2015 Updating and Screening Assessment for Renfrewshire Council

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

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Local Authority Officer	Karen McIndoe Environmental Health Officer
Department	Community Resources
Address	Renfrewshire Council Renfrewshire House Cotton Street Paisley PA1 1BR
Telephone	0141 618 7572
e-mail	karen.mcindoe@renfrewshire.gov.uk
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Executive Summary

A review of pollutant monitoring data and atmospheric emissions sources within Renfrewshire Council was undertaken. The assessment compared the available monitoring data to national air quality standards and followed the guidance in LAQM.TG (09) Technical Guidance.

Annual mean nitrogen dioxide (NO_2) concentrations recorded at all automatic monitoring sites in 2014 were below the annual mean objective level.

There were no exceedances of the NO_2 hourly mean at Glasgow Airport, Gordon St or Cockels Loan automatic monitoring sites.

Exceedances of the NO_2 annual mean objective (after distance correction) were measured at the following diffusion tube monitoring locations within the existing Paisley Town Centre (PTC) Air Quality Management Area (AQMA):

- Paisley 18 – Incle St
- Paisley 21 - Causeyside St (triplicate tubes at automatic monitor)
- Paisley 33 - 76 Causeyside St
- Paisley 35 - Old Sneddon St
- Paisley 43 - Smithhills St (East)

Exceedances of the annual mean objective outside of the AQMA (after distance correction) were measured at the following diffusion tube, monitoring locations:

- Renfrew 8 - Inchinnan Rd
- Renfrew 17 - Tanar Way
- Renfrew 62 - Cockels Loan (triplicate tubes at automatic monitor
- Renfrew 69 - Inchinnan Rd
- Johnstone 20 - High St
- Johnstone 59 – High St
- Paisley 31 - West Walkinshaw Farm

Detailed Assessments are currently being undertaken by the Council at these locations with the exception of West Walkinshaw. These reports will be submitted to the Scottish Government once completed. The NO_2 annual mean concentration measured at diffusion tube Renfrew 8 (62.0 $\mu g.m^{-3}$) located at Inchinnan Road, Renfrew during 2014 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.

Annual mean PM_{10} concentrations recorded at all automatic monitoring sites were below the annual mean objectives in 2014 except at the Gordon Street site where a PM_{10} annual mean of 21.2$\mu g.m^{-3}$ has been measured. However data capture for PM_{10} at this site was only 42% and so the result should be considered in this context. This automatic site is located within the Paisley AQMA boundaries. No exceedances of the PM_{10} short-term objective have been recorded in 2014 at any of the automatic site locations.

Data were gathered from various national and local sources with regards to atmospheric emissions from: road traffic; rail; aircraft; shipping; industrial processes; intensive farming operations; domestic properties; biomass plants; and dusty processes. The screening methods outlined in the technical guidance were used to determine the likelihood that a particular source would result in an exceedance of national air quality standards.

The review of new and changed emission sources identified no new sources that were likely to result in an exceedance of the NAQS objectives and that there is no requirement to proceed to a Detailed Assessment for any pollutant contained within the NAQS.

The next LAQM requirements for Renfrewshire Council are:

- Submission of the Detailed Assessments for Renfrew and High Street, Johnstone which are nearing completion.
- Proceed to a Detailed Assessment for the annual mean NO_2 objective at West Walkingshaw Farm, Paisley.
- Proceed to a Detailed Assessment for the 1 hour NO_2 objective at Inchinnan Road, Renfrew.
- Submission of 2016 Progress Report

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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 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 exceedances 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.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

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 μg/m^3 (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 μg/m^3	Running annual mean	31.12.2003
	3.25 μg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m^3	Annual mean	31.12.2005

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Particles (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/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.

Report Title	Date Completed	Conclusions
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.
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

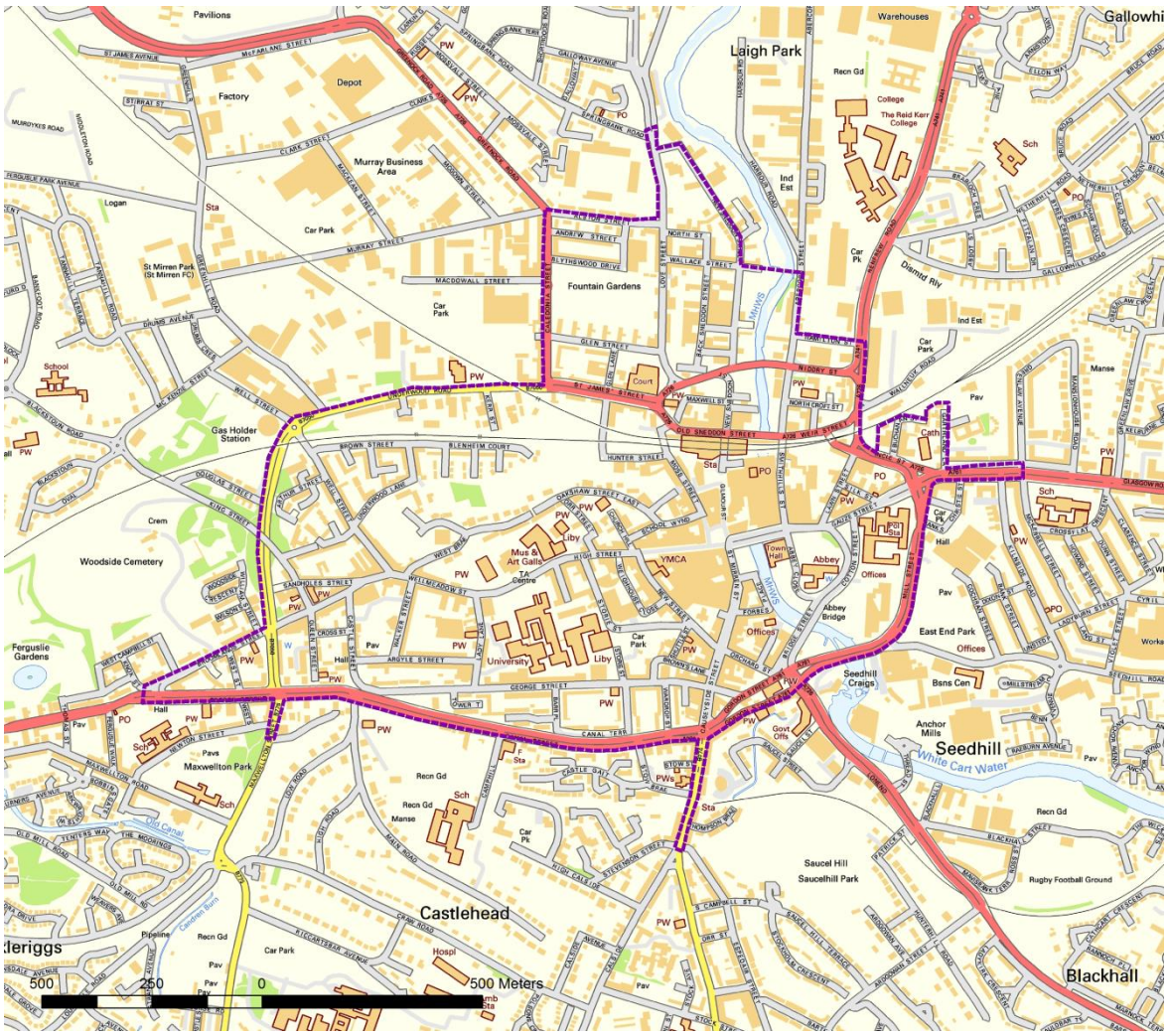
Report Title	Date Completed	Conclusions
		annual mean objective occurring at residential properties at ground floor level on Paisley Road. It was recommended that additional monitoring is conducted.
Progress Report 2013	April 2013	Analysis of the 2012 monitoring data did not identify any requirement 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.
Progress Report 2014	April 2014	Based on annual mean NO_2 concentrations measured during 2013, a requirement to proceed to a Detailed Assessment at High Street Johnstone has been identified. An update of the previous Detailed Assessment from 2009 for Tanar Way and Glen Sax Drive Renfrew area including Montgomery Drive, Paisley is also required. No new local developments have been identified that require a Detailed Assessment to be conducted and some have been noted for further consideration in the 2015 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



N	Legend: AQMA Boundary	RICARDO-AEA Contains Ordnance Survey data © Crown copyright and database right 2014

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

In 2014, five automatic monitoring sites were operational within the Renfrewshire Council area. These sites comprise of four NOx/NO_2 analysers and three FDMS-TEOM PM_{10} analysers. Central Road, Paisley site ceased operation in August 2014 as the location is considered no longer representative of exposure.

All of 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 Appendix B and in Table 2.1.

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-TEOM	Y	Y (0m)	4m	Y
Cockels Loan	Roadside	250463	665934	NO_2, PM_{10}	Chemiluminescence/ FDMS-TEOM	N	Y (0m)	18m	Y

Note: Central Road no longer has bus stops in operation, therefore there is no longer relevant public exposure at this site.

2.1.2 Non-Automatic Monitoring Sites

During 2014 Renfrewshire Council measured NO_2 concentrations across a network of 58 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 in Appendix B.

Monitoring commenced at the following sites in September 2014.

- Paisley 63 – Renfrew Road, Paisley
- Paisley 64 – Montgomery Road, Paisley
- Kilbarchan 65 – High Barholm, Kilbarchan
- Kilbarchan 66 – High Barholm, Kilbarchan
- Kilbarchan 67 – High Barholm, Kilbarchan
- Renfrew 68 – Paisley Road, Renfrew
- Renfrew 69 – Inchinnan Road, Renfrew
- Renfrew 70 – Inchinnan Road, Renfrew
- Renfrew 71 – Braille Crescent, Renfrew

A bias adjustment factor of 1.06 was derived from the local co-location study and 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	2.7m	N	68m	N
2	Oakshaw Street, Paisley	Urban Background	247925	664052	NO_2	Y	N	2.4m	Y(11m)	35m	Y
3	Lochfield Drive, Paisley	Urban Background	249004	662142	NO_2	N	N	2.4m	Y(8m)	1.5m	Y
4	Regent Street, Paisley	Urban Background	249665	664364	NO_2	N	N	2.7m	Y(9m)	2m	Y
7	High Street, Johnstone	Kerbside	242914	663198	NO_2	N	N	2.6m	Y (1.6m)	0m	Y
8	15 Inchinnan Road, Renfrew	Kerbside	250589	667547	NO_2	N	N	2.4m	Y (0.1m)	2.6m	Y
9	Station Road, Bishopton	Roadside	243975	670545	NO_2	N	N	2.4m	Y (13m)	3m	Y
13	Greenock Road, Paisley	Urban Background	247371	665674	NO_2	N	N	0.9m	Y (-12m)	23m (M8)	Y
15	Montgomery Drive, Paisley	Urban Background	249185	665713	NO_2	N	N	2.5m	Y (4.3m)	1.6m	Y
17	Tanar Way, Renfrew	Roadside	251524	666287	NO_2	N	N	2.3m	Y (6m)	28m	Y
18	Incle Street, Paisley	Roadside	248646	664208	NO_2	Y	N	2.7m	Y (1.5m)	5.5m	Y
19	Linwood Road, Paisley	Roadside	245701	663604	NO_2	N	N	2.5m	Y (5m)	2.5m	Y
20	High Street, Johnstone	Kerbside	242665	663290	NO_2	N	N	2.5m	Y (1.6m)	0.1m	Y
21	Causeyside Street, Paisley (Triplicate)	Roadside	248316	663612	NO_2	Y	Y	2.3m	Y (-6.3m)	9.9m	Y
23	Hillington Road, Renfrew	Roadside	251869	666628	NO_2	N	N	2.1m	Y (12m)	7m	Y
24	Glasgow Road, Renfrew	Roadside	251687	666788	NO_2	N	N	2.5m	Y (9m)	16m	Y
25	French Street, Renfrew	Urban Industrial	249700	666861	NO_2	N	N	2.5m	Y (6m)	3m	Y
27	Rossland Gardens, Bishopton	Suburban	243183	671188	NO_2	N	N	2.5m	Y (6m)	2m	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?
30	Kintyre Avenue, Linwood	Urban Background	243302	663998	NO_2	N	N	2.4m	Y (17m)	10m	Y
31	West Walkinshaw	Roadside	246188	666141	NO_2	N	N	2.2m	Y (-14m)	17m (M8)	Y
33	76 Causeyside Street, Paisley	Roadside	248277	663524	NO_2	Y	N	2.8m	Y (1.1m)	2.9m	Y
34	63 Causeyside Street, Paisley	Roadside	248303	663566	NO_2	Y	N	2.7m	Y (3m)	0.7m	Y
35	Old Sneddon Street, Paisley	Roadside	248360	664272	NO_2	Y	N	2.7m	Y (0.4m)	3.4m	Y
36	Caledonia Street, Paisley	Roadside	247948	664774	NO_2	Y	N	2.5m	Y (4.5m)	3.3m	Y
37	Central Road, Monitoring Station, Paisley (Triplicate)	Roadside	248438	664192	NO_2	Y	Y	3m	Y (43m)	1.5m	Y
38	99 Paisley Road, Renfrew	Roadside	250108	666856	NO_2	N	N	2.5m	Y (0.6m)	2.7m	Y
39	Glasgow Airport, Paisley (Triplicate)	Special	248293	666542	NO_2	N	Y	1.8m	N/A (Hotel approx. 600m)	45m	N
40	Hairst Street, Renfrew	Roadside	250763	667631	NO_2	N	N	2.5m	Y (0.25m)	6.2m	Y
41	Smithhills Street (West), Paisley	Roadside	248463	664175	NO_2	Y	N	2.7m	Y (16m)	5m	Y
42	Central Road (West), Paisley	Roadside	248371	664187	NO_2	Y	N	2.6m	Y (50m)	1.5m	N
43	Smithhills Street (East), Paisley	Roadside	248481	664153	NO_2	Y	N	2.5m	Y (0m)	2.5m	Y
44	Love Street, Paisley	Roadside	248209	664474	NO_2	Y	N	2.5m	Y (0.2m)	2.2m	Y
45	Xscape, Renfrew	Kerbside	251803	667365	NO_2	N	N	2.5m	Y (18m)	2m	Y
46	Ferry Village, Renfrew	Kerbside	251803	667365	NO_2	N	N	2.4m	Y (17m)	0.5m	Y
48	Glen Sax Drive, Renfrew	Roadside	251264	666217	NO_2	N	N	2.6m	Y (-9m)	45m	Y
49	Tanar Way 2, Renfrew	Roadside	251462	666326	NO_2	N	N	2.6m	Y (9m)	85m	N
50	Renfrew Road, Paisley	Roadside	248985	665494	NO_2	N	N	2.5m	Y (7m)	12m	Y
51	Kintyre Avenue 2, Linwood	Roadside	243344	663960	NO_2	N	N	2.4m	Y (5m)	31m	N

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?
52	Glasgow Road 2, Renfrew	Roadside	251515	666955	NO_2	N	N	2.3m	Y (4m)	3m	Y
53	Old Greenock Rd, Inchinnan	Roadside	248154	668832	NO_2	N	N	2.4m	Y (9m)	1.5m	Y
54	Easwald Bank, Kilbarchan	Roadside	241059	662743	NO_2	N	N	2.4m	Y (4.5m)	1.2m	Y
55	New Street, Kilbarchan	Roadside	240331	663404	NO_2	N	N	2.3m	Y (6m)	2.5m	Y
56	Paisley Road, Renfrew	Roadside	250579	667488	NO_2	N	N	2.4m	Y (3.5m)	4.5m	Y
57	Paisley Road, Renfrew	Roadside	250597	667473	NO_2	N	N	2.4m	Y (1.2m)	6m	Y
58	Glebe Street, Renfrew	Roadside	250667	667448	NO_2	N	N	2.3m	Y (4.5m)	2.8m	Y
59	High Street, Johnstone	Roadside	242656	663281	NO_2	N	N	2.5m	Y (0.1m)	1.7m	Y
60	Underwood Rd, Paisley	Roadside	247525	664326	NO_2	Y	N	2.4m	Y (7.8m)	0.5m	Y
61	High Barholm, Kilbarchan	Roadside	240584	663007	NO_2	N	N	2.4m	Y (0.1m)	1.1m	Y
62	Cockels Loan, Renfrew	Roadside	250463	665934	NO_2	N	Y	3m	Y (5m)	18m	Y
63	Renfrew Road, Paisley	Roadside	249159	665710	NO_2	N	N	2.4m	Y (6.8m)	3.7m	Y
64	Montgomery Road, Paisley	Roadside	249202	665708	NO_2	N	N	2.45m	Y (8.8m)	0.15 m	Y
65	High Barholm, Kilbarchan	Roadside	240599	663000	NO_2	N	N	2.2m	Y (0.4m)	2m	Y
66	High Barholm, Kilbarchan	Roadside	240573	663021	NO_2	N	N	2.2m	Y (0.4m)	1.6m	Y
67	High Barholm, Kilbarchan	Roadside	240512	663027	NO_2	N	N	2.3m	Y (1.8m)	3 m	Y
68	Paisley Road, Renfrew	Roadside	250522	667419	NO_2	N	N	2.3m	Y (0.2m)	3m	Y
69	Inchinnan Road, Renfrew	Roadside	250537	667602	NO_2	N	N	2m	Y (0.1m)	2.9m	Y
70	Inchinnan Road, Renfrew	Roadside	250599	667561	NO_2	N	N	2m	Y (4.5m)	3.7m	Y
71	Braille Crescent, Renfrew	Roadside	251729	666360	NO_2	N	N	2m	Y (5m)	25m (M8)	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

The annual mean NO_2 concentrations measured at the automatic monitoring locations within the Renfrewshire Council area from 2007 to 2014 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 2014 (%)	Annual mean concentrations ($\mu g.m^{-3}$)							
			2007	2008	2009	2010	2011	2012	2013	2014
Central Road, Paisley	Y	56%	**92**	**87**	**88**	**51.9** *	**57**	**51**	**61**	- 31**
Glasgow Airport	N	89.1%	-	25	25	28	23	22	20	22
Gordon Street, Paisley	Y	85.1%	35	36	34	**42**	**43***	38	34*	28
Cockels Loan	N	99.5%	-	-	-	-	-	-	-	34

* Annual mean calculated using short-term to long-term adjustment as data capture < 75%
** Central Road, Paisley site was closed in August 2014

The NO_2 annual mean measured at all automatic sites in 2014 were below the annual mean objective level. At Gordon Street, the measured NO_2 annual mean was significantly below the objective compared to previous years.

* Central Road, Paisley site was closed in August 2014

Figure 2.1. The chart indicates that measured NO_2 annual mean concentrations have in general decreased at Paisley Gordon Street but have fluctuated with no clear trend at Paisley Central Road and stayed relatively stable at Glasgow Airport over recent 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. There were no exceedances of the NO_2 hourly mean at Glasgow Airport, Gordon St or Cockels Loan automatic monitoring sites in 2014. Although 17 exceedances were measured at Central Rd Paisley this site is no longer considered to be in an area of relevant exposure.

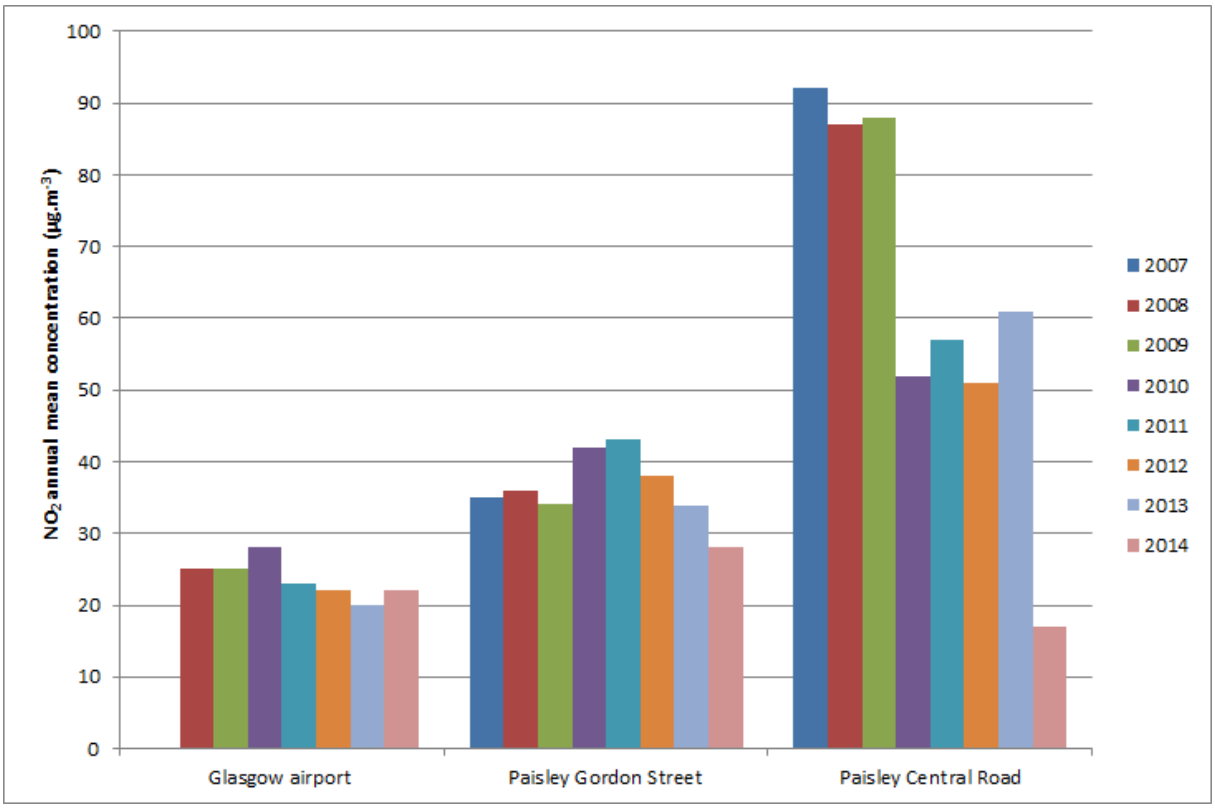
Table 2.4: NO_2 automatic monitoring results: Comparison with 1-hour mean objective

Site name	Within AQMA?	Data Capture 2014 (%)	Number of exceedances of hourly mean objective (200 $\mu g.m^{-3}$) 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	2014
Central Road, Paisley	Y	56%	**715**	**760**	**43***	2	**37**	**214**	17 (210)-*
Glasgow Airport	N	89.1%	1	0	9	0	0	0	0

Site name	Within AQMA?	Data Capture 2014 (%)	Number of exceedances 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	2014
Gordon Street, Paisley	Y	85.1%	0	1	**47**	1(149)	9	**46** (304)	0
Cockels Loan		99.5%	-	-	-	-	-	-	0

* Central Road, Paisley site was closed in August 2014

Figure 2.1: Trends in measured annual mean NO_2 concentrations (2007 – 2014)



Diffusion Tube Monitoring Data

Details of the annual mean NO_2 concentrations measured using diffusion tube sites during 2014 are presented in Table 2.5 and the series of results measured from 2008 to 2014 are presented in Table 2.6. Full details regarding the choice of bias adjustment factor used is presented in Appendix A.

Short-term to long-term adjustment calculations were required at 16 locations with data capture < 75%. This is due to the new diffusion tube sites installed in September 2014.

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.

Table 2.5: NO_2 diffusion tubes results 2014

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2014 (µg.m^{-3}) (Bias Adj. factor = 1.06)
Paisley 1	Gilmour Street, Paisley	Urban Centre	Y	N	83%	n/a	N	29.4
Paisley 2	Oakshaw Street, Paisley	Urban Background	Y	N	92%	n/a	N	17.8
Paisley 3	Lochfield Drive, Paisley	Urban Background	N	N	92%	n/a	N	12.4
Paisley 4	Regent Street, Paisley	Urban Background	N	N	92%	n/a	N	18.0
Johnstone 7	High Street, Johnstone	Kerbside	N	N	92%	n/a	N	36.7
Renfrew 8	Inchinnan Road, Renfrew	Kerbside	N	N	83%	n/a	Y	**62.0 (61.6)**
Bishopton 9	Station Road, Bishopton	Roadside	N	N	92%	n/a	N	19.2
Paisley 13	Greenock Road, Paisley	Roadside	N	N	92%	n/a	N	27.9 (30.6)
Paisley 15	Montgomery Drive, Paisley	Roadside	N	N	92%	n/a	Y	**41.2** (36.2)
Renfrew 17	Tanar Way, Renfrew	Roadside	N	N	92%	n/a	Y	**40.0 (42.1)**
Paisley 18	Incle Street, Paisley	Roadside	Y	N	92%	n/a	Y	**47.9 (45.8)**
Paisley 19	Linwood Road, Paisley	Roadside	N	N	92%	n/a	N	34.8
Johnstone 20	High Street, Johnstone	Kerbside	N	N	92%	n/a	Y	**45.2**
Paisley 21	Causeyside Street, Paisley	Roadside	Y	Triplicate	83%	n/a	N	39.4 **(48.1)**
Renfrew 23	Hillington Road, Renfrew	Roadside	N	N	92%	n/a	N	35.0
Renfrew 24	Glasgow Road, Renfrew	Roadside	N	N	50%	Yes	N	26.3
Renfrew 25	French Street, Renfrew	Urban Industrial	N	N	58%	Yes	N	19.2
Bishopton 27	Rossland Gardens, Bishopton	Suburban	N	N	92%	n/a	N	12.3
Linwood 30	Kintyre Avenue, Linwood	Urban Background	N	N	58%	Yes	N	22.5
Paisley 31 West Walkinshaw Farm	West Walkingshaw	Roadside	N	N	83%	n/a	N	33.1 **(44.6)**
Paisley 33	76 Causeyside Street, Paisley	Roadside	Y	N	92%	n/a	Y	**42.0 (40.0)**
Paisley 34	63 Causeyside Street, Paisley	Roadside	Y	N	83%	n/a	Y	**46.5** (36.9)
Paisley 35	Old Sneddon Street, Paisley	Roadside	Y	N	92%	n/a	Y	**47.3 (46.5)**

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2014 (µg.m^{-3}) (Bias Adj. factor = 1.06)
Paisley 36	49 Caledonia Street, Paisley	Roadside	Y	N	92%	n/a	N	38.7
Paisley 37	Central Road Monitoring Station	Roadside	Y	Triplicate	58%	Yes	N	32.1
Renfrew 38	99 Paisley Road, Renfrew	Roadside	N	N	92%	n/a	N	32.3
Paisley 39	Glasgow Airport, Paisley	Special	N	Triplicate	92%	n/a	N	21.3
Renfrew 40	Hairst Street, Renfrew	Roadside	N	N	92%	n/a	N	38.5
Paisley 41	Smithhills Street (west), Paisley	Roadside	Y	N	92%	n/a	Y	**48.8** (36.5)
Paisley 42	Central Road (west), Paisley	Roadside	Y	N	92%	n/a	N	29.1
Paisley 43	Smithhills Street (east), Paisley	Roadside	Y	N	92%	n/a	Y	**41.9 (41.9)**
Paisley 44	Love Street, Paisley	Roadside	Y	N	92%	n/a	N	29.5
Renfrew 45	Xscape, Renfew	Kerbside	N	N	92%	n/a	N	30.2
Renfrew 46	Ferry Village, Renfrew	Kerbside	N	N	58%	Yes	N	23.0
Renfrew 48	Glen sax Drive, Renfrew	Roadside	N	N	92%	n/a	N	35.2 (38.3)
Renfrew 49	Tanar Way 2, Renfrew	Roadside	N	N	92%	n/a	N	34.2
Paisley 50	Renfrew Road, Paisley	Roadside	N	N	92%	n/a	N	32.9
Linwood 51	Kintyre Avenue 2, Linwood	Roadside	N	N	58%	Yes	N	22.3
Renfrew 52	Glasgow Road 2, Renfrew	Roadside	N	N	92%	n/a	N	34.3
Inchinnan 53	Old Greenock Rd, Inchinnan	Roadside	N	N	83%	n/a	N	28.1
Kilbarchan 54	Easwald Bank, Kilbarchan	Roadside	N	N	75%	n/a	N	29.9
Kilbarchan 55	New Street, Kilbarchan	Roadside	N	N	50%	Yes	N	14.7
Renfrew 56	Paisley Road, Renfrew	Roadside	N	N	92%	n/a	N	39.3
Renfrew 57	Paisley Road, Renfrew	Roadside	N	N	75%	n/a	N	39.3
Renfrew 58	Glebe Street, Renfrew	Roadside	N	N	83%	n/a	N	26.5

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (%)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration 2014 (µg.m^{-3}) (Bias Adj. factor = 1.06)
Johnstone 59	High Street, Johnstone	Roadside	N	N	92%	n/a	Y	**57.0 (56.4)**
Paisley 60	Underwood Rd, Paisley	Roadside	Y	N	92%	n/a	Y	**42.2** (28.9)
Kilbarchan 61	High Barholm, Kilbarchan	Roadside	N	N	92%	n/a	Y	**40.3** (39.7)
Cockels Loan 62	Cockels Loan, Renfrew	Roadside	N	Y	92%	n/a	Y	**46.4 (43.4)**
Paisley 63	Renfrew Road, Paisley	Roadside	N	N	25%	Yes	Y	**40.1** (35.5)
Paisley 64	Montgomery Road, Paisley	Roadside	N	N	33%	Yes	N	32.3
Kilbarchan 65	High Barholm, Kilbarchan	Roadside	N	N	33%	Yes	N	37.7
Kilbarchan 66	High Barholm, Kilbarchan	Roadside	N	N	33%	Yes	N	21.5
Kilbarchan 67	High Barholm, Kilbarchan	Roadside	N	N	33%	Yes	N	19.1
Renfrew 68	Paisley Road, Renfrew	Roadside	N	N	25%	Yes	N	33.8
Renfrew 69	Inchinnan Road, Renfrew	Roadside	N	N	33%	Yes	Y	**44.3 (44.1)**
Renfrew 70	Inchinnan Road, Renfrew	Roadside	N	N	25%	Yes	N	32.0
Renfrew 71	Braille Crescent, Renfrew	Roadside	N	N	33%	Yes	N	38.5

NO_2 annual means in excess of the 40µg.m^{-3} objective are highlighted in bold. Distance corrected NO_2 annual means predicted at nearest relevant exposure are shown in brackets. Those sites that are still exceeding following distance correction are shaded in rose.

Table 2.6: Results of NO_2 Diffusion Tubes (2008 to 2014)

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)	2014 (Bias Adj. Factor = 1.06)
Paisley 1	Urban Centre	Y	27.1	25.4	30.4	32.6	28.7	27.0	29.4
Paisley 2	Urban Background	Y	18	17.7	23.4	19.1	21.0	20.0	17.8
Paisley 3	Urban Background	N	13	13.3	17.7	14.7	13.5	13.6	12.4
Paisley 4	Urban Background	N	16.1	18.7	24.1	20.5	21.8	19.0	18.0
Johnstone 7	Kerbside	N	34.3	30.8	**40.4**	33.4	37.4	38.3	36.7
Renfrew 8	Kerbside	N	37.9	**43.4**	**42.6**	**54.4**	**48.8** ?	**53.8 (53.8)**	**62.0 (61.6)**
Bishopton 9	Roadside	N	13.7	15.3	16.6	22	19.1	20.9	19.2
Paisley 13	Roadside	N	26	25.4	32.4	28.5	30.3	28.2	27.9 (30.6)
Paisley 15	Roadside	N	37.5	32.7	39.1	35.7	38.5	**43.7 (42.1)**	**41.2** (36.2)
Renfrew 17	Roadside	N	38.6	39.7	**42.4**	**41.9**	37.3	**45.2 (42.6)**	**40.0 (42.1)**
Paisley 18	Roadside	Y	**49.2**	**44**	**51.8**	**49.7**	**48.5 (41.7)**	**44.8** (35.4)	**47.9 (45.8)**
Paisley 19	Roadside	N	31.7	30.3	36.1	34.2	36.1	38.0	34.8
Johnstone 20	Kerbside	N	34.5	36.1	**46.8**	**43.2**	**44.4** (33.2)	**46.6** (34.3)	**45.2**
Paisley 21	Roadside	Y	39.4	37.6	**41.8**	**40.7**	38.6	37.7	39.4 **(48.1)**
Renfrew 23	Roadside	N	31.6	30.2	35.2	35.5	29.5	30.3	35.0
Renfrew 24	Roadside	N	24.2	24	30.5	26.9	26.7	26.6	26.3
Renfrew 25	Urban Industrial	N	17.4	16.5	22.2	19.4	19.2	19.4	19.2
Bishopton 27	Suburban	N	11.2	11	15.9	13.3	9.1	13.8	12.3
Linwood 30	Urban Background	N	17.8	19.3	24.1	22.2	20.2	22.7	22.5
West Walkingshaw 31	Roadside	N	28	25.9	28.4	34.9	29.9	36.9	33.1 **(44.6)**
Paisley 33	Roadside	Y	**44.4**	**41.4**	**50.7**	**46**	**42.5 (41.7)**	**45.9 (44.9)**	**42.0 (40.0)**
Paisley 34	Roadside	Y	**44.7**	**41.7**	**48**	**49.7**	**45.4** (34.5)	**48.6** (35.8)	**46.5** (36.9)
Paisley 35	Roadside	Y	**49.9**	**42.9**	**50.9**	**51.1**	**45.3 (45.3)**	**48.6 (48.6)**	**47.3 (46.5)**
Paisley 36	Roadside	Y	34.5	30.4	34.8	35.7	**40.5 (40.5)**	39.8	38.7
Paisley 37	Roadside	Y	**68**	**60.9**	**43.6**	**46.2**	39.9	**53.3**	32.1
Renfrew 38	Roadside	N	37.5	34.2	34.8	31.1	27.0	34	32.3

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)	2014 (Bias Adj. Factor = 1.06)
Paisley 39	Special	N	22.6	21.9	26.3	24	22.8	23	21.3
Renfrew 40	Roadside	N	-	-	-	**47.2**	**45.5** (26.2)	36.5	38.5
Paisley 41	Roadside	Y	-	-	-	**48.9**	**45.4** (38.3)	**45.5**	**48.8** (36.5)
Paisley 42	Roadside	Y	**46.2**	**42.7**	**44.5**	**43.1**	37.3	**42.6**	29.1
Paisley 43	Roadside	Y	**48.7**	**42.1**	**42.9**	**43.9**	39.1	**41.9**	**41.9 (41.9)**
Paisley 44	Roadside	Y	32	**45.8**	38.6	37.8	**46.4 (46.4)**	38.7	29.5
Renfrew 45	Kerbside	N	33.7	28.2	35.1	31.9	33.8	34.6	30.2
Renfrew 46	Kerbside	N	20.6	24.3	30.8	23.6	26.4	25.2	23.0
Renfrew 48	Roadside	N		27.3	38	**40.6**	35.7	**40.6 (47.3)**	35.2 (38.3)
Renfrew 49	Roadside	N	-	32.2	36	36.5	33.6	34.9	34.2
Paisley 50	Roadside	N	-	29.1	34	34.1	34.9	33.4	32.9
Linwood 51	Roadside	N	-	25.4	25.8	26	23.2	24.1	22.3
Renfrew 52	Roadside	N	-	33.5	35.7	38	35.8	32.6	34.3
Inchinnan53	Roadside	N	-	-	-	-	-	32.0	28.1
Kilbarchan 54	Roadside	N	-	-	-	-	-	31.0	29.9
Kilbarchan 55	Roadside	N	-	-	-	-	-	17.9	14.7
Renfrew 56	Roadside	N	-	-	-	-	-	**43.9** (39.5)	39.3
Renfrew 57	Roadside	N	-	-	-	-	-	27.5	39.3
Renfrew 58	Roadside	N	-	-	-	-	-	25.7	26.5
Johnstone 59	Roadside	N	-	-	-	-	-	**64.1 (64.1)**	**57.0 (56.4)**
Paisley 60	Roadside	N	-	-	-	-	-	**52.2** (31.1)	**42.2** (28.9)
Kilbarchan 61	Roadside	N	-	-	-	-	-	**47.5 (47.5)**	**40.3** (39.7)
Cockels Loan 62	Roadside	N	-	-	-	-	-	**60.8(60.8)**	**46.4 (43.4)**
Paisley 63	Roadside	N	-	-	-	-	-	-	**40.1** (35.5)
Paisley 64	Roadside	N	-	-	-	-	-	-	32.3
Kilbarchan 65	Roadside	N	-	-	-	-	-	-	37.7
Kilbarchan 66	Roadside	N	-	-	-	-	-	-	21.5

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)	2014 (Bias Adj. Factor = 1.06)
Kilbarchan 67	Roadside	N	-	-	-	-	-	-	19.1
Renfrew 68	Roadside	N	-	-	-	-	-	-	33.8
Renfrew 69	Roadside	N	-	-	-	-	-	-	**44.3 (44.0)**
Renfrew 70	Roadside	N	-	-	-	-	-	-	32.0
Renfrew 71	Roadside	N	-	-	-	-	-	-	38.5

NO_2 annual means in excess of the 40μg.m^{-3} objective are highlighted in bold. Distance corrected NO_2 annual means predicted at nearest relevant exposure are shown in brackets. Those sites that are still exceeding following distance correction are shaded in rose.

Figure 2.17 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites - 1

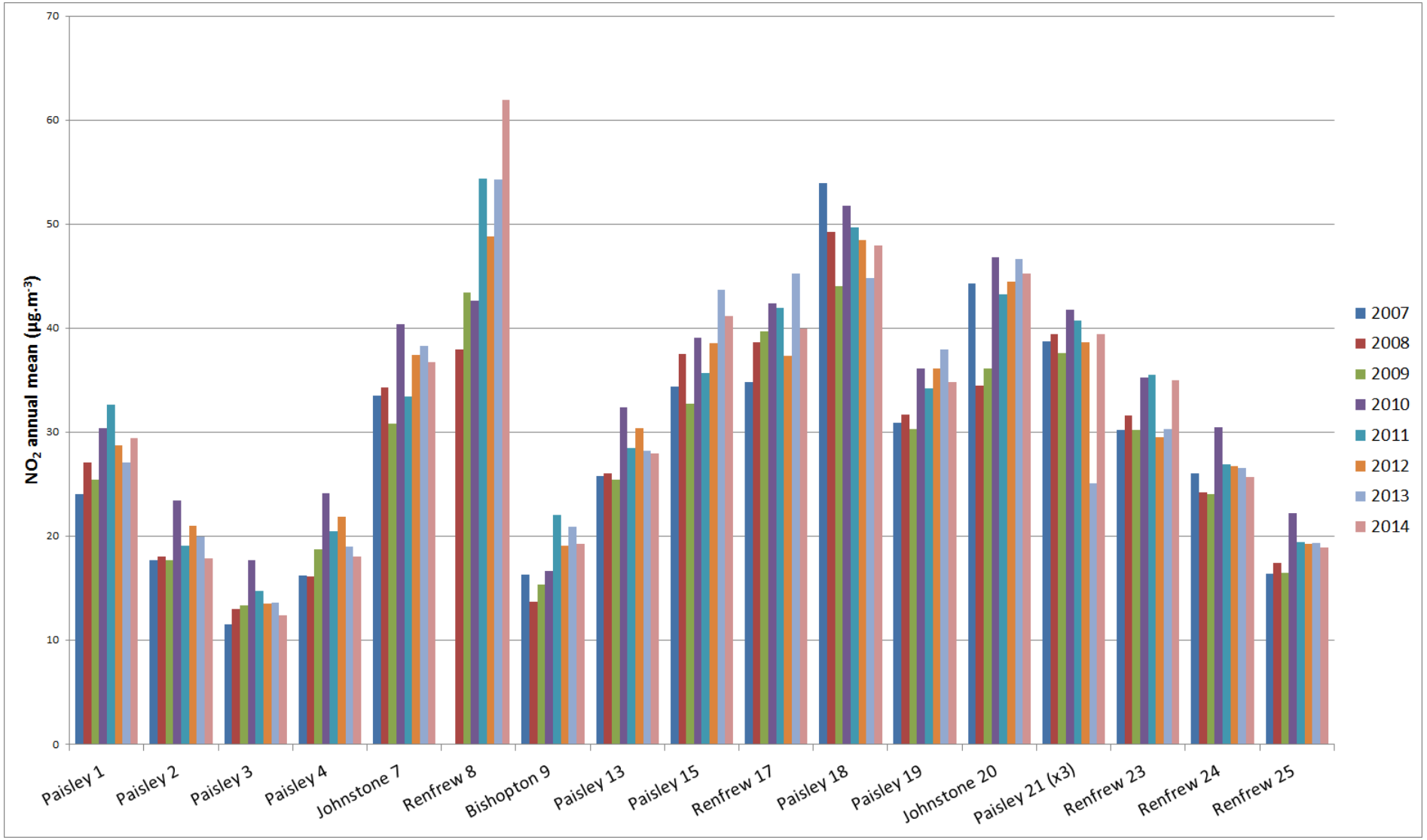


Figure 2.18 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites - 2

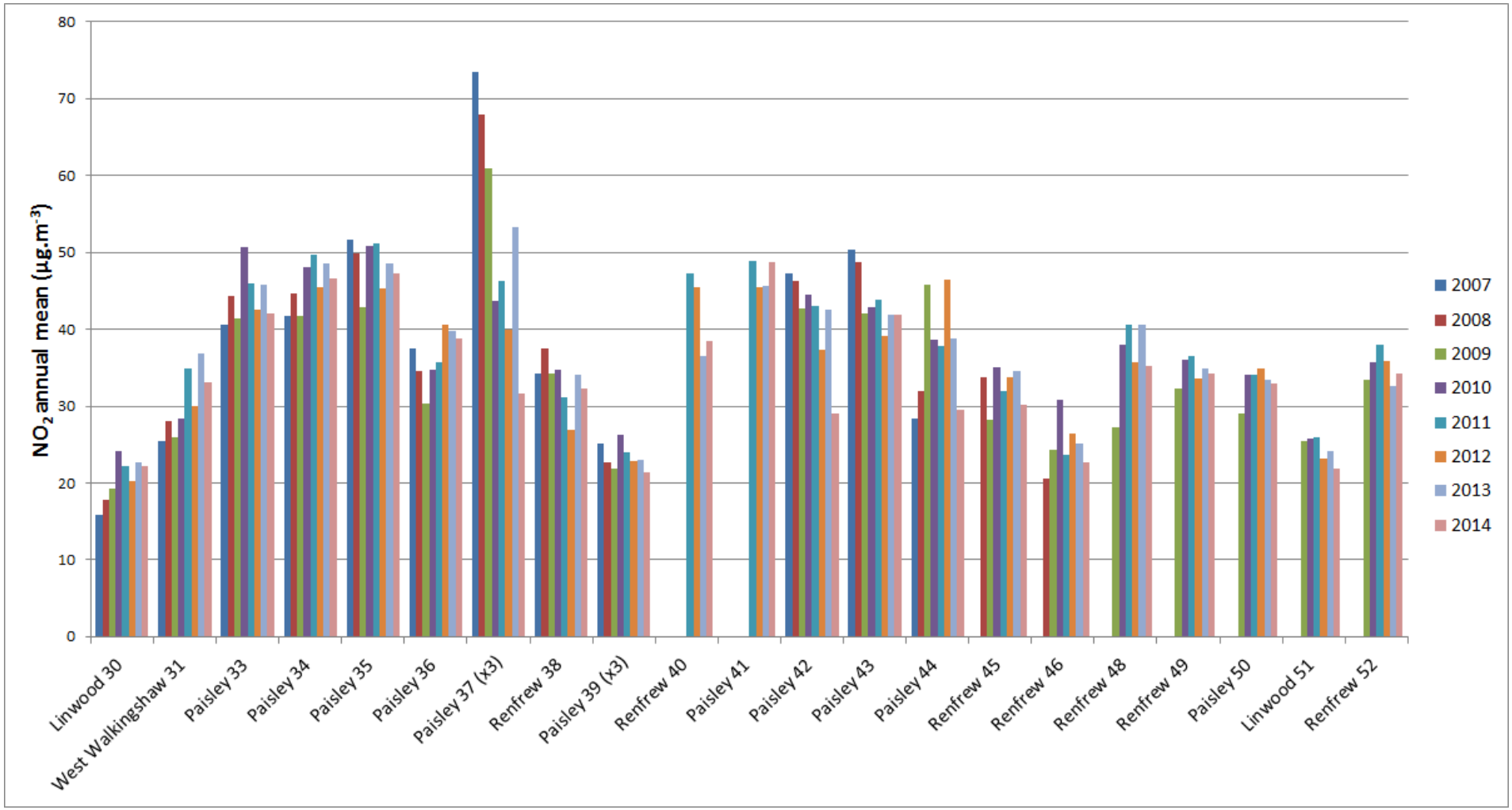
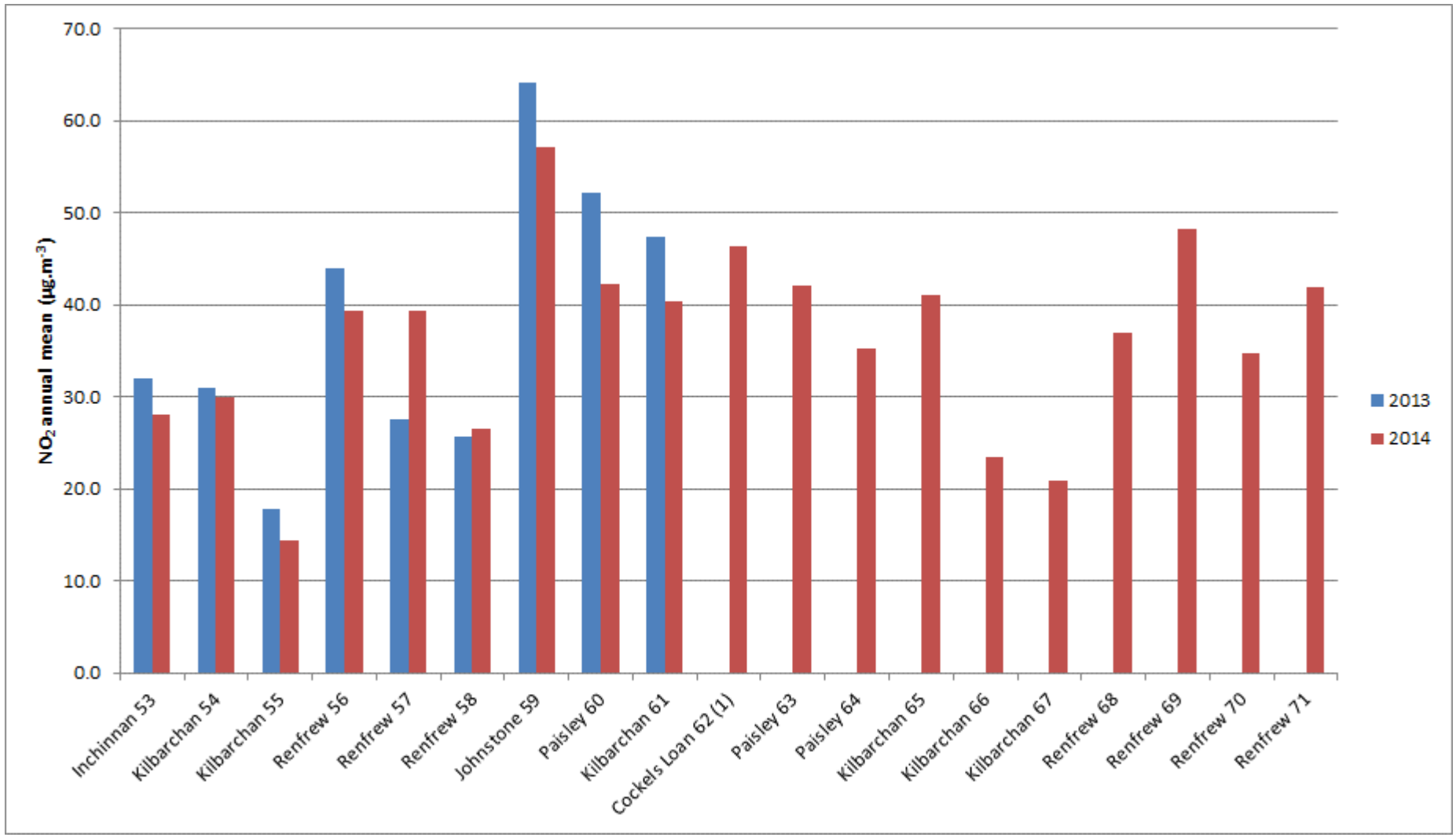


Figure 2.19 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites – 3



2.2.2 PM_{10}

The annual mean PM_{10} concentrations measured at the continuous monitors from 2008 to 2014 are presented in Table 2.7. A short-term to long-term adjustment has been applied to the Gordon Street and Cockels Loan measurements as data capture was below 75%. Details of the adjustment calculation are presented in Appendix A.

The annual mean PM_{10} concentration measured during 2014 was below the 18 $\mu g.m^{-3}$ Scottish objective at all sites except Gordon Street where a PM_{10} annual mean of 21.2$\mu g.m^{-3}$ has been measured. However data capture for PM_{10} at this site was only 42% and so the result should be considered in this context.

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 an upward 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 2014 are presented in Table 2.8. Daily mean PM_{10} concentrations in excess of 50 $\mu g.m^{-3}$ occurred on 1 day during 2014 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 2014 %[b]	Confirm Gravimetric Equivalent	Annual Mean Concentration (µg.m^{-3})						
						2008	2009	2010	2011	2012	2013	2014
Gordon Street	**Roadside**	Y	92%	42%	Y	15	**18**	**21**	16	15	17.9*	**21.2***
St James Street	**Roadside**	Y	77%	77%	Y	-	-	**23***	17	15	14.5	14.8
Cockels Loan			98%	52%		-	-	-	-	-	-	16.2*

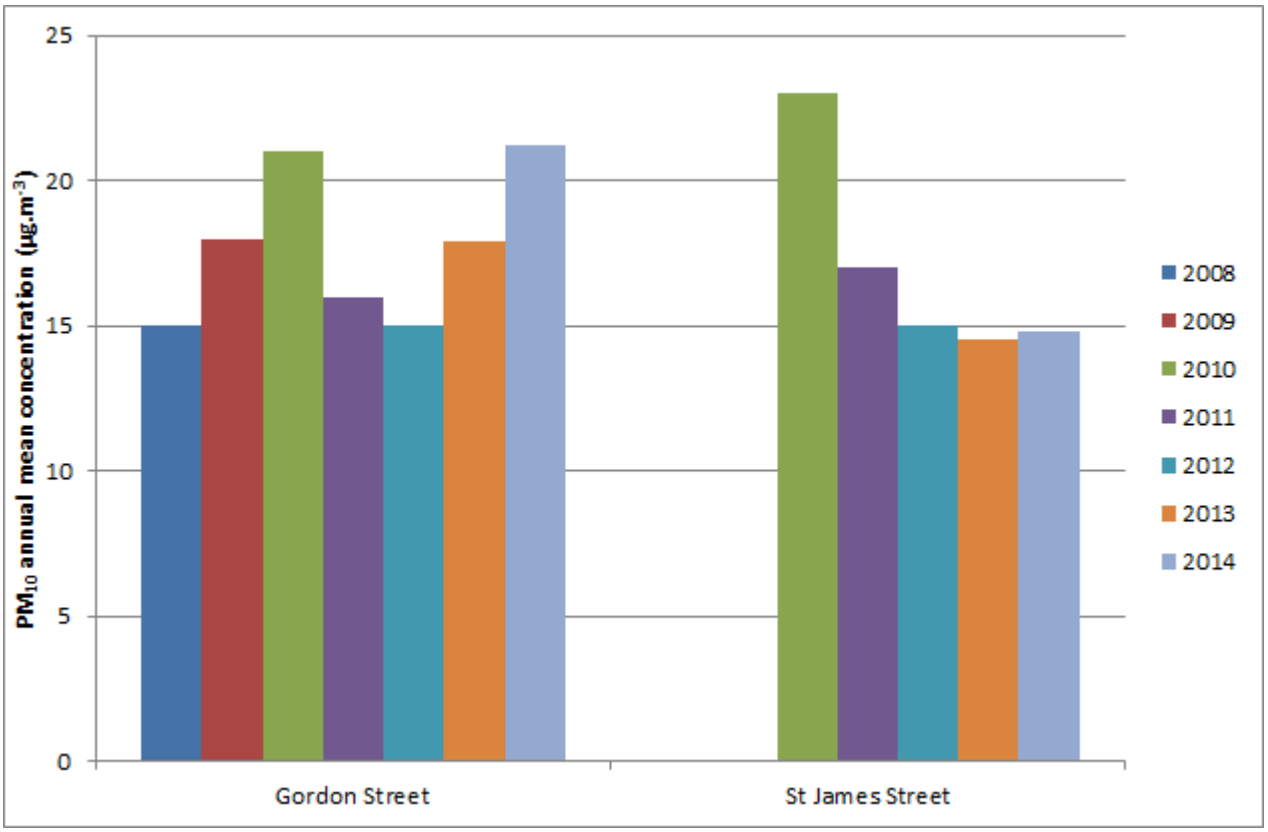
*Annualised – Short term to long term adjustment applied to calculate annual mean as valid data capture < 75%

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 Exceedances 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	2014
Gordon Street	**Roadside**	Y	92%	42%	Y	1	5	**11**	6	4 (43)	2 (40)	1 (49)
St James Street	**Roadside**	Y	77%	77%	Y	-	-	**8**	4	4	0	0 (42)
Cockels Loan			98%	52%		-	-	-	-	-	-	0 (43)

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



2.2.3 Sulphur Dioxide

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

Nitrogen Dioxide

The annual mean NO_2 concentrations measured at all four automatic monitoring sites were below the 40 $\mu g.m^{-3}$ during 2014. Measured NO_2 annual mean concentrations have in general decreased at Glasgow Airport and at Gordon Street over recent years.

There were no exceedances of the NO_2 hourly mean at Glasgow Airport, Gordon St or Cockels Loan automatic monitoring sites in 2014. Seventeen exceedances were measured at the Central Rd Paisley automatic monitor however this site is no longer considered to be in an area of relevant exposure.

Monitoring of annual mean NO_2 concentrations was also undertaken using the network of diffusion tube sites. Where measured concentrations were found to be in excess of the annual mean objective distance correction calculations were undertaken, where appropriate. The results are discussed below.

Within Existing Paisley Town Centre AQMA

Exceedances of the annual mean objective were measured at the following diffusion tube monitoring locations within the AQMA:

- Paisley 18 – Incle St
- Paisley 21 – Causeyside St (triplicate tubes at automatic monitor)
- Paisley 33 – 76 Causeyside St
- Paisley 35 – Old Sneddon St
- Paisley 43 - Smithhills St (East)

Outwith AQMA

Exceedances of the annual mean objective outside of the AQMA were measured at these locations:

- Renfrew 8 – Inchinnan Rd
- Renfrew 17 – Tanar Way
- Renfrew 62 - Cockels Loan (triplicate tubes at automatic monitor)
- Renfrew 69 – Inchinnan Rd
- Johnstone 20 – High St
- Johnstone 59 – High St

- Paisley 31 - West Walkinshaw Farm

Detailed Assessments are currently being undertaken by the Council at these locations with the exception of West Walkinshaw. These reports will be submitted to the Scottish Government once completed.

The NO_2 annual mean concentration measured at diffusion tube Renfrew 8, Inchinnan Road, Renfrew (62.0 $\mu g.m^{-3}$) during 2014 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.

Measured annual mean PM_{10} concentrations measured at both the St James and Cockels Loan automatic monitors during 2014 were below the 18 $\mu g.m^{-3}$ objective; both PM_{10} monitoring sites were also compliant with the daily mean objective. Measured annual mean PM_{10} concentrations measured at Gordon Street were above the objective, however the result calculated is based on a data capture of 42% and the results should be considered in this context.

Renfrewshire Council has measured concentrations of Nitrogen Dioxide above the annual mean objective at relevant locations outside of the existing Paisley Town Centre AQMA. Detailed Assessments for NO_2 are currently being undertaken at the following locations:

- High Street, Johnstone
- Montgomery Drive Paisley & Tanar Way /Glen Sax Drive, Renfrew
- Renfrew Town Centre

These reports are nearing completion and will enable the council to amend and/or declare AQMAs at these locations where necessary.

Renfrewshire Council has measured concentrations of NO_2 above the annual mean at relevant locations outside of the AQMA , and **will need to proceed to a Detailed Assessment**, for West Walkinshaw Farm, Paisley.

Renfrewshire Council has measured annual mean concentrations of NO_2 greater than 60 $\mu g.m^{-3}$ at relevant locations outside of the AQMA , and **will need to proceed to a Detailed Assessment**, for the 1 hour mean at Inchinnan Road Renfrew.

3 Road Traffic Sources

The following section has been completed based on the best available information and local knowledge.

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Renfrewshire Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Renfrewshire Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

Renfrewshire Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Renfrewshire Council confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

Renfrewshire Council confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

Renfrewshire Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Renfrewshire Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Airports require assessment if there is relevant exposure within 1km of the airport boundary.

Glasgow Airport is situated within the Renfrewshire Council area. Glasgow Airport facilitates around 8.8 million total passengers per annum and there are also receptors within 1 km of the airport boundary. The number of passengers using the airport per annum is below the 10 million people per annum threshold identified in technical guidance and as monitoring of NO_2 concentrations at the airport boundary has indicated that it is unlikely that NO_2 objectives will be exceeded, no further assessment is required.

Renfrewshire Council confirms that there are no new airports in the Local Authority area. Measured ambient NO_2 concentrations surrounding Glasgow airport are below objective levels, therefore no further assessment is required.

4.2 Railways (Diesel and Steam Trains)

In accordance with the technical guidance, it is necessary to assess emissions from stationary trains in relation to compliance with SO_2 objectives and moving trains for compliance with NO_2 objectives.

There are several rail links within the Renfrewshire Council area, however, all passenger train movements are electrified and therefore do not require further assessment.

4.2.1 Stationary Trains

Renfrewshire Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Renfrewshire Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping)

Ports require assessment for SO_2 concentrations resulting from fuel burning. Ports require assessment where there is relevant public exposure within 250 m and 1 km of the berths and main areas of manoeuvring.

No ports exist within Renfrewshire Council area. The nearest port is King George V docks on the River Clyde, opposite Braehead. However, these docks are located within Glasgow City Council area and therefore further assessment is not required.

Renfrewshire Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Renfrewshire Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been introduced

Renfrewshire Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Renfrewshire Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

Renfrewshire Council confirms that there are no petrol stations meeting the specified criteria**.**

5.4 Poultry Farms

Renfrewshire Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Two biomass installations have been identified for screening within the Renfrewshire Council area. The method described in TG (09), Box 5.8 has been used. Details of the biomass installations are presented in Table 6.1 below. The relevant nomograms were then used to assess whether the individual installations were exceeding the relevant pollutant emission rate for NO_2 and PM_{10}, based on the parameters of the individual installation. The results are presented in Table 6.2.

Observing Table 6.2, none of the biomass sources are exceeding the target emission rates.

Table 6.1: Biomass Facilities and Relevant Surrounding

Name of Establishment	Power (kW)	Building height (m)	Stack diameter (m)	Stack height (m)	Effective stack height (m)
St James Campus Biomass Boiler, 13/0586/PP	199	12	0.25	13.2	2
Renfrewshire Biomass Installation, Stock Street, 11/0081/PP	500	38	0.5	40	3.3

Table 6.2: Screening Results for Biomass Sources

Name of Establishment	Background Concentration		Target Emission Rate		Emission Rate		Exceeding Nomogram Value?
	NO_2 ($\mu g.m^{-3}$)	PM_{10} ($\mu g.m^{-3}$)	NO_x (g/s)	PM_{10} (g/s)	NO_x (g/s)	PM_{10} (g/s)	
St James Campus Biomass Boiler, 13/0586/PP	21.8	11.8	0.0498	0.0170	0.013	0.002	No
Renfrewshire Biomass Installation, Stock Street, 11/0081/PP	15.8	12.3	0.1381	0.0322	0.066	0.013	No

Renfrewshire Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

Renfrewshire Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment

6.3 Domestic Solid-Fuel Burning

Renfrewshire Council confirms that there are no areas where significant coal burning takes place as most of Renfrewshire Council area is within a Smoke Control Area.

Renfrewshire Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Dust emissions from a number of uncontrolled and fugitive sources can give rise to elevated PM_{10} concentrations. These sources include quarrying/mineral extraction, landfill sites, coal and material handling, major construction works and waste management sites. Since the last round of Review and Assessment Report, no new source has been identified.

Renfrewshire Council confirms that there are no new potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Renfrewshire Council monitored ambient NO_2 and PM_{10} concentrations using both automatic monitoring and passive diffusion tubes in 2014.

Annual mean NO_2 concentrations recorded at all automatic monitoring sites were below the annual mean objective in 2014. There were no exceedances of the NO_2 hourly mean at Glasgow Airport, Gordon St or Cockels Loan automatic monitoring sites in 2014 (Central Rd is no longer an area of relevant exposure).

There were no measured exceedances of the NO_2 hourly mean at any of the automatic monitoring sites.

Five diffusion tubes within the declared Paisley Town Centre AQMA recorded concentrations above the annual mean objective. There is no trend of concentrations at these diffusion tubes locations over recent years.

Following distance correction exceedances of the NO_2 annual mean objective at diffusion tubes outside of the AQMA were measured at seven locations:

- Renfrew 8 – Inchinnan Rd
- Renfrew 17 – Tanar Way
- Renfrew 62 - Cockels Loan (triplicate tubes at automatic monitor)
- Renfrew 69 – Inchinnan Rd
- Johnstone 20 – High St
- Johnstone 59 – High St
- Paisley 31 - West Walkinshaw Farm

Detailed Assessments are currently being undertaken by the Council at these locations with the exception of West Walkinshaw Farm. These reports will be submitted to the Scottish Government once completed.

The NO_2 annual mean concentration measured at diffusion tube Renfrew 8, Inchinnan Road, Renfrew (62.0 $\mu g.m^{-3}$) during 2014 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.

Measured annual mean PM_{10} concentrations measured at both the St James and Cockels Loan automatic monitors during 2014 were below the 18 $\mu g.m^{-3}$ objective; both PM_{10} monitoring sites were also compliant with the daily mean objective. Measured annual mean PM_{10} concentrations measured at Gordon Street were above the objective, however the result calculated is based on a data capture of 42% and the results should be considered in this context.

The review of monitoring data concluded Renfrewshire Council are required to proceed to a Detailed Assessment for the annual mean NO_2 objective at West Walkinshaw Farm and for the 1 hour mean objective at Inchinnan Road, Renfrew.

8.2 Conclusions from Assessment of Sources

Data were gathered from various national and local sources with regards to atmospheric emissions from: road traffic; rail; aircraft; shipping; industrial processes; intensive farming operations; domestic properties; biomass plants; and dusty processes. The screening methods outlined in the technical

guidance were used to determine the likelihood that a particular source would result in an exceedance of national air quality standards.

The review of new and changed emission sources identified no new sources that were likely to result in an exceedance of the NAQS objectives and that there is no requirement to proceed to a Detailed Assessment for any pollutant contained within the NAQS.

8.3 Proposed Actions

The Updating and Screening Assessment considered new monitoring data and a review of all emissions sources in the area.

The report proposed the following actions:

- Detailed Assessments for annual mean NO_2 concentrations at location close to the M8 in Renfrew, Renfrew Town Centre and High Street, Johnstone are currently being undertaken and the reports will be submitted in due course.
- Proceed to a Detailed Assessment for the annual mean NO_2 objective at West Walkinshaw Farm Paisley.
- Proceed to a Detailed Assessment for the 1 hour mean NO_2 objective at Inchinnan Road Renfrew.
- Submission of 2016 Progress Report

9 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

Renfrewshire Council (2014) LAQM Progress Report

Appendices

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

Appendix B: Figures

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

Factor from Local Co-location Studies

Two co-locations studies were conducted within the Renfrewshire Council area during 2014 at the two 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 Figure A.4.

Figure A.1: 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	08/01/2014	05/02/2014	25.1	29.8	25.9	27	2.5	9	6.2	27.8	99.9	Good	Good
2	05/02/2014	05/03/2014	25.1	32.3		29	5.1	18	45.7	23.4	94.0	Good	Good
3	05/03/2014	02/04/2014	22.2		19.6	21	1.8	9	16.5	19.0	100.0	Good	Good
4	02/04/2014	30/04/2014	20.5	20.8	20.5	21	0.2	1	0.4	18.9	100.0	Good	Good
5	30/04/2014	28/05/2014	17.2	19.4	19.6	19	1.3	7	3.3	16.2	81.5	Good	Good
6	28/05/2014	02/07/2014	7.4	6.0	5.4	6	1.0	16	2.5	14.8	100.1	Good	Good
7	02/07/2014	30/07/2014	16.1	15.0	7.1	13	4.9	39	12.2	15.1	94.2	Poor Precision	Good
8	30/07/2014	27/08/2014	12.9	8.1	10.6	11	2.4	23	6.0	15.1	96.4	Poor Precision	Good
9	27/08/2014	01/10/2014	21.6	21.0	21.2	21	0.3	1	0.8	18.6	35.2	Good	or Data Capture
10	01/10/2014	29/10/2014	20.2	21.9	24.1	22	2.0	9	4.9	25.8	63.1	Good	or Data Capture
11	29/10/2014	03/12/2014	12.2	33.1	35.7	27	12.9	48	32.0	26.5	63.0	Poor Precision	or Data Capture
12	03/12/2014	07/01/2015	27.1	26.7	27.0	27	0.2	1	0.5	32.4	100.0	Good	Good
13													
											Overall survey -->	Poor precision	Poor Overall DC

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

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Glasgow Airport

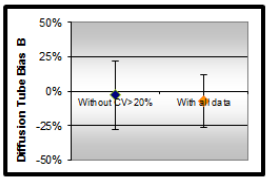
Precision: 9 out of 12 periods have a CV smaller than 20%

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

Bias calculated using 7 periods of data
Bias factor A: 1.02 (0.81 - 1.37)
Bias B: -2% (-27% - 23%)
Diffusion Tubes Mean: 21 μgm^{-3}
Mean CV (Precision): 9
Automatic Mean: 22 μgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 22 (17 - 29) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 9 periods of data
Bias factor A: 1.06 (0.88 - 1.33)
Bias B: -6% (-25% - 14%)
Diffusion Tubes Mean: 19 μgm^{-3}
Mean CV (Precision): 14 caution
Automatic Mean: 20 μgm^{-3}
Data Capture for periods used: 96%
Adjusted Tubes Mean: 20 (17 - 25) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure A.2: 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	08/01/2014	05/02/2014	39.8	42.1	37.0	40	2.6	6	6.3
2	05/02/2014	05/03/2014	41.8	38.2	22.6	34	10.2	30	25.4
3	05/03/2014	02/04/2014	35.5	38.0	32.4	35	2.8	8	7.0
4	02/04/2014	30/04/2014	33.8	33.5	38.0	35	2.5	7	6.2
5	30/04/2014	28/05/2014	34.7	39.3	38.2	37	2.4	6	6.0
6	28/05/2014	02/07/2014	12.0	10.7	13.5	12	1.4	12	3.5
7	02/07/2014	30/07/2014	27.3	28.1	25.1	27	1.6	6	3.9
8	30/07/2014	27/08/2014							
9	27/08/2014	01/09/2014	34.4	38.5	37.6	37	2.2	6	5.4
10	01/09/2014	29/10/2014	41.6	37.9	41.0	40	2.0	5	4.9
11	29/10/2014	03/12/2014	47.2	49.2	53.2	50	3.1	6	7.6
12	03/12/2014	07/01/2015	36.2	33.2	40.5	37	3.7	10	9.1
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
36.1	99.6	Good	Good
25.5	100.0	Poor Precision	Good
24.9	92.6	Good	Good
26.9	99.7	Good	Good
25.2	100.0	Good	Good
20.9	97.7	Good	Good
19.1	85.9	Good	Good
19.6	100.0		Good
28.9	69.0	Good	or Data Capture
34.8	79.0	Good	Good
54.7	74.8	Good	Good
26.3	24.6	Good	or Data Capture
Overall survey -->		Good precision	Poor Overall DC

Site Name/ ID: Gordon Street Paisley

Precision: 10 out of 11 periods have a CV smaller than 20%

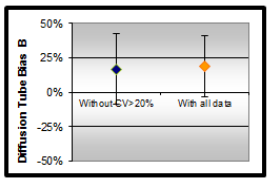
(Check average CV & DC from Accuracy calculations)

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

Bias calculated using 8 periods of data
Bias factor A: 0.88 (0.72 - 1.13)
Bias B: 14% (-12% - 39%)
Diffusion Tubes Mean: 35 µgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 30 µgm^{-3}
Data Capture for periods used: 91%
Adjusted Tubes Mean: 30 (25 - 39) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 9 periods of data
Bias factor A: 0.86 (0.72 - 1.07)
Bias B: 16% (-6% - 38%)
Diffusion Tubes Mean: 35 µgm^{-3}
Mean CV (Precision): 10
Automatic Mean: 30 µgm^{-3}
Data Capture for periods used: 92%
Adjusted Tubes Mean: 30 (25 - 37) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure A.3: Glasgow Scientific Services – National average bias adjustment factor 2014

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/15

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 spreadhseet 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 2015
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: Select the Laboratory that Analyses Your Tubes from the Drop-Down List. If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List. If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List. If a year is not shown, we have no data[2]

Step 4: 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 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/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
Glasgow Scientific Services	20% TEA in water	2014	KS	Glasgow City Council	10	75	65	14.6%	P	0.87
Glasgow Scientific Services	20% TEA in water	2014	KS	Marylebone Road Intercomparison	12	101	80	26.4%	G	0.79
Glasgow Scientific Services	20% TEA in water	2014		Overall Factor[3] (2 studies)				Use		0.83

Table A.1: Summary of bias adjustment factors at NO_2 automatic monitoring sites 2014

Co-location site	Tube Precision	Automatic data quality	Bias factor (excluding periods with cv > 20%)	Bias factor (using all available periods of data)
Glasgow Airport	Poor	Poor overall	1.02	1.06
Gordon Street, Paisley	Good	Poor overall	0.88	0.86

Discussion of Choice of Bias Adjustment Factor to Use

Diffusion tube bias adjustment factors for 2014 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 2014 data capture was low at the Glasgow Airport co-location study and the mean co-efficient of variation (precision) was over the recommended 10% for three periods with cv>20% when using all periods. Data capture was also low at Gordon Street co-location study during 2014.

The average of the factors derived from the Glasgow Airport and Gordon Street co-location studies of 0.96 is not consistent with the factors applied in previous years and results in an underestimation of the NO_2 concentrations. The national adjustment factor is only based on two studies where one is of poor precision, this factor was therefore not considered suitable.

Even if the precision and data capture at the Glasgow Airport co-location study were not good in 2014, the factor derived from this study (1.06) is the most consistent with previous years. 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 several diffusion tubes. The adjustment ratios were calculated as presented in the Tables below.

All the diffusion tubes with a data capture of 100% in 2014 have been used to get a representative relationship between the annual mean and the period mean within the area. The average ratio for each diffusion tubes is presented in Table A.2.

Table A.2: Summary of short term to long term adjustment factors at NO_2 diffusion tube sites in 2014

Diffusion Tube	Short term to long term adjustment Factor
Renfrew 24	1.03
Renfrew 25	1.07
Linwood 30	1.07
Paisley 37	1.07
Renfrew 46	1.07
Linwood 51	1.07
Kilbarchan 54	1.07
Kilbarchan 55	1.03
Renfrew 57	0.94
Paisley 63	0.96

Diffusion Tube	Short term to long term adjustment Factor
Paisley 64	0.86
Kilbarchan 65	0.86
Kilbarchan 66	0.86
Kilbarchan 67	0.86
Renfrew 68	0.82
Renfrew 69	0.86
Renfrew 70	0.83
Renfrew 71	0.86

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 2013 and 2014 based upon a z-score of <±2 were as follows:

- October to December 2013: 100%
- January to March 2014: 100%
- April to May 2014: 100%
- July to August 2014: 100%
- October to November 2014: 100%

Over a rolling five round WASP window, it is expected that 95% of laboratory results should be ≤+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 2014 is 100%.

Table A.2: NO_2 monthly mean measurements measured at diffusion tube sites 2014

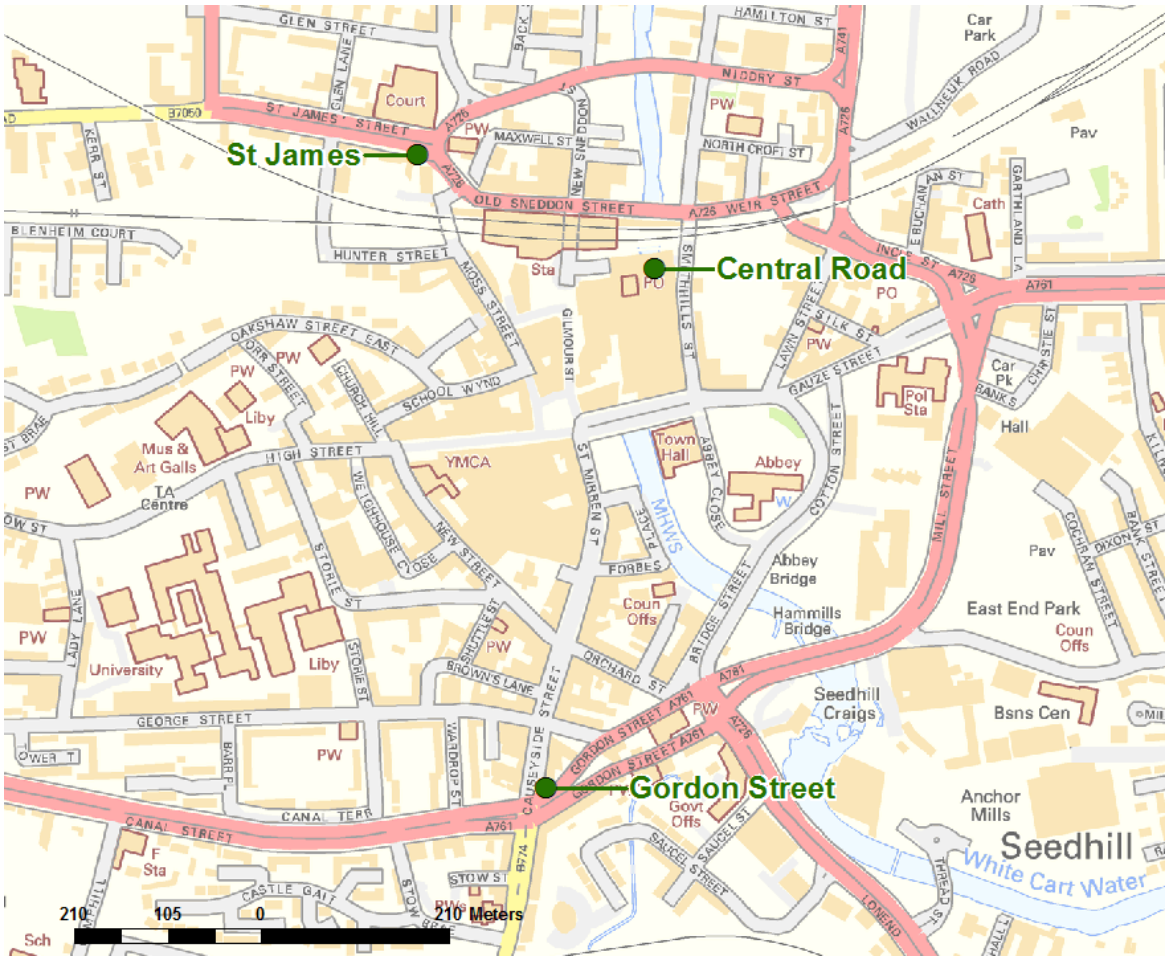
Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g.m^{-3}$)	Data capture 2014	Requires annualised ?	Bias adjusted annual mean ($\mu g.m^{-3}$) (1.06 adj factor)
Paisley1	37.6	34.5	24.8	26.5	26.7	-	-	13.6	22.6	24	41.9	25.1	27.7	83%	N	29.4
Paisley2	22.6	18.4	17.5	18	15	-	10.2	10.2	16	9.5	29.9	17.8	16.8	92%	N	17.8
Paisley3	13.8	9.1	10.5	13.6	11.8	-	5.8	7.1	11.6	11.8	23.4	9.7	11.7	92%	N	12.4
Paisley4	21.3	16.1	16.9	15.6	14.9	-	8.6	10.1	16.8	16.3	29.7	20.4	17.0	92%	N	18.0
Johnstone7	38.3	33	25.7	39.6	39.5	-	26.5	31.8	31.9	35.1	54.5	24.9	34.6	92%	N	36.7
Renfrew8	89.9	75.1	53.1	49.1	57	-		37.1	50.1	52.4	56.1	64.6	58.5	83%	N	62.0
Bishopton9	19.3	20.1	19	19.8	18.1	-	12	11	15.4	14	31.2	19.7	18.1	92%	N	19.2
Paisley13	24.5	26.7	26	27.4	29.4	-	21.1	25.6	26.9	20	32.4	30	26.4	92%	N	27.9
Paisley15	34.3	36.6	34.7	45.8	41.9	-	34.9	34.2	41.4	35.9	49.2	38.3	38.8	92%	N	41.2
Renfrew17	53.7	60.4	-	41	43.2	-	27	31.2	32	-	77.4	44.8	37.7	92%	N	40.0
Paisley18	46.8	53	42	47.5	46.2	-	33.1	36.2	42.4	43.3	58.9	48	45.2	92%	N	47.9
Paisley19	30.1	36.1	37.3	33.9	26.6	-	22.4	24.5	33.6	31.9	50	34.6	32.8	92%	N	34.8
Johnstone20	39.8	41	41.6	46.1	45.7	-	32.2	41.9	45.2	43.7	63.2	28.6	42.6	92%	N	45.2
Paisley 21(1)	39.8	41.8	35.5	33.8	34.7	-	27.3	-	34.4	41.6	47.2	36.2	37.2	83%	N	39.5
Paisley 21(2)	42.1	38.2	38	33.5	39.3	-	28.1	-	38.5	37.9	49.2	33.2	37.8	83%	N	40.1
Paisley 21(3)	37	22.6	32.4	38	38.2	-	25.1	-	37.6	41	53.2	40.5	36.6	83%	N	38.8
Renfrew23	35.7	40.1	33.3	36.5	30.3	-	19.3	21.4	28.3	31.6	54.3	32.5	33.0	92%	N	35.0
Renfrew24	30.9	29.9	23.4	22.8	21.1	-	16.7	-	-	-	-	-	24.1	50%	Y	26.3
Renfrew25	24.1	23.6	15.9	18.4	13.5	-	11.5	11.8	-	-	-	-	17.0	58%	Y	19.2
Bishopton27	15.4	13.1	12	12.3	9.5	-	6.9	5.5	10.8	11.2	18.8	11.8	11.6	92%	N	12.3
Linwood30	24.3	31.9	17.3	24.7	17.7	-	12.3	10.8	-	-	-	-	19.9	58%	Y	22.5
West Walkingshaw31	35.1	34.5	25.7	31.2	31.2	-	27.4	29.4	29.4	-	32.3	36.1	31.2	83%	N	33.1
Paisley 33	29.2	38.6	39.3	44.8	44.1	-	37.5	41.7	26.1	42.1	49.5	42.7	39.6	92%	N	42.0
Paisley 34	39.8	44.6	30.6	-	55.4	-	46.6	39	57.3	50.4	35.9	39.5	43.9	83%	N	46.5

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g.m^{-3}$)	Data capture 2014	Requires annualised ?	Bias adjusted annual mean ($\mu g.m^{-3}$) (1.06 adj factor)
Paisley 35	48.1	41	42.1	47.3	48.8	-	37.1	38.1	47.9	43.7	55.5	41.2	44.6	92%	N	47.3
Paisley 36	34.7	42.8	44.1	38	38.1	-	25.6	21.6	33.6	35.4	53.7	34.2	36.5	92%	N	38.7
Paisley 37(1)	33.1	32.1	41	29.7	27	-	21	19.8	-	-	-	-	29.1	58%	Y	33.0
Paisley 37(2)	51.1	32.6	24.4	28.6	17.8	-	19.1	23.3	-	-	-	-	28.1	58%	Y	31.9
Paisley 37(3)	49.9	35.3	21.3	26.5	26.2	-	22.7	13.4	-	-	-	-	27.9	58%	Y	31.6
Renfrew 38	32.6	40.1	2	31.6	31.1	-	26.8	24	30.7	31.6	46.6	37.6	30.4	92%	N	32.3
Paisley 39(1)	25.1	25.1	22.2	20.5	17.2	-	16.1	12.9	21.6	20.2	12.2	27.1	20.0	92%	N	21.2
Paisley 39(2)	29.8	32.3	2.1	20.8	19.4	-	15	8.1	21	21.9	33.1	26.7	20.9	92%	N	22.2
Paisley 39(3)	25.9	2.1	19.6	20.5	19.6	-	7.1	10.6	21.2	24.1	35.7	27	19.4	92%	N	20.6
Renfrew 40	41.1	45.6	35.1	36.4	37	-	29.7	17	34.4	41.2	42.2	39.7	36.3	92%	N	38.5
Paisley 41	50.4	60	44	44.8	43.3	-	40.4	25.6	40.1	45.7	54.3	57.6	46.0	92%	N	48.8
Paisley 42	44	28	24.5	31.9	26.5	-	17.5	11.7	26.6	26.8	43	21.3	27.4	92%	N	29.1
Paisley 43	42.3	42.4	43.9	39.8	39.6	-	34.7	17	37.3	37.5	55.5	44.7	39.5	92%	N	41.9
Paisley 44	35.8	32.3	26	30.5	27.6	-	20.7	10.9	22.4	29.6	43.7	26.2	27.8	92%	Y	29.5
Renfrew45	35.3	32.6	27.6	27.8	28.6	-	23.5	12.8	27.9	28.2	34.8	34.1	28.5	92%	N	30.2
Renfrew46	27.9	30	23.6	19.1	16.4	-	15.2	10.1	-	-	-	-	20.3	58%	N	23.0
Renfrew48	39.4	48	37.9	38.7	34.6	-	23	13.8	31.2	39	17.6	42.1	33.2	92%	N	35.2
Renfrew 49	42.4	41.8	31.5	34	29.6	-	25	16	27.9	33.4	38.4	35.3	32.3	92%	Y	34.2
Paisley 50	35.7	33.5	35.8	33.3	35.4	-	25	14.1	28.6	34	26.4	39.8	31.1	92%	N	32.9
Linwood51	30.1	27	19.5	24.3	18.4	-	13.2	5.2	-	-	-	-	19.7	58%	N	22.3
Renfrew 52	28.8	44.1	31	29.4	35.9	-	21.5	30.8	32.3	30.1	30.2	41.6	32.3	92%	N	34.3
Inchinnan53	29.9	32	30.3	28.6	26.1	-	19.9		25.1	25	37.3	10.5	26.5	83%	N	28.1
Kilbarchan 54	36	36.5	23.9	27.5	25.9	-	14.2	19.1	-	-	29.4	28.9	26.8	75%	N	28.4
Kilbarchan 55	14.5	14.7	12.6	16.9	13.8	-	8.2	-	-	-	-	-	13.5	50%	N	14.7
Renfrew 56	44.8	45	41	39.7	41.4	-	28.6	37.3	41.5	8.6	32.3	47.2	37.0	92%	N	39.3

Site name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean ($\mu g.m^{-3}$)	Data capture 2014	Requires annualised ?	Bias adjusted annual mean ($\mu g.m^{-3}$) (1.06 adj factor)
Renfrew 57	65	37.8	28.8	35.2	32.9	-	22.8	-	32.8	-	43.6	35	37.1	75%	N	39.3
Renfrew 58	33.1	28.2	24.3	26.8	22.3	-	15.9	-	21.3	24.1	28.7	25.6	25.0	83%	N	26.5
Johnstone 59	56	66.8	53.8	59.4	36.3	-	51.1	51.9	55.8	57.1	38.3	65.4	53.8	92%	N	57.0
Paisley 60	39.2	49.4	36.1	43.7	41.1	-	29.2	29.8	35.7	40.4	55.4	38	39.8	92%	N	42.2
Kilbarchan 61	41.8	48	27.4	45	42.8	-	27.2	31.3	32.9	36.8	43.3	42.1	38.1	92%	N	40.3
Cockels Loan 62 (1)	50.5	50	41.9	42.1	42.9	-	35.2	38.5	39.2	45.5	39.1	47.6	43.0	92%	N	45.5
Cockels Loan 62 (2)	72.3	47.6	47	43	42	-	36	11.5	50.9	41.4	29.2	52.3	43.0	92%	N	45.6
Cockels Loan 62 (3)	49.7	51.4	42.3	46.5	49.2	-	36.6	38.5	41	49.2	41.7	53.3	45.4	92%	N	48.1
Paisley 63	-	-	-	-	-	-	-	-	37.4	41.5	-	38.8	39.2	25%	Y	40.1
Paisley 64	-	-	-	-	-	-	-	-	31.6	26	47.4	37.3	35.6	33%	Y	32.3
Kilbarchan 65	-	-	-	-	-	-	-	-	1.7	74.2	48.6	41.4	41.5	33%	Y	37.7
Kilbarchan 66	-	-	-	-	-	-	-	-	21.5	22.7	29.6	20.8	23.7	33%	Y	21.5
Kilbarchan 67	-	-	-	-	-	-	-	-	17.1	17.2	26.5	23.5	21.1	33%	Y	19.1
Renfrew 68	-	-	-	-	-	-	-	-	30.7	-	40.4	45.3	38.8	25%	Y	33.8
Renfrew 69	-	-	-	-	-	-	-	-	38.5	40.7	78.1	37.8	48.8	33%	Y	44.3
Renfrew 70	-	-	-	-	-	-	-	-	-	33.8	40.9	34.2	36.3	25%	Y	32.0
Renfrew 71	-	-	-	-	-	-	-	-	29.4	40.6	55.6	43.8	42.4	33%	Y	38.5

Appendix B: Figures

Figure 9.1: Paisley automatic monitoring site locations



N

Legend:

Automatic Monitoring Site

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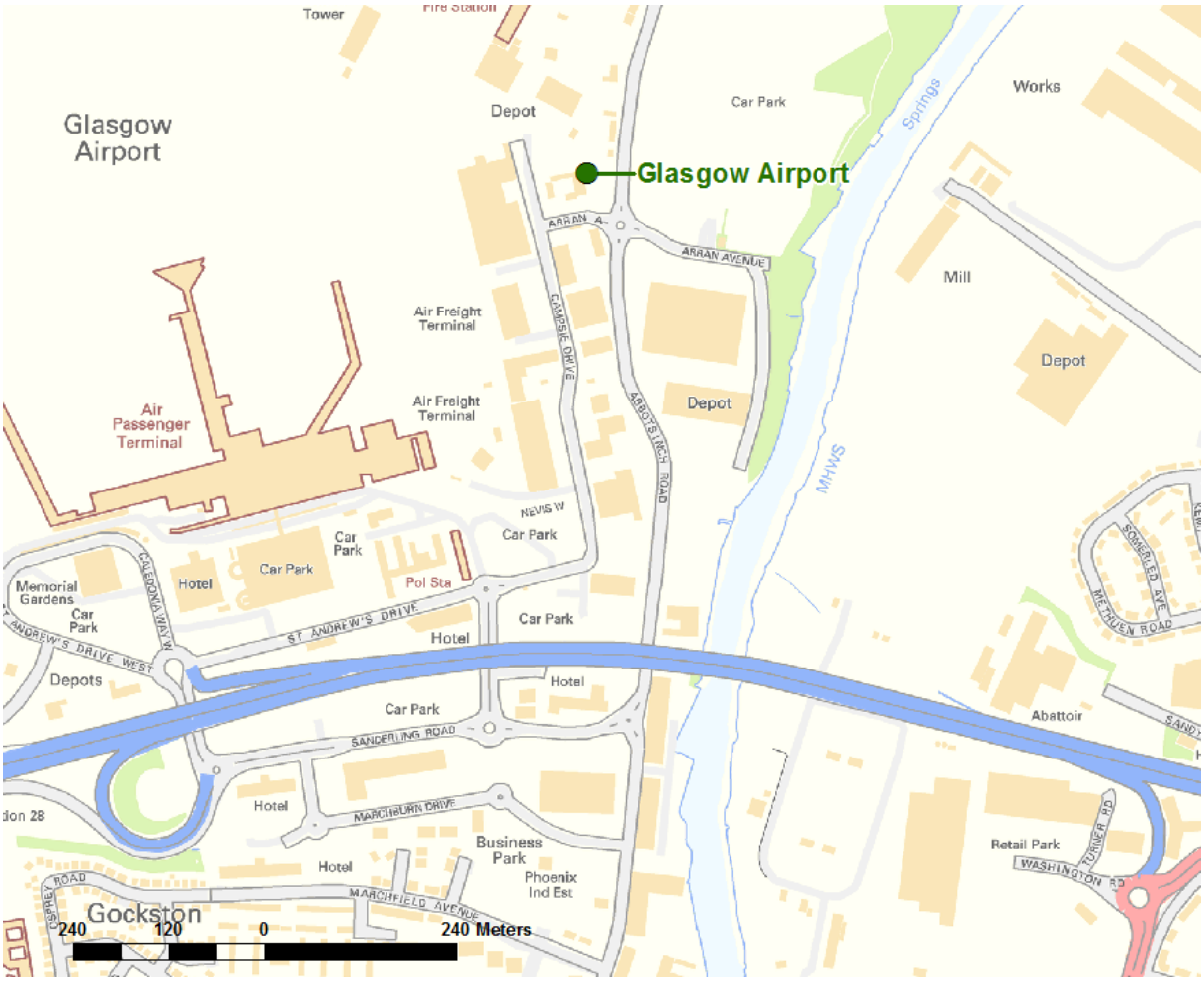
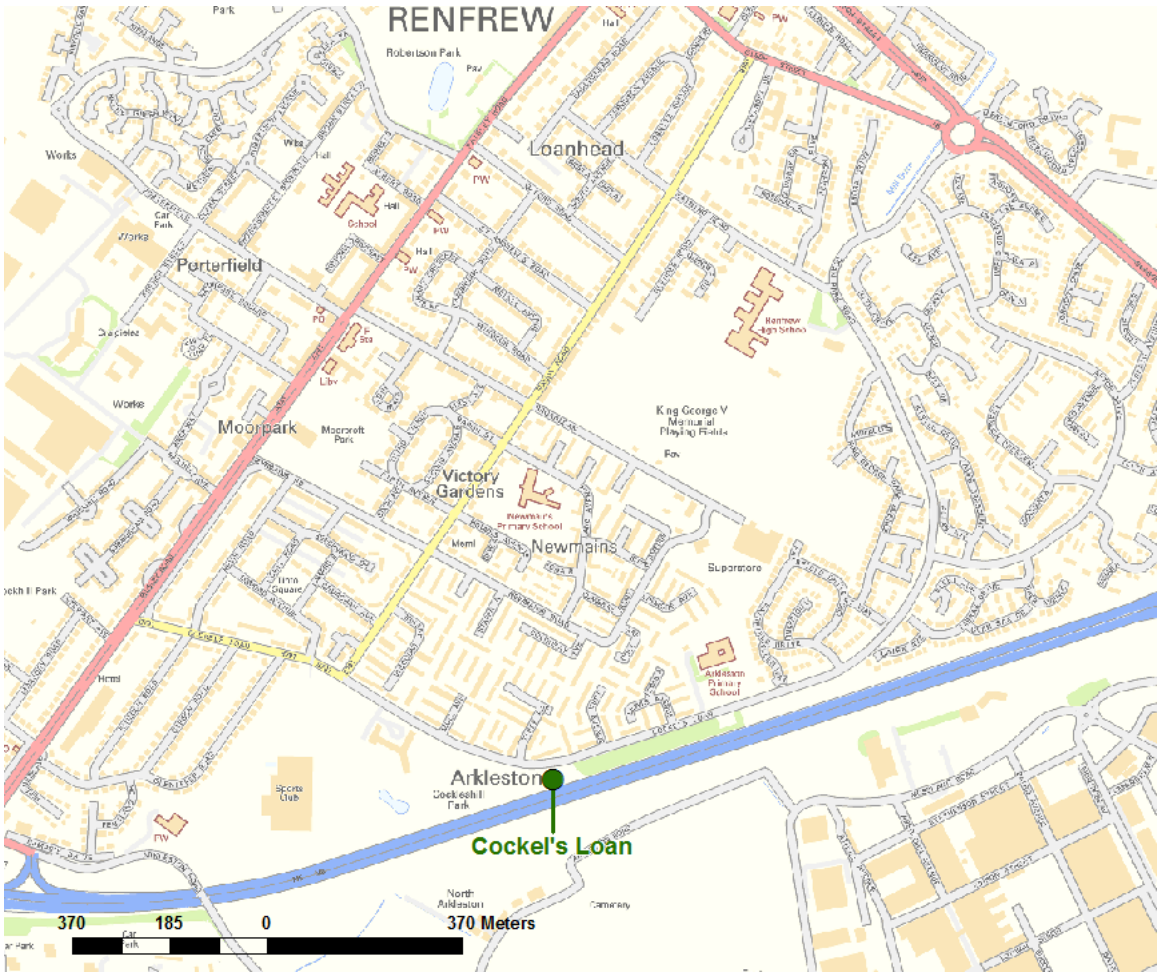
Figure 9.2: Glasgow Airport automatic monitoring site location



N	Legend: Automatic Monitoring Site	RICARDO-AEA Contains Ordnance Survey data © Crown copyright and database right 2015

Figure 9.3: Cockels Loan, Renfrew automatic monitoring site location



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Automatic Monitoring Site

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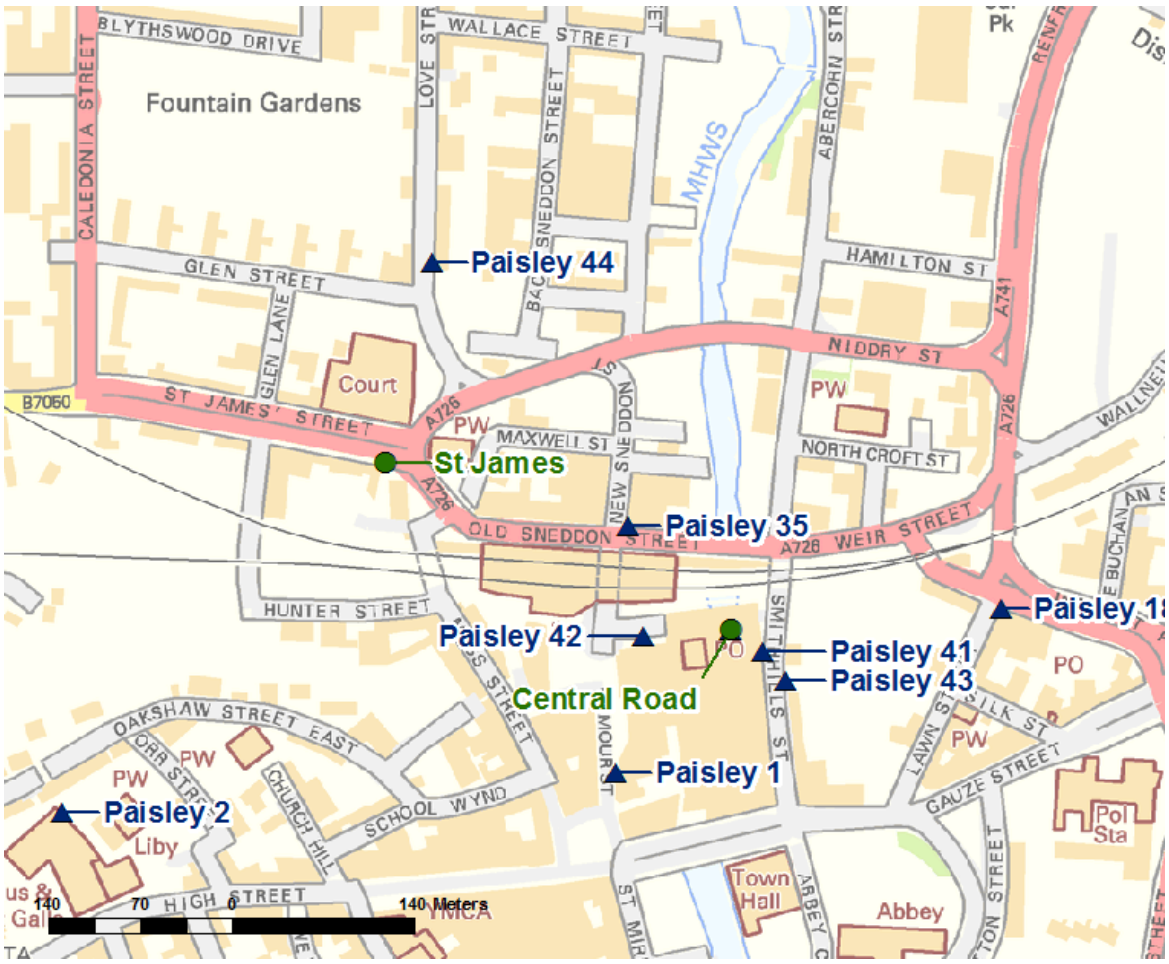
Figure 9.4: Paisley (central) diffusion tube sites



N

Legend:

▲ Diffusion Tubes

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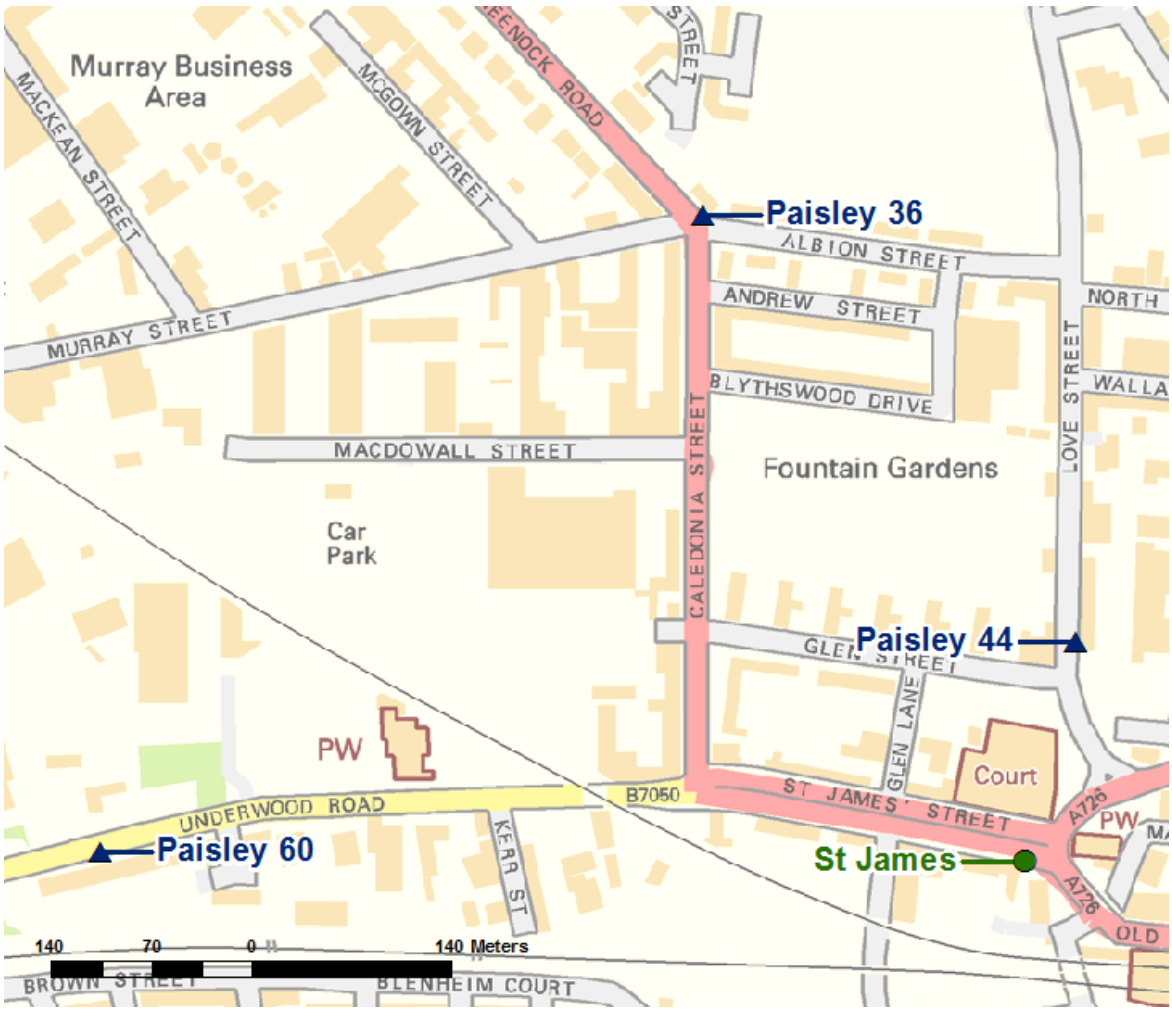
Figure 9.5: Paisley (west) diffusion tube sites



N

Legend:

▲ Diffusion Tubes

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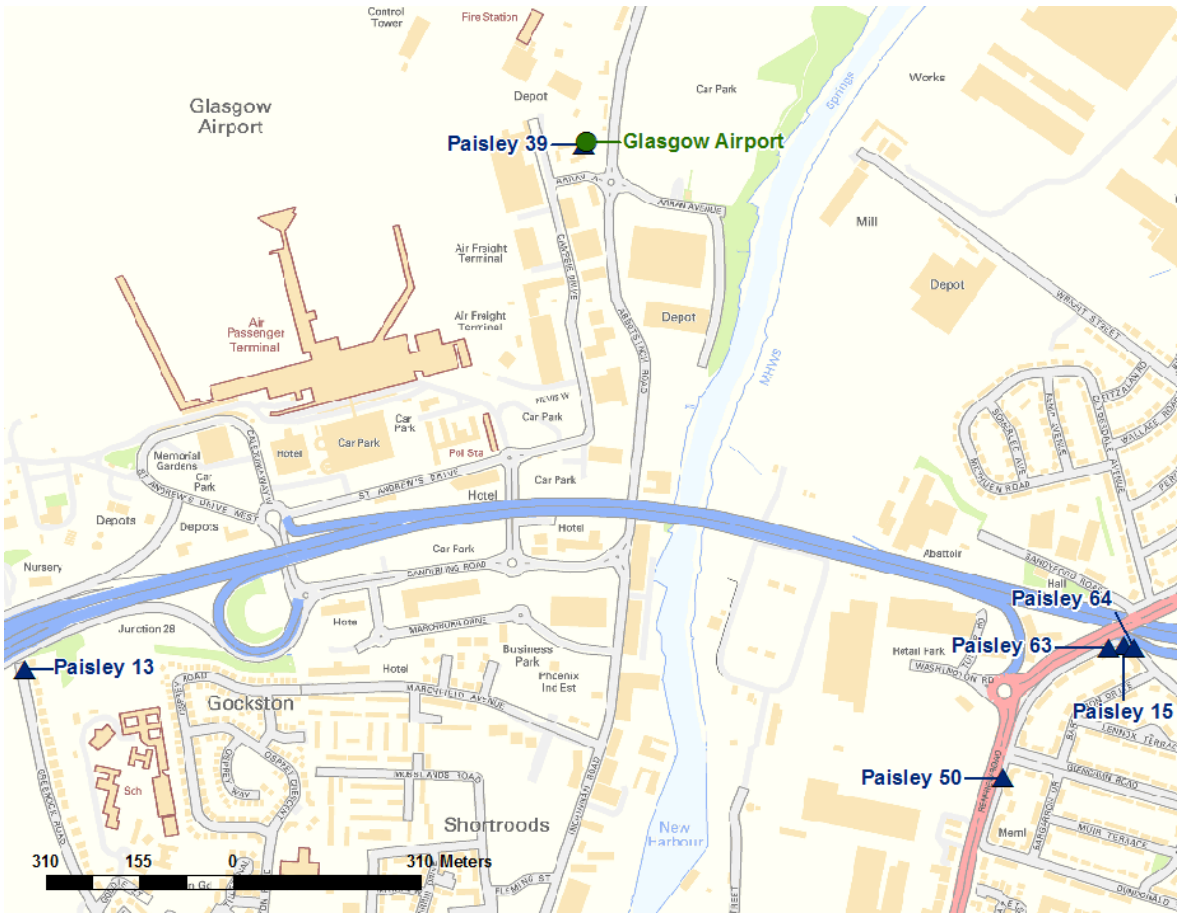
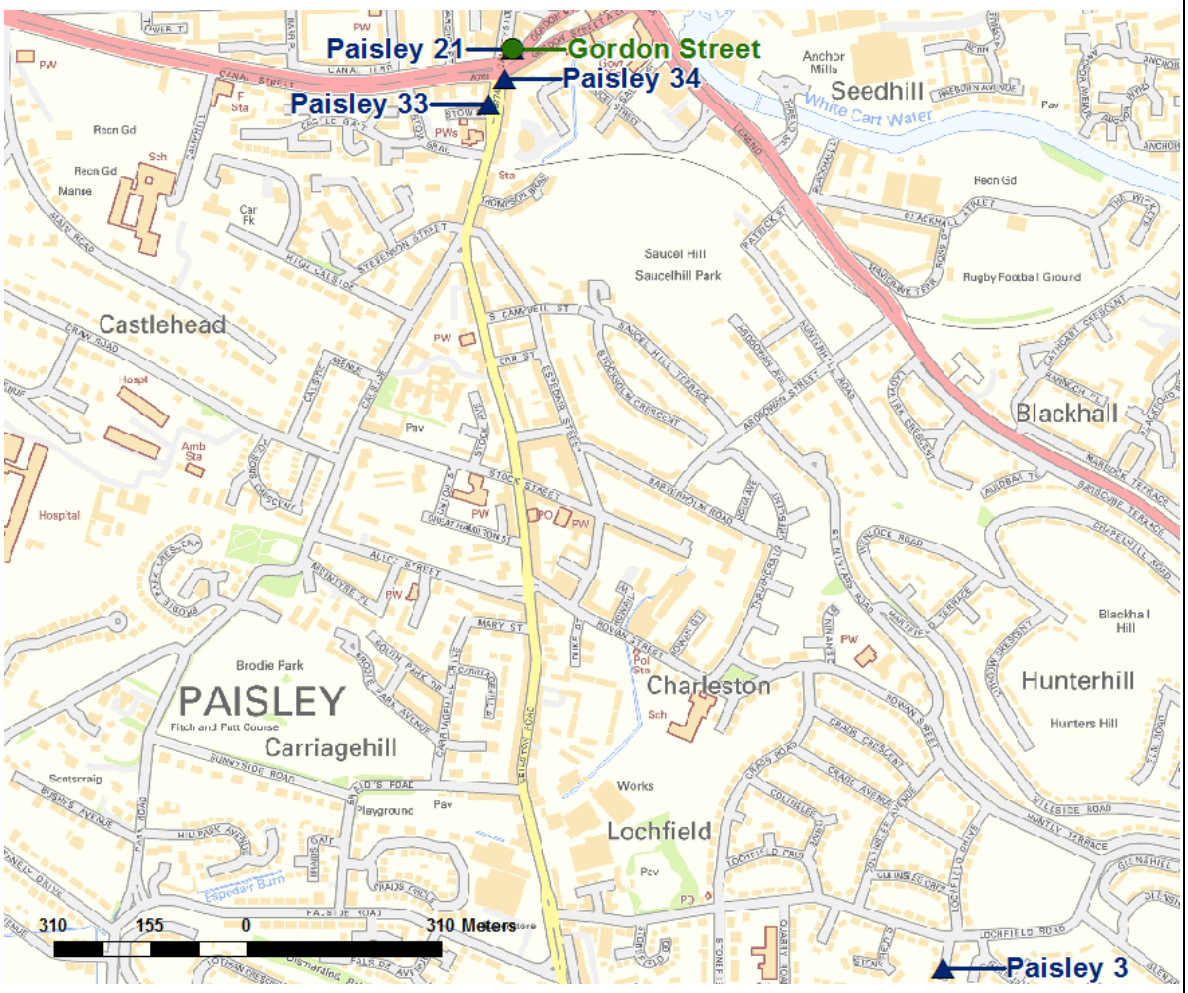
Figure 9.6: Paisley (north) diffusion tube sites



N	Legend: ▲ Diffusion Tubes	RICARDO-AEA Contains Ordnance Survey data © Crown copyright and database right 2015

Figure 9.7: Paisley (south) diffusion tube sites



N

Legend:

▲ Diffusion Tubes

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Figure 9.8: Paisley (south west) diffusion tube sites

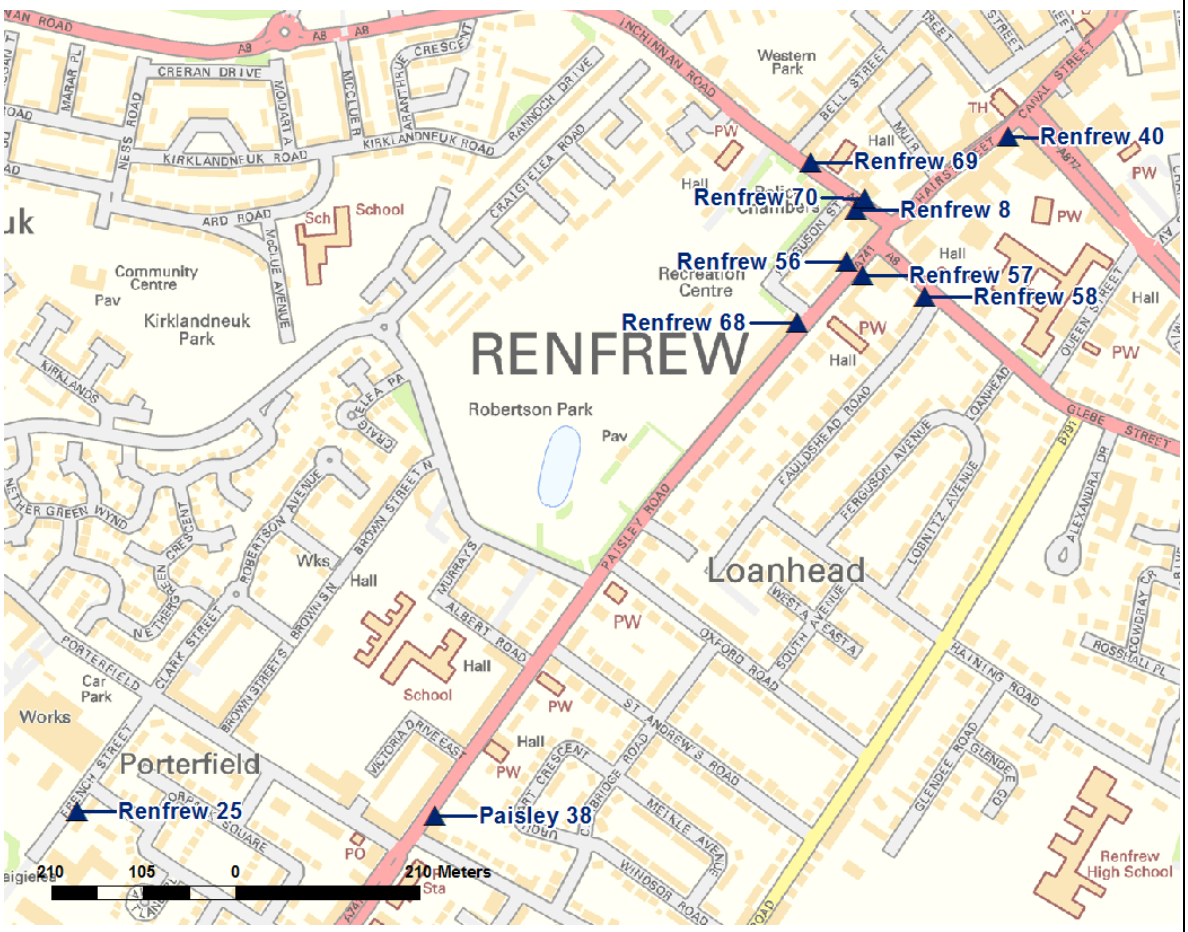
N

Legend:

Diffusion Tubes

RICARDO-AEA

Figure 9.9: Renfrew (central) diffusion tube sites



N

Legend:

▲ Diffusion Tubes

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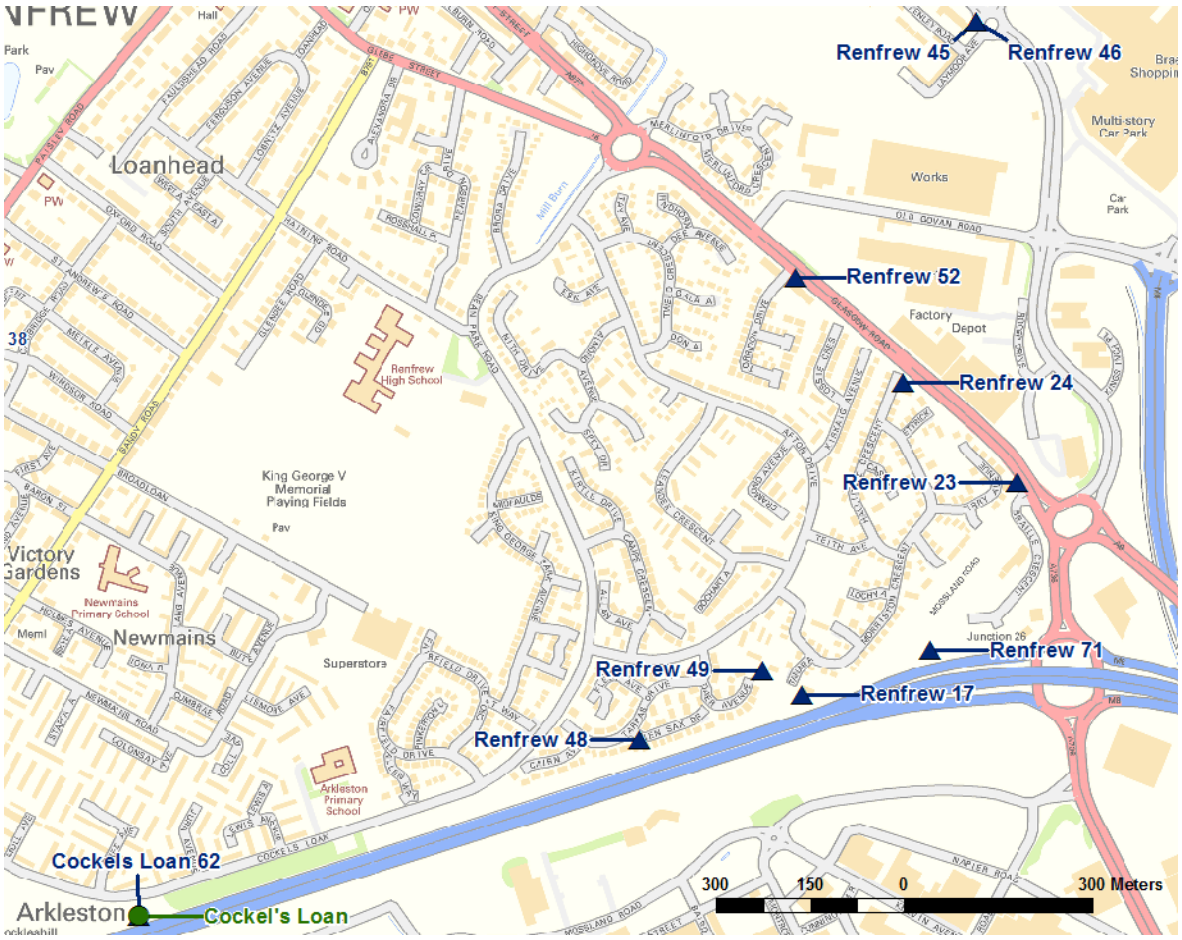
Figure 9.10: Renfrew (east) diffusion tube sites



N

Legend:

▲ Diffusion Tubes

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Figure 9.11: Linwood and Johnstone diffusion tube sites

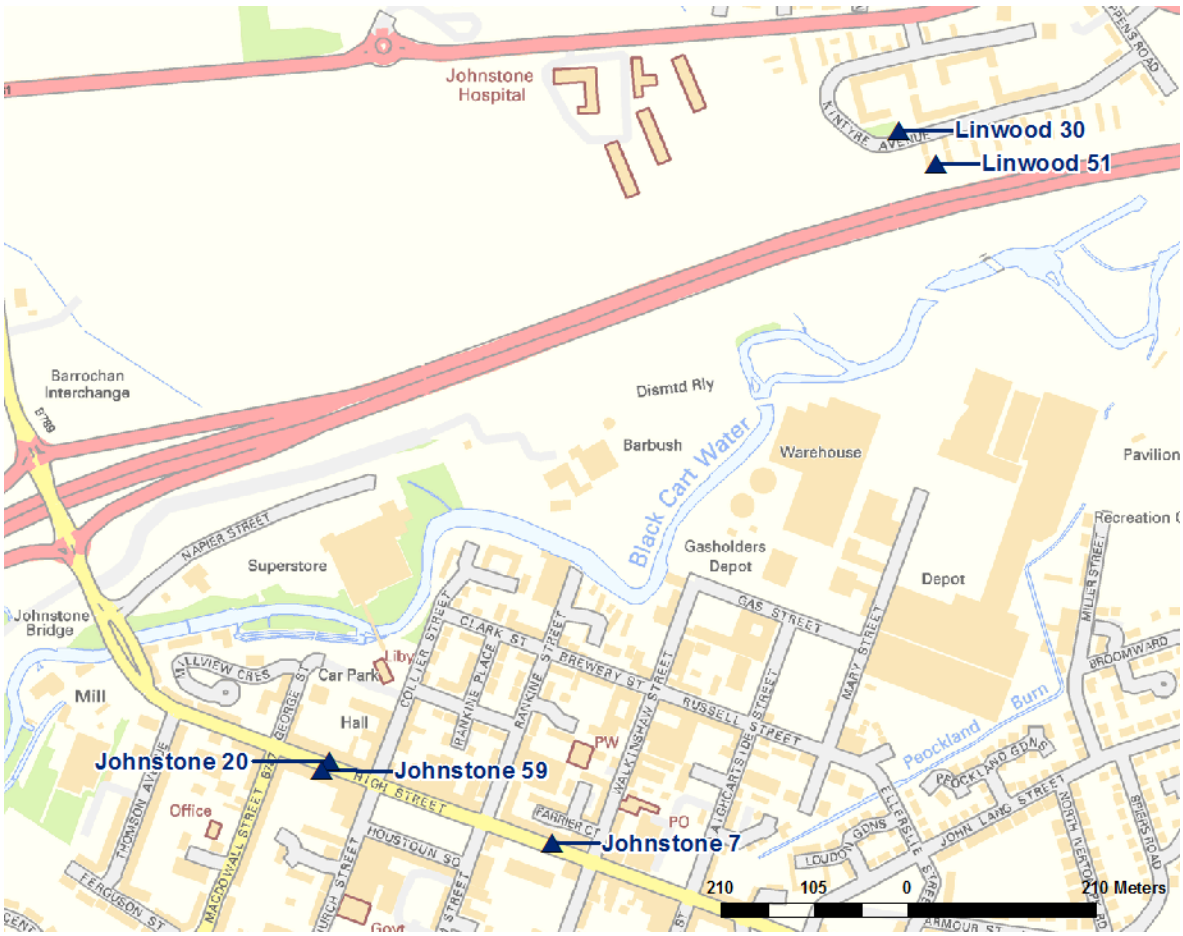

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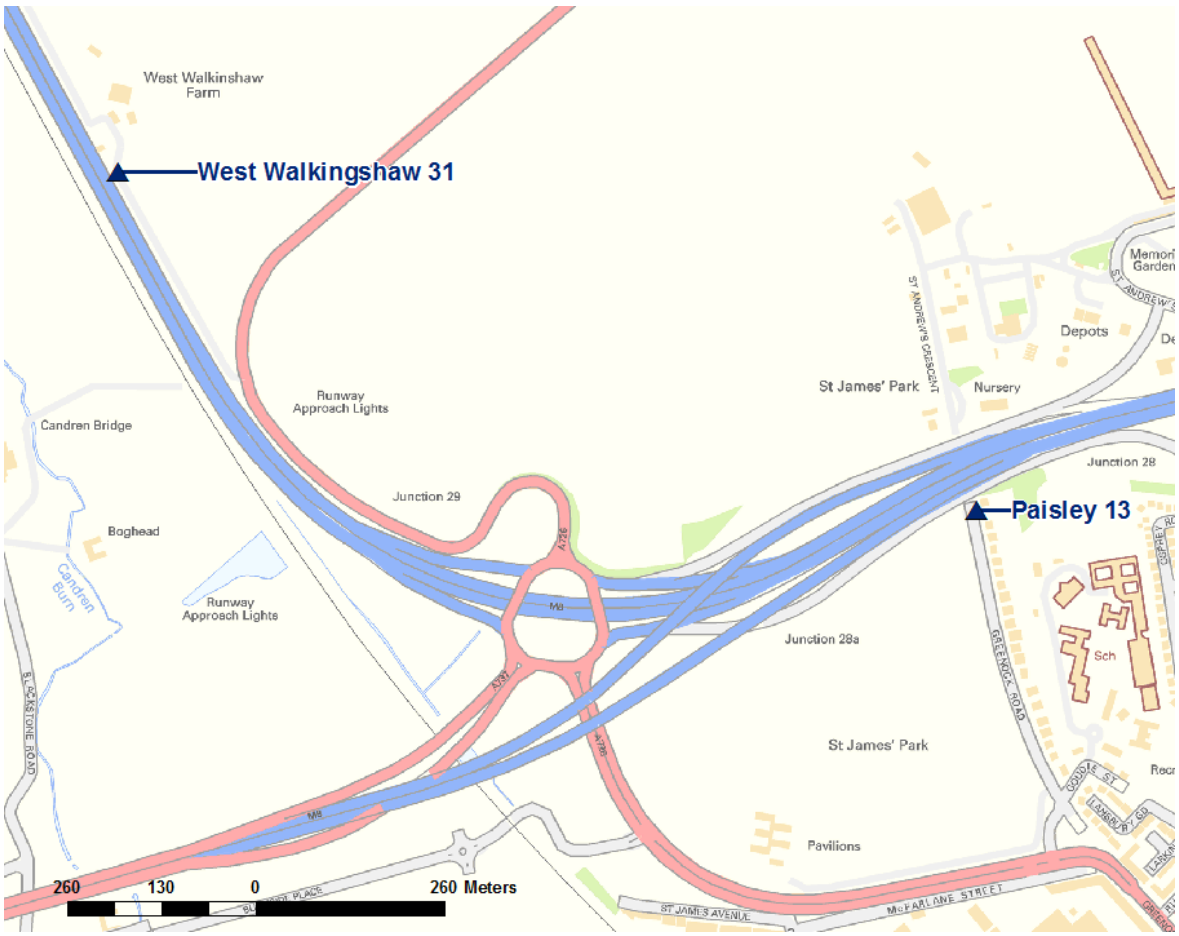
Figure 9.12: West Walkingshaw diffusion tube site



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Legend:

Diffusion Tubes

RICARDO-AEA

Missing figure No. Kilbarchan diffusion tube sites

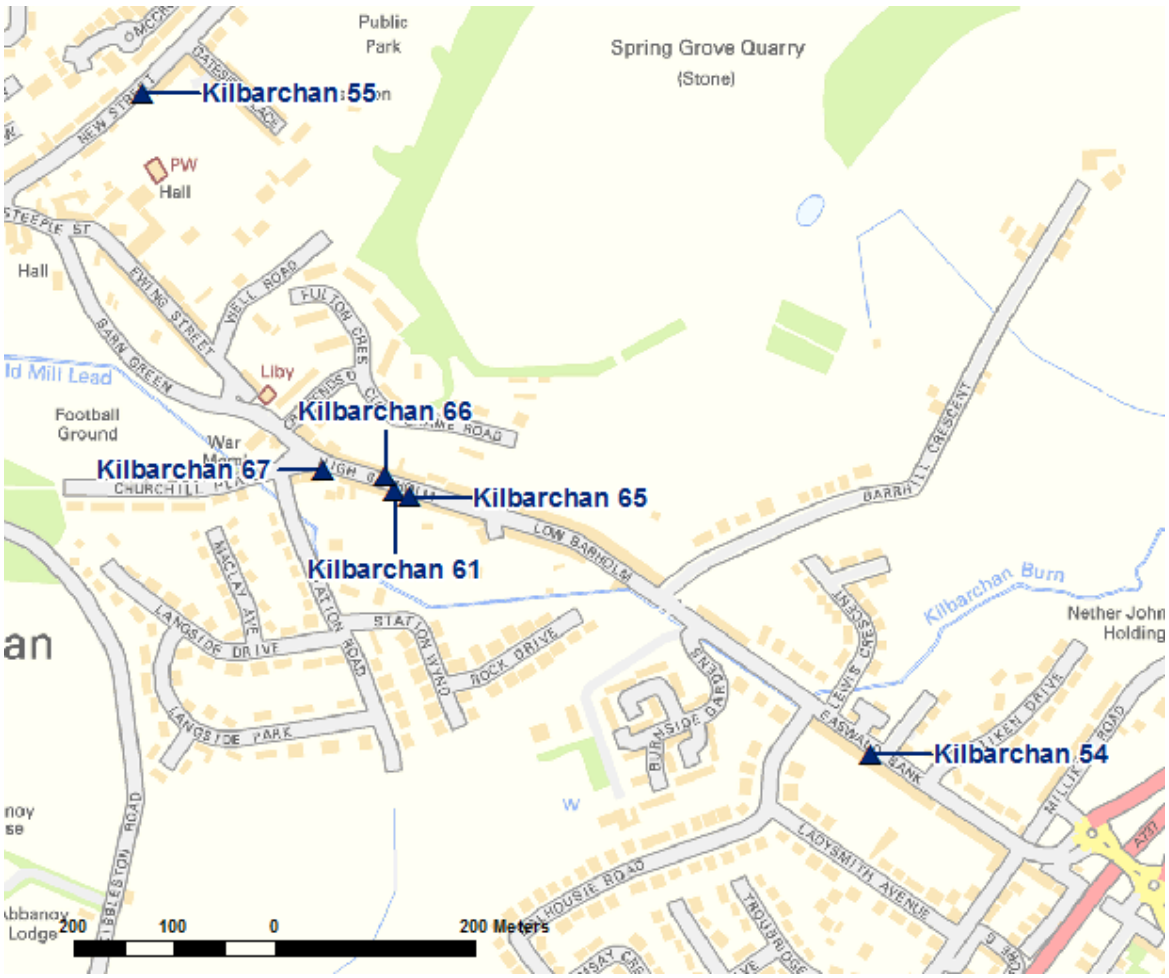
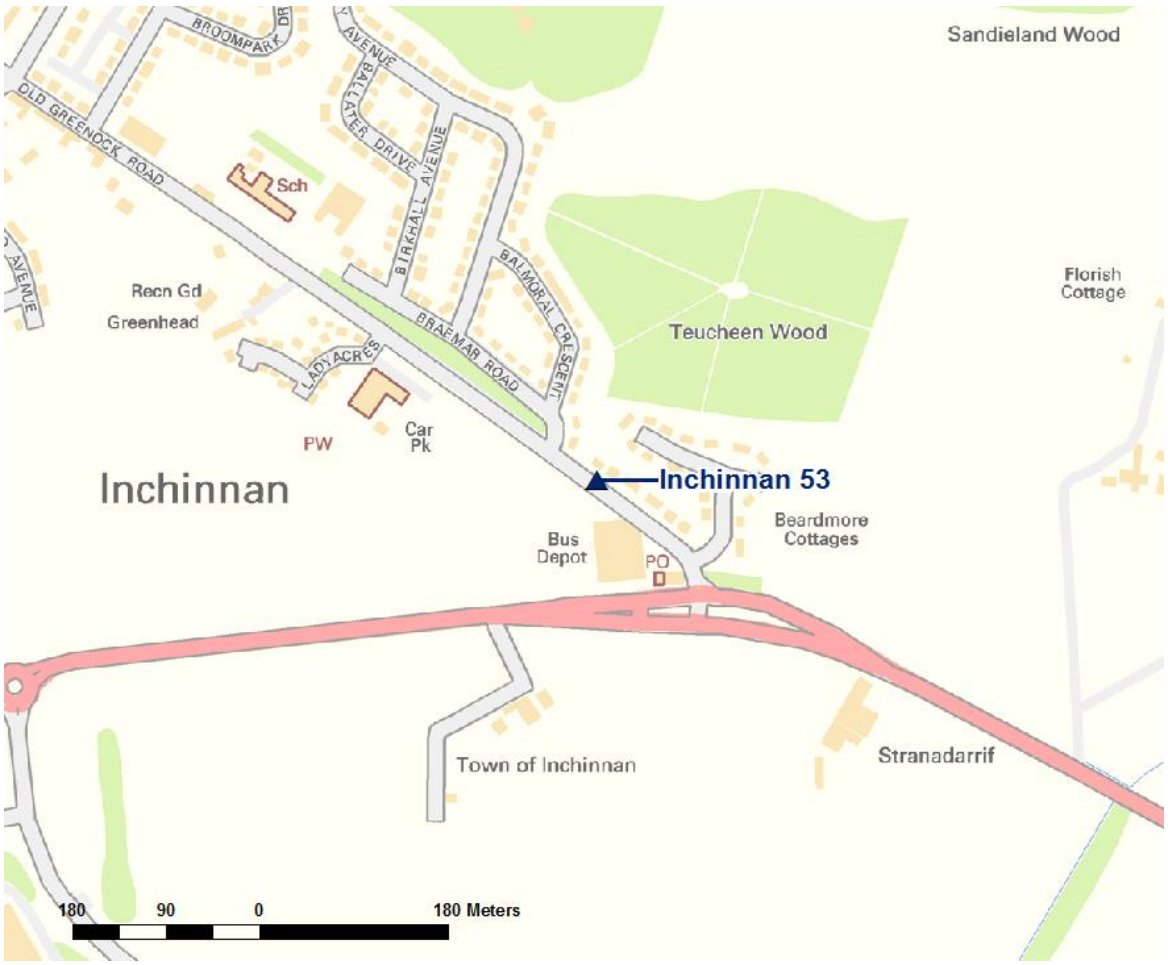


Figure 9.13: Bishopton diffusion tube sites

Figure 9.14: Inchinnan diffusion tube sites



N	Legend: ▲ Diffusion Tubes	RICARDO-AEA Contains Ordnance Survey data © Crown copyright and database right 2015