16.21	17.57	14.68	12.56
Adjusted NO_2 Average (µg/m^3) *Note 2*	13.13	14.23	11.89	10.17
			Limit Value	*40 µg/m^3 Note 1*

Note 1 EU Council Directive 2008/50/EC (as an annual average).
Note 2 Diffusion tube monitoring bias adjustment carried out based on UK DEFRA methodology. Diffusion tube bias is 0.81

Table A.2 NO_2 Concentrations Measured at Dolcain House, Clondalkin Using Passive Diffusion Tubes (June 2021 – August 2021).

Location	Location 1	Location 2	Location 3	Location 4
SO_2 (µg/m^3) **15/06/21 – 13/07/21**	<1.45	<1.45	<1.45	<1.45
SO_2 (µg/m^3) **13/07/21 – 10/08/21**	<1.32	<1.32	<1.32	<1.32
SO_2 Average (µg/m^3)	1.39	1.39	1.39	1.39
			Limit Value	*20 µg/m^3 Note 1*

Note 1 EU Council Directive 2000/69/EC (annual average limit for the protection of ecosystems).

Table A.3 SO_2 Concentrations Measured at Dolcain House, Clondalkin Using Passive Diffusion Tubes (June 2021 – August 2021).

Location	Location 1	Location 2	Location 3	Location 4
Benzene (µg/m^3) **15/06/21 – 13/07/21**	<0.27	<0.27	<0.27	<0.27
Benzene (µg/m^3) **13/07/21 – 10/08/21**	<0.27	<0.27	<0.27	<0.27
Benzene Average (µg/m^3)	<0.27	<0.27	<0.27	<0.27
			Limit Value	*5 µg/m^3 Note 1*

Note 1 EU Council Directive 2000/69/EC (as an annual average).

Table A.4 Benzene Concentrations Measured at Dolcain House, Clondalkin Using BTEX Tubes (June 2021 – August 2021)

Date	Average of Total Particles (ug/m^3)	Average of PM10 particles (ug/m^3)	Average of PM2.5 particles (ug/m^3)
15-Jun	26.6	15.4	6.0
16-Jun	10.6	7.3	5.3
17-Jun	9.7	6.4	4.5
18-Jun	10.7	7.3	4.9
19-Jun	14.3	9.5	6.3
20-Jun	8.7	6.1	4.4
21-Jun	13.3	8.3	5.1
22-Jun	12.7	8.0	5.0
23-Jun	6.6	3.6	1.7
24-Jun	12.4	7.3	4.3
25-Jun	8.8	6.0	3.9
26-Jun	6.8	4.7	3.1
27-Jun	6.8	4.8	3.4
28-Jun	12.8	8.1	4.4
29-Jun	-	-	-
30-Jun	-	-	-
01-Jul	-	-	-
02-Jul	-	-	-
03-Jul	-	-	-
04-Jul	-	-	-
05-Jul	-	-	-
06-Jul	-	-	-
07-Jul	-	-	-
08-Jul	-	-	-
09-Jul	-	-	-
10-Jul	-	-	-
11-Jul	-	-	-
12-Jul	-	-	-
13-Jul	7.8	4.3	1.9
14-Jul	10.2	5.3	2.3
15-Jul	9.3	5.3	2.7
16-Jul	14.8	8.4	4.3
17-Jul	21.8	12.3	5.8
18-Jul	-	-	-
19-Jul	-	-	-
20-Jul	-	-	-
21-Jul	-	-	-
22-Jul	-	-	-
23-Jul	-	-	-
24-Jul	-	-	-
25-Jul	-	-	-
26-Jul	-	-	-
27-Jul	-	-	-
28-Jul	-	-	-
29-Jul	-	-	-
30-Jul	-	-	-
31-Jul	-	-	-
01-Aug	-	-	-
02-Aug	-	-	-
03-Aug	-	-	-
04-Aug	-	-	-
05-Aug	-	-	-
06-Aug	-	-	-
07-Aug	-	-	-
08-Aug	-	-	-
09-Aug	-	-	-
10-Aug	25.6	14.1	3.5
11-Aug	25.9	13.0	3.5
12-Aug	34.7	19.2	7.3
13-Aug	23.6	15.1	7.6
14-Aug	15.0	10.6	6.1
15-Aug	12.1	7.6	3.9

Date	Average of Total Particles (ug/m^3)	Average of PM10 particles (ug/m^3)	Average of PM2.5 particles (ug/m^3)
16-Aug	17.5	11.1	5.3
17-Aug	15.0	9.7	3.8
Average	**14.6**	**8.8**	**4.5**
Max	**34.7**	**19.2**	**7.6**
Min	**6.6**	**3.6**	**1.7**
90.4th percentile		**14.6**	
Limit Values Note 1		*Daily 50 µg/m³* *Annual 40 µg/m³*	*Annual 25 µg/m³*

Note 1 EU Council Directive 2008/50/EC

Table A.5 PM_{10} and $PM_{2.5}$ Concentrations Measured at Static Monitoring Station (June 2021 – August 2021)