Baseline Air Quality: Final Report

Trafford Kingsway Park Primary School

For Trafford Council

ED60101001

Customer:

Trafford Council

Customer reference:

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Executive summary

Trafford Council requested Ricardo Energy & Environment ('Ricardo') to undertake a 12 month air quality monitoring study at Kingsway Primary School in Davyhulme, Trafford.

Continuous automatic monitoring was carried out for 3 months from the 1st March 2015 for Nitrogen Dioxide, Sulphur Dioxide, Particulate Matter (PM_{10} and $PM_{2.5}$) and 1,3 Butadiene.

Continuous automatic monitoring of Nitrogen Dioxide and Particulate Matter (PM_{10} and $PM_{2.5}$) has continued at the site to cover a 12 month period.

Non-automatic sampling for Heavy Metals and Dioxins was also carried out between March 2015 and July 2015.

The data provided in this report show that there are no exceedances of any of the air quality objectives at the study location for NO_2, SO_2, PM_{10}, $PM_{2.5}$ or 1.3 Butadiene. For PM_{10} the daily mean exceedance value was exceeded 5 times in 2015 and once in 2016. To achieve the air quality objective this limit must not be exceeded 35 time per annum.

Following 3 months of Heavy Metal measurements they concentrations were below the adopted assessment criteria. As a result no further heavy metals monitoring is required at the site.

The dioxins and furans concentrations are below the average quarterly results measure at Manchester Law Courts in 2010 (most recent results available). As a result no further dioxins and furans monitoring is required at the site.

Monitoring of NO_2, PM_{10} and $PM_{2.5}$ was undertaken for between 13 and 16 months across 2015 and 2016. Annualised annual mean concentrations for both years, based on the monitoring period and local monitoring data, indicates that air quality objectives would be achieved.

SO_2 monitoring at the site was concluded after 4 months. Over this period there were no exceedances of the air quality objectives. The annualised annual mean concentration was well below the relative objective. Therefore 4 months monitoring is considered sufficient as concentration are well below the relevant objectives.

Measurements of 1.3 Butadiene were below the analyser's limit of detection for the monitoring period. The results should therefore only be taken as indicative measurements, for the purpose of confirming that 1,3 butadiene concentrations at the sites are well within relevant limit values.

The concentrations for NO_2, SO_2, PM_{10}, and $PM_{2.5}$ are consistent with urban background monitoring locations in the national Automation Urban & Rural Network (AURN). The concentrations for these pollutants also correlated well with local monitoring sites.

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Appendix 1 Additional Calculations

1 Introduction

Trafford Council requested Ricardo to undertake a 12 month air quality monitoring study at Kingsway Primary School in Davyhulme, Trafford. The study includes monitoring over a 3 month period for 4 pollutants and a full 12 months monitoring for a further 3 pollutants. The 12 month period was extended for Particulate Matter due to faults with the analysers.

A wide range of components have been measured including:

- Nitrogen Dioxide (NO_2) – 13 months (1/3/15 to 27/4/16)
- Particulate Matter <10 microns in aerodynamic diameter (PM_{10}) – 15 months (1/3/15 to 5/6/16)
- Particulate Matter <2.5 microns in aerodynamic diameter ($PM_{2.5}$) – 13 months (1/3/15 to 2/4/16)
- Sulphur Dioxide (SO_2) – 3 months (1/3/15 to 30/6/15)
- Dioxins PM_{10} – 3 months (5/3/15 to 3/6/15)
- Heavy metals in PM_{10} – 3 months (10/4/15 to 31/7/15)
- 1,3 Butadiene – 3 months (1/3/15 to 31/5/15)

This report details the results of the study and a relative comparison of the results compared with the relevant limit values.

2 Ambient Air Quality Objectives and Limit Values

UK air quality objectives and targets are set out by relevant European Union (EU) directives and United Kingdom (UK) strategies. Where pollutants are not regulated under a UK air quality annual objective limit, the EU Ambient Air Quality Directive contains target values.

Directive 2004/107/EC, also known as the 4th Daughter Directive (4th DD)[1] relating to arsenic, cadmium, mercury and nickel in ambient air sets objectives for measurements for EU member states.

Directive 2008/50/EC on Cleaner Air for Europe, also referred to as the Air Quality Directive (AQD)[2] regulates SO_2, NO_2, PM_{10} and $PM_{2.5}$, as well as other compounds not covered in this study.

2.1 UK Air Quality Objectives

The UK Air Quality Standards Regulations 2010 (AQSR 2010)[3] impose limit values as detailed in the 4th DD and AQD, compliance with these objectives is a legal requirement in the UK. Statutory requirements for the UK relevant to this study are detailed in Table 1

Table 1 Statutory Air Quality Limit Values and Target Values

Pollutant	Averaging Period	Limit and Target Values µg.m^{-3}	Maximum Exceedances	Target Date
Nitrogen Dioxide	Annual	40	-	2006
Nitrogen Dioxide	1 Hour	200	18 pa	2006
Sulphur Dioxide	Annual	20	-	
Sulphur Dioxide	1 Hour	350	24	2005
Sulphur Dioxide	24 Hour	125	3	2005
Sulphur Dioxide	15 Min	266	35	2006
PM_{10}	24 Hour	50	35 pa	
PM_{10}	Annual	40	-	
$PM_{2.5}$	Annual	≤20% concentrations*	-	2020
$PM_{2.5}$	Annual	25	-	2015
1,3 Butadiene	Running Annual	2.25	-	2004
Lead	Annual	0.5	-	
Arsenic	Annual	0.006	-	2012
Cadmium	Annual	0.005	-	2012
Nickel	Annual	0.02	-	2012
Benzo(a)pyrene	Annual	0.001	-	2012

* ≤Progressive reduction target

[1] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0107&from=EN
[2] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF
[3] http://www.legislation.gov.uk/uksi/2010/1001/pdfs/uksi_20101001_en.pdf

The UK Air Quality Strategy, 2007 (UK AQS)[4] sets out objectives for local authorities, some of which are more stringent than those imposed by EU directives. Only objectives that mimic those of the EU directives are legally binding (under the EU regulations).

The EA H1 document lists non-statutory assessment criteria, known as EALs for several heavy metals.

Table 2 Environmental Assessment Levels

Pollutant	Long-term EAL, µg.m-3	Short-term EAL, µg.m-3
Arsenic (As)	0.003	-
Chromium (Cr)	5	150
Chromium VI (Cr VI)	0.0002	-
Cobalt (Co)	0.2	6
Manganese (Mn)	0.15	1500
Mercury (Hg)	0.25	7.5
Thallium (Tl)	1	30
Vanadium (V)	5	1

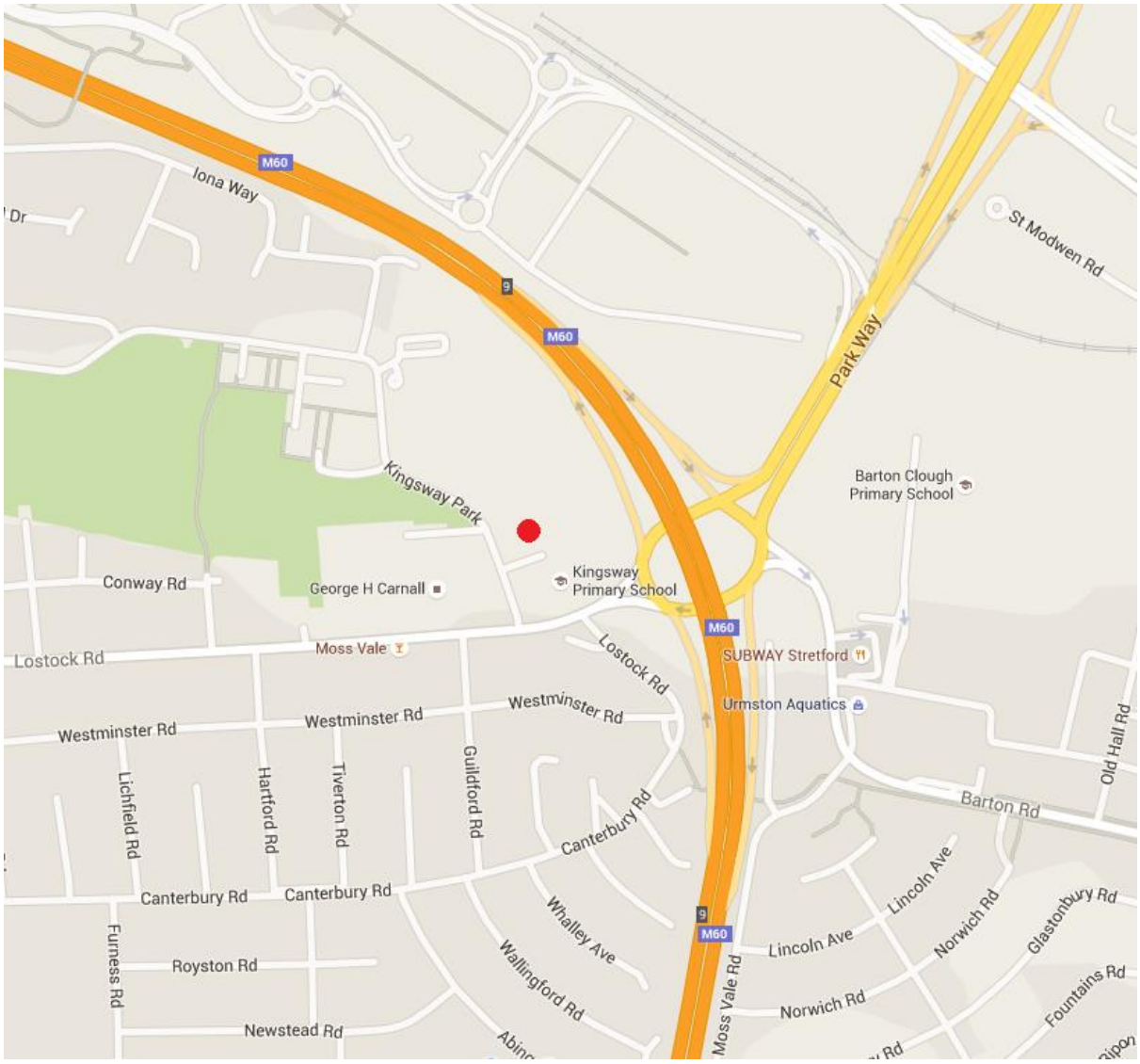
[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf

3 Details of monitoring programme

3.1 Monitoring Site

All monitoring was undertaken within a purpose built compound at Kingsway Primary School, Davyhulme. The monitoring station is 20 meters from Kingsway Park Road and 140 meters from the M60 Motorway and junction 9. The site can be classified as a background site under the siting criteria within the AQD. The inlets are positioned at a height of 3 meters.

Figure 1 Monitoring site location



3.2 Automatic Monitoring

3.2.1 Monitoring Equipment

The monitoring equipment was located at the Kingsway Park Primary School site. The site was installed on the 25th February 2015, with sampling starting on 1st March 2015.

The following continuous monitoring methods were used at Trafford Kingsway Park:

- NO, NO_2: MCERTS approved Teledyne API chemiluminescence analyser
- SO_2: MCERTS approved Teledyne API uv fluorescence analyser
- PM_{10}: MCERTS approved MetOne BAM 1020 beta attenuation monitor
- $PM_{2.5}$: MCERTS approved MetOne BAM 1020 beta attenuation monitor with smart heater
- 1 ,3 butadiene: Environnement VOC71M analyser

These methods were selected in order to provide real-time data. The NO_2, SO_2, PM_{10} and $PM_{2.5}$ analysers are European MCERTS approved reference methods and are used in the UK National Automatic Urban and Rural Network (AURN).

Each analyser provides a continuous output, proportional to the pollutant concentration. This output is recorded and stored every 10 seconds, and averaged to 15 minute average values by the on-site data logger. This logger is connected to a modem and interrogated twice daily, by telephone, to download the data to Ricardo. The data are then converted to concentration units and averaged to hourly mean concentrations.

The chemiluminescence analyser for NOx and uv fluorescence analyser for SO_2 are equipped with an automatic calibration system, which is triggered daily under the control of the data logger. Fully certificated calibration gas cylinders are also used at each site for manual calibration each month.

3.2.2 Quality assurance and quality control

Ricardo operates air quality monitoring stations within a tightly controlled and documented quality assurance and quality control (QA/QC) system. These procedures are documented in the AURN QA/QC manual[5].

Elements covered within this system include: definition of monitoring objectives, equipment selection, site selection, protocols for instrument operation calibration, service and maintenance, integrity of calibration gas standards, data review, scrutiny and validation.

All gas calibration standards used for routine analyser calibration are certified against traceable primary gas calibration standards at the Gas Standards Calibration Laboratory at Ricardo. The calibration laboratory operates within a specific and documented quality system and has UKAS accreditation for calibration of the gas standards used in this survey.

An important aspect of QA/QC procedures is the regular six-monthly intercalibration and audit check undertaken at every monitoring site. This audit has two principal functions: firstly to check the instruments and the site infrastructure, and secondly to recalibrate the transfer gas standards routinely used on-site, using standards recently checked in the calibration laboratory. Ricardo's audit calibration procedures are UKAS accredited to ISO 17025.

A full intercalibration audit was undertaken in line with current Greater Manchester Air Quality Network audit round in spring and autumn. At this visit, the essential functional parameters of the monitors such as noise, linearity and, for the NOx monitor, the efficiency of the NO_2 to NO converter are fully tested. In addition, the on-site transfer calibration standards are checked and re-calibrated if necessary, the air intake sampling system is cleaned and checked and all other aspects of site infrastructure are checked. In addition, an audit of the analysers is undertaken when they are installed and at the end of the monitoring period.

All air pollution measurements are reviewed daily by experienced staff at Ricardo. Data are compared with corresponding results from AURN monitoring stations and with expected air pollutant concentrations under the prevailing meteorological conditions. This review process rapidly highlights

[5] https://uk-air.defra.gov.uk/assets/documents/reports/empire/lsoman/LSO_manual_2012_Part_A_Issue_1_final.pdf

any unusual or unexpected measurements, which may require further investigation. When such data are identified, attempts are made to reconcile the data against known or possible local air pollution sources or local meteorology, and to confirm the correct operation of all monitors. In addition, the results of the daily automatic instrument calibrations are examined to identify any possible instrument faults. Should any faults be identified or suspected, arrangements are made for Ricardo personnel or equipment service contractors to visit the site as soon as possible.

At the end of every quarter, the data for that period are reviewed to check for any spurious values and to apply the best daily zero and sensitivity factors, and to account for information which only became available after the initial daily processing. At this time, any data gaps are filled with data from the data logger back-up memory to produce as complete a data record as possible.

3.3 Heavy metals monitoring

3.3.1 Sampling

Ricardo used a Partisol 2025 sampler to collect particulate in the PM_{10} fraction as specified in the AQD. The Partisol 2025 has an automatic sample change mechanism allowing unattended operation and filter exchange on a predetermined schedule. The instrument was set to exchange filters on a weekly schedule to provide four individual sample filters for a 4-week month monitoring period.

The monitoring periods where:

Period 1: 10/4/15 to 8/5/15

Period 2: 8/5/15 to 5/6/15

Period 3: 5/6/15 to 3/7/15

Period 4: 3/7/15 to 31/7/15

3.3.2 Analysis

The weekly filters are collated and combined into sampling months (four sampled filters). The sampling and analysis for metals is compliant with BS EN14902:2005, Standard method for the measurement of Pb, Cd, AS, and Ni in the PM_{10} fraction of suspended particulate matter. GN4 metricel filters were used as the sampling media. Chromium VI analysis was performed using discrete colorimetric analysis. The metals included in the analysis suite comprise the following:

- arsenic
- cadmium
- cobalt
- chromium
- copper
- mercury
- manganese
- nickel
- lead
- antimony
- thallium
- vanadium
- zinc

3.4 Dioxin monitoring

3.4.1 Sampling

Ricardo used a High Volume sampler for the collection of dioxin samples for subsequent analysis.

The method used for the analytical measurement complies with BS EN 1948-3:2006 for dioxins and BS EN 1948-4:2006 for dioxin like PCB.

The monthly samples are prepared for extraction and clean up prior to analysis. This provides a single sample for dioxin and for dioxin like PCB over the 3 month sampling period. In addition to the sample a blank sample was prepared using the same quantities of sample media and also analysed.

3.4.2 Dioxin Analysis

Sample media are prepared in a clean laboratory. The filter media being furnaced to remove any trace quantities of dioxin.

After exposure, the filter are removed from the sampling canister and stored in a laboratory freezer until ready for analysis.

Each filter set will be soxhlet extracted with toluene for a minimum of 18 hours each. These solutions are added to the washings and reduced to a few millilitres by air blow down. The resulting liquid is reduced in volume and solvent exchanged into a GC standard containing a selection of ^{13}C labelled dioxin/furan isomers. The final volume of liquid is 0.02 ml. The resulting liquid is then stored refrigerated until ready for analysis by gas chromatography-high resolution mass spectrometry (GC-HRMS).

The concentrated samples are transferred to GC vials and analysed for all congeners and total homologue groups using a GC and HRMS operating at a resolution of 10,000.

Calibration is achieved using a relative response standard containing known amounts of native and ^{13}C dioxin/furan isomers.

Identification of individual isomers is achieved by a combination of GC retention times and mass spectra. Identities of isomers significantly above the limit of detection are confirmed by isotope ratio.

The integration windows needed for the total dioxin/furan analysis is determined using a commercially available standard containing the first and last eluting isomers of each congener group specific to the GC column used.

The results for the native compounds and the extraction standard recoveries are calculated using the quantification scheme detailed in EN 1948-3:2006.

Limits of detection (LOD) are determined by assessing the baseline noise of a signal free portion of the chromatograms for one standard. The limits of detection quoted are the higher of either the calculated limits of detection or the concentrations detected in the laboratory blank.

The ITEQ values for individual congeners will be calculated for each sample using the NATO CCMS and WHO schemes. Where an isomer has a result less than the LOD a value equivalent to the LOD is used to determine the ITEQ. Therefore, these values represent a worst case assessment. Additional total ITEQ values are also calculated, assuming that where a result is less than the limit of detection then the ITEQ contribution is zero.

4 Results

4.1 Particulate matter

The results of the Particulate Monitoring can be found in Table 3 below

Table 3 Monthly mean concentrations of Particulate Matter at Trafford Kingsway Park 01/03/15 – 05/06/2016 (µg.m^{-3})

Period	PM_{10}	Data Capture %	$PM_{2.5}$	Data Capture %
Mar-15	38.82	23.8%	17.82	95.0%
Apr-15	22.27	49.0%	14.28	93.6%
May-15	13.32	99.7%	8.21	99.7%
Jun-15	16.94	100%	8.55	44.4%
Jul-15	15.04	97.4%	7.16	100.0%
Aug-15	15.65	99.7%	8.38	100.0%
Sep-15	17.13	71.8%	11.98	95.1%
Oct-15	23.63	96.2%	16.26	99.2%
Nov-15	24.54	61.7%	11.76	88.8%
Dec-15	24.31	13.7%	8.76	94.8%
Jan-16	19.90	52.2%	8.22	79.7%
Feb-16	17.78	64.5%	11.52	70.7%
Mar-16	19.00	65.7%	12.03	94.8%
Apr-16	15.54	97.9%	11.95	7.9%
May-16	20.80	100%	-	-
Estimated Annual Mean 2015[1]	18.93	71.3%	12.00	91.2%
Daily mean exceedances	5		-	
Estimated Annual Mean 2016[1]	18.26	76.6%	9.84	82.3%
Daily mean exceedances	1		-	

[1] Annual mean estimation carried out in line with Local Authority Technical Guidance Document LAQM.TG16

The estimated annual mean concentration for both particulate fractions are well below the annual mean objective of 40 µg.m^{-3} for both 2015 and 2016, suggesting that the site would be unlikely to exceed the annual mean limit in either year. The average concentration across a full 12 month period was also below the annual mean concentration objective. Details of the annualisation calculation is provided in Appendix 1. The daily mean objective of 50 µg.m^{-3} was exceeded 5 times in 2015 and once in 2016. This indicates that it is very unlikely that the short term PM_{10} objective of 35 per annum would be exceeded over a calendar year.

The poor PM_{10} data capture achieved in March and April 2015 was a result of a recurring pump voltage fault that resulted in the sampling flow to be outside of acceptable limits. This was then followed by an

intermittent fault with the pump controller cable from November 2015 to March 2016. The data gap in the $PM_{2.5}$ monitoring in June 2015 was a result of a sampling tape fault.

Figure 2 Daily mean particulate concentrations at Trafford Kingsway 01/03/2015 – 05/06/2016

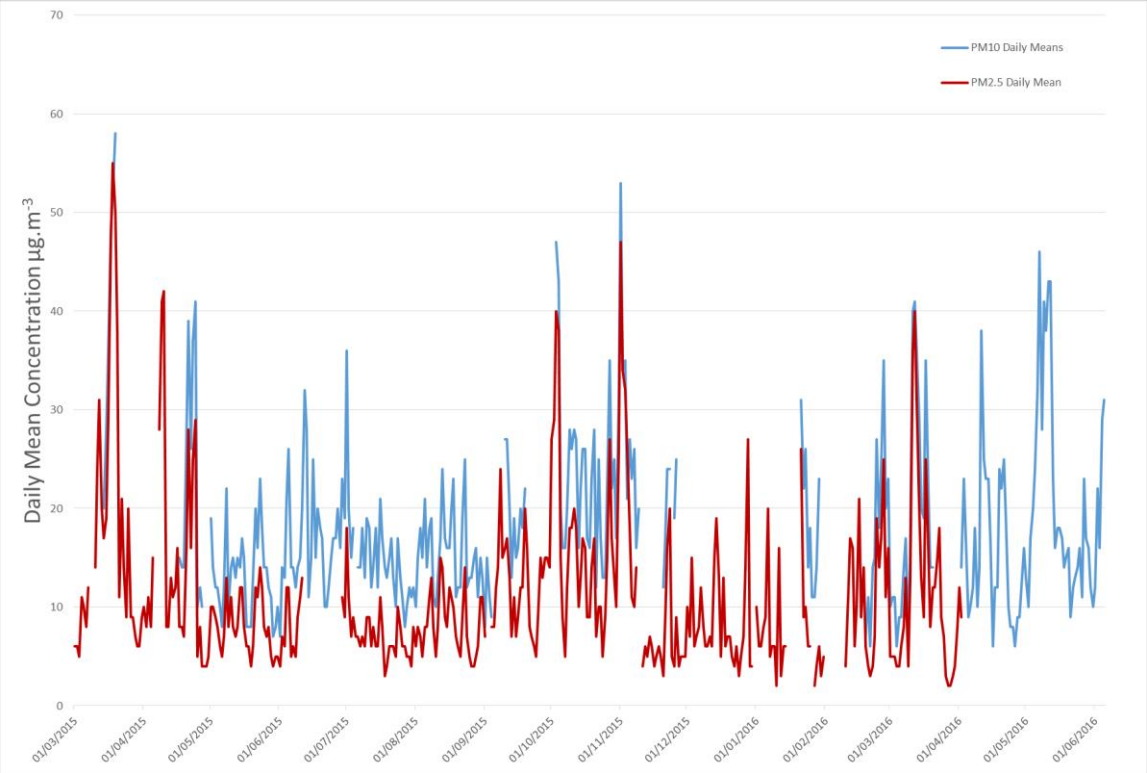
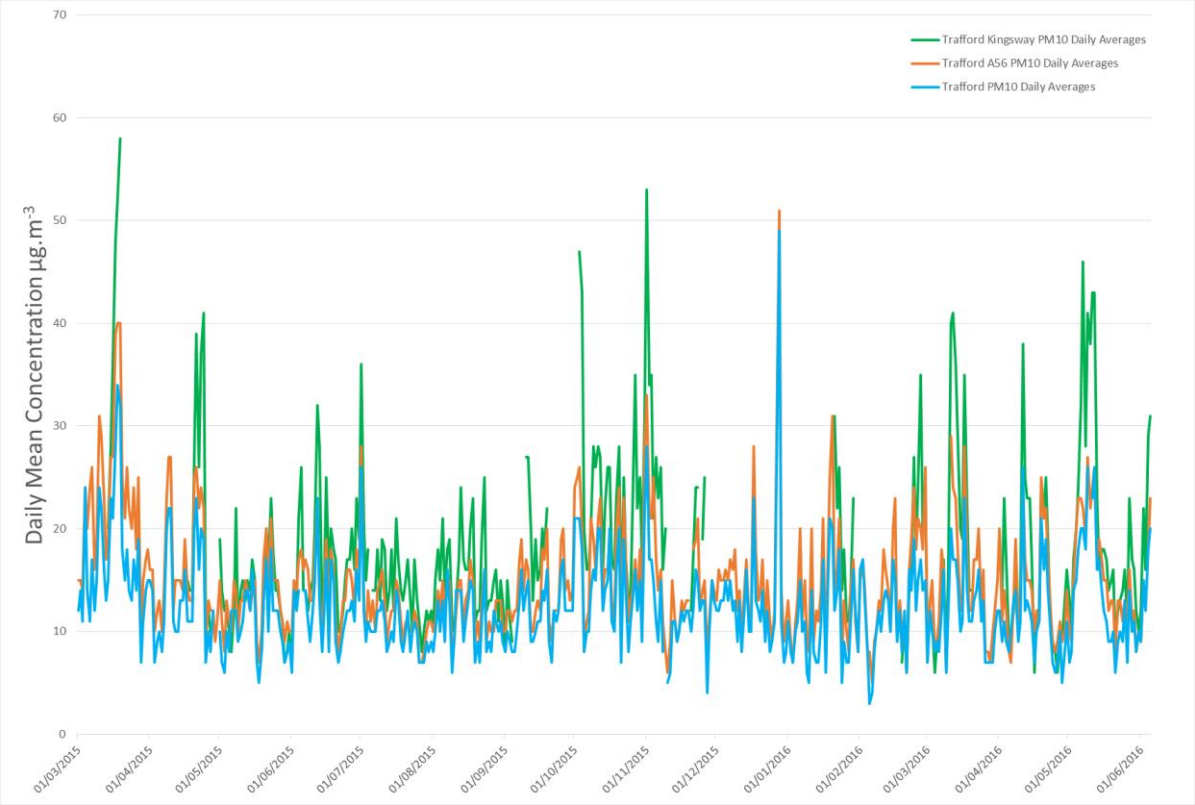


Figure 2 compares the daily mean particulate concentrations measured by the two particulate analysers.

Figure 3 compares the PM_{10} concentrations measured at Trafford Kingsway with the two local authority monitoring sites. There is a strong correlation between the three sites, validating the Trafford Kingsway Park data.

Figure 3 Daily mean particulate concentrations at Trafford Kingsway, Trafford & Trafford A56 01/03/2015 – 05/06/2016



Data from 1st April for Trafford and 1st January for Trafford A56 is provisional. Data will be fully ratified at the end of 2016. The data is subject to change and has been used for comparison purposes only.

4.2 Nitrogen Dioxide

The results of the Nitrogen Dioxide monitoring can be found in Table 4 below

Table 4 Monthly mean concentrations of Nitrogen Dioxide at Trafford Kingsway Park 01/03/15 – 2704/2016 (µg.m^{-3})

Period	NO_2	Data Capture %
Mar-15	28	99.2
Apr-15	26	98.3
May-15	15	98.9
Jun-15	19	99.6
Jul-15	16	99.6
Aug-15	19	99.5
Sep-15	31	99.9
Oct-15	37	99.6
Nov-15	25	99.6
Dec-15	22	100
Jan-16	33	99.9
Feb-16	34	96.8
Mar-16	33	99.3
Apr-16	29	91.3
Estimated Annual Mean 2015[1]	24.91	-
1 hour mean exceedances	0	-
Estimated Annual Mean 2016[1]	27.49	-
1 hour mean exceedances	0	-

[1] Annual mean estimation carried out in line with Local Authority Technical Guidance Document LAQM.TG16

The estimated annual mean concentration for NO_2 is well below the annual mean objective of 40 µg.m^{-3} for both 2015 and 2016. This suggests that the site would be unlikely to exceed the limit. Details of the calculation estimation is provided in Appendix 1.

For the 14 month monitoring period there were no exceedances of the 1 hour mean objective of 200 µg.m^{-3}. As there have been no exceedances it is unlikely that the short term NO_2 objective of 18 per annum would be exceeded over either calendar year.

Figure 4 Daily mean NO_2 concentrations at Trafford Kingsway Park 01/03/2015 – 26/04/2016

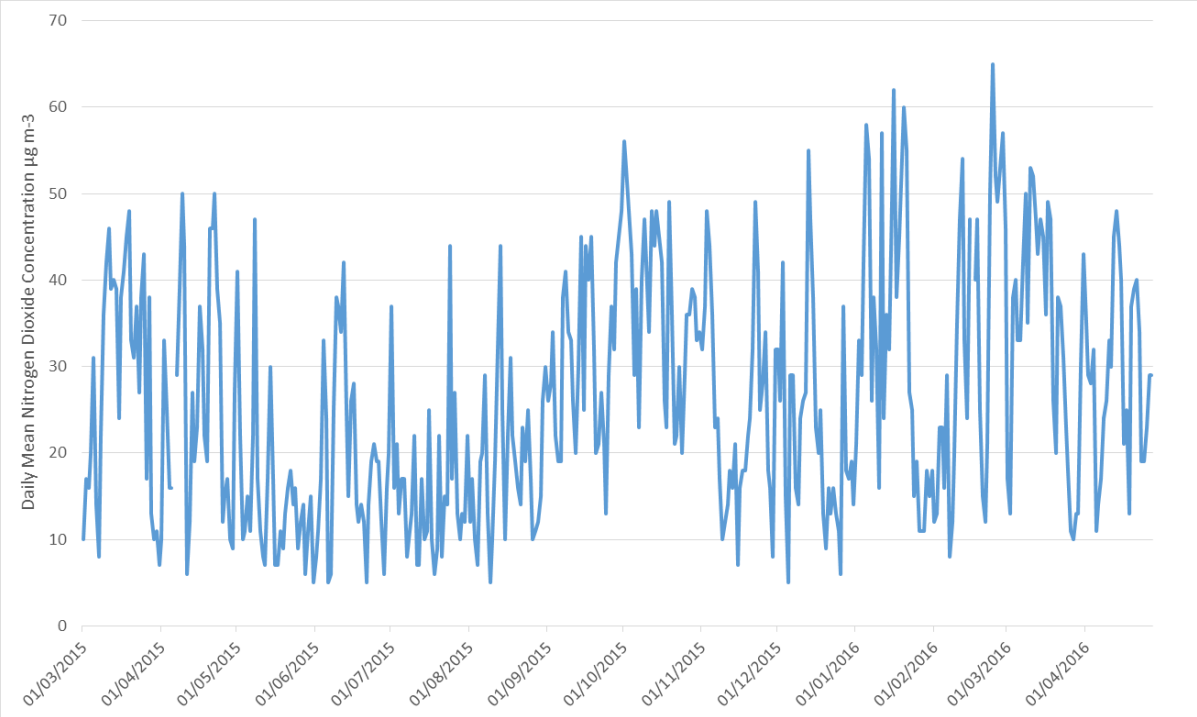


Figure 5 One hour mean NO_2 concentrations at Trafford Kingsway Park 01/03/2015 – 26/04/2016

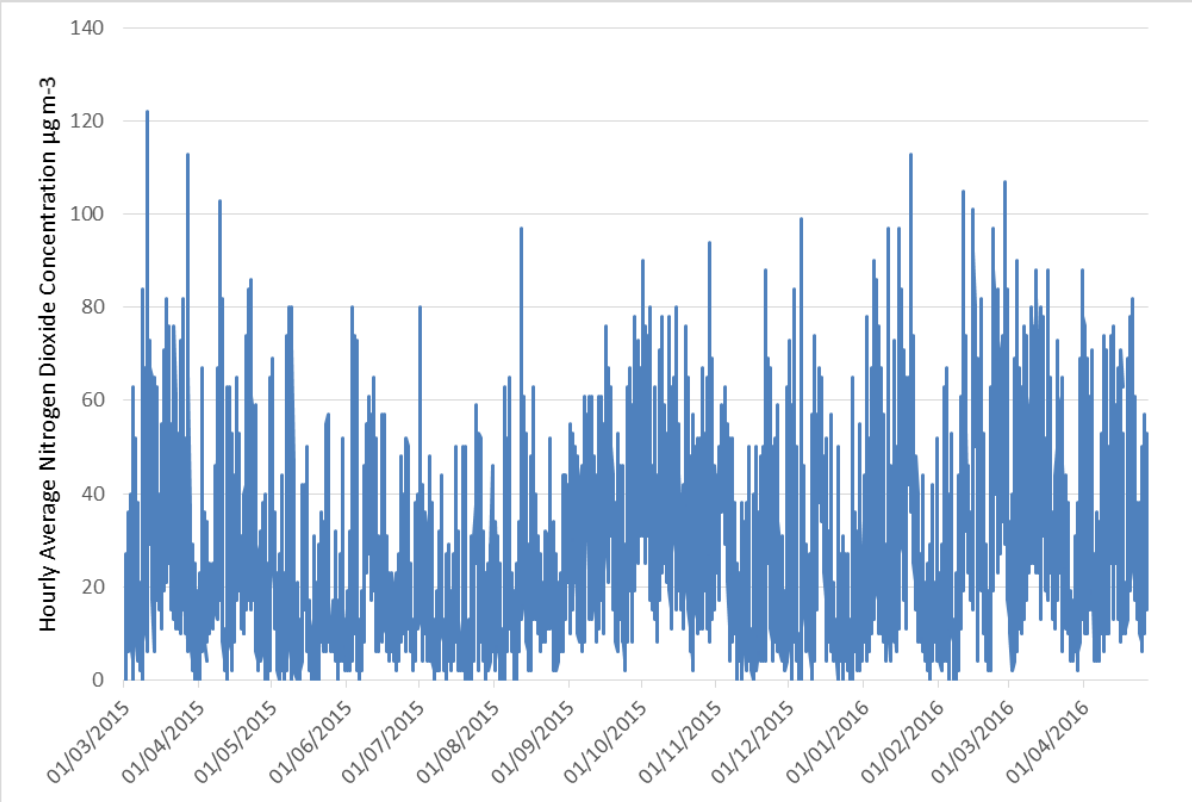
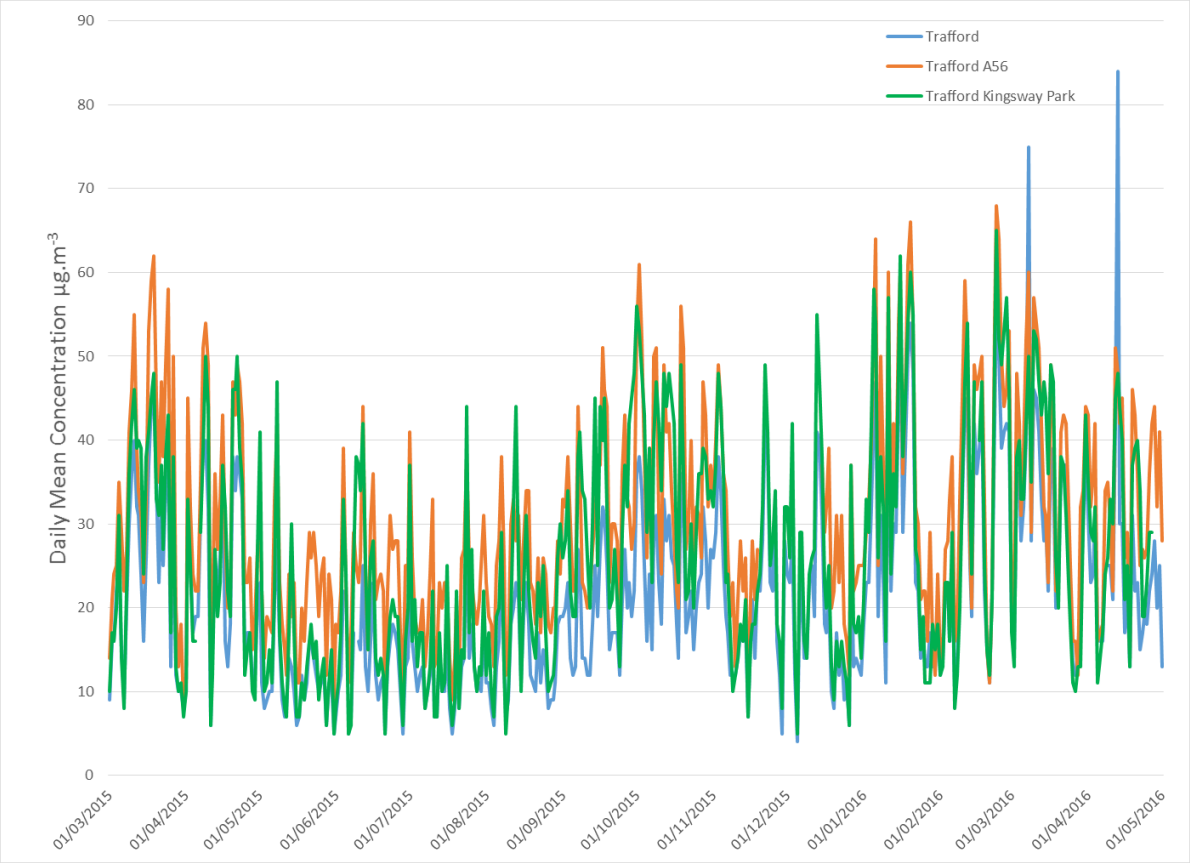


Figure 6 compares the measured NO_2 concentrations at Trafford Kingsway with the two local authority monitoring sites. As with the particulate analysers, the concentrations measured correlate well with the two local monitoring sites. As Trafford A56 is a roadside monitoring site, higher concentrations of NO_2 are expected at this location. This is reflected when the measured concentrations at the three sites are compared.

Figure 6 Daily mean NO_2 concentrations at Trafford Kingsway Park, Trafford and Trafford A56 01/03/2015 – 01/05/2016



2016 data for Trafford and Trafford A56 is provisional. Data will be fully ratified at the end of the year. The data is subject to change and has been used for comparative purposes only.

4.3 Sulphur Dioxide

The results of the Sulphur Dioxide monitoring can be found in table 5 below.

Table 5 Monthly mean concentrations of Sulphur Dioxide 01/03/15 – 30/06/2015 (µg.m^{-3})

Period	SO_2 Monthly Average	1 hr Mean Exceedance (350µg.m-3)	24hr Mean Exceedance (125µg.m-3)	15min Mean Exceedance (266µg.m-3)	Data Capture %
Mar-15	2	0	0	0	99.7%
Apr-15	2	0	0	0	98.8%
May-15	2	0	0	0	99.5%
3 Month Average	2	0	0	0	99.3%
Jun-15	3	0	0	0	99.4%
Estimated Annual Mean[1]	3.93	-	-	-	

[1] Annual mean estimation carried out in line with Local Authority Technical Guidance Document LAQM.TG16

Figure 7 Daily mean SO2 concentrations at Trafford Kingsway Park 01/03/2015 – 09/07/2015

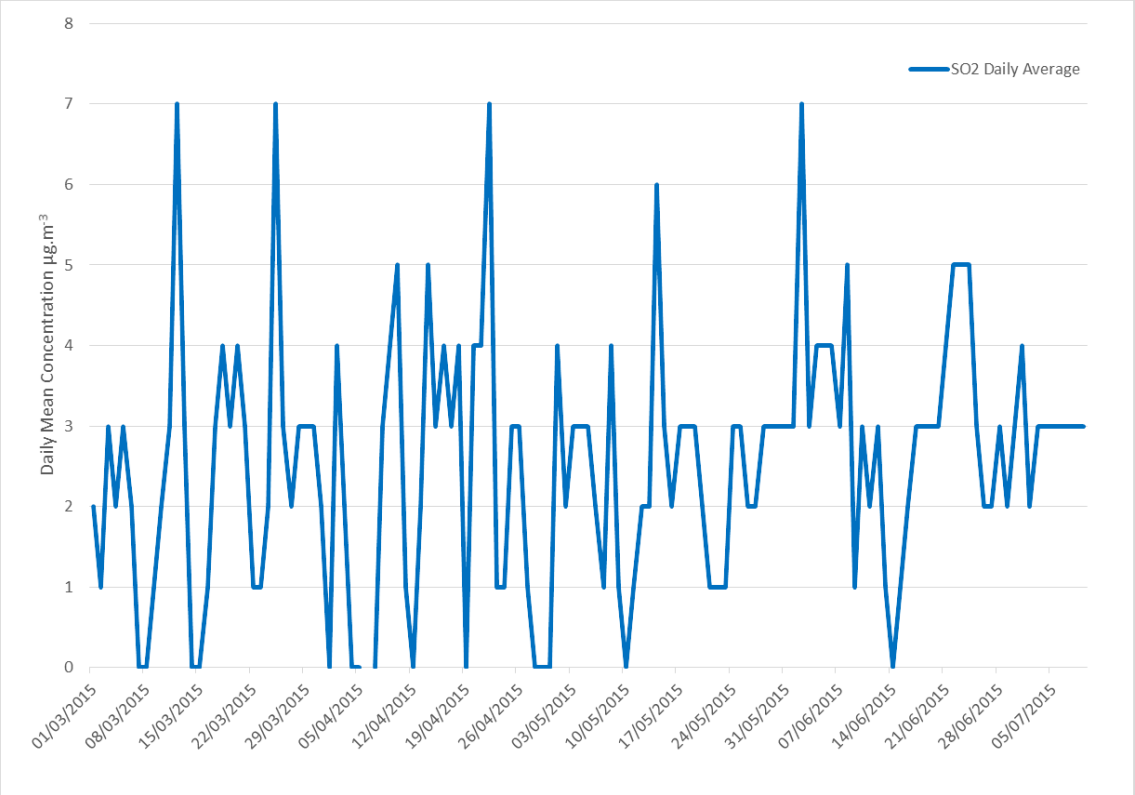
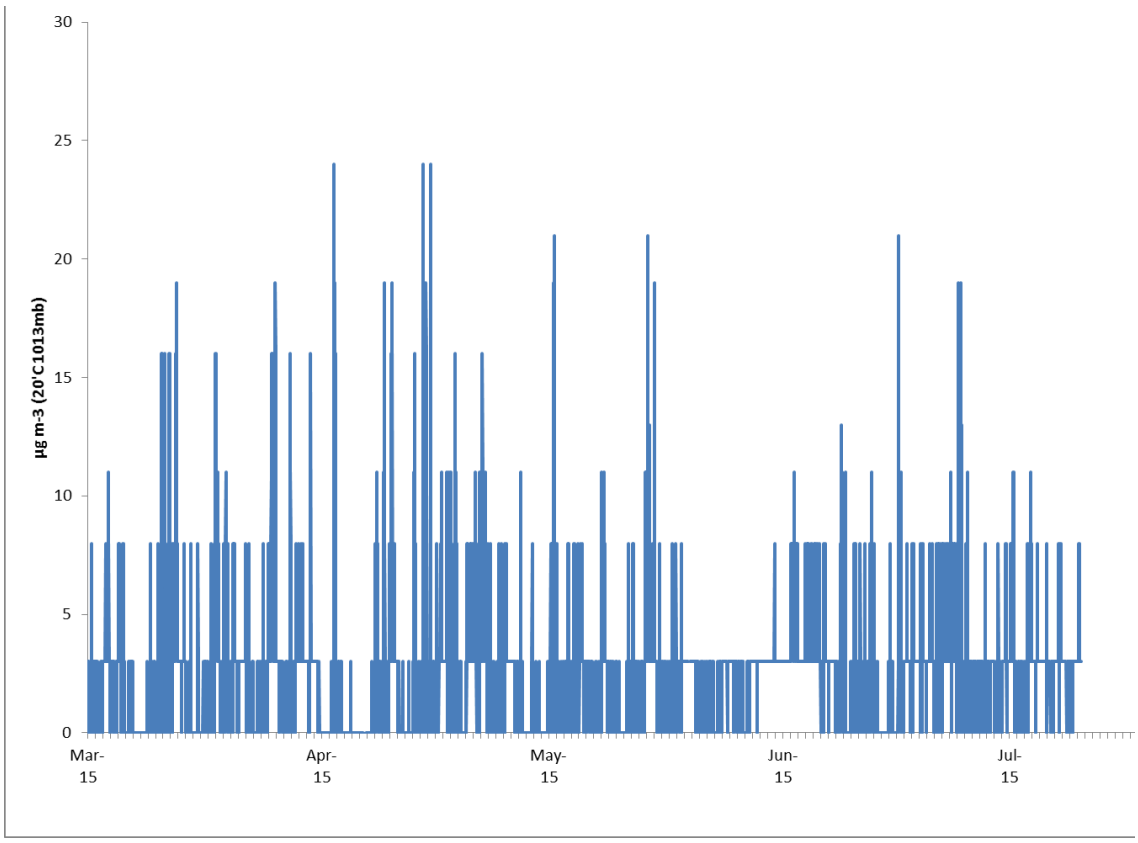


Figure 8 15 Minute Average SO2 concentrations at Kingsway Park 01/03/2014 – 09/07/2015



SO_2 is not monitored at another location within Trafford so it is not possible to compare the monitored concentrations with another local site. Monitoring for all pollutants would normally be undertaken over 12 month period to account for month variation. However, the LAQM TG09 document states that monitoring over a 3 month period is sufficient if it is apparent that concentrations are well below the relevant objective. At Trafford Kingsway Park this is the case for all SO_2 objectives.

There was no significant data gaps in the SO_2 monitoring. At 99.3% data capture achieved the 90% target.

4.4 1,3 Butadiene

Monitoring of 1,3 Butadiene was undertaken over a 3 month period from 1st March 2015 to 1st June 2015. Over this period data capture of 94.3% was achieved.

The 1,3 Butadiene was sampled at 15 minute averages. Over the 3 month monitoring period the measured concentrations remained under the analyser's limit of detection at 0.055 $\mu g.m^{-3}$. The results should therefore only be taken as indicative measurements, for the purpose of confirming that 1,3 butadiene concentrations at the sites are well within relevant limit values.

Measured concentrations for the 3 month period are therefore also well below the air quality objective of 2.25 $\mu g.m^{-3}$ for a running annual mean. Monitoring for all pollutants would normally be undertaken over a 12 month period to account for month variation. However, the LAQM TG09 document states that monitoring over a 3 month period is sufficient if it is apparent that concentrations are well below the relevant objective. Therefore, no further monitoring for 1,3 Butadiene is required at this location.

4.5 Dioxins and Furans

The Dioxin and Furan measurements are summarised in Table 6.

Table 6 Dioxin and Furan concentrations (fgTEF.m-3)

Congeners	Kingsway School	Manchester*
Dioxins:		
2,3,7,8-TCDD	0.38	4.4
1,2,3,7,8-PeCDD	0.94	4.21
1,2,3,4,7,8-HxCDD	0.14	0.42
1,2,3,6,7,8-HxCDD	0.17	0.58
1,2,3,7,8,9-HxCDD	0.17	-
1,2,3,4,6,7,8-HpCDD	0.15	4.11
OCDD	0.1	8.93
Furans:		
2,3,7,8-TCDF	0.14	4.4
1,2,3,7,8-PeCDF	0.05	4.21
2,3,4,7,8-PeCDF	0.59	1.76
1,2,3,4,7,8-HxCDF	0.28	1.83
1,2,3,6,7,8-HxCDF	0.28	1.4
2,3,4,6,7,8-HxCDF	0.31	1.6
1,2,3,7,8,9-HxCDF	0.38	0.63

Congeners	Kingsway School	Manchester*
1,2,3,4,6,7,8-HpCDF	0.16	3.91
1,2,3,4,7,8,9-HpCDF	0.09	0.62
OCDF U 0.017	0.00	3.27
Total Dioxin + Furan	***4.28***	***48.7***

*This is the quarter average from 2010 measured at Manchester Law Courts as part of the TOMPs national network

The average concentration of dioxins and furans at the Kingsway park site was 4.28 fg.TEF.m^{-3}. No ambient air quality standard exists for these compounds, there is no safe limit of these compounds in ambient air. There are limits on point source emissions, such as power station emissions.

The results are compared with the 2010 average concentrations recorded at Manchester Law Courts. This is the latest set of data available from Defra's UK Air[6]. The average concentrations recorded at the Kingsway Park site are below these concentrations. As a result no further dioxins and furans monitoring is required at the site.

4.6 Heavy Metals

The Heavy Metals measurements are summarised in Table 7.

Table 7 Concentrations of Heavy Metals at Kingsway Park (ng.m-3)

	Period 1	Period 2	Period 3	Period 4	Assessment Criteria (AC)	% of AC*
AS	0.79	<0.01	0.75	<0.01	3	26.3%
Cd	<0.02	<0.02	<0.01	<0.02	5	0.4%
Co	<0.03	<0.03	<0.03	<0.03	200	0.015%
Cr	3.02	2.58	3.73	3.17	5000	0.075%
Cu	11.1	7.7	10.2	9	10000	0.11%
Hg	<0.03	<0.03	<0.03	<0.03	250	0.012%
Mn	6.38	3.07	5.99	3.04	150000	0.0043%
Ni	1.06	0.77	1.05	0.61	20	5.3%
Pb	7.6	4.6	7.49	4.56	250	3.04%
Sb	3.04	1.53	3	1.52	5000	0.061%
Tl	<0	<0	<0	<0	1000	0%
V	0.96	1.12	1.09	0.8	5000	0.023%
Zn	19.76	11.34	16.48	13.06	-	-

*Percentage of Assessment Criteria compare with worst case period
< indicates that result was below the limit of detection

[6] http://uk-air.defra.gov.uk/data/tomps-data

The worst case period has been assessed against the adopted assessment criteria in the final column of Table 7. All the measurements are well below the assessment criteria. As a result no further heavy metals monitoring is required at the site.

5 Conclusions

Monitoring of NO2, PM10 and PM2.5 was undertaken between 13 and 16 months across 2015 and 2016. Annualised annual mean concentrations for both 2015 and 2016 confirm that there was no exceedance of air quality objective levels for these pollutants.

SO2 monitoring at the site was concluded after 4 months. The annualised annual mean concentration was well below the relative air quality objective level. Therefore 4 months monitoring was considered sufficient as concentrations were well below the relevant objectives.

Measurements of 1,3 Butadiene were below the analyser's limit of detection for the monitoring period. The results should only be taken as indicative measurements, for the purpose of confirming that 1,3 butadiene concentrations at the sites are well below the relevant limit values.

All Heavy Metal measurements are below the adopted assessment criteria. As a result no further heavy metals monitoring is required at the site.

The dioxins and furans concentrations are below the average quarterly results measure at Manchester Law Courts in 2010 (most recent results available). As a result no further dioxins and furans monitoring is required at the site.

The concentrations for NO2, SO2, PM10, and PM2.5 are consistent with urban background monitoring locations, in the region, in the national AURN network. The concentrations for these pollutants also correlated well with local monitoring sites.

Appendices

Appendix 1: Additional calculations

Appendix 1: Additional calculations

Conversion of period means to annual means using correction factors

For data annualisation, only data sets where more than 75% data capture has been used. AURN monitoring sites within the north-west were used to calculate the ratio. For the PM_{10} calculations the two Trafford Council monitoring sites Trafford and Trafford A56 were included in the calculations. SO_2 is only monitored at two AURN sites in the North-west, both were used to calculate the annualisation factor.

Table 8 Annualisation factor calculations used for PM10 annual mean estimation 2015

Long Term Site	Year	Annual Mean	Period Mean	Ratio (Am/Pm)
Carlisle Roadside	2015	17.28	17.21	1.00
Salford Eccles	2015	17.68	17.44	1.01
Liverpool Speke	2015	13.94	13.87	1.01
Warrington	2015	15.39	15.09	1.02
Trafford A56	2015	17.71	17.38	1.02
Trafford	2015	15.12	14.98	1.01
			Ratio	**1.01**

Table 9 Annualisation factor calculations used for PM10 annual mean estimation 2016

Long Term Site	Year	Annual Mean	Period Mean	Ratio (Am/Pm)
Carlisle Roadside	2015	17.28	16.48	1.05
Salford Eccles	2015	17.68	17.92	0.99
Liverpool Speke	2015	13.94	15.46	0.90
Warrington	2015	15.39	16.49	0.93
Trafford A56	2015	17.71	17.67	1.00
Trafford	2015	15.12	15.25	0.99
			Ratio	**0.98**

Table 10 Annualisation factor calculations used for PM2.5 annual mean estimation 2015

Long Term Site	Year	Annual Mean	Period Mean	Ratio (Am/Pm)
Blackpool Marton	2015	8.48	7.68	1.10
Carlisle Roadside	2015	10.16	10.13	1.00
Salford Eccles	2015	10.59	9.94	1.06
Liverpool Speke	2015	9.15	9.00	1.02
Manchester Piccadilly	2015	10.48	10.10	1.04
Warrington	2015	9.27	8.51	1.09
Wigan Centre	2015	10.76	10.38	1.04
			Ratio	**1.05**

Table 11 Annualisation factor calculations used for PM2.5 annual mean estimation 2016

Long Term Site	Year	Annual Mean	Period Mean	Ratio (Am/Pm)
Blackpool Marton	2015	8.48	8.93	0.95
Carlisle Roadside	2015	10.16	-	-
Salford Eccles	2015	10.59	10.89	0.97
Liverpool Speke	2015	9.15	10.96	0.84
Manchester Piccadilly	2015	10.48	11.68	0.90
Warrington	2015	9.27	10.68	0.87
Wigan Centre	2015	10.76	10.64	1.01
			Ratio	**1.38**

Table 12 Annualisation factor calculations used for NO_2 annual mean estimation 2015

Long Term site	Year	Annual Mean	Period Mean (1/3/15 to 31/12/15)	Ratio (Am/Pm)
Blackpool Marton	2015	15.61	14.64	1.07
Glazebury	2015	15.46	14.53	1.06
Liverpool Speke	2015	22.29	21.67	1.03
Manchester Piccadilly	2015	39.37	38.03	1.04
Preston	2015	21.96	20.75	1.06
Warrington	2015	21.78	21.07	1.03
Wigan Centre	2015	19.39	18.52	1.05
			Ratio	**1.048**

Table 13 Annualisation factor calculations used for NO_2 annual mean estimation 2016

Long Term site	Year	Annual Mean	Period Mean (1/1/16 to 27/4/16)	Ratio (Am/Pm)
Blackpool Marton	2015	15.61	19.00	0.82
Glazebury	2015	15.46	18.32	0.844
Liverpool Speke	2015	22.29	24.93	0.89
Manchester Piccadilly	2015	39.37	43.21	0.91
Preston	2015	21.96	28.05	0.78
Warrington	2015	21.78	27.37	0.80
Wigan Centre	2015	19.39	21.78	0.89
			Ratio	**0.848**

Table 14 Annualisation factor calculations used for SO2 annual mean estimation

Long Term site	Year	Annual Mean	Period Mean	Ratio (Am/Pm)
Liverpool Speke	2014	2.54	1.67	1.52
Manchester Piccadilly	2014	2.46	1.39	1.77
			Ratio	**1.64**

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