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Air Quality Review And Assessment Progress Report for Fife Council 2006/7

Report to Fife Council

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Executive Summary

Fife Council is undertaking the third round of air quality review and assessment, in which sources of air pollutant emissions are reassessed to identify whether the situation has changed since the previous round, and if so, what impact this may have on the likelihood of compliance with Air Quality Strategy objectives.

As with previous rounds, this third round of review and assessment comprises two steps. The first step is an Updating and Screening Assessment, which updates the previous assessment for all pollutants identified in the Air Quality Regulations. Where a significant risk of exceedance is identified for a pollutant it will be necessary for the Local Authority to proceed to a Detailed Assessment. Where a Local Authority does not need to undertake a Detailed Assessment, a progress report is required instead.

Fife Council completed the first of these two steps, the Updating and Screening Assessment, in July 2006. This first Progress Report reviews all new monitoring data and monitoring locations and provides an update on any other significant developments during 2006.

On the basis of this assessment, no further action is required in respect of the pollutants:

- Carbon Monoxide
- Benzene
- 1,3-Butadiene
- Lead
- Sulphur Dioxide

However, as monitoring data for 2006 (both automatic and diffusion tube data) indicate that there may be an exceedence of the objectives for nitrogen dioxide and PM_{10} particulate matter in Bonnygate, Cupar then a Detailed Assessment is required for this area. The Detailed Assessment, to be produced by April 2008, will include an examination of monitoring data for an additional year (2007), air quality modelling undertaken as part of proposed road schemes for the area, any additional modelling required and any other relevant information available. If the Detailed Assessment confirms the exceedence of the Air Quality Objective then Fife Council will need to proceed to the declaration of an Air Quality Management Area in Cupar.

At Appin Crescent, Dunfermline, Fife Council has recently installed a continuous automatic analyser to more accurately determine NO_2 concentrations at this location. These data will form part of a future Detailed Assessment report.

The six month of PM_{10} monitoring at Admiralty Rd, Rosyth indicates that the 2010 annual average air quality objective for this pollutant may be exceeded at this location. Hence, monitoring over a full year will also be required in this area. Again these data will form part of a future Detailed Assessment report.

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1 Introduction

This Air Quality Progress Report has been prepared for Fife Council to comply with the Local Air Quality Management (LAQM) system introduced in Part IV of the Environment Act 1995. The report conforms to the Progress Report Guidance, LAQM.PRG(03)[1] and the Scottish Executive Revised Policy Guidance[2] and Technical Guidance, LAQM TG(03)[3] issued under Section 88(1) of the Environment Act 1995. Pursuant to Section 88(2) of the Environment Act 1995, Fife Council and the author of this report have had due regard to the relevant guidance.

1.1 Purpose Of The Progress Report

Local Authorities need to produce an annual progress report to provide continuity of assessment between the 3-yearly Updating and Screening Assessments of local air quality.

The purpose of the progress report is to:

- Provide both a review and update on air quality issues;
- Provide information on new and proposed developments that might affect air quality and the results of the monitoring;
- Identify changes in circumstances early on, that might require a Detailed Assessment;
- Assist with Local Air Quality Management (LAQM) process;
- Help Local Authorities implement Local Air Quality Management;
- Identify overall improvements in air quality.

In addition to the minumum requirements for a Progress Report, LAQM.PRG(03) outlines additional elements that could be added:

- progress on implementation of action plans;
- an assessment of the monitoring data in relation to likely exceedences of the objectives;
- progress on local air quality strategies;
- a list of planning applications that have the potential to affect local air quality;
- progress on implementing those elements of the local transport plan (local transport strategies in Scotland and Borough Spending Plans in London) that might affect air quality; and
- any relevant updates on planning policies that relate specifically to air quality.

Fife Council has not been required to implement any action plans or air quality strategies. Assessment of monitoring data is contained within this report and a summary of relevant planning applications is provided in Section 3.2. Consideration of transport proposals in the Fife Structure Plan was included in the Updating and Screening Assessment and specific details of the most pertinent of these proposals (Cupar relief road) are provided in Section 5 of this report.

1.2 Air Quality Strategy Objectives

The Air Quality Strategy's standards and objectives are shown in Table 1.1. The table shows the standards in $\mu g\ m^{-3}$ ($mg\ m^{-3}$ for CO) with the number of exceedences that are permitted (where applicable).

Table 1.1 Objectives included in the Air Quality Regulations and subsequent Amendments, for the purpose of Local Air Quality Management

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene			
All authorities	16.25 μg m^{-3}	running annual mean	31.12.2003
Authorities in England and Wales only	5.00 μg m^{-3}	annual mean	31.12.2010
Authorities in Scotland and Northern Ireland only	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			
Authorities in England, Wales and Northern Ireland only	10.0 mg m^{-3}	maximum daily running 8-hour mean	31.12.2003
Authorities in Scotland only	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[a]	200 μg m^{-3} not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	40 μg m^{-3}	annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)[b]			
All authorities	50 μg m^{-3} not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 μg m^{-3}	annual mean	31.12.2004
Authorities in Scotland only[c]	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

a. These objectives are provisional.
b. Measured using the European gravimetric transfer sampler or equivalent.
c. These 2010 Air Quality Objectives for PM_{10} apply in Scotland only, as set out in the Air Quality (Scotland) Amendment Regulations 2002.

In Scotland, the PM_{10} objectives for 2010 have been adopted into regulation and hence, assessment against these objectives is required. However, in England, Wales and Greater London the 2010 objectives for PM_{10} are not currently included in Regulations for the purpose of LAQM.

1.3 Summary Of Conclusions of the 2006 Updating and Screening Assessment[4]

CARBON MONOXIDE

The results of 9-months of carbon monoxide monitoring at Admiralty Road, Rosyth, and the short-term monitoring undertaken by the Transportation Department indicate that CO concentrations are well below objective set. There are no roads in Fife which require further screening according to the criteria in the technical guidance. There are no new industrial processes, road or other developments that require detailed assessment with respect to this pollutant. Hence, a detailed assessment is not required for carbon monoxide.

BENZENE
Results of the ongoing air quality monitoring studies for Ineos and BP indicate that ambient concentrations of benzene in Fife meet the Air Quality Strategy Objective. There are no new industrial processes, roads, petrol stations or other developments that require detailed assessment for this pollutant. Hence, a detailed assessment is not required for benzene.

1,3-BUTADIENE
Results of ongoing air quality monitoring study for Ineos indicate that ambient concentrations of 1,3-butadiene in Fife meet the Air Quality Strategy Objective. There are no new industrial processes, roads, or other developments that require detailed assessment for this pollutant. Hence, a detailed assessment is not required for 1,3-butadiene.

LEAD
No ambient monitoring for lead is carried in Fife. However, the emissions of lead from industrial processes are unlikely to result in an exceedence of the objectives for lead. There are no new industrial processes or other developments that require detailed assessment for this pollutant. Hence, a detailed assessment is not required for lead.

NITROGEN DIOXIDE
Measurements of NO_2 at the automatic monitoring sites at North Approach Road, Kincardine and at Admiralty Road, Rosyth indicate that NO_2 concentrations will meet the Air Quality Strategy Objective for NO_2 at these sites. Initial results at the new automatic monitoring site in Bonnygate, Cupar indicate that concentrations at this site may approach the objective and this is confirmed by the diffusion tube results in this area.

Of those diffusion tubes located in areas relevant for exposure (i.e. not at kerbside locations) only one other site - Appin Crescent, Dunfermline – has concentrations that approach (but do not exceed) the NO_2 objective.

Screening of roads and junctions throughout Fife indicates that there is unlikely to be any exceedence of the NO_2 Air Quality Objective.

There are no industrial processes or planned developments that are likely to lead to an exceedence of the NO_2 objective.

Fife Council are already proactively investigating the areas of elevated NO_2 concentrations identified by monitoring with additional diffusion tubes - deployed in April 2006 - and the establishment of the automatic monitoring station in Bonnygate.

A detailed assessment is not required for nitrogen dioxide.

SULPHUR DIOXIDE
Monitoring of sulphur dioxide by automatic monitoring, Smoke and SO_2 network monitoring and diffusion tubes indicate that the air quality objectives for SO_2 are met in Fife. There are no industrial processes or planned developments that are likely to lead to an exceedence of the SO_2 objective. Hence, a detailed assessment is not required for sulphur dioxide.

PM_{10}
The monitoring of PM_{10} at Admiralty Road, Rosyth indicates that the 2004 air quality objectives for PM_{10} are met at this location. However, projecting measured concentrations forward to 2010 indicates that the 2010 Objective may be closely approached. Initial data for the Bonnygate site indicates the same situation for the 2004 Objective, but more likelihood of an exceedence of the 2010 Objective. As Fife Council plan to undertake more monitoring at Admiralty Road and Bonnygate, no further assessment is required at this time. However, it is recommended that a full year of monitoring be undertaken at both sites.

The DMRB screening assessment of roads and junctions in Fife shows estimated concentrations well below the 2004 PM_{10} Air Quality Objective and also below the 2010 PM_{10} Objective.

There are no significant domestic or industrial sources of PM_{10}.
Hence, a detailed assessment is not required for PM_{10}.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

New monitoring data for 2006, for the following pollutants, have become available since the 2006 Updating and Screening Assessment and are reviewed for this progress report:

- Carbon Monoxide (CO),
- Benzene;
- 1,3-butadiene;
- Nitrogen dioxide (NO_2);
- Sulphur Dioxide (SO_2);
- PM_{10}.

Fife Council have carried out automatic monitoring for CO, NO_2, SO_2, and PM_{10} during 2006 and extensive NO_2 measurements with diffusion tubes. Additional NO_2, SO_2, benzene and 1,3-butadiene data are available from a study of air quality around the refinery at Grangemouth (Ineos Manufacturing (Scotland) Ltd) and measurements of benzene and other hydrocarbon compounds in the vicinity of Hound Point are available from BP Exploration Operating Company Ltd. Automatic SO_2 data are also available from Scottish Power Generation Ltd from a monitoring site close to Longannet Power Station.

2.1.1 Automatic Air Quality Monitoring

Fife Council operated three automatic air quality monitoring stations during 2006. Two long-term stations were operated, one at a roadside site at North Approach Road, Kincardine and the other at a kerbside site in Bonnygate, Cupar. The Groundhog mobile site was operated at Admiralty Road, Rosyth from 26 September 2006 and data are available for the period October 06 to March 07. Full details of these monitoring stations are provided in Appendix 1 and are summarised in Table 2.1

Table 2.1 Fife Council Automatic Monitoring Locations

Location	Site Type	Monitoring Equipment	Pollutants Measured
North Approach Road, Kincardine (Grid reference 293191 687518)	Roadside	Rollalong – NO_x Analyser (with diffusion tubes in triplicate)	NO_x, NO & NO_2
Admiralty Road, Rosyth (Grid reference 311752, 683515)	Roadside	Groundhog mobile monitoring unit (with diffusion tubes in triplicate)	NO_x, NO & NO_2, SO_2 and PM_{10}.
Bonnygate, Cupar (Grid reference 337401 714572)	Kerbside	Street enclosure with NOx and PM_{10} analysers (with diffusion tubes in triplicate)	NO_x, NO & NO_2 and PM_{10}.

Automatic measurements of SO_2 are also undertaken on behalf of Scottish Power Generation Ltd at Blair Mains, a monitoring site downwind of Longannet Power Station.

Table 2.2 Scottish Power Generation Ltd Automatic Monitoring Location

Location	Site Type	Pollutants Measured
Blair Mains (Grid reference NS972864)	Rural	SO_2 (and wind speed and direction)

Short-period carbon monoxide monitoring has also been undertaken by Fife Council Transportation Department.

2.1.2 Non - Automatic Air Quality Monitoring

Fife Council operates an extensive NO_2 monitoring survey with monitoring sites in East, West and Central Fife. The location of these monitoring sites and data for 2006 and previous years are provided in Section 2.2.5 and Appendix 2. Fife Council also undertake sulphur dioxide diffusion tube monitoring with a triplicate tube site at Markinch, close to Tullis Russell Papermakers and at long running monitoring sites at Valleyfield, close to Longannet Power Station, and at a site in Culross High Street (see Section 2.2.6).

As part of the commitment of Ineos Manufacturing (Scotland) Ltd to monitor any potential environmental impact from its Grangemouth oil refinery on the surrounding area, the National Physical Laboratory were commissioned to conduct an ongoing ambient air quality survey over a wide area around the Firth of Forth. Measurements are made monthly at 22 sites using passive diffusion tube techniques. NO_2, SO_2 and a range of organic pollutants including benzene and 1,3-butadiene are monitored using diffusive samplers. Results from the 4 sites in Fife within this survey are presented in this report.

Measurements of benzene and other hydrocarbon compounds are also undertaken by NPL on behalf of BP Exploration Operating Company Ltd in the vicinity of Hound Point[6]. These results are presented in Section 2.2.2.

2.2 Monitoring Results for 2006

2.2.1 Carbon Monoxide (CO)

No new continuous automatic carbon monoxide monitoring has been undertaken in Fife. Previous levels monitored at Admiralty Road, Rosyth were well below the Air Quality Objective for carbon monoxide.

As in previous years, short periods of carbon monoxide monitoring have been undertaken by Fife Council Transportation Department at a number of roadside locations. Measurements were undertaken with Marksmann 660 street monitors. The results are summarised in Table 2.3.

Table 2.3 Roadside Carbon Monoxide Monitoring

Site Number and Location	Monitoring Period	Maximum 8-hour concentration mg m^{-3}
Site 7 Leven, Windygates Rd/Glenlyon Rd	03/03/07 – 09/03/07	3.2
Site 13 Dunfermline, Carnegie Drive/Pilmuir Street,	13/03/07 – 19/03/07	3.6
Site 16 Kirkcaldy, Victoria Rd/Dunniker Rd	03/03/07 – 09/03/07	0.9
Site 24 Rosyth, Admiralty Rd/Queensferry Rd	03/03/07 – 09/03/07	0.6
Site 34. Cupar, Bonnygate Crossgate Traffic Lights	03/03/07 – 09/03/07	1.0
Site 35 Dunfermline, Appin Crescent	13/03/07 – 19/03/07	1.2
Site 36 Kirkcaldy, St Clair St/Junction Rd	01/02/07 – 07/02/07	1.4

Whilst none of these monitoring periods are sufficiently long to permit a full assessment of carbon monoxide concentrations over a full annual period, they all indicate that concentrations are likely to be well below the Air Quality Strategy Objective of 10.0 mgm^{-3} for the running 8-hour mean concentration.

On the basis of the monitoring data, Fife Council is not required to carry out a Detailed Assessment for Carbon Monoxide.

2.2.2 Benzene

Benzene concentration data are available from the ambient air quality survey[5], undertaken by NPL, for Ineos Manufacturing (Scotland) Ltd in the area surrounding the Grangemouth oil refinery in Falkirk District. Results for the four sites within Fife for the 12-month period July 2005-July 2006 are shown in Table 2.4. The results have been converted from ppb into mass units at 20°C and 1 atmosphere.

Table 2.4 Benzene Diffusion Tube Annual Mean Concentrations (µg m^{-3}) from the NPL network around Grangemouth[5] (sites in Fife only)

Site code	Location	1999 – 2000	2000 - 2001	2001 – 2002	2002 – 2003	2003 - 2004	2004 – 2005	2005 – 2006
16	Ford View, Cairneyhill	0.98	0.98	0.65	0.98	0.98	0.65	0.65
17	Shoreline nr. Charlestown Harbour	0.98	1.30	0.65	0.98	0.98	0.98	0.65
20	Mercer Road, Kincardine	1.30	0.98	0.98	0.65	0.65	0.65	0.65
21	Near Shoreline, Culross	0.98	0.98	0.98	0.98	0.98	0.98	0.98

As in previous years, annual mean benzene levels, for the 12-month period July 2005 – July 2006, were well below the AQS objective (for the running annual mean) of 16.25µg m^{-3} for the end of 2003, and within the AQS objective of 3.25µg m^{-3} for 2010. Ambient benzene concentrations do not appear to be increasing.

BP Exploration continues its monitoring of a range of hydrocarbon species at 12 locations on either side of the Forth river around the Hound Point tanker berth[6]. A summary of the results for benzene is shown in Table 2.5.

Table2.5 Benzene Diffusion Tube Annual Mean Concentrations (µg m^{-3}) from the NPL network around Hound Point[6]

Site code	Location	2002 - 2003	2003 – 2004	2004 – 2005	2005 – 2006
1	Carlowirie Cr, Dalmeny, Edinburgh	1.3	1.0	1.0	0.7
2	Near Whitehouse Point, South Queensferry	1.3	1.0	1.0	1.0
3	Carmolite Rd, South Queensferry	1.0	1.0	1.0	1.0
4A	Queens Ferry Lodge, North Queensferry, Fife	1.3	1.0	1.0	1.0
4B	Nr The Old Battery, North Queensferry, Fife	1.6	1.3	1.0	1.0
5	Breakers Way, Dalgety Bay, Fife	1.0	1.0	1.0	1.0
6	Hopewood Mews, Dalgety Bay, Fife	1.0	1.0	1.0	0.7
6R	Duplicate sample at Hopewood Mews	-	-	-	0.7
9	Coast between Aberdour and Burntisland, Fife	1.0	1.0	1.0	0.7
10	Brigg's Yard, Burntisland, Fife	1.0	1.0	0.7	0.7
11	Belvedere Hotel, West Wemyss, Fife	1.0	1.0	1.0	0.7
13	Forth View Hotel Aberdour, Fife	1.0	1.0	0.7	0.7
16	Braefoot Point, Fife	1.0	1.0	0.7	0.7

The results show that annual mean benzene levels, for the period September 2005 – January 2007, were well below the AQS objective (for the running annual mean) of 16.25µg m^{-3} for the end of 2003, and within the AQS objective of 3.25 µg m^{-3} for 2010.

The report of the Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Group[7] for 2005 concluded that "the work undertaken in 2005 demonstrates that the facilities at Mossmorran and Braefoot Bay continue to pose no significant risk to the health of the local community".

On the basis of this monitoring data, Fife Council is not required to carry out a Detailed Assessment for benzene.

2.2.3 1,3-Butadiene

The Ineos ambient air quality survey in the vicinity of Grangemouth refinery[5] included measurement of 1,3-butadiene. Results for the four sites within Fife for the 12-month period July 2005-July 2006 are shown in Table 2.6. The results have been converted from ppb into mass units at 20^{O}C and 1 atmosphere.

Table 2.6 1,3-Butadiene Diffusion Tube Annual Mean Concentrations (µg m^{-3}) from the NPL network (sites in Fife only)

Site code	Location	1999 - 2000	2000 - 2001	2001 - 2002	2002 - 2003	2003 - 2004	2004 – 2005	2005 – 2006
16	Ford View, Cairneyhill	0.25	0.14	0.11	0.16	0.09	<0.1	<0.1
17	Shoreline nr. Charlestown Harbour	0.32	0.18	0.14	0.14	0.14	<0.1	<0.1
20	Mercer Road, Kincardine	0.23	0.11	0.11	0.14	0.11	<0.1	<0.1
21	Near Shoreline, Culross	< 0.23	0.18	0.11	0.14	0.18	<0.1	<0.1

All sites in Fife appear to meet the AQS running annual mean objective of 2.25µg m^{-3} set for 31 December 2003.

The report of the Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Group[7] for 2005 concluded that "the work undertaken in 2005 demonstrates that the facilities at Mossmorran and Braefoot Bay continue to pose no significant risk to the health of the local community".

On the basis of this monitoring data, Fife Council is not required to carry out a Detailed Assessment for 1,3-butadiene.

2.2.4 Lead

There are no new data to report. The Updating and Screening assessment of 2003 concluded that emissions of lead from industrial processes in Fife are not likely to exceed the objectives for lead to be achieved in 2004 and 2008.

Fife Council is not required to carry out a Detailed Assessment for lead.

2.2.5 Nitrogen Dioxide

2.2.5.1 Automatic Monitoring of Nitrogen Dioxide

Automatic monitoring of nitrogen dioxide was undertaken at 3 locations in Fife during 2006 - North Approach Road, Kincardine, Admiralty Road, Rosyth and Bonnygate, Cupar. Details of these monitoring stations are provided in Appendix 1.

QA/QC of the automatic monitoring data in Fife
Dundee City Council Scientific Services undertook quality control of the automatic data for Fife Council monitoring sites during 2006. Scientific Services have confirmed that their procedures generally follow the requirements of the Technical Guidance. This gives a high degree of confidence in the data obtained, both for reliable concentrations at the automatic sites and for bias correction data for the diffusion tubes.

Automatic NO_2 Monitoring at North Approach Road, Kincardine
Fife Council have been undertaking automatic measurements of NO_X (NO, NO_2 and NO_X) at a roadside site on the North Approach road in Kincardine-on-Forth (grid reference 293191 687518) since 2003. Data capture for the calendar year 2006 was 98%. The annual mean NO_2 concentration measured by this system was 26µgm^{-3} in 2006. This is within the AQS objective of 40 µg m^{-3} for the annual mean and similar to the 2005 annual average at this site of 24µg m^{-3} (Table 2.7).

There were no exceedences of the 1-hour air quality objective of 200µg m^{-3}. One hour of exceedence was recorded in 2003 and none have been recorded since up to 18 are permitted in any calendar year.

Using the 2006 annual mean NO_2 concentration, it is possible to predict annual means for future years using the approach set out in the Guidance LAQM TG (03) (updated version Jan 2006). Estimated concentrations for 2010 are shown in Table 2.7.

Table 2.7 Nitrogen Dioxide Data from Kincardine Roadside Automatic NOx Monitoring Site

Site	Year	Data Capture	Max. 1-hour mean NO_2, μgm^{-3}	No. of 1-hour means > 200 μgm^{-3}	Annual Mean NO_2, μgm^{-3}	Predicted 2005 Annual Mean NO_2, μgm^{-3}	Predicted 2010 Annual Mean NO_2, μgm^{-3}
North Approach Road, Kincardine	2003	86%	248	1	38	36	30
	2004	96%	135	0	31	30	26
	2005	81%	138	0	24	-	21
	2006	98.3	116	0	26	-	23

The measured annual mean for 2006, and the predicted annual mean for 2010, are within the AQS objective of 40μgm^{-3}.

In addition, traffic on this section of road reduced considerably in October 2004 with the opening of the Kincardine Eastern Link Road. Hence, the reduction in NO_2 concentrations seen in 2005 and 2006 is in line with expectations – and further reductions are anticipated shortly after 2008 when the planned new bridge crossing and the northern approach bypass road are completed.

Automatic NO_2 Monitoring at Admiralty Road, Rosyth

As recommended in the 2006 Updating and Screening Report, the mobile monitoring unit was resited to Admiralty Road, Rosyth in 2006. Monitoring at this site was undertaken for the period October 2006 – March 2007. A summary of the nitrogen dioxide data is presented in Table 2.8.

Table 2.8 Nitrogen Dioxide Data from Admiralty Road, Rosyth Automatic NOx Monitoring Site

Site	Monitoring period	Max. 1-hour mean NO_2 $\mu g\ m^{-3}$	No. of 1-hour means > 200 $\mu g\ m^{-3}$	Period Mean NO_2 concentration $\mu g\ m^{-3}$
Admiralty Rd Rosyth	11/07/05 – 25/08/05	62	0	16
	October 2006 – March 2007	126	0	28

The measured concentrations indicate that it is unlikely that the Air Quality Objective for NO_2 will be exceeded at this site.

Automatic NO_2 Monitoring at Bonnygate, Cupar

Fife Council installed a new automatic monitoring site for NOx and PM_{10} at Bonnygate, Cupar in late 2005. Due to the access requirements in this narrow street, the site had to be located very close to the kerb – the sample inlet is approximately 0.5m from the edge of the kerb (See Appendix 1). A summary of the results for the first year of monitoring – 2006 – is provided in Table 2.9.

Table 2.9 Nitrogen Dioxide Data from Bonnygate, Cupar Automatic NOx Monitoring Site

Site	Monitoring period	Data Capture	Max. 1-hour mean NO_2 $\mu g\ m^{-3}$	No. of 1-hour means > 200 $\mu g\ m^{-3}$	Annual Mean NO_2, $\mu g\ m^{-3}$
Bonnygate, Cupar	2006	82%	231	1	48

The Air Quality Review and Assessment Helpdesk provides adjustment factors to estimate NO_2 concentrations at a range of distances from a kerbside station. For the Cupar site, the façade of the buildings are estimated to be within 5m of the kerbside site and hence, an adjustment factor of 0.95 is appropriate. This would give an annual average NO_2 concentration of 45.6$\mu g\ m^{-3}$. Hence, the air quality objective for NO_2 at this location is exceeded.

2.2.5.2 Diffusion Tube monitoring of Nitrogen Dioxide

As discussed in the Updating and Screening Report[4] 2006, Fife Council has made a number of changes to the NO_2 monitoring sites. Some sites have been re-located and at others, the number of diffusion tubes has been increased from one to two or three. In particular, some tubes have been re-sited at the facades of buildings, to better represent public exposure. Table 2.10 lists NO_2 diffusion tube monitoring sites operating during all or part of 2006. The table shows current sites, sites that

have been discontinued or relocated and includes the 8 new tubes that have been installed during 2006.

Table 2.10 Location of NO_2 Diffusion Tubes in 2006

Site Location	Site Code	Type	Start Date	End Date	East	North	Comments
West Area							
Halbeath Bypass	D8	K	1999	2003	312883	688584	Discontinued
Bothwell Street, Dunfermline	AQM3	K	1999	2003	309513	686895	Moved to building façade of St Leonards School
St Leonards Primary School, Dunfermline	AQM3	R(F)	2004		309770	686573	Replaces Bothwell St site
Carnegie Drive, Dunfermline	AQM4	K	1999	2006-	309467	687625	Relocated to Pittencrieff St
Carnegie Drive (A), Dunfermline	C'GIE DR A	R(F)	2004	-	309019	687632	Triplicate tube
Carnegie Drive (B), Dunfermline	C'GIE DR B	R(F)	2004	-	309019	687632	Triplicate tube
Carnegie Drive (C), Dunfermline	C'GIE DR C	R(F)	2004	-	309019	687632	Triplicate tube
Rumblingwell, Dunfermline (5N)	DRM5	R	1996	-	307866	688231	ex UK NO_2 Network site
Aytoun Grove, Dunfermline (6N)	DRM6	UB		-	308328	688426	ex UK NO_2 Network site
Admiralty Road, Rosyth	AQM5	K	1999	-	312103	683439	
Admiralty Road (A), Rosyth	ADM RO A	R(F)	2004	-	312140	683439	Triplicate tube
Admiralty Road (B), Rosyth	ADM RO B	R(F)	2004	-	312140	683439	Triplicate tube
Admiralty Road (C), Rosyth	ADM RO C	R(F)	2004	-	312140	683439	Triplicate tube
Barrie Street, Dunfermline (8N)	DRM8	UB		-	308379	688249	ex UK NO_2 Network site
Appin Crescent (A), Dunfermline (9N)*	DRM9A	R	1999	-	309882	687713	ex UK NO_2 Network site Triplicate tube
Appin Crescent (B), Dunfermline (9N)*	DRM9B	R	2004	-	309882	687713	Triplicate tube
Appin Crescent (C), Dunfermline (9N)*	DRM9C	R	2004	-	309882	687713	Triplicate tube
Appin Crescent (1) Dunfermline	APP CR1	R(F)	2004	-	309887	687720	
Appin Crescent (2) Dunfermline	APP CR2	R(F)	2004	-	309885	687701	
Appin Crescent (3) Dunfermline	APP CR3	R(F)	2006		309975	687716	New site 2006
High Street, Cowdenbeath	C'BEATH	K	1996	-	316523	691740	
North Approach Road (1) Kincardine	K'DINE1	K	1996	-	293182	687530	
North Approach Road (2) Kincardine	K'DINE2	K	1996	-	293182	687530	
North Approach Road (A) Kincardine	ROLLALONG A	R	2004	-	293191	687518	Co-location study Triplicate tube
North Approach Road (B) Kincardine	ROLLALONG B	R	2004	-	293191	687518	Co-location study Triplicate tube
North Approach Road (C) Kincardine	ROLLALONG C	R	2004	-	293191	687518	Co-location study Triplicate tube
Main Street, Carnock	D12	K	1999	2003	304221	689064	Discontinued
Pittencrieff St, Dunfermline	PITT ST	R(F)	2006		308743	687549	New site 2006 - from Carnegie Drive
Central Area							
Esplanade, Kirkcaldy	ESPLANADE	K	1996	2003	327863	690262	Discontinued
St Clair Roundabout, Kirkcaldy		K	1996	2003	329084	692612	Discontinued
St Clair Street (1), Kirkcaldy	ST CLAIR 1	R(F)	2004	-	329105	692992	
St Clair Street (2), Kirkcaldy	ST CLAIR 2	R(F)	2004	-	329185	693055	
St Clair Street (3), Kirkcaldy	ST CLAIR 3	R(F)	2006	-	329173	693069	New site 2006
Wedderurn Road, Kirkcaldy	WEDDERBURN	UB		-	325288	693086	
Redhouse Roundabout, Kirkcaldy	REDHOUSE R/B	K	1996	2003	329198	695281	Discontinued
Lovat Road, Glenrothes	LOVAT RD	K	1996	-	328600	699470	
North Street, Glenrothes		I		2003	327062	701115	Discontinued
Dunnikier Rd, Kirkcaldy	DUNNIKIER	R(F)	2004	-	328152	692350	
Victoria Rd, Kirkcaldy	VICTORIA	R(F)	2004	-	328152	692325	
Glenlyon Road, Levenmouth	GLENLYON	K	1998	-	337357	701318	
Bawbee Bridge, Levenmouth	BAWBEE BR	K	1998	2003	337787	700402	Discontinued
Chapel Roundabout, Kirkcaldy	CHAPEL R/B	K	1998	2003	325023	694405	Discontinued
Leslie Roundabout, Glenrothes	LESLIE R/B	K	1998	2003	326350	701938	Discontinued
Leslie High St	LESLIE HIGH ST	R(F)	2004	-	325111	701806	
Queensway, Glenrothes	QUEENSWAY	K	1999	-	327849	701114	
Adsa Roundabout, Kirkcaldy	ASDA R/B	K		-	328735	694053	
East Area							
City Road (1), St Andrews (1N) (A)		R	1996	-	350586	716580	ex UK NO_2 Network site Duplicate tube
City Road (2), St Andrews (B)		R	2004	-	350586	716580	Duplicate tube
Bell Street (1), St Andrews		R	1997	-	350708	716716	
Bell Street (2) St Andrews		R(F)	2004	-	350716	716669	
Market Street,St Andrews		R	1997	2003	350899	716744	Discontinued
South Street, St Andrews		K	1997	2003	351060	716642	Discontinued
Windsor Gdns, St Andrews (4N)		UB		-	349122	715313	ex UK NO_2 Network site
Crossgate, Cupar		K		-	337538	714527	
South Road, Cupar		R		-	337513	713616	
Cupar Road, Auchtermuchty		R		-	324186	711801	
Millfield, Cupar (4N)		UB		-	336867	713878	ex UK NO_2 Network site
Bonnygate, Cupar (1N) Bonnygate 1		R	1996	-	337411	714572	ex UK NO_2 Network site
Bonnygate, Cupar Bonnygate 2		R(F)	2004	-	337491	714586	
Bonnygate, Cupar Bonnygate 3 (A)		R(F)	2005	-	337455	714605	Duplicate tube

Site Location	Site Code	Type	Start Date	End Date	East	North	Comments
Bonnygate, Cupar Bonnygate 3 (B)		R(F)	2005	-	337455	714605	Duplicate tube
Bonnygate, Cupar Bonnygate B4		R(F)	2005	-	337477	714576	
Ladywynd, Cupar Ladywynd B5		R(F)	2006		337405	714607	New site
Bonnygate West, Cupar Bonnygate B6		R(F)	2006		337342	714579	New site
Bonygate, Cupar Monitor BA		K	2006		337401	714573	New site Triplicate co-location
Bonygate, Cupar Monitor BB		K	2006		337401	714573	New site Triplicate co-location
Bonygate, Cupar Monitor BC		K	2006		337401	714573	New site Triplicate co-location

K = Kerbside, 0-1m from the kerb of a busy road
R = Roadside, 1-5m from the kerb
R(F) = façade of buildings on street
I = Intermediate, 20-30m from the kerb
UB = Urban Background, >50m from any busy road

The locations of all diffusion tube monitoring sites have been presented in map format in previous Review and Assessment reports produced by Fife Council.

QA/QC of Diffusion Tubes

Diffusion tubes used by Fife Council are supplied and analysed by Dundee City Council Scientific Services. The laboratory participate in 3 schemes which ensure that the NO_2 tube results meet acceptable standards.

1. The WASP scheme which is run by the Health and Safety Laboratory. Each month one tube is sent for testing. Results are compared with other participating labs and feedback on performance provided.

2. Every three months 3 tubes and a blank for analysis are supplied for exposure at an intercomparison site operated as part of the Support to Local Authorities for Air Quality Management contract funded by the Scottish Executive, Defra and the other DAs. Again, results are compared with other participating labs and feedback on performance provided.

3. Each month a QC NO_2 solution is also provided via this contract. This solution is run as an internal check for NO_2 tubes in the laboratory. The solution is tested after every 21 NO_2 tube samples.

Dundee also use in-house quality assurance standards. The tube preparation method is 20%TEA in water.

Bias Correction for Diffusion tubes

Diffusion tube samplers are a simple and cost effective method of measuring NO_2. However they are classed as an indicative method and are known to have a systematic bias compared to more accurate results obtained from well calibrated automatic analysers. The degree of systematic bias depends on the laboratory preparing and analysing the tubes and on the methodology employed for that analysis. Hence, it is necessary to determine a bias adjustment factor appropriate for the particular diffusion tubes used in Fife. The methodology for determining the appropriate bias adjustment factor is outlined in the Technical Guidance[3] and several online tools are also available to assist with this process.

For the diffusion tubes used in Fife there are several sources of information available from which to assess the bias adjustment factor. Co-located diffusion tubes are deployed in triplicate at the 3 automatic sites. However, a full 12 months of co-located diffusion tube and automatic monitor results is only available from the Kincardine site. In addition, the Review and Assessment Helpdesk provides an overall assessment of bias adjustment factors for all diffusion tube suppliers. The results from these various sources are presented in Table 2.11.

Table 2.11 Bias correction factor for 2006 for NO_2 diffusion tubes used in Fife

Source	Annual average NO_2 from automatic monitor (2006) (Cm)	Annual Average NO_2 from diffusion tubes (2006) (Dm)	Bias Adjustment Factor (A=Cm/Dm)	Bias Adjustment Factor - using Local Authority R&A Spreadsheet
Kincardine	26	34	0.765	0.76
Cupar	48 (Apr – Dec)	39 (Apr – Dec)	1.23	1.19
Admiralty Road, Rosyth	28.4 (Oct – Dec only)	31.5 (Oct – Dec only)	0.9	N/A
Summary data from Review and Assessment Helpdesk			0.83	

The table shows that the bias adjustment factor is very different at the kerbside site at Cupar compared to the two roadside sites at Kincardine and Rosyth. This is in line with the findings of the Local Authority Support intercomparison of tubes from all suppliers at the kerbside site at Marylebone Road in London. The bias adjustment factor determined from this site is generally higher than for roadside or background sites.

The average of the bias adjustment factor from Kincardine and Rosyth is 0.83, which is identical to the summary factor provided by Air Quality Review and Assessment Helpdesk. As the majority of diffusion tube monitoing sites in Fife are now roadside or background sites, it is appropriate to use this value and disregard the kerbside value.

Hence, for the 2006 diffusion tube data for Fife, a bias correction factor of 0.83 will be used.

This is in line with the factor determined in 2003 (0.81) and 2004 (0.84) but higher than for 2005 (0.73).

Fife Council Diffusion Tube Results

The annual mean nitrogen dioxide concentrations for 2006 (uncorrected and bias adjusted) and predicted results for 2010 are provided in Table 2.12 for Fife Council diffusion tube sites. Predictions for 2010 have been based on forward projection of the results for 2006. Results for previous years are provided in Appendix 2.

Table 2.12 Summary of Fife Council NO_2 Diffusion Tubes Concentrations

Site Location	Type	East	North	2006 Uncorrected μgm^{-3}	2006 Bais adjusted μgm^{-3}	Predicted 2010 μgm^{-3}	Comment
West Area							
St Leonards Primary School, Dunfermline	R(F)	309770	686573	24	20	17	
Carnegie Drive, Dunfermline	K	309467	687625	50	**41**	36	Jan -Mar
Carnegie Drive (A), Dunfermline	R(F)	309019	687632	42	35	30	
Carnegie Drive (B), Dunfermline	R(F)	309019	687632	43	36	31	
Carnegie Drive (C), Dunfermline	R(F)	309019	687632	38	32	28	
Rumblingwell, Dunfermline (5N) *	R	307866	688231	30	25	22	
Aytoun Grove, Dunfermline (6N)*	UB	308328	688426	16	13	11	
Admiralty Road, Rosyth	K	312103	683439	43	36	32	
Admiralty Road (A), Rosyth	R(F)	312140	683439	39	32	28	
Admiralty Road (B), Rosyth	R(F)	312140	683439	40	33	29	
Admiralty Road (C), Rosyth	R(F)	312140	683439	38	32	28	
Barrie Street, Dunfermline (8N)*	UB	308379	688249	17	14	12	
Appin Crescent (A), Dunfermline (9N)*	R	309882	687713	40	33	29	
Appin Crescent (B), Dunfermline (9N)*	R	309882	687713	41	34	29	
Appin Crescent (C), Dunfermline (9N)*	R	309882	687713	42	35	30	
Appin Crescent (1) Dunfermline	R(F)	309887	687720	32	27	23	
Appin Crescent (2) Dunfermline	R(F)	309885	687701	49	**41**	36	
Appin Crescent (3) Dunfermline	R(F)	309975	687716	46	38	33	Apr - Dec
High Street, Cowdenbeath	K	316523	691740	27	22	19	
North Approach Road (1) Kincardine	K	293182	687530	43	36	31	
North Approach Road (2) Kincardine	K	293182	687530	45	37	32	
North Approach Road (A) Kincardine	R	293191	687518	33	27	23	
North Approach Road (B) Kincardine	R	293191	687518	36	30	26	
North Approach Road (C) Kincardine	R	293191	687518	34	28	24	
Pittencrieff St, Dunfermline	R(F)	308743	687549	26	22	19	Apr - Dec
Central Area							
St Clair Street (1), Kirkcaldy	R(F)	329105	692992	41	34	29	
St Clair Street (2), Kirkcaldy	R(F)	329185	693055	45	37	32	
St Clair Street (3), Kirkcaldy	R(F)	329173	693069	38	32	28	Apr - Dec
Wedderurn Road, Kirkcaldy	UB	325288	693086	15	12	10	
Lovat Road, Glenrothes	K	328600	699470	21	17	15	
Dunnikier Rd, Kirkcaldy	R(F)	328152	692350	35	29	25	
Victoria Rd, Kirkcaldy	R(F)	328152	692325	42	35	30	
Glenlyon Road, Levenmouth	K	337357	701318	32	27	23	
Leslie High St	R(F)	325111	701806	25	21	18	
Queensway, Glenrothes	K	327849	701114	26	22	19	
Adsa Roundabout, Kirkcaldy	K	328735	694053	35	29	25	
East Area							
City Road (1), St Andrews (1N)* (A)	R	350586	716580	32	27	23	
City Road (2), St Andrews (B)	R	350586	716580	32	27	23	
Bell Street (1), St Andrews	R	350708	716716	34	28	24	
Bell Street (2) St Andrews	R(F)	350716	716669	32	27	23	
Windsor Gdns, St Andrews (4N)*	UB	349122	715313	10	8	7	
Crossgate, Cupar	K	337538	714527	30	25	22	
South Road, Cupar	R	337513	713616	20	17	15	
Cupar Road, Auchtermuchty	R	324186	711801	34	28	24	
Millfield, Cupar (4N)*	UB	336867	713878	13	11	10	
Bonnygate, Cupar (1N)* Bonnygate 1	R	337411	714572	33	27	23	
Bonnygate, Cupar Bonnygate 2	R(F)	337491	714586	51	**42**	36	
Bonnygate, Cupar Bonnygate 3 (A)	R(F)	337455	714605	55	**46**	40	
Bonnygate, Cupar Bonnygate 3 (B)	R(F)	337455	714605	57	**47**	41	
Bonnygate, Cupar Bonnygate B4	R(F)	337477	714576	39	32	28	
Ladywynd, Cupar Ladywynd B5	R(F)	337405	714607	24	20	17	
Bonnygate West, Cupar Bonnygate B6	R(F)	337342	714579	26	22	19	
Bonygate, Cupar Monitor BA	K	337401	714573	37	31	27	
Bonygate, Cupar Monitor BB	K	337401	714573	39	32	28	
Bonygate, Cupar Monitor BC	K	337401	714573	39	32	28	

K = Kerbside, 0-1m from the kerb of a busy road, R = Roadside, 1-5m from the kerb, R(F) = façade of buildings on street, I = Intermediate, 20-30m from the kerb, UB = Urban Background, >50m from any busy road, Bold type indicates exceedence of Air Quality Objective for NO_2

Table 2.12 shows that two diffusion tube monitoring sites in Bonnygate, Cupar exceed the 40μgm^{-3} Air Quality Objective for nitrogen dioxide (Bonnygate Cupar 2 – 42μgm^{-3} and Bonnygate Cupar 3 – duplicate tube 46/47μgm^{-3}). These sites are both on the north side of Bonnygate in the narrowest part of the street close to Crossgate - see Figure 1. As these sites are located on the façade of the buildings, they are appropriate for exposure of the general population. The diffusion tube site on the south side of Bonnygate 4, opposite to Sites 2 and 3, had lower concentrations (32μgm^{-3}).

However, the automatic monitor in Bonnygate, which is on the south side of the road located approximately 100m west from Crossgate had concentrations exceeding the NO_2 objective even when these were corrected to account for the kerbside location of this site. Other monitoring sites in or close to Bonnygate (Bonnygate 5 in Ladywynd and Bonnygate 6, further west in the more open part of Bonnygate) had much lower concentrations. This indicates the likely localised extent of the area of exceedence of the NO_2 Air Quality Objective.

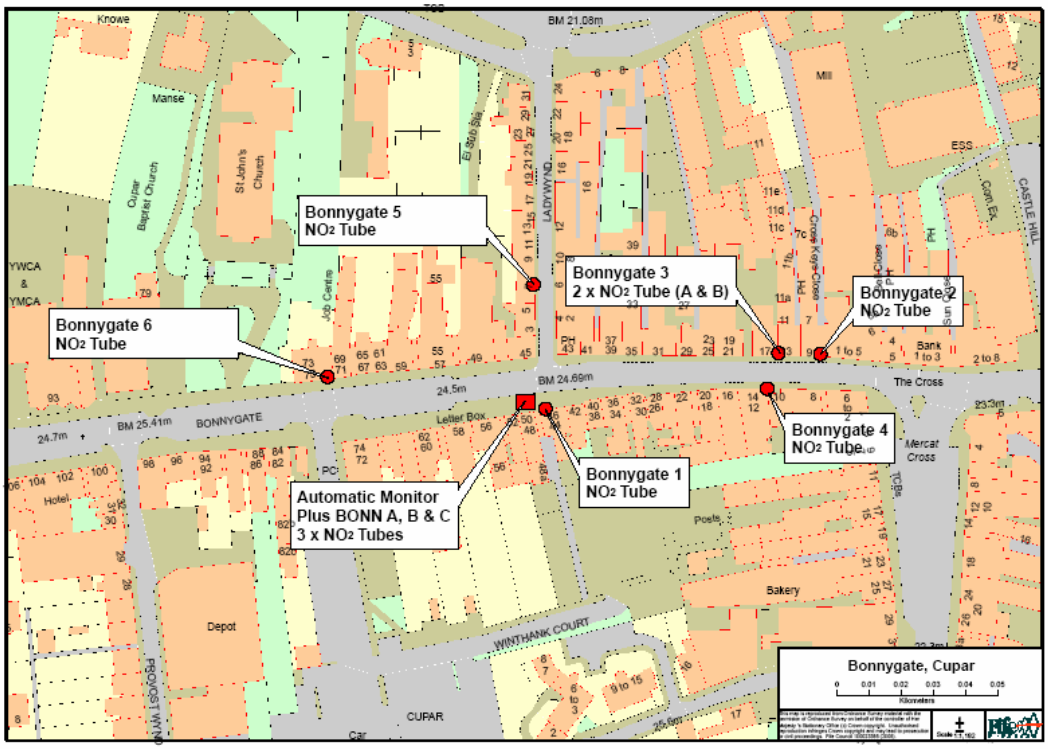

Figure 1 Location of Automatic and Diffusion Tube Monitoring Locations in Bonnygate, Cupar

The kerbside site located at Carnegie Drive in Dunfermline had concentrations above the NO_2 Objective. However, this site just exceeded (41μgm^{-3}) based on only 3-months of data and, in addition, this site is at a kerbside location and hence not appropriate for exposure of the general population. This site was relocated to a building façade site in Pittencrieff St in April 2006. The triplicate site at the building façade in Carnegie Drive did not exceed the Objective.

One of the monitoring sites in Appin Crescent (Appin Crescent 2 on the south side of Appin Crescent) also just exceeded the Objective (41μgm^{-3}). However, the other 3 diffusion tube sites in Appin Crescent recorded concentrations below the Objective. Fife Council has already initiated more detailed monitoring in this area with the additional diffusion tube monitoring sites and has recently relocated the automatic monitor, previously at Kincardine, to Appin Crescent to obtain more accurate information on NO_2 concentrations in this area. (Details of the Appin Crescent site are provided in Appendix 1)

Grangemouth NO_2 Diffusion Tube Results

The air quality survey for Ineos in the vicinity of Grangemouth refinery[5] includes measurement of NO_2. Measurements were made monthly at four sites in Fife using passive diffusion tube techniques, with analysis being conducted by Analytical Data Services Ltd on behalf of NPL. The latest data available are for the 12-month period July 2005 to July 2006 (Results from this study are only available as 12-month means starting and ending July). The results have been converted from ppb into mass units at 20^{O}C and 1 atmosphere (Table 2.13). No data were available to enable bias correction of tubes analysed by this laboratory, so the results are presented uncorrected.

Table 2.13 NO_2 Diffusion Tube Annual Mean Concentrations (µg m^{-3}) from the Ineos network

Site Code	Location	1999/ 2000	2000/ 2001	2001/ 2002	2002/ 2003	2003/ 2004	2004/ 2005	2006/ 2007
16	Ford View, Cairneyhill	11	10	11	13	15	12	13
17	Shoreline nr. Charlestown Harbour	10	10	10	17	17	12	19
20	Mercer Road, Kincardine	13	11	11	15	19	13	15
21	Near Shoreline, Culross	8	8	10	13	13	12	12

The 12-month mean concentrations at these sites remain well within the AQS Objective of 40μg m^{-3}.

2.2.5.3 Summary for Nitrogen Dioxide:

Fife Council will need to carry out a Detailed Assessment for NO_2 in the Bonnygate Cupar area. The aim of the Detailed Assessment will be to confirm the exceedence and to define its extent. The Detailed Assessment, to be produced by April 2008, will include an examination of monitoring data for an additional year (2007), air quality modelling undertaken as part of proposed road schemes for the area, any additional modelling required and any other relevant information available. If the Detailed Assessment confirms the exceedence of the Air Quality Objective then Fife Council will need to proceed to the declaration of an Air Quality Management Area in Cupar.

A Detailed Assessment will also be provided for Appin Crescent, Dunfermline and Fife Council has recently installed a continuous automatic analyser at this location to more accurately determine NO_2 concentrations.

2.2.6 Sulphur Dioxide

Automatic SO_2 Data
Results for the SO_2 monitoring at the continuous monitoring site at Admiralty Rd, Rosyth are provided in Table 2.14. Details of the monitoring site are provided in Appendix 1.

Table 2.14 Sulphur Dioxide Automatic Monitoring Data from Admiralty Rd, Rosyth (µg m^{-3})

Period	Max. 15 minute Mean (µgm^{-3})	Max. 1-hour Mean (µgm^{-3})	Max. 24-hour Mean (µgm^{-3})
December 2004 – August 2005	176	119	18
October 2006 – March 2007	92	75	13
AQS Objective	266 (max. 35 exceedences)	350 (max. 24 exceedences)	125 (max. 3 exceedences)

The maximum 15-minute, 1-hour, and 24-hour mean SO_2 concentrations at Admiralty Rd, Rosyth were well within the relevant AQS objectives for the 6-month monitoring period at this site. Hence, it is unlikely that any of the Air Quality Objectives for SO_2 will be exceeded over a full calendar year at this site.

Sulphur dioxide monitoring is also undertaken on behalf of Longannet Power Station[8] at Blair Mains (Grid Reference NS972864) to the north east of the power station. Results for 2006 for this site are provided in Table 2.15.

Table 2.15 Sulphur Dioxide Automatic Monitoring Data from Blair Mains, Fife (µg m^{-3})

Period	Max. 15 minute Mean (µgm^{-3})	Max. 1-hour Mean (µgm^{-3})	Max. 24-hour Mean (µgm^{-3})
2005	129	74	Not available
2006	166	88	Not available
AQS Objective	266 (max. 35 exceedences)	350 (max. 24 exceedences)	125 (max. 3 exceedences)

The table shows that there were no exceedences of the 15min or 1-hour Air Quality Objectives for SO_2. The maximum daily value recorded at the site is not available, but the 99.18th percentile of daily values was 21µgm^{-3} and hence, the daily objective was also not exceeded.

SO_2 Diffusion Tubes
Although SO_2 diffusion tube data are not considered sufficiently accurate for inclusion in the Review and Assessment process, the following are included for completeness and to provide a broad indication of air quality. Diffusion tubes were deployed by both Fife Council, and by NPL as part of their survey on behalf of Ineos.

The monitoring sites operated by Fife Council (Table 2.16) are close to the Tullis Russell papermill and will help to assess any changes in emissions due to the proposed change from burning gas to using another coal fired boiler.

Data for the sites in the NPL study for BP Exloration, within Fife, are presented in Table 2.17. The averaging period for these data is from July to July.

Table 2.16 Fife Council SO_2 Concentration (µg m^{-3}) by Diffusion tube

	Main Street Culross	Valleyfield Dunfermline	Mount Frost Drive Markinch (1)	Mount Frost Drive Markinch (2)	Mount Frost Drive Markinch (3)
2003	4	-	-	-	-
2004	4	4[1]	16[2]	11[2]	9[2]
2005	4	4	7	9	7
2006	4	4	12	12	12

1 - 03/08/04 – 30/11/04 only
2 – from 03/08/04

Table 2.17 Ineos Network SO_2 Concentration (µg m^{-3}) by Diffusion tube

	Ford View, Cairney Hill Site 16	Shoreline nr. Charlestown Harbour Site 17	Mercer Road, Kincardine Site 20	Near Shoreline, Culross Site 21
Jul 2002 – Jul 2003	3	8	5	5
Jul 2003 – Jul 2004	3	8	3	3
Jul 2004 – Jul 2005	3	5	3	3
Jul 2005 – Jul 2006	3	5	3	3

The Air Quality Strategy includes an objective of 20 μgm^{-3} for the annual and winter mean SO_2 concentration, for protection of ecosystems, which is applicable only in rural areas. This may be applicable to the two shoreline sites at Charlestown and Culross. The 12-month mean at all sites is well within this objective.

2.2.7 PM_{10}

Automatic monitoring of PM_{10} was undertaken at 2 locations in Fife during 2006 - Admiralty Road, Rosyth and Bonnygate, Cupar. Details of these monitoring stations are provided in Appendix 1.

Automatic PM_{10} Data from Admiralty Rd, Rosyth
PM_{10} monitoring was undertaken at Admiralty Road, Rosyth, as discussed in previous sections. Monitoring at this site was undertaken for the period October 2006 – March 2007. A summary of the data is presented in Table 2.18.

Table 2.18 Automatic PM_{10} Monitoring data (Gravimetric Equivalent) – Admiralty Rd, Rosyth

Period	Scaling factor to gravimetric units	Mean Period Concentration (µg m^{-3})	Estimate Annual Mean Concentration for 2006 (µg m^{-3})	Exceedences of 24-hour objective	Max. 24-hour mean (µg m^{-3})
Dec 2004 – Aug 2005	1.3	19	N/A	Not available	59
	1.14	17	N/A	-	-
Oct 2006 – Mar 2007	1.3	23	23	7	74
	1.14	20	20	5	65

The estimated annual mean PM_{10} concentration for 2006 at the Rosyth site has been calculated from the 6-monthly average Oct 06 – Mar 07 using the methodology given in Box 6.5 of the Technical Guidance. The comparative sites selected were Edinburgh St Leonards, Glasgow Centre and Perth -

data for these sites were obtained from the Scottish Executive Air Quality in Scotland Website www.scottishairquality.co.uk . The period to annual ratios for these sites were 1.02, 0.98 and 1.01 respectively and hence, a correction factor of 1.0 was applied to the Rosyth data to obtain the estimated annual average for 2006.

Hence, the monitoring at Rosyth indicates that concentrations at this site are well below the PM_{10} Air Quality objectives for 2004. Projecting the annual mean concentration forward to 2010, using the methodology of Box 8.6 in the Technical Guidance indicates an annual average concentration of 22µgm^{-3} or 19µgm^{-3} based on gravimetric scaling factors of 1.3 or 1.14 respectively.

This indicates that the 2010 Air Quality Objective for PM_{10} may be closely approached or exceeded at this site.

Fife Council will need to undertake further PM_{10} monitoring at this location and produce a Detailed Assement as part of this process. It is recommended that the monitoring method should be one which has been shown to be equivalent to the EU reference method.

Automatic PM_{10} data from Bonnygate, Cupar
Monitoring of PM_{10} at the site in Bonnygate, Cupar commenced on 19 December 2005. The measured concentrations for 2006 are presented in Table 2.19.

Table 2.19 Automatic PM_{10} Monitoring data (Gravimetric Equivalent) – Bonnygate, Cupar

Period	Data Capture	Scaling factor to gravimetric units	Mean Period Concentration (µg m^{-3})	Exceedences of 24-hour objective	Max. 24-hour mean (µg m^{-3})
2006	84%	1.3	26	4	76
		1.14	23	4	66

The table shows that the annual average PM_{10} concentration in 2006 was 26μgm^{-3} or 23µgm^{-3} based on gravimetric scaling factors of 1.3 or 1.14 respectively. This projects forward to an estimated concentration for 2010 of 24μgm^{-3} or 22µgm^{-3} respectively. Hence, the PM_{10} air quality objective for 2010 may be exceeded at this site. However, it should be noted that the monitor is situated close to the kerb and not at the façade of buildings which would be a more appropriate location for PM_{10} exposure – this location had to be selected because of difficulties with access restrictions at this site. There is no agreed adjustment factor for PM_{10} concentrations from kerbside to building façade.

Given that a Detailed Assessment for NO_2 will be required at this site, it is recommended that this assessment be extended to PM_{10}.

Additional monitoring of PM_{10} in Fife was undertaken by the Scottish Environment Protection Agency[9] (SEPA). The monitoring was undertaken in response to concern expressed by residents in the Markinch area of Glenrothes regarding deposition of heavy gritty dust particles. SEPA established a PM_{10} monitoring site in the area using an Osiris light scattering monitor and associated meteorological measurements for the period December 2005 – June 2006. The results from the Osiris monitor for PM_{10} are considered to be indicative only.

During the monitoring the uncorrected results from the Osiris monitor recorded an average PM_{10} concentration of 12.7µg m^{-3} and a maximum 24-hourly concentration of 47.8µg m^{-3} (only 3 days had concentrations in excess of 35µg m^{-3}). Hence, on the basis of the uncorrected results over the 6-month monitoring period the 2004 and 2010 AQS objectives for PM_{10} (40µg m^{-3} and 18µg m^{-3} respectively) were not exceeded. Even if these results are multiplied by the TEOM correction factor of 1.3, these AQS objectives are not exceeded. As the monitoring was only undertaken for a 6-month period it is not possible to give a definitive comparison with the 24-hour PM_{10} AQS Objectives for 2004 and 2010.

3 New Developments – Industrial Processes

3.1 Regulated Processes

The following information from SEPA provides details of changes to regulated industrial process during 2006.

Glenrothes Area:
The following sites have closed in the past year:

- Smith Anderson - Part A Paper making and Gas Boiler.
- Thomas Muir Metals Kirkcaldy - Aluminium smelter.
- GM Mining: 2 Permits revoked. 1 for Kingslaw Open Cast Coal site (Kirkcaldy). 1 for loading coal at Redford Railway Sidings (Thornton).
- Core Products (timber process)
- I and H Brown: The Begg Open Cast Coal site (Kirkcaldy)
- Brand Rex: Coating process, using more than 5 tonnes of solvent in a 12-month period.

There have been 7 applications for intensive agriculture permits: Part A poultry units.

Stirling Area:
SEPA are not aware of any regulated process that increased emissions by more than 30%.

The following changes have been introduced:

- FMC (Metal coating) at Dunfermline are installing new spraybooths. This should result in increased dispersion of emissions from the process.
- There is still a proposal for a seed crushing/ biodiesel plant at Rosyth, although no PPC application has been received yet.
- Lexmark (Part A Inorganic Chemicals PPC) at Rosyth has now ceased production and are in the process of surrendering their PPC permit.
- Gordon Curtis Motors have ceased operating a vehicle respray installation at Milesmark, but have yet to surrender their permit.

SEPA are not aware of any new petrol stations with a throughput greater than 2000m^3 of petrol, although Kingdom Services had ceased operation for a while, it has now re-opened.

SEPA have just issued a deemed PPC permit for Aitkenhead OCC mine, in Clackmannanshire, close to the Fife border. This has had an IPC authorisation for some time but has never operated. Scottish Coal now wish to proceed with the deemed application as the site may come into operation.

An application has also been lodged by Scottish Power Generation Ltd for a change to the process authorisation for Longannet and Cockenzie Power Stations – "IPC Variation for a 65kT Sulphur Dioxide Bubble". The supporting documentation with this application indicates that all SO_2 air quality criteria will be comfortably met at Longannet and, for NOx and particle emissions the contribution does not have a significant impact on ambient concentrations with respect to the air quality objectives. For the Longannet station, SO_2 monitoring at Blair Mains (see section 2.1.1 and 2.2.6) will continue to confirm these findings (for SO_2).

3.2 Planning Applications

Scottish Power Generation Ltd has submitted an application for planning permission to construct and operate a Biomass Power Station at Longannet[10] in Fife (07/01283/WEIA). Extracts from the planning application are presented below:

> *"……. ScottishPower Generation Ltd has submitted an application for planning permission to construct and operate a Biomass Power Station at Longannet in Fife. The site is located adjacent*

to the existing Longannet Power Station. The proposed development is referred to as the Biomass Power Station.

The Biomass Power Station will burn up to 135,000 tonnes of biomass and generate approximately 20-25MW of electrical power for export to the grid, which is sufficient to provide enough renewable energy for up to 33,000 households. By comparison, the adjacent existing Longannet Power Station burns approximately 5 million tones of coal per year and has a net power output of 2,304MW. However, the existing Longannet Power Station uses predominantly coal, a non-renewable fuel source.

The stack height selected for the optimum dispersion of pollutants is determined to be 85m above foundation level based on the findings of the stack height modelling. Predicted Contributions of all pollutants and resultant Predicted Environmental Concentrations are well within the relevant Environmental Quality Standards. Overall, predicted pollutant contributions from the Biomass Power Station are considered to be of neutral significance. Site management will ensure levels are kept within permitted limits at all stages of development"

Scottish Biopower Ltd have submitted a planning application (07/00170/CEIA) for a Biomass Facility at Westfield Opencast Coal Site[11]. Extracts from the planning application are presented below:

"*The Westfield Biomass Facility will consist of the following plant:*

- *a Biomass fired Combined Heat and Power (CHP) Plant*
- *a Wood Pellet Manufacturing Plant, and*
- *a Stockpiling and Processing Area for fuel for the CHP Plant, raw materials for the Pellet Manufacturing Plant and woodchip to external customers.*

The Westfield Biomass Facility is proposed to have the dual functions of providing electricity to the distribution network for local consumption, in addition to providing electricity for the biomass preparation, and steam and electricity for the Pellet Manufacturing Plant production process.

The CHP plant will have a gross output of approximately 40.6MW electrical power with a fuel consumption of circa 350,000 tonnes of biomass per annum (depending on the fuel type and its moisture content). This plant will require a small amount of oil or possibly gas fuel during start-up only. The fuel source for the boiler will consist of woodchip which will be delivered to the CHP Plant from the Stockpile and Processing area by overhead conveyor.

Air emissions may arrise during the construction phase from the use of equipment and vehicles (dust and other air emissions). During operation, emissions will arise from both the proposed CHP Plant and associated traffic movements. The increase in pollutant concentrations from vehicle emissions is predicted to be insignificant and therefore not of concern to human health. Emissions from the proposed CHP boiler will be via one stack (chimney) and from the Pellet Plant's four drier stacks. A computer model which simulates the dispersion of air, has identified that stack heights of 75m for the CHP Plant and 30m for the Pellet Manufacturing Plant would provide dispersion that is within air quality guidelines.

The impacts on air quality during the construction phase are expected to be minimal. The impacts during operation of the facility from emissions, vapour plume and transport are also predicted to be minimal, although further assessment will be required at the next phase."

SITA UK has a planning application for a Waste to Energy Plant at Binn Farm, Glenfarg, which is in Perth and Kinross but close to the border with Fife. Although already approved by Perth and Kinross Council, this application will now also be reviewed by Fife Council.

Scottish Biopower, has submitted a planning application for the erection of 49MW Biomass combined heat and power plant (including fuel storage, ancillary plant and equipment) and formation of access roads at Auchmuty & Rothes Mills, Glenrothes, Fife. This application has been "Permitted with Conditions" by Fife Council.

DMF Biodiesel has a planning application for installation of a bio-diesel process facility and associated infrastructure, vehicular parking and erection of boundary fence at Milne Road, Rosyth Waterfront. This application has been "Permitted with Conditions" by Fife Council.

4 New Developments – Transport

New Road Developments
See information on proposed development options for Cupar Town Centre in Chapter 5.

Roads with substantially increased trafic flows
No further roads with a AADT flow greater than 10,000 vehicles per day or roads with HDV flows greater than 2,000 veh/day have been identified since the Updating and Screening Assessment report.

No roads with a AADT flow greater than 10,000 vehicles per day experienced an increase in flow greater than 25% since the Updating and Screening Assessment report.

Trains
No new locations have been identified where trains are stationary with engines running for more than 15 mins.

Airports
There are no significant changes to report since the Updating and Screening Assessment report.

Bus stations
The bus stations at St. Andrews, Leven and Glenrothes have been redeveloped and those at Kirkcaldy and Dunfermline are in the process of redevelopment. However, this work will not affect the number of buses using these facilities. Hence, there are no significant changes to report since the last Updating and Screening Assessment report.

Shipping
There are no significant changes to report since the last Updating and Screening Assessment report.

Petrol stations
SEPA are not aware of any new petrol stations with a throughput greater than 2000m^3 of petrol, although Kingdom Services had ceased operation for a while, it has now re-opened.

5 New Developments – Residential, Commercial and Public

The likely air quality impact of two proposed development options for Cupar Town Centre are currently under evaluation by WSP Environmental. Each of these development options will introduce an element of residential development into the town of Cupar and will involve a degree of change to the local road network, which will in turn have an impact on local air quality. A summary of the two development options is given below:

- Option A: The introduction of some residential development (approximately 500 units) with no major changes to the existing highway network but some improvement to the signalized junctions in the centre of Cupar; and
- Option B: The introduction of significant residential development (approximately 1200 units), some retail and industrial development and the construction of an associated relief road to the north of the town.

The results show that both the proposed development options (Option A and Option B) would cause a small increase in pollutant concentrations at some locations. However, the concentrations predicted for future years either with or without either development are all below those predicted for the 2006 baseline year. This is due to an expected future improvement (i.e. decrease) in background concentrations and vehicle emissions.

Option A would cause a small increase in NO_2 concentrations at all locations included in the assessment and a small increase in PM_{10} concentrations at the majority of the receptors locations included in the assessment.

The modelling results for Option B indicate that the introduction of the relief road would cause a significant decrease in NO_2 concentrations and a small decrease in PM_{10} concentrations along the A91 in Cupar Town Centre. However, an increase in pollutant concentrations is anticipated along Bank Road and Burnside North which would connect the town centre to the relief road.

According to the assessment significance criteria the impact of Option A is considered to be minor adverse to insignificant for NO_2 and insignificant to neutral for PM_{10}. The impact of Option B is considered to vary from minor beneficial to minor adverse for NO_2 and insignificant to neutral for PM_{10}.

Should an Air Quality Action Plan be required for Cupar, further modelling work will be undertaken to assess the effect of the proposed road schemes on areas which are likely to exceed the Air Quality Objectives for NO_2 and/or PM_{10}.

6 Conclusions

This progress report has followed the guidance set in Part IV of the Environment Act 1995 Local Air Quality Management LAQM.PRG(03) to ensure continuity in the LAQM process. The following conclusions arise from the findings in this report:

1. Previous results of the carbon monoxide monitoring at Admiralty Road, Rosyth and short-term monitoring undertaken by the Transportation Department in 2006 indicate that the Air Quality Strategy Objectives for CO are likely to be met. There are no new industrial processes, road or other developments that require detailed assessment with respect to this pollutant. Hence, new information in 2006 confirms the conclusion of previous reports that a Detailed Assessment is not required for CO.
2. Results of the ongoing air quality monitoring study for Ineos and BP Exploration indicate that ambient concentrations of benzene in Fife during 2006 met the Air Quality Strategy Objective. There are no new industrial processes, roads, petrol stations or other developments that require detailed assessment for this pollutant. Hence, new information in 2006 confirms the conclusion of previous reports that a Detailed Assessment is not required for benzene.
3. Results of ongoing air quality monitoring study for Ineos also indicate that ambient concentrations of 1,3-butadiene in Fife during 2006 met the Air Quality Strategy Objective. There are no new industrial processes, roads, or other developments that require detailed assessment for this pollutant. Hence, new information in 2006 confirms the conclusion of previous reports that a Detailed Assessment is not required for 1,3-butadiene.
4. No ambient monitoring of lead was carried out in 2006. There are no new industrial processes or other developments that require detailed assessment for this pollutant. A Detailed Assessment is not required for lead.
5. Measurements of NO_2 at the automatic monitoring sites at North Approach Road, Kincardine during 2006 and Admiralty Road, Rosyth (Oct 06 – Mar 07) indicate that the Air Quality Strategy Objective for NO_2 is met at these sites. However, the automatic monitoring of NO_2 at Bonnygate Cupar indicates that the Objective is exceeded at this kerbside location. Even when the results are adjusted to likely concentrations at the façade of buildings, the Objective is still exceeded.

   Measurements of NO_2 with diffusion tube samplers confirm an exceedence of the Air Quality Objective in Bonnygate.

   One diffusion tube monitoring site in Appin Crescent, Dunfermline showed a slight exceedence of the Air Quality Objective at this location. Fife Council has recently installed an automatic nitrogen dioxide monitor at this location to accurately determine concentrations in this area.

   Hence, new information in 2006 indicates that a **Detailed Assessment is required for NO_2 in the Bonnygate, Cupar area.** It also confirms the requirement for automatic NO_2 monitoring to be undertaken in Appin Crescent, Dunfermline. Fife Council has recently commenced this monitoring (see Appendix 1) and the results will form part of the **Detailed Assessment for Appin Crescent.**
6. Results for sulphur dioxide monitoring in Fife in 2006 indicate that Air Quality Strategy Objectives for SO_2 are unlikely to be exceeded. There are no new industrial processes, road or other developments that require detailed assessment with respect to this pollutant. Hence, new information in 2006 confirms the conclusion of previous reports that a Detailed Assessment is not required for SO_2.
7. PM_{10} particle concentration data for 2006 are available for Bonnygate, Cupar and Admiralty Road, Rosyth (Oct 06 – Mar 07). The data for the Bonnygate, Cupar kerbside site indicate that the 2010 Air Quality Objective for PM_{10} is likely to be exceeded - there is no correction factor

available to estimate PM_{10} concentrations at the façade of buildings in Bonnygate. **Hence, given that a Detailed Assessment for NO_2 is required at this site, it is recommended that this assessment be extended to PM_{10}.**

At Rosyth, the data indicate that the 2010 Air Quality Objective for PM_{10} may just be exceeded. **Hence, Fife Council need to undertake further PM_{10} monitoring at this site and a Detailed Assessment will be provided as part of this process.**

8. There were no significant changes to industrial processes and no new industrial processes during 2006. However, several significant planning applications have been submitted.

9. Proposed plans for major residential development and highway modifications for Cupar are currently being evaluated. These will need to be further assessed as part of the Detailed Assessment recommended for the Cupar area.

Fife Council accepts the above conclusions and will implement the recommendations.

7 References

[1] Part IV of the Environment Act 1995 Local Air Quality Management, Progress Report Guidance LAQM PRG (03)

[2] Scottish Executive - Part IV of the Environment Act 1995. Local Air Quality Management, Revised Policy Guidance Feb 2003 Paper 2003/2

[3] Part IV of the Environment Act 1995. Local Air Quality Management. Technical Guidance LAQM.TG(03) January 2003.

[4] Air Quality Updating and Screening Assessment Report for Fife Council - 2006. AEAT/ENV/R/2237. July 2006.

[5] Black J.K. et al, Ambient Atmospheric Survey in the Vicinity of Grangemouth for 2005-2006, NPL report reference 106505/QT03E031\05_06 February 2007.

[6] Black J.K. et al, Ambient Atmospheric Survey for Hydrocarbons in the Vicinity of Hound Point – Annual Survey 2005 – 2006. NPL reference 106608/QT03E0710/05_06 Apr 2007.

[7] Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Group – 2005 Annual Report. June 2006.

[8] RWE Power International. Review of Annual Air Quality Impacts around Longannet Power Station compared to Air Quality Objectives – Calendar Year 2006. Ref ENV/214/2007, March 2007

[9] SEPA report SE06_TR01 – Air Quality Monitoring: Determination of Ambient Particulate Matter (PM_{10}) at Mount Frost, Markinch 2005-2006.

[10] Scottish Power, Longannet Biomass Power Station Planning Application (07/01283/WEIA) – Non-Technical Summary

[11] Scottish BioPower Ltd., Proposed Westfield Biomass Facility (07/00170/CEIA) – Environmental Statement Non-Technical Summary

8 Acknowledgements

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Appendices

Appendix 1: Details of Automatic Monitoring Stations in Fife

Appendix 2: Nitrogen Dioxide Diffusion Tube Results

Appendix 1

Details of Automatic Monitoring Stations in Fife

North Approach Road, Kincardine:

Station Name:	North Approach Rd, Kincardine
Site Owner/operator:	Fife Council/Dundee Scientific Services
Northing:	293191
Easting:	687518
Zone/agglomeration:	
Site Classification:	Roadside (4m from kerb)
Manifold type and height:	Fan manifold, 3m
Network affiliation:	None
Quality control procedures:	Daily calibration with BOC cylinders
Pollutants measured on site:	NOx, NO, NO_2
Instrument manufacturer:	Monitor Europe ME 9841B
Calibration procedure and frequency:	Daily calibration with BOC Spectaseal cylinders (450ppb NO)
Site service arrangements:	Casella
Co-located passive sampler Comments:	Triplicate NO_2 tubes installed

Admiralty Road, Rosyth

Station Name:	Groundhog, Admiralty Road, Rosyth
Site Owner/operator:	Fife Council/Dundee Scientific Services
Northing:	311752
Easting:	683515
Zone/agglomeration:	
Site Classification:	Roadside (7/8m from kerb)
	Inlet at building facade
Manifold type and height:	Fan manifold, 3m
Network affiliation:	None
Quality control procedures:	Daily calibration with BOC cylinders
Pollutants measured on site:	NOx, NO NO_2 SO_2 PM_{10} Met
Instrument manufacturer:	NOx – ME 9841B SO_2 – ME9850B PM_{10} – TEOM 1400a
Calibration procedure and frequency:	Daily calibration with BOC Spectaseal
	cylinders (NO 450ppb, SO_2 450ppb, CO
	20ppm, zero air)
Site service arrangements:	Casella
Co-located passive sampler	Triplicate NO_2 tubes installed
Comments:	50yds from road junction

Bonnygate
Cupar, Fife

Station Name:	Bonnygate, Cupar
Site Owner/operator:	Fife Council/Dundee Scientific Services
Easting:	337401
Northing:	714572
Altitude:	
Zone/agglomeration:	
Site Classification:	Kerbside (<1m from Kerb)
Distance to kerb and road name/number	0.5m to Bonnygate (A91)
Distance to nearest junction and joining road name/number	Opposite the junction with Ladywynd
Start date of monitoring	19 December 2005
Manifold type and height:	Single Teflon tube, Inlet height 1.7m
Network affiliation:	None
Quality control procedures:	Calibration with Air Liquide gas cylinder
Pollutants measured on site:	PM_{10} (TEOM) NOx, NO, NO_2
Instrument manufacturer:	TEOM – R and P NOx – Teco i-series
Calibration procedure and frequency:	3-weekly manual calibration and autocalibration every 3 days
Site service arrangements:	6-monthly service by Air Monitors
Co-located passive sampler	Triplicate NO_2 tubes installed
Comments:	

Appin Crescent
Dunfermline, Fife

Station Name:	Appin Crescent, Dunfermline
Site Owner/operator:	Fife Council
Easting:	309926
Northing:	687722
Altitude:	
Zone/agglomeration:	
Site Classification:	Roadside
Distance to kerb and road name/number	Approx 2m to Appin Crescent (A907)
Distance to nearest junction and joining road name/number	Minor junctions 35m to East and 75m to West. Roundabout junction with A823 approx 500m to West.
Start date of monitoring	August 2007
Manifold type and height:	Single Teflon tube, Inlet height 1.7m
Network affiliation:	None
Quality control procedures:	Calibration with Air Liquide gas cylinder
Pollutants measured on site:	NOx, NO, NO_2
Instrument manufacturer:	Monitor Europe ME 9841B
Calibration procedure and frequency:	3-weekly manual calibration and autocalibration every 3 days
Site service arrangements:	6-monthly service by Air Monitors
Co-located passive sampler	Triplicate NO_2 tubes to be installed
Comments:	

Appendix 2

Nitrogen Dioxide Diffusion Tube Results

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3})

West Area	Halbeath Bypass	Bothwell Street, Dunfermline	St Leonards Primary School Dunfermline	Carnegie Drive, Dunfermline	Carnegie Drive (A), (B), (C). Dunfermline (triplicate) A	B	C	Rumblingwell Dunfermline (DUN5N)*	Aytoun Grove, Dunfermline (DUN6N)*
Type†	K	K	R(F)	K	R(F)			R	UB
Easting	312883	309513	309770	309467	309019			307866	308328
Northing	688584	686895	686573	687625	687632			688231	688426
2000 (U)	26	31		39				25	14
2001 (U)	31	35		41				27	17
2002‡	27	31		40				23	15
2003 (U)	36	46		53				35	20
2003‡	29	37		43				28	16
2004(U)	Discontinued	Discontinued	26[1]	47	36[1]	36[1]	37[1]	31	18
2004‡			22	39	30	30	31	26	15
2005(U)	-	-	27[2]	44	39	37	38	29	17
2005	-	-		32	29	27	28	21	12
2006 (U)			**24**	**50**[3]	**42**	**43**	**38**	**30**	**16**
2006			**20**	**41**	**35**	**36**	**32**	**25**	**13**
Predicted 2010	-	-	17	36	30	31	28	22	11

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
*Sites which are also part of the UK NO2 Network
1. monitoring commenced on 30/03/04 (9-months)
2. only three months of monitoring data due to construction works at school
3. only 3 months of data (Jan- Mar 06)

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued.

West Area	Admiralty Road, Rosyth	Admiralty Road (triplicate) A	B	C	Barrie Street, Dunfermline (DUN 8N)*	Appin Crescent, Dunfermline (DUN 9N)* (triplicate) A	B	C	Appin Crescent Dunferm. (1)	Appin Crescent Dunferm. (2)	Appin Crescent Dunferm. (3)	High Street, Cowden-beath
Type†	K	R(F)			UB	R			R(F)	R(F)	R(F)	K
Easting	312103	312103			308379	309882			309887	309885	309975	316523
Northing	683439	683439			688249	687713			687720	687701	687716	691740
2000 (U)	38				15	33						24
2001 (U)	42				15	35						27
2002‡	36				14	34						22
2003 (U)	52				22	49						31
2003‡	42				18	40						25
2004(U)	46	23[1]	24[1]	24[1]	17	42[1]	40[1]	39[1]	36[2]	45[3]		27
2004‡	37	19	20	20	14	35	34	33				23
2005(U)	43	35[4]	36[4]	32[4]	16	38	40	40	33	47		26
2005	31	26	26	23	12	28	29	29	24	34		19
2006(U)	**43**	**39**	**40**	**38**	**17**	**40**	**41**	**42**	**32**	**49**	**46**[5]	**27**
2006	**36**	**32**	**33**	**32**	**14**	**33**	**34**	**35**	**27**	**41**	**38**	**22**
Predicted 2010	32	28	29	28	12	29	29	30	23	36	33	19

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1 monitoring commenced on 30/03/04 (9-months)
2 monitoring commenced on 03/08/04 (<6-months)
3 monitoring commenced on 31/08/04 (<6-months)
4 no date Arp/May/June – 9 months data only
5 New site data starts April – 9 months data only

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued.

West Area	North Approach Road Kincardine (1)	North Approach Road Kincardine (2)	North Approach Road Kincardine (triplicate)			Main Street, Carnock	Pittencrieff St Dunfermline
			A	B	C		
Type†	K	K	Co-location			K	R(F)
Easting	293182	293182	293191			304221	308743
Northing	687530	687530	687518			689064	687549
2000 (U)	41					26	
2001 (U)	51	52				26	
2002‡	47	49				25	
2003 (U)	63	60				31	
2003‡	51	49				25	
2004(U)	51	50	36	37	37	Discontinued	
2004‡	43	42	30	31	31		
2005 (U)	45	47	35	34	35		
2005	33	34	26	25	26		
2006 (U)	**43**	**45**	**33**	**36**	**34**		**26**[1]
2006	**36**	**37**	**27**	**30**	**28**		**22**[1]
Predicted 2010	31	32	23	26	24		19

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1. New site data starts April – 9 months data only

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued

Central Area	Esplanade Kirkcaldy	St Clair St Round-about	St Clair Street, Kirkcaldy (1)	St Clair Street, Kirkcaldy (2)	St Clair Street, Kirkcaldy (3)	Wedderurn Road, Kirkcaldy	Redhouse Round-about, Kirkcaldy	Lovat Road, Glenrothes	North Street Glenrothes (Rothesay Place)	Dunnikier Rd Kirkcaldy
Type†	K	K	R(F)	R(F)	R(F)	UB	K	K	I	R(F)
Easting	327863	329084	329105	329185	329173	325288	329198	328600	327062	328152
Northing	690262	692612	692992	693055	693069	693086	695281	699470	701115	692350
2000 (U)	19	25				13	26	17	15	
2001 (U)	22	26				14	32	18	19	
2002‡	20	23				13	30	18	18	
2003 (U)	27	34				19	42	24	25	
2003‡	22	28				15	34	19	20	
2004 (U)	Discontinued	Discontinued	39[1]	42[1]		16	discontinued	21	discontinued	35[1]
2004‡			33	35		13		18		29
2005 (U)			37	41		14		19		36
2005			27	30		10		14		26
2006(U)			**41**	**45**	**38**[2]	**15**		**21**		**35**
2006			**34**	**37**	**32**[2]	**12**		**17**		**29**
Predicted 2010			29	32	28	10		15		25

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1 monitoring commenced on 01/04/04 (9-months)
2 new site data starts April – 9 months data only

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued

Central Area	Victoria Rd Kirkcaldy	Glenlyon Road, Leven	Bawbee Bridge, Leven	Chapel Roundabout Kirkcaldy	Leslie Roundabout Glenrothes	Leslie High Street	Queensway Glenrothes	Adsa Roundabout, Kirkcaldy
Type†	R(F)	K	K	K	K	R(F)	K	K
Easting	328152	337357	337787	325023	326350	325111	327849	328735
Northing	692325	701318	700402	694405	701938	701806	701114	694053
2000 (U)		26	21	21	19		22	24
2001 (U)		32	25	24	20		26	27
2002‡		28	20	24	21		23	28
2003 (U)		38	29	30	29		31	39
2003‡		31	23	24	23		25	32
2004 (U)	38[1]	32	discontinued	discontinued	discontinued	29[1]	27	34
2004‡	32	27				24	23	29
2005 (U)	40	32				27	26	32
2005	29	23				20	19	23
2006(U)	**42**	**32**				**25**	**26**	**35**
2006	**35**	**27**				**21**	**22**	**29**
Predicted 2010	30	23				18	19	25

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1 monitoring commenced on 01/04/04 (9-months)

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued

East Area	City Road, St Andrews (1N)* (duplicate)		Bell Street, St Andrews (1)	Bell Street St Andrews (2)	Market Street St Andrews	South Street, St Andrews	Windsor Gardens St Andrews (4N)*	Crossgate, Cupar
	A	B						
Type†	R		R	R(F)	R	K	UB	K
Easting	350586		350708	350716	350899	351060	349122	337538
Northing	716580		716716	716669	716744	716642	715313	714527
2000 (U)	24		27		17	19	7	23
2001 (U)	26		28		17	23	8	28
2002‡	26		30		17	19	8	27
2003 (U)	36		39		24	24	10	33
2003‡	29		32		19	19	8	27
2004 (U)	28	31[1]	29	33[1]	discontinued	Discontinued	11	28
2004‡	24	26	24	28			9	24
2005 (U)	30	32	30	30			8	28[2]
2005	22	23	22	22			6	20
2006(u)	**32**	**32**	**34**	**32**			**10**	**30**
2006	**27**	**27**	**28**	**27**			**8**	**25**
Predicted 2010	23	23	24	23			7	22

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1 monitoring commenced on 02/03/04 (10-months)
2 no data Mar/Apr/May/June – monitoring for 8 months only

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued

East Area	South Road, Cupar	Cupar Road, Auchtermuchty	Millfield, Cupar (4N)*	Bonnygate Cupar (1N)*	Bonnygate Cupar (2)	Bonnygate Cupar (3) (duplicate) A	Bonnygate Cupar (3) (duplicate) B	Bonnygate Cupar (4)
Type†	R	R	UB	R	R(F)	R(F)		R(F)
Easting	337513	324186	336867	337411	337491	337455		337477
Northing	713616	711801	713878	714572	714586	714605		714576
2000 (U)			10	30				
2001 (U)	17	27	11	29				
2002‡	15	25	12	31				
2003 (U)	21	33	16	38				
2003‡	17	27	13	31				
2004 (U)	17	32	13	34	49[1]			
2004‡	14	27	11	28	41			
2005 (U)	18	32	13	31	51[2]	54[3]	48[3]	38[4]
2005	13	23	10	23	37	39	35	28
2006(U)	**20**	**34**	**13**	**33**	**51**	**55**	**57**	**39**
2006	**17**	**28**	**11**	**27**	**42**	**46**	**47**	**32**
Predicted 2010	15	24	10	23	36	40	41	28

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.
1 monitoring commenced on 30/03/04 (9-months)
2 no data for Apr/Oct/Nov – 9 months monitoring only
3 monitoring commenced Mar 2005 – 10 months data only
4 Monitoring started Apr 2005 – 9 months data only

Annual Mean Nitrogen Dioxide Concentrations from Fife Council Monitoring Sites (μgm^{-3}) continued

East Area	Ladywynd Cupar (5)	Bonnygate West, Cupar (6)	Bonnygate Monitor, Cupar (triplicate) A	B	C
Type†	R(F)	R(F)	Co-location		
Easting	337405	337342	337401		
Northing	714607	714579	714573		
2000 (U)					
2001 (U)					
2002‡					
2003 (U)					
2003‡					
2004 (U)					
2004‡					
2005 (U)					
2005					
2006(U)	**24**	**26**	**37**	**39**	**39**
2006	**20**	**22**	**31**	**32**	**32**
Predicted 2010	17	19	27	28	28

† Defra classification K – Roadside, R – Roadside, UB – urban background. I – Intermediate sites are no longer used in the National network but are useful for additional local information, R(F) refers to roadside sites at the façade of buildings.
U Unbiased data
‡ Bias adjusted data using a Bias A of 0.78 for 2002, 0.81 for 2003, 0.84 for 2004,0.731 for 2005 and 0.83 for 2006.

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