Newry and Mourne District Council

LAQM Detailed Assessment

AGGX5436897

June 2012

Move Forward with Confidence

DOCUMENT CONTROL SHEET

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TABLE OF CONTENTS

Executive Summary

The Environment (Northern Ireland) Order 2002 places a statutory duty on local authorities to review and assess air quality within their area and take account of Government Guidance when undertaking such work.

Bureau Veritas has been commissioned by Newry and Mourne District Council to provide a Detailed Assessment investigating exceedences of the short term objectives for NO_2 and PM_{10} in Canal Street, Newry.

As fewer than 18 exceedences of the hourly mean NO_2 objective of 200µg/m^3 were recorded at the monitoring stations in Newry in 2011, it is not necessary to amend the existing Air Quality Management Area (AQMA) to include the hourly NO_2 objective.

Analysis of the daily variation in recorded PM_{10} concentrations in comparison to local traffic profiles, seasonal variation in PM_{10} concentrations, background monitoring results and the relationship between temperature and PM_{10} concentration all indicate that domestic heating using kerosene, wood and coal is an important source of PM_{10} in Newry. 80 to 90% of daily exceedences occurred over the winter months (between October and March) in 2010 and 2011. Monitoring on Canal Street indicates that domestic heating contribution to PM_{10} is significant enough to cause exceedences of the daily mean objective when in combination with traffic derived pollution. Monitoring at other locations in Newry also shows a significantly higher daily mean PM_{10} concentrations during the winter months which may also be due city wide contributions from domestic heating from sources other than natural gas, but the exceedences are less extensive in these areas.

Based on the findings of this assessment, declaration of an AQMA for daily mean PM_{10} concentrations is recommended. The geographic extent of this AQMA should be determined in reference to information of the location and extent of burning of fuels such as kerosene, wood and coal for domestic heating purposes in combination with the presence of main roads. It is concluded that the combined impact of these domestic sources and traffic emissions from busy roads leads to exceedence of the daily mean objective. It is therefore recommended that the AQMA be confined to the area of Canal Street which is a street canyon, where the combination of road traffic and domestic heating emissions along with poor dispersion are likely to have caused exceedence of the objective. Based on current information, it is recommended that the AQMA for PM_{10} be declared for length of Canal Street between Barrack Street and Canal Quay.

1 Introduction

1.1 Project Background

The Environment (Northern Ireland) Order 2002 places a statutory duty on local authorities to review and assess air quality within their area and take account of Government Guidance when undertaking such work.

This report is a Detailed Assessment for the 1-hour mean objective (200µg/m^3) for NO_2 and the 24-hour mean objective (50 µg/m^3) for PM_{10} at Canal Street, Newry. Newry and Mourne District Council (NMDC) is the competent authority for this area. The council have commissioned this report as exceedances of the 1-hour mean objective for NO_2 (200µg/m^3, not to be exceeded more than 18 times a year) and the 24-hour mean objective for PM_{10} (50 µg/m^3, not to be exceeded more than 35 times a year) were recorded in 2010 by the automatic air quality monitoring station on Canal Street, Newry.

1.2 Legislative Background

The air quality objectives applicable to Local Air Quality Management (LAQM) in Northern Ireland are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003 (No. 342). The objectives are shown in Table 1. This table shows the objectives in units of micrograms per cubic metre (µg/m^3). For carbon monoxide, the units used are milligrammes per cubic metre (mg/m^3). Table 1 includes the number of permitted exceedences in any given year (where applicable).

The locations where the AQS objectives apply are defined in the AQS as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed [to pollutant concentrations] over the relevant averaging period of the AQS objective. Typically these include residential properties and schools/care homes for longer period (i.e. annual mean) pollutant objectives and high streets for short-term (i.e. 1-hour) pollutant objectives.

Table 1 Air Quality Objectives included in the Regulations for Local Air Quality Management in Northern Ireland

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured As	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	3.25 µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide (CO)	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004

	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.3 Local Air Quality Management (LAQM) Review and Assessment

As established by the Environment Act 1995 Part IV, the Environment (Northern Ireland) Order 2002 Part III, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives set down by Government for a number of pollutants. The process of Review and Assessment of air quality undertaken by local authorities is set out under the Local Air Quality Management (LAQM) regime and involves a phased three yearly assessment of local air quality. Where the results of the Review and Assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of the AQS objectives.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS)[1] and introduced the idea of local authority 'Review and Assessment'. The Government subsequently published policy and technical guidance related to the Review and Assessment processes in 1998. This guidance has since been reviewed and the latest documents include Policy Guidance (LAQM.PG (09))[2] and Technical Guidance (LAQM.TG (09))[3]. The guidance lays down a progressive, but continuous, framework for the local / district authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

Defra and the Devolved Administrations released the latest Policy and Technical Guidance in February 2009, in anticipation of the fourth round of Review and Assessment and updated LAQM tools and emissions factors in 2010.

1 DoE, 1997, 'The United Kingdom National Air Quality Strategy', The Stationary Office

2 Policy Guidance LAQM.PG(09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

3 Technical Guidance LAQM.TG (09) (2009), Part IV of the Environment Act 1995, Local Air Quality Management, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland, The Stationery Office

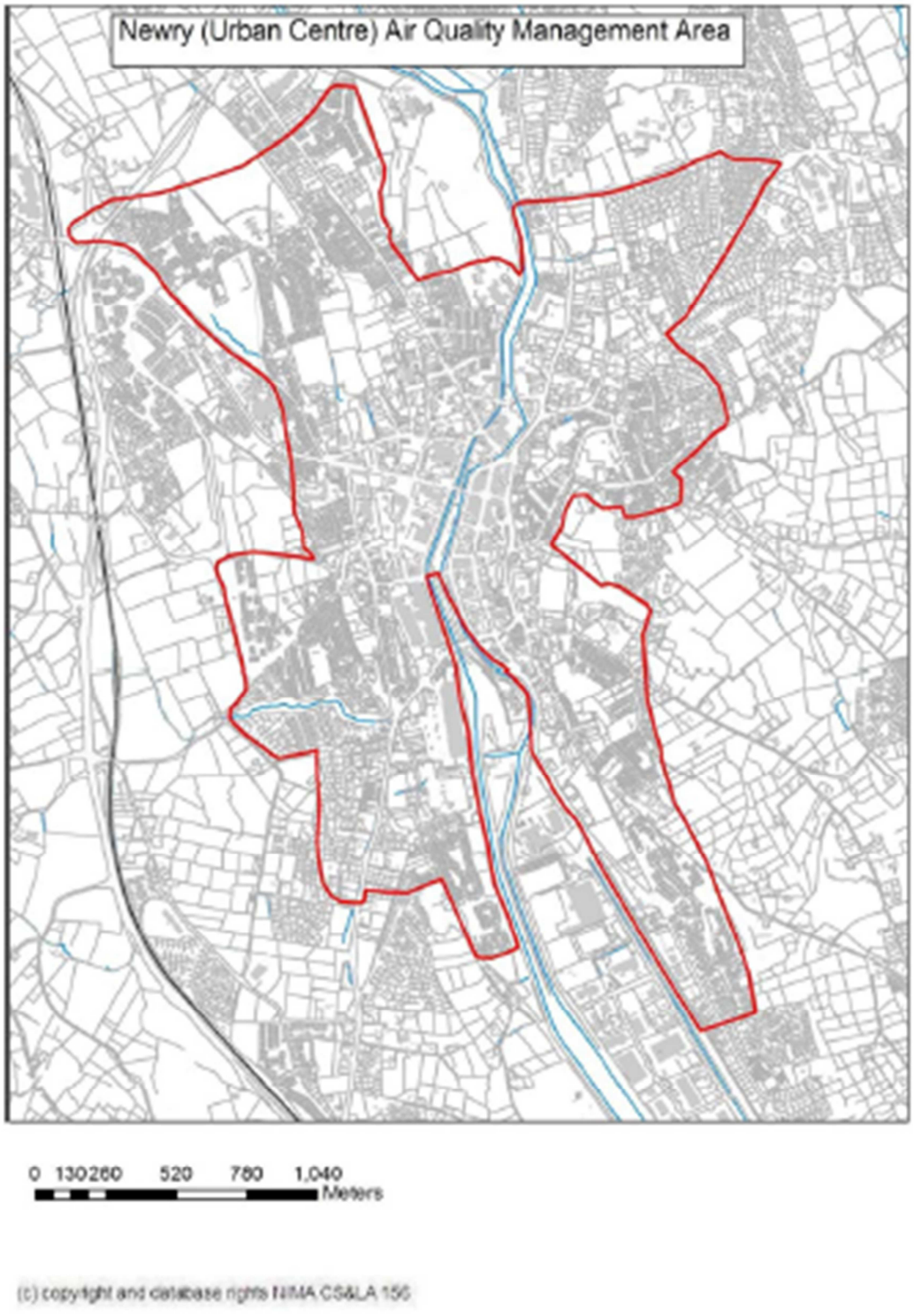
1.4 Summary of Review and Assessment Undertaken by Newry and Mourne District Council

Table 2 Summary of Newry and Mourne Air Quality Review and Assessment

Title of Work	Summary of Report
USA (2004)	Potential exceedences of the NO_2 and PM_{10} AQS objectives in the vicinity of several roads in Newry City centre
Detailed Assessment (2005)	Concluded a risk of exceeding air quality objectives for NO_2 and PM_{10} in Newry city centre. There was a high degree of uncertainty in the modelling results. Following discussions with the Environment and Heritage Service of the Department of Environment (NI), NMDC resolved to declare five AQMAs for the annual mean NO_2 objective and the 24-hour PM_{10} objective
USA (2006)	Concluded that the risk of the air quality objectives for NO_2 being exceeded outside existing AQMAs was negligible for all sources. In addition, the USA indicated that there was little likelihood of the 2004 air quality objectives for PM_{10} being exceeded.
Further Assessment (2007)	The results showed that NO_2 annual average concentrations within the AQMA were still likely to exceed the AQS objective along Canal Street, Water Street and Kilmorey Street in Newry City. Given the uncertainties in modelling PM_{10}, the focus of the further assessment and source apportionment study was therefore focused on NO_X and NO_2
Further Modelling (2009)	The model performance was improved from 2005 results. The results showed that NO_2 annual average concentrations within the AQMA were still likely to exceed the AQS objective along Canal Street, Water Street, Kilmorey Street, and a newly identified street, Sandy Street in Newry City. The model indicated that there was little likelihood of the 2004 air quality objectives for PM_{10} being exceeded within Newry City. The Council resolved to revoke existing 5 AQMAs and to declare one AQMA for the annual mean NO_2 objective covering all areas of possible exceedance - Newry (Urban Centre) AQMA.
USA (2009)	As no new or significantly changed sources of pollutants were identified a further detailed assessment was not required. Newry and Mourne Council finalised the Action Plan for the Newry (Urban Centre) AQMA.
Progress Report 2010	The PM_{10} AQ Objective was not breached during 2009. A new site was established at Canal Street in June 2009. This site recorded 21 exceedances of the daily mean objective for PM_{10} 50µg/m^3. The street had formerly been

Title of Work	Summary of Report
	declared an AQMA for PM_{10} but this was revoked following further dispersion modelling results (Further Assessment 2009), which indicated that exceedance of PM_{10} objective was not likely within Newry City. Monitoring of PM_{10} has continued at this location. 2009 monitoring data found that a number of sites of relevant exposure breached the annual mean objective for nitrogen dioxide. All of these sites were within the existing AQMA.
Progress Report 2011	2010 monitoring data identified exceedances of the annual mean objective for nitrogen dioxide (NO_2) (40µg/m^3) for a number of streets within Newry City. These streets are within an existing Air Quality Management Area - Newry (Urban Centre) Air Quality Management Area for which there is an agreed Action Plan. During 2010 air quality monitoring in Canal Street, Newry, monitored exceedances for the 1-hour mean objective (200µg/m^3) for NO_2 at and for the 24-hour mean objective (50µg/m^3) for PM_{10}. Consequently Newry and Mourne District Council propose to proceed to a Detailed Assessment for the 1-hour mean objective for NO_2 and the 24-hour mean objective for PM_{10} at Canal Street, Newry.

Figure 1 - Map Showing Boundary of Newry (Urban Centre) AQMA



1.5 Scope and Methodology of the Detailed Assessment

The purpose of the Detailed Assessment is to provide the Local Authority with an opportunity to supplement the information they have gathered in their earlier Review and Assessment work and more accurately assess the impact of pollution sources on local receptors at identified hotspots through dispersion modelling.

The general purpose of the Detailed Assessment is to provide robust information in order to determine if exceedences of the Air Quality Strategy (AQS) objectives are likely to occur in the assessed areas and, if confirmed, to determine the extent of the areas of exceedence. This information would assist in establishing the area and any amendments to be included within the existing Air Quality Management Area (AQMA) in Newry, if needed. This Assessment will seek to identify with reasonable certainty whether or not pollutant concentrations are likely to exceed the hourly mean NO_2 or 24-hour mean PM_{10} AQS objectives and, if so, define the extent and magnitude of the exceedences.

The Detailed Assessment would follow the methodology and use the tools recommended by Defra's Technical Guidance LAQM.TG(09) to complete such assessment. TG(09) states that "*Because of the wide range of sources and local circumstances that may prevail, it is not possible to set prescriptive guidance for the Detailed Assessment*". It is considered that a detailed analysis of the monitoring data collected in Canal Street and in Newry in general is the best methodology for this Detailed Assessment. Further modelling of pollution levels in Canal Street is not considered to be beneficial in this assessment (at this time) for the following reasons:

- "*Dispersion models are inevitably poorer at predicting short-term peaks than they are at predicting annual mean concentrations, and the process of model verification is extremely challenging*"[4].

- Further dispersion modelling is unlikely to lead to significantly different findings to the assessment carried out by Bureau Veritas in the Further Assessment of 2007 until revised vehicle emissions factors (due to be released sometime in 2012) are available. The results of this assessment can be re-interpreted in view of developments in standard modelling methodology as part of a wider update likely to be required in 2012 as further quantification of Action Plan measures is required.

- There are widely acknowledged deficiencies in the available national emission factors for vehicles. Predicted emissions are generally lower than those observed in reality, and the traffic fleet assumptions are likely to differ significantly from the actual fleet in Newry. Specifically the diesel proportion of the fleet in Northern Ireland is known to be significantly higher than the rest of the UK, and new information is expected to focus on revision to emissions factors for diesel cars (as well as other vehicle types). The emission factors are likely to be updated in 2012, but this is not likely to occur in the timeframe of this Detailed Assessment (due before end of April 2012).

The proposed methodology therefore involves analysis of monitoring data collected in Newry with reference to daily and seasonal variations, traffic profiles and meteorological data.

Analysis of data has been carried out using the Openair[5] package for air quality data analysis within the statistical package "R"[6].

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[4] Local Air Quality Management Technical Guidance LAQM.TG(09)

[5] Carslaw, D.C. and K. Ropkins, (2012) openair --- an R package for air quality data analysis. Environmental Modelling & Software. Volume 27-28, 52-61.
David Carslaw and Karl Ropkins (2012). openair: Open-source tools for the analysis of air pollution data. R package version 0.5-18.

[6] R Development Core Team (2011). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

2 Baseline Information

2.1 Air Quality Monitoring Data

2.1.1 Automatic Monitoring data

NMDC operates three continuous air quality monitoring sites within their district. These are the roadside sites on Trevor Hill and Canal Street and the background site on Monaghan Row. Recent results from these monitoring stations are shown in Table 3. The Canal Street monitoring station has been operational since June 2009.

Canal Street is a heavily trafficked street with frequent congestion and slow moving traffic. The Street is also on an incline, which is likely to lead to increased exhaust emissions as vehicles accelerate up the hill. In addition to these high levels of emissions, dispersion of pollutants is likely to be poor due to the 'Street Canyon' layout of the street. Tall buildings on both sides of the road are likely to lead to the formation of vortices and recirculation of air flow that can trap pollutants and restrict dispersion. The location of the Canal Street monitoring station within the street canyon on this busy road is likely to some extent to explain the high levels of pollution recorded in comparison to the other monitoring stations. The monitoring site in Canal Street is shown in Figure 2.

Figure 2 - Photo of Canal Street Automatic Monitoring Station

Table 3 - Results of Automatic Monitoring - Comparison with AQS Objectives

Site Name	Pollutant	Within AQMA ?	Objective	Data Capture for Full Calendar Year 2011	2008	2009	2010	2011
Monaghan Row	PM_{10}	Y	Annual Mean (40µg/m^3)	94.5	18	14	21	14
	PM_{10}	Y	24-hour mean exceedences (50µg/m^3, not to be exceeded more than 35 times a year)		12 (34)	6	16 (40)	13
Trevor Hill	NO_2	Y	Annual Mean (40µg/m^3)	91.1	46	44	44	31
	NO_2	Y	1-hour mean exceedences (200µg/m^3 not to be exceeded more than 18 times a year)		5 (172)	0	8 (178)	1
	PM_{10}	Y	Annual Mean (40µg/m^3)	89.4	26	24	31	22
	PM_{10}	Y	24-hour mean exceedences (50µg/m^3, not to be exceeded more than 35 times a year)		12 (44)	6	46 (55)	26 (47)
Canal Street	NO_2	Y	Annual Mean (40µg/m^3)	94.5	-	-	44	33
	NO_2	Y	1-hour mean exceedences (200µg/m^3, not to be exceeded more than 18 times a year)		-	-	34	6
	PM_{10}	Y	Annual Mean (40µg/m^3)	90	-	31[1]	37	30
	PM_{10}	Y	24-hour mean exceedences (50µg/m^3, not to be exceeded more than 35 times a year)		-	21[1]	73	39

If the period of valid data is less than 90% of a full year, the 90th percentile of daily means is included in brackets.

[1] Only partial year data collection

These results show that the neither the NO_2 annual mean or hourly mean AQS objective was exceeded at the automatic monitoring stations in Newry in 2011. The hourly mean objective for NO_2 will therefore not be considered further with regards to amending the AQMA as it was not exceeded in the most recent year of monitoring data.

The PM_{10} annual mean objective was also not exceeded at these monitoring sites in 2011. The PM_{10} objective of 50 µg/m^3, not to be exceeded more than 35 times a year was exceeded at the Canal Street monitoring site (39 exceedences), although the number of exceedences was significantly less than that recorded in 2010 (73 exceedences).

2.1.2 Nitrogen Dioxide Diffusion Tube Data

In 2010 NMDC deployed 35 NO_2 diffusion tubes per month at 33 sites within the District (all within Newry City Centre). The NO_2 diffusion tubes used were prepared and analysed by Gradko Ltd using the 50% TEA in acetone method. Results for these sites between 2007 and 2011 are provided in Table 4. Full details are available in annual air quality reports.

Analysis of UK continuous NO_2 monitoring data has shown that it is unlikely that the hourly mean NO_2 objective, of 18 hourly means over 200µg/m^3, would be exceeded where the annual mean objective is below 60µg/m^3 [7]. Monitored annual average NO_2 concentrations for 2011 are below 60µg/m^3; therefore, the NO_2 hourly mean AQS objective is expected to be met in Newry.

[7] AEAT (May 2008) Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective. A report produced for the Department for Environment, Food and Rural Affairs, the Scottish Government, the Welsh Assembly Government and the Department of the Environment in Northern Ireland.

Table 4 NO_2 passive monitoring results in the study area

Location	Bias Adjusted Annual Mean Concentration				
	2007	2008	2009	2010	2011
Canal St (Pub)	**60**	**49**	**61**	**65**	46
13 Canal Street	**-**	**-**	**-**	**57**	27
Catherine Street	**43**	36	**42**	**52**	28
Mourneview Park	**-**	**-**	**-**	10	-
College Gardens	**-**	**-**	**-**	24	-
25 Sandy Street	**49**	**41**	**49**	**58**	34
59 Sandy Street	**45**	**56**	**56**	**51**	34
Arthur Street	**-**	**-**	**-**	25	-
Church Street	**-**	**-**	**-**	31	-
Hennessy Park	**-**	**-**	**-**	19	-
Water Street	**46**	40	**46**	**60**	32
Trevor Hill 1	**41**	35	**44**	**45**	29
Trevor Hill 2	**41**	34	**43**	**44**	31
Trevor Hill 3	**41**	33	**45**	**44**	34
33 Kilmorey St	**52**	**43**	**53**	**60**	39
52 Kilmorey St	**48**	39	**48**	**54**	29
Main Ave Derrybeg	**-**	**-**	**-**	20	-
4 Bridge St	**-**	31	38	**43**	25
60 Bridge St	**-**	**-**	**-**	33	21
Basin View Terrace	33	32	**41**	**45**	27
Doran's Hill	**-**	**-**	**-**	29	17
Dominic / Patrick St	31	29	25	**41**	22
Francis Street	39	32	**42**	**46**	28
Market Office	22	18	22	24	14
St Mary Street	29	23	32	34	-
115 Chapel St	**-**	**-**	**-**	23	13
42 Patrick St	**48**	35	**46**	**52**	31
Monaghan Row	13	13	14	16	9
Pine Grove	**-**	**-**	**-**	37	21
4 Windsor Hill	**-**	26	39	25	25
9 Kilmorey Terrace	**-**	25	31	**40**	20
2 Chapel Street	**-**	**-**	28	34	20
71 Kilmorey Street	**-**	**-**	**51**	**69**	37
Camlough Road1	**-**	**-**	16	22	11
Camlough Road2	**-**	**-**	20	25	15
Parkhead Cresent	-	-	-	-	13
1 Forkhill Road	-	-	-	-	11
Lower Edward St	-	-	-	-	18
Soho Bus Depot	-	-	-	-	18
Dundalk St NTH	-	-	-	-	16
Church St W/Point	-	-	-	-	21
Newry St Kilkeel	-	-	-	-	13

3 Results and Discussion

Hourly PM_{10} monitoring data from all monitoring stations in Newry from 2007 onwards data has been imported in to the Openair[8] package that contains a collection of functions to analyse air pollution data and allows plotting of complex plots of air quality data. The Canal Street monitoring station has been operational since the middle of 2009.

3.1 Daily, Hourly and Seasonal Variations

Figure 3 shows a plot of hourly PM_{10} concentrations averaged across hours of the day and season and Figure 4 shows a plot of hourly NO_2 and PM_{10} concentrations from the Canal Street monitoring station. The noteworthy aspects of these plots are:

- At all monitoring sites PM_{10} concentrations are significantly higher in the winter months than in the summer; and,
- At all monitoring sites, including the Monaghan Row background site, peak PM_{10} concentrations occur between 7pm and 9pm, which is later than when peak NO_2 concentrations occur.

As peak concentrations are generally in the evening after the traffic rush hour, and at all sites there is little diurnal variation in concentration during the summer months, these plots suggest that the predominant source of PM_{10} pollution is not traffic related.

However, peak PM_{10} can be observed at other monitoring sites as a result of generally calmer conditions and reduced dispersion. To confirm whether the diurnal PM_{10} pattern observed at Canal Street indicates a non-traffic source or not, the pattern has been compared with those at several sites in southern England where central heating is natural gas fired, and therefore in these locations local profiles of PM_{10} are predominantly traffic related or due to general background influences. As shown in Figure 5. PM_{10} concentrations at two urban background sites (Southampton and Reading) do peak at the same time of day as concentrations at Canal Street, however, the peaks are much less pronounced. Indeed, the peak PM_{10} concentrations in winter evenings at Canal Street far exceed the peaks at the roadside Marylebone monitoring site, where the 2011 annual average concentration was 38µg/m^3, and therefore greater than that at Canal Street.

The pronounced nature of these patterns, and the fact that absolute concentrations are higher in winter months suggests that fuel burning for heating purposes is a major source of PM_{10} in Newry.

As a result of high levels of smoke in Newry the Council embarked on a programme of creating smoke control zones within the City. Properties within these zones are only permitted to use authorised smokeless fuels for their heating and cooking appliances. Between 1991 and 1999 seven smoke control areas were created encompassing over 5000 private dwellings, which lead to an 80% reduction in smoke levels within the city between 1989 and 1999. These smoke control areas cover the same area as the AQMA.

It is understood that kerosene is one of the major heating fuels used in Newry. Natural gas use is increasing in the area, but it is understood that coal and wood burning are also on the increase. Liquid fuel, such as kerosene, can be used legally in a smoke control area if burnt in any fireplace specially designed or adapted for combustion of liquid fuel[9]. However, combustion of fuels such as kerosene (12 gPM_{10}/GJ), coal (120g/GJ) and wood (20-60g/GJ) is known to emit more PM_{10} per unit of heat generated than the burning of natural gas (1g/GJ)[10], which explains the evening peak concentrations.

[8] Openair: Open-source tools for the analysis of air pollution data, David Carslaw and Karl Ropkins (2011), R package version 0.5-18.

[9] Smokecontrol.defra.gov.uk/guidance.php?a=f&q=3#4

[10] Measurement and Modelling of Fine Particulate Emissions (PM_{10} and PM2.5) from Wood Burning Biomass Boilers. Report to the Scottish Government. AEA Environment and Technology, 2008

Figure 3 – Daily and Seasonal PM_{10} Variation in Newry

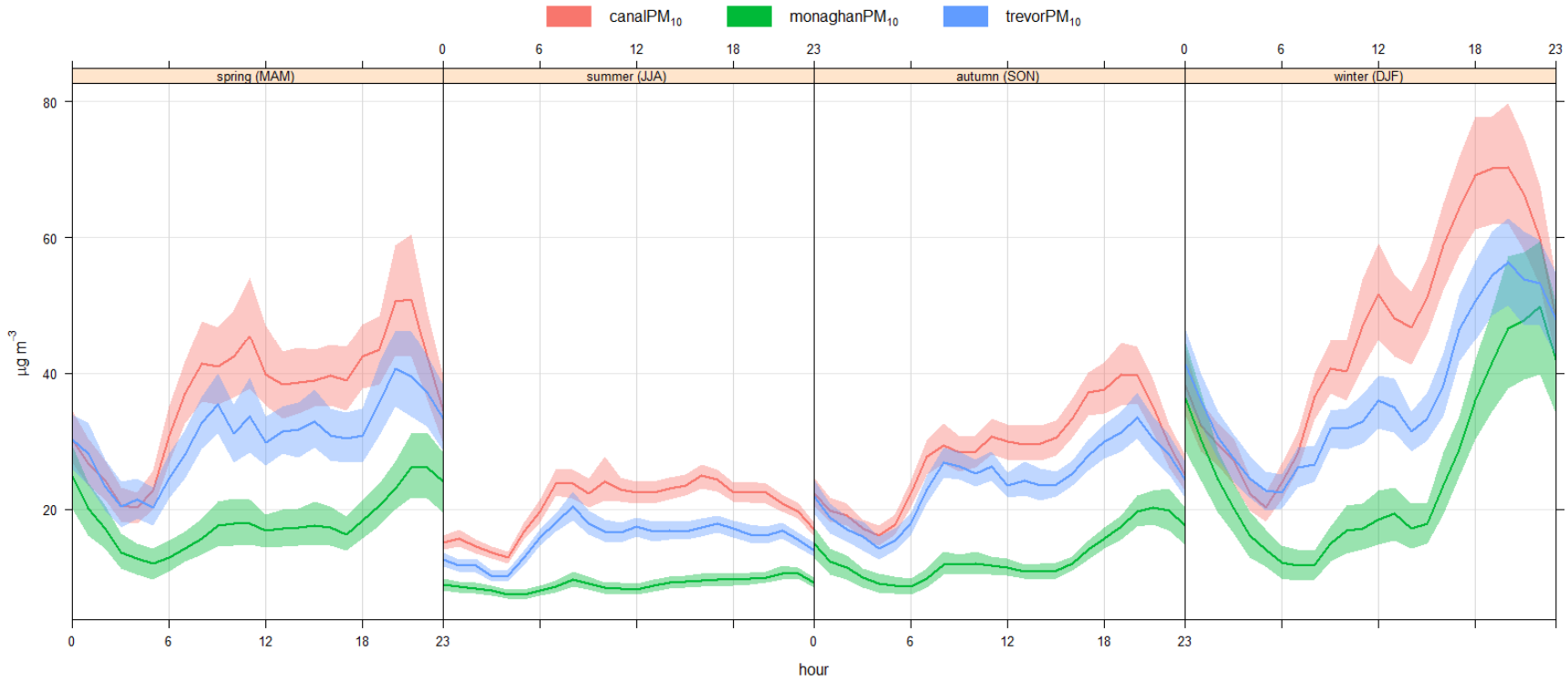


Figure 4 – Daily NO_2 and PM_{10} Variation at the Canal Street Monitoring Site

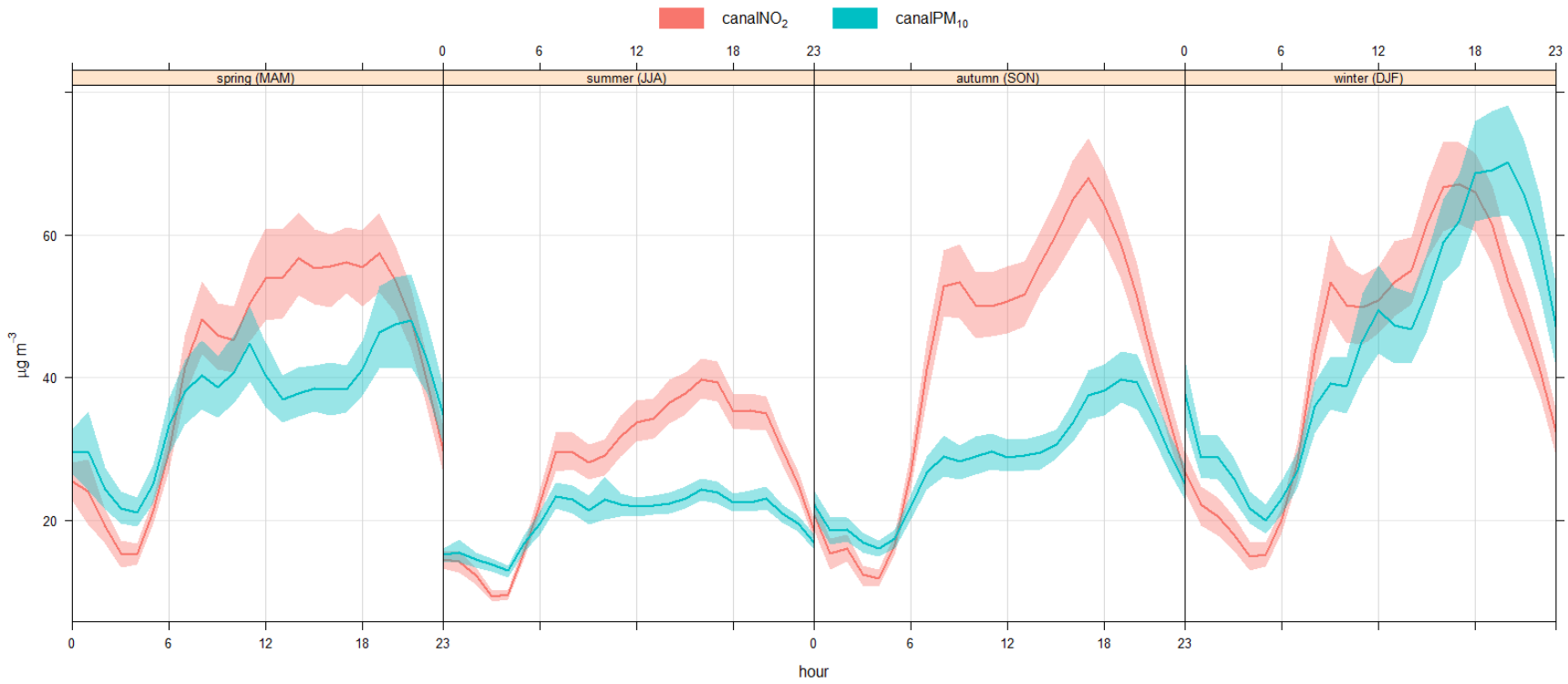


Figure 5 - Diurnal PM_{10} Variation at Canal Street and three Monitoring Sites in England

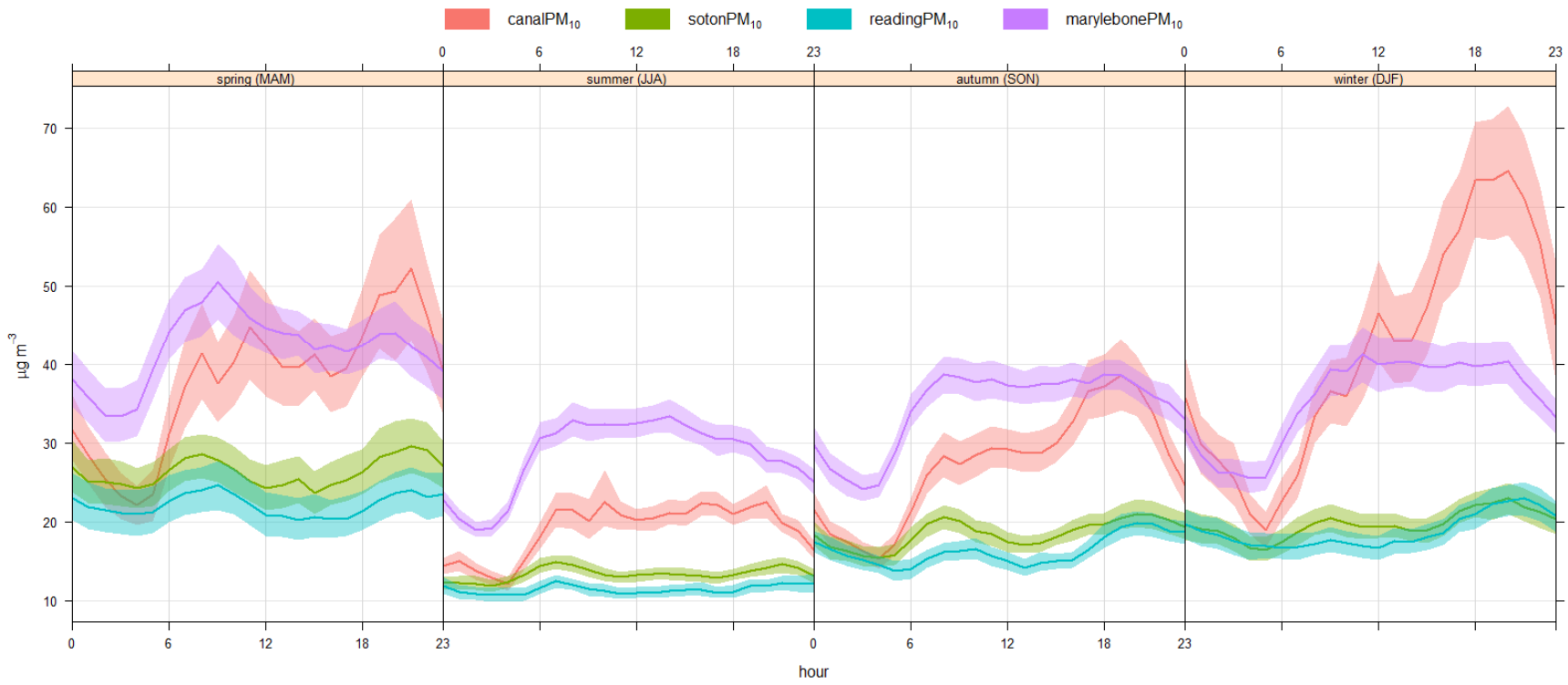
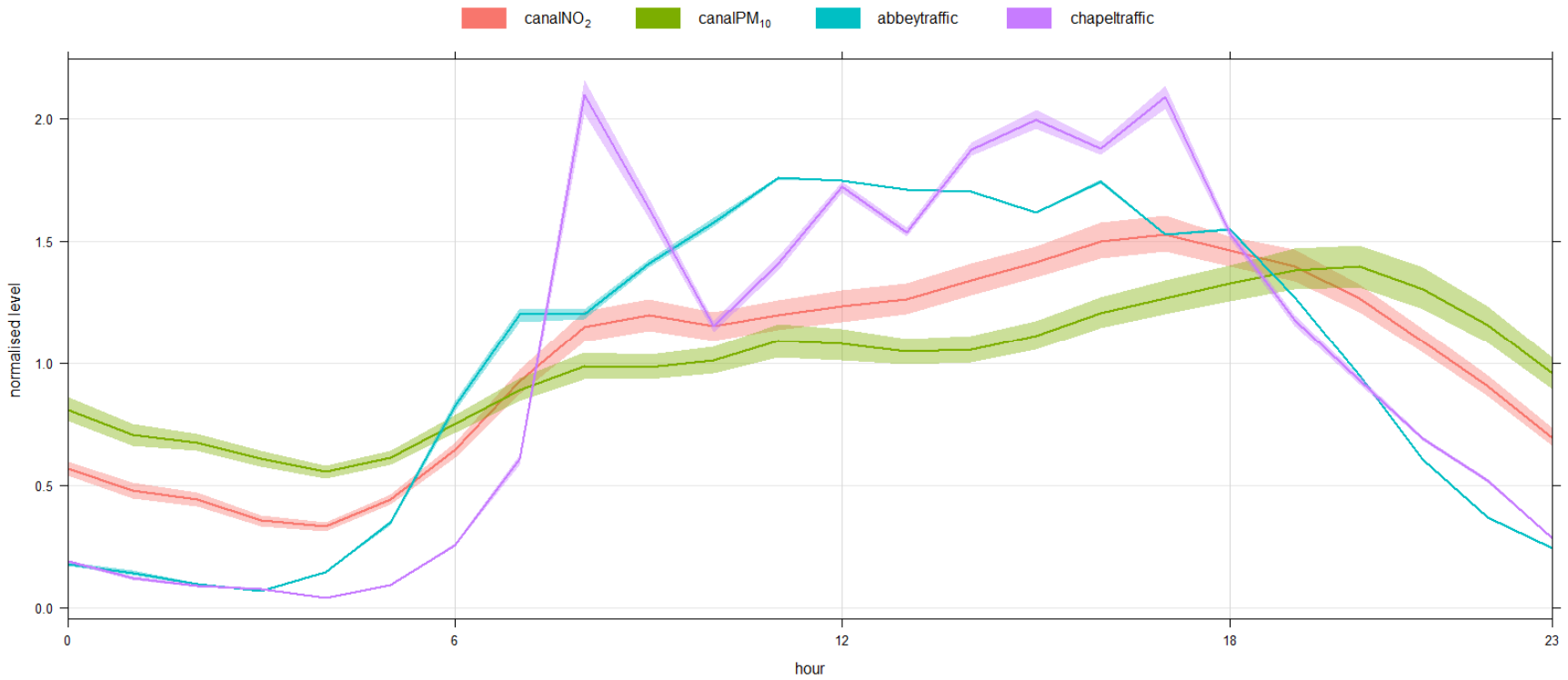


Figure 6 shows a plot of normalised NO_2 and PM_{10} concentrations along with diurnal traffic profiles from Chapel Street and Abbey Way in Newry. This shows that evening peak traffic flows occur before 6pm, as does the peak NO_2 concentration. This indicates that most NO_2 at the monitoring stations is traffic derived, and that additional sources of PM_{10} are likely to be contributing in the evening hours.

Figure 6 – Hourly Averaged Normalised NO_2 and PM_{10} Concentrations at Canal Street Monitoring Station and Diurnal Traffic Profiles in Newry



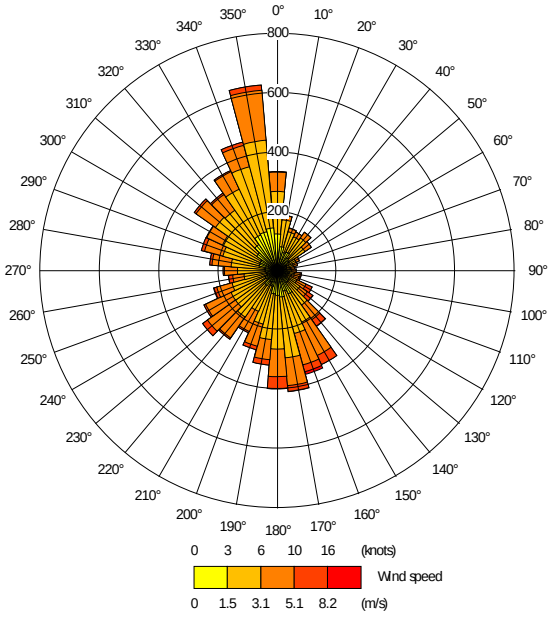
3.2 Meteorological Data

As meteorological data is not collected at the Canal Street automatic air quality monitoring station, National Weather Prediction (NWP) data for the location of the monitoring station has been obtained from the Met Office to try to identify any patterns leading to the recorded exceedences of the short-term Air Quality Strategy Objectives. Data from 2010 was obtained to determine any conditions that may have lead to the very high number of exceedences recorded. As the meteorological data was not obtained from a monitoring location at the same site as the air quality monitoring equipment, interpretation of pollution concentrations as a result of prevailing wind directions is not considered to be possible as the erroneous conclusions could be drawn. The data has been used to determine pollution patterns in relation to wind speeds and temperatures.

NWP datasets are based on the Unified Model operated by the UK Met Office for the purposes of forecasting weather conditions. There are a number of advantages in using NWP data, in particular, the data is produced to site specifically representative of the location of interest. 2010 was an unusual year of weather, with a higher proportion of northerly winds and cold conditions, which lead to a general pattern of higher pollution levels recorded across the UK.

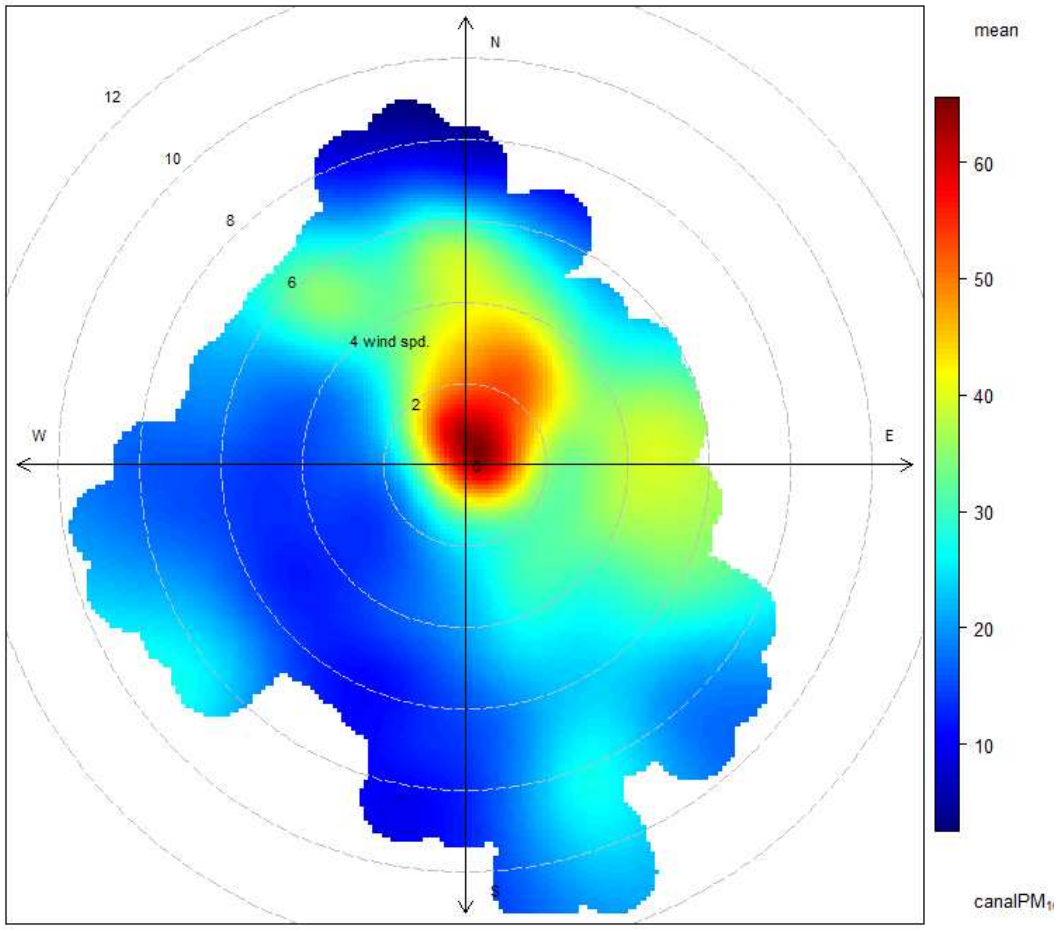
For information, the wind rose for the NWP 2010 meteorological data is shown in Figure 7, where the dominant northerly winds observed during the year can be clearly identified.

Figure 7 – Wind Rose of NWP Data for Canal Street, 2010



The highest PM_{10} concentrations occur when wind speeds are lowest. This is shown in Figure 8. This is most likely to be because conditions are typically calmer and wind speeds are lower in the evenings reducing pollutant dispersal. Newry City is located in the basin of a valley and is subject to temperature inversions. Therefore, levels of pollution are likely to climb within the city until either the temperature inversion lifts or wind speeds pick up.

Figure 8 – Polar Plot of PM_{10} Concentrations Recorded at the Canal Street Monitoring Station in 2010



4 Conclusions and Recommendations

As part of the Local Air Quality Management (LAQM) regime, a Detailed Assessment based on analysis of monitoring data was carried out for Canal Street, Newry. This was required as more than 35 exceedences of the PM_{10} daily mean air quality objective of 50µg/m^3 and more than 18 exceedences of the NO_2 hourly mean of 200µg/m^3 were recorded at this monitoring site in 2010.

As fewer than 18 exceedences of the hourly mean NO_2 objective of 200µg/m^3 were recorded at the monitoring stations in Newry in 2011, it is not necessary to amend the existing AQMA to include the hourly NO_2 objective. 39 exceedences of the PM_{10} daily mean objective for PM_{10} of 50µg/m^3 were recorded in 2011, indicating that an AQMA for the PM_{10} daily mean objective is required.

Analysis of the daily variation in recorded PM_{10} concentrations in comparison to local traffic profiles, seasonal variation in PM_{10} concentrations, background monitoring results and the relationship between temperature and PM_{10} concentration all indicate that domestic heating is an important source of PM_{10} in Newry. 80 to 90% of daily exceedences occurred over the winter months (between October and March) in 2010 and 2011. Monitoring on Canal Street indicates that when this regional source adds to traffic derived pollution near busy roads, exceedences occur. Clearly, domestic heating emissions alone are not enough to cause greater than 35 daily exceedences of 50µg/m^3 as the objective is only exceeded at Canal Street. In this area, the combined impact of traffic emissions from road traffic within Canal Street, the street canyon configuration of the street, and domestic heating emissions are likely to have resulted in exceedence of the objective.

This leads to the conclusion that an AQMA for the daily mean PM_{10} objective is required. The geographic extent of the AQMA would need to be determined. This could be based on modelling, however the estimation of emissions from domestic heating sources is somewhat uncertain. It is therefore recommended that the AQMA be confined to the area of Canal Street which is a street canyon, where the combination of road traffic and domestic heating emissions along with poor dispersion are likely to have caused exceedence of the objective. Based on current information, it is recommended that the AQMA for PM_{10} be declared for length of Canal Street between Barrack Street and Canal Quay shown in Figure 9.

Figure 9 – Suggested AQMA for Daily Mean PM_{10} Objective