



# Derry City Council

## **Air Quality Review and Assessment: Stage 3 Report**

## **Executive Summary**

November 2004



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# **Review and Assessment of Air Quality in Derry City Council Area**

## **Executive Summary**

The following summarises the main findings of the first round of the review and assessment of air quality, which was undertaken in three stages, for Derry City Council. A brief summary of the conclusions of the stage 1 and Stage 2 reports is given. The final, Stage 3 report is discussed in more detail.

In Northern Ireland, the Environment (Northern Ireland) Order 2002 provides the framework for local air quality management. The provisions in Part 3 of the Order are largely enabling and give relevant authorities the flexibility to take forward local policies to suit local needs. There is a duty to meet the Air Quality limit values set within the European Commission Air Quality Framework Directive on which the UK national air quality objectives are based. In areas where air quality objectives are not expected to be met, District Councils are required to declare Air Quality Management Areas and initiate an action plan to improve air quality in such areas.

Assessment has been made of the air quality in Derry. The levels of the seven key Air Quality Strategy pollutants have been measured and compared to government targets. Predictions have then been made to determine whether these targets will be met by specified deadlines. This process has been undertaken in a three staged approach.

### **Stage 1 Report**

In August 2001, Derry City Council completed a Stage 1 Report for the Review and Assessment of Air Quality and this concluded that a Stage 2 review and assessment was required for the pollutants nitrogen dioxide from traffic sources and sulphur dioxide and particulate matter from domestic solid fuel burning. It was found also that a Stage 2 assessment for the pollutants NO<sub>2</sub> and SO<sub>2</sub> from industrial sources would be required.

### **Stage 2 Report**

The National Environmental Technical Centre (NETCEN) was commissioned to report on emissions from traffic and industrial sources. The Design Manual for Roads and Bridges (DMRB) was used to screen the traffic emissions. Cambridge Environmental Research Consultants Ltd (CERC) was also commissioned by Derry City Council to carry out advanced dispersion modelling in twelve 1 kilometre square areas in the Council district where there was perceived extensive use of solid fuel for domestic heating purposes. The ADMS-Urban model (version 1.7) was used to determine the impact on air quality in these areas. An extensive Fuel Use Survey was commissioned by the Council and conducted by the Foyle Regional Energy Authority (FREA) to provide detailed data for modelling purposes.

The Stage 2 Report was completed in February 2004. It concluded that emissions arising from road transport at seven road junctions in the Derry City Council area would not pose a threat to exceedance of the PM<sub>10</sub> limits but might cause an exceedance of the objective for nitrogen dioxide. It was therefore recommended that further monitoring be conducted at these receptor sites and that consideration be given to completing a Stage 3 review and assessment with advanced dispersion modelling employed to determine if exceedences would be likely.

Emissions arising from industrial sources were not expected to lead to an exceedance of the objectives for NO<sub>2</sub> and SO<sub>2</sub> and so further assessment was deemed not to be necessary. However, the contribution of pollutant levels from the industrial sources to the existing ambient levels from proximate residential areas, where solid fuel is used for heating purposes, could still potentially lead to a combined effect causing possible exceedences of limit values. This would require consideration at Stage 3.

The dispersion modelling conducted on the twelve 1 kilometre squares did not predict any pollutant exceedences. However, exceedences of the SO<sub>2</sub> or PM<sub>10</sub> objectives could not yet be ruled out from domestic solid fuel burning within areas of denser housing in the Council district. This was due to the revised guidance requirement to consider 500m x 500m grid square areas and so, there was identified a need to proceed to a stage 3 review and assessment for these pollutants.

### **Stage 3 Report**

The Stage 3 Report was completed in August 2004. Reference was made to the Local Air Quality Management Policy Guidance LAQM. PGNI(03) and also the Local Air Quality Management Technical Guidance LAQM. TG(03).

In addition to the seven road junctions to be modelled for NO<sub>2</sub> emissions from traffic sources, Derry City Council had highlighted sixteen urban and ten rural 500m x 500m grid square locations where there was perceived to be extensive use of solid fuel for domestic heating purposes.

To provide more accurate input data for rural locations for dispersion modelling purposes, a fuel use survey was conducted by the Council in the rural area deemed to have the highest incidence of solid fuel use. Data was extrapolated from this survey to predict fuel use in the other rural locations. Data from the previous Fuel Use Survey conducted by FREA was used again for modelling purposes in the sixteen urban areas.

CERC was again commissioned by Derry City Council to undertake air quality modelling for the traffic locations identified and the twenty-six domestic solid fuel-burning areas at Stage 3. The advanced dispersion modelling system, ADMS-Urban(Version 2.0), was used to determine if there would be predicted exceedences of the AQS objectives for PM<sub>10</sub> or SO<sub>2</sub> within the twenty-six

areas and also the AQS objectives for NO<sub>2</sub> from traffic sources. Traffic engineers from the Department of Regional Development Roads Service provided traffic counts and other data for dispersion modelling purposes.

### **Emissions of NO<sub>2</sub> from Traffic Sources**

The results of the modelling for the traffic sources indicate that there is a very small area of exceedence of the 2005 annual NO<sub>2</sub> AQS objective at the Creggan Road / Infirmary Road junction. This occurs on the junction itself, in the middle of the road. The maximum predicted concentration of NO<sub>2</sub> is 42.5 ug/m<sup>3</sup>, equivalent to 106% of the 2005 AQS objective of 40 ug/m<sup>3</sup>.

However, the results of the model verification suggest that the model may be significantly underpredicting the concentrations at this junction so that the area of exceedence may cover a larger area. The monitored concentration of NO<sub>2</sub> is approximately 1.7 times larger than the modelled value. Figure 8.30 in the report shows what the extent of the area of exceedence would be if the concentrations of NO<sub>2</sub> were 1.7 times larger than those predicted. As the Guidance suggests that monitoring should take preference over modelled predictions, Derry City Council is recommending that an Air Quality Management Area be designated for this road junction. The extent of the area of exceedence is as demarcated in Figure 8.30.

It should be noted that the monitoring results at the Creggan Road junction were based on only one diffusion tube positioned at a place of relevant public exposure on a building façade. As it could be argued that this may not be sufficiently robust data on which to declare an AQMA, it is proposed to continue monitoring with several NO<sub>2</sub> diffusion tubes positioned at different locations at this junction. Consideration is also being given to the repositioning of a continuous chemi-luminescent NO<sub>x</sub> monitor at the Creggan Road/ Infirmary Road junction.

The modelling exercise also showed that four of the other road junctions of concern are predicted to have pollutant concentrations of up to 99% of the AQS annual NO<sub>2</sub> objective limit. The following table details the maximum predicted concentrations of NO<sub>2</sub> at these locations.

Junction	Maximum annual average		Maximum 99.79 <sup>th</sup> percentile of hourly average	
	Predicted concentration (µg/m <sup>3</sup> )	% of 2005 AQS objective	Predicted concentration (µg/m <sup>3</sup> )	% of 2005 AQS objective
<b>Buncrana Road / Racecourse Road</b>	39.4	99	139.3	70
<b>Pennyburn roundabout</b>	37.0	93	138.1	69
<b>Strand Road junction</b>	38.6	97	141.2	71
<b>Dales Corner</b>	37.6	94	145.5	73
Woodburn Park / Dungiven Road	34.5	86	135.8	68
Glenshane Road at Altnagelvin Hospital	29.6	74	129.2	65
Creggan Road / Infirmary Road	42.5	106	146.3	73

Again, the monitoring results were based on only one diffusion tube placed on a building façade at each junction. Therefore, as for the Creggan road site, it is proposed to locate a number of diffusion tubes at each of these junctions in order to obtain better monitoring data. As the objective limits are not predicted to be exceeded at these locations, there is no requirement, unless further monitoring suggests otherwise, to declare Air Quality Management Areas.

### **Emissions of PM<sub>10</sub> from Domestic Sources**

The results of the modelling for domestic sources showed that there are no predicted exceedences of the 2004 annual average AQS objective for PM<sub>10</sub> at any of the urban or rural locations.

The daily average concentration of PM<sub>10</sub> for the year 2004 is predicted to be exceeded in three of the modelled areas. These are Ballymagroarty, Claudy and Bogside (site b).

The area of exceedence in Ballymagroarty is very small and the values exceed by a small amount with the predicted concentration of 50.2ug/m<sup>3</sup> representing 100% of the Air Quality Strategy objective. Given the fact that a very high adjustment factor, derived from the Brandywell continuous monitoring site was used, it is likely that there is no cause for concern in this area.

At the rural location of Claudy, a value of 62.7ug/m<sup>3</sup>, which represents 125% of the limit value of 50ug/m<sup>3</sup>, is predicted. Again, the high adjustment factor used across Derry is likely to lead to a gross overestimate of the impact, so it is unlikely that this predicted exceedence is a real one.

At the Bogside (site b) location, there is predicted to be a very small exceedence of the limit value for this pollutant. The predicted value is 50.8ug/m<sup>3</sup> representing 102% of the limit value. The modelled exceedence in this area is supported by the continuous monitoring data for the year April 2002 to March 2003. However, the ratified data for the subsequent year shows that there were only 30 exceedences of the PM<sub>10</sub> daily average at the Brandywell site.

Therefore, as more recent monitoring data is displaying lower levels and the fact that the predicted exceedence is marginal, it is unlikely that the modelled exceedence will be a real one. The Technical Guidance also suggests that monitoring take preference over modelled results.

Based on the above, it is concluded that it will not be a requirement to recommend the declaration of air quality management areas for PM<sub>10</sub> for any of the areas listed above.

Regarding the provisional 2010 AQS annual average and the daily average concentrations of PM<sub>10</sub>, there are predicted to be exceedences of both pollutant limit values over an area covering most of urban Derry and the rural area of Claudy. However, as these predictions are also derived using a high adjustment factor from the Brandywell monitoring site, the exceedences may be lower

considering the subsequent year's lower monitored data. Derry City Council will be keeping this under review and will undertake further monitoring and/or advanced dispersion modelling in the coming years.

### **Emissions of SO<sub>2</sub> from Domestic Sources**

The results of the dispersion modelling indicate that there are two areas of predicted exceedence of the 2005 AQS objective for 15 minute concentrations of SO<sub>2</sub> in the urban Derry area.

In the Shantallow grid square, a value of 273ug/m<sup>3</sup>, representing 103% of the 2005 AQS objective, is predicted. The area of exceedence is small and the values only exceed by a small amount. As the predicted 99.9<sup>th</sup> percentile of 15 minute average concentrations of SO<sub>2</sub> were scaled using adjustment factors based on modelled and monitored concentrations at the Brandywell site, this represents a worst case adjustment and will give a gross overprediction of pollutant concentrations. It is therefore likely that the exceedence at the Shantallow area is not a cause for concern.

The second area of predicted exceedence covers a large area to the northeast of Derry, encompassing Gransha, Enagh, Maydown, Strathfoyle, Campsie and Donnybrewer. The predicted 99.9<sup>th</sup> percentile of 15 minute average concentrations of SO<sub>2</sub> is 446ug/m<sup>3</sup> and this represents 168% of the AQS objective of 266ug/m<sup>3</sup>. This area of predicted exceedence is due primarily to the estimated emissions from Coolkeeragh power station and the Invista(UK) Ltd plant, located approximately 1500m to the northeast of the modelled grid square at Strathfoyle. However, the emissions from these sources were estimated using year 2000 NAEI gridded data and emissions have reduced substantially in the interim and are predicted to continue to do so. It should also be noted that Coolkeeragh power station is currently in the process of conversion to gas-fired operation and this is likely to further reduce emissions.

It should be borne in mind also that diffusion tube results for the Strathfoyle area showed substantially less monitored concentrations of SO<sub>2</sub> than other areas in the Council district that were not deemed to have modelled exceedences. Although not an accurate methodology for determination of the short term AQS objective concentrations at specific locations, the SO<sub>2</sub> diffusion tubes do afford a reasonable indication of the spatial variability of the pollutant.

Indeed, the exceedence predicted at this location is unlikely to be a true one because the emissions data are higher than current emissions data and also, the resulting concentrations have been increased using a worst case adjustment factor as previously described. Any conclusions about possible exceedences due to emissions from the two point sources indicated should be drawn from detailed dispersion modelling studies of these sources and the areas of exceedence here are not a cause for concern.

## **Conclusions**

Consideration has been given to the requirement to declare Air Quality Management Areas where it is unlikely that the air quality objectives for the pollutants of concern will be met.

Following detailed dispersion modelling, verified against available monitoring results, it is recommended that Derry City Council does not declare Air Quality Management Areas for the pollutants PM<sub>10</sub> or SO<sub>2</sub> originating from domestic solid fuel burning sources (or for the industrial contribution thereto).

It is recommended however, that Derry City Council declare an Air Quality Management Area for NO<sub>2</sub> at the Creggan Road/Infirmary Road junction. The area of exceedence will be as described by the estimate of the worst case area of exceedence contour on the map in Figure 8.30 of the Report. Note has also been taken of the requirement that the boundary match up with physical features and can be described both geographically and in words. Therefore, a detailed map clearly demarcating the boundaries of the Air Quality Management Area will be submitted in due course.

An air quality strategy and action plan will be produced, setting out clear aims and objectives to ensure improvements are made to the air quality within the designated Air Quality Management Area. The Council is to establish a multidisciplinary project group to identify any action that can be taken to reduce the emissions of NO<sub>2</sub> at this location.

As the basis for this declaration is limited monitoring data in conjunction with dispersion modelling, further diffusion tube and also chemi-luminescent monitoring are proposed at this location.

Derry City Council is also in the process of purchasing an advanced dispersion modelling facility and will be in a position to formulate on-going predictions for the pollutants of concern at the key locations indicated.