Appendix 8.1

Detailed Dispersion Model Inputs and Outputs

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Summary of Key Pollutants Considered

The key pollutant emissions associated with combustion processes are oxides of nitrogen (NO_x). Nitrogen Dioxide (NO_2) is classed as both a primary and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources.

Nitrogen oxides (NO_x) which constitute a group of different chemicals that are all formed by the reaction of nitrogen — the most abundant gas in air — with oxygen. NO_x comprises colourless nitric oxide (NO) and the reddish-brown, very toxic and reactive nitrogen dioxide (NO_2). NO_x emissions also lead to the subsequent formation of 'secondary' PM and ground -level ozone in the atmosphere, and cause harm to the environment by contributing to the acidification and eutrophication of waters and soils.

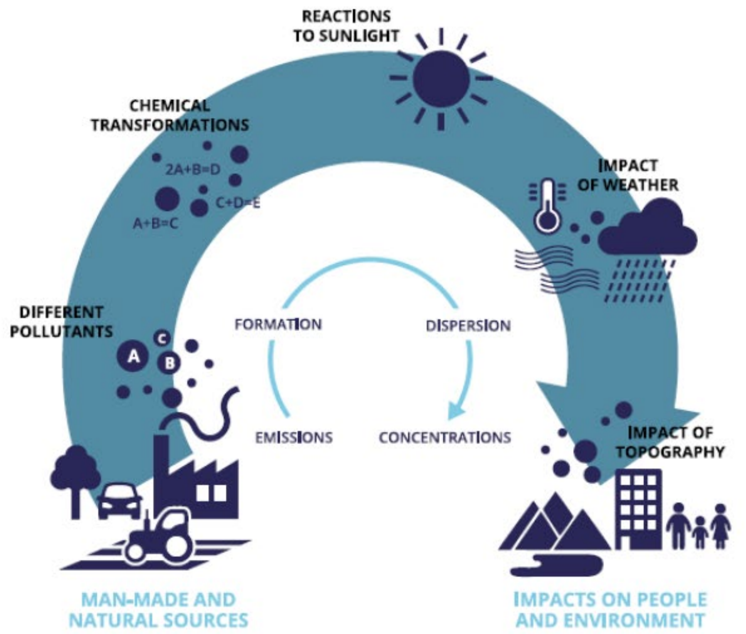

Figure 8.1 Air Pollution from Emission to Exposure

Poor air quality is a serious health and environmental problem. Certain harmful air pollutants are emitted directly from vehicles, such as 'primary' particulate matter (PM) and nitrogen oxides (NO_X). Others, such as ozone and 'secondary' PM, form in the atmosphere after emissions of precursor pollutants, including NO_X and volatile organic compounds. Different sources of pollution, including transport and non-transport sources, emit different types and ratios of pollutants.

The extent to which the population and environment are exposed to harmful levels of air pollution is a complex issue, dependent on how pollutants travel in the atmosphere, their mixing and how they react under different meteorological conditions. Road transport emissions are, relatively, more harmful than those from other sources, as most emissions tend to occur in areas where people live and work, such as cities and towns.

Pollutant Concentrations

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

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

Dispersion Model Selection

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

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

- An up-to-date dispersion model in which the boundary layer structure is characterised by theheight of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accuratelythan does the use of Pasquill-Gifford stability categories, which were used in many previousmodels (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non- Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;
- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings; and,
- A facility to calculate long-term averages of hourly mean concentration, dry and wetdeposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data.

ADMS Roads is designed to estimate NO_2 and PM_{10} and other inert pollutant concentrations from motor vehicles. The science of ADMS Roads is significantly more advanced than that of most other air dispersion models (such as CALINE, ISC and R91) in that it incorporates the latest understanding of the boundary layer structure and goes beyond the simplistic Pasquill-Gifford stability categories method withexplicit calculation of important parameters. The model uses advanced algorithms for the height- dependence of wind speed, turbulence and stability to produce improved predictions.

Model Inputs

Oveview

- **GIS:** ADMS Roads has an interface with MapInfo GIS (Geographical Information System) packages, which were used in the building of the model.
- **User-defined outputs:** The pollutants assessed, the averaging time (which may be an annual

average or a shorter period), the percentiles and exceedance values that are of interest, and whether or not a rolling average is required were set for the PM_{10} and NO_2 limits so they can be directly compared to the relevant Air Quality Objectives.

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- **Surface roughness:** The surface roughness in the study area was set to 0.5m.
- **The Monin – Obukhov** length was set to reasonably limit the occurrence of very stable atmospheric conditions. In this case it was defined as 30 m.
- **Receptor Locations:** The main sensitive receptors considered as part of the air quality assessment are the surrounding existing properties – these are representative worst-case receptors. Ground floor (1.5m) is considered. Table 10A.1 details the locations modelled.

Surface Roughness

A length scale parameter called the surface roughness length is used in the model to characterise the study area in terms of the effects it will have on wind speed and turbulence, which are key factors in the modelling.

The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length. A surface roughness length of 0.5 m has been used within the model to represent the average surface characteristics across the study area.

Meteorological Data

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

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

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

The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using three years of data from Dublin Airport, between 2016 and 2020.

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

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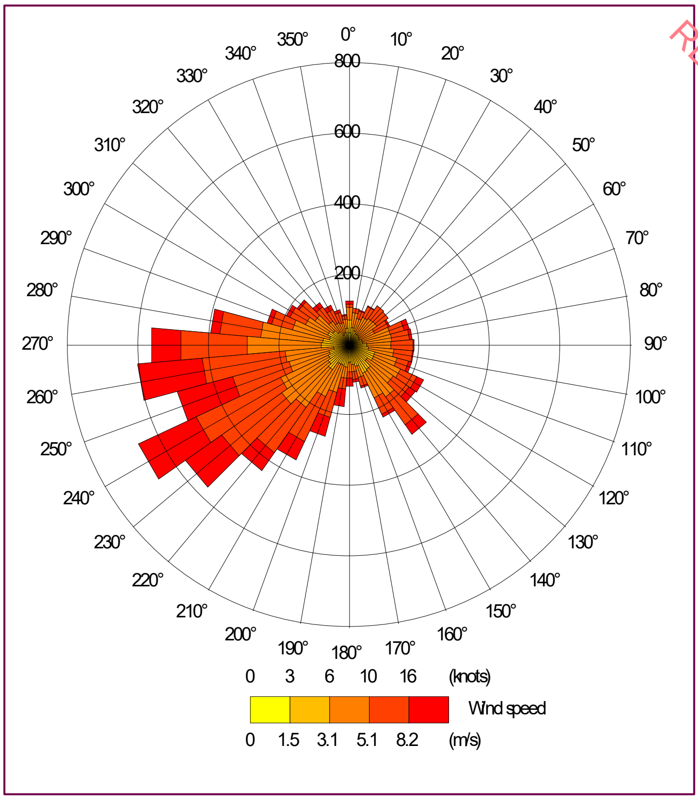

Figure 8.2 Dublin Airport WindRose 2016

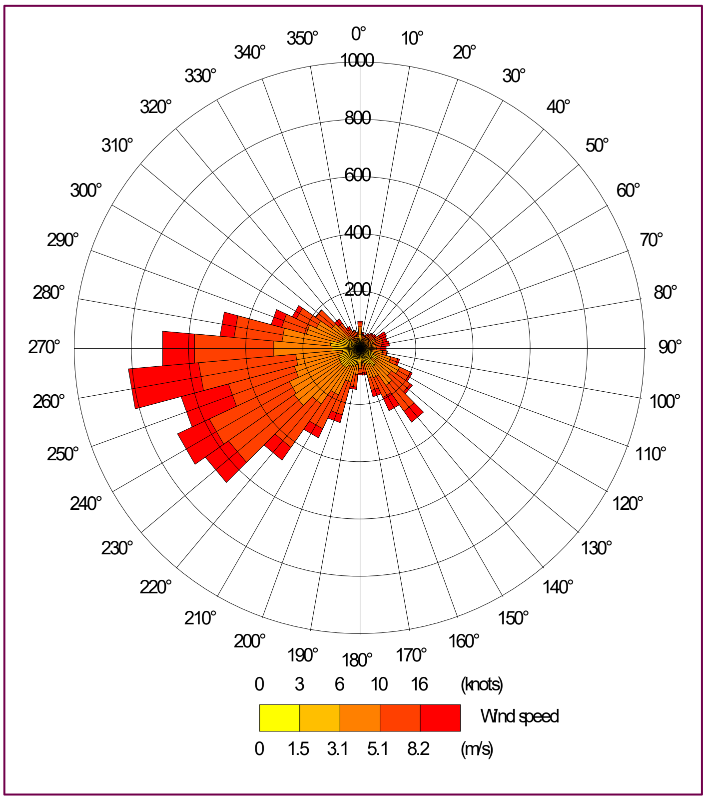

Figure 8.3 Dublin Airport WindRose 2017

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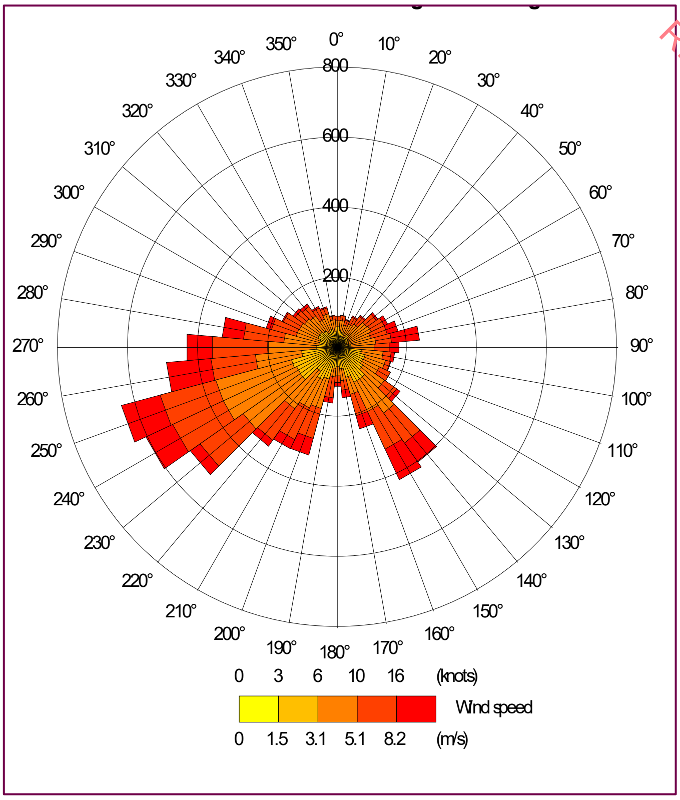

Figure 8.4 Dublin Airport WindRose 2018

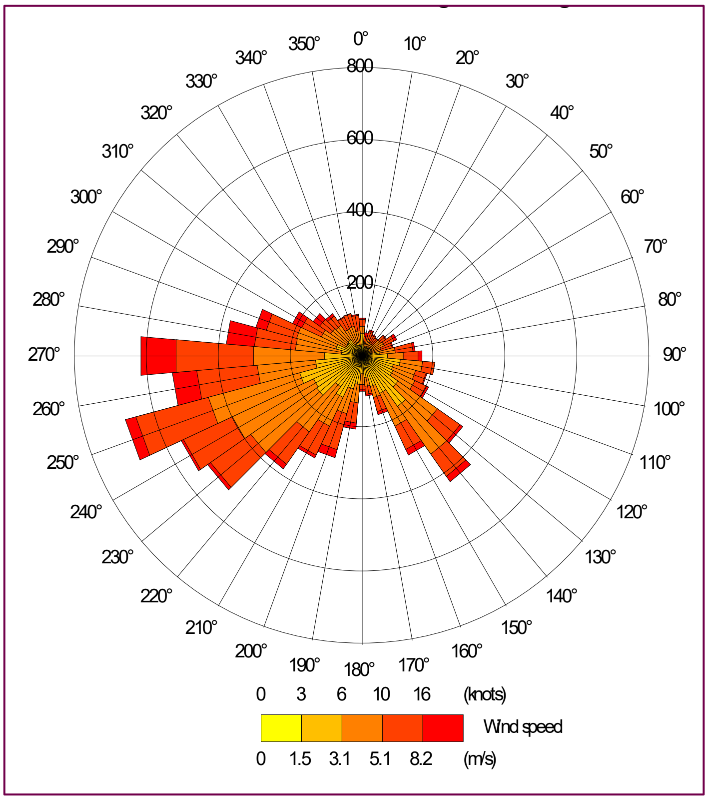

Figure 8.5 Dublin Airport WindRose 2019

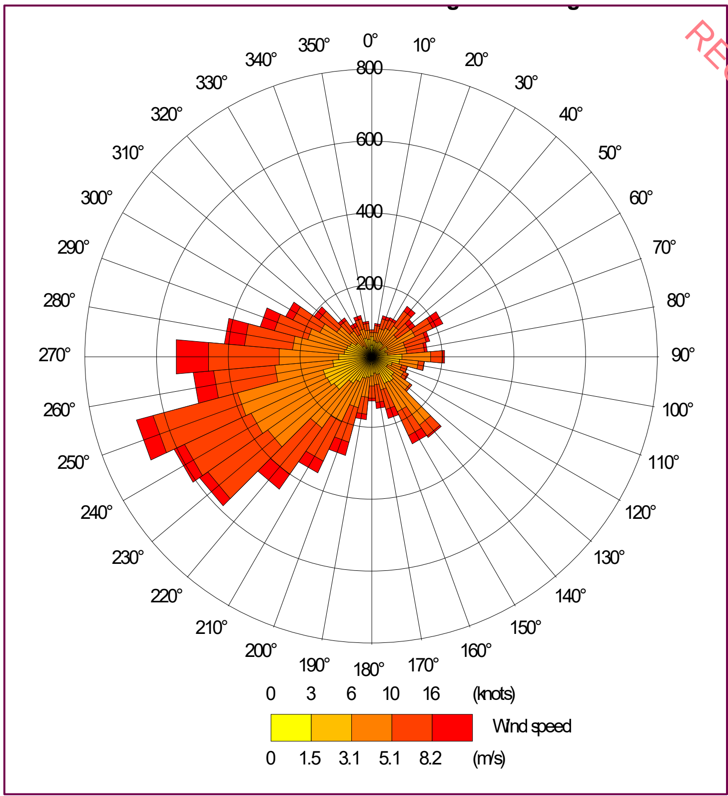

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Figure 8.6 Dublin Airport WindRose 2020

Figure 8.7 Air Quality Receptors

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Background Data - Rathmines Station

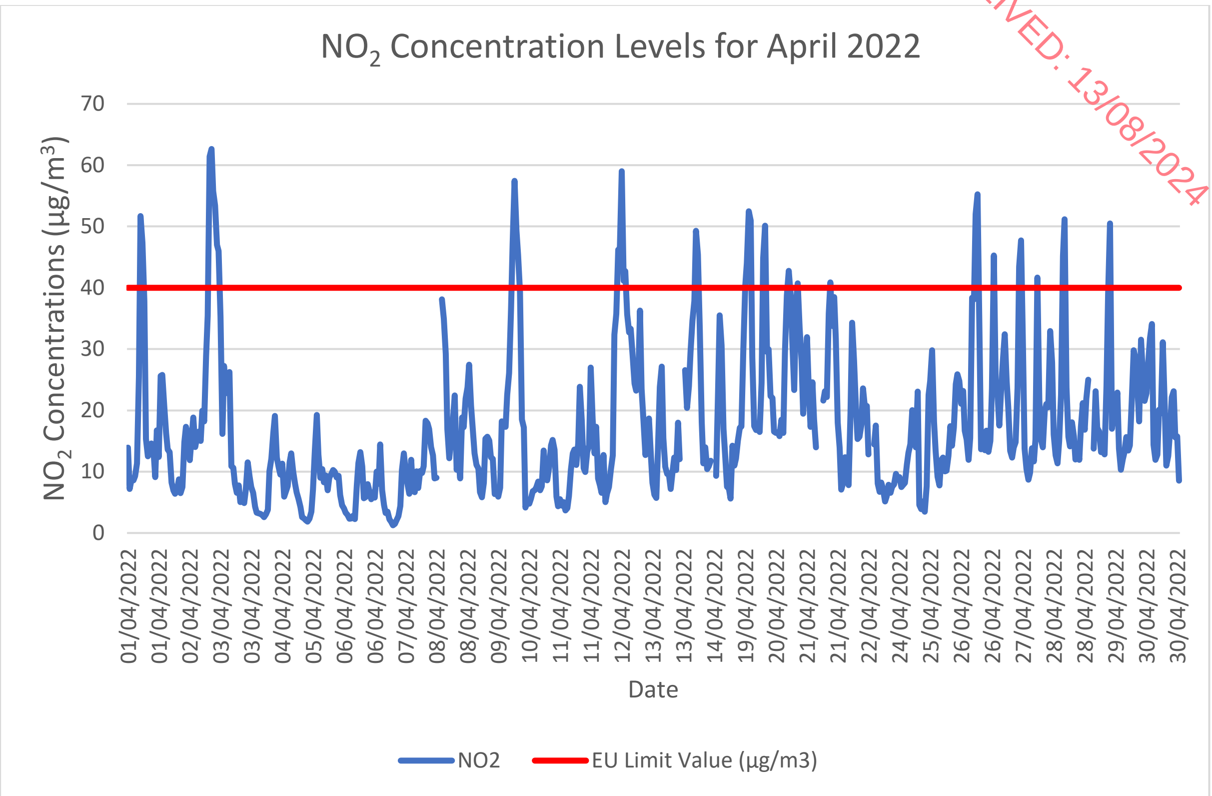

Figure 8.8 No$_2$ Concentration Levels for April 2022

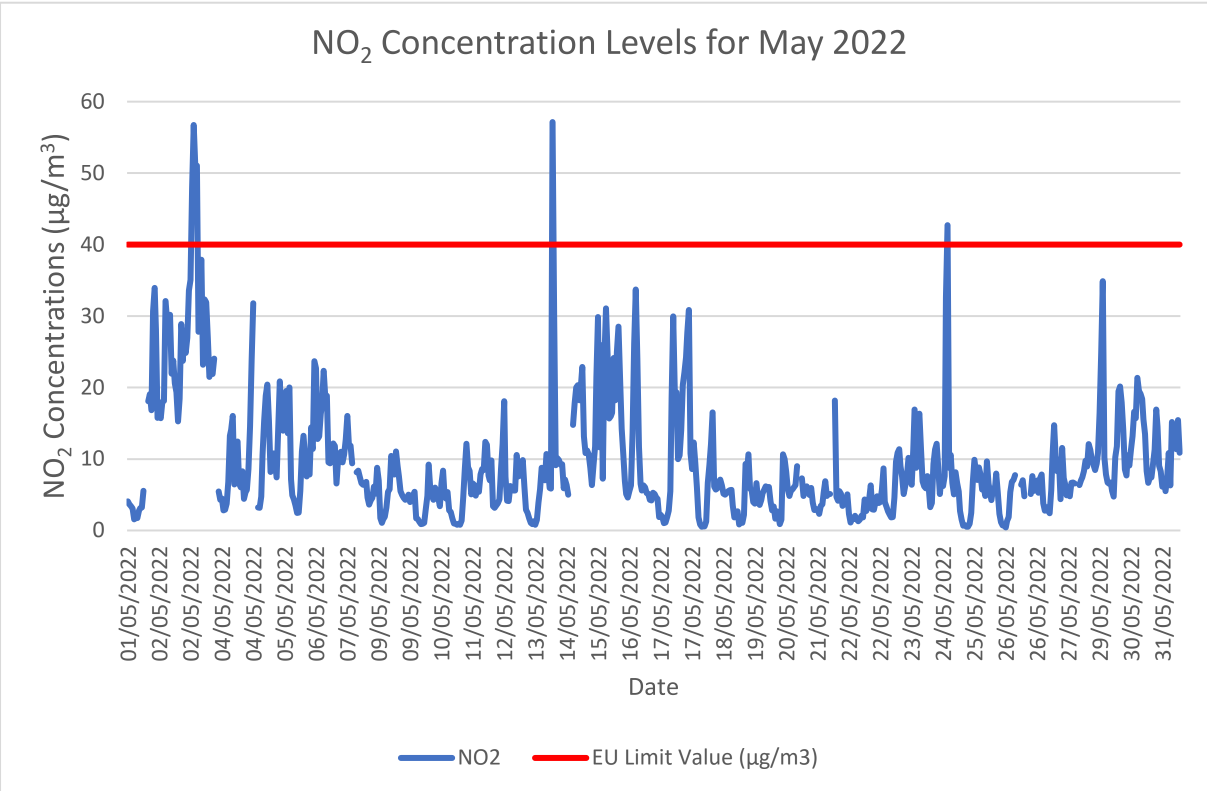

Figure 8.9 No$_2$ Concentration Levels for May 2022

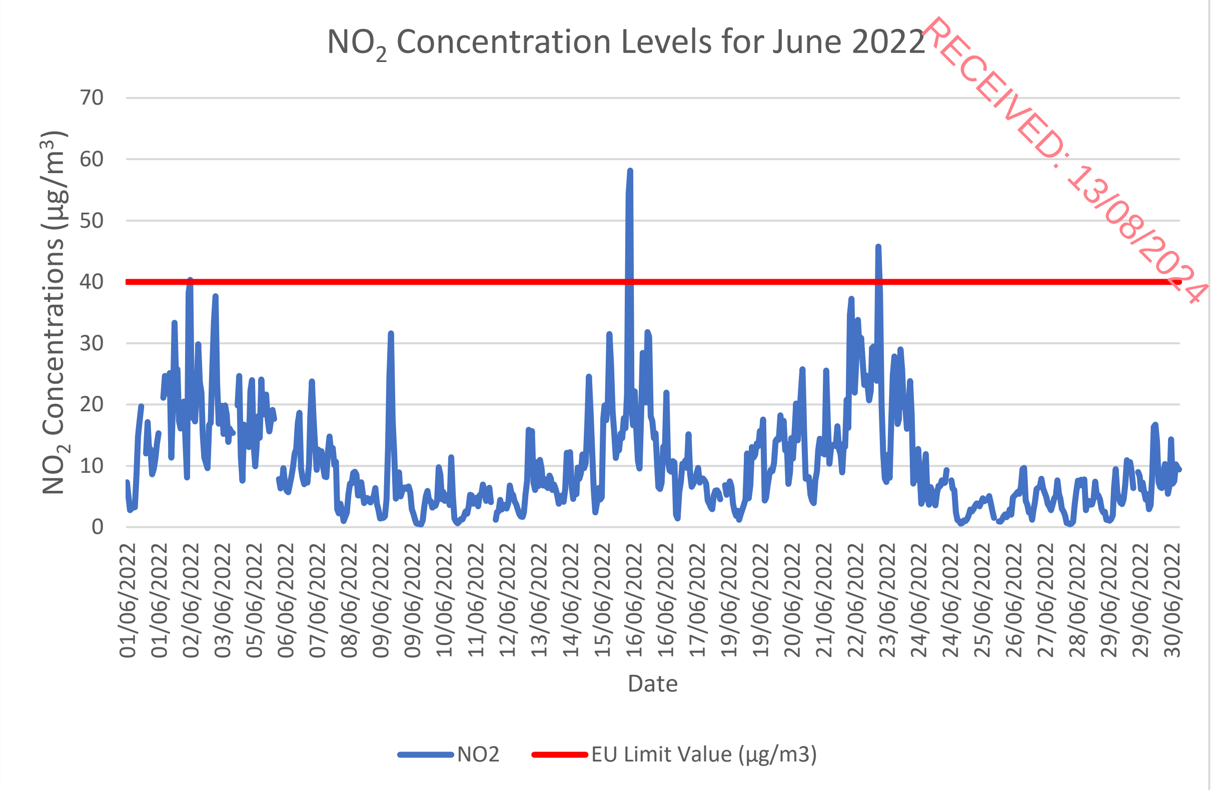

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Figure 8.10 No$_2$ Concentration Levels for June 2022

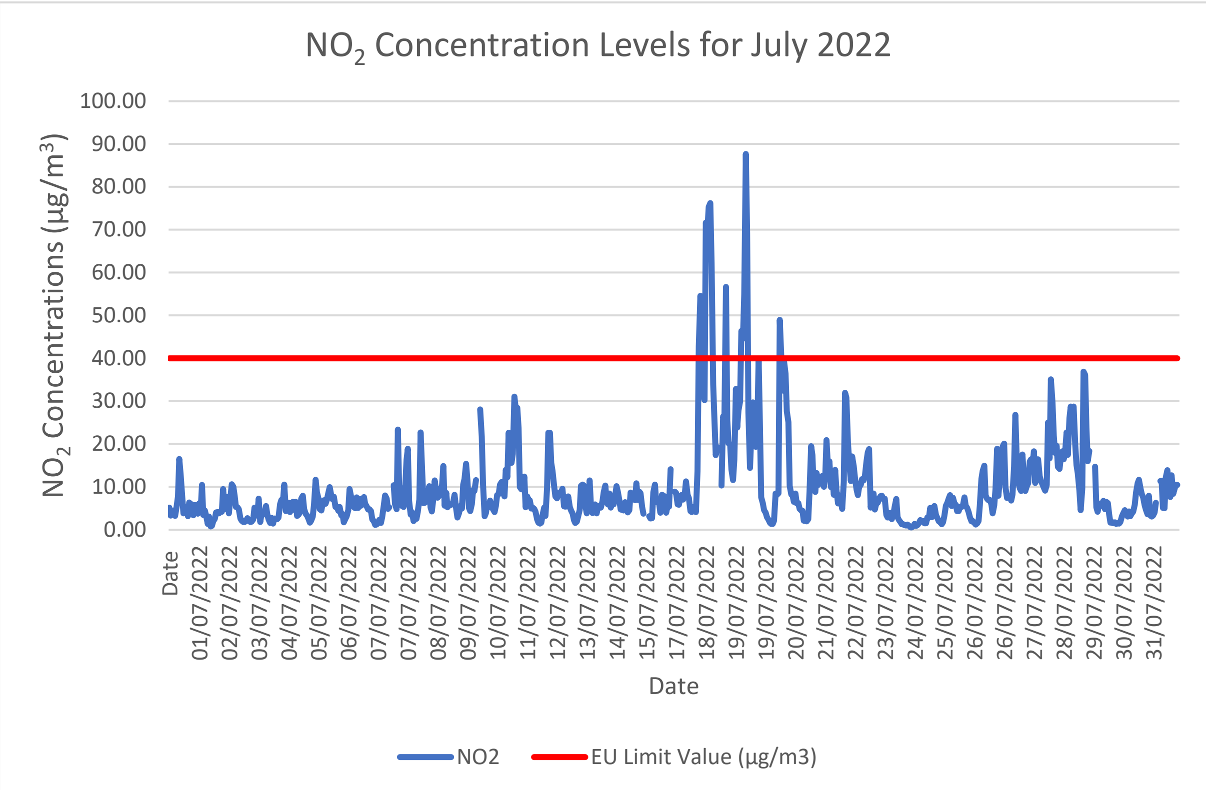

Figure 8.11 No$_2$ Concentration Levels for July 2022

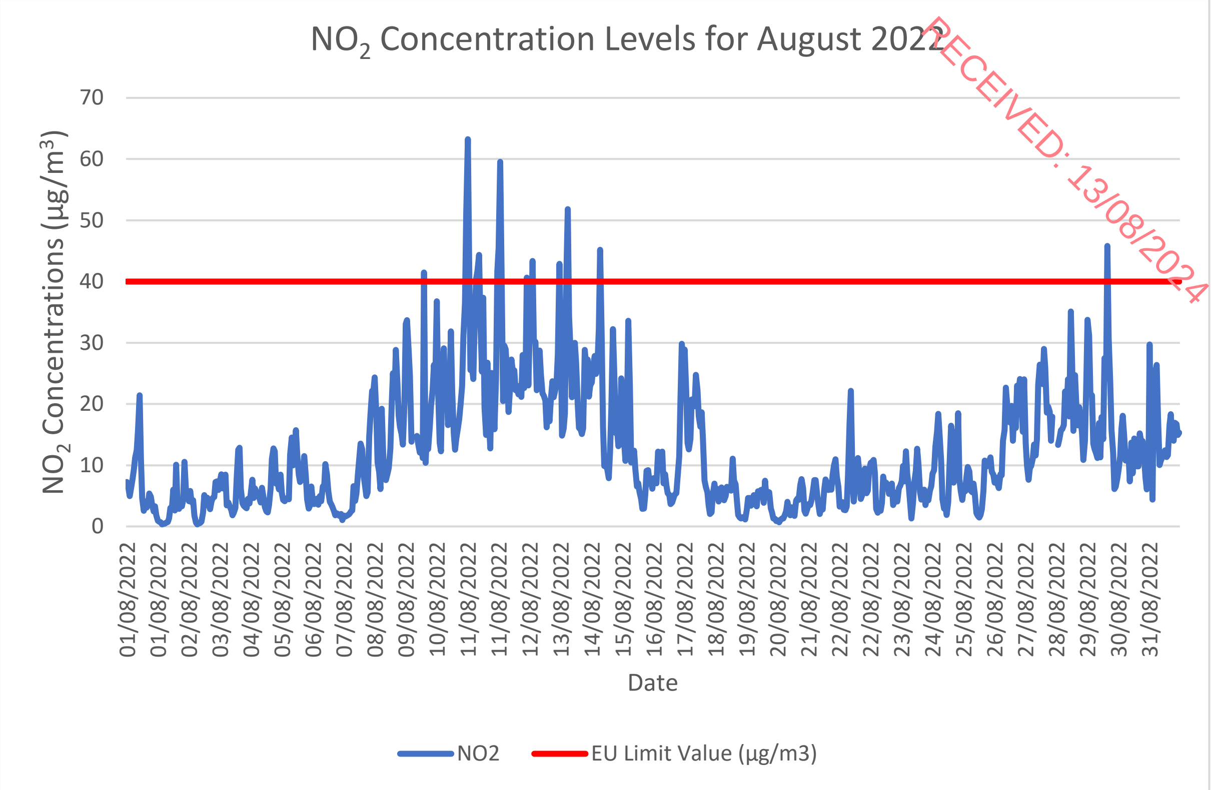

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Figure 8.12 No₂ Concentration Levels for August 2022

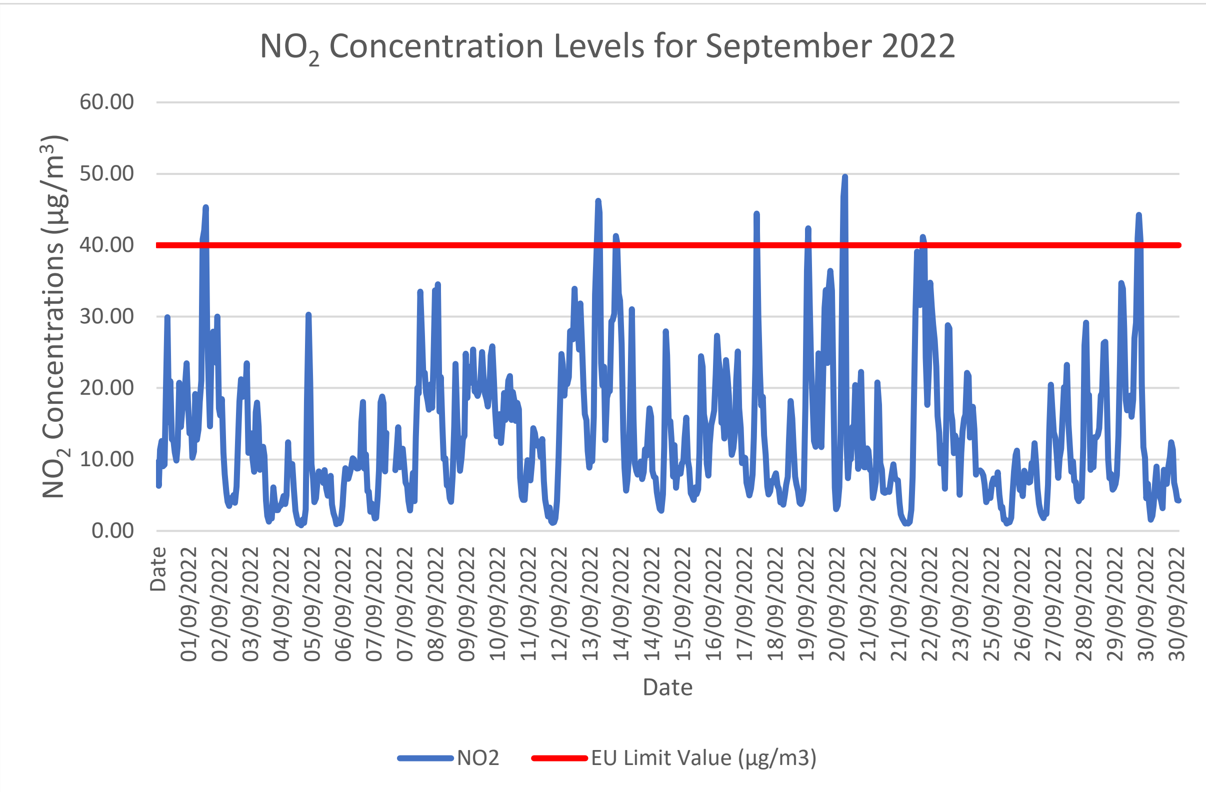

Figure 8.13 No₂ Concentration Levels for September 2022

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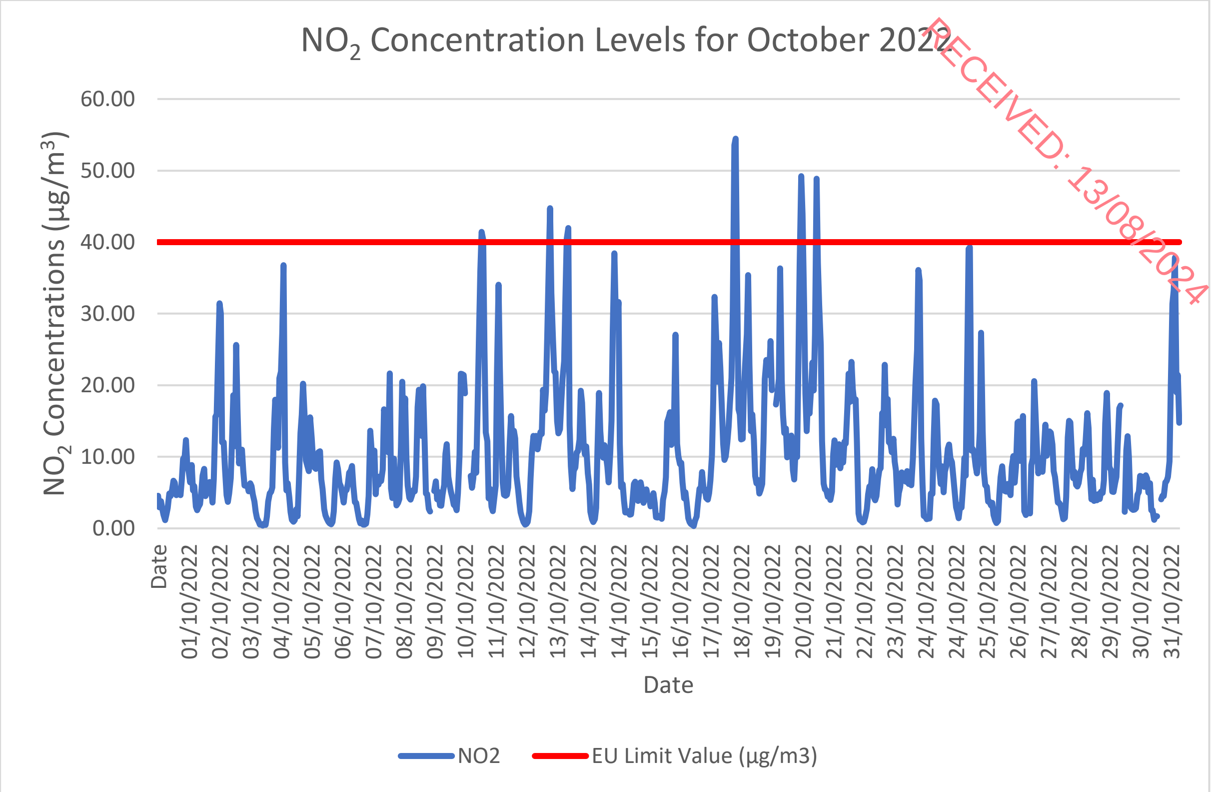

Figure 8.14 No$_2$ Concentration Levels for October 2022

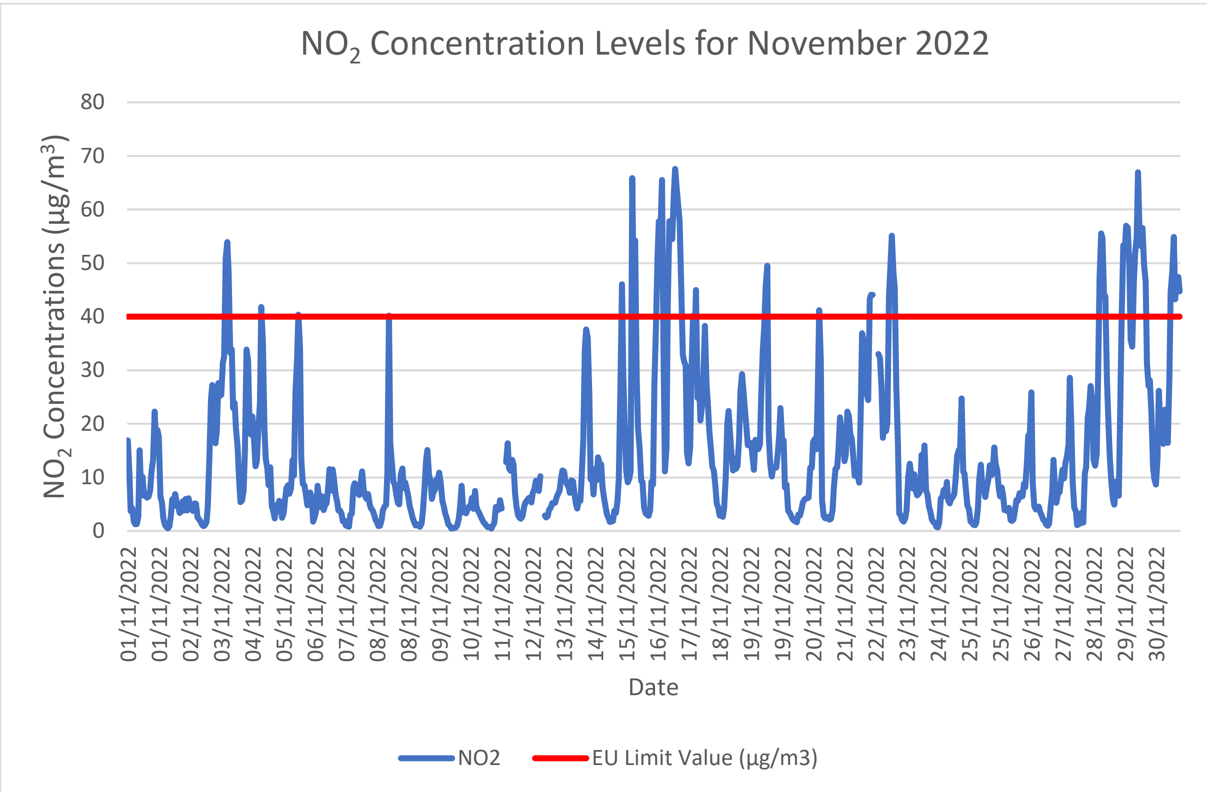

Figure 8.15 No$_2$ Concentration Levels for November 2022

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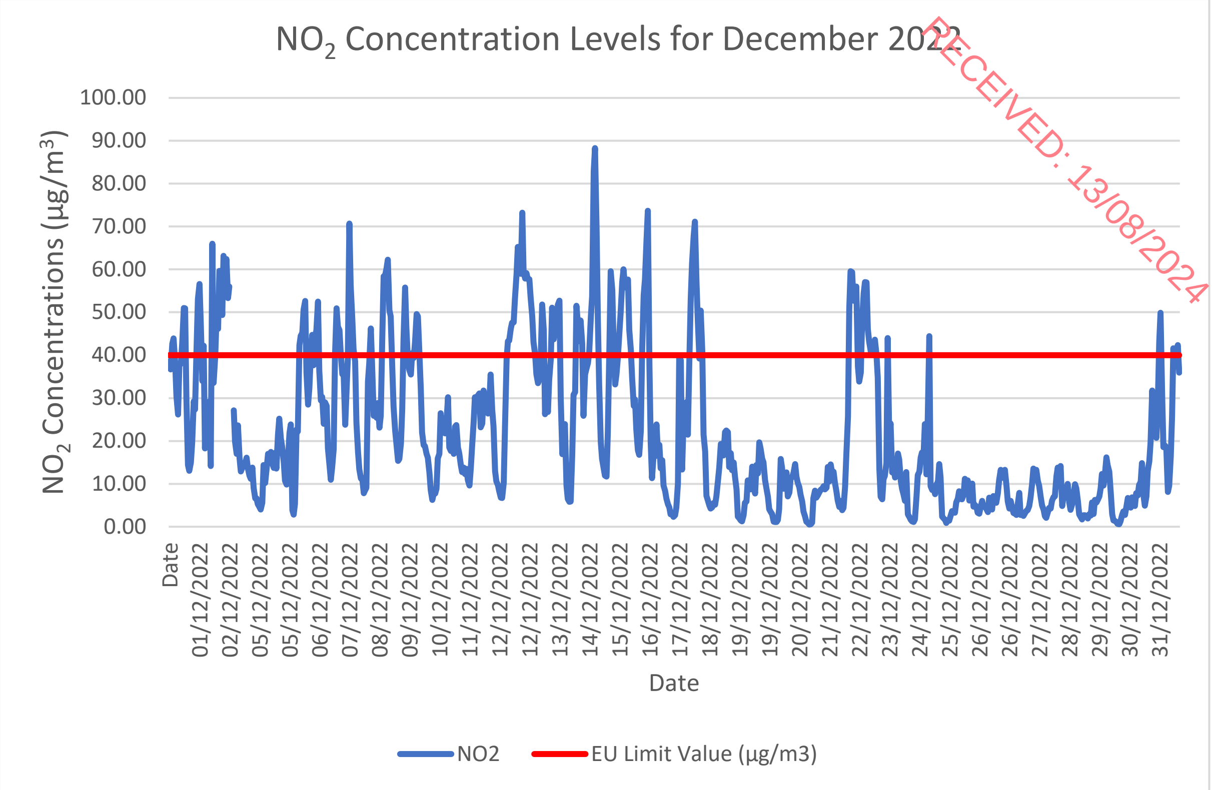

Figure 8.16 No₂ Concentration Levels for December 2022

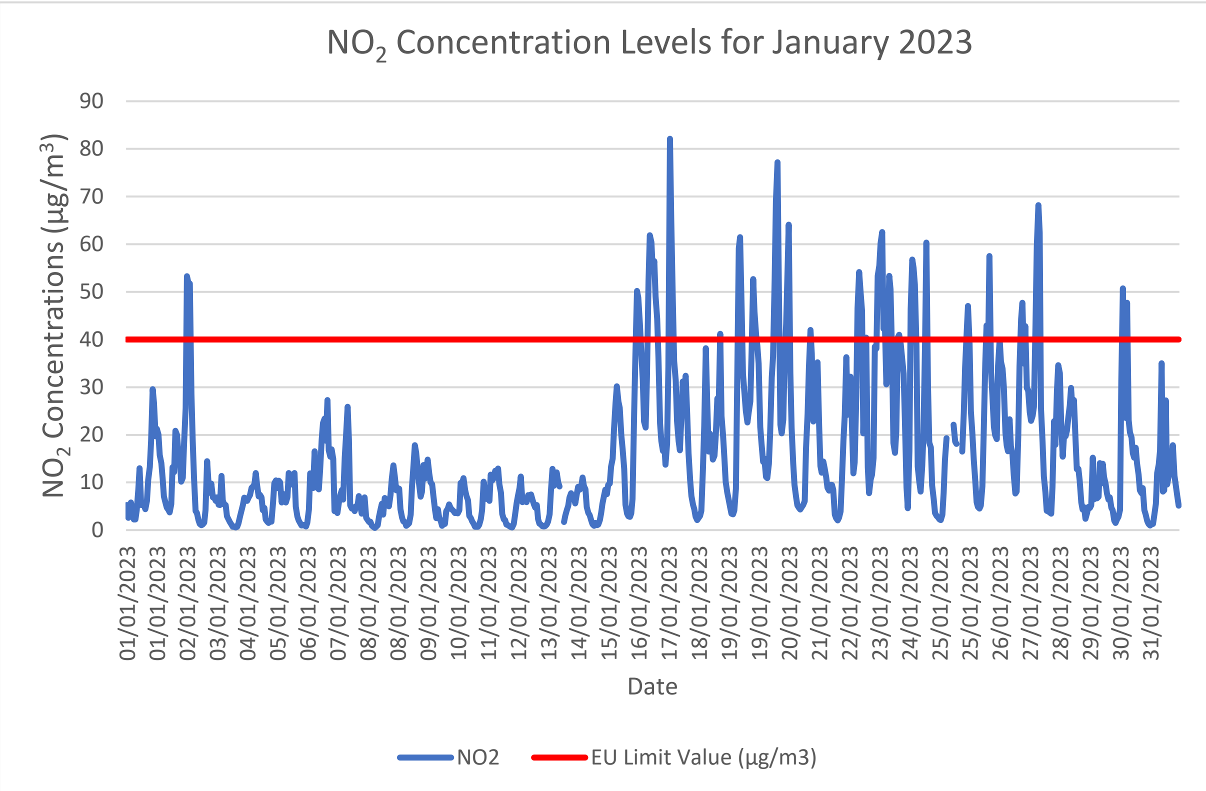

Figure 8.17 No₂ Concentration Levels for January 2023

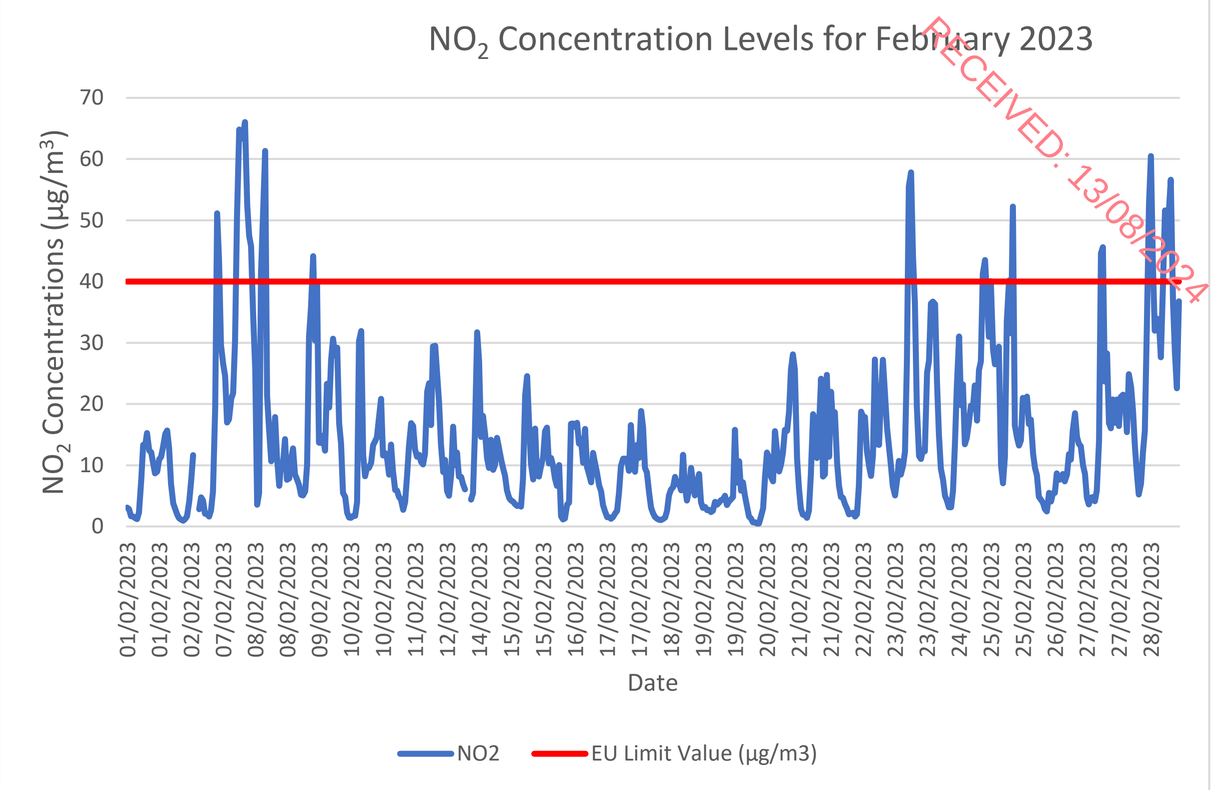

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Figure 8.18 No$_2$ Concentration Levels for February 2023

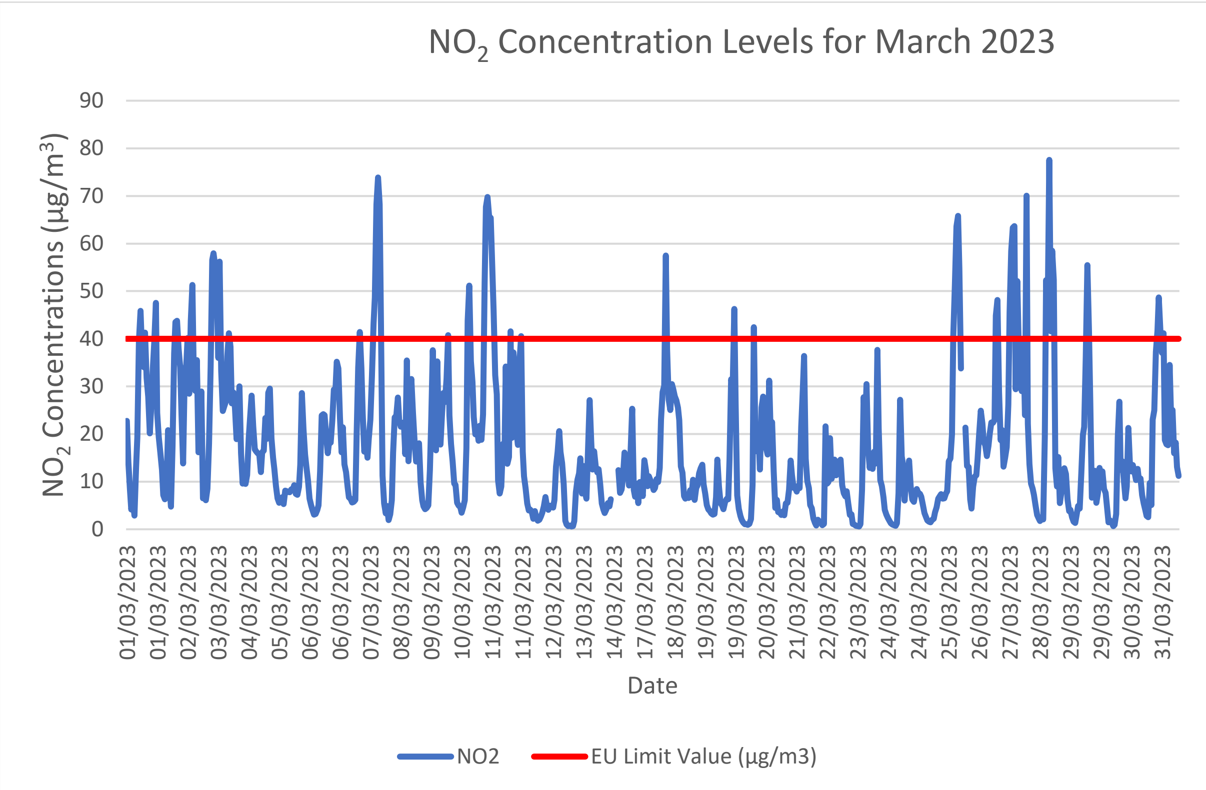

Figure 8.19 No$_2$ Concentration Levels for March 2023

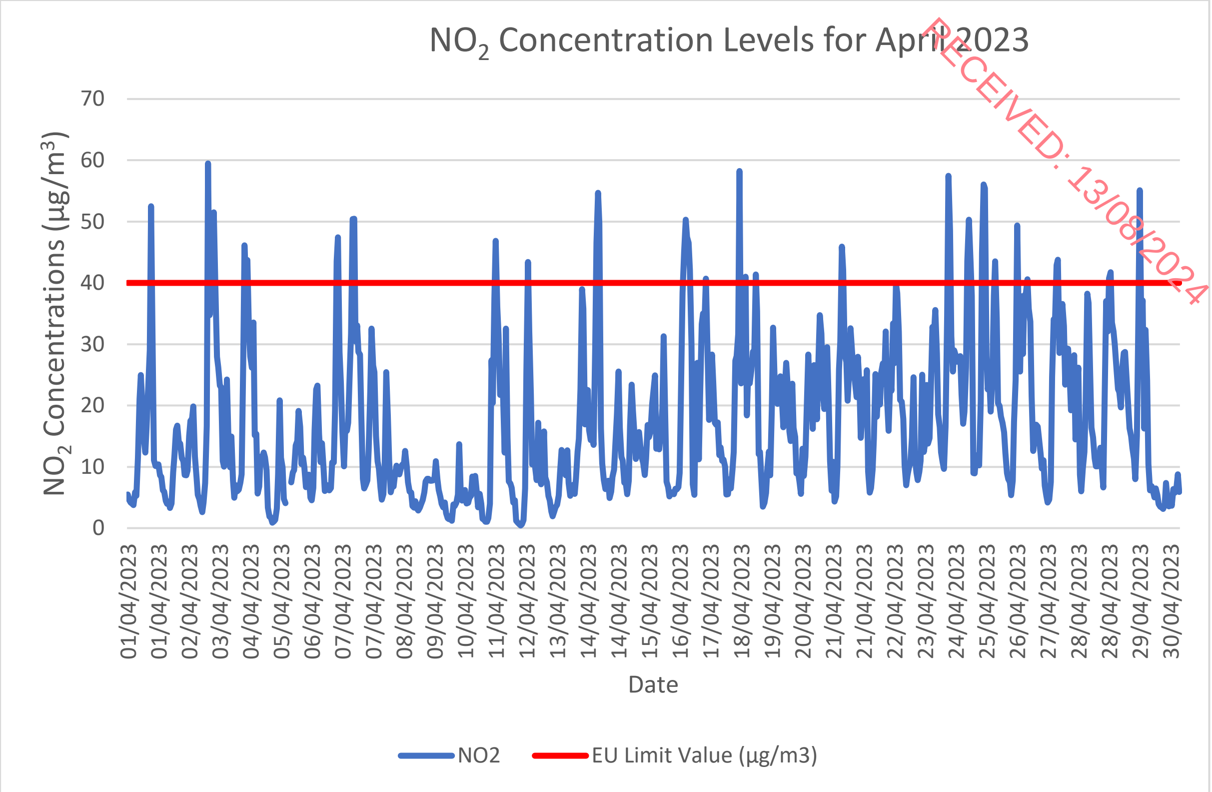

Figure 8.20 No₂ Concentration Levels for April 2023

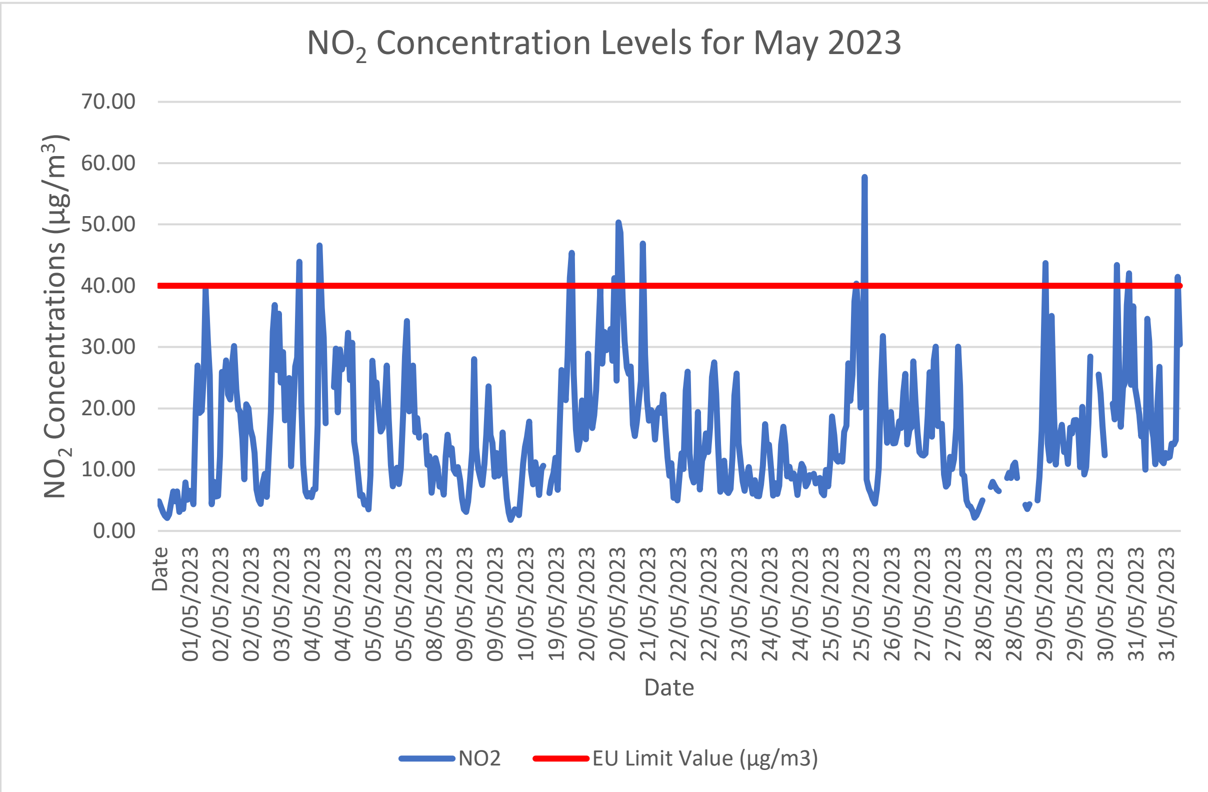

Figure 8.21 No₂ Concentration Levels for May 2023

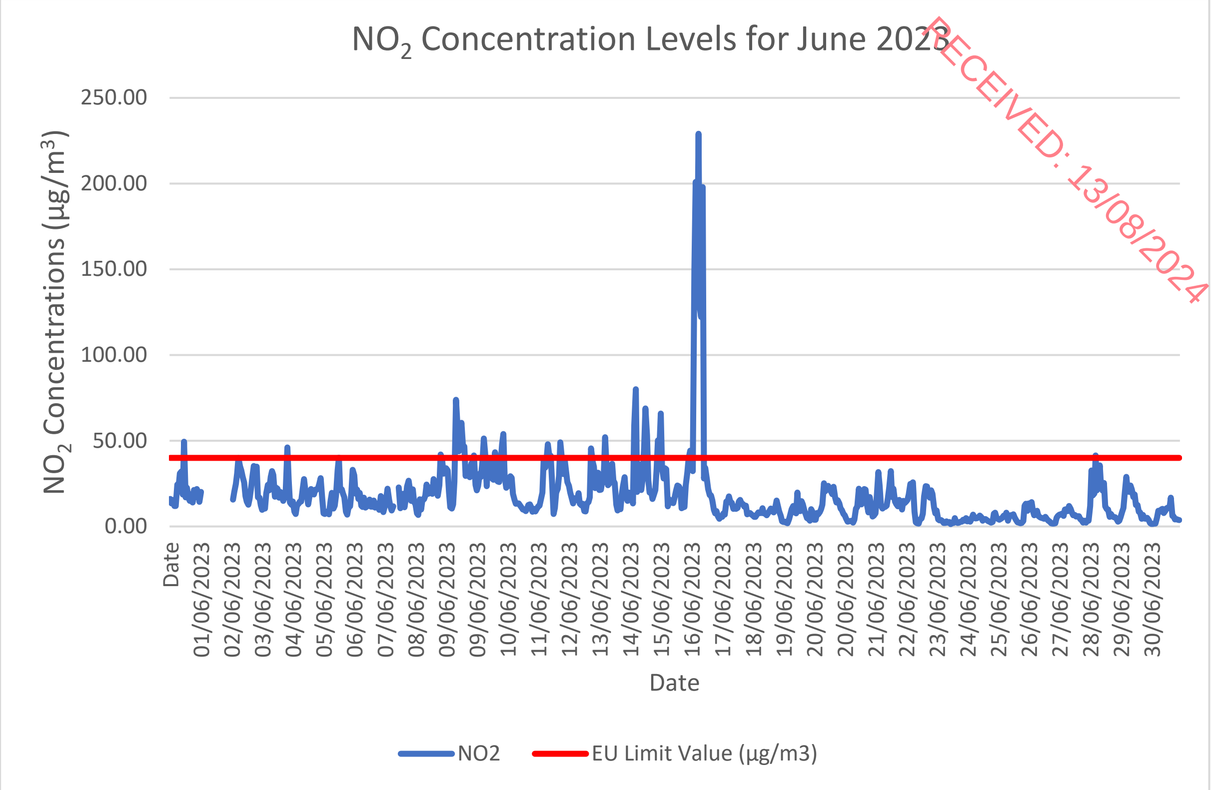

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Figure 8.22 No₂ Concentration Levels for June 2023

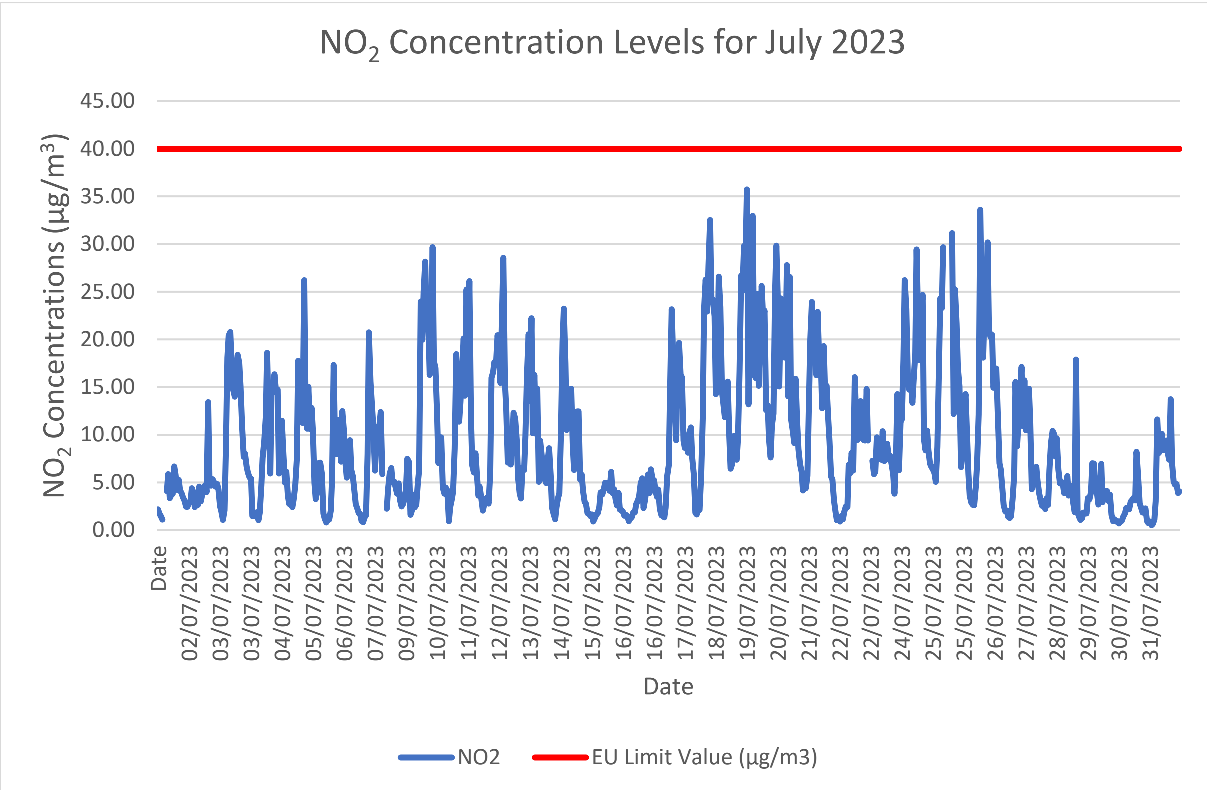

Figure 8.23 No₂ Concentration Levels for July 2023

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Kildare Station

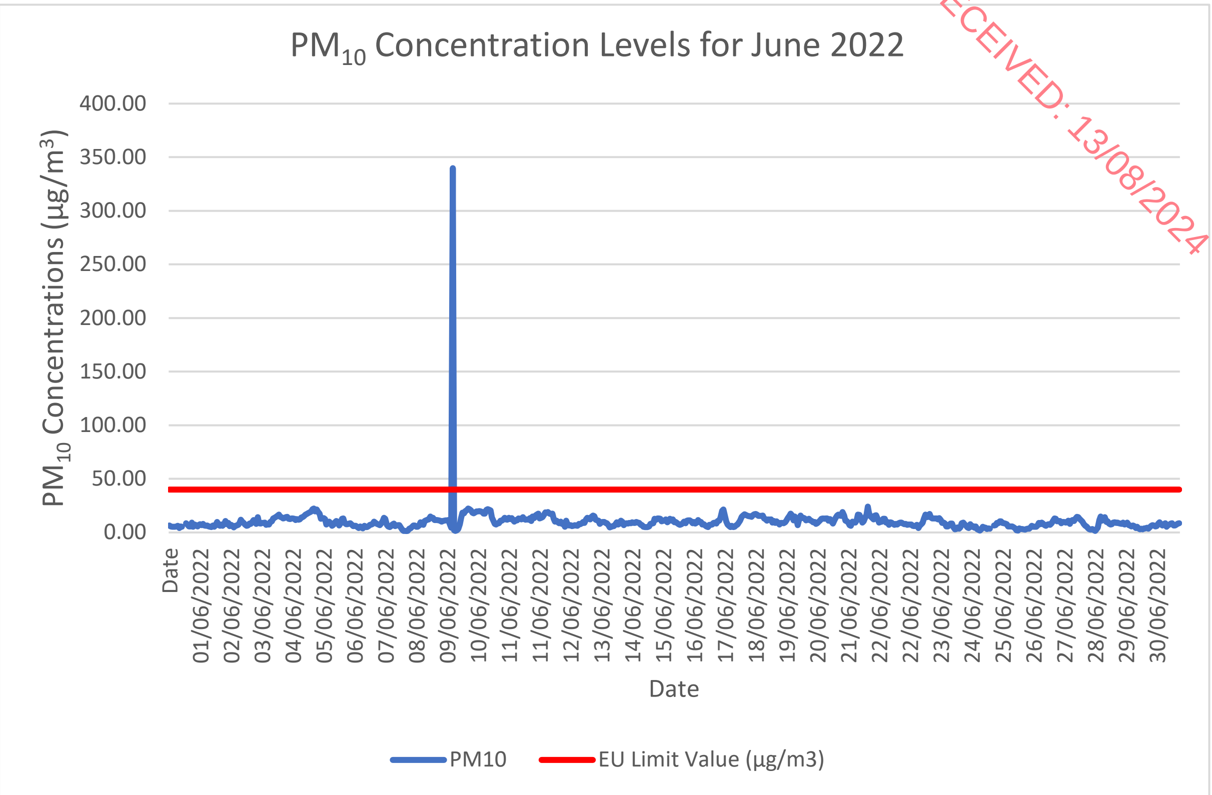

Figure 8.24 PM_{10} Concentration Levels for June 2022

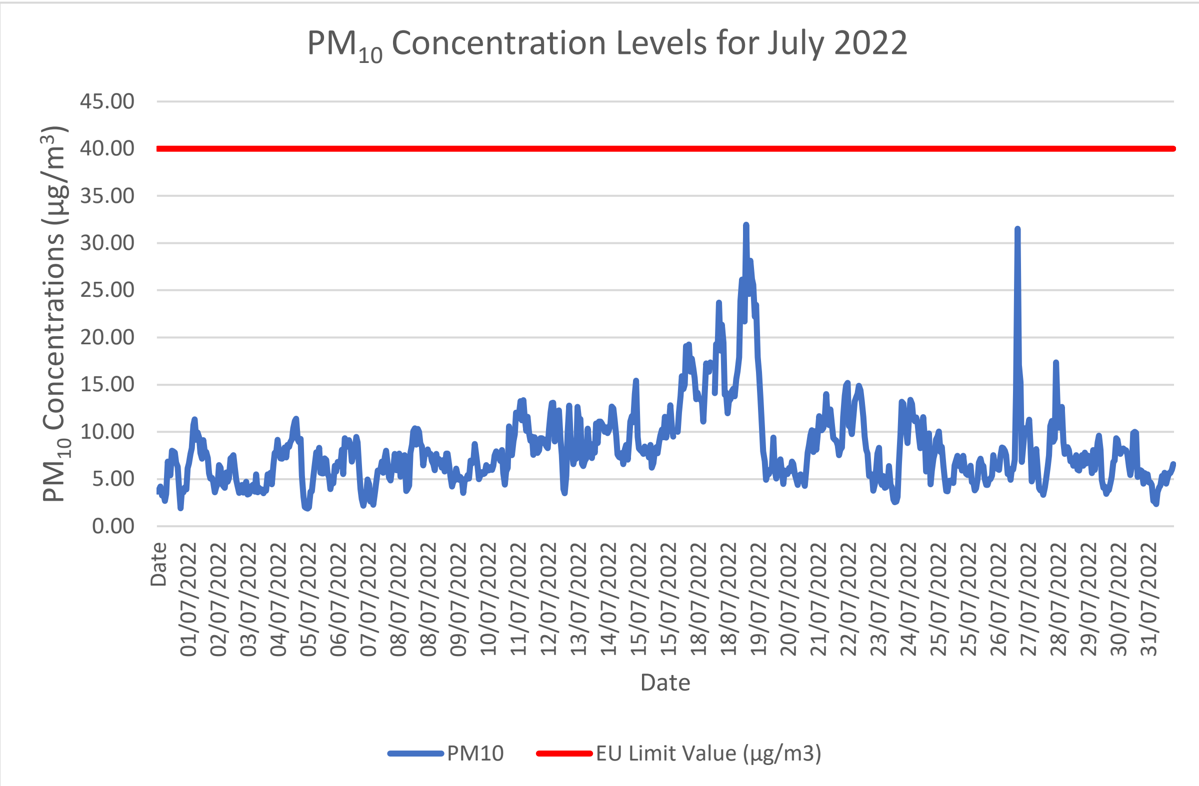

Figure 8.25 PM_{10} Concentration Levels for July 2022

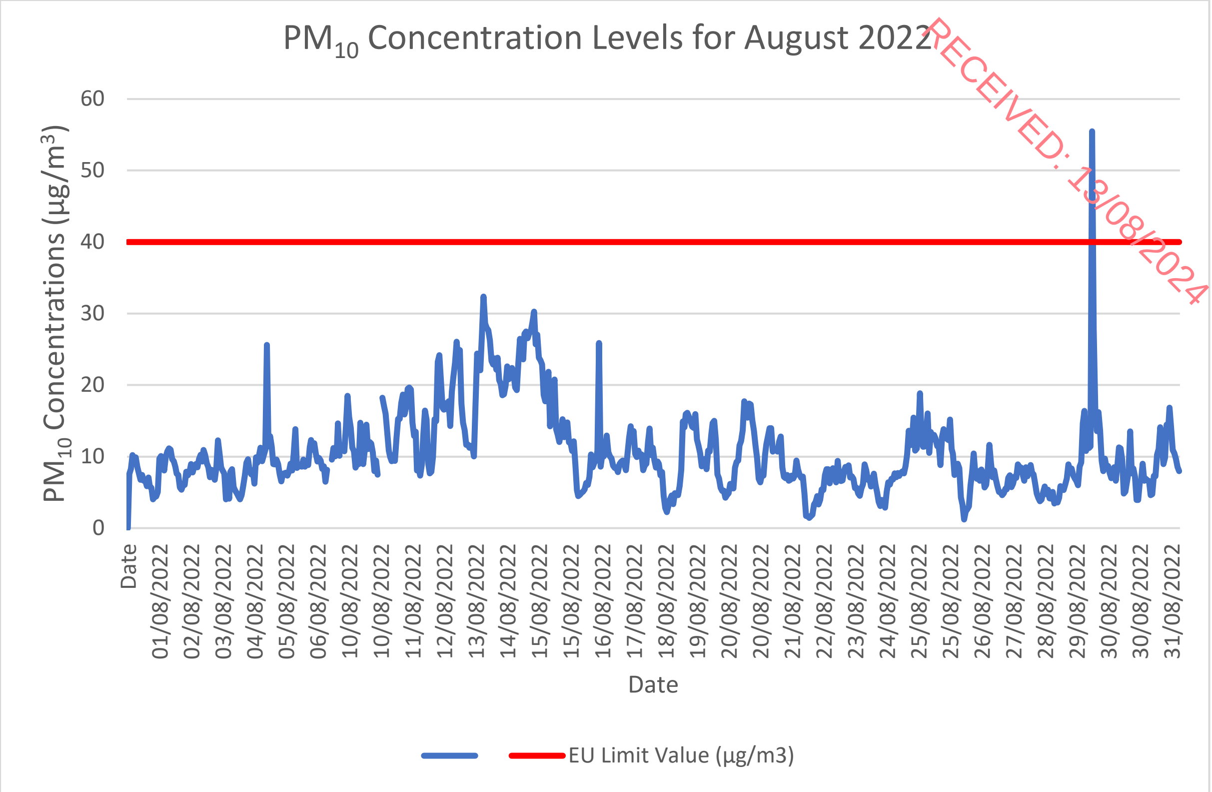

Figure 8.26 PM_{10} Concentration Levels for August 2022

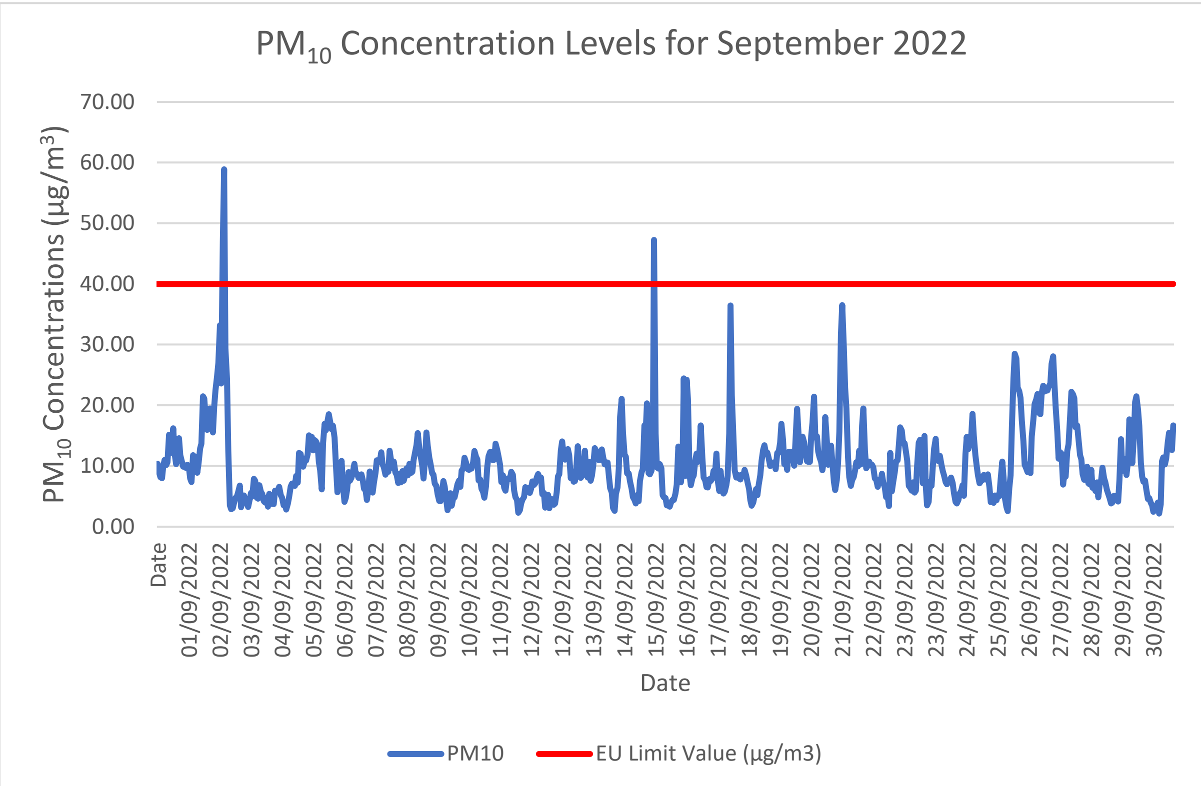

Figure 8.27 PM_{10} Concentration Levels for September 2022

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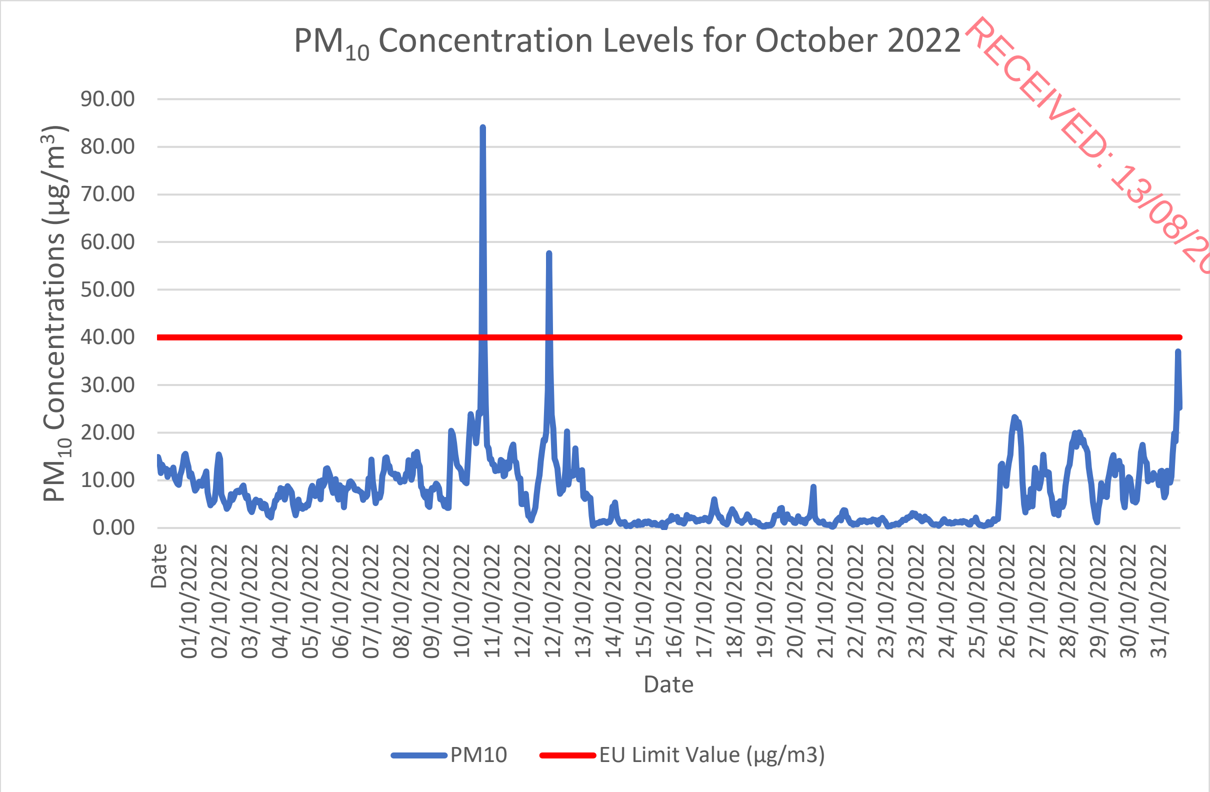

Figure 8.28 PM_{10} Concentration Levels for October 2022

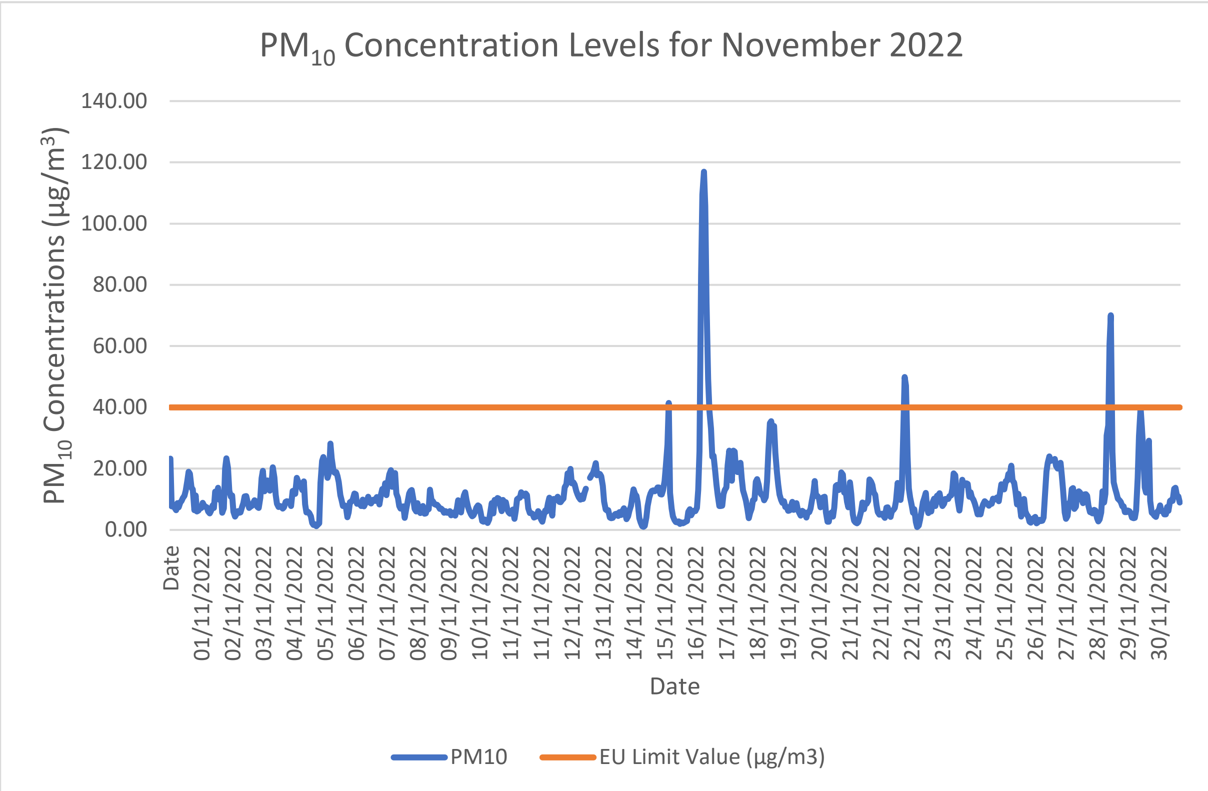

Figure 8.29 PM_{10} Concentration Levels for November 2022

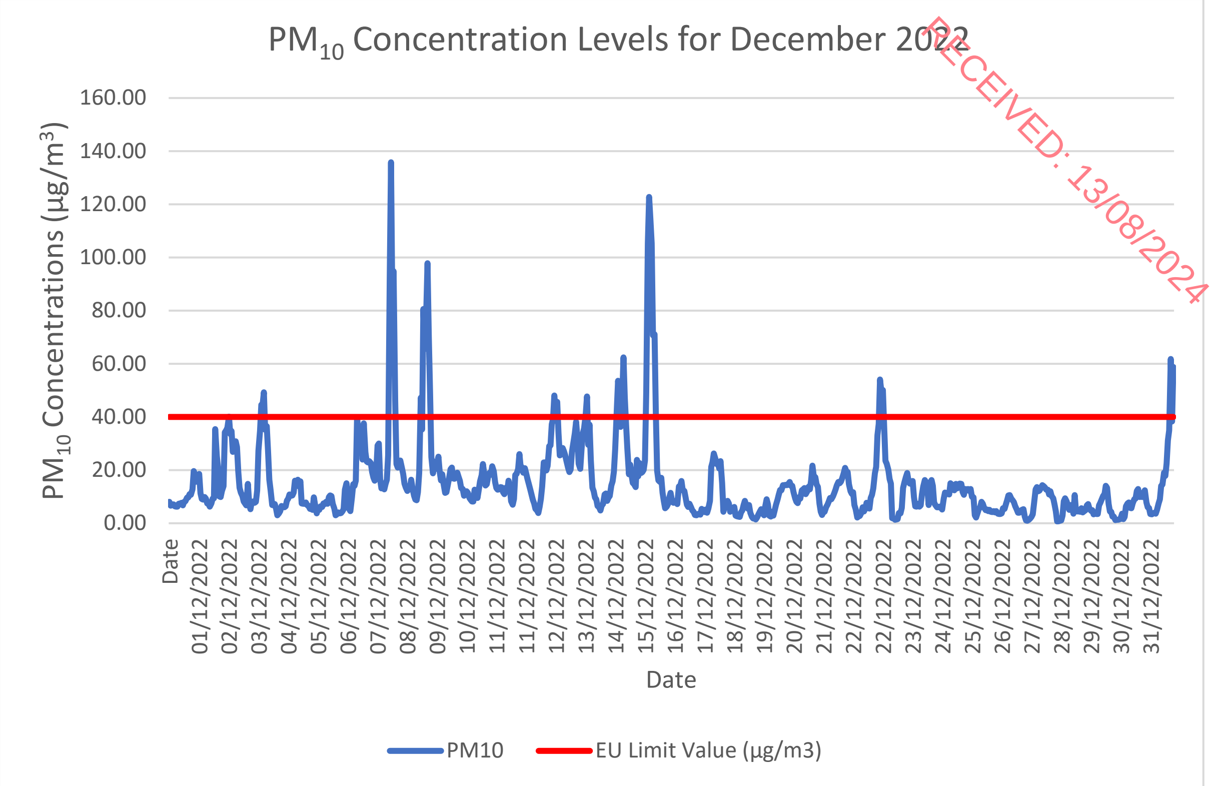

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Figure 8.30 PM_{10} Concentration Levels for December 2022

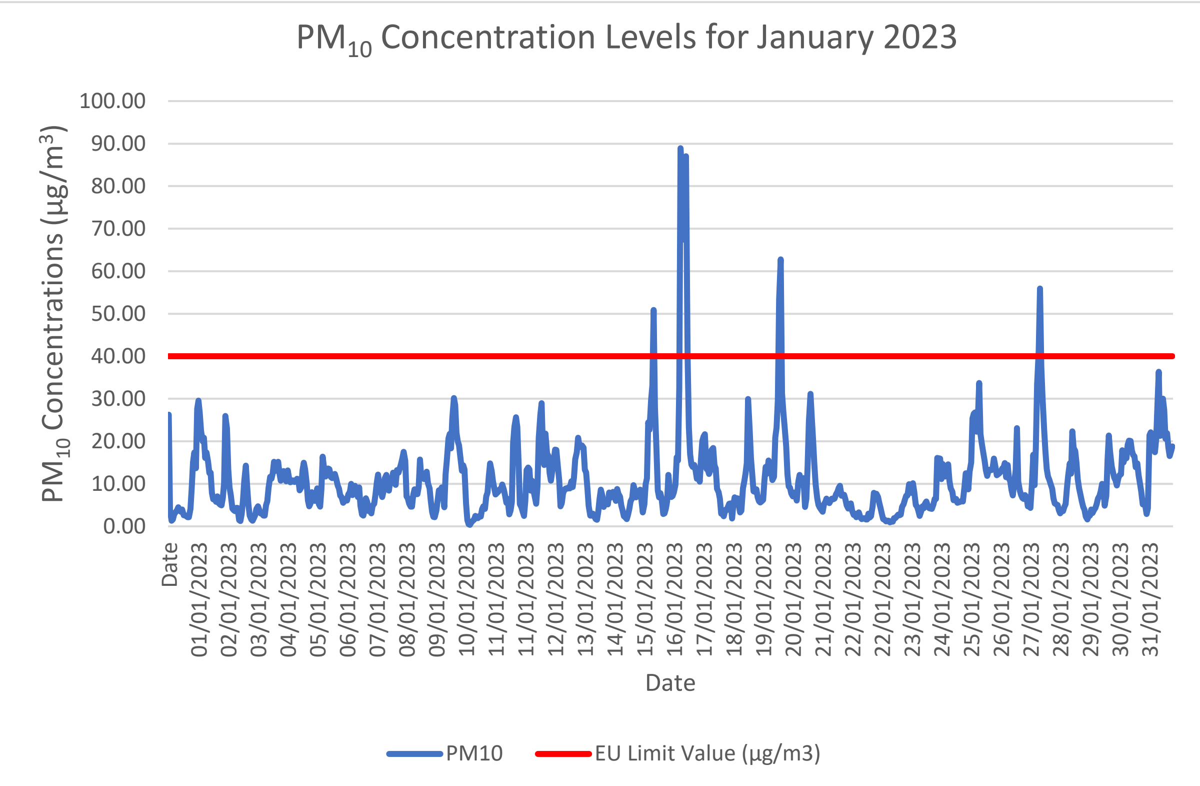

Figure 8.31 PM_{10} Concentration Levels for January 2023

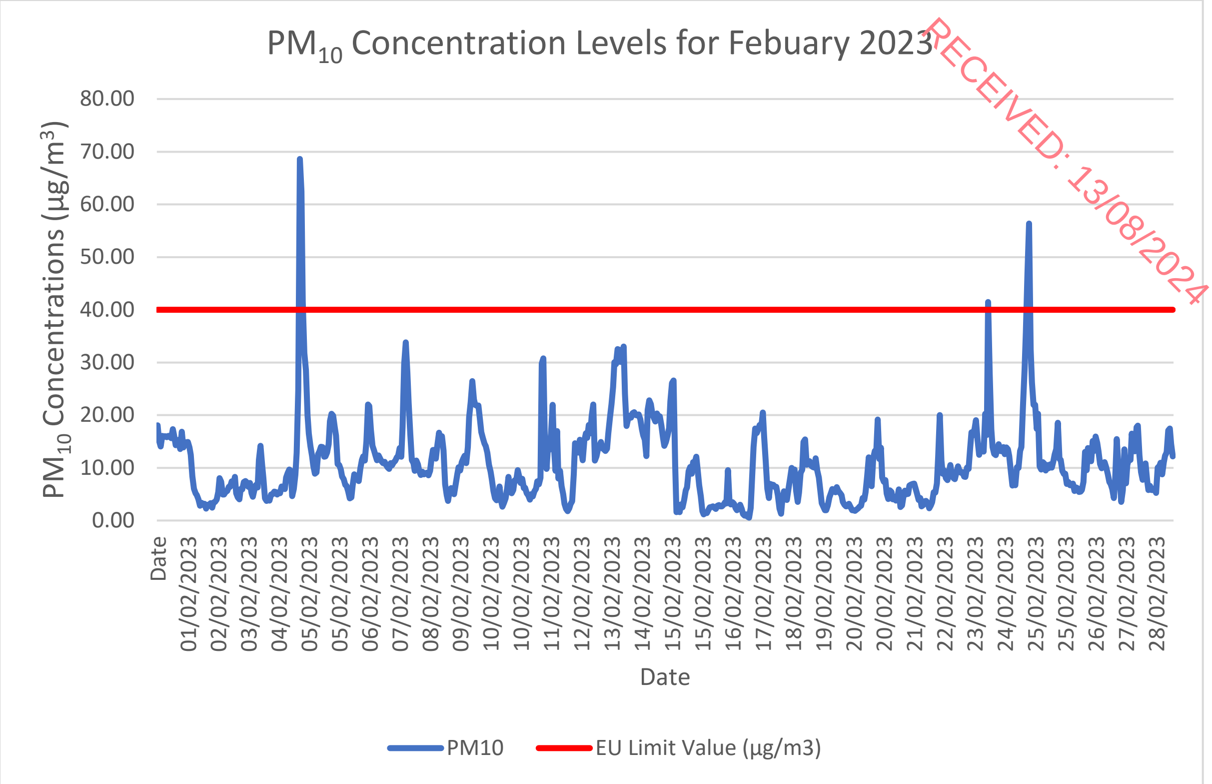

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Figure 8.32 PM_{10} Concentration Levels for February 2023

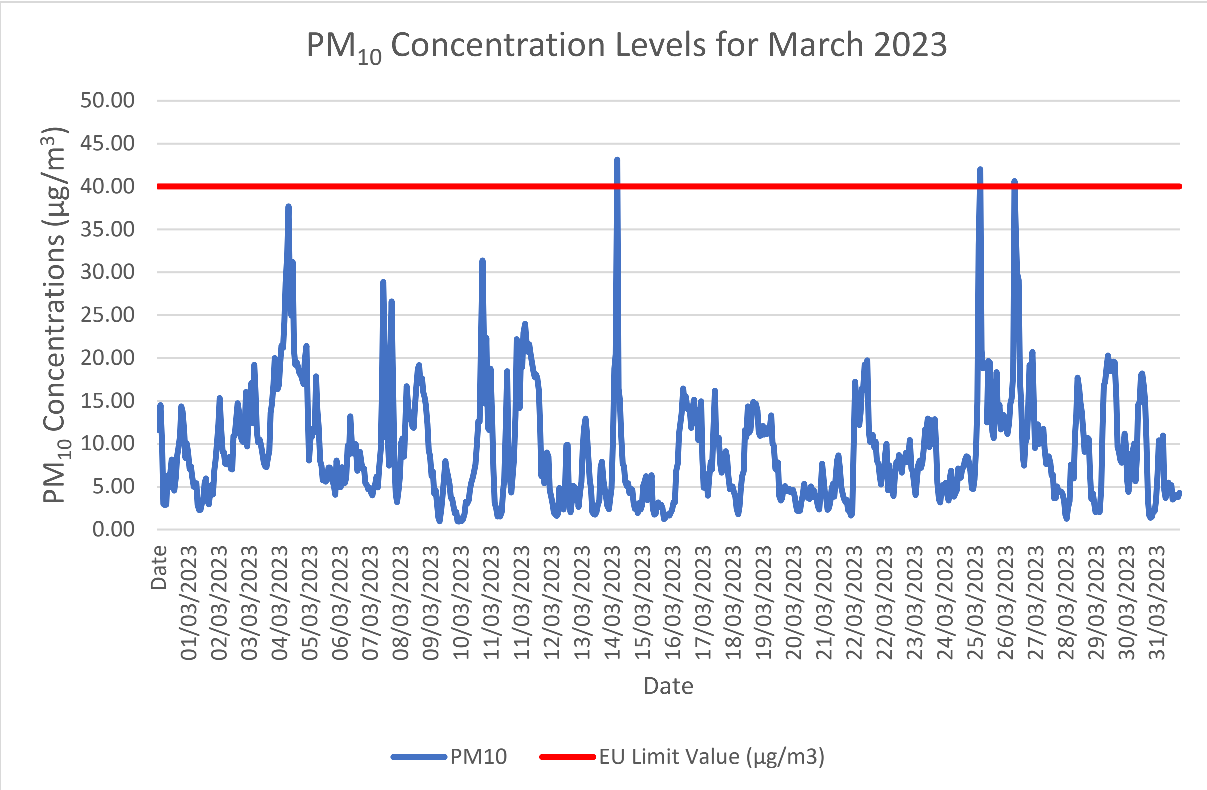

Figure 8.33 PM_{10} Concentration Levels for March 2023

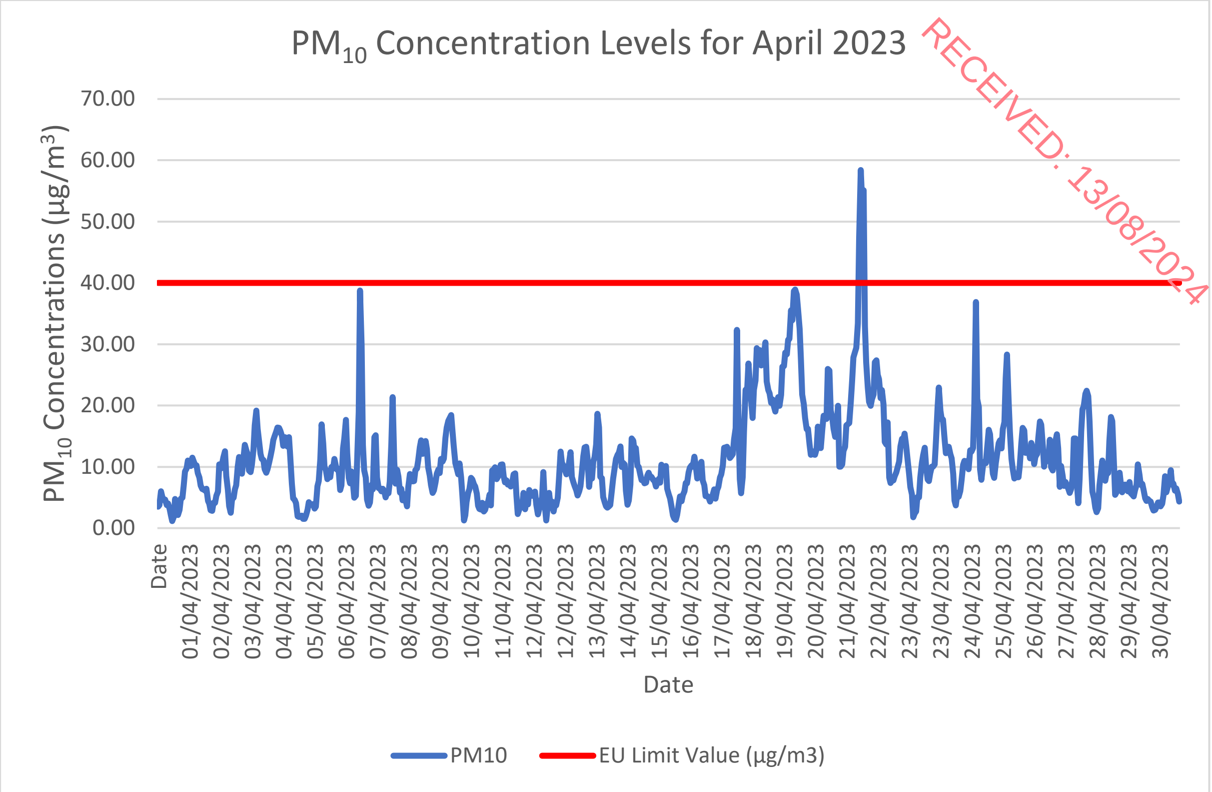

Figure 8.34 PM$_{10}$ Concentration Levels for April 2023

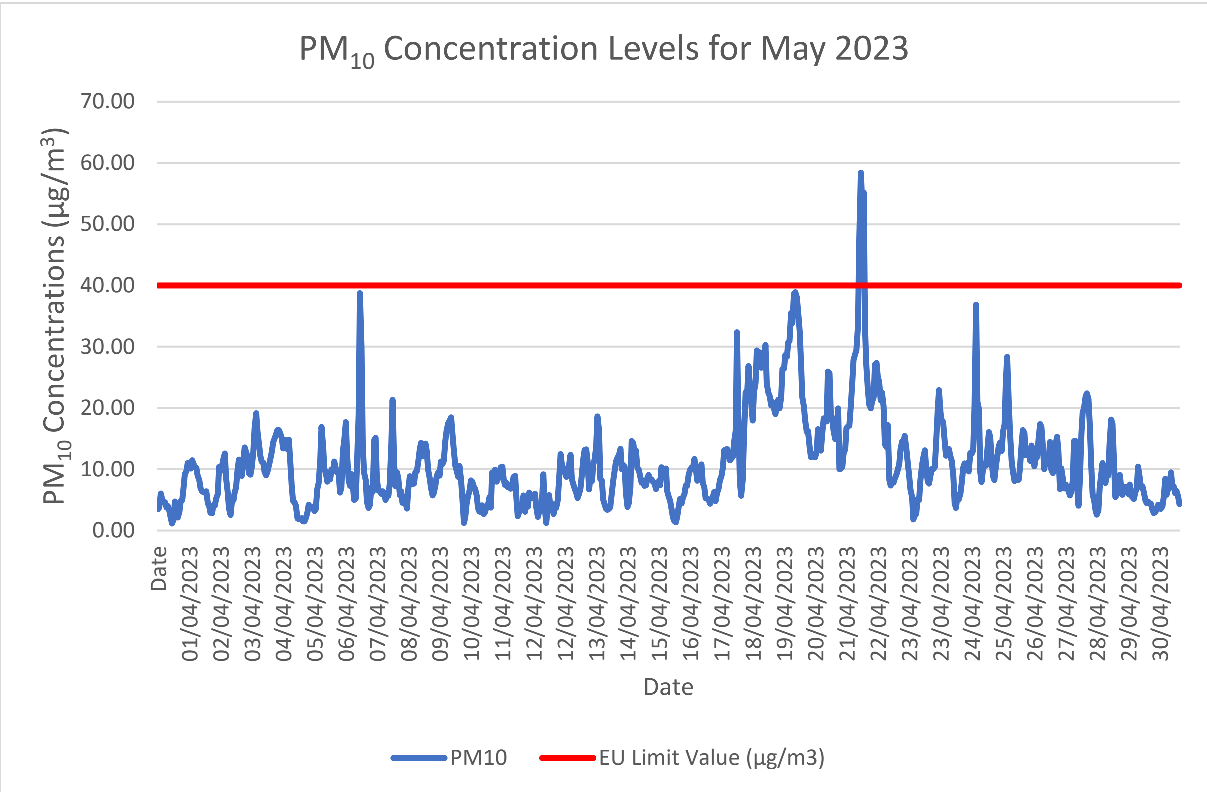

Figure 8.35 PM$_{10}$ Concentration Levels for May 2023

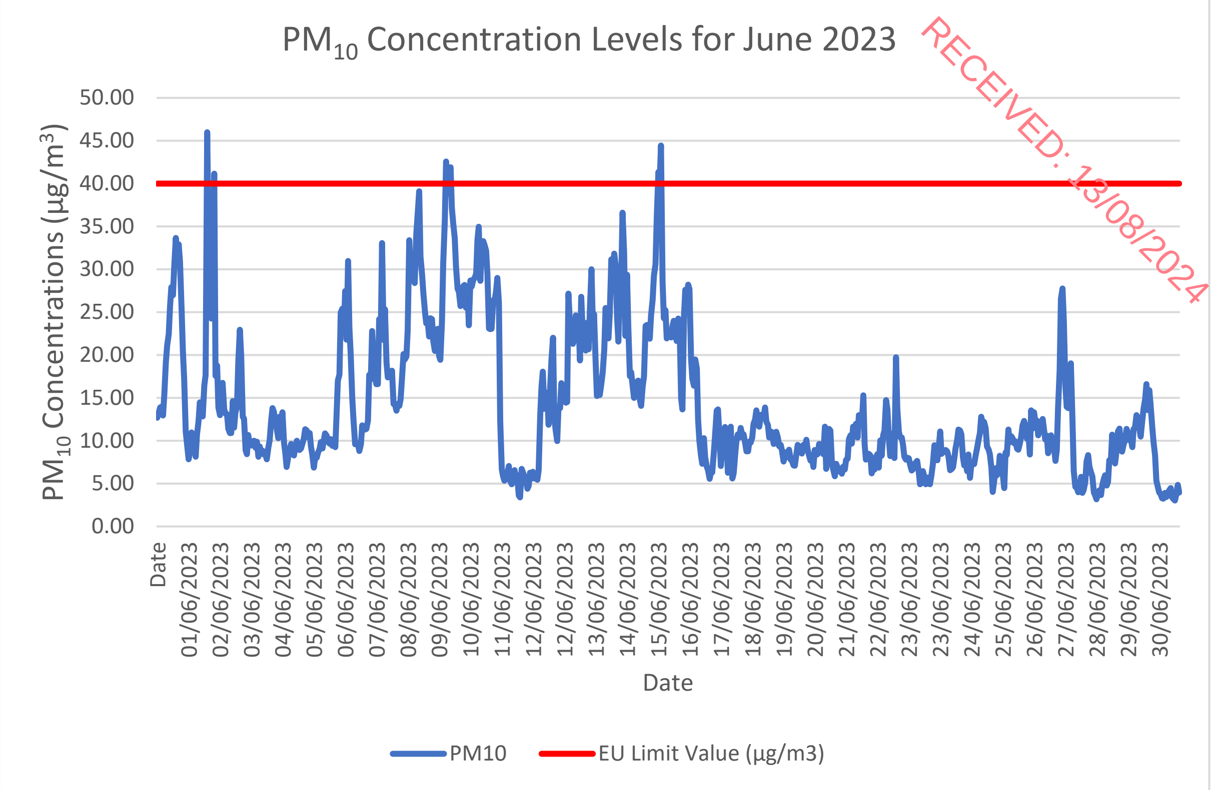

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Figure 8.36 PM$_{10}$ Concentration Levels for June 2023

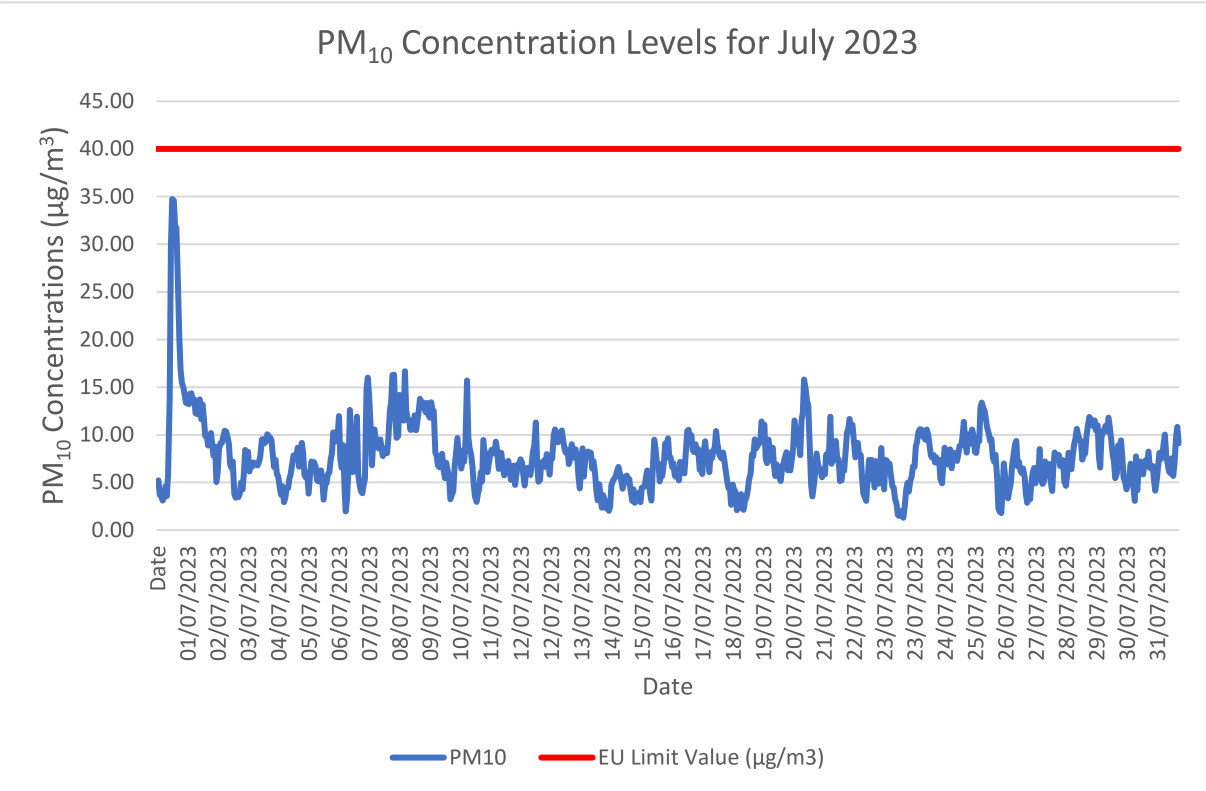

Figure 8.37 PM$_{10}$ Concentration Levels for July 2023

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Particulate Matter - PM_{10}

The average for PM_{10} for 2023 is **13.27**[1] **µg/m³**. This is used as the background data concentration.

The latest average for $PM_{2.5}$ is **9.47**[2] **µg/m³**. This is used as the background data concentration.

Nitrogen Dioxide - NO_2

The latest average for NO_x is **18.12**[3] **µg/m³.** This is used as the background data concentration.

The latest average for NO_2 is **9.96**[4] **µg/m³.** This is used as the background data concentration.

[1] https://www.epa.ie/publications/monitoring--assessment/air/air-quality-in-ireland-2022.php Average for 22 recording sites in 2022 for PM10. Table A10 Summary statistics for daily PM_{10} concentrations in Zone C in Ireland in 2022

[2] Average of 19 recording sites in Ireland 2022 for $PM_{2.5}$. Table A13 Summary statistics for daily PM2.5 concentrations in Zone C in Ireland in 2022.

[3] Average of 13 recoding sites for NOx. Table A4 Summary statistics for hourly NOx concentrations in Ireland in 2022 for Zones C and D.

[4] Average of 13 recoding sites for NO2. Table A2 Summary statistics for hourly NO2 concentrations in Ireland in 2022 for Zones C and D

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Model Outputs

Detailed Dispersion Modelling

Narrative

The likely impact from process emissions may be estimated using an appropriate atmospheric dispersion model and reliable emission estimates. The emissions from the installation are based on information provided by the applicant. The emission data is presented in Table 8.1 (based on gas fired units) and 8.2 (in the unlikely event that gas supply to the turbines is interrupted or becomes unavailable, the reciprocating gas engines can operate either on piped gas supply or on stored on-site natural gas.).

Table 8.1 Gas Turbines

Source		OS x	(m)	stack height (m)	stack ID (m)	efflux velocity (m/s)	Temperature oC	Nox (g/s)
GT1	GT Exhaust DC1	286257	219522	20	1.5	27.7	514.15	0.510
GT2	GT Exhaust DC1	286250	219517	20	1.5	27.7	514.15	0.510
GT3	GT Exhaust DC1	286265	219527	20	1.5	27.7	514.15	0.510
GT4	GT Exhaust DC1	286273	219531	20	1.5	27.7	514.15	0.510
GT5	GT Exhaust DC1	286296	219545	20	1.5	27.7	514.15	0.510
GT6	GT Exhaust DC1	286304	219550	20	1.5	27.7	514.15	0.510
GT7	GT Exhaust DC1	286312	219555	20	1.5	27.7	514.15	0.510
GT8	GT Exhaust DC1	286319	219559	20	1.5	27.7	514.15	0.510
GT9	GT Exhaust DC2	286362	219586	20	1.5	27.7	514.15	0.510
GT10	GT Exhaust DC2	286370	219591	20	1.5	27.7	514.15	0.510
GT11	GT Exhaust DC2	286377	219596	20	1.5	27.7	514.15	0.510
GT12	GT Exhaust DC2	286385	219601	20	1.5	27.7	514.15	0.510
GT13	GT Exhaust DC2	286408	219615	20	1.5	27.7	514.15	0.510
GT14	GT Exhaust DC2	286415	219620	20	1.5	27.7	514.15	0.510
GT15	GT Exhaust DC2	286422	219625	20	1.5	27.7	514.15	0.510
GT16	GT Exhaust DC2	286430	219630	20	1.5	27.7	514.15	0.510
GT17	GT Exhaust DC3	286473	219654	20	1.5	27.7	514.15	0.510
GT18	GT Exhaust DC3	286480	219659	20	1.5	27.7	514.15	0.510
GT19	GT Exhaust DC3	286488	219664	20	1.5	27.7	514.15	0.510
GT20	GT Exhaust DC3	286496	219669	20	1.5	27.7	514.15	0.510
GT21	GT Exhaust DC3	286518	219684	20	1.5	27.7	514.15	0.510
GT22	GT Exhaust DC3	286526	219688	20	1.5	27.7	514.15	0.510
GT23	GT Exhaust DC3	286533	219693	20	1.5	27.7	514.15	0.510
GT24	GT Exhaust DC3	286541	219698	20	1.5	27.7	514.15	0.510
GT25	GT Exhaust DC4	286699	219594	20	1.5	27.7	514.15	0.510
GT26	GT Exhaust DC4	286707	219599	20	1.5	27.7	514.15	0.510
GT27	GT Exhaust DC4	286715	219603	20	1.5	27.7	514.15	0.510
GT28	GT Exhaust DC4	286722	219608	20	1.5	27.7	514.15	0.510
GT29	GT Exhaust DC4	286745	219623	20	1.5	27.7	514.15	0.510
GT30	GT Exhaust DC4	286752	219628	20	1.5	27.7	514.15	0.510
GT31	GT Exhaust DC4	286760	219633	20	1.5	27.7	514.15	0.510
GT32	GT Exhaust DC4	286768	219637	20	1.5	27.7	514.15	0.510
GT33	GT Exhaust DC5	286459	219394	20	1.5	27.7	514.15	0.510
GT34	GT Exhaust DC5	286450	219409	20	1.5	27.7	514.15	0.510
GT35	GT Exhaust DC5	286454	219401	20	1.5	27.7	514.15	0.510
GT36	GT Exhaust DC5	286464	219386	20	1.5	27.7	514.15	0.510
GT37	GT Exhaust DC5	286494	219341	20	1.5	27.7	514.15	0.510
GT38	GT Exhaust DC5	286489	219348	20	1.5	27.7	514.15	0.510
GT39	GT Exhaust DC5	286484	219356	20	1.5	27.7	514.15	0.510
GT40	GT Exhaust DC5	286479	219364	20	1.5	27.7	514.15	0.510
GT41	GT Exhaust DC6	286404	219540	20	1.5	27.7	514.15	0.510
GT42	GT Exhaust DC6	286409	219532	20	1.5	27.7	514.15	0.510
GT43	GT Exhaust DC6	286414	219525	20	1.5	27.7	514.15	0.510
GT44	GT Exhaust DC6	286419	219518	20	1.5	27.7	514.15	0.510
GT45	GT Exhaust DC6	286434	219495	20	1.5	27.7	514.15	0.510
GT46	GT Exhaust DC6	286440	219487	20	1.5	27.7	514.15	0.510
GT47	GT Exhaust DC6	286449	219472	20	1.5	27.7	514.15	0.510
GT48	GT Exhaust DC6	286445	219480	20	1.5	27.7	514.15	0.510

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Table 8.2 Back Up Generators

Source		OS x	(m)	stack height (m)	stack ID (m)	efflux velocity (m/s)	Temperature oC	Nox (g/s)
GT1	GT Exhaust DC1	286257	219522	20	1.5	27.7	514.15	2.618
GT2	GT Exhaust DC1	286250	219517	20	1.5	27.7	514.15	2.618
GT3	GT Exhaust DC1	286265	219527	20	1.5	27.7	514.15	2.618
GT4	GT Exhaust DC1	286273	219531	20	1.5	27.7	514.15	2.618
GT5	GT Exhaust DC1	286296	219545	20	1.5	27.7	514.15	2.618
GT6	GT Exhaust DC1	286304	219550	20	1.5	27.7	514.15	2.618
GT7	GT Exhaust DC1	286312	219555	20	1.5	27.7	514.15	2.618
GT8	GT Exhaust DC1	286319	219559	20	1.5	27.7	514.15	2.618
GT9	GT Exhaust DC2	286362	219586	20	1.5	27.7	514.15	2.618
GT10	GT Exhaust DC2	286370	219591	20	1.5	27.7	514.15	2.618
GT11	GT Exhaust DC2	286377	219596	20	1.5	27.7	514.15	2.618
GT12	GT Exhaust DC2	286385	219601	20	1.5	27.7	514.15	2.618
GT13	GT Exhaust DC2	286408	219615	20	1.5	27.7	514.15	2.618
GT14	GT Exhaust DC2	286415	219620	20	1.5	27.7	514.15	2.618
GT15	GT Exhaust DC2	286422	219625	20	1.5	27.7	514.15	2.618
GT16	GT Exhaust DC2	286430	219630	20	1.5	27.7	514.15	2.618
GT17	GT Exhaust DC3	286473	219654	20	1.5	27.7	514.15	2.618
GT18	GT Exhaust DC3	286480	219659	20	1.5	27.7	514.15	2.618
GT19	GT Exhaust DC3	286488	219664	20	1.5	27.7	514.15	2.618
GT20	GT Exhaust DC3	286496	219669	20	1.5	27.7	514.15	2.618
GT21	GT Exhaust DC3	286518	219684	20	1.5	27.7	514.15	2.618
GT22	GT Exhaust DC3	286526	219688	20	1.5	27.7	514.15	2.618
GT23	GT Exhaust DC3	286533	219693	20	1.5	27.7	514.15	2.618
GT24	GT Exhaust DC3	286541	219698	20	1.5	27.7	514.15	2.618
GT25	GT Exhaust DC4	286699	219594	20	1.5	27.7	514.15	2.618
GT26	GT Exhaust DC4	286707	219599	20	1.5	27.7	514.15	2.618
GT27	GT Exhaust DC4	286715	219603	20	1.5	27.7	514.15	2.618
GT28	GT Exhaust DC4	286722	219608	20	1.5	27.7	514.15	2.618
GT29	GT Exhaust DC4	286745	219623	20	1.5	27.7	514.15	2.618
GT30	GT Exhaust DC4	286752	219628	20	1.5	27.7	514.15	2.618
GT31	GT Exhaust DC4	286760	219633	20	1.5	27.7	514.15	2.618
GT32	GT Exhaust DC4	286768	219637	20	1.5	27.7	514.15	2.618
GT33	GT Exhaust DC5	286459	219394	20	1.5	27.7	514.15	2.618
GT34	GT Exhaust DC5	286450	219409	20	1.5	27.7	514.15	2.618
GT35	GT Exhaust DC5	286454	219401	20	1.5	27.7	514.15	2.618
GT36	GT Exhaust DC5	286464	219386	20	1.5	27.7	514.15	2.618
GT37	GT Exhaust DC5	286494	219341	20	1.5	27.7	514.15	2.618
GT38	GT Exhaust DC5	286489	219348	20	1.5	27.7	514.15	2.618
GT39	GT Exhaust DC5	286484	219356	20	1.5	27.7	514.15	2.618
GT40	GT Exhaust DC5	286479	219364	20	1.5	27.7	514.15	2.618
GT41	GT Exhaust DC6	286404	219540	20	1.5	27.7	514.15	2.618
GT42	GT Exhaust DC6	286409	219532	20	1.5	27.7	514.15	2.618
GT43	GT Exhaust DC6	286414	219525	20	1.5	27.7	514.15	2.618
GT44	GT Exhaust DC6	286419	219518	20	1.5	27.7	514.15	2.618
GT45	GT Exhaust DC6	286434	219495	20	1.5	27.7	514.15	2.618
GT46	GT Exhaust DC6	286440	219487	20	1.5	27.7	514.15	2.618
GT47	GT Exhaust DC6	286449	219472	20	1.5	27.7	514.15	2.618
GT48	GT Exhaust DC6	286445	219480	20	1.5	27.7	514.15	2.618

where fuel is HVO or ULS diesel
Based on an NO_x emission concentration of 154 mg/m^3 at STP 15% O_2 where stack temperatures are same as for gas

The objective of the dispersion modelling assessment is to predict the likely effect of the prevailing climate, local surface conditions and adjacent buildings on plume behaviour; and to predict the likely worst-case airborne concentrations at the nearest sensitive receptors around the installation. The pattern of pollutant dispersion may be estimated using several years of historical meteorological data from a representative site.

Air quality impacts are assessed against the annual mean and short-term Air Quality Limit Values for NO_2. The main assessment Scenario ignore impacts from process upsets, fluctuations and accidents. This is contingent on a programme of planned preventative maintenance being implemented to ensure that the risk of unplanned emissions is minimised. The main emission Scenario is based on the use of gas-fired turbines which will be the normal operation use except where there is a failure in the grid supply.

According to current professional Guidance5, dispersion modelling studies should include a Sensitivity Analysis for model inputs, to provide an estimate of the possible errors in the predictions. The EPA has published requirements for dispersion modelling.6 This includes advice on the Agency's requirements for reporting. These Guidance documents have been taken into account in the assessment.

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A widely recognised mathematical model (ADMS) has been used to predict how emissions will be dispersed taking account of the source conditions (using ELVs and stack gas flow rates); release conditions (efflux velocity and temperature); meteorological conditions from a representative site (in this case data from Dublin Airport); building effects and surface conditions (surface roughness).

ADMS 6 was developed specifically for industrial point sources.7 The model is widely used for environmental assessment and is generally considered by environmental agencies to be suitable for air quality impact assessment subject to its proper use.

The temperature and efflux velocity of the stack gases are based on client supplied data. The emissions have been considered as a continuous, steady state elevated point source release. The locations of the stacks are listed in Table 8.1 and Table 8.2. The details of the buildings and flue locations were obtained from the site planning drawings and the map base.

The surface roughness conditions at the site have initially been assumed to be typical of suburban areas, with a surface roughness value of 0.5m. This value is likely to represent conditions at receptors around the installation. A model sensitivity analysis has been conducted to assess the significance of adopting a range of roughness length values and is shown to be of negligible significance.

The selection of suitable meteorological data needs to be conducted with care. The main limiting factor for suitable meteorological data is continuous observations of cloud cover, used in the model to determine atmospheric stability. Five years of hourly sequential data from Dublin Airport, approximately 38km to the north-east has been used in this study.

The dispersion model used can take account of the effects of re-circulating flow or downwash effects caused by buildings near the point of release. Building effects have been considered. Details of the buildings considered in the model are listed in the Table below, based on the drawings provided by the applicant.

Table 8.3 Building Dimensions used in Dispersion Model

Building Dimensions used in Dispersion Model						
Building	**OS x**	**OS y**	**Height (m)**	**Length (m)**	**Width (m)**	**Angle to North (degrees)**
DC1	286229	219624	18	152	92	147
DC2	286341	219693	18	152	92	147
DC3	286452	219763	18	152	92	147

5 ADMLC January 2021. Guidelines for the Preparation of Short Range Dispersion Modelling Assessments for Compliance with Regulatory Requirements – An Update to the ADMLC 2004 Guidance.

6 https://www.epa.ie/publications/compliance--enforcement/air/air-guidance-notes/EPA-Air-Dispersion-Modelling-Guidance-Note-(AG4)-2020.pdf

7 CERC 2016. ADMS-5, The Multiple Source Air Dispersion Model. CERC, Cambridge. The model version used in this assessment is 5.5.5.0 with interface version 5.2.0 10/11/2016.

DC4	286680	219703	18	152	92	147
DC5	286512	219562	18	152	92	237
DC6	286554	219429	18	152	92	237

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The averaging time for NO2 is based on a 1-hour average. The 1-hour 99.8%ile has been calculated for NO2. No chemistry has been assumed in the model predictions. The predicted contours for the annual mean NO2 are plotted in Figure 8.39. The predicted 99.8%ile is plotted in Figure 8.40. This assumes that NO2 is 0.50 of the predicted NOx, based on EPA guidelines.

Predictions have been made at 42 fixed point receptors as listed in in the table below to represent exposure at existing nearest sensitive receptors around the site and to assist with the model Sensitivity Analysis. These predictions have been modelled at a height of 1.5m above ground level. Predictions have also been made for the worst-case meteorological conditions using a 10m resolution grid.

Atmospheric chemistry and photo-lytic reactions have been ignored in the dispersion modelling. No allowance has been made for typical NOx:NO2 chemistry in the model predictions.

ADMS Model Outputs – Gridded – Main Gas Turbines

Results have been reported for the location where the highest concentration is predicted. This is considered a robust and conservative approach.

Table 8.4 Dublin Airport Met Data 2016 – Model Outputs

ID	X	Y	LTConc|ug/m3|NOx|<All sources>|-| 1hr	P100.00|ug/m3|NOx|<All sources>|-| 1hr	P 99.80|ug/m3|NOx|<All sources>|-| 1hr
1	286706	219893	10.60	86.40	82.40
2	287029	219772	12.10	77.70	76.50
3	287068	219791	11.00	71.40	70.60
4	287098	219791	10.20	68.80	68.00
5	287080	219883	9.76	62.50	61.10
6	287075	219979	8.35	58.40	54.20
7	287121	220007	7.64	55.50	50.70
8	285909	220060	2.25	51.80	50.40
9	285968	219333	3.20	77.30	71.00
10	286171	219231	3.31	82.00	77.80
11	286218	219186	2.96	85.40	77.00
12	286390	218945	1.38	64.50	60.40

13	286405	218835	1.08	54.30	49.40
14	285959	219180	2.39	63.40	59.10
15	286009	219188	2.56	66.90	63.10
16	286055	219209	2.83	71.30	67.50
17	286098	219199	2.88	73.70	69.90
18	286125	219180	2.79	73.50	69.70
19	286131	219155	2.62	73.10	68.30
20	286178	219173	2.81	79.40	73.30
21	286217	219136	2.56	80.40	76.20
22	286155	219029	1.93	65.70	62.10
23	285324	219573	1.24	64.40	35.60
24	285498	219775	1.49	62.80	38.30
25	285521	219808	1.53	62.40	38.60
26	285552	219843	1.60	61.20	40.00
27	285571	219961	1.64	60.20	38.40
28	285476	220075	1.44	55.80	32.60
29	285579	220030	1.64	57.70	36.70
30	285725	220019	2.00	51.70	42.20
31	285613	220268	1.52	55.30	32.80
32	285677	220246	1.61	55.80	35.10
33	285772	220357	1.40	51.50	33.80
34	286041	220289	1.28	49.50	40.50
35	286069	220311	1.19	52.30	40.60
36	286296	220395	1.09	57.60	41.60
37	286344	220398	1.19	54.30	41.90
38	286394	220405	1.33	48.50	42.90
39	286631	220328	2.79	52.20	47.10

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40	286543	218679	0.76	60.70	39.20
41	286520	218592	0.68	62.60	35.30
42	286781	218684	0.80	48.10	38.10

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Table 8.5 Dublin Airport Met Data 2017 – Model Outputs

ID	X	Y	LTConc|ug/m3|NOx|<All sources>|-| 1hr	P100.00|ug/m3|NOx|<All sources>|-| 1hr	P 99.80|ug/m3|NOx|<All sources>|-| 1hr
1	286706	219893	11.20	85.70	82.90
2	287029	219772	14.90	77.90	76.80
3	287068	219791	13.50	71.60	71.00
4	287098	219791	12.70	69.50	68.20
5	287080	219883	11.50	61.80	60.80
6	287075	219979	9.46	55.00	54.20
7	287121	220007	8.63	51.00	50.70
8	285909	220060	2.68	51.80	49.90
9	285968	219333	2.14	77.10	71.50
10	286171	219231	2.10	81.70	75.80
11	286218	219186	1.84	85.00	73.80
12	286390	218945	0.81	64.80	58.60
13	286405	218835	0.65	54.20	49.40
14	285959	219180	1.60	61.90	59.10
15	286009	219188	1.70	65.20	62.70
16	286055	219209	1.85	70.50	67.00
17	286098	219199	1.84	74.00	68.60
18	286125	219180	1.75	72.80	67.50
19	286131	219155	1.62	73.20	65.40
20	286178	219173	1.74	79.70	71.40
21	286217	219136	1.54	80.40	70.20

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22	286155	219029	1.10	65.20	58.40
23	285324	219573	0.75	36.50	32.80
24	285498	219775	1.11	42.50	37.00
25	285521	219808	1.20	41.40	37.90
26	285552	219843	1.32	42.20	39.30
27	285571	219961	1.53	40.30	37.10
28	285476	220075	1.41	35.00	32.50
29	285579	220030	1.62	38.30	36.60
30	285725	220019	2.09	44.90	42.80
31	285613	220268	1.70	53.80	32.80
32	285677	220246	1.83	53.70	34.80
33	285772	220357	1.72	54.60	33.40
34	286041	220289	1.72	43.30	41.20
35	286069	220311	1.59	43.10	41.20
36	286296	220395	1.06	49.00	39.40
37	286344	220398	1.10	45.00	39.30
38	286394	220405	1.18	43.70	40.30
39	286631	220328	2.60	49.40	46.60
40	286543	218679	0.51	53.60	39.60
41	286520	218592	0.45	58.30	34.70
42	286781	218684	0.57	54.70	36.20

Table 8.6 Dublin Airport Met Data 2018 – Model Outputs

ID	X	Y	LTConc|ug/m3|NOx|<All sources>|-| 1hr	P100.00|ug/m3|NOx|<All sources>|-| 1hr	P 99.80|ug/m3|NOx|<All sources>|-| 1hr
1	286706	219893	7.48	86.10	80.80
2	287029	219772	9.49	77.70	76.40
3	287068	219791	8.61	71.80	70.70

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4	287098	219791	8.09	69.00	67.90
5	287080	219883	7.58	62.30	60.50
6	287075	219979	6.39	61.40	53.50
7	287121	220007	5.90	61.10	50.30
8	285909	220060	3.51	64.50	51.00
9	285968	219333	4.07	75.20	71.80
10	286171	219231	3.67	81.20	76.30
11	286218	219186	3.07	84.40	76.50
12	286390	218945	1.19	64.80	60.10
13	286405	218835	0.94	53.90	49.30
14	285959	219180	2.89	62.30	59.30
15	286009	219188	3.05	65.80	63.30
16	286055	219209	3.32	70.60	68.50
17	286098	219199	3.27	73.90	69.70
18	286125	219180	3.06	72.10	67.90
19	286131	219155	2.80	73.90	66.90
20	286178	219173	2.96	78.20	71.60
21	286217	219136	2.54	79.70	73.00
22	286155	219029	1.87	65.10	60.10
23	285324	219573	1.26	56.90	34.50
24	285498	219775	1.31	53.50	36.00
25	285521	219808	1.35	48.30	37.20
26	285552	219843	1.42	45.20	37.90
27	285571	219961	1.57	57.50	36.60
28	285476	220075	1.46	55.30	31.30
29	285579	220030	1.71	57.30	35.30
30	285725	220019	2.35	51.30	41.10

31	285613	220268	2.11	47.70	32.60
32	285677	220246	2.33	48.70	34.90
33	285772	220357	2.44	53.10	34.40
34	286041	220289	2.59	48.80	42.10
35	286069	220311	2.40	49.40	42.20
36	286296	220395	1.51	47.90	41.20
37	286344	220398	1.49	45.60	40.40
38	286394	220405	1.52	49.40	41.80
39	286631	220328	2.48	54.10	46.90
40	286543	218679	0.69	43.40	39.30
41	286520	218592	0.61	41.00	35.60
42	286781	218684	0.74	50.40	36.10

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Table 8.7 Dublin Airport Met Data 2019 – Model Outputs

ID	X	Y	LTConc|ug/m3|NOx|<All sources>|-| 1hr	P100.00|ug/m3|NOx|<All sources>|-| 1hr	P 99.80|ug/m3|NOx|<All sources>|-| 1hr
1	286706	219893	6.45	82.60	77.30
2	287029	219772	9.43	77.50	76.20
3	287068	219791	8.57	71.20	70.10
4	287098	219791	8.16	68.70	67.20
5	287080	219883	7.10	61.20	60.30
6	287075	219979	5.79	54.80	53.40
7	287121	220007	5.36	51.10	50.30
8	285909	220060	2.86	56.90	48.90
9	285968	219333	2.30	76.40	70.90
10	286171	219231	2.15	82.90	74.90
11	286218	219186	1.95	83.70	74.60
12	286390	218945	1.20	64.80	61.70

13	286405	218835	0.97	54.90	51.70
14	285959	219180	1.59	62.30	58.90
15	286009	219188	1.68	65.50	62.60
16	286055	219209	1.84	70.80	67.00
17	286098	219199	1.84	73.80	67.90
18	286125	219180	1.76	74.20	67.10
19	286131	219155	1.64	72.80	64.90
20	286178	219173	1.80	79.30	70.80
21	286217	219136	1.66	79.50	70.80
22	286155	219029	1.18	65.50	58.20
23	285324	219573	1.11	58.80	34.90
24	285498	219775	1.49	60.50	37.90
25	285521	219808	1.58	58.60	39.10
26	285552	219843	1.71	54.60	39.80
27	285571	219961	1.91	49.90	37.40
28	285476	220075	1.75	50.70	32.30
29	285579	220030	1.99	49.60	36.60
30	285725	220019	2.46	44.50	41.90
31	285613	220268	1.96	55.20	32.50
32	285677	220246	2.06	58.70	34.70
33	285772	220357	1.83	64.20	33.70
34	286041	220289	1.64	53.40	40.80
35	286069	220311	1.50	49.20	40.70
36	286296	220395	1.05	44.70	38.40
37	286344	220398	1.12	49.90	39.60
38	286394	220405	1.23	56.20	41.20
39	286631	220328	2.31	56.60	47.10

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40	286543	218679	0.85	51.00	40.50
41	286520	218592	0.72	48.80	35.90
42	286781	218684	0.98	44.30	39.50

Table 8.8 Dublin Airport Met Data 2020 – Model Outputs

ID	X	Y	LTConc|ug/m3|NOx|<All sources>|-| 1hr	P100.00|ug/m3|NOx|<All sources>|-| 1hr	P 99.80|ug/m3|NOx|<All sources>|-| 1hr
1	286706	219893	8.31	85.80	80.80
2	287029	219772	9.72	77.50	76.00
3	287068	219791	8.82	71.30	70.20
4	287098	219791	8.32	68.70	67.30
5	287080	219883	7.74	61.80	60.60
6	287075	219979	6.69	60.70	53.50
7	287121	220007	6.16	60.20	50.30
8	285909	220060	1.94	52.20	48.00
9	285968	219333	3.67	76.30	72.00
10	286171	219231	4.23	82.50	79.60
11	286218	219186	3.79	85.40	81.60
12	286390	218945	1.40	64.50	61.90
13	286405	218835	1.06	55.20	51.20
14	285959	219180	3.10	63.30	60.10
15	286009	219188	3.34	66.90	63.90
16	286055	219209	3.67	70.90	68.40
17	286098	219199	3.73	72.20	70.00
18	286125	219180	3.62	73.90	70.80
19	286131	219155	3.41	72.80	69.90
20	286178	219173	3.63	81.00	75.70
21	286217	219136	3.25	80.30	76.20

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22	286155	219029	2.43	65.90	62.60
23	285324	219573	0.92	56.00	32.60
24	285498	219775	0.94	61.00	37.30
25	285521	219808	0.95	59.90	36.50
26	285552	219843	0.98	56.40	37.40
27	285571	219961	1.02	52.40	36.40
28	285476	220075	0.92	55.20	31.40
29	285579	220030	1.05	57.60	34.50
30	285725	220019	1.36	56.70	39.00
31	285613	220268	1.20	61.50	32.50
32	285677	220246	1.32	60.50	34.70
33	285772	220357	1.41	57.80	34.20
34	286041	220289	1.70	52.30	42.30
35	286069	220311	1.64	53.80	42.10
36	286296	220395	1.34	58.00	40.70
37	286344	220398	1.37	55.00	41.80
38	286394	220405	1.43	49.50	41.80
39	286631	220328	2.65	53.20	47.60
40	286543	218679	0.70	43.00	38.60
41	286520	218592	0.62	40.30	34.30
42	286781	218684	0.74	47.10	38.30

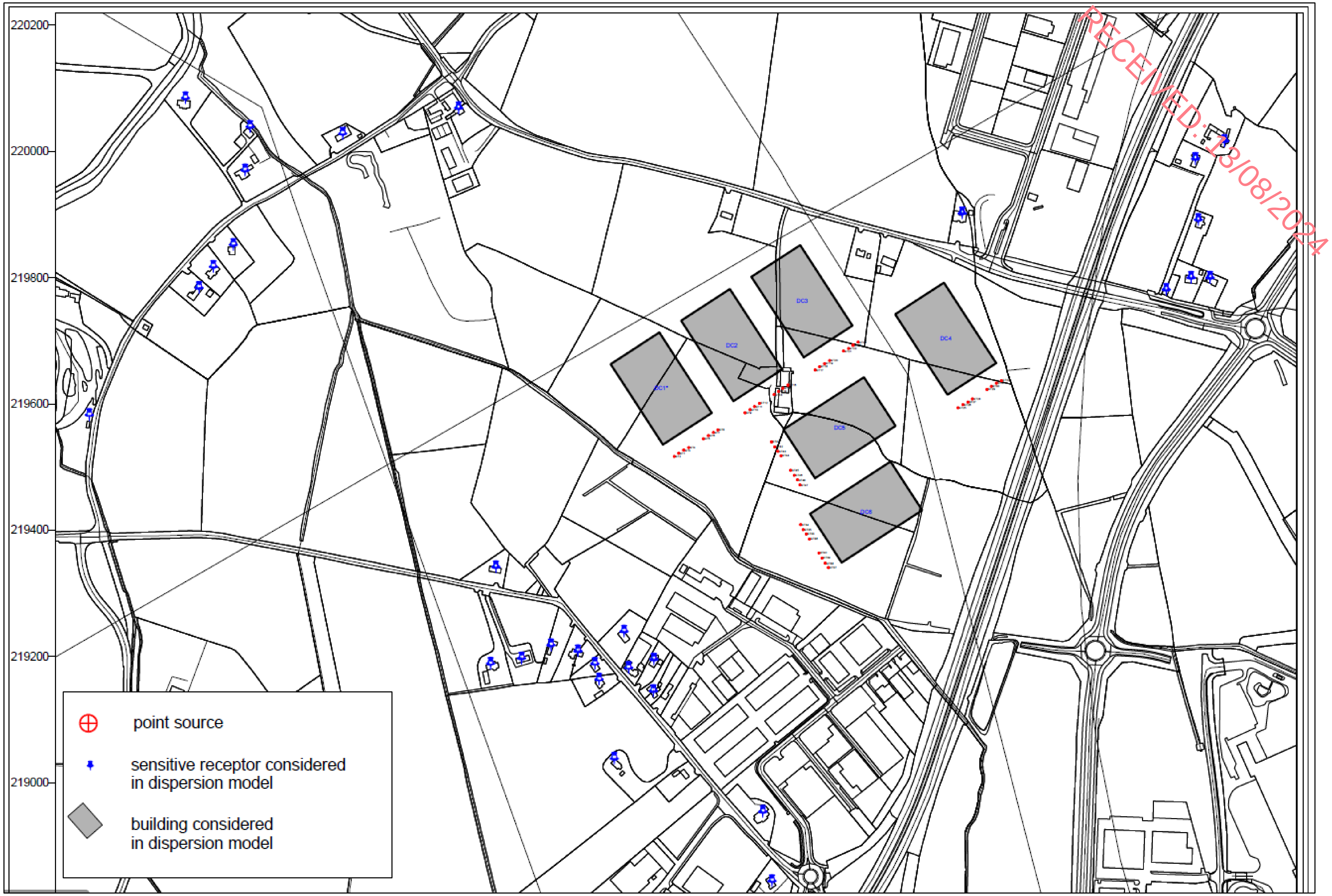

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Figure 8.38: ADMS Model Figures – Gridded – Main Gas Turbines (showing receptors, point sources and buildings detailed in the model).

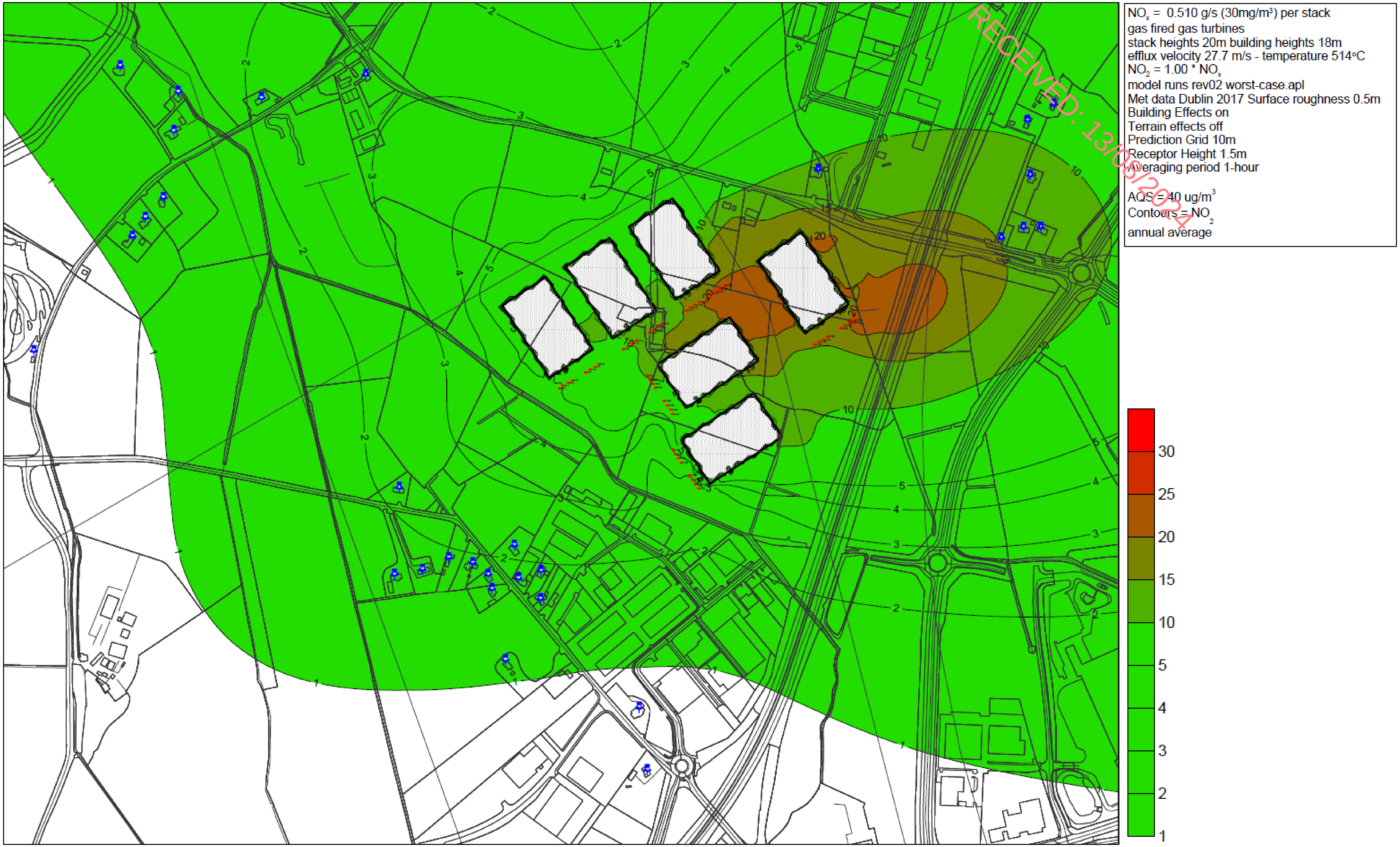

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Figure 8.39: Annual Mean Nitrogen Dioxide

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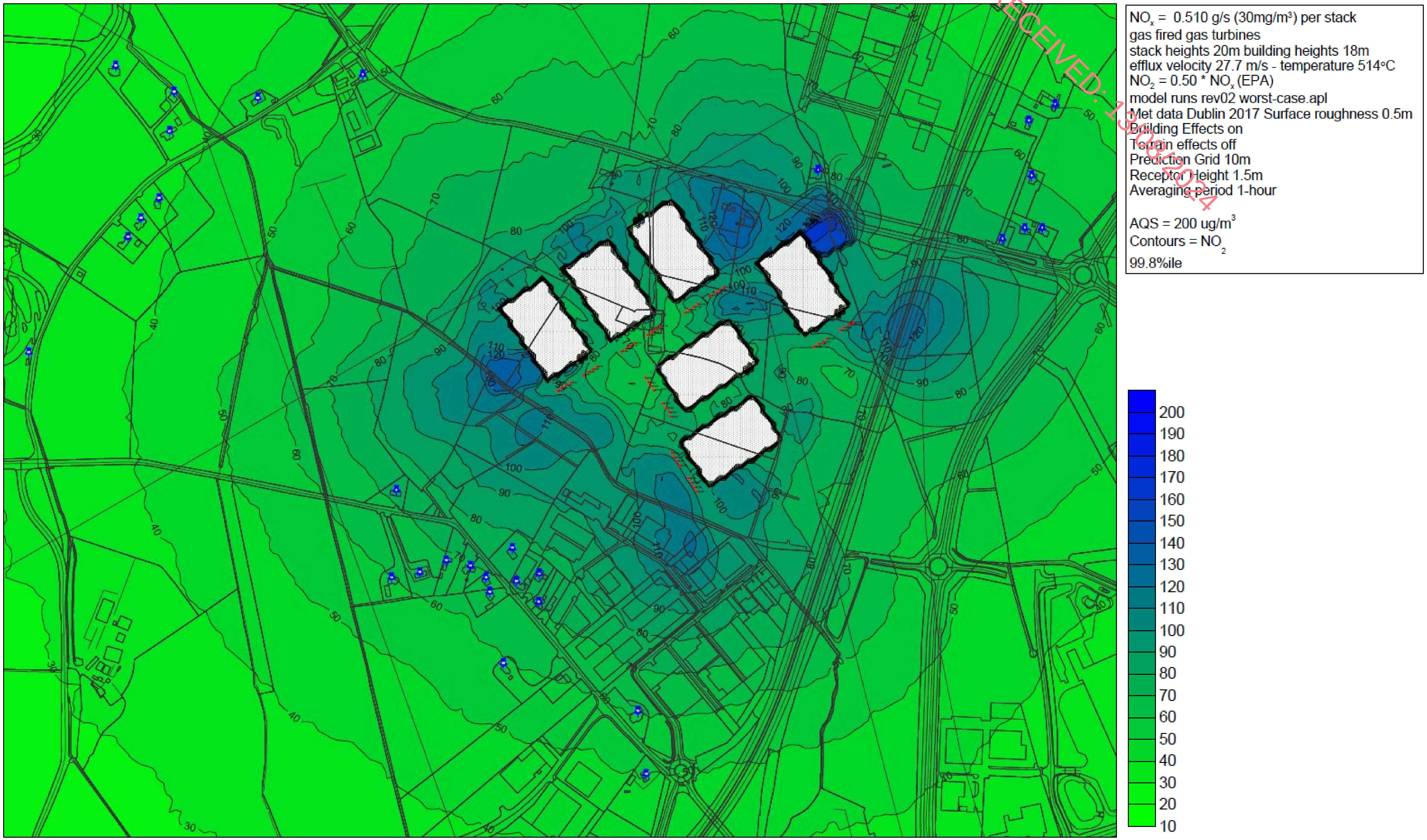

Figure 8.40 Short Term Nitrogen Dioxide

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ADMS Model Outputs – Gridded – Back Up Generators

Results have been reported for the location where the highest concentration is predicted. This is considered a robust and conservative approach.

The previous assessment considered the impacts from the proposed gas and diesel-fired turbines. This Section considers the impacts from up to 120 proposed gas-fired reciprocating engines. This description relates to the proposed use of 120 gas-fired reciprocating engines. The locations of the receptors and the proposed stacks and buildings are shown in the figure below. The details of the stack emissions are listed below. The model predictions include two Scenarios. The first Scenario assumes that all 120 reciprocating gas engines will be fired at maximum output simultaneously. The operator has advised that in practice it is unlikely that all units will operate simultaneously, so a second Scenario considers the impacts from 60 units operating. This assessment adopts the same worst-case dispersion conditions as previously reported (Dublin 2017 and surface roughness of 0.5m).

The predicted contours for main worst-case operational Scenario for the annual mean NO_2 are plotted The predicted 99.8%ile for the worst-case operational Scenario is plotted in Figure 8.40. This assumes that NO2 is 0.50 of the predicted NOx, based on EPA guidelines.

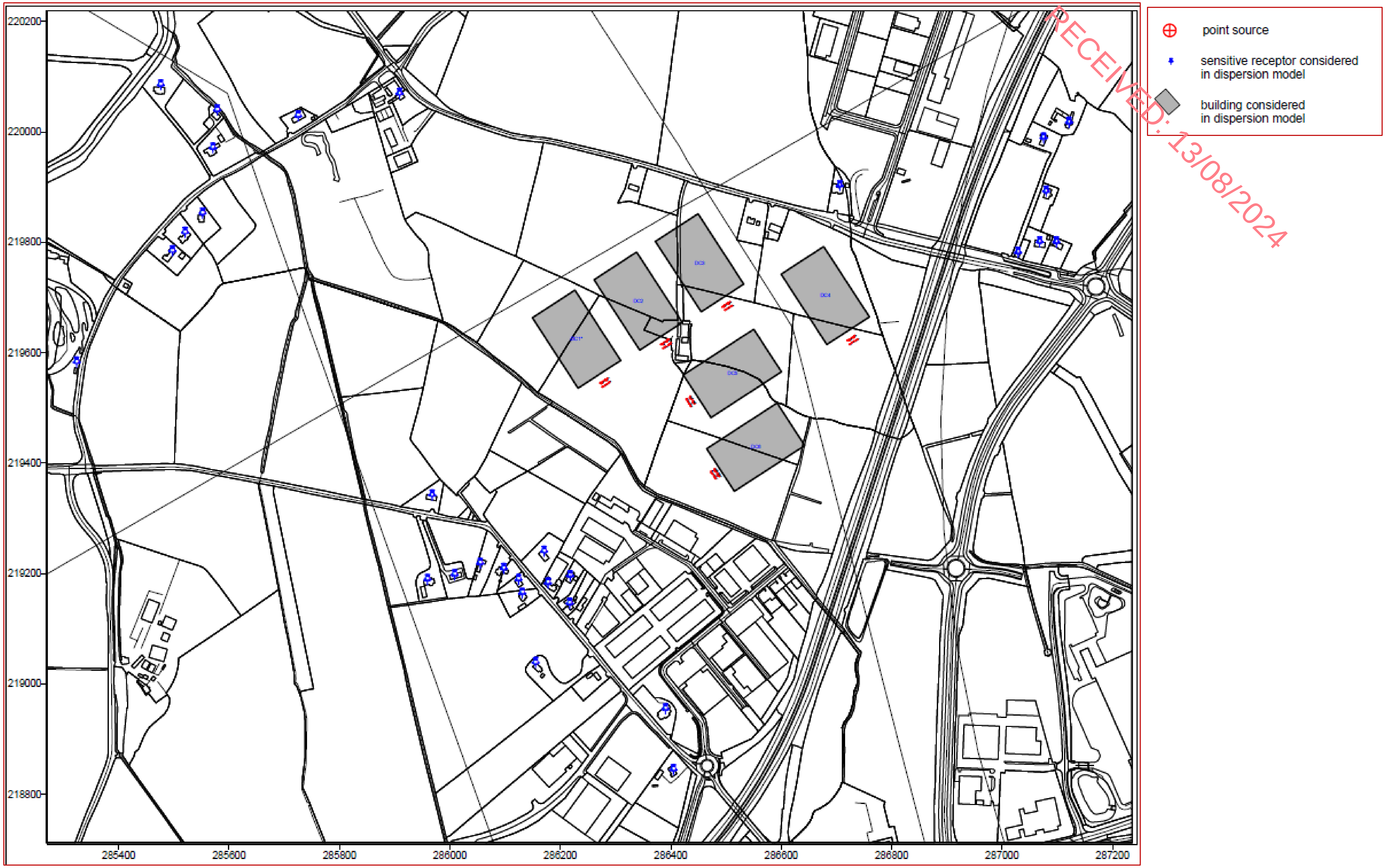

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Figure 8.41: ADMS Model Outputs – Gridded – Back Up Generators

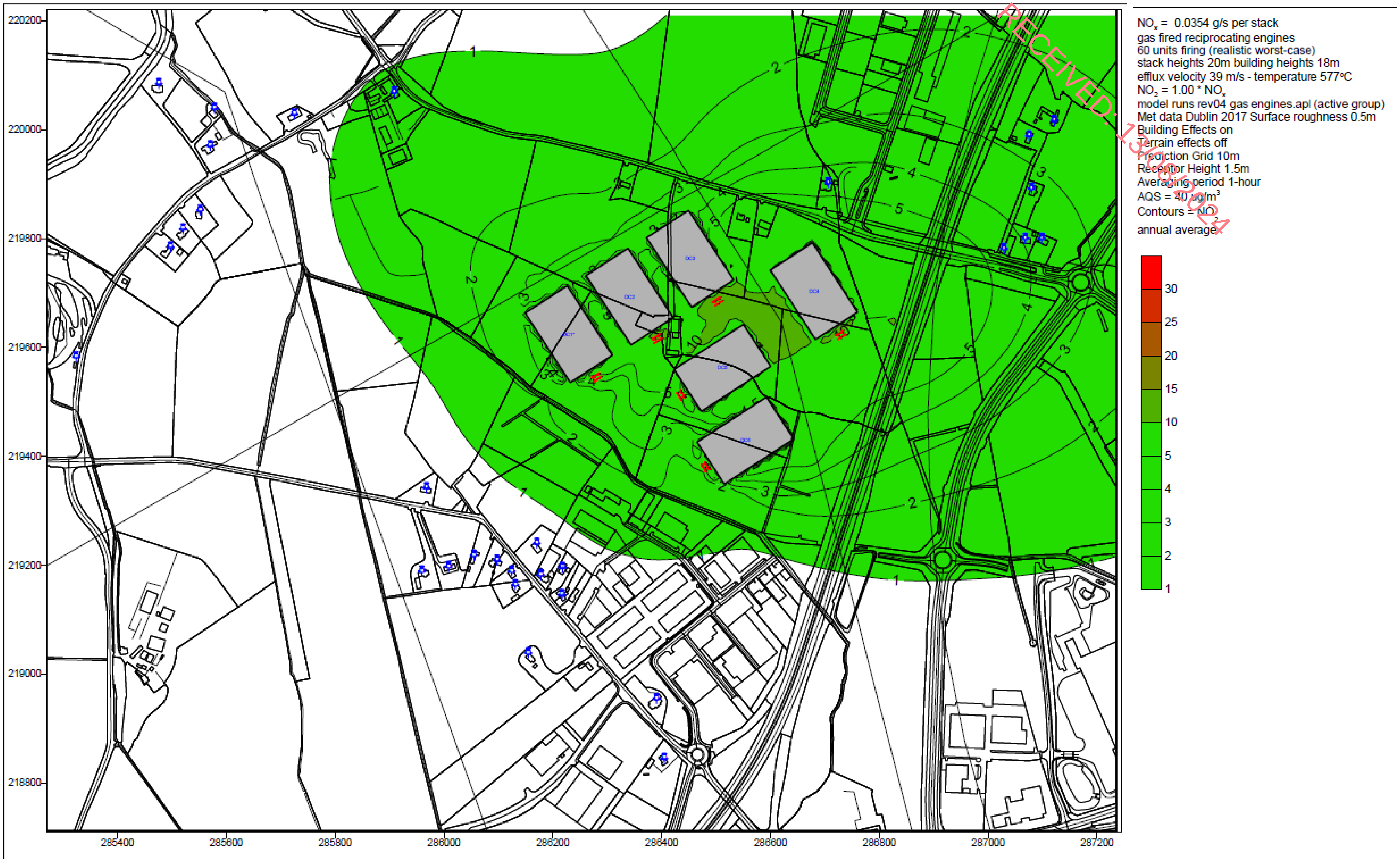

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Figure 8.42: Annual Mean NO2

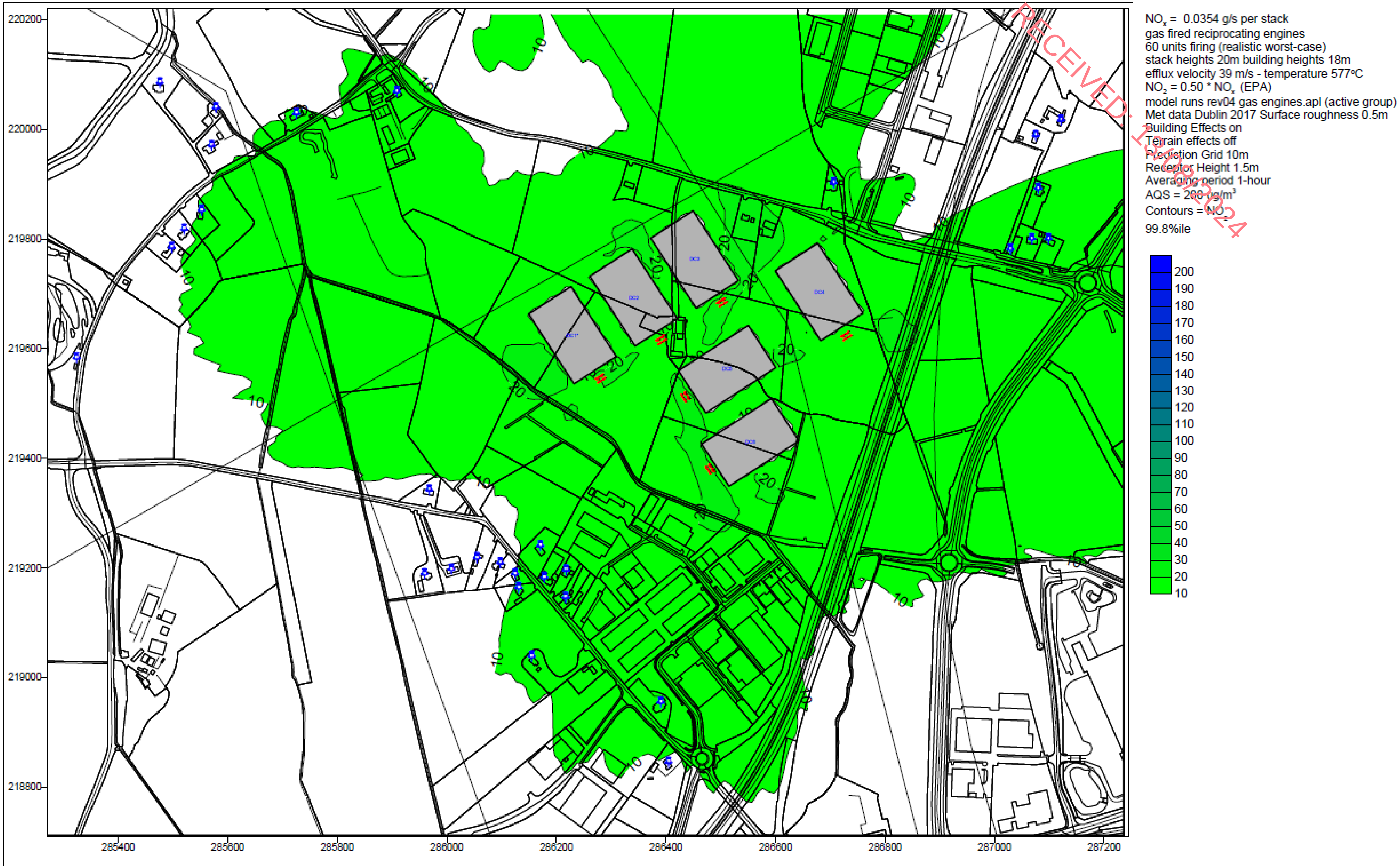

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Figure 8.43: Short Term Nitrogen Dioxide

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Detailed Construction Dust Assessment Methodology -IAQM 2023

Introduction

The main air quality impacts that may arise during demolition and construction activities are:

1. **dust deposition, resulting in the soiling of surfaces;**
2. **visible dust plumes, which are evidence of dust emissions;**
3. **elevated PM_{10} concentrations, as a result of dust generating activities on site; and**
4. **an increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the site[1].**

The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of dust in all size fractions. The ambient dust relevant to health outcomes will be that measured as PM_{10}, although most of this will be in the coarse ($PM_{2.5-10}$) fraction, rather than the $PM_{2.5}$ fraction. Research undertaken in the USA[2] suggests that 85% to 90% by weight of the fugitive dust emissions of PM_{10} from construction sites are $PM_{2.5-10}$ and 10% to 15% are in the $PM_{2.5}$ fraction.

There are other potential impacts, such as the release of heavy metals, asbestos fibres or other pollutants during the demolition of certain buildings, such as former chemical works, or the removal of contaminated soils. The release of certain fungal spores during the demolition of old buildings can also give rise to specific concerns if immune-compromised people are likely to be exposed, for example close to an oncology unit of a hospital. These issues need to be considered on a site by site basis, and are not covered by the IAQM 2023 Guidance.

Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out (for example by using the EPUK's criteria), then it should be assessed using the same methodology and significance criteria as operational traffic impacts. The impacts of exhaust emissions from on-site plant and site traffic are not considered further in this Guidance.

Receptors

Human Receptor

A 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling[3], or exposure to PM over a time period relevant to the air quality objectives, as defined in the Government's technical guidance for Local Air Quality Management[4]. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production). Care should be taken to ensure that the assessment takes into account whether exposure will arise in practice (e.g. computer chip manufacture is sensitive to dust and so premises are likely to have extensive dust filtering equipment and exposure may therefore not be increased).

Ecological Receptor

An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g.

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on foraging habitats). For locations with a statutory designation, e.g. Special Areas of Conservation (SACs) and Areas of Special Scientific Interest (ASSIs), consideration should be given as to whether the particular site is sensitive to dust and this will depend on why it has been designated. Some non-statutory sites (i.e. local wildlife sites) and/or locations with very specific sensitivities may also be considered if appropriate. The inclusion or exclusion of sites should be justified in the assessment.

Dust from construction sites deposited on vegetation may create ecological stress within the local plant community. During long dry periods dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Rainfall removes the deposited dust from foliage and can rapidly leach chemicals into the soil. Plant communities near short-term works are likely to recover within a year of the dust soiling stress ceasing. However, large scale construction sites may give rise to dust deposition over an extended period of time and adversely affect vascular plants. For example cement dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt.

Limestone dust coating of lichen has been shown to damage its photosynthetic apparatus. These types of damage over a long period have the potential to change plant community structure and function. Noticeable effects include the increase in ruderal and pioneer plant communities.

Risk of Dust Emissions

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or health or ecological impacts is related to:

1. **the activities being undertaken (demolition, number of vehicles and plant etc.);**
2. **the duration of these activities;**
3. **the size of the site;**
4. **the meteorological conditions (wind speed, direction and rainfall);**
5. **the proximity of receptors to the activities;**
6. **the adequacy of the mitigation measures applied to reduce or eliminate dust; and**
7. **the sensitivity of the receptors to dust.**

The quantity of dust emitted from construction operations will be related to the area of land being worked, and the level of construction activity (nature, magnitude and duration). Emissions from construction vehicles passing over unpaved ground can be particularly important. These will be related to the silt content of the soil (defined by the US Environmental Protection Agency as particles smaller than 75 micrometres [μm] in diameter), as well as the speed and weight of the vehicle, the soil moisture content, the distance covered and the frequency of vehicle movements.

Weather

Although not specifically required as part of the IAQM dust assessment method, analysis of the local climatic conditions was also undertaken to provide additional context to the risk assessment and assist in the determination of the sensitivity of the area.

The wind direction, wind speed and rainfall, at the time when a construction activity is taking place, will also influence whether there is likely to be a dust impact. Due to the variability of the weather, it is impossible to predict what the weather conditions will be when specific construction activities are being undertaken.

Local wind speed and direction influences the dispersion of dust. This will depend on the frequency that the receptor is downwind and the distance of the receptors from the construction activities. Higher wind speeds will result in the highest potential release of dust from a site. Buildings, structures and trees can also influence dispersion.

Adverse impacts can occur in any direction from a site. They are, however, more likely to occur downwind of the prevailing wind direction and/or close to the site. It should be noted that the 'prevailing' wind direction is usually the most frequent direction over a long period such as a year; whereas construction activity may occur over a period of weeks or months during which the most frequent wind direction might be quite different. The most frequent wind direction may also not be the direction from which the wind speeds are highest. The use of the prevailing wind direction in the assessment of risk is most useful, therefore, for construction projects of long duration.

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Dust impacts are more likely to occur during drier periods, as rainfall acts as a natural dust suppressant.

Seasonal

Impacts during the summer and winter months are generally different, and if it can be guaranteed that the construction will take place during a particular season (with this enforced through a planning condition, for example), consideration could be given to using seasonal wind and rainfall data. This type of guarantee is not usual because the start of construction depends on many factors.

Topography & Natural Barriers

Local conditions also need to be accounted for. Topography and natural barriers (e.g. woodland) will reduce airborne concentrations due to impaction. In addition, if the locality has a history of dust generating activities, such as quarrying, a given level of additional dust may be more acceptable, i.e. more readily tolerated, than in a suburban residential area. Alternatively, impacts may be less acceptable, where nearby residents have become sensitised to dust, have a history of complaining and may therefore be more likely to complain about a new dust source. Similarly, in rural areas agricultural activities may generate dust and this should be taken into account in the assessment of risk.

Assessment Procedure (Risk/Magnitude/Impact highlighted as appropriate to this Project)

This guidance provides a framework for the assessment of risk. Every site is different and therefore this guidance cannot be too prescriptive and professional judgement is required. Any judgements must be fully auditable in the dust assessment report, with the source(s) defined and choice of dust risk category justified for each activity (see below). Where justification cannot be given, a precautionary approach must be taken and the highest level of mitigation recommended.

Activities on construction sites have been divided into four types to reflect their different potential impacts. These are:

1. **Demolition;**
2. **Earthworks;**
3. **Construction; and**
4. **Trackout.**

The potential for dust emissions is assessed for each activity that is likely to take place. Obviously, if an activity is not taking place, e.g. demolition, then it does not need to be assessed.

The assessment methodology considers three separate dust impacts:

1. annoyance due to dust soiling;
2. the risk of health effects due to an increase in exposure to PM_{10}; and
3. harm to ecological receptors with account being taken of the sensitivity of the area that may experience these effects.

The assessment is used to define appropriate mitigation measures to ensure that there will be no significant effect.

The assessment steps are summarised below and in **Figure A**.

STEP 1 is to screen the requirement for a more detailed assessment.

No further assessment is required if there are no receptors within a certain distance of the works.

STEP 2 is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:

1. the scale and nature of the works, which determines the potential dust emission magnitude (STEP 2A); and

2. the sensitivity of the area (STEP 2B).

These factors are combined in STEP 2C to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

STEP 3 is to determine the site-specific mitigation for each of the four potential activities in STEP 2. This will be based on the risk of dust impacts identified in STEP 2. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account.

STEP 4 is to examine the residual effects and to determine whether or not these are significant.

STEP 5 is to prepare the dust assessment report.

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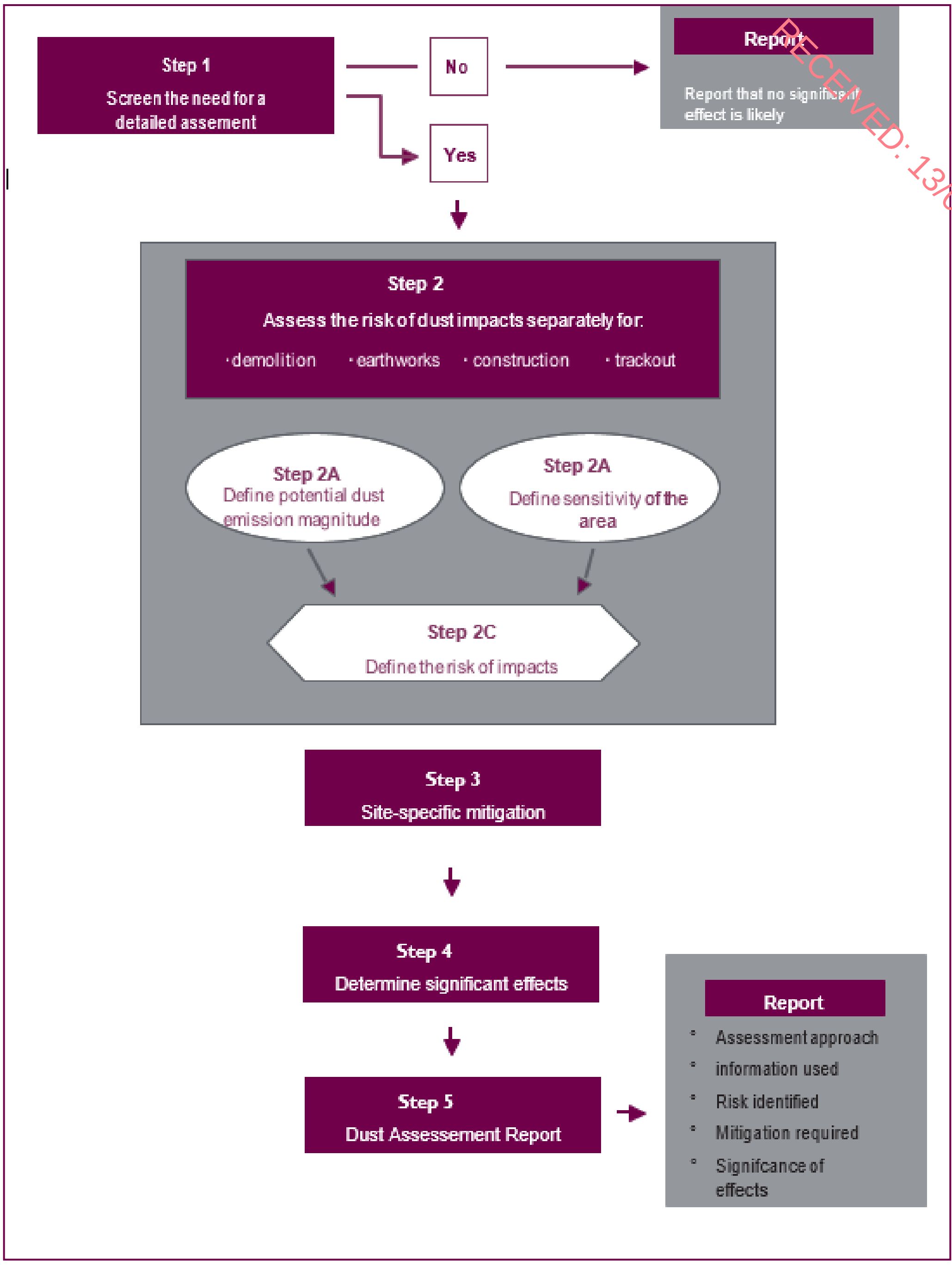

Figure A: Steps to Perform a Dust Assessment

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STEP 1: SCREEN THE NEED FOR A DETAILED ASSESSMENT

This step is deliberately chosen to be conservative, and will require assessments for most schemes. The distances cited here, and in subsequent sections, take account of the exponential decline in both airborne concentrations and the rate of deposition with distance, as well as practical experience of members of the Working Group.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is "negligible", and any effects will be not be significant.

Box 1: Screening Criteria

An assessment will normally be required where there is:

- a 'human receptor' within:
  - 350 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).
- an 'ecological receptor' within:
  - 50 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

STEP 2: ASSESS THE RISK OF DUST IMPACTS

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

1. the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (**STEP 2A**); and,
2. the sensitivity of the area to dust impacts (**STEP 2B**), which is defined as low, medium or high sensitivity.

These two factors are combined in **STEP 2C** to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time.

Where appropriate, the site can be divided into 'zones' for the dust risk assessment. This may result in different mitigation levels being applied to each zone. This could be where different parts of a large site are different distances from the nearest receptors, or where development activities move away from a receptor through time on a large scheme.

However, on complex sites where activities are not easily segregated the mitigation appropriate for the highest risk category should be applied. The aim is to ensure that it is clear what mitigation is supposed to be implemented on a site and to make auditing this simpler.

Every site is different in terms of timing (seasonality), building type (construction materials), duration and scale (area, volume and height), and therefore professional judgement must be applied by a technically competent assessor (see **Box 2**) when allocating activities into one of the three potential dust emission magnitude categories. Justification of the category used must be stated in the report. Where there is doubt, the higher risk category should be applied (e.g. if the site is assessed as low/ medium then mitigation appropriate to a medium site should be applied).

Box 2: Technical Competency of Assessor

The following risk assessment procedure requires 'professional judgement'. Those who are responsible for making this judgement must be able to demonstrate technical competency in the assessment of dust impacts. It is difficult to define precisely who has sufficient experience and expertise to make reasonable judgements, but, a person with full Membership of IAQM *and* experience of assessing dust impacts for a minimum of 10 diverse projects, including some complex multi-phase projects and similar projects to that being assessed, is likely to be technically competent.

IAQM is the only professional body specifically for air quality practitioners in the UK, although there are a number of more general environmental professional bodies, whose members may be competent.

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STEP 2A: Define the Potential Dust Emission Magnitude

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large.

The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that, in each case, not all the criteria need to be met, and that other criteria may be used if justified in the assessment:

Demolition: Example definitions for demolition are:

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 <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.

The proposed developed dust emission magnitude for Demolition has been **Small.**

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

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 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and

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 proposed developed dust emission magnitude for Earthworks is **Large.**

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Box 3: Crushing and Screening

Mobile crushing equipment can be a significant source of dust associated with the demolition phase. This equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland, under the Environmental Permitting Regulations 2010 in England and Wales, and equivalent legislation in Scotland and Northern Ireland.

Equipment should be designed and operated in accordance with the most recent version of Process Guidance Note 3/16 for Mobile Crushing and Screening (note this is under review).

Professional judgement will be required to determine how the use of crushing and screening equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes

Box 4: Concrete Batching Plant

Concrete batching equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland under the Environmental Permitting Regulations 2010 and equivalent legislation in Scotland and Northern Ireland.

Such equipment should be operated in accordance with the latest version of Process Guidance Note 3/1 on Guidance for Blending, Packing, Loading, Unloading and Use of Bulk Cement.

Professional judgement will be required to determine how the use of concrete batching equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

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; and

Small: Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The proposed developed dust emission magnitude for Construction is **Large**

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;

Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and

Small: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

The proposed developed dust emission magnitude for Trackout is **Large.**

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

Table A sets out the dust emission magnitude for each activity.

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Table A: Dust Emission Magnitude for this Project

Source	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Large
Trackout	Large

STEP 2B: Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

1. the specific sensitivities of receptors in the area;
2. the proximity and number of those receptors;
3. in the case of PM_{10}, the local background concentration; and
4. site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The type of receptors at different distances from the site boundary or, if known, from the dust generating activities, should be included. Consideration also should be given to the number of 'human receptors'. Exact counting of the number of 'human receptors', is not required. Instead it is recommended that judgement is used to determine the approximate number of receptors (a residential unit is one receptor) within each distance band. For receptors which are not dwellings professional judgement should be used to determine the number of human receptors for use in the tables, for example a school is likely to be treated as being in the >100 receptor category.

The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in STEP 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

A number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however, there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

A series of boxes provide guidance on the sensitivity of different types of receptor to dust soiling (**Box 6**), health effects (**Box 7**) and ecological effects (**Box 8**).

In all cases the specific circumstances should be taken into account and may mean that on occasion the examples given will be subject to exceptions. For instance, the first occupants moving into residential dwellings on a large phased housing development, may reasonably be expected to be less sensitive to dust soiling effects (albeit for a limited time) than other residential receptors. **Box 9** contains additional factors that may need to be taken into account.

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Box 6: Sensitivities of People to Dust Soiling Effects

For the sensitivity of people and their property to soiling, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

High sensitivity receptor – surrounding land where:

- users can reasonably expect enjoyment of a high level of amenity; or
- the appearance, aesthetics or value of their property would be diminished by soiling; and
- the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.
- indicative examples include dwellings, museums and other culturally important collections, medium andlong term car parks[b] and car showrooms.

Medium sensitivity receptor

- users would expect[a] to enjoy a reasonable level of amenity, but would not reasonably expect[a] to enjoy the same level of amenity as in their home; or
- the appearance, aesthetics or value of their property could be diminished by soiling; or
- the people or property wouldn't reasonably be expected[a] to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.
- indicative examples include parks and places of work.

Low sensitivity receptor

- the enjoyment of amenity would not reasonably be expected[a]; or
- property would not reasonably be expecteda to be diminished in appearance, aesthetics or value by soiling; or
- there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
- indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks[b] and roads.

[a] People's expectations will vary depending on the existing dust deposition in the area.
[b] Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

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Box 7: Sensitivities of People to the Health Effects of PM_{10}

For the sensitivity of people to the health effects of PM_{10}, the IAQM recommends that the air quality practitioner assumes that there are three sensitivities based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period, consistent with the Defra's advice for local air quality management (Defra. 2009, LAQM Technical Guidance LAQM.TG (09).

High sensitivity receptor

- locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, [a] relevant location would be one where individuals may be exposed for eight hours or more in a day).[a]
- Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.

Medium sensitivity receptor

- locations where the people exposed are workers , and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).
- Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.

Low sensitivity receptor

- locations where human exposure is transient.
- indicative examples include public footpaths, playing fields, parks and shopping streets.

[a] This follows Defra guidance as set out in LAQM.TG(09).
[b] Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM10. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

[c] There are no standards that apply to short-term exposure,

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Box 8: Sensitivities of Receptors to Ecological Effects

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

The advice of an ecologist should be sought to determine the need for an assessment of dust impacts on sensitive habitats and plants[a]. Professional judgement is required to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the likely effect and the value of the ecological asset. A habitat may be highly valuable but not sensitive, alternatively it may be less valuable but more sensitive to dust deposition. Consequently, specialist ecological advice should also be sought to determine the sensitivity of the ecological receptors to dust impacts. In general most receptors will either be of high sensitivity or low sensitivity i.e. either sensitive or not to dust deposition. The following provides an example of possible sensitivities:

High sensitivity receptor

- locations with an international or national designation and the designated features may be affected by dust soiling; or
- locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain
- indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.

Medium sensitivity receptor

- locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
- locations with a national designation where the features may be affected by dust deposition.
- indicative example is a Area of Special Scientific Interest (ASSI) with dust sensitive features.

Low sensitivity receptor

- locations with a local designation where the features may be affected by dust deposition.
- indicative example is a local Nature Reserve with dust sensitive features.

[a] A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

Table B, **Table C**, and **Table D** show how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts respectively. These tables take account of a number of factors which may influence the sensitivity of the area. When using these tables, it should be noted that distances are to the dust source and so a different area may be affected by trackout than by on-site works. The highest level of sensitivity from each table should be recorded. It is not necessary to work through the whole of each table once it is clear that the highest level of sensitivity has been determined.

While these tables are necessarily prescriptive, professional judgement may be used to determine alternative sensitivity categories, and the factors set out in **Box 9** may be useful to consider. Any judgements made should be fully documented..

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Box 9: Additional Factors to Consider when Determining the Sensitivity of the Area

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<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

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 6** and **Box 9**.

[b] Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. The sensitivity of the area in this case would be high.

[c] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

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Table B: Sensitivity of the Area to Human Health Impacts [a b]

Receptor Sensitivity	Annual Mean PM10 concentration[c]	Number of Receptors[d]	Distance from the Source (m)[e]				
			<20	<50	<100	<200	<350
High	>32 µg/m^3 (>18 µg/m^3 in Scotland)	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3 (>18 µg/m^3 in Scotland)	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

[a] *The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 7** and **Box 9**.*

[b] *Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. If the annual mean PM10 concentration is 29 µg/m^3, the sensitivity of the area would be high.*

[c] *Most straightforwardly taken from the national background maps but should also take account of local sources. The values are based on 32 µg/m^3 being the annual mean concentration at which an exceedance of the 24-hour objective is likely in England, Wales and Northern Ireland. In Scotland there is an annual mean objective of 18µg/m^3.*

[d] In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

[e] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table C: Sensitivity of the Area to Ecological Impacts [a b]

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Receptor Sensitivity	Distance from the Source (m)[c]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table D: Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological	Negligible	Negligible	Negligible	Negligible

Notes:

[a] *The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site. See **STEP 2B**, **Box 8** and **Box 9**.*

[b] *Only the highest level of area sensitivity from the table needs to be considered.*

[c] *For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site.*

STEP 2C Define the Risk of Impacts

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The dust emission magnitude determined at **STEP 2A** should be combined with the sensitivity of the area determined at **STEP 2B** to determine the risk of impacts with no mitigation applied. The matrices in **Table E**, **Table F**, **Table G** and **Table H** provide a method of assigning the level of risk for each activity. This should be used to determining the level of mitigation that must be applied. Mitigation is discussed in **STEP 3**. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation will be required.

Table E: Risk of Dust Impacts- Demolition

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 F: Risk of Dust Impacts- Earthworks

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 G: Risk of Dust Impacts- Construction

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 H: Risk of Dust Impacts- Trackout

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