AIR QUALITY + CLIMATE
(Porter)

IN THE MATTER OF AN APPLICATION TO
AN BORD PLEANÁLA
FOR PERMISSION FOR
STRATEGIC INFRASTRUCTURE DEVELOPMENT
(THE CHILDREN'S HOSPITAL OF IRELAND)

ABP Reg. No. PL29N.PA0024

AND IN THE MATTER OF AN ORAL HEARING

Statement of Evidence of Edward Porter
On the topic of Air Quality and Climate

Date 17 October 2011

1. Qualifications and Experience

My name is Edward Porter. I am a Chartered Chemist and hold a degree (B.Sc) in Chemistry from University of Sussex (1991) and a PhD in Chemistry from the University College Dublin (1997). I am giving evidence to assist the Oral Hearing on the topic of Air Quality and Climate.

I am currently Director of Air Quality and Climate with AWN Consulting. I am qualified to give evidence in relation to air quality and climate on this project as I have considerable experience in the areas of planning of proposed developments with regard to air quality and climate, assessment of air quality for compliance purposes and air quality mitigation measures in relation to both construction sites and operational developments.

Some relevant projects include:

- M9/M10 Kilcullen To Powerstown (2004)
- M7/M8 Portlaoise to Castletown/Cullahill (2004)
- M3 Clonee To North of Kells (2002)
- N2 Slane Bypass Scheme (2011)
- M11 Enniscorthy Bypass (2009)
- N28 Cork to Ringaskiddy Road Scheme (2007)
- M17 Tuam to Galway Road Scheme (2005)
- 2nd Liffey Valley Bridge (2000)
- Spencer Dock Conference Centre (2000)
- Liffey Valley Phase II (2003)
- Mahon Shopping Centre (2001)
- Dundrum Shopping Centree Phase II (2007)

2. Role in Proposed Development

My role in this project was to advise on air quality and climate impacts of the proposed development which I have done since 2010 and I confirm that I advised the project team of the likely effects of the design and that I recommended mitigations measures that have been incorporated into the design of the project.

The documentation within this application for which I am responsible is contained in Chapters 8 and 9.

I have also prepared responses to observations and objections made in relation to this topic which I have provided to assist this Oral Hearing.

3. Key Issues in relation to Air Quality & Climate

3.1. INTRODUCTION

Chapters 8 and 9 of Volume 2 of EIS sets out the likely air quality and climate impacts, respectively, of the proposed development of the Children's Hospital of Ireland at the Mater Hospital Campus.

When considering a development of this nature the air quality and climate impacts of the following phases of the development are considered:

- Temporary impacts of the construction phase; and
- Long term impacts of the operational phase.

3.2. DESCRIPTION OF EXISTING ENVIRONMENT

Meteorological data[1]

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 8 km north of the site. For data collated during five representative years (2001 - 2005), the predominant wind direction is south-westerly with an average wind speed of approximately 3-5 m/s.

Baseline assessment[2]

Existing baseline levels of NO_2, PM_{10}, CO and benzene based on the existing baseline survey and extensive long-term data from Dublin City Council are currently below ambient air quality limit values in the vicinity of the proposed development.

3.3. <u>POTENTIAL</u> IMPACTS ARISING FROM PROPOSED DEVELOPMENT

3.3.1 Construction Phase Potential Impacts

Process emissions[3]

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[1] Section 8.3.1, Volume 2, EIS.
[2] Section 8.3.2, Volume 2, EIS.
[3] Section 8.4.1, Volume 2, EIS.

During the operational phase of the proposed CHoI the primary sources of air emissions are deemed long term and will include air emissions due to:

- vehicles accessing the car parking on site;
- process air emissions on site;
- additional vehicular traffic on public roads.

Dust generation[4]

Dust deposition, PM_{10} and $PM_{2.5}$ concentrations have been predicted during the construction phase of the project at the nearest sensitive locations beyond the site boundary. The modelling has investigated the potential deposition and concentrations of dust, PM_{10} and $PM_{2.5}$ for the following activities:

- Movement of full trucks on paved public roads,
- Movement of full trucks on unpaved haul roads,
- Excavation, loading and unloading of material,
- Movement of empty trucks on unpaved haul roads,
- Movement of empty trucks on paved public roads.

As stated in Section 8.5 of Volume 2 of the EIS, there is the potential for a number of emissions to the atmosphere during the construction of the development. In particular, the construction activities may generate quantities of dust. Construction vehicles, generators etc., will also give rise to some exhaust emissions. Construction activities can also lead to outbreaks of nosocmial invasive aspergillosis.

In relation to the construction phase of the development the key issues will be the potential for dust generation and possible impacts at sensitive receptors. In this regards, a dust minimisation plan will be formulated to ensure that all construction activities are minimised wherever possible. The dust minimisation plan will be based on best practice and will follow a hierarchy of prevention, suppression and containment.

3.3.2 Operational Phase Potential Impacts

- Air emissions[5]

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[4] Section 8.4.2, Volume 2, EIS.
[5] Section 8.4.3, Volume 2, EIS.

As stated in Section 8.5 of Volume 2 of the EIS, there is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}. Space heating using natural gas will also give rise to some air emissions including NO_2 and CO.

- Air dispersion modelling[6]

The key issues in relation to the operational impact of the scheme will be air emissions from vehicles accessing the development. These vehicle-related air emissions have been assessed using the UK DMRB screening model, which is a recommended screening model for assessing the impact of traffic on air quality. The "Do minimum" screening modelling assessments for PM_{10}, $PM_{2.5}$, CO and benzene indicated that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the impact of the development will account for at most 1.8% of the respective limit values. Cumulatively, levels will still be well within the ambient air quality limit values under all scenarios. Levels of all three pollutants range from 25 - 50% of the respective limit values in 2015. Thus, the impact of the development for these three pollutants is negligible.

The detailed air modelling assessment for NO_2, using CAL3QHCR, indicates that annual concentrations will be within the air quality standard under all scenarios. Levels of NO_2, with the development in place, will peak at 93% of the annual limit value in 2015. The maximum one-hour modelling assessment for NO_2 also indicates that levels will be within the applicable limit value in 2015 for all scenarios. The impact of the development on NO_2 levels will be to increase levels by, at most, 1% of the respective annual mean or maximum one-hour limit values in 2015. Thus, the impact of the development, in terms of NO_2, is deemed slight adverse.

In summary, levels of traffic-derived air pollutants will not exceed the ambient air quality standards both with and without the development in place. Thus, the impact of the development in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is either negligible or slight adverse.

In terms of climate, road traffic would be expected to be the dominant source of greenhouse gas emissions. Vehicles will give rise to CO_2 and N_2O emissions in the

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[6] Section 8.4.4, Volume 2, EIS.

region of the proposed development. However, greenhouse gas emissions, as a result of this scheme, will be insignificant in terms of Ireland's obligations under the Kyoto Protocol.

Due to the energy efficient nature of the development design, through use of measures such as Passive building design, natural ventilation and use of a Cooling Heating and Power Plant, emissions from the proposed development will have a negligible impact on air quality and climate.

3.4. MITIGATION MEASURES PROPOSED

3.4.1 Construction Phase

The detailed dust assessment during the construction phase of the project has found that dust nuisance is unlikely to occur assuming that the following mitigation measures are in place:

- The site layout will be planned to minimize the movement of construction traffic around the site and away from sensitive receptors;
- A solid site barrier 8m high along the border between the existing hospitals and 3m along Eccles Street will be erected for the duration of the construction phase;
- During the demolition phase, buildings to be demolished will be wrapped in a suitable material to prevent fugitive dust escaping;
- Enclosed chutes and covered skips will be employed during the demolition phase. Measures will also be employed to minimise any drop heights;
- The haul road will be finished with a temporary tar macadam surfacing (or similar) to minimise the spreading of dust and provide an even surface for truck movements;
- Road sweeping and washing will be in continuous operation along the North Circular Road, Berkeley Road and Eccles Street between 8.00am and 6.00pm for the full duration of the substructure works. Thereafter the roads will be inspected twice daily and cleaning as required;
- The co-ordination of the excavators with the truck movements may necessitate stockpiling material. The height of stock piles will be limited to 5-6m, but never higher than the 3m high hoarding along Eccles St. All material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind;
- Any stockpiled material will be dampened during dry periods to prevent the spreading of dust. A "Dust Boss" system will also be adopted to suppress

any air borne dust. This system utilises a low grade fan to blow a fine controlled water mist over the excavation area and haul routes. This system was used successfully during the basement excavation of the MMUH Adult Hospital;

- A wheel wash system will be implemented on-site to prevent mud being tracked onto the adjoining roads. The wheel wash will be located a minimum of 20m but sufficiently far from the exit to allow trucks to 'drip off' prior to exit. The wheel wash footprint will measure approximately 5m X 3m and will consist of a wash platform to allow for one full wheel revolution. Direct spray nozzles will be located on side walls and will be designed to prevent overspray from the jets;

- Vehicles onsite shall turn off engines when not in use to prevent idling emissions;

- Vehicles using site roads shall have their speeds restricted to 10 km/h;

- The excavation vehicles will be 4-axle Hino 700 rigid tippers (or similar) and will carry approximately $10m^3$ of excavated material. The tippers will have a built-on tarpaulin that will cover the excavated material during transit. No large off-road Dump trucks will be allowed to operate on public roads;

- Dust deposition will be monitored, using Bergerhoff gauges, at the boundary of the site to ensure compliance with the EPA limit of 350 $mg/m^2/day$.

Asbestos containing materials have been identified within the buildings to be demolished as outlined in Appendix 5b of the EIS. This material will be removed by a specialist contractor prior to the commencement of the demolition phase.

The measures outlined above will also help to mitigate the risk of nosocmial invasive aspergillosis. Additional measures such as cleaning of air in clinical areas and measures to physically protect at-risk patients will also be required. Further details associated with the mititgation measures which will be undertaken to mitigate the risk from aspergillosis are outlined in Chapter 5 – Human Beings.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of soil will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of the operations.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practise and procedures.

3.4.2 Operational Phase

The detailed air modelling assessment has found that the impact associated with the operational phase of the development will not be significant and thus site-specific mitigation measures are unwarranted.

3.5. PREDICTED RESIDUAL IMPACTS (i.e., POST-MITIGATION)

3.5.1 Construction Phase Impacts

As set out in Section 8.7.1 of Volume 2 of the EIS, the impact on air quality during the construction phase of the development will be:

The emissions from the combined operational processes lead to a peak dust deposition level averaged over the full year of 62 mg/(m^2*day) at the nearest receptor (see Table 8.16 in Chapter 8, Volume 2, EIS). Based on an existing deposition rate of 127 mg/(m^2*day) in the region of the proposed site, the combined dust deposition level including the proposed operations peaks at 189 mg/(m^2*day) which is 54% of the T.A. Luft Limit Value of 350 mg/(m^2*day). Of this the proposed construction phase activities will contribute at most 18% of the limit value.

Predicted PM_{10} concentrations are significantly lower than the ambient air quality standards at the nearest receptors (see Table 8.16 in Chapter 8, Volume 2, EIS). The predicted levels equate to at most 90% of their respective National and EU Limit Values. Of this the proposed construction phase activities will contribute at most 19% of the limit values.

Predicted $PM_{2.5}$ concentrations at the nearest receptors are significantly lower than the limit value of 25 $\mu g/m^3$ which will be in place after 2015 (see Table 8.16). Based on an existing $PM_{2.5}$ concentration of 12 $\mu g/m^3$ in the region, the annual $PM_{2.5}$ concentration including the site operations peaks at 12.3 $\mu g/m^3$. This peak level equates to 49% of the annual limit value for $PM_{2.5}$ which will come into force in 2015. Of this the proposed construction phase activities will contribute at most 1% of the limit value.

3.5.2 Operational Phase Impacts

In relation to impacts on air quality during the operational phase, the results of the "Do minimum" screening modelling assessments for PM_{10}, CO and benzene indicate that concentrations will be significantly within the ambient air quality standards under all scenarios.

In addition, the impact of the development will account for at most 1.2% of the respective limit values. Cumulatively, levels will still be well within the ambient air quality limit values under all scenarios. Levels of all three pollutants range from 25 - 47% of the respective limit values in 2015. Thus, the impact of the development for these three pollutants is negligible. "Do nothing" screening modelling assessments

for $PM_{2.5}$ indicates that concentrations will be significantly within the ambient air quality standards under all scenarios. In addition, the impact of the development will account for 1.8% of the annual limit value. Cumulatively, levels will still be within the $PM_{2.5}$ limit value under all scenarios. Levels of $PM_{2.5}$ will peak at 50% of the limit value in 2015. Thus, the impact of the development for $PM_{2.5}$ is negligible. The detailed air modelling assessment for NO_2 indicates that annual concentrations will be within the air quality standard under all scenarios.

Thus, using the assessment criteria outlined in Tables 8.14 and 8.15, the impact of the development in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is either negligible or slight adverse.

4. Submissions and Responses

The following persons made submissions to the Board in relation to the issues of air quality and climate:

- Nuala Morris;
- Mater Private Hospital;
- An Taisce; and
- Paschal Donohoe.

Given that certain of the persons who made submissions dealt with similar issues, I propose to deal with those issues in turn.

4.1. Issue – Reference to the Dust Impact During Construction

Submission:
A number of submissions[7] raise concern over the dust impact from the construction phase.

Response:
It is understood that submissions by the Nuala Morris, the Mater Private Hospital and Paschal Donohoe TD have raised concerns over the possible dust impact during construction. As discussed in Chapter 8 of the EIS, a detailed assessment was

[7] Submission dated 12 September 2011, received from Nuala Morris, submission dated submission dated 14 September 2011, received from Paschal Donohoe TD, submission dated 12 September 2011, received from Tom Philips & Associates on behalf of Mater Private Hospital.

undertaken of the construction phase of the project. Air dispersion modelling of the key construction activities was undertaken using the USEPA regulatory model AERMOD as outlined in Section 8.2.3 of the EIS. Section 8.7 of the EIS indicates that compliance with all relevant particulate / dust standards (for dust deposition, PM_{10} and $PM_{2.5}$) will be achieved provided the mitigation measures outlined in Section 8.6.1 are enforced. In order to ensure that the mitigation measures are effectively implemented a dust minimisation plan will be formulated for the construction phase of the project, to ensure that all construction activities are minimised wherever possible. The dust minimisation plan, as outlined in Appendix 8B of the EIS will be based on best practice[1] and will include the mitigation measures outlined in Section 3.4.1.

4.2. Issue – Reference to the Air Emissions Impact During Operation

Submission:

An Taisce in their submission[8] to the Bord have argued that the EPA is unable to state that air pollution levels in Dublin city centre for nitrogen dioxide (NO_2) are within the EU limit values and specifically that Dublin is *"already in breach of a number of air quality limit values, or is unable to show it is in compliance"*. An Taisce also point to a recent study[2] that they suggest indicates that concentrations of indoor air pollutants tend to be much higher than those outdoors.

Response:

In order to confirm the veracity of this submission, the EPA air quality data has been examined. The EPA currently monitors nitrogen dioxide (NO_2) at eight locations across Dublin including three urban stations. Two of the urban monitors are traffic-orientated urban stations (Winetavern Street & Coleraine Street) and one station is an urban background station (Rathmines)[3,4].

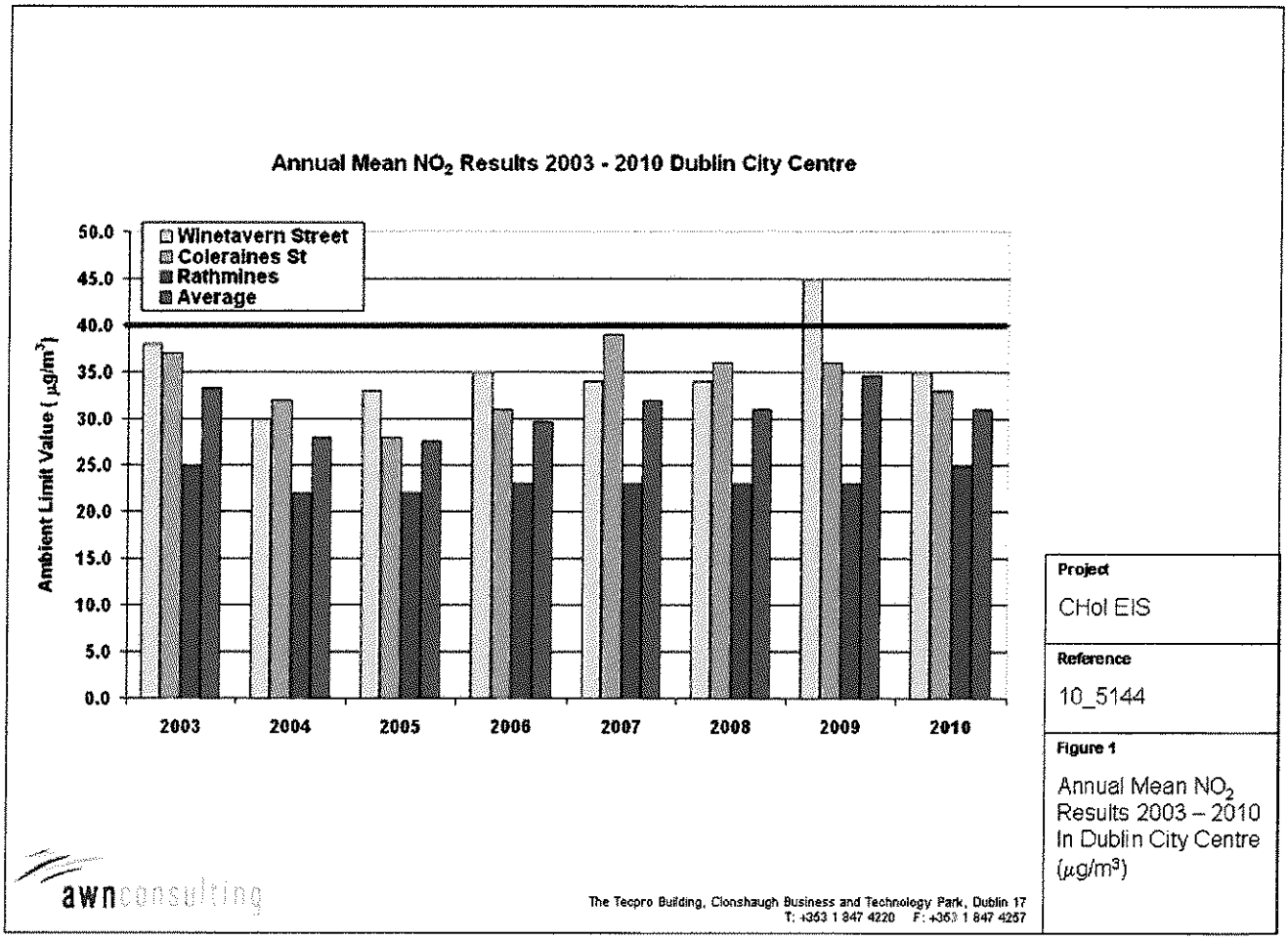
The most recent EPA air monitoring report covering 2010[3] indicates that compliance with all relevant ambient air quality standards was achieved in this year. The report does indicate that there is potential for nitrogen dioxide (NO_2) to exceed the ambient air quality limit values outlined in Council Directive 2008/50/EC (transposed into Irish Law as S.I. 180 of 2011) at traffic-orientated locations. Indeed at one location (Winetavern Street) the annual mean limit value outlined in Council

[8] Submission dated submission dated 14 September received from An Taisce

Directive 2008/50/EC (which is applicable from 2010 onwards) was exceeded. However, this result was not typical as is shown in Figure 1 which illustrates the annual mean NO_2 concentrations at the three urban locations over the last eight years. The graphic also outlines the average concentration across the three locations.

For the current assessment, a conservative background NO_2 concentration of 30 □g/m^3 was selected which is significantly higher than the urban background station results for Rathmines in recent years. Thereafter, the contribution of local traffic to the existing levels of NO_2 was determined using the UK DMRB and the USEPA CAL3QHCR air dispersion models as outlined in Section 8.7.2 of the EIS. Modelling results indicate that concentrations of NO_2 would be below the annual limit value at all locations. "Do nothing" annual average levels of NO_2 peak at 92% of the annual limit value in the opening year. With the scheme in place, the detailed assessment indicates that the annual average concentration will remain below the annual limit value in the opening year peaking at 93% of the annual limit value. The impact of the development will account for around 1% of the annual limit values in 2015.

Thus, using the assessment criteria outlined in Section 8.4 of the EIS, the impact of the development in terms of NO_2 is slight adverse.



In relation to the Challoner & Gill paper[2], the study was conducted in busy street canyons in Dublin city centre which may not be representative of the current location. The study focussed on NO_X and $PM_{2.5}$ in mainly shops and offices which were either mechanically or naturally ventilated. In relation to $PM_{2.5}$, the study generally found that outdoor levels were lower than indoor levels during the day but that the reverse was generally true during non-working hours i.e. indoor levels were lower than outdoor levels. The conclusion drawn from this was that movement within shops / offices were suspending $PM_{2.5}$ particles in the air during working hours which then settle out overnight. In relation to $PM_{2.5}$, it should be borne in mind that the under construction Mater Adult Hospital and the proposed Children's Hospital of Ireland will be fitted with HEPA filters with an efficiency of 99.995% at 0.3 microns and thus will very effectively clean the air as it travels from outdoors to the internal hospital environment.

In relation to NO_2, the study found that outdoor levels were lower than indoor levels during non-working hours whilst the results for working hours were much closer to unity with one location (Site 6) consistently showing much lower indoor NO_2 than outdoor NO_2 during the working day. The conclusion drawn from the results was that the fewer air changes at night (mechanical ventilation is off and windows/doors shut) keeps the higher day time concentrations indoors overnight while the outdoor concentrations reduce. In this regard it should be noted that the proposed Children's Hospital of Ireland will not be turning off the mechanical ventilation at night and thus the ratio of indoor to outdoor air is likely to be near unity based on the results above.

5. Conclusion

During the construction phase of the development a dust minimisation plan will be formulated for the construction phase of the project, to ensure that all construction activities are minimised wherever possible. The dust minimisation plan will be based on best practice and will follow a hierarchy of prevention, suppression and containment. These three principles are embedded in the measures which have been highlighted above.

In relation to the operational phase, levels of traffic-derived air pollutants will not exceed the ambient air quality standards both with and without the development in place. Based on a detailed assessment of air quality emissions, the impact of the development in terms of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene is either negligible or slight adverse.

References

(1) Mayor Of London (2006) The Control of Dust & Emissions From Construction & Demolition Best Practice Guidance

(2) Challoner & Gill (2011) Indoor / outdoor air quality relationships in an Urban Environment: Dublin Case Studies, Proceedings of the ITRN2011

(3) Environmental Protection Agency (2011) Air Quality Monitoring Report 2010 (& previous annual reports 1997-2009)

(4) Environmental Protection Agency (2010) Review Of Ambient Air Quality Monitoring In Ireland