2014 Air Quality Progress Report for Renfrewshire Council

In fulfillment of Part IV of the Environment Act 1995 Local Air Quality Management

April 2014

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Executive Summary

Renfrewshire Council has prepared a Progress Report as required by the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

A review of monitoring data from 2013 has concluded that:

- The NO_2 annual mean measured at the Central Road site in Paisley was in excess of the objective during 2013 as in previous years. The monitoring site is not however at a location where relevant exposure for the annual mean averaging period applies.
- The NO_2 annual mean measured at Gordon Street was below the 40 $\mu g.m^{-3}$ objective during 2013, measured concentrations have decreased at this site when compared to the previous two years. At Glasgow Airport the measured NO_2 annual mean was significantly below the objective as in previous years.
- Hourly mean NO_2 concentrations in excess of the 200 $\mu g.m^{-3}$ objective were measured 214 times during 2013 at the Central Road monitoring site, which is in excess of the 18 times specified in the NO_2 objective. However a recent review of this site has confirmed that the location is no longer considered to be representative of an area of relevant public exposure in terms of the objectives. All bus services, with the exception of a Sunday night service, have now been removed from Central Road. Whilst bus services were in operation here in 2013, since this ceased at the beginning of 2014 there is now no reason for anyone to spend time in this area and no relevant exposure is present. The monitor at this site will be decommissioned and moved to an alternative location. The Scottish Government, their technical advisors Ricardo-AEA and SEPA agree with this conclusion.
- At the Gordon Street automatic monitoring site 46 hourly mean NO_2 concentrations in excess of the 200 µg.m-3 objective were measured during 2013. Due to landscaping works the monitor was out of commission for approximately four months of 2013. As data capture at this site was low, the 99.79th percentile of 1-hour means was calculated as 304 $\mu g.m^{-3}$ which is in excess of the 200 $\mu g.m^{-3}$ hourly mean objective. The Gordon Street site is also within the existing Paisley AQMA for exceedances of the NO_2 annual mean and 1-hour mean objectives therefore no further action is required except for continuing to implement the air quality action plan measures. It is worth noting that after the site was reinstalled at Gordon Street, landscaping works continued in close proximity to the monitor including stone cutting using a petrol powered saw and a digger operating next to the monitor. This would have increased the concentrations in the immediate vicinity of the site but may not have been representative of general NO_2 concentrations in the surrounding site and at nearby receptors.
- Annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were measured at three diffusion tubes sites within the Paisley AQMA following distance correction of diffusion tube measurements:
    - Paisley 33 - 76 Causeyside Street, Paisley
    - Paisley 35 - Old Sneddon Street, Paisley
    - Paisley 43 - Smithhills Street (east), Paisley

- Out-with the existing Paisley AQMA, distance corrected 2013 annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were estimated at the nearest relevant exposure to the following diffusion tube sites:

    - Renfrew 8 – Inchinnan Road
    - Paisley 15 – Montgomery Drive Paisley
    - Renfrew 17 – Tanar Way, Renfrew
    - Renfrew 48 – Glen Sax Drive, renfrew
    - Johnstone 59 – High Street Johnstone
    - Kilbarchan 61 – High Barholm, Kilbarchan

The Renfrew 8 diffusion tube was moved to its current position in March 2013 on Inchinnan Road within Renfrew Town Centre as a result of recommendations within a Detailed Assessment of the area in 2012. This is a new area of exceedance identified within the area so Renfrewshire Council will deploy further diffusion tubes to gain a better understanding of the area of exceedance, and to investigate the potential cause of this further. A review of this further data and investigations will be undertaken as part of the Updating and Screening Assessment in 2015. Should there continue to be exceedances Renfrewshire Council will consider whether a further modelling assessment is required of the area to allow us to better define the area of exceedence or whether to go immediately to declaration of an AQMA.

The tubes at Montgomery Drive Paisley, Tanar Way Renfrew & Glen Sax Drive Renfrew will be considered in conjunction as all are influenced by traffic on the M8. A Detailed Assessment of this area in Renfrew adjacent to the M8 was undertaken in 2009. Modelling predicted exceedances at some residential receptors however, given issues relating to over-estimation caused by the adjustment factor used, it was recommended additional monitoring was obtained. Renfrewshire Council purchased and installed an automatic continuous monitor (NO_2 and PM_{10}) within this area at the end of last year. However start up and operating issues with the monitors has resulted in insufficient data being gathered to date to inform our decision making. It is anticipated that sufficient automatic continuous monitoring data will be obtained by the beginning of next year to undertake an update of the 2009 Detailed Assessment of this area and thereafter declare an AQMA if/where required. This assessment will include the Montgomery Drive area.

The NO_2 annual mean concentration measured at High Street Johnstone (64.1 $\mu g.m^{-3}$) during 2013 was in excess of the 60 $\mu g.m^{-3}$ threshold at which TG(09) recommends that there may be a risk of the NO_2 1-hour mean objective being exceeded. This result was however calculated based on a data capture of 75% and the results should be considered in this context. Renfrewshire Council will proceed to a Detailed Assessment of NO_2 at this location. The relatively high measured NO_2 concentrations indicate that there is also a high risk of the Scottish annual mean PM_{10} objective being exceeded. PM_{10} will be considered in the Detailed Assessment. Renfrewshire Council have considered using an automatic NOx/NO_2 analyser at this location to get a better idea of short-term peaks in NO_2 concentrations. Previous attempts to install a traditional continuous AQ monitor or to deploy diffusion tubes at first floor level have failed however and alternative options i.e. AQ Mesh are now being considered for this location.

It should be noted that the diffusion tube site Kilbarchan 61 was deployed in April 2013; so data capture was only 58% during 2013 and the NO_2 annual mean concentration has been calculated using a short-term to long-term adjustment. The Council's Roads Services have intimated that road works in the Kilbarchan and surrounding area last year may have resulted in more traffic and queuing traffic in this location. To reduce uncertainty it would therefore be appropriate to wait until a full 12 months of monitoring data is available before conducting a Detailed Assessment at this location. More diffusion tubes will be deployed at this location during 2014.

- Annual mean PM_{10} concentrations measured during 2012 at both the Gordon Street and St James sites in Paisley were below the Scottish 18 $\mu g.m^{-3}$ objective, no further action is required for PM_{10} at these locations.

No new local developments have been identified that require a Detailed Assessment to be conducted. Planning applications that may impact upon air quality have been reviewed and noted where relevant for further consideration in the 2015 Updating and Screening assessment

The next LAQM requirements for Renfrewshire Council are:

- Conduct a Detailed Assessment for High Street Johnstone and an update of the previous Detailed Assessment from 2009 for Tanar Way & Glen Sax Drive Renfrew area including Montgomery Drive, Paisley.
- Updating and Screening assessment to be submitted in 2015 including a review of further data and investigations of Renfrew Town Centre.
- Submit Paisley AQMA Action Plan Progress Report with the USA due in April 2015.

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1 Introduction

1.1 Description of Local Authority Area

The Renfrewshire Council area is situated to the west and south west of Glasgow. It covers approximately 261 km^2 and is bordered by Glasgow City, East Renfrewshire, Inverclyde, North Ayrshire and West Dunbartonshire Council areas. Renfrewshire has a population of around 170,000, with the majority of which inhabiting the main towns of Paisley, Renfrew, Johnstone and Erskine. Paisley is the largest town in Scotland with a population of over 75,000.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in Scotland** are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre $\mu g.m^{-3}$ (milligrammes per cubic metre, $mg.m^{-3}$ for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1: Air Quality Objectives included in Regulations for purpose of LAQM in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	**Measured as**	
Benzene	16.25 $\mu g.m^{-3}$	Running annual mean	31.12.2003
	3.25 $\mu g.m^{-3}$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g.m^{-3}$	Running annual mean	31.12.2003
Carbon monoxide	10 $mg.m^{-3}$	Running 8-hour mean	31.12.2003
Lead	0.50 $\mu g.m^{-3}$	Annual mean	31.12.2004
	0.25 $\mu g.m^{-3}$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g.m^{-3}$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g.m^{-3}$	Annual mean	31.12.2005
Particulate Matter (PM_{10}) (gravimetric)	50 $\mu g.m^{-3}$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 $\mu g.m^{-3}$	Annual mean	31.12.2010
Sulphur dioxide	350 $\mu g.m^{-3}$, 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

1.4 Summary of Previous Review and Assessments

Renfrewshire Council undertake regular reviews of air quality within the council area. A summary of the LAQM review and assessment reports completed since 2007 are presented in Table 1.2.

Table 1.2: Summary of previous LAQM review and assessment reports

Report Title	Date Completed	Conclusions
Updating and Screening Assessment	January 2007	Detailed Assessment required for PM_{10} in Paisley Town Centre.
Detailed Assessment (Paisley Town Centre)	February 2008	AQMA to be declared within Paisley Town Centre for PM_{10} and NO_2 annual mean objectives.
Progress Report	April 2008	Detailed Assessment required for NO_2 in High Street, Johnstone and Renfrew.
Updating and Screening Assessment	April 2009	No new potential exceedances of the objective were identified and therefore no requirement to proceed to a Detailed Assessment for any pollutant.
Detailed Assessment (Johnstone and Renfrew)	June 2009	Johnstone: modelling predicted that NO_2 objectives would be met at specified receptor locations. Renfrew: modelling predicted that exceedances of the NO_2 annual mean objective were predicted at numerous locations adjacent to the M8. It was recommended that further monitoring should be carried out to verify modelling predictions.
Progress Report	May 2010	No new potential exceedances of objectives were identified and therefore no requirement to proceed to a Detailed Assessment for any pollutant or due to any emission sources.
Further Assessment (Paisley)	January 2011	No exceedances of the NO_2 and PM_{10} annual mean objectives were predicted outside the Paisley Town Centre AQMA. Therefore the extent of the existing AQMA was still valid.

Report Title	Date Completed	Conclusions
Progress Report	June 2011	No new potential exceedances of objectives were identified and therefore no requirement to proceed to a Detailed Assessment for any pollutant or due to any emission sources. However, automatic monitoring was proposed near residential properties, adjacent to the M8, due to recorded concentrations close to the objectives. Although, a suitable location is yet to be identified.
Updating and Screening assessment	April 2012	Based on annual mean NO_2 concentrations measured during 2011, the report concluded that a Detailed Assessment of NO_2 was required at Hairst St, Renfrew. No other potential exceedances of the objectives were identified from the 2011 monitoring data or screening assessments conducted for the Updating and Screening assessment
Detailed Assessment of Air Quality 2011 - Town Centre, Renfrew	October 2012	The dispersion modelling assessment of road traffic emissions in Renfrew Town Centre concluded that NO_2 concentrations in excess of the annual mean objective are not occurring at any of the first floor flats in the study area and that it is not currently necessary to declare an AQMA. The modelling assessment predicted that there may be exceedances of the NO_2 annual mean objective occurring at residential properties at ground floor level on Paisley Road. It was recommended that additional monitoring is conducted.
Progress Report 2013	April 2013	Analysis of the 2012 monitoring data did not identify any requirement to proceed to Detailed Assessment at any location. Exceedances of the NO_2 annual mean objective were measured within the existing Paisley AQMA. No new local developments have been identified that require a Detailed Assessment to be conducted or require further consideration in the next Updating and Screening assessment.

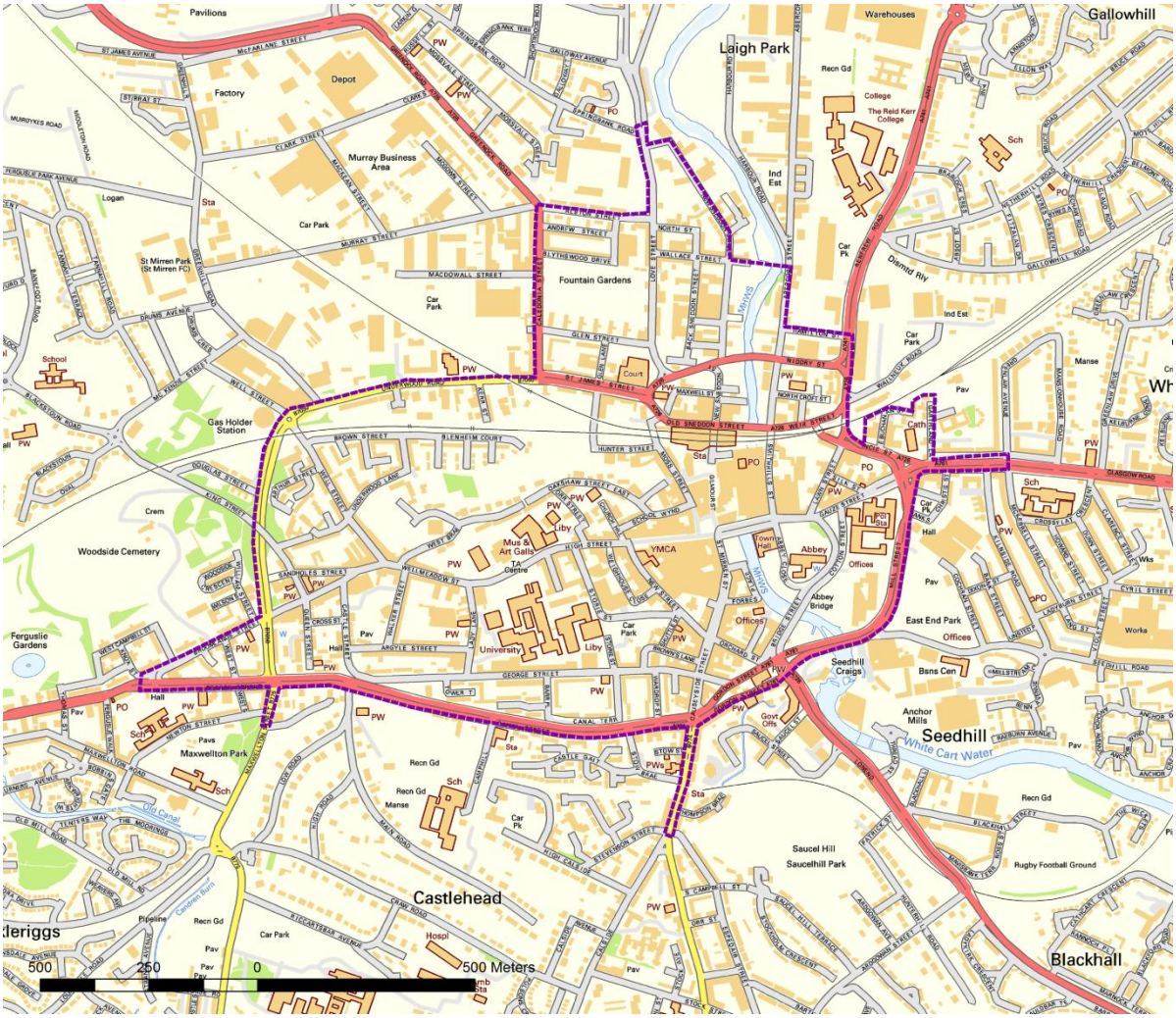
Renfrewshire Council declared the Central Road, Paisley Air Quality Management Area (AQMA) for exceedances of the NO_2 1-hour mean objective in 2005 based on the conclusions of the 2004 Detailed Assessment. The AQMA was declared for Central Road and extended beneath the multi-storey car park.

Based on subsequent measurements another detailed dispersion modelling assessment was conducted in 2008. The Detailed Assessment indicated that the annual mean NO_2 and PM_{10}

objectives would be widely exceeded across most of Paisley town centre. It was therefore proposed to amend the existing Central Road AQMA to cover the whole of Paisley town centre.

The AQMA was amended in August 2009 and a single AQMA, known as the Paisley Town Centre AQMA, was declared for the PM_{10} annual mean objective, NO_2 1-hour mean objective and the NO_2 annual mean objective. A map of the AQMA is provided in Figure 1.1.

Figure 1.1: Map of Paisley Town Centre AQMA Boundary



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AQMA Boundary

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2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

Renfrewshire Council currently undertakes monitoring of the following pollutants covered by the UK air quality strategy:

- Nitrogen Dioxide (NO_2)
- Particulate Matter (PM_{10})

Measurements are conducted using both automatic and passive techniques.

2.1.1 Automatic Monitoring Sites

Five automatic monitoring sites are operational within the Renfrewshire Council area. These sites comprise of four NOx/NO_2 analysers, three TEOM PM_{10} analysers, two of which were fitted with FDMS units during 2013. These are located at four sites within Paisley.

- Central Road, Paisley
- Glasgow Airport, Paisley
- Gordon Street/Causeyside Street, Paisley
- St James, Paisley
- Cockel's Loan, Renfrew (The PM_{10} analyser has recently been upgraded with a FDMS unit at this site)

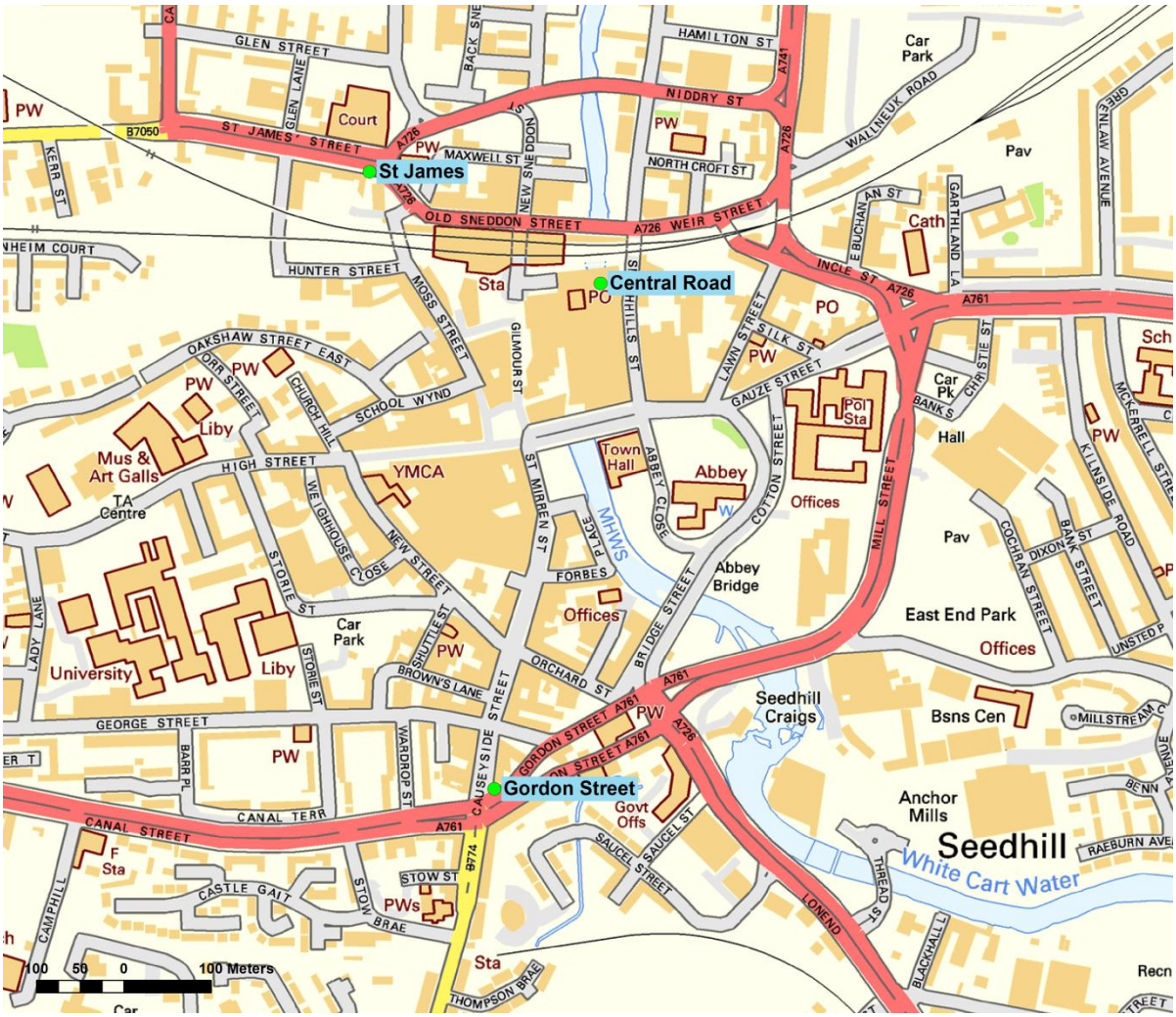
The Gordon Street automatic site has moved location by a few metres during 2013 following resurfacing and removal of flower beds.

Automatic monitoring of NO_2 and PM_{10} commenced at the Cockel's Loan, Renfrew site on the 26th September 2013. The measurements recorded during the last few months of 2013 have not been reported due to data quality issues. 2014 measurements from this new site will be reported in the 2015 Updating and Screening assessment.

With the exception of the newly operational Cockel's Loan site, Renfrewshire Council's automatic sites are part of the Scottish Air Quality database network, whereby monitoring data are managed to the same procedures and standards as AURN sites by Ricardo-AEA.

Maps showing the locations of the automatic monitoring sites are presented in Figure 2.1 to Figure 2.3. Details of the sites are presented in Table 2.1.

Figure 2.1: Paisley automatic monitoring site locations



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Automatic monitoring site

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Figure 2.2: Glasgow Airport automatic monitoring site location

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Automatic monitoring site

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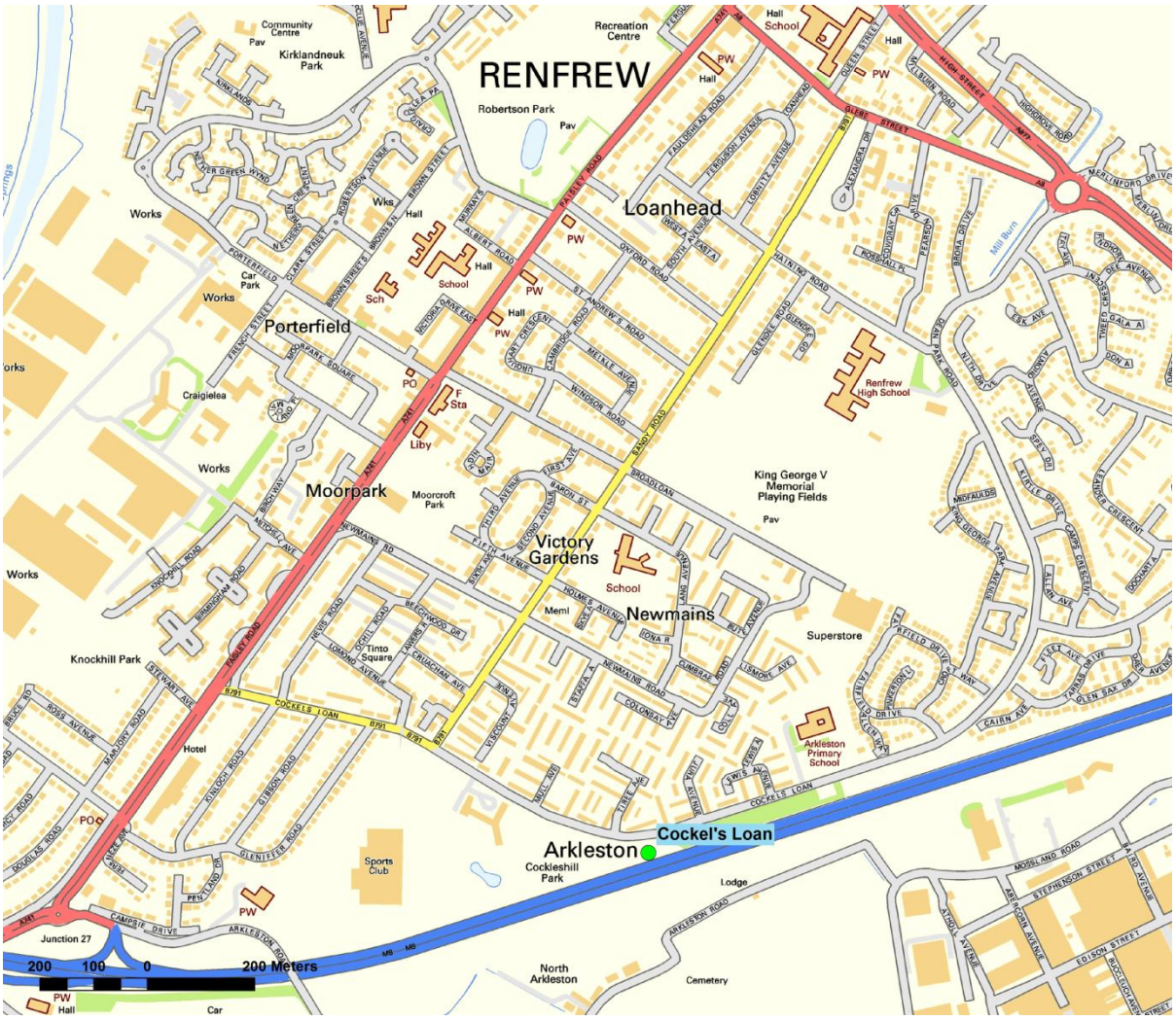
Figure 2.3: Cockel's Loan, Renfrew automatic monitoring site location



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Automatic monitoring site

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Table 2.1: Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring technique	In AQMA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Central Road, Paisley	Roadside	248438	664192	NO_2	Chemiluminescence	Y	Y (2m)	1.5m	Y
Glasgow Airport	Special	248297	666545	NO_2	Chemiluminescence	N	N (60m)	40m	N
Gordon Street, Paisley	Roadside	248316	663612	NO_2, PM_{10}	Chemiluminescence/FDMS	Y	Y (9m)	6m	Y
St James St, Paisley	Roadside	248173	664320	PM_{10}	FDMS	Y	Y (0m)	4m	Y
Cockel's Loan	Roadside	250463	665934	NO_2, PM_{10}	Chemiluminescence/TEOM	N	Y (0m)	18m	Y

Note: At the Central Road site relevant exposure existed in 2013 although the bus stops are now no longer operational and the location is no longer considered representative of exposure

2.1.2 Non-Automatic Monitoring Sites

During 2013 Renfrewshire Council measured NO_2 concentrations across a network of 49 diffusion tube sites. Details of the diffusion tube monitoring locations are presented in Table 2.2. The locations include kerbside, roadside, and urban background sites.

Maps showing the locations of the non-automatic monitoring sites are presented in Figure 2.4 to Figure 2.15.

Monitoring commenced at the following sites between March and May 2013.

- Renfrew 56 – Paisley Road, Renfrew
- Renfrew 57 – Paisley Road, Renfrew
- Renfrew 58 – Glebe Street, Renfrew
- Johnstone 59 – High Street, Johnstone
- Paisley 60 – Underwood Road, Paisley
- Kilbarchan 61 – High Barholm, Kilbarchan

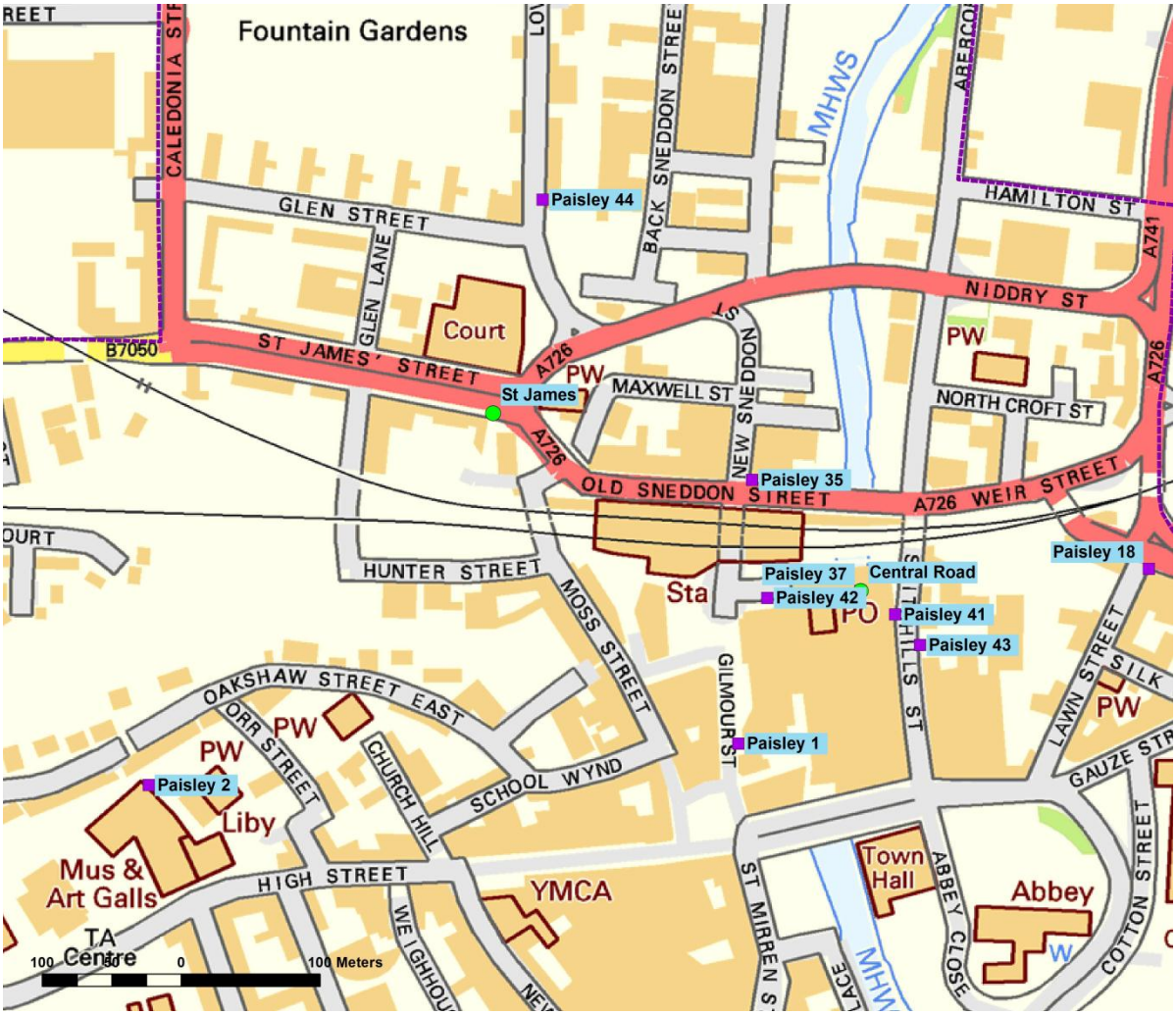
A bias adjustment factor of 1.115 reported derived from the local co-location studies conducted at Central Road, Paisley and Glasgow Airport has been used to adjust the diffusion tube results. Full details of the diffusion tube QA/QC are presented in Appendix A.

Table 2.2: Details of Non-Automatic Monitoring Sites

Site	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA ?	Co-located with a continuous analyser ? (Y/N)	Tube height	Relevant Exposure ?	Dist. to kerb	Worst-case Location?
1	Gilmour Street, Paisley	Urban Centre	248350	664082	NO_2	Y	N	2.7 m	N	68 m	N
2	Oakshaw Street, Paisley	Urban Background	247925	664052	NO_2	Y	N	2.7 m	Y(11m)	35 m	Y
3	Lochfield Drive, Paisley	Urban Background	249004	662142	NO_2	N	N	2.7 m	Y(8m)	1.5 m	Y
4	Regent Street, Paisley	Urban Background	249665	664364	NO_2	N	N	2.7 m	Y(9m)	2 m	Y
7	High Street, Johnstone	Kerbside	242914	663198	NO_2	N	N	2.7 m	Y (1.5m)	0 m	Y
8	15 Inchinnan Road, Renfrew	Roadside	250589	667547	NO_2	N	N	2.7 m	Y (0m)	3 m	Y
9	Station Road, Bishopton	Roadside	243975	670545	NO_2	N	N	2.7 m	Y (13m)	3 m	Y
13	Greenock Road, Paisley	Roadside	247371	665674	NO_2	N	N	70c m	Y (8.5m)	2 m	Y
15	Montgomery Drive, Paisley	Roadside	249185	665713	NO_2	N	N	2.7 m	Y (4m)	22 m	Y
17	Tanar Way, Renfrew	Roadside	251524	666287	NO_2	N	N	2.7 m	Y (6m)	28 m	Y
18	Incle Street, Paisley	Roadside	248646	664208	NO_2	Y	N	2.7 m	Y (16m)	5 m	Y
19	Linwood Road, Paisley	Roadside	245701	663602	NO_2	N	N	2.7 m	Y (5m)	2.5 m	Y
20	High Street, Johnstone	Kerbside	242665	663290	NO_2	N	N	2.7 m	Y (1.5m)	0 m	Y
21	Causeyside Street, Paisley (Triplicate)	Roadside	248316	663612	NO_2	Y	Y	2.7 m	Y (9m)	6 m	Y
23	Hillington Road, Renfrew	Roadside	251869	666628	NO_2	N	N	2.7 m	Y (12m)	7 m	Y
24	Glasgow Road, Renfrew	Roadside	251687	666788	NO_2	N	N	2.7 m	Y (9m)	16 m	Y
25	French Street, Renfrew	Urban Industrial	249700	666861	NO_2	N	N	2.7 m	Y (6m)	3 m	Y
27	Rossland Gardens, Bishopton	Suburban	243183	671188	NO_2	N	N	2.7 m	Y (6m)	2 m	Y
30	Kintyre Avenue, Linwood	Urban Background	243302	663998	NO_2	N	N	2.7 m	Y (17m)	10 m	Y
31	West Walkinshaw	Roadside	246188	666141	NO_2	N	N	2.7 m	Y (35m)	17 m	Y
33	76 Causeyside Street, Paisley	Roadside	248277	663524	NO_2	Y	N	2.7 m	Y (0.5m)	3 m	Y
34	63 Causeyside Street, Paisley	Roadside	250766	667640	NO_2	Y	N	2.7 m	Y (3m)	0 m	Y
35	Old Sneddon Street, Paisley	Roadside	248360	664272	NO_2	Y	N	2.7 m	Y (0m)	3.5 m	Y
36	Albion Street/Gourock Road, Paisley	Roadside	247948	664774	NO_2	Y	N	2.7 m	Y (4.5m)	3 m	Y
37	Central Road, Monitoring Station, Paisley (Triplicate)	Roadside	248438	664192	NO_2	Y	Y	3 m	Y (43m)	1.5 m	Y
38	99 Paisley Road, Renfrew	Roadside	250108	666856	NO_2	N	N	2.7 m	Y (0m)	3 m	Y

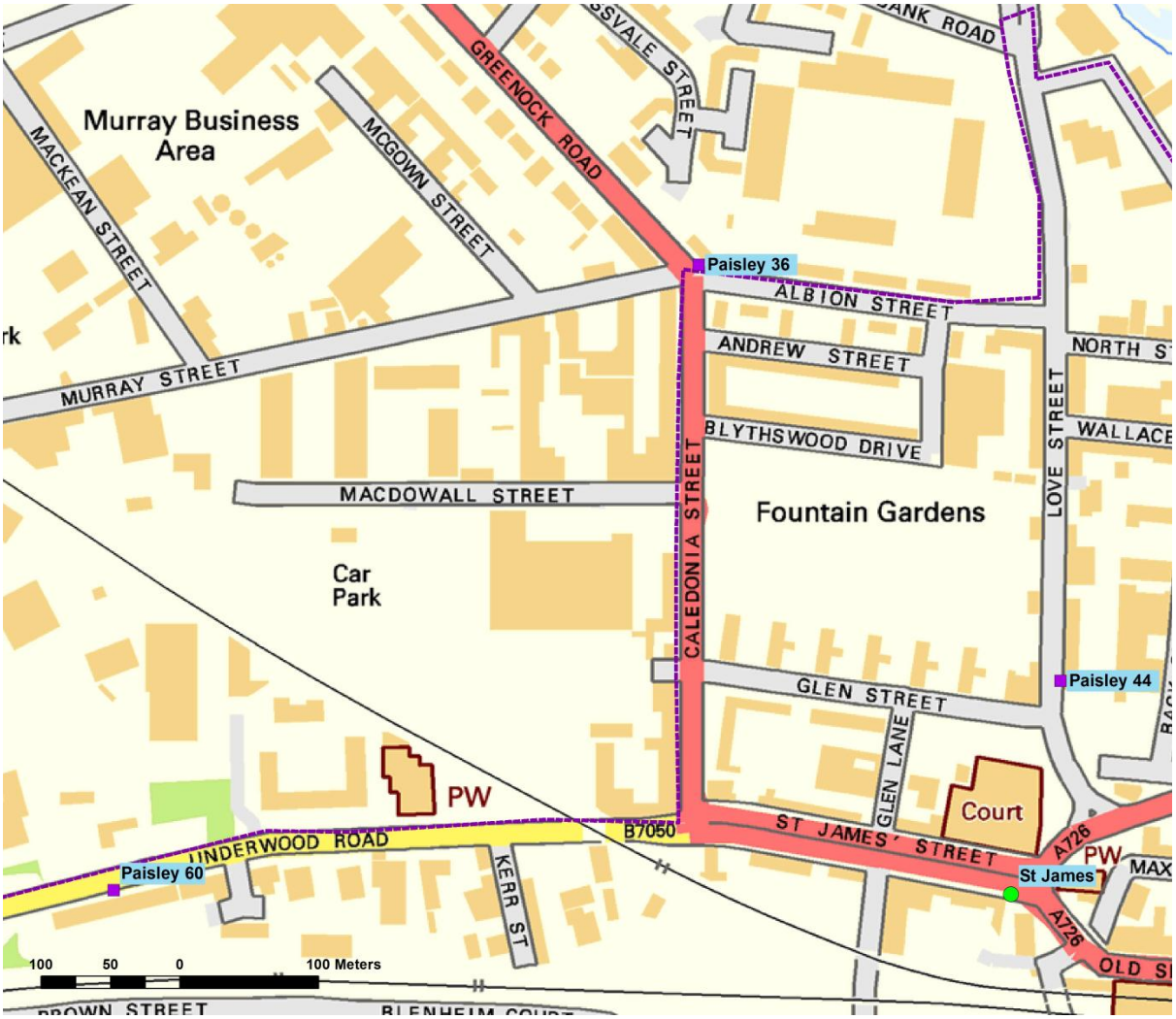
Site	Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA ?	Co-located with a continuous analyser ? (Y/N)	Tube height	Relevant Exposure ?	Dist. to kerb	Worst-case Location?
39	Glasgow Airport, Paisley (Triplicate)	Special	248293	666542	NO_2	N	Y	1.4 m	N/A	45 m	N
40	Hairst Street, Renfrew	Kerbside	250764	667631	NO_2	N	N	2.7 m	Y (16m)	0 m	Y
41	Smithhills Street (West), Paisley	Roadside	248463	664175	NO_2	Y	N	2.7 m	Y (10m)	5 m	Y
42	Central Road (West), Paisley	Roadside	248371	664187	NO_2	Y	N	2.7 m	Y (50m)	1.5 m	N
43	Smithhills Street (East), Paisley	Roadside	248481	664153	NO_2	Y	N	2.7 m	Y (0m)	4 m	Y
44	Love Street, Paisley	Roadside	248209	664474	NO_2	Y	N	2.7 m	Y (0m)	2 m	Y
45	Xscape, Renfrew	Kerbside	251250	667880	NO_2	N	N	2.7 m	Y (12m)	1 m	Y
46	Ferry Village, Renfrew	Kerbside	251803	667365	NO_2	N	N	2.7 m	Y (17m)	0.5 m	Y
48	Glen Sax Drive, Renfrew	Roadside	251264	666217	NO_2	N	N	2.7 m	Y (9m)	45 m	Y
49	Tanar Way 2, Renfrew	Roadside	251462	666326	NO_2	N	N	2.7 m	Y (9m)	85 m	N
50	Renfrew Road, Paisley	Roadside	248985	665494	NO_2	N	N	2.7 m	Y (7m)	12 m	Y
51	Kintyre Avenue 2, Linwood	Roadside	243344	663960	NO_2	N	N	2.7 m	Y (5m)	35 m	N
52	Glasgow Road 2, Renfrew	Roadside	251515	666955	NO_2	N	N	2.7 m	Y (4m)	3 m	Y
53	Old Greenock Rd, Inchinnan	Roadside	248154	668832	NO_2	N	N	2.7 m	Y (10m)	1.5m	Y
54	Easwald Bank, Kilbarchan	Roadside	241059	662743	NO_2	N	N	2.7 m	Y (4.5m)	1.5m	Y
55	New Street, Kilbarchan	Roadside	240331	663404	NO_2	N	N	2.7 m	Y (6.5m)	2m	Y
56	Paisley Road, Renfrew	Roadside	250579	667488	NO_2	N	N	2.7 m	Y (4m)	4m	Y
57	Paisley Road, Renfrew	Roadside	250595	667472	NO_2	N	N	2.7 m	Y (0m)	7m	Y
58	Glebe Street, Renfrew	Roadside	250662	667455	NO_2	N	N	2.7 m	Y (4m)	3.5m	Y
59	High Street, Johnstone	Roadside	242656	663280	NO_2	N	N	2.7 m	Y (0m)	2m	Y
60	Underwood Rd, Paisley	Roadside	247526	664323	NO_2	Y	N	2.7 m	Y (8m)	0 m	Y
61	High Barholm, Kilbarchan	Roadside	240584	663007	NO_2	N	N	2.7 m	Y (0m)	1.5 m	Y
62	Cockels Loan, Renfrew	Roadside	250463	665934	NO_2	N	Y	3 m	Y (0m)	21 m	Y

Figure 2.4: Paisley (central) diffusion tube sites



N	**Legend:** ■ Diffusion tube site	RICARDO-AEA **Contains Ordnance Survey data © Crown copyright and database right 2014**

Figure 2.5: Paisley (West) diffusion tube sites



N

Legend:

■ Diffusion tube site

RICARDO-AEA

Figure 2.6: Paisley (north) diffusion tube sites

N

Legend:

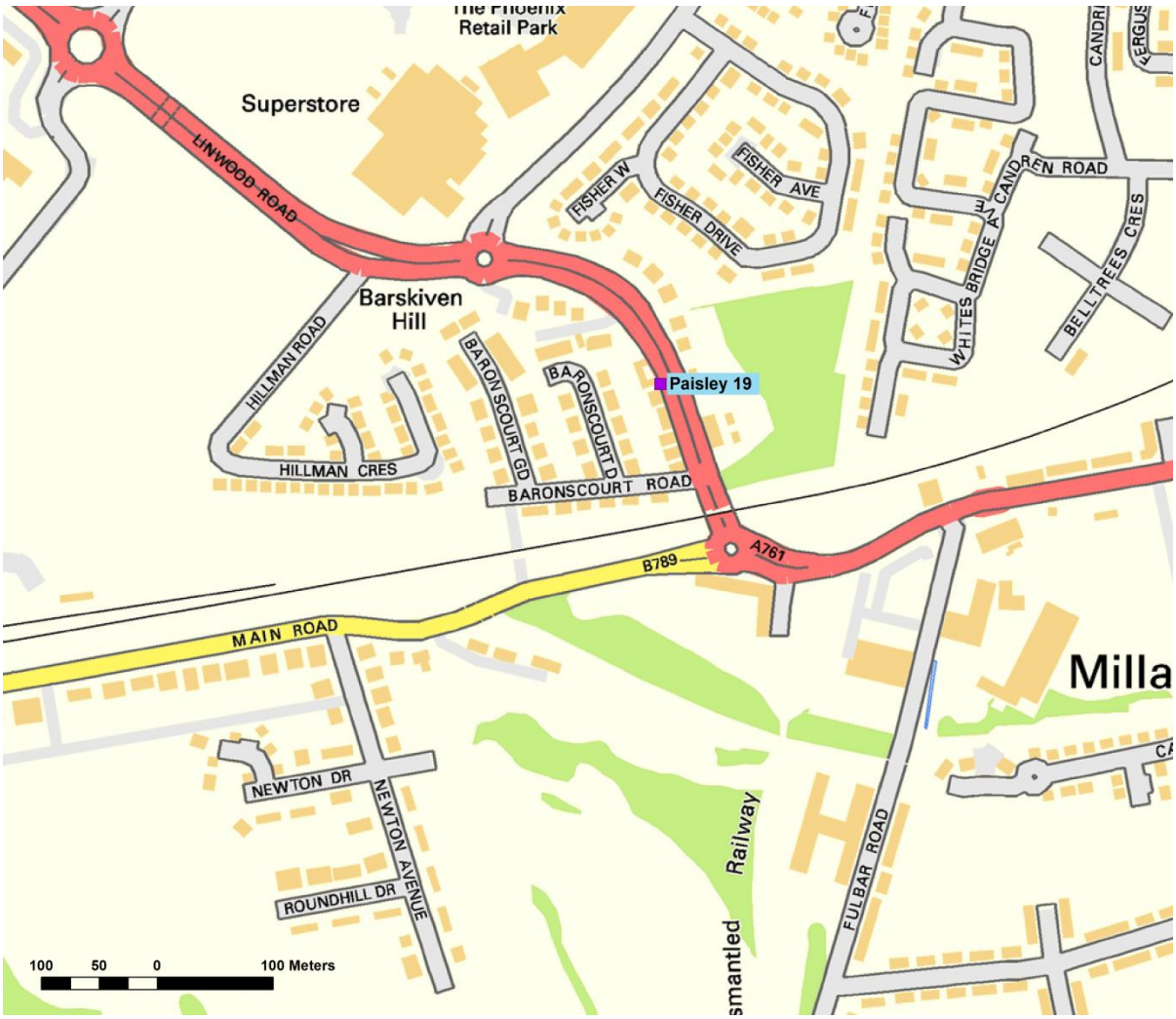
■ Diffusion tube site

RICARDO-AEA

Figure 2.7: Paisley (south) diffusion tube sites

N	**Legend:** ■ Diffusion tube site	RICARDO-AEA **Contains Ordnance Survey data © Crown copyright and database right 2014**

Figure 2.8: Paisley (south west) diffusion tube sites



N

Legend:

■ Diffusion tube site

RICARDO-AEA

Figure 2.9: Renfrew (central) diffusion tube sites

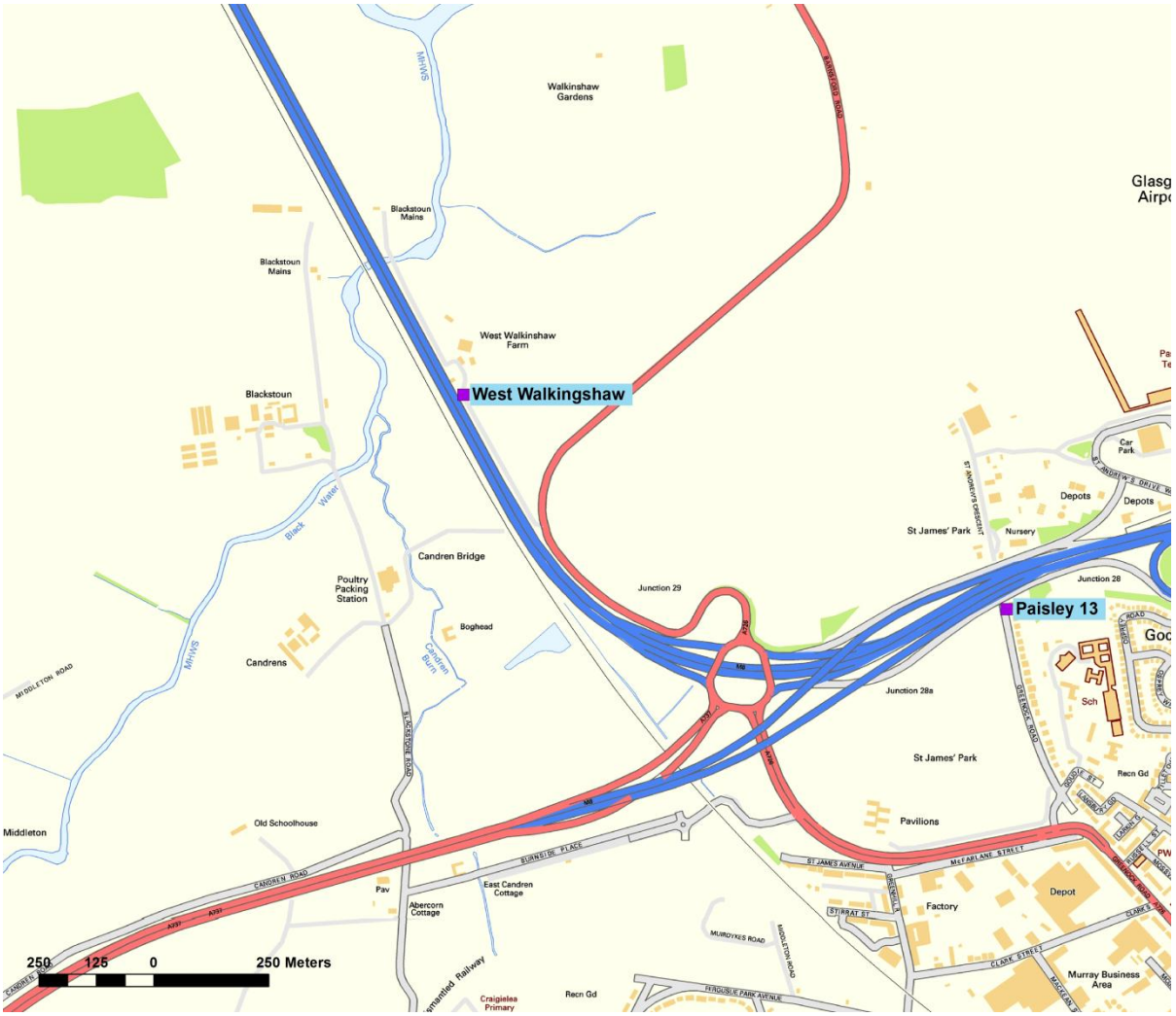
N	**Legend:** ■ Diffusion tube site	RICARDO-AEA **Contains Ordnance Survey data © Crown copyright and database right 2014**

Figure 2.10: Renfrew (east) diffusion tube sites

N	**Legend:** ■ Diffusion tube site	RICARDO-AEA **Contains Ordnance Survey data © Crown copyright and database right 2014**

Figure 2.11: Linwood and Johnstone diffusion tube sites

Figure 2.12: West Walkingshaw diffusion tube site



N

Legend:

■ Diffusion tube site

RICARDO-AEA

Figure 2.13: Kilbarchan diffusion tube sites

N

Legend:

■ Diffusion tube site

RICARDO-AEA

Figure 2.14: Bishopton diffusion tube sites

Figure 2.15: Inchinnan diffusion tube sites

N	**Legend:** ■ Diffusion tube site	RICARDO-AEA **Contains Ordnance Survey data © Crown copyright and database right 2014**

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO_2)

Automatic Monitoring Data

The annual mean NO_2 concentrations measured at the automatic monitoring locations within the Renfrewshire Council area from 2007 to 2013 are presented in Table 2.3. Concentrations in excess of the 40 $\mu g.m^{-3}$ objective are highlighted in bold.

Table 2.3: NO_2 Automatic monitoring results: Comparison with annual mean objective

Site name	Within AQMA ?	Data Capture 2013 (%)	Annual mean concentrations ($\mu g/m^3$)						
			2007	2008	2009	2010	2011	2012	2013
Central Road, Paisley	Y	97.5%	**92**	**87**	**88**	**51.9***	**57**	**51**	**61**
Glasgow Airport	N	99.4%	-	25	25	28	23	22	20
Gordon Street, Paisley	Y	52.4%	35	36	34	**42**	**43***	38	34*

*** Annual mean calculated using short-term to long-term adjustment as data capture < 75%**

A bar chart showing the trends in annual mean NO_2 concentrations over the last seven years is presented in Figure 2.16. The chart indicates that measured NO_2 annual mean concentrations have in general decreased at Glasgow Airport but have fluctuated with no clear trend at the automatic sites within the Paisley AQMA over recent years.

The NO_2 annual mean measured at the Central Road site was in excess of the objective during 2013 as in previous years. The monitoring site is not however at a location where relevant exposure for the annual mean averaging period applies.

Annual data capture for NO_2 measurements was low (52%) at Gordon Street during 2013. The site was not operational between March and July as resurfacing and landscaping work was being conducted. The NO_2 annual mean at the Gordon Street site has therefore been estimated using a short-term to long-term adjustment factor derived from nearby background monitoring sites. Details of the adjustment calculation are presented in Appendix A. The adjusted NO_2 annual mean of 33.8 $\mu g.m^{-3}$ is below the objective.

At Glasgow Airport the measured NO_2 annual mean was significantly below the objective as in previous years.

The number of measured 1-hour mean concentrations in excess of the 200 $\mu g.m^{-3}$ short-term objective are presented in Table 2.4. Hourly mean concentrations in excess of the 200 $\mu g.m^{-3}$ objective were measured 214 times during 2013 at the Central Road monitoring site, which is significantly in excess of the 18 times specified in the hourly-mean NO_2 objective. However a recent review of this site has confirmed that the location is no longer considered to be representative of an area of relevant public exposure in terms of the objectives. All bus services, with the exception of a Sunday night service, have now been removed from Central Road. Whilst bus services were in operation here in 2013, since this ceased at the beginning of 2014 there is now no reason for anyone to spend time in this area and no relevant exposure is present. The monitor at this site will be decommissioned and moved to an alternative location. The Scottish Government, their technical advisors Ricardo-AEA and SEPA agree with this conclusion.

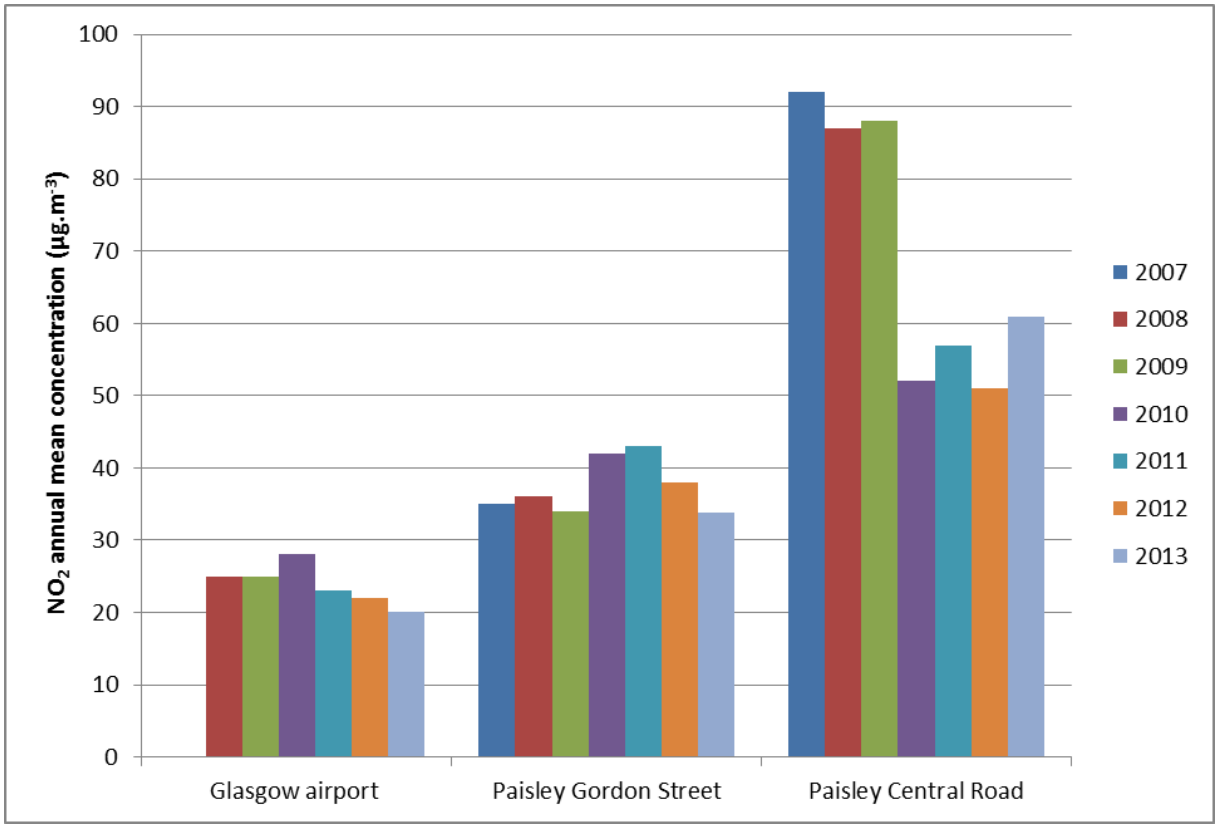
More than 18 hourly mean NO_2 concentrations in excess of the 200 $\mu g.m^{-3}$ objective were also measured at the Gordon Street site. As the data capture was below 90% at Gordon Street during 2013 the 99.79th percentile of hourly means was also calculated; the calculated percentile of 303 $\mu g.m^{-3}$ is in excess of the 200 $\mu g.m^{-3}$ objective. This site is also within the existing Paisley AQMA. It is worth noting that after the site was reinstalled at Gordon Street, landscaping works continued in

close proximity to the monitor including stone cutting using a petrol powered saw and a digger operating next to the monitor. This would have increased the concentrations in the immediate vicinity of the site but may not have been representative of general NO_2 concentrations in the surrounding site and at nearby receptors.

Table 2.4: NO_2 automatic monitoring results: Comparison with 1-hour mean objective

Site name	Within AQMA ?	Data Capture 2013 (%)	Number of exceedences of hourly mean objective (200 µg.m-3) For data capture < 90%, the 99.79th %ile of 1-hr means is shown in brackets (µg.m-3)					
			2008	2009	2010	2011	2012	2013
Central Road, Paisley	Y	97.5%	715	760	43*	2	37	**214**
Glasgow Airport	N	99.4%	1	0	9	0	0	0
Gordon Street, Paisley	Y	52.4%	0	1	47	1(149)	9	46 (304)

Figure 2.16: Trends in measured annual mean NO_2 concentrations (2007 – 2013)



Diffusion Tube Monitoring Data

Details of the annual mean NO_2 concentrations measured using diffusion tube sites during 2013 are presented in Table 2.5 and the series of results measured from 2008 to 2013 are presented in Table 2.6. A bias adjustment factor of 1.115 was applied to all 2013 diffusion tube results; this factor was derived from the local co-location studies at the automatic monitoring sites at Central Road, Paisley and Glasgow Airport. An explanation regarding the choice of bias adjustment factor used is presented in Appendix A.

Data capture was generally good across the network of diffusion tubes during 2013, short-term to long-term adjustment calculations were required at two locations with data capture < 75%.

At locations where measured annual mean concentrations were in excess of the 40 $\mu g.m^{-3}$ objective; distance correction calculations have been conducted to estimate the annual mean concentration at the nearest location of relevant exposure. The calculation was conducted using the 'NO_2 with distance from road calculator' available to download on the Defra LAQM support website. The estimated annual mean concentrations at the nearest relevant exposure are presented in brackets in Table 2.5 at relevant tube locations.

Exceedances of the NO_2 annual mean objective at locations within the existing AQMA

Following distance correction of the diffusion tube measurements, annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were estimated at the nearest relevant exposure to the following diffusion tube sites within the existing Paisley AQMA during 2013:

- Paisley 33 - 76 Causeyside Street, Paisley
- Paisley 35 - Old Sneddon Street, Paisley
- Paisley 43 - Smithhills Street (east), Paisley

Relevant exposure for tubes Paisley 33, Paisley 35 and Paisley 43 are at first floor level, further analysis of exposure at first floor level at these locations will be undertaken.

Exceedances of the NO_2 annual mean objective at locations out-with the existing Paisley AQMA

Out-with the existing Paisley AQMA, distance corrected annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were estimated at the nearest relevant exposure to the following diffusion tube sites;

- Renfrew 8 – 15 Inchinnan Road, Renfrew: This tube was relocated from a kerbside location in March 2013. A Detailed Assessment was conducted in the Renfrew Town Centre area in 2012 which concluded that NO_2 concentrations in excess of the annual mean objective were not occurring at any of the first floor flats in the study area and that it was not necessary at that time to declare an AQMA. The report also recommended re-locating the diffusion tubes from kerbside locations to the building facades to get a better idea of concentrations at locations of relevant exposure. This tube was relocated further along Inchinnan Road at the building façade of two ground floor flats in March 2013. The 2013 NO_2 annual mean measured at this location has therefore been calculated using a short-term to long-term adjustment This is a new area of exceedance identified within the area so Renfrewshire Council will deploy further diffusion tubes to gain a better understanding of the area of exceedance, and to investigate the potential cause of this further. A review of this further data and investigations will be undertaken as part of the Updating and Screening Assessment in 2015. Should there continue to be exceedances Renfrewshire Council will consider whether a further modelling assessment is required to allow us to better define the area of exceedence or whether to go immediately to declaration of an AQMA.

- Paisley 15 – Montgomery Drive Paisley: This site is located close to the slip road from the M8 motorway onto Renfrew Road. The measured NO_2 annual mean during 2013 was 43.7 $\mu g.m^{-3}$

(NO_2 annual mean estimated at nearest relevant exposure was 42.1 $\mu g.m^{-3}$ based on a distance correction calculation using the distance of the nearest relevant exposure from the slip road). Distance correcting using the distance from the M8 motorway also indicates that NO_2 annual mean in excess of 40 $\mu g.m^{-3}$ is occurring at the nearest relevant exposure. A Detailed Assessment requires to be undertaken for this area which will be done in conjunction with the update of the Detailed Assessment for the Renfrew M8 Tanar Way/Glen Sax Drive area as all locations are influenced by the M8 traffic.

- Renfrew 17 – Tanar Way, Renfrew: This diffusion tube is located 4m from residential properties located approximately 26m to the north of the M8 motorway. The measured NO_2 annual mean during 2013 was 45.2 $\mu g.m^{-3}$ (NO_2 annual mean estimated at nearest relevant exposure was 42.6 $\mu g.m^{-3}$). A Detailed Assessment of this area was undertaken in 2009. Modelling predicted exceedances at some residential receptors however, given issues relating to over-estimation caused by the adjustment factor used, it was recommended additional monitoring was obtained. Renfrewshire Council purchased and installed an automatic continuous monitor (NO_2 and PM_{10}) within this area (Cockel's Loan) at the end of 2013. However start up and operating issues with the monitors has resulted in insufficient data being gathered to date to inform our decision making. It is anticipated that sufficient automatic continuous monitoring data will be obtained by the beginning of next year to undertake an update of the 2009 Detailed Assessment of this area and thereafter declare an AQMA if/where required.

- Renfrew 48 – Glen Sax Drive, Renfrew: This tube is also located to the north of the M8 motorway which is the main road source at this location. The M8 is approximately 26m from the façade of the nearest residential building façade. The tube is located a further 19m away from the motorway. The relevant exposure is therefore closer to the main road source than the diffusion tube in this case. The distance corrected NO_2 annual mean at the nearest relevant exposure during 2013 was 47.3 $\mu g.m^{-3}$.

- Johnstone 59 – High Street Johnstone: This diffusion tube was initially deployed in March 2013, the data capture at this site for the year was therefore 75% and a short-term to long-term adjustment has not been applied. The measured NO_2 annual mean (calculated using 9 months data) during 2013 was 64.1 $\mu g.m^{-3}$ which is significantly in excess of the 40 $\mu g.m^{-3}$ annual mean objective; and is in excess of the 60 $\mu g.m^{-3}$ threshold at which TG(09) recommends that there may be a risk that the NO_2 1-hour mean objective is being exceeded.

- Kilbarchan 61 – High Barholm, Kilbarchan: This diffusion tube was also newly deployed in April 2013 with a data capture of 58%; therefore a short-term to long-term adjustment has been applied to the data to estimate an annual mean concentration. The NO_2 annual mean during 2013 was 47.5 $\mu g.m^{-3}$. This diffusion tube is located at the building façade in a fairly narrow street with ground floor residential properties located close to the road.

- A bar chart showing the trends in annual mean NO_2 concentrations measured across the Renfrewshire Council network of diffusion tubes over recent years is presented in Figure 2.17 and Figure 2.18.

Table 2.5: NO_2 diffusion tubes results 2013

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2013 ($\mu g.m^{-3}$) (Bias Adj. factor = 1.13)
Paisley 1	Gilmour Street, Paisley	Urban Centre	Y	N	92%	n/a	N	27.0
Paisley 2	Oakshaw Street, Paisley	Urban Background	Y	N	83%	n/a	N	20.0
Paisley 3	Lochfield Drive, Paisley	Urban Background	N	N	100%	n/a	N	13.6
Paisley 4	Regent Street, Paisley	Urban Background	N	N	100%	n/a	N	19.0
Johnstone 7	High Street, Johnstone	Kerbside	N	N	100%	n/a	N	38.3
Renfrew 8	Inchinnan Road, Renfrew	Kerbside	N	N	100%	n/a	Y	**53.8 (53.8)**
Bishopton 9	Station Road, Bishopton	Roadside	N	N	92%	n/a	N	20.9
Paisley 13	Greenock Road, Paisley	Roadside	N	N	100%	n/a	N	28.2
Paisley 15	Montgomery Drive, Paisley	Roadside	N	N	100%	n/a	Y	**43.7 (42.1)**
Renfrew 17	Tanar Way, Renfrew	Roadside	N	N	92%	n/a	Y	**45.2 (42.6)**
Paisley 18	Incle Street, Paisley	Roadside	Y	N	100%	n/a	Y	44.8 (35.4)
Paisley 19	Linwood Road, Paisley	Roadside	N	N	83%	n/a	N	38.0
Johnstone 20	High Street, Johnstone	Kerbside	N	N	92%	n/a	Y	46.6 (34.3)
Paisley 21	Causeyside Street, Paisley	Roadside	Y	Triplicate	75%	n/a	N	37.7
Renfrew 23	Hillington Road, Renfrew	Roadside	N	N	92%	n/a	N	30.3
Renfrew 24	Glasgow Road, Renfrew	Roadside	N	N	100%	n/a	N	26.6
Renfrew 25	French Street, Renfrew	Urban Industrial	N	N	100%	n/a	N	19.4
Bishopton 27	Rossland Gardens, Bishopton	Suburban	N	N	100%	n/a	N	13.8
Linwood 30	Kintyre Avenue, Linwood	Urban Background	N	N	100%	n/a	N	22.7
West Walkingshaw 31	West Walkingshaw	Roadside	N	N	83%	n/a	N	36.9
Paisley 33	76 Causeyside Street, Paisley	Roadside	Y	N	100%	n/a	N	**45.9 (44.9)**
Paisley 34	63 Causeyside Street, Paisley	Roadside	Y	N	100%	n/a	N	48.6 (35.8)
Paisley 35	Old Sneddon Street, Paisley	Roadside	Y	N	100%	n/a	N	**48.6 (48.6)**
Paisley 36	49 Caledonia Street, Paisley	Roadside	Y	N	92%	n/a	N	39.8
Paisley 37	Central Road Monitoring Station	Roadside	Y	Triplicate	100%	n/a	N	**53.3**
Renfrew 38	99 Paisley Road, Renfrew	Roadside	N	N	100%	n/a	N	34

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2013 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2013 (µg.m^{-3}) (Bias Adj. factor = 1.13)
Paisley 39	Glasgow Airport, Paisley	Special	N	Triplicate	100%	n/a	N	23
Renfrew 40	Hairst Street, Renfrew	Roadside	N	N	92%	n/a	N	36.5
Paisley 41	Smithhills Street (west), Paisley	Roadside	Y	N	100%	n/a	N	45.5 (38)
Paisley 42	Central Road (west), Paisley	Roadside	Y	N	100%	n/a	N	42.6 (27.3)
Paisley 43	Smithhills Street (east), Paisley	Roadside	Y	N	100%	n/a	N	**41.9 (41.9)**
Paisley 44	Love Street, Paisley	Roadside	Y	N	100%	n/a	N	38.7
Renfrew 45	Xscape, Renfew	Kerbside	N	N	100%	n/a	N	34.6
Renfrew 46	Ferry Village, Renfrew	Kerbside	N	N	100%	n/a	N	25.2
Renfrew 48	Glen sax Drive, Renfrew	Roadside	N	N	100%	n/a	Y	40.6 **(47.3)**
Renfrew 49	Tanar Way 2, Renfrew	Roadside	N	N	100%	n/a	N	34.9
Paisley 50	Renfrew Road, Paisley	Roadside	N	N	100%	n/a	N	33.4
Linwood 51	Kintyre Avenue 2, Linwood	Roadside	N	N	92%	n/a	N	24.1
Renfrew 52	Glasgow Road 2, Renfrew	Roadside	N	N	100%	n/a	N	32.6
Inchinnan53	Old Greenock Rd, Inchinnan	Roadside	N	N	100%	n/a	N	32.0
Kilbarchan 54	Easwald Bank, Kilbarchan	Roadside	N	N	92%	n/a	N	31.0
Kilbarchan 55	New Street, Kilbarchan	Roadside	N	N	83%	n/a	N	17.9
Renfrew 56	Paisley Road, Renfrew	Roadside	N	N	75%	n/a	Y	43.9 (39.5)
Renfrew 57	Paisley Road, Renfrew	Roadside	N	N	75%	n/a	N	27.5
Renfrew 58	Glebe Street, Renfrew	Roadside	N	N	83%	n/a	N	25.7
Johnstone 59	High Street, Johnstone	Roadside	N	N	75%	n/a	Y	**64.1 (64.1)**
Paisley 60	Underwood Rd, Paisley	Roadside	Y	N	58%	Yes	Y	**52.2** (31.1)
Kilbarchan 61	High Barholm, Kilbarchan	Roadside	N	N	58%	Yes	Y	**47.5 (47.5)**
Cockels Loan 62	Cockels Loan, Renfrew	Roadside	Y	Y	25%	Yes	Y	60.8 (60.8)

NO_2 annual mean in excess of the 40µg.m^{-3} objective shown in bold; Distance corrected NO_2 annual mean predicted at nearest relevant exposure shown in brackets

Table 2.6: Results of NO_2 Diffusion Tubes (2008 to 2013)

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) μg/m^3					
			2008* (Bias Adj. Factor = 0.97)	2009* (Bias Adj. Factor = 1.02	2010* (Bias Adj. Factor = 1.03)	2011 (Bias Adj. Factor = 1.09)	2012 (Bias Adj. Factor = 1.13)	2013 (Bias Adj. Factor = 1.12)
Paisley 1	Urban Centre	Y	27.1	25.4	30.4	32.6	28.7	27.0
Paisley 2	Urban Background	Y	18	17.7	23.4	19.1	21.0	20.0
Paisley 3	Urban Background	N	13	13.3	17.7	14.7	13.5	13.6
Paisley 4	Urban Background	N	16.1	18.7	24.1	20.5	21.8	19.0
Johnstone 7	Kerbside	N	34.3	30.8	**40.4**	33.4	37.4	38.3
Renfrew 8	Kerbside	N	37.9	**43.4**	**42.6**	**54.4**	**48.8** (28.4)	**53.8 (53.8)**
Bishopton 9	Roadside	N	13.7	15.3	16.6	22	19.1	20.9
Paisley 13	Roadside	N	26	25.4	32.4	28.5	30.3	28.2
Paisley 15	Roadside	N	37.5	32.7	39.1	35.7	38.5	**43.7 (42.1)**
Renfrew 17	Roadside	N	38.6	39.7	**42.4**	**41.9**	37.3	**45.2 (42.6)**
Paisley 18	Roadside	Y	**49.2**	**44**	**51.8**	**49.7**	**48.5 (41.7)**	44.8 (35.4)
Paisley 19	Roadside	N	31.7	30.3	36.1	34.2	36.1	38.0
Johnstone 20	Kerbside	N	34.5	36.1	**46.8**	**43.2**	**44.4** (33.2)	46.6 (34.3)
Paisley 21	Roadside	Y	39.4	37.6	**41.8**	**40.7**	38.6	37.7
Renfrew 23	Roadside	N	31.6	30.2	35.2	35.5	29.5	30.3
Renfrew 24	Roadside	N	24.2	24	30.5	26.9	26.7	26.6
Renfrew 25	Urban Industrial	N	17.4	16.5	22.2	19.4	19.2	19.4
Bishopton 27	Suburban	N	11.2	11	15.9	13.3	9.1	13.8
Linwood 30	Urban Background	N	17.8	19.3	24.1	22.2	20.2	22.7
West Walkingshaw 31	Roadside	N	28	25.9	28.4	34.9	29.9	36.9
Paisley 33	Roadside	Y	**44.4**	**41.4**	**50.7**	**46**	**42.5 (41.7)**	**45.9 (44.9)**
Paisley 34	Roadside	Y	**44.7**	**41.7**	**48**	**49.7**	**45.4** (34.5)	48.6 (35.8)
Paisley 35	Roadside	Y	**49.9**	**42.9**	**50.9**	**51.1**	**45.3 (45.3)**	**48.6 (48.6)**
Paisley 36	Roadside	Y	34.5	30.4	34.8	35.7	**40.5 (40.5)**	39.8
Paisley 37	Roadside	Y	**68**	**60.9**	**43.6**	**46.2**	39.9	**53.3**

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) µg/m^3					
			2008* (Bias Adj. Factor = 0.97)	2009* (Bias Adj. Factor = 1.02	2010* (Bias Adj. Factor = 1.03)	2011 (Bias Adj. Factor = 1.09)	2012 (Bias Adj. Factor = 1.13)	2013 (Bias Adj. Factor = 1.12)
Renfrew 38	Roadside	N	37.5	34.2	34.8	31.1	27.0	34
Paisley 39	Special	N	22.6	21.9	26.3	24	22.8	23
Renfrew 40	Roadside	N	-	-	-	**47.2**	**45.5** (26.2)	36.5
Paisley 41	Roadside	Y	-	-	-	**48.9**	**45.4** (38.3)	**45.5**
Paisley 42	Roadside	Y	**46.2**	**42.7**	**44.5**	**43.1**	37.3	**42.6**
Paisley 43	Roadside	Y	**48.7**	**42.1**	**42.9**	**43.9**	39.1	**41.9**
Paisley 44	Roadside	Y	32	**45.8**	38.6	37.8	**46.4 (46.4)**	38.7
Renfrew 45	Kerbside	N	33.7	28.2	35.1	31.9	33.8	34.6
Renfrew 46	Kerbside	N	20.6	24.3	30.8	23.6	26.4	25.2
Renfrew 48	Roadside	N		27.3	38	**40.6**	35.7	40.6 **(47.3)**
Renfrew 49	Roadside	N	-	32.2	36	36.5	33.6	34.9
Paisley 50	Roadside	N	-	29.1	34	34.1	34.9	33.4
Linwood 51	Roadside	N	-	25.4	25.8	26	23.2	24.1
Renfrew 52	Roadside	N	-	33.5	35.7	38	35.8	32.6
Inchinnan53	Roadside	N	-	-	-	-	-	32.0
Kilbarchan 54	Roadside	N	-	-	-	-	-	31.0
Kilbarchan 55	Roadside	N	-	-	-	-	-	17.9
Renfrew 56	Roadside	N	-	-	-	-	-	**43.9 (39.5)**
Renfrew 57	Roadside	N	-	-	-	-	-	27.5
Renfrew 58	Roadside	N	-	-	-	-	-	25.7
Johnstone 59	Roadside	N	-	-	-	-	-	**64.1 (64.1)**
Paisley 60	Roadside	N	-	-	-	-	-	**52.2** (31.1)
Kilbarchan 61	Roadside	N	-	-	-	-	-	**47.5 (47.5)**
Cockels Loan 62	Roadside	N	-	-	-	-	-	**60.8(60.8)**

NO_2 annual mean in excess of the 40µg.m^{-3} objective shown in bold

Distance corrected NO_2 annual mean predicted at nearest relevant exposure shown in brackets

Figure 2.17: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – 1

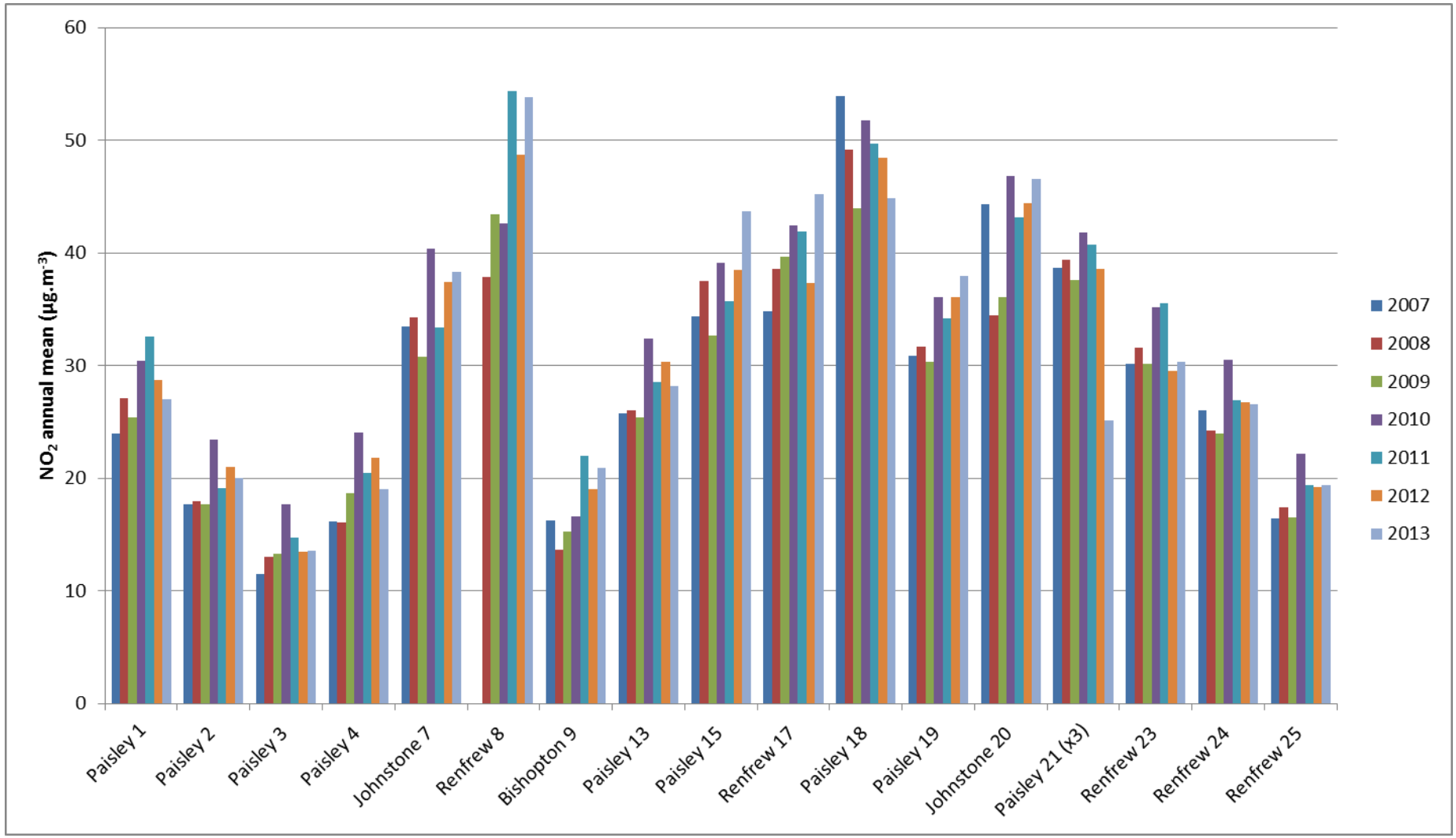
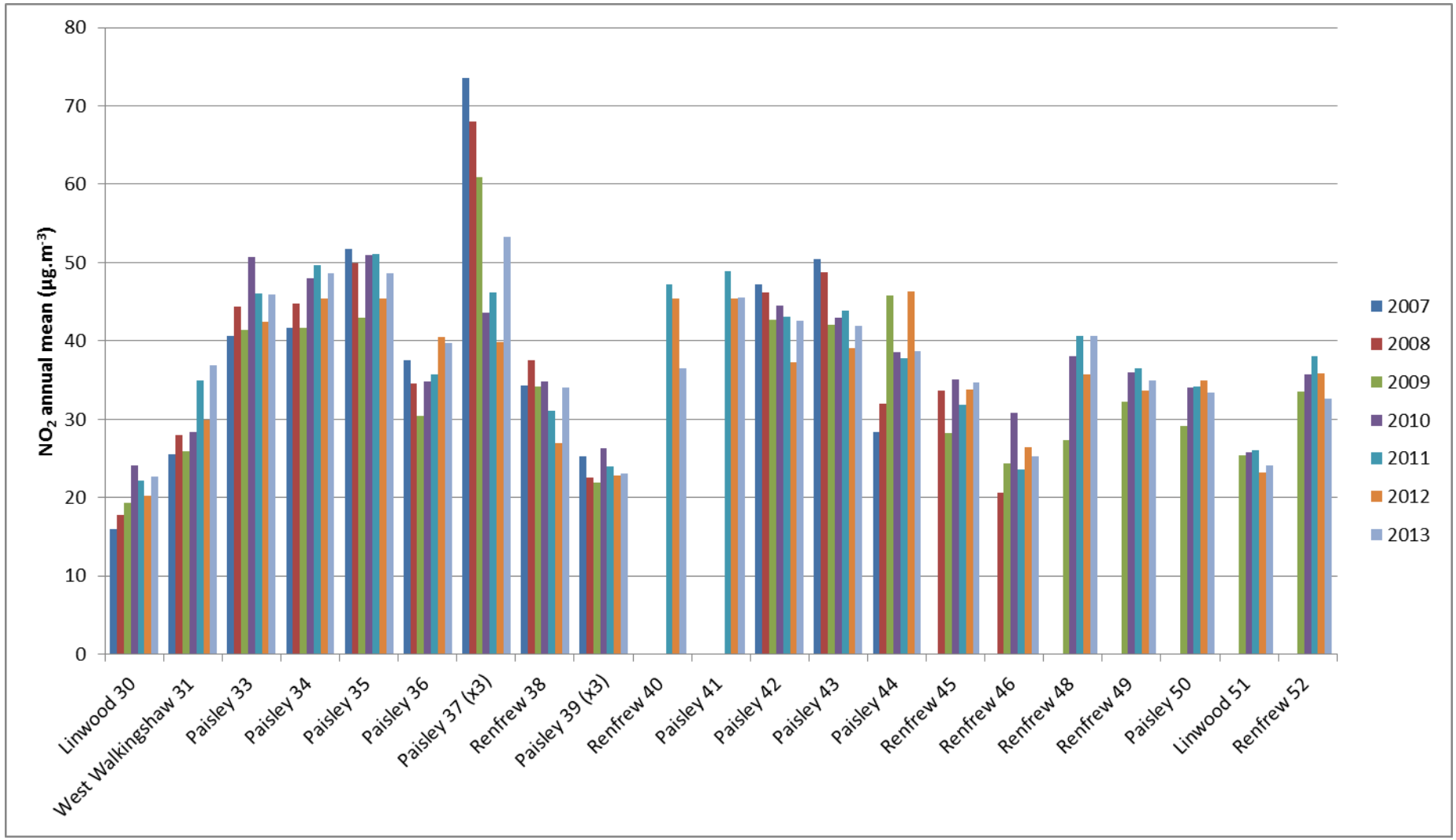


Figure 2.18: Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites – 2



2.2.2 Particulate Matter (PM_{10})

The annual mean PM_{10} concentrations measured from 2008 to 2013 are presented in Table 2.7 and Figure 2.19. A short-term to long-term adjustment has been applied to the Gordon Street measurements as data capture was below 75% due to the site not being operational during resurfacing and landscaping work between March and July. Details of the adjustment calculation are presented in Appendix A.

The annual mean PM_{10} concentration measured during 2013 at both sites was below the 18 $\mu g.m^{-3}$ Scottish objective.

A bar chart showing trends in annual mean PM_{10} concentrations measured over recent years is presented in Figure 2.19. The chart indicates a downward trend in annual mean concentrations at the St James Street PM_{10} measurement site over recent years and no clear trend at the Gordon Street site.

The number of 24-hour mean PM_{10} concentrations in excess of the 50 $\mu g.m^{-3}$ daily mean objective measured from 2008 to 2012 are presented in Table 2.8. Daily mean PM_{10} concentrations in excess of 50 $\mu g.m^{-3}$ occurred on 2 days during 2013 at the Gordon Street site. This is within the seven permitted exceedances specified in the Scottish PM_{10} objectives.

Table 2.7: Results of PM_{10} automatic monitoring for comparison with annual mean objective

Site name	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2013 %[b]	Confirm Gravimetric Equivalent	Annual Mean Concentration (µg.m^{-3})					
						2008	2009	2010	2011	2012	2013
Gordon Street	Roadside	Y	82%	47%	Y	15	**18**	**21**	16	15	17.9*
St James	Roadside	Y	93%	93%	Y	-	-	**23***	17	15	14.5

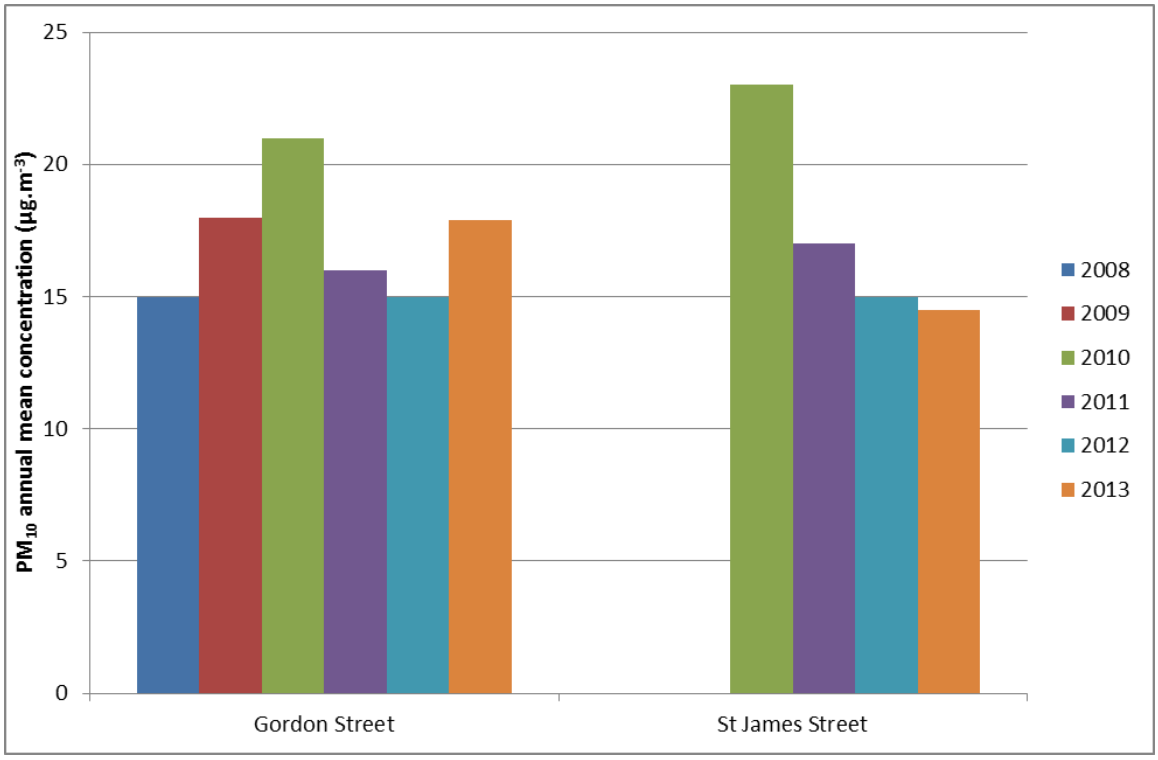
***Annualised – Short term to long term adjustment applied to calculate annual mean as valid data capture < 75%**

Table 2.8: Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour Mean Objective

Site name	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2013 %[b]	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 µg.m^{-3}) (98.1th %ile in brackets where data capture < 90% (µg.m^{-3}))					
						2008	2009	2010	2011	2012	2013
Gordon Street	Roadside	Y	82%	47%	Y	1	5	**11**	6	4 (43)	2(40)
St James	Roadside	Y	93%	93%	Y	-	-	**8**	4	4	0

Where data capture for full calendar year is less than 90%, the 98.1th percentile of 24-hour means is included in brackets

Figure 2.19: Trends in annual mean PM_{10} concentrations measured from 2008 – 2013



2.2.3 Sulphur Dioxide (SO_2)

Renfrewshire Council does not currently measure sulphur dioxide within the council area. Historically SO_2 was measured at Glasgow airport; this was discontinued following a continued decline in measured concentrations that were substantially below the objective.

2.2.4 Benzene

Renfrewshire Council does not currently measure benzene concentrations within the council area. No significant sources of benzene have been identified in previous rounds of review and assessment.

2.2.5 Other Pollutants Monitored

No other atmospheric pollutants are measured within the Renfrewshire Council area.

2.2.6 Summary of Compliance with AQS Objectives

The annual mean NO_2 concentrations measured at the Central Road automatic monitoring site during 2013 was in excess of the 40 $\mu g.m^{-3}$ objective. The monitoring site is not however at a location where relevant exposure for the annual mean averaging period applies. The annual mean NO_2 concentrations measured at both the Glasgow Airport and Gordon Street automatic monitoring sites were below the 40 $\mu g.m^{-3}$ during 2013. Measured NO_2 annual mean concentrations have in general decreased at Glasgow Airport over recent years but have fluctuated with no clear trend at the automatic sites within the Paisley AQMA.

Hourly mean NO_2 concentrations in excess of the 200 $\mu g.m^{-3}$ objective were measured 214 times during 2013 at the Central Road monitoring site, which is in excess of the 18 times specified in the hourly-mean NO_2 objective. However a recent review of this site has confirmed that the location is no longer considered to be representative of an area of relevant public exposure in terms of the objectives. All bus services, with the exception of a Sunday night service, have now been removed from Central Road. Whilst bus services were in operation here in 2013, since this ceased at the beginning of 2014 there is now no reason for anyone to spend time in this area and no relevant exposure is present. The monitor at this site will be decommissioned and moved to an alternative location. The Scottish Government, their technical advisors Ricardo-AEA and SEPA agree with this conclusion.

At the Gordon Street automatic monitoring site 46 hourly mean NO_2 concentrations in excess of the 200 $\mu g.m^{-3}$ objective were measured during 2013. Data capture was low during 2013 at this site due to resurfacing and landscaping work being conducted at the site between March and July. The 99.79th percentile of 1-hour means was calculated as 304 $\mu g.m^{-3}$ which is in excess of the 200 $\mu g.m^{-3}$ hourly mean objective. The Gordon Street site is also within the existing Paisley AQMA for exceedances of the NO_2 annual mean and 1-hour mean objectives.

No exceedances of the short-term NO_2 objective were measured at the Glasgow Airport site.

Annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were measured at three diffusion tube sites within the existing Paisley AQMA during 2013

Out-with the existing Paisley AQMA, distance corrected annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were estimated at the nearest relevant exposure to the following diffusion tube sites:

- Renfrew 8 – 15 Inchinnan Road Renfrew
- Paisley 15 – Montogomery Drive Paisley
- Renfrew 17 – Tanar Way, Renfrew
- Renfrew 48 – Glen Sax Drive, Renfrew
- Johnstone 59 – High Street Johnstone
- Kilbarchan 61 – High Barholm, Kilbarchan

The NO_2 annual mean concentration measured at High Street Johnstone (64.1 $\mu g.m^{-3}$) during 2013 was in excess of the 60 $\mu g.m^{-3}$ threshold at which TG(09) recommends that there may be a risk of the NO_2 1-hour mean objective being exceeded. This result was however calculated based on a data capture of 75% and the results should be considered in this context. Renfrewshire Council have considered using an automatic NOx/NO_2 analyser at this location to get a better idea of short-term peaks in NO_2 concentrations. Previous attempts to install a traditional continuous AQ monitor or to deploy diffusion tubes at first floor level have failed and alternative options i.e. AQ Mesh are now being considered for this location.

Measured annual mean PM_{10} concentrations measured at both Gordon Street and St James during 2013 were below the 18 $\mu g.m^{-3}$ objective; both PM_{10} monitoring sites were also compliant with the daily mean objective.

Renfrewshire Council has measured concentrations of Nitrogen Dioxide above the annual mean objective at relevant locations outside of the existing Paisley AQMA, and **will need to proceed to a Detailed Assessment** for NO_2 at the following locations:

- High Street, Johnstone
- Montgomery Drive Paisley & Tanar Way/Glen Sax Drive Renfrew following obtaining 6 months automatic continuous monitoring data from the new Cockel's Loan site.

Renfrewshire Council will wait until a full 12 months of monitoring data (diffusion tube data) is available at the following locations before considering the requirement for a Detailed Assessment.

- Inchinnan Road, Renfrew
- High Barholm, Kilbarchan

Renfrewshire Council will deploy further diffusion tubes on Inchinnan Road, Renfrew to determine the extent of exceedences surrounding diffusion tube 8 Inchinnan Rd. Further investigations will be undertaken as to the cause of exceedences here.

3 New Local Developments

3.1 Road Traffic Sources

No new road traffic sources have been identified within the Renfrewshire Council area since the last Updating and Screening assessment.

3.2 Other Transport Sources

No other transport sources have been identified within the Renfrewshire Council area since the last Updating and Screening assessment.

3.3 Industrial Sources

No new industrial sources have been identified within the Renfrewshire Council area since the last Updating and Screening assessment.

3.4 Commercial and Domestic Sources

Two new commercial biomass combustion sources within the Renfrewshire Council area have been identified during 2013.

13/0586/PP - Proposal; Installation of external wall insulation and render system, alterations to boiler room and installation of external flue. - Alice Street, Great Hamilton Street, Stock St, Calside, Paisley - Planning Status - Granted

An application for two proposed biomass boilers within an existing gas installation on land off Stock Street, Paisley has been granted planning permission.

An air quality impact assessment was submitted, the results of the dispersion modelling assessment indicated predicted pollutant concentrations were below the relevant air quality standards at all locations within the assessment extents. Impacts on baseline concentrations at sensitive receptor locations were not considered to be significant.

11/0811/PP - Brown St/Porterfield Rd, Renfrew; Biomass boiler associated with Erection of primary school, community learning & pre-5 centre, associated landscaping, playing fields, 7 a-side sports pitch, car parking and drop-off areas - Planning Status - Granted

The air quality assessment submitted in support of the planning application for a biomass boiler concluded that the range of forecast process contributions will cause an imperceptible increase in NO_2 and PM_{10} concentrations at most of the specific receptor locations considered, however at a number of locations the process contribution will cause a small increase in concentrations.

3.5 New Developments with Fugitive or Uncontrolled Sources

No new developments with fugitive or uncontrolled sources have been identified during 2012.

Renfrewshire Council has identified the following new or previously unidentified local developments which may impact on air quality in the Local Authority area.

- 2 x biomass boilers at Alice Street, Great Hamilton Street, Stock St, Calside, Paisley
- Biomass boiler at Primary School, Brown St/Porterfield Rd, Renfrew

These will be taken into consideration in the next Updating and Screening Assessment

4 Local / Regional Air Quality Strategy

Renfrewshire Council does not currently have a local or regional air quality strategy.

5 Planning Applications

The following planning applications have been noted that may impact on air quality:

13/0441/PP - Gauze St/Lawn Street, Paisley - Erection of residential development comprising 31 flats and associated parking and access - Planning Status – Granted.

The air quality assessment submitted in support of the planning application concluded that *'The predicted annual mean levels of pollution for NO_2 and PM_{10} at the most exposed elevations in Gauze Street are unlikely to exceed the EC annual mean limit value of 40 µg.m^{-3}. However the annual mean imit Value for NO_2 is at risk of being exceeded at the elevation closest to the Lawn Street/Gauze Street junction and at the future development phase in Smithshill Street. Air pollution levels reduce significantly with height above local ground level. The Scottish annual mean PM_{10} objective of 18µg.m^{-3} is highly unlikely to be exceeded at any of the proposed dwellings'*

Based on the conclusions of the air quality assessment, the following measures were proposed by Renfrewshire Council to mitigate the effects of air pollution within the proposed development:

- All habitable rooms with windows facing onto Gauze Street, Smithshill Street or Lawn Street (R1-R4 as detailed in figure 3.1 of the Air Quality Assessment) from ground floor up to and including third floor level shall be fitted with low flow 'whole house' mechanical ventilation. The air intake for this system shall be drawn at roof level.
- All ventilation systems shall be located >3m from any flue or chimney to prevent any products of combustion being drawn into the domestic ventilation system

12/0837/PP - Braille Crescent, J26, M8 - Erection of 40 terraced dwelling houses including associated roads and parking, landscaping and boundary fencing - Planning Status - Granted

The air quality assessment concluded that '*the proposed development does not lead to a breach of any air quality standards or a significant worsening of air quality at a number of sensitive receptor locations around the development site near J26 of the M8.*

The proposed development does not introduce new receptors into an area where air quality standards for NO_2 and PM_{10} are expected to be exceeded in the completion year of 2014.

Overall, the results of the assessment show that the air quality impact due to the proposed residential development is classified as imperceptible. The significance of the air quality impact is therefore negligible.'

13/0277/PP - Land at Glasgow Rd/Old Govan Rd, Rocep Drive, Renfrew - Demolition of existing buildings. Erection of retails (Class 1) development with outdoor sports facilities, residential development, access, car parking, landscaping and associated works. - Planning Status - Pending

The air quality impact assessment submitted in support of this planning application concluded that *'the development will not "lead to a significant increase in emissions, degradation in air quality or increase in exposure". As such, air quality (NO_2 and PM_{10}) is a low priority consideration.'*

Renfrewshire Council has confirmed that the air quality assessment for this proposal is satisfactory.

13/0049/PP - Braehead Shopping Centre Planning Permission In principle Erection of mixed use development comprising Class 1 (retail use), Class 2 (financial, professional and other services), Class 3 (food & drink use), Class 7 (hotel use), Class 11 (assembly & leisure), including an events arena and other ancillary uses; construction of transport interchanges and route for Fastlink bus service, car parking, roads & accesses, footpaths and covered walkways, public realm works (including provision of open space & civic square), together with landscaping, all associated works and necessary infrastructure ; and demolition of some buildings - Planning Status - Registered

The air quality chapter of the Environmental Statement submitted in support of this planning application concluded that '*there is predicted to be a* ***NEGLIGIBLE*** *impact on the concentrations of* NO_2 *and* PM_{10} *in both Areas A and B as a result of the development.'*

Renfrewshire Council's Community Resources response to the application stated that they are satisfied that the increase in traffic volume and the resultant change in pollutant concentrations, associated with the proposed development, will have no significant impact on the environment. Environmental Services therefore have no objection or conditions to be attached subject to approval of the application.

The following planning application has been granted but is still awaiting submission of an Air Quality Assessment:

13/0293/PP - Gauze St/Cotton St, Paisley Erection of residential development comprising 23 flats with associated parking (amendment to planning consent 07/1213/PP) - Planning Status - Granted awaiting submission of air quality assessment.

6 Air Quality Planning Policies

The Renfrewshire Local Development Plan Supplementary Guidance[1] was published in January 2013. The document contains guidance structured into five key themes which include Economy, Centres, Infrastructure, Places and Environment.

The document makes specific reference to air quality and states that:

'Development proposals which have the potential to have a detrimental impact on air quality will not be acceptable unless measures to mitigate the impact of air pollutants are proposed and can be agreed with the Planning Authority. The Council will, in assessing an application for such developments, require the submission of an assessment of the likely impact of the development on air quality and any mitigation measures that are proposed.'

Appendix 1 of the document includes information on what is required to be submitted as part of an air quality assessment; and states that proposed assessment methodologies and datasets should be agreed with the Council's Community Resources Team prior to the commencement of the assessment.

[1] Renfrewshire Council (2013) Renfrewshire Local Development Plan Supplementary Guidance January 2013; available to download at http://www.renfrewshire.gov.uk/

7 Local Transport Plans and Strategies

Renfrewshire Council's latest Local Transport strategy was published in 2007. Air quality is not considered within this document.

8 Implementation of Action Plans

At the time of writing there is nothing significant to report on progress with the Paisley AQMA Action Plan. Renfrewshire Council have agreed with the Scottish Government to provide an Action Plan Progress Report at the time of submitting the USA due in 2015.

9 Conclusions and Proposed Actions

9.1 Conclusions from New Monitoring Data

The NO_2 annual mean measured at the Central Road site in Paisley was in excess of the objective during 2013 as in previous years. The monitoring site is not however at a location where relevant exposure for the annual mean averaging period applies.

The NO_2 annual mean measured at Gordon Street was also below the 40 $\mu g.m^{-3}$ objective during 2013, measured concentrations have decreased at this site when compared to the previous two years. At Glasgow Airport the measured NO_2 annual mean was significantly below the objective as in previous years.

Hourly mean NO_2 concentrations in excess of the 200 $\mu g.m^{-3}$ objective were measured 214 times during 2013 at the Central Road monitoring site, which is in excess of the 18 times specified in the NO_2 objective. However, a recent review of this site has confirmed that the location is no longer considered to be representative of an area of relevant public exposure in terms of the objectives. All bus services, with the exception of a Sunday night service, have now been removed from Central Road. Whilst bus services were in operation here in 2013, since this ceased at the beginning of 2014 there is now no reason for anyone to spend time in this area and no relevant exposure is present. The monitor at this site will be decommissioned and moved to an alternative location. The Scottish Government, their technical advisors Ricardo - AEA and SEPA agree with this conclusion.

At the Gordon Street automatic monitoring site 46 hourly mean NO_2 concentrations in excess of the 200 µg.m-3 objective were measured during 2013. As data capture was low during 2013 at this site the 99.79th percentile of 1-hour means was calculated as 304 $\mu g.m^{-3}$ which is in excess of the 200 $\mu g.m^{-3}$ hourly mean objective. The Gordon Street site is also within the existing Paisley AQMA for exceedances of the NO_2 annual mean and 1-hour mean objectives therefore no further action is required except for continuing to implement the air quality action plan measures. It is worth noting that after the site was reinstalled at Gordon Street, landscaping works continued in close proximity to the monitor including stone cutting using a petrol powered saw and a digger operating next to the monitor. This would have increased the concentrations in the immediate vicinity of the site but may not have been representative of general NO_2 concentrations in the surrounding site and at nearby receptors.

Annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were measured at three diffusion tube sites within the Paisley AQMA. Out-with the existing Paisley AQMA, distance corrected 2013 annual mean NO_2 concentrations in excess of the 40 $\mu g.m^{-3}$ objective were estimated at the nearest relevant exposure to the following diffusion tube sites:

- Renfrew 8 – 15 Inchinnan Road
- Paisley 15 – Montogomery Drive Paisley
- Renfrew 17 – Tanar Way, Renfrew
- Renfrew 48 – Glen Sax Drive, Renfrew
- Johnstone 59 – High Street Johnstone
- Kilbarchan 61 – High Barholm, Kilbarchan

The Renfrew 8 diffusion tube was moved to its current position in March 2013 on Inchinnan Road as a result of recommendations within a Detailed Assessment of Renfrew Town Centre in 2012. This is a new area of exceedance identified within the area so Renfrewshire Council will deploy further diffusion tubes to gain a better understanding of the area of exceedance, and to investigate the potential cause of this further. A review of this further data and investigations will be undertaken as part of the Updating and Screening Assessment in 2015. Should there continue to be exceedences

Renfrewshire Council will consider whether a further modelling assessment is required or whether to go immediately to declaration of an AQMA.

The tube at Montgomery Drive, Paisley and the tubes at Tanar Way & Glen Sax Drive Renfrew will be considered in conjunction as all are influenced by traffic on the M8. A Detailed Assessment of this area in Renfrew adjacent to the M8 was undertaken in 2009. Modelling predicted exceedences at some residential receptors however, given issues relating to over-estimation caused by the adjustment factor used, it was recommended additional monitoring was obtained. Renfrewshire Council purchased and installed an automatic continuous monitor (NO_2 and PM_{10}) within this area at the end of 2013. However start up and operating issues with the monitors has resulted in insufficient data being gathered to date. It is anticipated that sufficient automatic continuous monitoring data will be obtained by the beginning of 2015, to facilitate an update of the 2009 Detailed Assessment of this area. This assessment will include the Montgomery Drive area.

It should be noted that the diffusion tube site Kilbarchan 61 was deployed in April 2013; so data capture was only 58% during 2013 and the NO_2 annual mean concentration has been calculated using a short-term to long-term adjustment. We have also been notified by our Roads Services that road works in the Kilbarchan and surrounding area last year resulted in more traffic and queuing traffic in this location. To reduce uncertainty it would therefore be appropriate to wait until a full 12 months of monitoring data is available before conducting a Detailed Assessment at this location.

The NO_2 annual mean concentration measured at High Street Johnstone (64.1 $\mu g.m^{-3}$) during 2013 was in excess of the 60 $\mu g.m^{-3}$ threshold at which TG(09) recommends that there may be a risk of the NO_2 1-hour mean objective being exceeded. This result was however calculated based on a data capture of 75% and the results should be considered in this context. Renfrewshire Council may consider using an automatic NOx/NO_2 analyser at this location to get a better idea of short-term peaks in NO_2 concentrations. Previous attempts to install a traditional continuous AQ monitor or to deploy diffusion tubes at first floor level have failed and alternative options i.e. AQ Mesh are now being considered for this location.

The relatively high measured NO_2 concentrations indicate that there is also a high risk of the Scottish annual mean PM_{10} objective being exceeded. PM_{10} should be considered in the Detailed Assessment.

Annual mean PM_{10} concentrations measured during 2012 at both the Gordon Street and St James sites in Paisley were less than the 18 $\mu g.m^{-3}$ objective, no further action is required.

9.2 Conclusions relating to New Local Developments

The review of local developments has not identified any locations where there may be a risk of the air quality objectives being exceeded; no additional air quality assessment is recommended at this time. Planning applications that may impact upon air quality have been reviewed and noted where relevant for further consideration in the 2015 Updating and Screening assessment.

9.3 Proposed Actions

The new monitoring data has identified the need to proceed to a Detailed Assessment for NO_2 at the following locations;

- High Street, Johnstone
- Montgomery Drive Paisley & Tanar Way/Glen Sax Drive Renfrew following obtaining 6 months automatic continuous monitoring data from the new Cockel's Loan site.

Renfrewshire Council will wait until a full 12 months of monitoring data (diffusion tube data) is available at the following locations before considering the requirement for a Detailed Assessment.

- Inchinnan Road, Renfrew
- High Barholm, Kilbarchan

Renfrewshire Council will deploy further diffusion tubes on Inchinnan Road, Renfrew to gain a better understanding of the area of exceedance, and to investigate the potential cause of this further. A review of this further data and investigations will be undertaken as part of the Updating and Screening Assessment in 2015. Should there continue to be exceedances Renfrewshire Council will consider whether a further modelling assessment is required of the area or whether to go immediately to declaration of an AQMA.

No change to the existing Paisley AQMA boundary is required based on the 2013 monitoring results.

The next LAQM requirements for Renfrewshire Council are:

- Conduct a Detailed Assessment for High Street Johnstone and an update of the previous Detailed Assessment from 2009 for Renfrew Tanar Way/Glen Sax Drive area including Montgomery Drive area.
- Updating and Screening assessment to be submitted in 2015.
- Submit Paisley AQMA Action Plan Progress Report with the USA due in April 2015.

10 References

Defra (2014) UK Air Local Air Quality Management Support website; http://laqm.defra.gov.uk/

Air Quality in Scotland website (2014); www.scottishairquality.co.uk

National Physical Laboratory (2014) National diffusion tube bias adjustment factor spread sheet (v 03/14 Final v2)

Renfrewshire Council (2004) LAQM Progress Report

Renfrewshire Council (2007) LAQM Updating and Screening assessment

Renfrewshire Council (2008) LAQM Detailed Assessment

Renfrewshire Council (2008) LAQM Progress Report

Renfrewshire Council (2009) Detailed Assessment

Renfrewshire Council (2009) LAQM Updating and Screening assessment

Renfrewshire Council (2010) LAQM Progress Report

Renfrewshire Council (2011) Further Assessment

Renfrewshire Council (2011) LAQM Progress Report

Renfrewshire Council (2012) Detailed Assessment – Renfrew

Renfrewshire Council (2013) LAQM Progress Report

Appendices

Appendix A: Quality Assurance / Quality Control (QA/QC) Data

Appendix A: QA/QC Data

QA/QC of diffusion tube monitoring

NO_2 diffusion tubes are supplied and analysed by Glasgow Scientific Services using a preparation mixture of 20% triethanolamine (TEA) in water. Glasgow Scientific Services is a UKAS accredited laboratory with documented Quality Assurance/Quality Control (QA/QC) procedures for diffusion tube analysis. The laboratory prepares the diffusion tubes using the 20% triethanolamine (TEA) in water method.

Glasgow Scientific Services have participated in recent HSL WASP NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be satisfactory during the previous five rounds in 2012 and 2013 based upon a z-score of $< \pm 2$ were as follows:

- October to December 2012: 100%
- January to March 2013: 50%
- April to June 2013: 25%
- July to September 2013: 100%
- October to December 2013: 100%

Over a rolling five round WASP window, it is expected that 95 % of laboratory results should be $\leq \pm 2$. If this percentage is substantially lower than 95 % for a particular laboratory, within this five round window, then one can conclude that the laboratory in question may have significant systematic sources of bias in their assay. In this case the average percentage over the last five rounds up to the end of 2013 is 75%.

Diffusion Tube Bias Adjustment Factors

Three co-location studies were conducted within the Renfrewshire Council area during 2013 at the three sites where NO_2 concentrations are measured using automatic analysers. Bias factors have been calculated for each site. Details of the co-location factor calculations, including the precision checks are presented in Figures A.1 to A.3. A summary of the calculated factors is presented in Table A.1. The bias factor from the national database is presented in Fig A.4.

Figure A.1: Co-location study – Central Road, Paisley

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	02/01/2013	30/01/2013	47.9	33.3	38.4	40	7.4	19	18.4	57.1	99.3	Good	Good
2	30/01/2013	27/02/2013	44.4	37.7	44.9	42	4.0	9	10.0	55.8	100.0	Good	Good
3	27/02/2013	27/03/2013	48.3	50.4	46.2	48	2.1	4	5.2	58.4	71.7	Good	or Data Capture
4	27/03/2013	24/04/2013	45.4	39.5	37.4	41	4.1	10	10.3	54.5	100.0	Good	Good
5	24/04/2013	29/05/2013	50.2	48.0	47.4	49	1.5	3	3.7	58.9	100.0	Good	Good
6	29/05/2013	26/06/2013	55.9	60.7	56.8	58	2.6	4	6.3	61.2	100.0	Good	Good
7	26/06/2013	31/07/2013	43.4	45.8	50.1	46	3.4	7	8.4	57.7	99.2	Good	Good
8	31/07/2013	04/09/2013	47.6	48.3	41.6	46	3.7	8	9.1	58.3	100.0	Good	Good
9	04/09/2013	02/10/2013	42.6	38.9	49.9	44	5.6	13	13.9	51.7	100.0	Good	Good
10	02/10/2013	30/10/2013	47.3	50.6	46.1	48	2.3	5	5.8	64.2	97.3	Good	Good
11	30/10/2013	04/12/2013	50.2	51.4	64.8	55	8.1	15	20.1	85.3	100.0	Good	Good
12	04/12/2013	31/12/2013	57.7	54.7	57.8	57	1.8	3	4.4	65.1	100.0	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

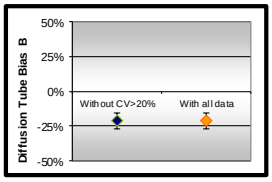
Site Name/ ID:	Central Road Paisley

Precision: 12 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	1.27 (1.19 - 1.37)
Bias B	-22% (-27% - -16%)
Diffusion Tubes Mean:	48 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	61 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	61 (57 - 65) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	1.27 (1.19 - 1.37)
Bias B	-22% (-27% - -16%)
Diffusion Tubes Mean:	48 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	61 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	61 (57 - 65) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure A.2: Co-location study – Glasgow Airport

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	02/01/2013	30/01/2013	26.2							30.0	100.0		Good
2	30/01/2013	27/02/2013	27.0	26.4	22.9	25	2.2	9	5.5	27.8	100.0	Good	Good
3	27/02/2013	27/03/2013	27.2	23.4	19.8	23	3.7	16	9.2	24.9	99.9	Good	Good
4	27/03/2013	24/04/2013	20.5	21.2	17.4	20	2.0	10	5.0	21.0	100.0	Good	Good
5	24/04/2013	29/05/2013	15.5	13.9	16.5	15	1.3	9	3.3	13.4	100.0	Good	Good
6	29/05/2013	26/06/2013	17.2	16.3	17.2	17	0.5	3	1.3	14.0	99.9	Good	Good
7	26/06/2013	31/07/2013	16.9	16.4	13.6	16	1.8	11	4.4	15.9	96.5	Good	Good
8	31/07/2013	04/09/2013	13.2	13.3	14.8	14	0.9	7	2.2	15.0	100.0	Good	Good
9	04/09/2013	02/10/2013	18.7	17.3	17.9	18	0.7	4	1.7	18.8	100.0	Good	Good
10	02/10/2013	30/10/2013	17.6	22.1	21.6	20	2.5	12	6.1	21.0	97.3	Good	Good
11	30/10/2013	04/12/2013	34.5	37.6	30.5	34	3.6	10	8.8	29.5	100.0	Good	Good
12	04/12/2013	31/12/2013	21.0	25.7	19.6	22	3.2	14	7.9	15.0	100.0	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

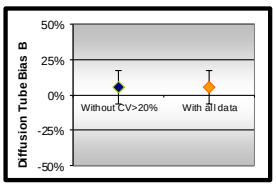
Site Name/ ID:	Glasgow Airport

Precision: 11 out of 11 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.96 (0.86 - 1.08)
Bias B	4% (-8% - 16%)
Diffusion Tubes Mean:	20 µgm^{-3}
Mean CV (Precision):	10
Automatic Mean:	20 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	20 (18 - 22) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.96 (0.86 - 1.08)
Bias B	4% (-8% - 16%)
Diffusion Tubes Mean:	20 µgm^{-3}
Mean CV (Precision):	10
Automatic Mean:	20 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	20 (18 - 22) µgm^{-3}



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Version 04 - February 2011

Figure A.3: Co-location study – Gordon Street, Paisley

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	02/01/2013	30/01/2013	46.7	37.5	41.6	42	4.6	11	11.4
2	30/01/2013	27/02/2013	39.6	35.2	39.6	38	2.5	7	6.3
3	27/02/2013	27/03/2013							
4	27/03/2013	24/04/2013							
5	24/04/2013	29/05/2013							
6	29/05/2013	26/06/2013	31.3	32.1	32.7	32	0.7	2	1.7
7	26/06/2013	31/07/2013		26.6	27.6	27	0.7	3	6.4
8	31/07/2013	04/09/2013	23.0	19.9	20.5	21	1.6	8	4.1
9	04/09/2013	02/10/2013	16.0	21.5	23.1	20	3.7	18	9.3
10	02/10/2013	30/10/2013	42.7	41.8	42.9	42	0.6	1	1.5
11	30/10/2013	04/12/2013	52.7	46.3	49.7	50	3.2	6	8.0
12	04/12/2013	31/12/2013	61.1	31.1	37.6	43	15.8	36	39.2
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
46.4	99.7	Good	Good
47.0	99.9	Good	Good
53.0	28.9		or Data Capture
0.0	0.0		or Data Capture
0.0	0.0		or Data Capture
0.0	0.0	Good	or Data Capture
27.0	25.5	Good	or Data Capture
20.3	98.0	Good	Good
32.4	100.0	Good	Good
34.5	26.6	Good	or Data Capture
87.1	56.3	Good	or Data Capture
23.5	100.0	Poor Precision	Good
Overall survey -->		Good precision	Poor Overall DC

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Gordon Street Paisley

Precision: 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%

Bias calculated using 4 periods of data

Bias factor A: 1.2 (0.91 - 1.78)

Bias B: -17% (-44% - 10%)

Diffusion Tubes Mean: 30 µgm^{-3}

Mean CV (Precision): 11 caution

Automatic Mean: 37 µgm^{-3}

Data Capture for periods used: 99%

Adjusted Tubes Mean: 36 (28 - 54) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 5 periods of data

Bias factor A: 1.03 (0.65 - 2.42)

Bias B: -3% (-59% - 53%)

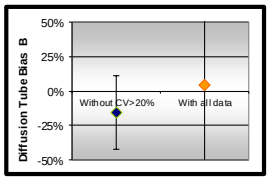
Diffusion Tubes Mean: 33 µgm^{-3}

Mean CV (Precision): 16 caution

Automatic Mean: 34 µgm^{-3}

Data Capture for periods used: 100%

Adjusted Tubes Mean: 34 (21 - 80) µgm^{-3}



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Version 04 - February 2011

Figure A.4: Glasgow Scientific Services – National average bias adjustment factor 2013

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/14

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2014
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:								
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.								
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953								
Analysed By[1]	Method To undo your selection, choose (All) from the pop-up list	Year[2] To undo your selection, choose (All)	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)	
Glasgow Scientific Services	20% TEA in water	2013	R	East Dunbartonshire Council	12	29	31	-4.1%	P	1.04	
Glasgow Scientific Services	20% TEA in water	2013	R	East Dunbartonshire Council	12	40	36	9.1%	G	0.92	
Glasgow Scientific Services	20% TEA in water	2013	R	East Dunbartonshire Council	10	33	36	-8.9%	P	1.10	
Glasgow Scientific Services	20% TEA in water	2013	R	East Dunbartonshire Council	11	25	27	-4.7%	G	1.05	
Glasgow Scientific Services	20% TEA in water	2013	KS	Marylebone Road Intercomparison	12	95	81	17.6%	G	0.85	
Glasgow Scientific Services	20% TEA in water	2013		Overall Factor[3] (5 studies)				Use		0.99	

Table A.1: Summary of bias adjustment factors at NO_2 automatic monitoring sites 2013

Co-location site	Tube Precision	Automatic data quality	Bias factor (excluding periods with cv > 20%)	Bias factor (using all available periods of data)
Central Road, Paisley	Good	Good overall	1.27	1.27
Glasgow Airport	Good	Good overall	0.96	0.96
Gordon Street, Paisley	Good	Poor overall – low data capture	1.2	1.03

Discussion of Choice of Factor to Use

Diffusion tube bias adjustment factors for 2013 are available from both the local co-location studies and the national database of co-location studies. Historically Renfrewshire Council have used an average of the local adjustment factors to adjust their diffusion tube results.

A summary of the local bias factors both excluding periods with a cv > 20%; and using all 12 periods are presented in Table A.1. When adjusting single tube measurements the factor calculated using all 12 periods should be used; it is therefore important that this is representative of the bias calculated using triplicate tube surveys with 'good' precision.

During 2013 data capture was low at the Gordon Street co-location study and the mean co-efficient of variation (precision) was over the recommended 10% for both periods with cv > 20% and when using all periods. The Gordon Street co-location study was not therefore considered suitable for inclusion when calculating the average bias adjustment factor for 2013.

Based on this, the average of the factors derived from the Central Road, Paisley and Glasgow Airport co-location studies have been used to adjust the 2013 diffusion tube measurements. The average factor of 1.115 is consistent with the factor applied to the 2012 results (1.13). The resulting annual mean NO_2 concentrations also appear to be reasonably consistent with those measured in recent years; and when compared with the automatic monitoring data.

PM Monitoring Adjustment

All PM_{10} measurements were made using TEOM analysers fitted with FDMS units. The measurements are therefore considered gravimetric equivalent and no adjustments have been applied to the data.

All TEOM FDMS data were fully ratified by Ricardo-AEA to AURN standards.

Short-term to Long-term Data adjustment

Due to annual data capture less than 75%, a short to long term data adjustment was applied to the annual mean NO_2 and PM_{10} measurements at Gordon Street; and to annual mean NO_2 at diffusion tube sites Paisley 60, Kibarchan 61 and Cockel's Loan. The adjustment ratios were calculated as presented in Tables A.1 to A.4.

Table A.1: Short-Term to Long-Term Monitoring Data Adjustment – Gordon St, Paisley NO_2

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Edinburgh St Leonards	Urban Background	22.2	26.1	0.849
Glasgow Waulkmillglen Reservoir	Urban Background	11.0	12.6	0.871
			Average ratio (Am/Pm)	**0.860**

Table A.2: Short-Term to Long-Term Monitoring Data Adjustment – Gordon St, Paisley PM_{10}

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Edinburgh St Leonards	Urban Background	13.6	14.0	0.971
Glasgow Waulkmillglen Reservoir	Urban Background	12.0	12.0	1.005
			Average ratio (Am/Pm)	**0.988**

Table A.3: Short-Term to Long-Term Monitoring Data Adjustment – Paisley 60 & Kilbarchan 61 NO_2 diffusion tube sites

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Edinburgh St Leonards	Urban Background	22.2	21.0	1.058
Glasgow Waulkmillglen Reservoir	Urban Background	11.0	8.9	1.233
			Average ratio (Am/Pm)	**1.145**

Table A.4: Short-Term to Long-Term Monitoring Data Adjustment – Renfrew Cockel's Loan NO_2 diffusion tube

Site Name	Site Type	Annual Mean (Am)	Period Mean (Pm)	Ratio (Am/Pm)
Edinburgh St Leonards	Urban Background	22.2	24.1	0.922
Glasgow Waulkmillglen Reservoir	Urban Background	11.0	11.5	0.957
			Average ratio (Am/Pm)	**0.940**

QA/QC of Automatic Monitoring

Ricardo-AEA currently carries out all data checks and ratification on behalf of the Scottish Government for Renfrewshire Council at all of the automatic sites with the exception of the new site at Cockel's Loan. This consists of polling the data on a daily basis; and 6 monthly site audits.

Local site operator (LSO) calibration procedures are conducted at the automatic NOx analysers on a monthly basis. Each NOx analyser carries out an automatic calibration every three days. The automatic calibrations are used by Ricardo-AEA to scale and ratify the data. Renfrewshire Council carries out all filter changes on their TEOM/FDMS analysers.

Table A.2: NO_2 monthly mean measurements measured at diffusion tube sites 2013

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g.m^{-3}$)	Data capture 2013	Requires annualised ?	Bias adjusted annual mean ($\mu g.m^{-3}$) (1.115 adj factor)
Paisley1	41.4	28.5	36.1	26.1	20.2	20.3	2.4	15.3	16	33.4	-	27.1	24.3	92%	No	27.0
Paisley2	22.3	25	26	19.6	13.1	-	-	7	11.8	13.5	26.6	14.3	17.9	83%	No	20.0
Paisley3	23.2	17.7	21	12	7.4	7.8	5.8	2.5	7.4	19.4	19.9	2.1	12.2	100%	No	13.6
Paisley4	30.5	23.8	20.7	16	12.4	12.3	10.8	5.7	11.8	15.3	27.5	17.9	17.1	100%	No	19.0
Johnstone7	47.4	42.4	42.6	32.5	29	31.7	28.2	17.1	25.7	40.4	46.4	28.8	34.4	100%	No	38.3
Renfrew8	-	-	43.2	37.4	45	45.1	45.9	46.9	51.8	52.8	72.1	57.2	48.7	83%	Yes	53.8
Bishopton9	28.8	25.6	24.1	19.3	13.5	15	-	9	7.2	20.5	26	17.2	18.7	92%	No	20.9
Paisley13	25.6	31	30.8	24.8	26	27.2	23.7	16.6	17.6	25.9	36.4	17.9	25.3	100%	No	28.2
Paisley15	52.6	46.5	52.5	39.6	33.9	39	29.4	21.5	24.7	46.5	51.6	32.2	39.2	100%	No	43.7
Renfrew17	63.6	42.6	44.6	44.1	34.6	-	19.5	29.7	31	44.7	46.2	45.5	40.6	92%	No	45.2
Paisley18	53.4	38.5	50.3	36.2	37	35.8	28.7	26.3	26.5	42	64.5	43.3	40.2	100%	No	44.8
Paisley19	44.3	-	39.4	30.4	33.9	29.7	19.4	21.7	-	35.4	48.2	38.2	34.1	83%	No	38.0
Johnstone20	51.1	59.5	37.6	42.1	-	45	33.6	27.7	29.8	47.5	49.7	36	41.8	92%	No	46.6
Paisley 21(1)	46.7	39.6	-	-	-	31.3	-	23	16	42.7	52.7	61.1	0.0	67%	No	43.6
Paisley 21(2)	37.5	35.2	-	-	-	32.1	26.6	19.9	21.5	41.8	46.3	31.1	32.4	75%	No	36.2
Paisley 21(3)	41.6	39.6	-	-	-	32.7	27.6	20.5	23.1	42.9	49.7	37.6	35.0	75%	No	39.1
Renfrew23	49.8	32.1	-	27.1	23	20.5	15.5	13.9	11.9	33.2	43.7	28.2	27.2	92%	No	30.3
Renfrew24	45.5	31.4	30.1	24.6	18.2	18	11.8	9.4	11.1	24.3	36.2	25.4	23.8	100%	No	26.6
Renfrew25	34.8	20.7	22.5	16.4	10.6	12.1	8.7	8.9	9.1	20.1	26.6	17.8	17.4	100%	No	19.4
Bishopton27	23.6	18.5	17.7	10.2	8.3	6.7	6.8	8.1	6.1	13.1	17.4	12.2	12.4	100%	No	13.8
Linwood30	35.4	24.3	30.1	21.3	12.5	16.1	13.1	11	10.7	24.3	29.6	15.4	20.3	100%	No	22.7
West Walkingshaw31	40.3	31.9	31.7	25.9	27.7	32.7	-	-	29.7	30.9	46.9	33.2	33.1	83%	No	36.9
Paisley 33	48.1	43.3	47.7	35.7	45.5	42.1	36.9	29.1	35	41	50.8	38.3	41.1	100%	No	45.9

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean (µg.m^{-3})	Data capture 2013	Requires annualised ?	Bias adjusted annual mean (µg.m^{-3}) (1.115 adj factor)
Paisley 34	60.5	49.9	59.5	48.6	33.7	38.8	35.2	32.5	34.1	51.9	41.2	37	43.6	100%	No	48.6
Paisley 35	48	53.9	45	37.1	38.9	42.8	35.5	35.9	37.4	41.8	59.4	47.7	43.6	100%	No	48.6
Paisley 36	45.1	32.9	45.1	29.4	28.7	35.5		28.7	27.4	40.9	41	37.5	35.7	92%	No	39.8
Paisley 37(1)	47.9	44.4	48.3	45.4	50.2	55.9	43.4	47.6	42.6	47.3	50.2	57.7	48.4	100%	No	54.0
Paisley 37(2)	33.3	37.7	50.4	39.5	48	60.7	45.8	48.3	38.9	50.6	51.4	54.7	46.6	100%	No	52.0
Paisley 37(3)	38.4	44.9	46.2	37.4	47.4	56.8	50.1	41.6	49.9	46.1	64.8	57.8	48.5	100%	No	54.0
Renfrew 38	32.3	36.3	34.9	24.7	18.4	31.2	21.2	25.2	26.3	31.5	45	38.5	30.5	100%	No	34.0
Paisley 39(1)	26.2	27	27.2	20.5	15.5	17.2	16.9	13.2	18.7	17.6	34.5	21	21.3	100%	No	23.7
Paisley 39(2)	-	26.4	23.4	21.2	13.9	16.3	16.4	13.3	17.3	22.1	37.6	25.7	21.2	92%	No	23.7
Paisley 39(3)	-	22.9	19.8	17.4	16.5	17.2	13.6	14.8	17.9	21.6	30.5	19.6	19.3	92%	No	21.5
Renfrew 40	42.5	40.7	35.6	31.6	32.2	26.5	23.6	22.2	29.6	33.4		41.7	32.7	92%	No	36.5
Paisley 41	50.7	45.3	38.9	38	32.4	35.3	32.2	29.1	35.4	39.6	68.5	44.8	40.9	100%	No	45.5
Paisley 42	53.1	28.5	55.8	49.4	32.9	31.7	31.6	21.2	26.2	55	38.9	34.1	38.2	100%	No	42.6
Paisley 43	46.9	36.8	40.6	32.1	33.6	35.4	34.2	28.4	35.1	40	50.4	37	37.5	100%	No	41.9
Paisley 44	110	50.4	32	32.5	21.2	21.1	17.8	16.3	21.1	32.2	38.4	23.8	34.7	100%	No	38.7
Renfrew45	45.5	34.9	33.7	27.1	23.2	25.5	21.9	17.5	36.2	34.1	49.2	23.8	31.1	100%	No	34.6
Renfrew46	34.1	28.5	21.7	17.3	16.5	16.7	12.1	15	23.8	21.2	39.6	24.7	22.6	100%	No	25.2
Renfrew48	60.9	37.5	37.5	32.6	29.6	26.8	27	27.2	17.4	45.1	53	42.6	36.4	100%	No	40.6
Renfrew 49	39.1	36.5	33	30.5	25.2	23.2	21.8	18.9	28.8	34.9	47	36.8	31.3	100%	No	34.9
Paisley 50	34.4	33.4	31.1	22.2	26.5	28.7	23.5	17.5	25.9	33	44.8	38.8	30.0	100%	No	33.4
Linwood51	30	24	25.1	19.3	14	14.2	-	8.8	25.2	25	32.7	19.6	21.6	92%	No	24.1
Renfrew 52	37.6	30.6	33.1	20.4	22.7	25.8	14.3	22.1	16.3	32.6	55.5	39.4	29.2	100%	No	32.6
Inchinnan53	43.7	31.3	30.1	26.2	22.9	17.9	20.7	16.9	25.2	26.4	45.4	38.1	28.7	100%	No	32.0
Kilbarchan 54	41.8	27.3	33.3	32.9	-	21.5	17.6	16.4	24	26	34.1	30.6	27.8	92%	No	31.0

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean (µg.m^{-3})	Data capture 2013	Requires annualised ?	Bias adjusted annual mean (µg.m^{-3}) (1.115 adj factor)
Kilbarchan 55	27.5	17.5	21.3	13	13.2	10	7.8	-	-	19.3	18.3	12.4	16.0	83%	No	17.9
Renfrew 56	-	-	42.8	36.9	34.3	-	-	31.9	32.1	39.2	58.2	43.6	39.3	75%	No	43.9
Renfrew 57	-	-	41.7	30.8	27.8	28.6	18.8	16.9	23.4	31.7	2.1	-	24.6	75%	No	27.5
Renfrew 58	-	-	31.5	21.2	21.1	19.6	19.3	14.1	19.8	25.9	34.6	23.7	23.1	83%	No	25.7
Johnstone 59	-	-	-	57.7	53.2	61.7	45.9	40.3	54.8	58.2	80.5	65.4	57.5	75%	No	64.1
Paisley 60	-	-	-	-	32.1	36.9	-	31	32.3	47.5	65.3	41.1	46.8	58%	Yes	52.2
Kilbarchan 61	-	-	-	-	25.1	39.7	-	24.6	29.9	43.8	55	42.1	42.6	58%	Yes	47.5
Cockels Loan 62 (1)	-	-	-	-	-	-	-	-	-	52	63.5	58.5	54.5	25%	Yes	60.8
Cockels Loan 62 (2)	-	-	-	-	-	-	-	-	-	48.5	69.8	49	52.4	25%	Yes	58.4
Cockels Loan 62 (3)	-	-	-	-	-	-	-	-	-	52.5	77.2	50.7	56.5	25%	Yes	63.0