

2014 Air Quality Progress Report for Dumfries and Galloway Council

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

June 2015

Local Authority Officer	Jim Coltart
Department	Environmental Health and Trading Standards Planning and Environmental Services
Address	Dumfries and Galloway Council Municipal Chambers Buccleuch Street Dumfries DG1 2AD
Telephone	01387 245970
e-mail	jim.coltart@dumgal.gov.uk
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Summary

Results of monitoring for nitrogen dioxide (NO₂) show that all the concentrations meet the objectives, therefore there is no need to proceed to a detailed assessment for NO₂. In previous reports the objectives for sulphur dioxide, carbon monoxide, lead, benzene and 1,3 butadiene have all been assessed as being unlikely to be exceeded in Dumfries and Galloway. Hence no requirement for a new detailed assessment has been identified from monitoring.

No new requirement to proceed to a detailed assessment for any of the relevant pollutants has been identified as a result of new local developments. As mentioned in previous reports it had been intended to carry out a detailed assessment for PM₁₀ at the village of Cairnryan due to the perceived increase in traffic through the village when the new Stena Line ferry at Old House Point, Cairnryan became fully operational. However with cost considerations in mind it is now intended to carry out screening monitoring for PM₁₀ (using an Osiris monitor) with a view to establishing whether it would be appropriate to proceed to a detailed assessment at Cairnryan.

No part of the Council-area has been designated as an air quality management area to date.

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1 Introduction

1.1 Description of local authority area.

Dumfries and Galloway is located in south-west Scotland. To the north, the region shares borders with South Ayrshire, East Ayrshire and South Lanarkshire; to the east with Scottish Borders; and to the south with the county of Cumbria. Lying to the north of the Solway Firth and to the east of the Irish Sea, Dumfries and Galloway occupies a land area of approximately 6,439 km², making it the third largest of Scotland's 32 local authorities. Its population of approximately 147,284 is projected to fall to around 146,000 over the next 10 years. The largest town is Dumfries (31,600), followed by Stranraer (10,800) and Annan (8,300), with other settlements having populations of 4,500 or fewer. The economy of the region is based primarily on agriculture and forestry with light industry and tourism making significant contributions. Some 30% of Scotland's dairy cattle come from Dumfries and Galloway, and textiles, engineering and food processing are important industries in towns such as Dumfries, Kirkcudbright, Wigtown, Newton Stewart, New Galloway, Moffat, Lockerbie, Annan, Castle Douglas and Dalbeattie. The ferry ports at Cairnryan provide links to Belfast and Larne via Loch Ryan and the Irish Sea.

1.2 Purpose of progress report.

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act 1995ⁱ, 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 designate as an air quality management area the part or parts of its area in which it appears likely that exceedences will occur and prepare an air quality action plan 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. However, if the progress report identifies the risk of exceedence of an air quality objective, the local authority is required to proceed to a detailed assessment in respect of the pollutant concerned.

1.3 Air quality objectives

The air quality objectives applicable to local air quality management in Scotland are set out in the Air Quality (Scotland) Regulations 2000ⁱⁱ (Scottish Statutory Instrument No. 97) and the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish Statutory Instrument No. 297). Table 1 shows the objectives in units of microgrammes per cubic metre ($\mu\text{g}/\text{m}^3$) apart from the carbon monoxide objective which is expressed in milligrammes per cubic metre (mg/m^3) with the number of exceedences in each year that are permitted (where applicable). (The air quality objectives for other parts of the UK can be found in the Government's Air Quality Strategy for England, Scotland, Wales and Northern Irelandⁱⁱⁱ).

i, ii, iii See references on page 19

Table 1 Air quality objectives prescribed in regulations for the purpose of local air quality management in Scotland.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m ³ (or less)	Running annual mean	31/12/2003
	3.25 µg/m ³ (or less)	Running annual mean	31/12/2010
1,3-butadiene	2.25 µg/m ³ (or less)	Running annual mean	31/12/2003
Carbon monoxide	10 mg/m ³ (or less)	Running 8-hour mean	31/12/2003
Lead	0.5 µg/m ³ (or less)	Annual mean	31/12/2004
	0.25 µg/m ³ (or less)	Annual mean	31/12/2008
Nitrogen dioxide	200 µg/m ³ (or less) not to be exceeded more than 18 times a year	1-hour mean	31/12/2005
	40 µg/m ³ (or less)	Annual mean	31/12/2005
Particles (PM ₁₀)	50 µg/m ³ (or less) not to be exceeded more than 7 times a year	24-hour mean	31/12/2010
	18 µg/m ³ (or less)	Annual mean	31/12/2010
Sulphur dioxide	350 µg/m ³ (or less) not to be exceeded more than 24 times a year	1-hour mean	31/12/2004
	125 µg/m ³ (or less) not to be exceeded more than 3 times a year	24-hour mean	31/12/2004
	266 µg/m ³ (or less) not to be exceeded more than 35 times a year	15-minute mean	31/12/2005

1.4 Summary of previous reviews and assessments^{iv}

- 1.4.1 The findings of the first review and assessment of air quality in Dumfries and Galloway (commenced in 1998) were that the air quality objectives were likely to be met. As a consequence no air quality management areas were declared (which is still the position to date).
- 1.4.2 In 2003, an updating and screening assessment was carried out, the results of which generally supported the conclusions of the first round. However, in line with the Department for Environment, Food and Rural Affairs' (DEFRA's) revised technical guidance (2003), it was found that a detailed assessment of sulphur dioxide (SO₂) levels at the ferry ports of Stranraer and Cairnryan would be required.
- 1.4.3 In 2004 a detailed assessment of the influence of shipping on SO₂ levels at Cairnryan was carried out, the conclusion of which was that an air quality management area was not required. With regard to the detailed assessment at Stranraer this was initially put on hold pending Stena Line's proposed re-location to Cairnryan but subsequent to DEFRA's amendment of their technical guidance (2006) which relaxed the screening criteria for SO₂ related to shipping it was found that a detailed assessment for SO₂ at Stranraer was no longer required.
- 1.4.4 In 2005 monitoring results detailed in a progress report indicated that there was no requirement to proceed to a detailed assessment for any of the relevant pollutants.
- 1.4.5 In 2006 the conclusions of an updating and screening assessment were that the relevant air quality objectives would be met and that consequently there was no requirement to undertake a detailed assessment. Three road junctions in Dumfries were however predicted to marginally exceed the 2010 annual mean PM₁₀ objective.
- 1.4.6 Monitoring results detailed in the 2007 progress report showed that the current air quality objectives for the relevant pollutants were being met. Projected PM₁₀ levels at the monitoring site at Buccleuch Street, Dumfries indicated that the 2010 annual mean PM₁₀ objective would not be met but there was no relevant exposure at this roadside site. With regard to the marginal exceedences of the PM₁₀ annual mean predicted at three road junctions in the 2006 updating and screening assessment, traffic flows would be checked at the relevant areas to see if they were in line with estimated levels.
- 1.4.7 The main findings of the 2008 progress report were that whilst the air quality objectives in force at the time were being met, PM₁₀ levels at Buccleuch Street, Dumfries were again predicted to exceed the 2010 PM₁₀ annual mean objective and after a re-assessment of relevant exposure it was decided that a detailed assessment for PM₁₀ should be carried out to include Buccleuch St., Dumfries and the three road junctions in Dumfries which had previously been predicted to marginally exceed the 2010 PM₁₀ annual mean objective.
- 1.4.8 A detailed assessment for PM₁₀ was commenced in 2008 covering Buccleuch Street, and the junctions of Brooms Road/Annan Road, Glasgow Street/Galloway Street and Whitesands/Buccleuch Street, all in Dumfries. Concentrations of PM₁₀ were modelled for 2010 using the ADMS roads dispersion model. Projections of measured PM₁₀ concentrations did not identify an exceedence at the site of the Buccleuch Street PM₁₀ monitor itself; however exceedences of the 2010 annual

mean objective were predicted at all three junctions and exceedance of the 2010 PM₁₀ 24-hour mean objective was predicted at one junction (Whitesands/Buccleuch Street). It was subsequently decided to carry out PM₁₀ monitoring at these junctions to supplement this assessment. PM₁₀ monitoring at the Buccleuch St./Whitesands junction was commenced on 10/08/10.

- 1.4.9 In 2009 an updating and screening assessment was carried out having regard to DEFRA's further revision of their technical guidance TG(09)^v published in February 2009. The results of monitoring together with the evaluation of new and changed sources to identify those that might give rise to a risk of an exceedance of an air quality objective did not identify any new requirement to proceed to a detailed assessment. A previous commitment to carry out a detailed assessment of PM₁₀ at Cairnryan in the event that Stena Line re-located from Stranraer to Cairnryan was reiterated.
- 1.4.10 A progress report in 2010 found that NO₂ levels monitored during the previous year met the relevant objectives. PM₁₀ monitoring at the junction of Whitesands and Buccleuch Street had commenced but no new PM₁₀ data were reported as the BAM monitor had only recently been set up. No new requirement to proceed to a detailed assessment was identified as a result of monitoring or new developments.
- 1.4.11 A report, dated 24/08/11, supplementary to the PM₁₀ detailed assessment carried out in 2008/09, gave details of the results of PM₁₀ monitoring which took place over a period of six months at the junction of Buccleuch Street and Whitesands, Dumfries using a BAM monitor. The results when annualised for 2010 showed an annual mean of 15.75 µg/m³ and no exceedances of the 24-hour mean. Originally it had been intended to monitor at three junctions but as the modelling had indicated a higher annual mean and more exceedances of the 24-hour mean at the Buccleuch Street/Whitesands road junction than at the other two junctions (i.e. it was the worst case) it was concluded in the report that the objectives were also being met at the other two junctions and that there was no need to designate any air quality management areas.
- 1.4.12 The progress report submitted in November 2011 concluded that the objectives for NO₂ were being met, that there was no requirement for a detailed assessment for NO₂ and that monitoring at the junction of Whitesands and Buccleuch Street, Dumfries met the objectives for PM₁₀ therefore no air quality management areas were required.
- 1.4.13 The 2012 updating and screening assessment showed that the results of NO₂ monitoring together with the evaluation of new and changed sources to identify those that might give rise to a risk of an exceedance of an air quality objective did not identify any new requirement to proceed to a detailed assessment for any pollutant.
- 1.4.14 The conclusions of the 2013 progress report were that the objectives for NO₂ were being met and that no new requirement to proceed to a detailed assessment for any of the relevant pollutants had been identified as a result of new local developments. A previously planned detailed assessment for PM₁₀ at Cairnryan had been postponed pending completion of further developments at the Stena Line Port at Old House Point.

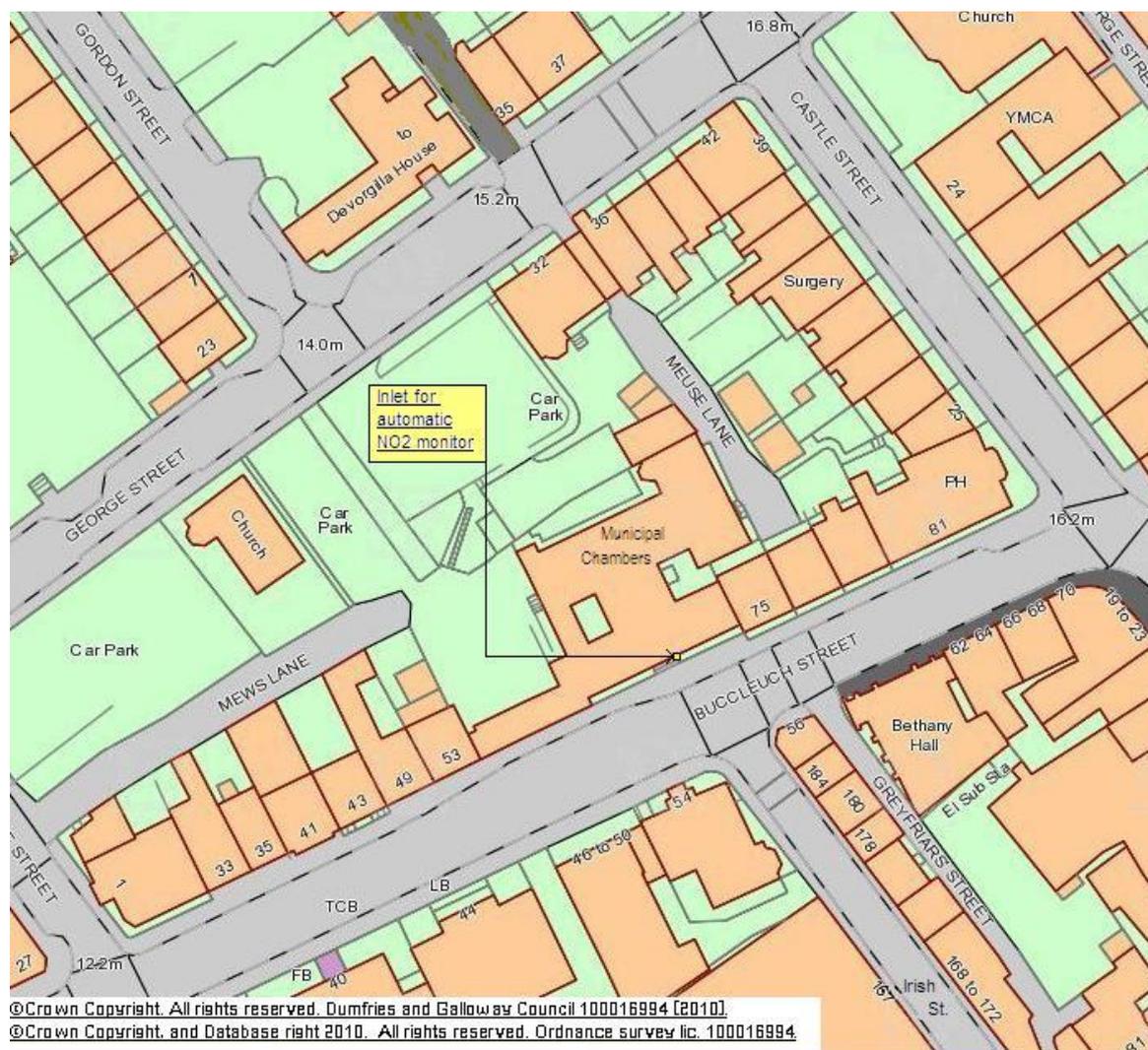
2. New Monitoring Data

2.1 Automatic monitoring

2.1.1 Dumfries NO₂

A continuous (chemiluminescent) NO₂ monitor (API M200A) is located at the Municipal Chambers, Buccleuch Street, Dumfries and forms part of the UK Automatic Urban and Rural Air Quality Monitoring Network (AURN). Routine calibrations of the automatic monitor are carried out fortnightly by Council staff, with six-monthly audits carried out by Ricardo-AEA. Data ratification is carried out by the Ricardo-AEA Quality Assurance and Control Unit.

Figure 1 - Map of NO₂ automatic monitoring site at Buccleuch St., Dumfries.



The air intake for the monitor is situated at a height of approximately 2.2 metres in the supporting framework of one of two decorative lamps on either side of the Municipal Chambers entrance. The air-intake tube goes through a window to the monitor which is located in the basement of the building.

2.1.2 Eskdalemuir NO₂

Since December 2004 a continuous NO₂ monitor has been located at the Observatory at Eskdalemuir as part of the AURN. The Observatory^{vi} is currently managed by the British Geological Society and the Met Office. Ratification is carried out by the Ricardo-AEA Quality Assurance and Control Unit.

Figure 2 - Map of NO₂ automatic monitoring site at Eskdalemuir Observatory.

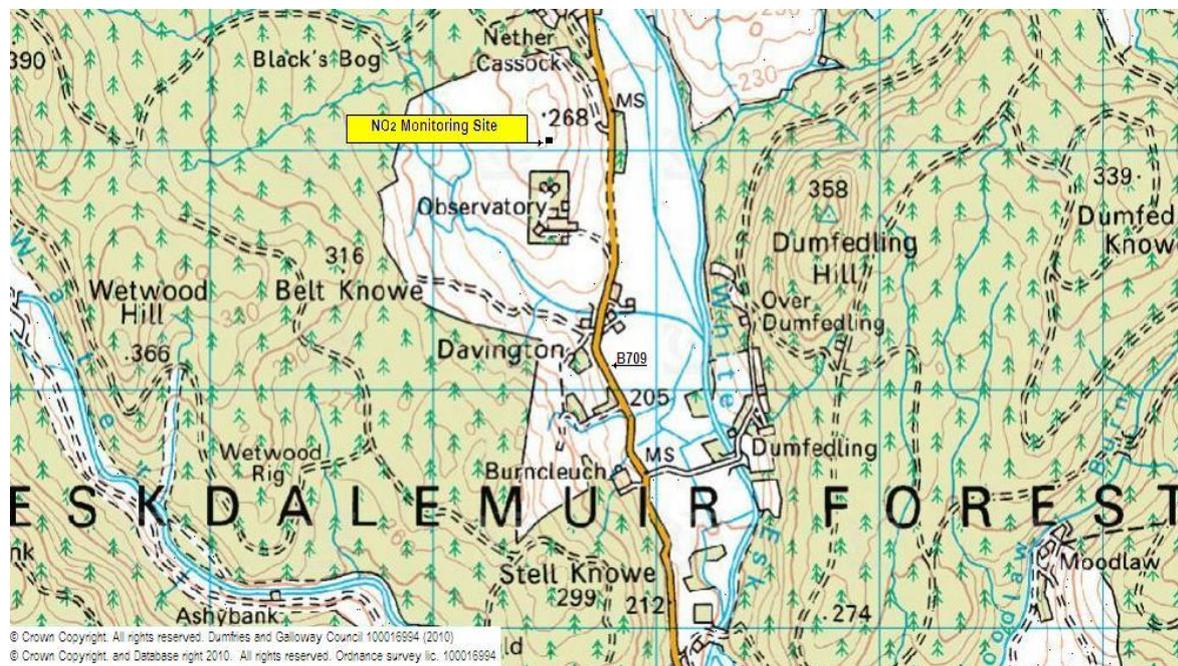


Table 2 Details of automatic monitoring sites.

Site Name	Site Type	Grid Ref.	Inlet Height (metres)	Pollutant	Monitoring Technique	Within AQMA?	Relevant Exposure?	Distance to kerb (metres)	Worst-case Exposure?
Buccleuch Street Dumfries	Roadside	297025 576259	2.2	NO ₂	Automatic	No	Yes (<1m)	4.3	Yes
Eskdalemuir	Rural	323551 603022	2.7	NO ₂	Automatic	No	No	n/a	n/a

2.2 Non-automatic monitoring.

NO₂ diffusion tubes are deployed for monthly exposure periods at the twelve sites shown in Table 3. Triplicate tubes are used at two sites namely at Buccleuch Street (East), and Buccleuch Street Bridge, with duplicate tubes at Buccleuch Street (West), while the rest of the sites have single tubes. Locations of the diffusion tubes are shown in Appendix 2 Figures 8 to 15. The tubes were prepared and analysed by Environmental Scientifics Group (Didcot) using 50% triethanolamine (TEA) in acetone. Environmental Scientifics Group demonstrated satisfactory performance for 2013 in the Workplace Analysis Scheme for Proficiency (WASP) (an independent analytical performance-testing scheme).

The triplicate tubes at Buccleuch St., (East) are co-located with the NO₂ automatic monitor. The local bias-adjustment factor was 0.85 and this has been used in preference to the national bias-adjustment factor for 2013 of 0.81 (v09-14, derived by amalgamation of 44 studies including Dumfries and Galloway's). Further details of the local co-location study are provided in Appendix 1.

Table 3 Details of NO₂ diffusion tube sites.
(see maps at appendix 2)

Site Name	Site Type	OS Grid Ref	Height of tube(s) (m)	Number of tubes	Within AQMA?	Relevant Exposure?	Distance to kerb of nearest road (metres)	Worst-case Location?
M74 Slip Road. Lockerbie	Intermediate	313345 581416	2.6	single	No	No (32m)	1.9	Yes
Buccleuch St. (E) Dumfries	Roadside	297025 576259	2.2	triplicate (co-located with automatic monitor)	No	Yes (<1m)	4.3	Yes
Buccleuch St. (W) Dumfries	Kerbside	296949 576218	2.9	duplicate	No	Yes (<1m)	1.0	No
Buccleuch St. (S) Dumfries	Kerbside	297978 576219	2.9	single	No	Yes (<1m)	0.6	No
Buccleuch St. Bridge Dumfries	Roadside	296868 576182	3.0	triplicate	No	Yes (<1m)	5.0	Yes
Loreburn St. Dumfries	Kerbside	297349 576188	2.8	single	No	Yes (<1m)	1.0	No
St. Michael St. Dumfries	Roadside	297457 575692	2.9	single	No	Yes (<1m)	3.1	No
Argyll Drive Dumfries	Background	299378 578847	2.8	single	No	Yes (1m)	1.7	No
Nith Place Dumfries	Kerbside	297280 575804	2.9	single	No	Yes (<1m)	0.7	Yes
* Charlotte Street, Stranraer	Roadside	206085 560859	2.2	single	No	Yes (<1m)	4.0	No
Port Rodie Car Park Stranraer	Other	206268 561020	2.6	single	No	No (160m)	N/A	Yes
* A77 Cairnryan	Roadside	207216 567422	2.4	single	No	No (19m)	2.0	Yes

* The diffusion tube locations at Charlotte Street, Stranraer and A77 Cairnryan have been changed since previous years due to developments at these sites. In each case the tube location has moved to the other side of the roadway. The Charlotte Street site-type is now roadside rather than kerbside.

2.3 Comparison of monitoring results with air quality objectives.

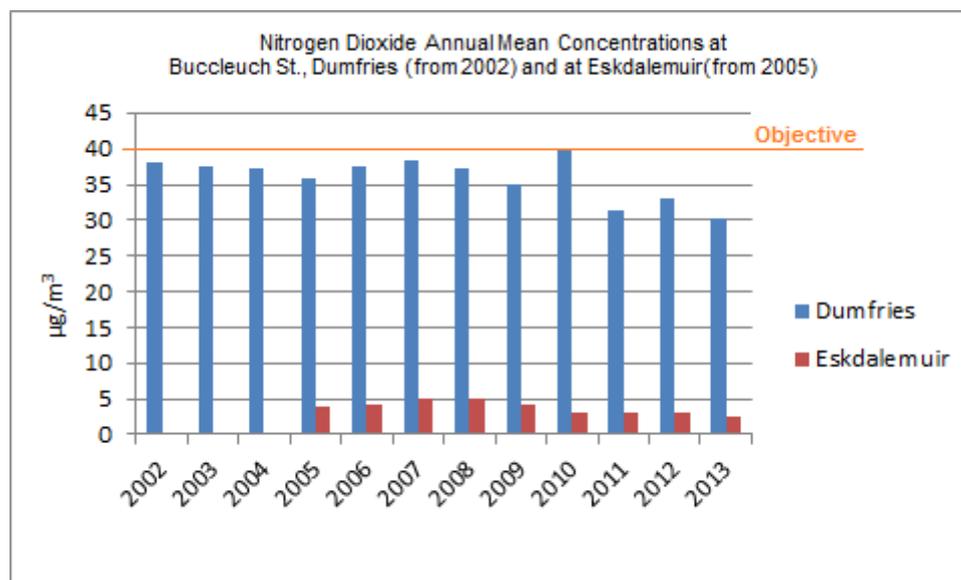
2.3.1 NO₂ automatic monitoring data.

All of the NO₂ results from automatic monitoring noted below meet the relevant objectives.

Table 4 Results of automatic monitoring for NO₂ - comparison with annual mean objective (40µg/m³ or less).

Location	Within AQMA	Valid data capture for full calendar year 2013 %	Annual mean concentrations (µg/m ³)											
			2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Buckleuch St Dumfries (Roadside site)	No	99-1%	38.0	37.6	37.3	35.9	37.5	38.3	37.3	35.0	39.9	31.5	33.1	30.2
Eskdalemuir (Rural site)	No	99-1%	n/a	n/a	n/a	3.8	4.3	5.0	5.1	4.3	3.0	3.2	3.0	2.5

Figure 3 Trends in annual mean NO₂ concentrations at automatic monitoring sites at Dumfries and at Eskdalemuir.



The annual mean concentrations at the roadside site at Buccleuch Street, Dumfries have fallen somewhat below the objective in the past three years with the 2013 figure being the lowest annual mean concentration recorded since automatic monitoring began at this site in March 2001. The concentrations at Eskdalemuir remain low reflecting the rural nature of the site with the 2013 concentration also being the lowest recorded since the automatic monitor was installed there in December 2004.

Table 5 Results of automatic monitoring for nitrogen dioxide - comparison with 1-hour mean objective ($200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times).

Location	Within AQMA?	Valid data capture for calendar year 2013 %	Number of hourly means > $200\mu\text{g}/\text{m}^3$											
			2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Buccleuch St Dumfries (Roadside site)	No	99.1%	0	2	0	1	0	5	4	0	3	2	0	1
Eskdalemuir (Rural site)	No	99.1%	n/a	n/a	n/a	0	0	0	0	0	0	0	0	0

2.3.2 NO₂ diffusion tube monitoring data.

All bias-corrected NO₂ results from diffusion tube monitoring meet the annual mean objective of $40\mu\text{g}/\text{m}^3$ or less.

Table 6 Annual mean results of nitrogen dioxide diffusion tubes 2008 to 2013.

Location		Within AQMA?	Full calendar year data capture 2013 %	Annual mean concentrations (microgrammes per cubic metre)					
				2008 (bias corrected x 0.93)	2009 (bias corrected x 0.83)	2010 (bias corrected x 0.92)	2011 (bias corrected x 0.83)	2012 (bias corrected x 0.88)	2013 (bias corrected x 0.85)
M74 Slip Road	Lockerbie	No	100%	31.1	28.2	37.0	30.6	31.6	28.1
***Buccleuch St. (E)	Dumfries	No	100%	37.3	34.2	39.8	31.5	33.2	30.3
††Buccleuch St. (W)	Dumfries	No	96%	32.4	31.3	35.2	30.0	31.4	27.8
Buccleuch St. (S)	Dumfries	No	100%	32.2	32.5	36.1	34.1	31.9	30.3
†††Buccleuch St Bridge	Dumfries	No	97%	31.6	32.3	34.0	28.2	28.8	26.6
Nith Place,	Dumfries	No	100%	32.9	30.8	35.0	26.8	30.0	27.5
Loreburn St.	Dumfries	No	83%	28.4	26.0	30.8	24.5	30.1	26.4
St Michael St.	Dumfries	No	100%	24.9	24.9	28.5	23.8	26.7	22.4
Argyll Drive	Dumfries	No	100%	12.2	11.0	12.1	10.7	12.1	8.7
Charlotte St.	Stranraer	No	100%	20.3	18.7	21.8	17.7	18.1	17.9
Port Rodie Car Park	Stranraer	No	92%	15.0	17.5	18.2	16.6	12.4	10.4
A77 Cairnryan	Stranraer	No	92%	20.6	19.2	21.6	19.6	21.5	20.9

*** Triplicate tubes co-located with AURN automatic monitor

†† Duplicate tubes

††† Triplicate tubes

n/a not applicable i.e. tube not deployed at site in year shown.

Figure 4 Trends in annual mean NO₂ diffusion tube concentrations over the last six years at all sites.

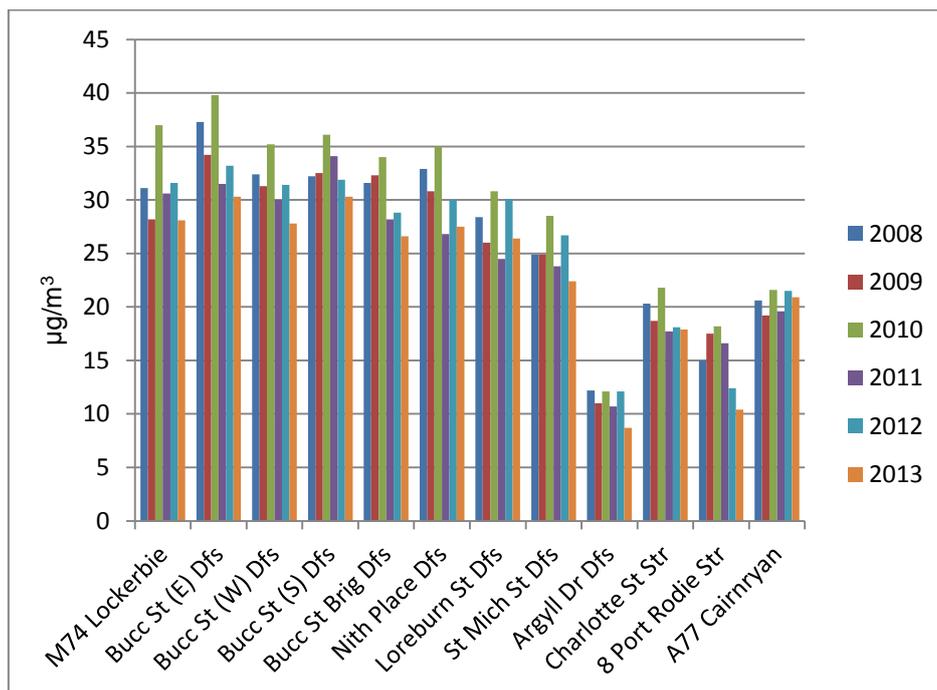


Figure 5 Graphs showing annual mean NO₂ diffusion tube concentrations over the last six years at sites in Buccleuch Street, Dumfries.

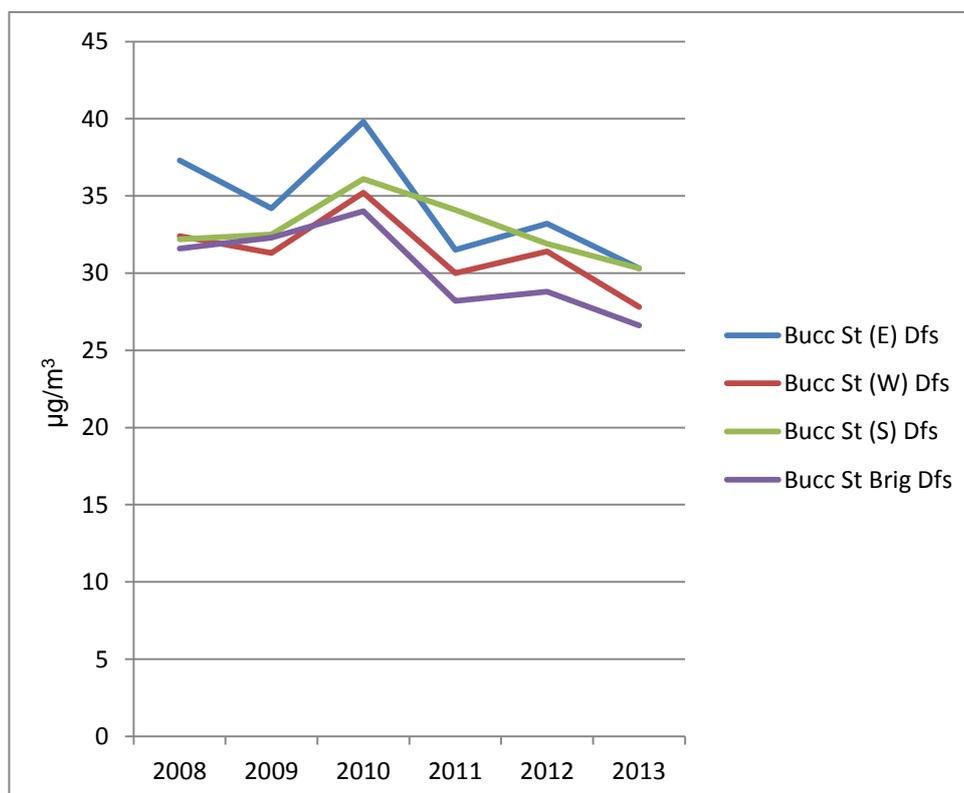


Figure 6 Graphs showing annual mean NO₂ diffusion tube concentrations over the last six years at sites other than Buccleuch Street, Dumfries.

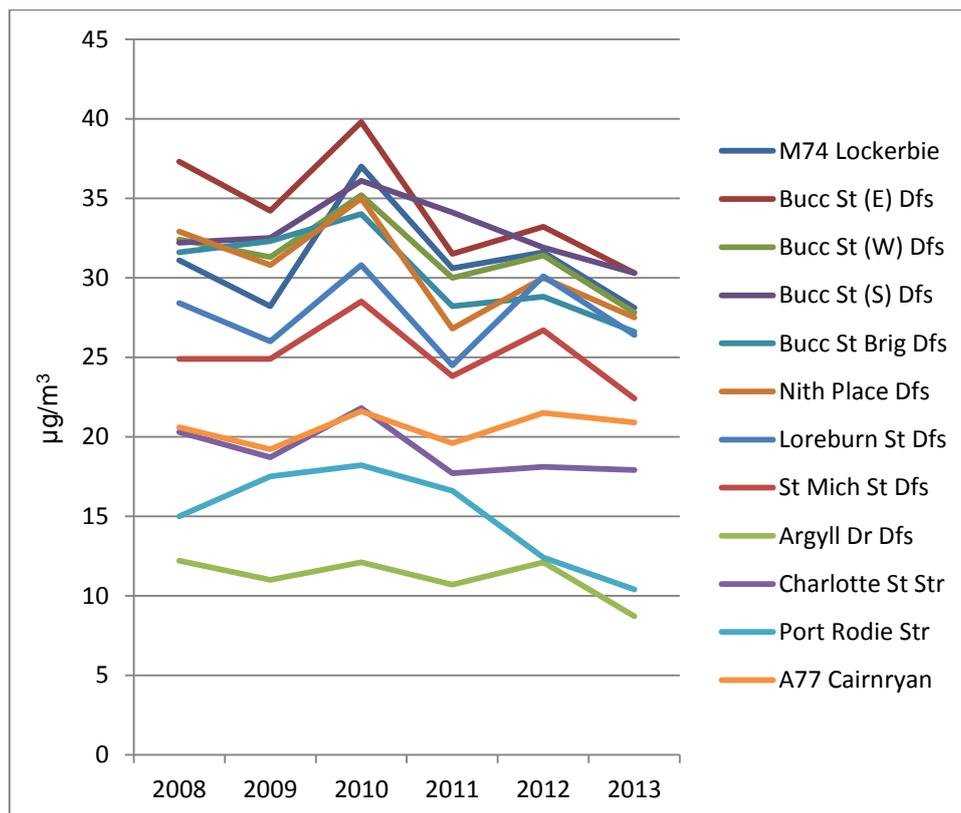
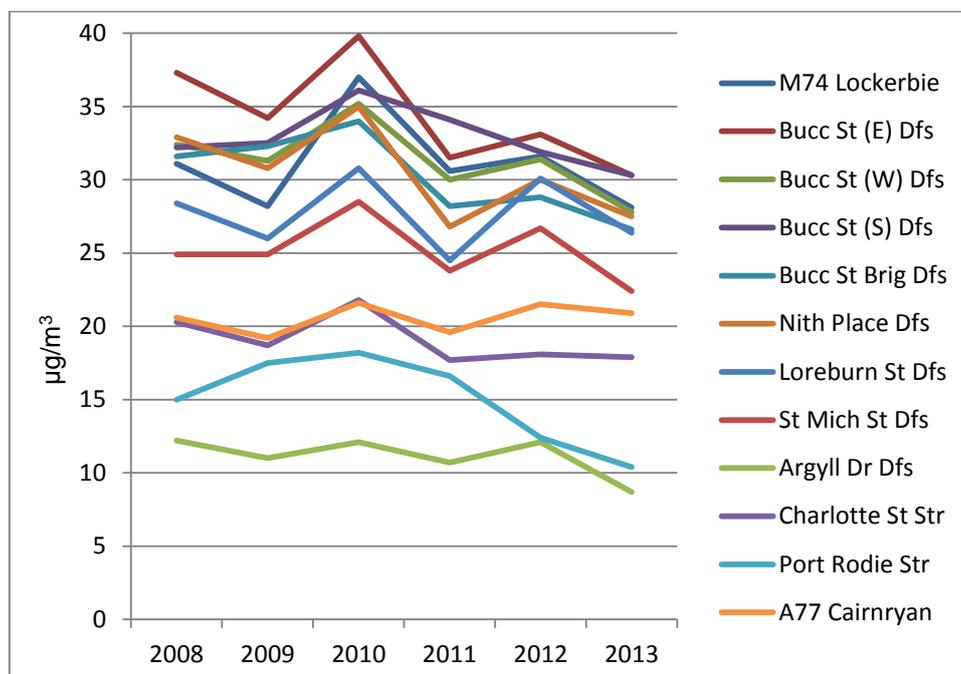


Figure 7 Graphs showing annual mean NO₂ diffusion tube concentrations over the last six years at all sites.



Results of monitoring for NO₂ in the Council-area have been examined and the results for 2013 are found to meet the objectives, therefore there is no need to proceed to a detailed assessment for NO₂.

3. New local developments.

3.1 Commercial and domestic sources

3.1.1 As reported in 2013 planning consent has been granted for a new 350-bed hospital at Garroch Farm, Garroch Loaning, Cargenbridge, Dumfries. An environmental statement^{vii} prepared by EnviroCentre Ltd., focused on the impacts of traffic emissions, as design information on the stack associated with the operation of a CHP/biomass boiler had not been made available. The modelling predictions indicated that that the annual average concentrations of both NO₂ and PM₁₀ for future year scenarios were well below their corresponding air quality objectives at each of the identified sensitive receptors. The potential impact of the energy centre with regard to air quality has not been specifically assessed as yet.

3.1.2 Planning consent has been granted for biomass boilers at the following locations:

- Ardoch & Clonhie, Enterkinfoot, Thornhill
- Blairinnie Farm, Parton, Castle Douglas
- Cavens Country House, Kirkbean, Dumfries
- Drumstinchall House, Dalbeattie
- Goldilea House, Dumfries
- Hightae Inn, Hightae, Lockerbie
- Kirkennan House, Palnackie, Dalbeattie
- Smiths at Gretna Green

3.2 Industrial sources

3.2.1 Planning consent has been granted for four poultry-breeding units, biomass boiler building and incinerator building at land to the north-west of Blackrig Farm, Lochmaben.

3.3 New developments with fugitive or uncontrolled sources.

3.3.1 Planning consent has been granted for a proposed Zero-Waste Park at land to the east of the existing Eco-Deco Plant on Lockerbie Road Dumfries.

3.3.2 Planning consent has been granted for the extension to the existing surface coal mine at Glenmuckloch, Kirkconnel (the eastern extension) without the requirement to transport coal by conveyor thereby permitting transportation of coal from Glenmuckloch to Crowbandsgate Coal Disposal Point and Rail Siding via the A76 & New Cumnock.

The above developments will be taken into consideration in the next updating and screening assessment. Apart from the above no significant road traffic (or other transport) sources, industrial, commercial, or domestic sources have been identified.

4. Conclusions

4.1 Conclusions from new monitoring data.

New NO₂ monitoring data indicate that the objectives for NO₂ are being met therefore there is no requirement for a detailed assessment for NO₂.

4.2 Conclusions relating to new local developments.

No new requirement to proceed to a detailed assessment for any of the relevant pollutants has been identified as a result of new local developments.

5. Proposed actions

A detailed assessment for PM₁₀ at Cairnryan had been previously planned to be undertaken when the new Stena Line port at Old House Point, Cairnryan was fully operational and all works and subsequent developments had been completed. With regard to the costs of monitoring involved however it is now intended to carry out screening monitoring for PM₁₀ using an Osiris monitor with a view to establishing whether it would be appropriate to proceed to a detailed assessment at Cairnryan.

6. References

- i. The Environment Act 1995 (UK Parliament Public General Acts).
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Appendix 1 Details of NO₂ co-location study

Table 7 Details of co-location study at Buccleuch Street Dumfries 2013.

Date	Monthly average (continuous monitor) (µg/m ³)	Ratified/provisional data	Data capture %	Monthly average (diffusion tubes) (µg/m ³)	Ratio:- continuous/diffusion tube result
January	36.94	Ratified	99.85	43.77	0.84
February	37.25	Ratified	95.84	44.93	0.83
March	38.06	Ratified	99.55	42.63	0.89
April	29.25	Ratified	99.71	32.33	0.90
May	26.25	Ratified	99.88	29.90	0.88
June	26.95	Ratified	99.85	31.67	0.85
July	24.73	Ratified	96.30	29.83	0.83
August	23.42	Ratified	99.88	30.10	0.78
September	26.49	Ratified	99.41	36.80	0.72
October	29.15	Ratified	99.85	36.07	0.81
November	42.84	Ratified	99.76	40.70	1.05
December	22.30	Ratified	99.88	27.97	0.80
Average	30.30		99.1%	35.56	

Bias-adjustment factor = continuous mean/diffusion tube mean = 30.30/35.56 = 0.85

Diffusion tube bias = (diffusion tube mean minus continuous mean) divided by continuous mean = (35.56 - 30.03)/30.30 = 0.17 i.e. tubes over-read by approximately 17%.

Table 8 Diffusion tube annual averages 2013.

Location of diffusion tube(s)		A	B	C	D
		Annual average µg/m ³	Annual average bias-corrected with local bias adjustment factor (x 0.85)	Annual average using Defra's national bias adjustment spreadsheet	Annual average bias-corrected with national bias adjustment factor (x 0.81)
M74 Slip Road	Lockerbie	33.0	28.1	28	27
***Buccleuch St. (E)	Dumfries	35.6	30.3	30	29
††Buccleuch St. (W)	Dumfries	32.7	27.8	29 [#]	26
Buccleuch St. (S)	Dumfries	35.6	30.3	30	29
†††Buccleuch St Bridge	Dumfries	31.3	26.6	27	25
Nith Place,	Dumfries	32.3	27.5	27	26
Loreburn St.	Dumfries	31.0	26.4	26	25
St Michael St.	Dumfries	26.4	22.4	22	21
Argyll Drive	Dumfries	10.2	8.7	9	8
Charlotte St.	Stranraer	21.0	17.9	18	17
Port Rodie Car Park	Stranraer	12.2	10.4	10	10
A77 Cairnryan	Stranraer	24.6	20.9	21	20

(µg/m³ = microgrammes per cubic metre)

***Triplicate tubes co-located with AURN automatic monitor

†† Duplicate tubes

††† Triplicate tubes

[#]The spreadsheet excludes the single tube result for July 2013 (see table 9).

All the locally bias-corrected results in column B are within the objective for the NO₂ annual mean ($\leq 40 \mu\text{g}/\text{m}^3$). Use of the national bias-adjustment factor for Environmental Scientifics Group of 0.81 would have given slightly lower results as shown in column D but the local factor is preferred.

Table 9 Monthly diffusion tube results for 2013

Site	Monthly diffusion tube results (microgrammes per cubic metre)												Average	Adjusted Average. (x 0.85)
	j a n	f e b	m a r	a p r	m a y	j u n	j u l	a u g	s e p	o c t	n o v	d e c		
M74 Slip Road, Lockerbie	36.2	37.8	27.5	24.9	29.7	29.4	27.8	31.4	35.4	33.6	51.3	31.4	33.0	28.1
***Buccleuch St (East), Dumfries	45.0	44.2	46.8	33.3	31.4	32.0	30.8	30.1	37.6	35.4	42.9	30.6	35.6	30.3
	42.6	46.7	45.1	34.1	28.3	31.6	30.1	30.9	37.1	36.8	36.9	26.0		
	43.7	43.9	36.0	29.6	30.0	31.4	28.6	29.3	35.7	36.0	42.3	27.3		
**Buccleuch St (West), Dumfries	44.4	42.6	40.2	34.3	26.1	25.1	22.7	27.2	25.7	33.4	35.5	27.8	32.7	27.8
	42.8	38.7	40.5	33.8	27.8	27.7	V	28.6	33.4	36.3	37.5	31.0		
Buccleuch St (South), Dumfries	39.2	43.4	46.0	35.0	25.0	28.1	27.7	30.1	38.9	37.6	42.7	33.6	35.6	30.3
***Buccleuch St Bridge, Dumfries	45.2	36.8	41.4	28.1	21.8	23.0	23.3	24.6	27.7	33.7	35.8	32.6	31.3	26.6
	45.6	38.6	37.2	35.6	22.8	31.2	22.8	23.4	29.1	33.7	33.3	23.1		
	V	35.8	42.3	33.4	21.5	24.3	23.3	22.4	29.9	32.9	35.1	29.9		
Nith Place, Dumfries	38.2	41.5	44.9	31.6	24.8	26.2	23.6	23.9	32.4	29.4	40.9	29.6	32.3	27.5
Loreburn St Dumfries	44.8	36.4	39.8	33.7	22.0	26.0	22.8	V	31.7	31.8	V	20.9	31.0	26.4
St Michael St Dumfries	33.6	31.1	35.3	24.2	26.0	20.2	17.7	15.9	28.1	27.2	35.5	22.0	26.4	22.4
Argyll Drive Dumfries	17.5	14.5	12.0	7.7	6.6	6.1	6.0	7.1	10.9	10.2	19.1	4.2	10.2	8.7
Charlotte St Stranraer	19.3	31.8	25.0	19.8	15.6	20.6	22.8	17.5	22.4	21.9	24.1	11.3	21.0	17.9
Port Rodie Car Park Stranraer	19.1	22.7	14.3	10.5	8.9	10.1	9.4	9.6	6.1	11.6	12.4	V	12.2	10.4
A77 Cairnryan Stranraer	V	28.7	22.3	21.6	16.0	27.5	25.5	15.3	25.0	34.0	29.7	24.9	24.6	20.9

***TriPLICATE tubes (co-located with automatic monitor)

**Duplicate tubes

***TriPLICATE tubes

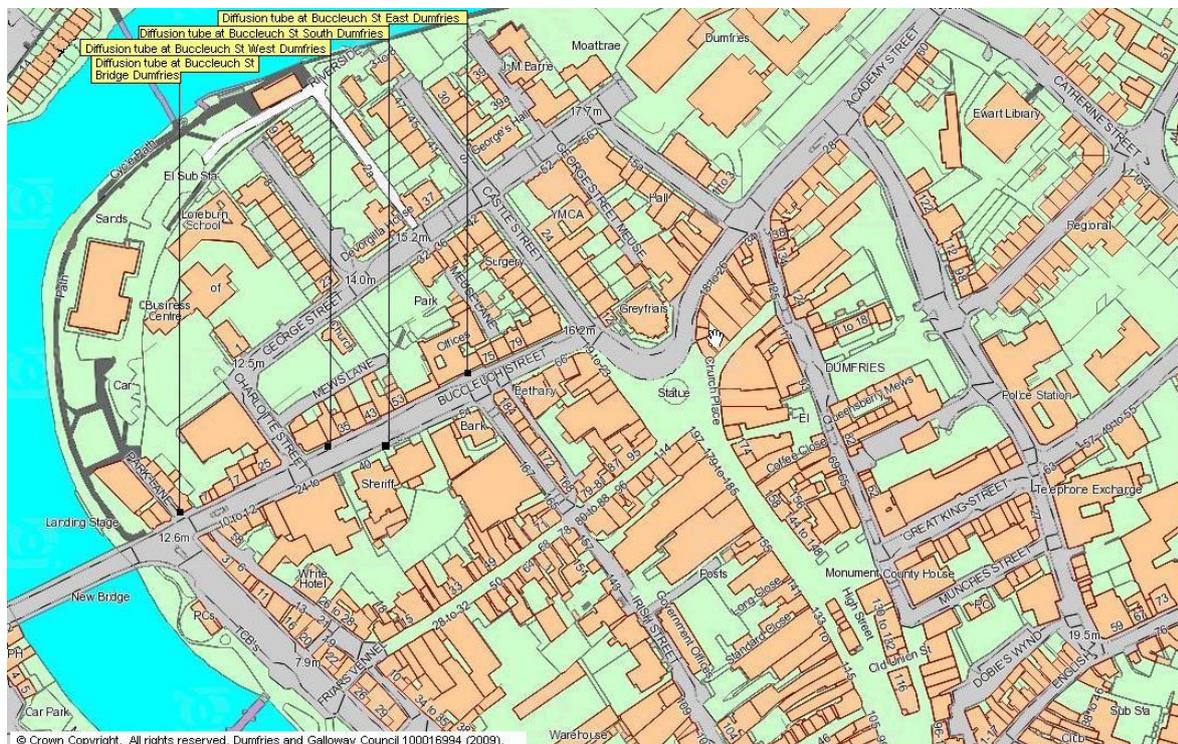
V - Tube(s) vandalised (or otherwise removed or sample tubes contaminated or result[s] rejected)

Appendix 2 Maps of non-automatic monitoring sites.

Figure 8 Map of diffusion tube site at M74 Lockerbie.



Figure 9 Map of diffusion tube sites at (from left to right) Buccleuch St. Bridge, Buccleuch St. West, Buccleuch St. South, & Buccleuch St. East, Dumfries.



Appendix 2 Maps of non-automatic monitoring sites (continued).

Figure 10 Map of diffusion tube site at Loreburn St., Dumfries.

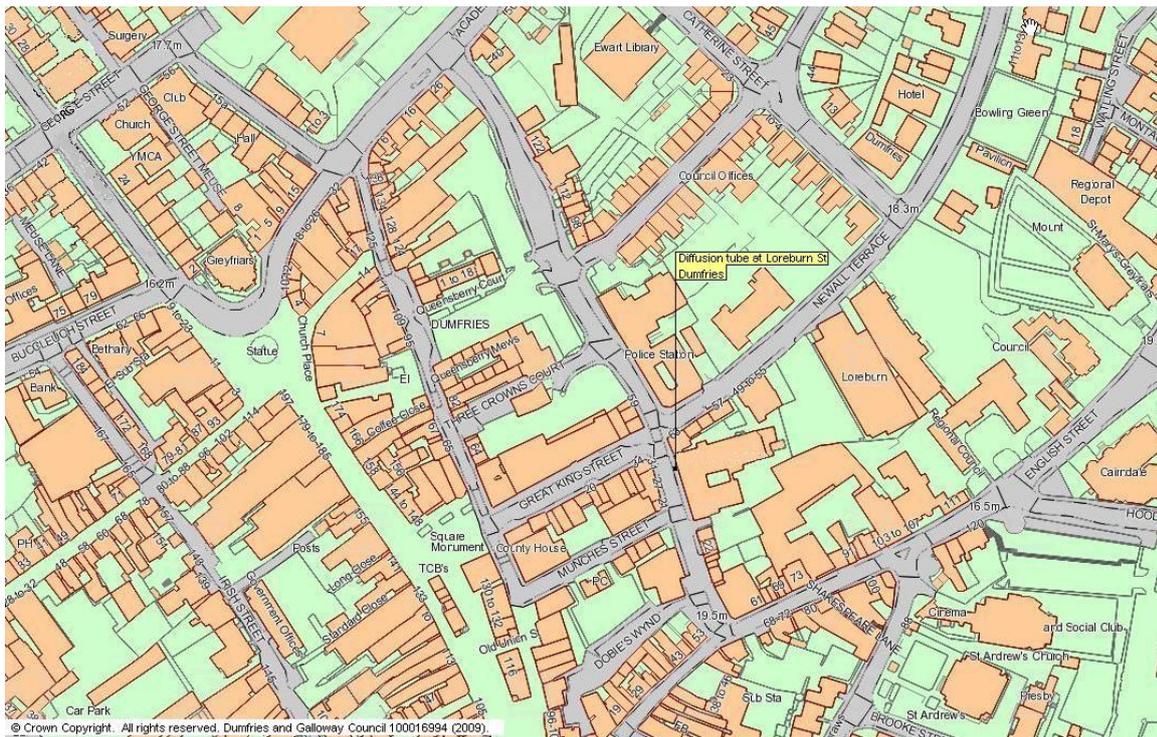
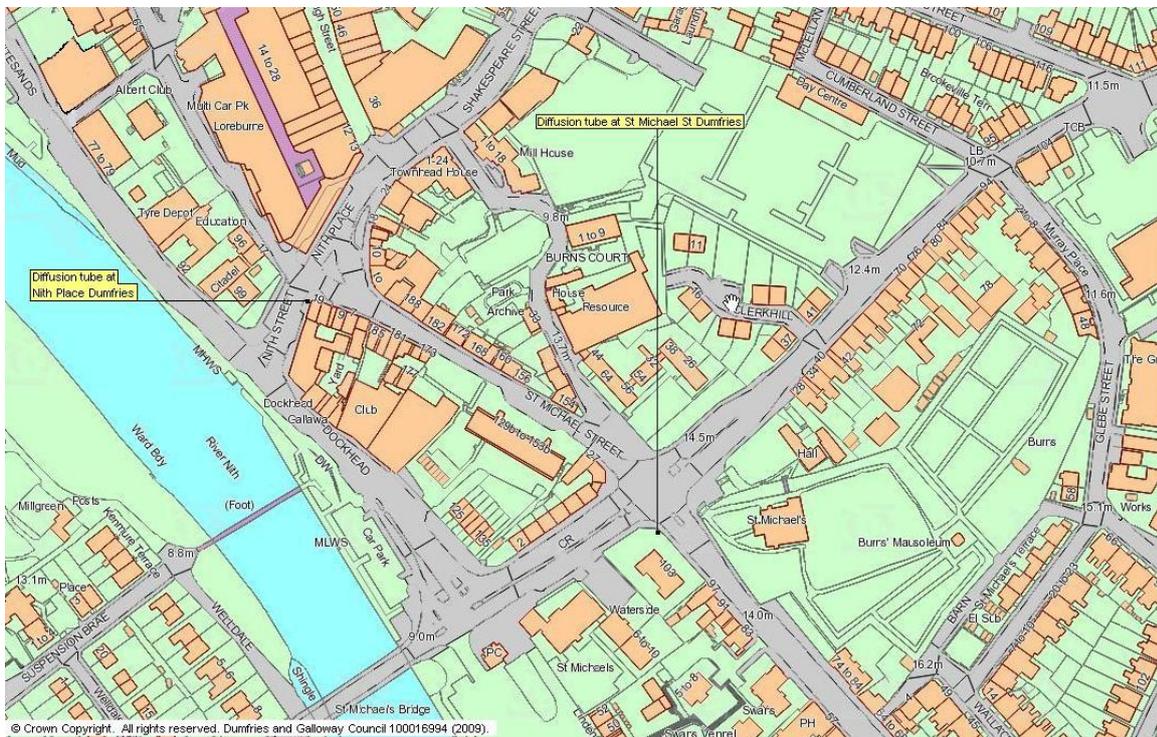


Figure 11 Map of diffusion tube site at Nith Place and St Michael St., Dumfries.

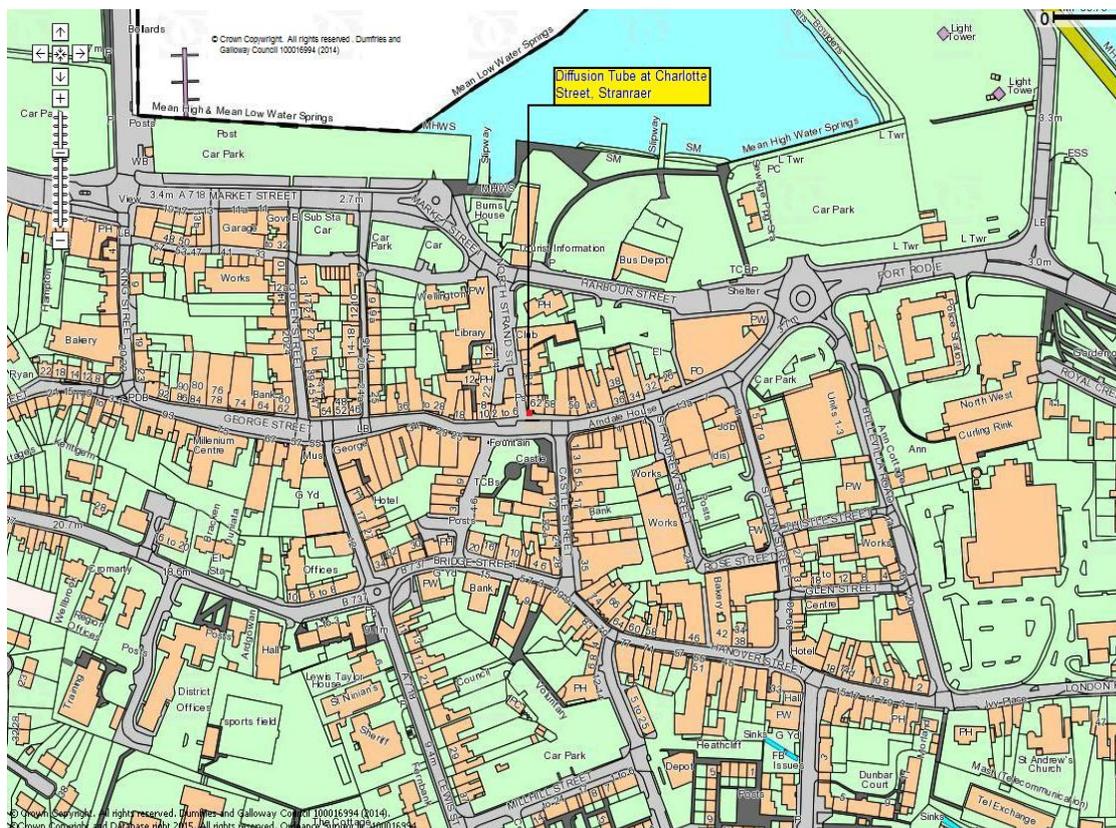


Appendix 2 Maps of non-automatic monitoring sites (continued).

Figure 12 Map of diffusion tube site at Argyll Drive, Heathhall Dumfries.



Figure 13 Map of diffusion tube site at Charlotte St., Stranraer.



Appendix 2 Maps of non-automatic monitoring sites (continued).

Figure 14 Map of diffusion tube site at Port Rodie Car Park Stranraer.

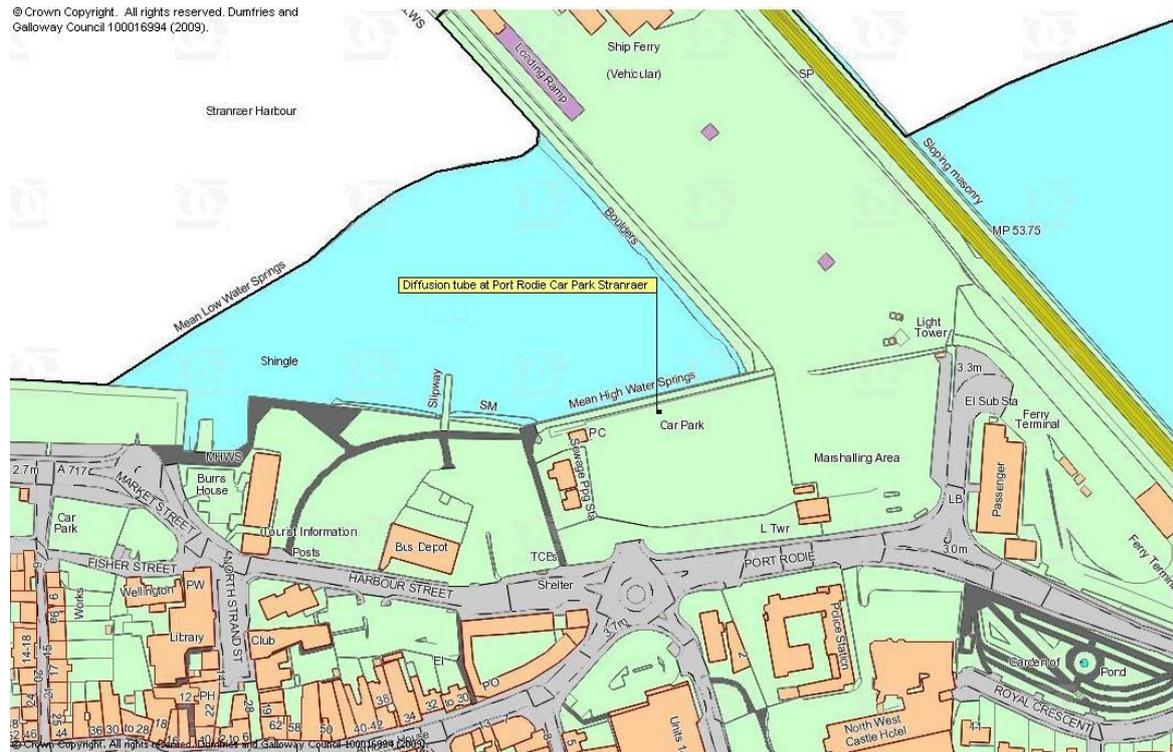


Figure 15 Map of diffusion tube site at A77 Cairnryan.

