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ENVIRONMENTAL MANAGEMENT
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Local Air Quality Management

Updating and Screening Assessment

for

Moray Council

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EXECUTIVE SUMMARY

This is the Updating and Screening Assessment (U&SA) required under The Environment Act 1995 and subsequent regulations. The Act requires that Local authorities conduct a Review and Assessment of air quality in their area to assess compliance with the objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000 (Ref. 1), the Air Quality Regulations 2000 (Ref. 2) and Air Quality (Scotland) Amendment Regulations 2002 (Ref. 3).

The report has reviewed the conclusions made during Round 1 and considered any new sources or any changes that have occurred since the first stage Review and Assessment that may affect air quality.

The assessment has concluded that a detailed assessment is not required for carbon monoxide, benzene, 1,3-butadiene, lead, nitrogen dioxide or sulphur dioxide.

The assessment has concluded that a detailed assessment is required for particles (PM_{10}) to be submitted to the Scottish Executive by the end of April 2004.

In addition Moray Council will be required to continue their assessment of air quality for all other pollutants in their area and produce an annual progress report to the Scottish Executive by the end of April 2004.

1 INTRODUCTION

1.1 Review and Assessment Framework

The Environment Act 1995 and subsequent Regulations require Local authorities to conduct a Review and Assessment of air quality in their area to assess compliance with the standards and objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000 (Ref.1), the Air Quality Regulations 2000 (Ref.2) and Air Quality (Scotland) Amendment Regulations 2002 (Ref. 3).

The air quality objectives for the purpose of Review and Assessment are shown in Table 1.

Table 1 Objectives included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the Purpose of Local Air Quality Management.

Pollutant	Objective		Date to be Achieved By
	Concentration	Measured As	
Benzene	16.25µg/m^3 (5ppb)	Running annual mean	31 December 2003
	3.25 µg/m^3 (1ppb)	Running annual mean	31 December 2010
1,3-Butadiene	2.25µg/m^3 (1ppb)	Running annual mean	31 December 2003
Carbon monoxide	10mg/m^3 (10ppm)	Running 8 hour mean	31 December 2003
Lead	0.5µg/m^3	Annual mean	31 December 2004
	0.25µg/m^3	Annual mean	31 December 2008
Nitrogen Dioxide	200µg/m^3 (105ppb) not to be exceeded more than 18 times per year[1]	1 hour mean	31 December 2005
	40µg/m^3 (21ppb)	Annual mean	31 December 2005

Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times per year[2]	24 hour mean	31 December 2004
	40µg/m^3	Annual mean	31 December 2004
	50µg/m^3 not to be exceeded more than 7 times per year[3]	24 hour mean	31 December 2010
	18µg/m^3	Annual mean	31 December 2010
Sulphur dioxide	350µg/m^3 (132ppb) not to be exceeded more than 24 times a year[4]	1 hour mean	31 December 2004
	125µg/m^3 (47ppb) not to be exceeded more than 3 times a year[5]	24 hour mean	31 December 2004
	266µg/m^3 (100ppb) not to be exceeded more than 35 times a year[6]	15 minute mean	31 December 2005

[1] corresponds to the 99.8th percentile concentration of hourly means

[2] corresponds to the 90th percentile concentration of 24-hour means

[3] corresponds to the 98th percentile concentration of 24-hour means

[4] corresponds to the 99.7th percentile concentration of 1-hour means

[5] corresponds to the 99th percentile concentration of 24-hour means

[6] corresponds to the 99.9th percentile concentration of 15-minute means

The framework of local air quality management (LAQM) requires a Review and Assessment of air quality by Local authorities on a regular basis. The first round of the Review and Assessment was completed by Moray Council during 2000. The first round of Review and Assessment by Moray Council concluded that it was unlikely that there would be any breach of air quality objectives for any pollutants.

The second round of the Review and Assessment commenced in 2003 and has two phases. The first stage of the second round of Review and Assessment is to conduct an Updating and Screening Assessment (U&SA). The U&SA considers any changes that have occurred since the first round of Review and Assessment that may affect air quality.

Where the U&SA identifies that there may be a risk of an exceedence of an air quality objective at a location with relevant public exposure then a Detailed Assessment must be undertaken. A Detailed Assessment will consider any risk of exceedence of an objective to greater depth in order to determine whether it is necessary to declare an air quality management area.

This report represents the U&SA of air quality within Moray and follows the guidance laid out in the Technical Guidance document LAQM.TG(03) (Ref.4).

1.2 Description of Moray

The Moray Council area is situated in the north east of Scotland south of the Moray Firth. The area varies topographically from estuarine waters in the north to mountainous areas in the south reaching altitudes greater than 800m above sea level.

Moray is neighboured by Highland Council to the south and west, by the Moray Firth to the north, and by Aberdeenshire to the east.

Moray has a relatively low population density with roughly 86,940 people living in the area. The principal town in Moray Council is Elgin although Buckie, Keith, Forres, and Lossiemouth are also large towns. The main areas of industry and commerce are found in Elgin. There are several quarrying industries around Keith, Dufftown and Dallachy near Fochabers.

The area is quite densely forested. The three most prominent rivers in the Moray area are the Rivers Spey, Lossie, and Findhorn. The Spynie Canal drains the lower part of Moray.

There are no motorways within the district although there are several major roads: A96, A95, A98, A920, A941, A940, and the A942. There is one mainline railway which operates in Moray. Several small ports and harbours are operational along the Moray Firth at Cullen, Portknockie, Buckie, Hopeman, Burghead, Lossiemouth, Findochty and Findhorn. No commercial airports are found within the Moray area but there are two RAF airfields in operation at Lossiemouth and Kinloss.

A map of the area is included in Figure 1 of Appendix 2.

2 REVIEW AND ASSESSMENT OF CARBON MONOXIDE

Carbon monoxide (CO) is produced by the incomplete combustion of organic substances. The main source of CO is from vehicle emissions.

The first round of Review and Assessment of air quality within the Moray Council (Ref. 5) area concluded that it was unlikely that there would be an exceedence of air quality objectives for carbon monoxide (CO). The Scottish Executive accepted this conclusion.

The air quality objective for CO as set out in the Air Quality (Amendment) Regulations 2000 is presented in Table 2.

Table 2 Air Quality Objective for Carbon Monoxide

Concentration	Measured As	Date to be Achieved by
10.0 mg/m^3	Running 8 hour mean	31.12.03

The maximum running 8-hour mean therefore should not exceed 10 mg/m^3.

An assessment of the impact of emission sources of CO and available monitoring data is made in Sections 2.1 to 2.4.

2.1 Background Concentration

AEA Technology National Environment Technology Centre (NETCEN) (Ref.6) has mapped the estimated annual mean background CO concentration for the UK including the Moray area. The maps are included in Appendix 3. The maps indicate that in 2001 the annual mean background CO concentration was less than 0.2 mg/m^3. From the NETCEN detailed databases an area average of 0.117mg/m^3 was calculated for Moray. Box No.2.3 in the Technical guidance LAQM.TG(03) (Ref. 4) provides a correction factor to be applied to 2001 background concentrations to obtain an estimated background concentration for 2003. A factor of 0.826 has therefore been applied to the estimated 2001 concentration giving an estimated background concentration for 2003 of 0.096 mg/m^3.

2.2 Monitoring data

Moray Council does not undertake any monitoring of CO. An estimation of CO concentration has therefore been made utilising monitoring data from the closest national network monitoring site.

The closest national network monitoring site to Moray is in Aberdeen. The monitoring site in Aberdeen is situated within an urban area therefore it is classified classed as an Urban

Background Site. The maximum daily running 8-hour mean concentrations measured at Aberdeen for 2000 to 2001 are presented in Table 3.

Table 3 Maximum 8-hour Running Mean CO Concentrations measured at Aberdeen National Network Monitoring Site

	2000	2001
Maximum daily running 8-hour mean concentration (mg/m^3)	2.3	5.1

The CO concentration is monitored at Aberdeen using an automatic infra-red analyser. The analyser continuously measures the CO concentration and averages the concentration over hourly periods. A running 8-hour concentration is then calculated.

The concentrations measured at the Aberdeen site are significantly higher than the predicted background CO annual mean concentration from the NETCEN maps, which is lower than the NAQS objective for CO. Given that the emissions experienced at the Aberdeen site will be in excess of those experienced within Moray, due to much higher traffic counts, it will be unlikely that the urban background concentration in Moray will exceed the NAQS objective for CO.

Any potential exceedence of the NAQS objective for CO would be therefore expected to be due to a pollution hotspot. The impact from road traffic and industrial sources is considered in Section 2.3 and 2.4.

2.3 Road Traffic

Two-thirds of the total emissions of CO in the UK are due to road transport. Technical guidance LAQM.TG(03) (Ref. 4) states that any exceedence of CO objectives is only likely to occur close to very busy roads or junctions.

The technical guidance LAQM.TG(03) (Ref. 4) states that very busy roads should only be considered where the 2003 annual mean background concentration is expected to be above 1 mg/m^3. Since the predicted background CO concentration was 0.096 mg/m^3 it is considered unlikely that emissions from any very busy roads will cause exceedence of the NAQS objective for CO. No roads were therefore assessed for the impact of CO emissions.

2.4 Industrial Sources

The Scottish Environment Protection Agency (SEPA) was consulted (Ref. 7) on emissions from industrial processors within Moray Council and neighbouring local authority areas. CO is not listed as a regulated pollutant for any of the regulated companies within Moray. It was concluded that it was unlikely that emissions from any industrial processes within or

outwith Moray were likely to cause an exceedence of the NAQS objective for CO. A list of SEPA regulated processes is provided in Appendix 6.

2.5 Conclusion

The CO concentrations monitored at Aberdeen AURN site indicate that the NAQS objective for CO is unlikely to be exceeded in an urban environment. Moray will not be subjected to emissions rates as high as those experienced at the Aberdeen site therefore it is unlikely that concentrations will exceed NAQS objective levels within Moray. In addition it is considered unlikely that there will be any localised exceedence of the NAQS objective for CO as a result of emissions from road traffic or industrial sources.

National studies indicate that the ambient CO concentration is likely to fall in the coming years with a decrease in emissions, particularly from motor vehicles as a result of improved vehicle technology.

It is therefore considered that the maximum running 8-hour mean CO concentration in Moray will remain below 10 mg/m^3 during 2003.

A Detailed Assessment for CO is not required for Moray Council.

3 REVIEW AND ASSESSMENT FOR BENZENE

Benzene is an additive to vehicle fuel. The majority of emissions of benzene come from petrol vehicle exhausts.

The Air Quality Review Study prepared for the first round Review and Assessment for Moray Council (Ref.5) concluded that it was unlikely that there would be an exceedence of air quality objectives for benzene. The Scottish Executive accepted this conclusion.

The air quality objective for benzene as set out in the Air Quality Regulations 2000 is presented in Table 4. A stricter objective has also been introduced in Scotland for 2010.

Table 4 Air Quality Objectives for Benzene

Concentration	Measured As	Date to be Achieved by
16.25 μg/m^3	Running annual mean	31.12.03
3.25 μg/m^3	Running annual mean	31.12.10

The predicted running annual mean therefore should not exceed 16.25 μg/m^3 by the end of 2003. In addition the predicted running annual mean should not exceed 3.25μg/m^3 by the end of 2010.

Technical guidance LAQM.TG(03) (Ref. 4) states that the limit value for Benzene of 5 μg/m^3 has been transposed into UK legislation and will become effective by the beginning of 2010.

An assessment of the impact of emission sources of benzene and available monitoring data is made in Sections 3.1 to 3.7.

3.1 Background Concentration

NETCEN has mapped estimated annual mean background benzene concentrations for 2001, 2003 and 2010. The maps are included in Appendix 3. The estimated annual mean concentration for all three years is significantly less than 0.3 μg/m^3. The average benzene concentration, calculated from the NETCEN detailed databases of background concentrations (Ref. 6) for the Moray area is 0.05 μg/m^3 for 2001. Using the factors 0.875 and 0.659 for 2003 and 2010 respectively, provided in Box 3.3 of the technical guidance LAQM.TG(03) (Ref.4), predicted benzene concentrations for Moray of 0.046 μg/m^3 for 2003 and 0.039 μg/m^3 for 2010 have been calculated.

3.2 Monitoring Data

Moray Council does not undertake monitoring of benzene. The closest national network monitoring site is at Edinburgh Medical School, an Urban Background site in Edinburgh. The maximum running annual mean concentrations measured at the site are presented in Table 5.

Table 5 Maximum Running Annual Mean Benzene Concentrations Measured at Edinburgh Medical School

	1999	2000	2001
Maximum running annual mean Benzene concentration ($\mu g/m^3$)	1.98	1.72	1.38

The maximum running annual mean concentrations measured at Edinburgh Medical School are therefore below both the 2003 and 2010 NAQS objectives for benzene. Ambient benzene concentrations in Moray will be expected to be lower than those experienced at Edinburgh Medical School as Moray is more rural and has lower traffic flows.

3.3 Road Traffic

Technical guidance document LAQM.TG(03) (Ref.4) states that Local authorities need only consider emissions from 'very busy roads' where the 2010 background is expected to be above $2\mu g/m^3$. The estimated 2010 background concentration for Moray taken from the NETCEN maps was less than $0.3\ \mu g/m^3$.

Emissions from road traffic are therefore not considered likely to result in an exceedence of LAQM objectives for benzene.

3.4 Industrial Sources

SEPA was consulted (Ref.7) on emissions from industrial processors within Moray and neighbouring local authority areas. Since the last Air Quality Review and Assessment (Ref. 8), two new industrial processes, which are regulated for benzene namely, The Harbour Station in Lossiemouth and Victoria Filling Station in Forres have been identified. It was concluded that considering these new pollutant sources it was unlikely that emissions from any industrial processes within or outwith Moray were likely to cause an exceedence of the NAQS objective for benzene. A list of SEPA regulated processes is provided in Appendix 6.

3.5 Petrol Stations

The technical guidance document LAQM.TG(03) (Ref. 4) states that there is a potential for an exceedence of the 2010 objective for benzene where emissions from large petrol stations are combined with emissions from nearby busy roads.

A busy road is defined as a road with an annual average daily traffic flow greater than 30,000 vehicles per day. There are no roads within the Moray Council area with traffic flows exceeding this level, therefore it is considered unnecessary to assess emissions from petrol stations in isolation. It is unlikely therefore that there will be any exceedence of the 2010 benzene objective as a result of emissions from petrol stations.

SEPA confirmed that there are 13 regulated petrol stations within the Moray Council area, one of which is a harbour filling station. SEPA correspondence (Ref. 7) stated that there was no significant non-compliance of emission limit values at any of these sites.

3.6 Major Fuel Storage Depots

There are no major fuel depots situated within the Moray Council area therefore no consideration of emissions from major fuel depots has been made. The nearest two depots to Moray area are in Aberdeen and Inverness (Ref. 4) and are highly unlikely to have an impact on air quality in the Moray area.

3.7 Conclusion

Monitoring of benzene undertaken at Edinburgh Medical School indicates that the NAQS objectives for benzene are unlikely to be exceeded in urban locations. Ambient benzene concentrations in Moray are likely to be lower than those measured at the Edinburgh Medical School. It is therefore concluded that ambient benzene concentrations are unlikely to exceed NAQS objectives for benzene.

No emissions sources of benzene were identified that are considered likely to cause localised exceedences of NAQS objectives for benzene.

The technical guidance document LAQM.TG(03) (Ref. 4) states that national policy measures are expected to further reduce emissions of benzene, in particular by reducing the content of benzene in petrol. It is therefore considered unlikely that there will be any exceedence of NAQS objectives for benzene.

A detailed assessment for benzene is not required for Moray Council.

4 REVIEW AND ASSESSMENT FOR 1,3 BUTADIENE

The primary sources of 1,3-butadiene are vehicle emissions and industrial processes. Catalytic converters remove a high percentage of emissions of 1,3-butadiene from motor vehicles.

The first round of Review and Assessment of air quality within the Moray Council (Ref.5) concluded that it was unlikely that there would be an exceedence of air quality objectives for 1,3-butadiene. The Scottish Executive accepted this conclusion.

The air quality objective for 1,3-butadiene as set out in the Air Quality Regulations 2000 is presented in Table 6.

Table 6 Air Quality Objectives for 1,3-butadiene

Concentration	Measured As	Date to be Achieved by
2.25 μg/m^3	Running annual mean	31.12.03

The running annual mean therefore should not exceed 2.25 μg/m^3 by the end of 2003.

An assessment of the impact of emission sources of 1,3-butadiene and available monitoring data is made in Sections 4.1 to 4.3.

4.1 Background Concentrations

NETCEN (Ref. 6) has mapped estimated annual mean background 1,3-butadiene concentrations for 2001 and 2003. The maps are included in Appendix 3. The estimated annual mean concentration for both years is significantly below 0.1 μg/m^3. The average 1,3-butadiene concentration, calculated from the NETCEN (Ref. 6) 1 x 1 km^2 database of background concentrations, for Moray area for 2003 is 0.0162 μg/m^3.

4.2 Monitoring Data

Moray Council does not undertake monitoring of 1,3-butadiene. The closest national network-monitoring site is at Edinburgh Medical School, an Urban Background site in Edinburgh. The maximum running annual mean concentrations measured at the site are presented in Table 7.

Table 7 Maximum Running Annual Mean 1,3-butadiene Concentrations Measured at Edinburgh Medical School

	1999	2000	2001
Maximum running annual mean 1,3 butadiene concentration (μg/m^3)	0.21	0.19	0.20

The maximum running annual mean concentrations measured at Edinburgh Medical School are therefore below both of the NAQS objectives for 1,3-butadiene. 1,3-butadiene concentrations in Moray will be expected to be lower than those experienced at Edinburgh Medical School as Moray is more rural.

4.3 Industrial Sources

SEPA was consulted on emissions from industrial processes within Moray and neighbouring local authority areas (Ref. 7). None of the regulated industrial companies operating within Moray Council emitted 1,3-butadiene. It was concluded that it was unlikely that emissions from any industrial processes within or outwith Moray were likely to cause an exceedence of the NAQS objective for 1,3-butadiene. A list of SEPA regulated processes is provided in Appendix 6.

4.4 Conclusion

Monitoring of benzene undertaken at Edinburgh Medical School indicates that the NAQS objective for 1,3-butadiene is unlikely to be exceeded in urban locations. Ambient 1,3-butadiene concentrations in Moray are unlikely to be higher than those measured at the Edinburgh Medical School. It is therefore concluded that ambient 1,3-butadiene concentrations are unlikely to exceed NAQS objective levels.

No emissions sources were identified that are considered likely to cause a localised exceedence of the NAQS objective for 1,3-butadiene.

As with benzene the technical guidance document LAQM.TG(03) (Ref. 4) states that a number of national policy measures are expected to further reduce emissions of 1,3-butadiene from road vehicles.

It is therefore considered unlikely that there will be any exceedence of the NAQS objective for 1,3-butadiene.

A Detailed Assessment for 1,3-butadiene is not required for Moray.

5 REVIEW AND ASSESSMENT FOR LEAD

Since the addition of lead to petrol was banned in 2000, the principal source of lead is from industrial emissions.

The first round of Review and Assessment Air Quality Study for the Moray Council area (Ref. 5) concluded that it was unlikely that there would be an exceedence of air quality objectives for lead. The Scottish Executive accepted this conclusion.

The air quality objective for lead as set out in the Air Quality Regulations 2000 is presented in Table 8.

Table 8 Air Quality Objectives for Lead

Concentration	Measured As	Date to be Achieved by
0.5 μg/m^3	Annual mean	31.12.2004
0.25 μg/m^3	Annual mean	31.12.2008

The running annual mean therefore must not exceed 0.5 μg/m^3 by the end of 2004 and 0.25 μg/m^3 by the end of 2008.

An assessment of the potential impact of emissions sources of lead and available monitoring data is made Sections 5.1 to 5.3.

5.1 Monitoring data

Moray Council does not undertake any monitoring for lead. There are no automatic monitoring stations for lead; however there are network batch monitoring stations for lead situated in Glasgow, Falkirk and Motherwell.

The monitoring site in Glasgow is situated in the east end of the city in an area that formerly contained a number of small foundries. No foundries are still in operation in the area, which is now mainly residential. The monitoring site in Motherwell is situated about 500m from a large steel mill and is adjacent to several main roads.

The monitoring data for all three sites are presented in Table 9. The levels recorded at the mobile station at Larbert in the Falkirk Council area recorded levels of <0.001μg/m^3

Table 9 Annual Mean Lead-in-air Concentrations at Glasgow and Motherwell National Network Monitoring Sites

		1999	2000	2001
Annual mean lead-in-air concentration ($\mu g/m^3$)	Glasgow	0.02	0.017	0.025
	Falkirk	-	<0.001	<0.001
	Motherwell	0.016	0.009	0.016

The annual mean lead-in-air concentration measured all three sites are therefore well below NAQS objective levels. The lead-in-air concentration in Moray would be expected to be lower than that experienced at the three monitoring sites.

5.2 Industrial Sources

SEPA was consulted (Ref. 7) on emissions from industrial processes within Moray and neighbouring Local Authority areas. It was concluded that it was unlikely that emissions from any industrial processes within or outwith Moray were likely to cause an exceedence of the NAQS objective for lead. A list of SEPA regulated processes is provided in Appendix 6.

5.3 Conclusion

Monitoring of lead undertaken in Glasgow, Motherwell and Falkirk indicates that the NAQS objective is unlikely to be exceeded in urban locations. Ambient lead concentrations in Moray are unlikely to be higher than those measured at any of the three sites. As lead in petrol is now banned, use of lead is now combined to certain industrial processes. Ambient lead concentrations are therefore expected to remain fairly constant in the future. Lead in air concentrations are not expected to rise and so it can be concluded that the objectives will also be met in 2004 and 2008.

No emissions sources were identified that are considered likely to cause a localised exceedence of the NAQS objective for lead.

It is therefore considered unlikely that there will be any exceedence of the NAQS objective for lead.

A Detailed Assessment for lead is not required for Moray Council.

6 REVIEW AND ASSESSMENT FOR NITROGEN DIOXIDE

Primary sources of nitrogen dioxide (NO_2) are from vehicle engines and combustion processes. NO_2 is also generated by the reaction of oxides of nitrogen (NO_x) and atmospheric ozone (O_3).

The Scottish Executive and SEPA raised concern about lack of NO_2 monitoring data included in the Air Quality Review Study for Moray Council (Ref. 5). The Supplementary Air Quality Report First Stage Review and Assessment for Moray Council (Ref. 8) made use of new data from nine diffusion tube monitoring locations in Moray and consulted SEPA on regulated processes. It concluded that it was unlikely that there would be an exceedence of air quality objectives for NO_2. The Scottish Executive accepted this conclusion.

There are two air quality objectives for NO_2, an annual mean objective and an hourly objective, set out in the Air Quality Regulations 2000. The objectives are presented in Table 10.

Table 10 Air Quality Objectives for Nitrogen Dioxide

Concentration	Measured As	Date to be Achieved by
40 µg/m^3	Annual mean	31.12.2005
200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005

The annual mean concentration therefore should not exceed 40 µg/m^3 by the end of 2005. In addition it should be predicted that there will be fewer than 18 hourly exceedences of 200 µg/m^3 in a year by the end of 2005.

An assessment of the potential impact of emission sources of NO_2 and available monitoring data is made in sections 6.1 to 6.6.

6.1 Background Concentration

AEA Technology NETCEN (Ref. 6) has mapped estimated annual mean background concentrations for both NO_x and NO_2 for the years 2001, 2005 and 2010. The maps are included in Appendix 3.

The estimated annual mean NO_x concentration for all three years is below 20 µg/m^3. The maximum predicted NO_X concentration, taken from the NETCEN 1 x 1 km^2 background concentration database (Ref. 6), for the region occurring in 2001 is 10.9 µg/m^3. Future concentrations of NO_2 were calculated using the factors supplied in Box.6.6 of the Technical

Guidance LAQM.TG(03) (Ref. 4). The NO_2 component of total NO_x is predicted to be below 10 μg/m^3 for all areas of Moray during 2001 but is predicted to fall to below 8 μg/m^3 for the whole of the Council area by 2005.

6.2 Monitoring Data

Moray Council monitors NO_2 at a number of sites within the area, all of which have been operational since 1999. Monitoring is undertaken using passive diffusion tubes. A discussion of the analysis of the diffusion tubes is discussed in Section 6.2.1 with the results presented in Section 6.2.2.

Additional automatic monitoring was conducted by SEPA in Rothes for two periods during February and May 2002 (Ref. 9). The site was chosen as it is in an area with a high density of distilleries, a busy road and within an area of relevant public exposure. The topography of the area surrounding the monitoring site is also prone to the formation of inversion layers, which accentuates atmospheric pollution within the vicinity at ground level.

6.2.1 QA/QC of Diffusion Tube Monitoring Data

The laboratory analysis of the passive diffusion tubes used by Moray Council is undertaken by Aberdeen City Council, Laboratory of the Public Analyst. Aberdeen City Council is UKAS accredited for the analysis of nitrogen dioxide diffusion tubes. It also participates in the Workplace Analysis Scheme for Proficiency (WASP) for NO_2 and the NETCEN NO_2 Network Quality Solutions Programme (Appendix 1: Correspondence). Aberdeen City Council changed the preparation of the diffusion tubes in 2001. Prior to 2001 diffusion tubes were prepared from 50% triethanolamine in acetone. Since 2001 NO_2 diffusion tubes are prepared from 20% triethanolamine in deionised water. The change in method is shown in Table 11 to have reduced the bias factor between the diffusion tube and automatic monitoring results, which indicates a greater accuracy.

Diffusion tube monitoring is not as accurate as continuous monitoring techniques. The technical guidance LAQM.TG(03) (Ref. 4) recommends that diffusion tubes should be co-located with chemiluminesence analysers to compare the results in order to validate the performance of the diffusion tubes and analysis technique. This performance is assessed by calculating laboratory bias and all diffusion tubes analysed at the same laboratory must have their results corrected to allow for the bias.

Three diffusion tubes analysed by Aberdeen City Council have been co-located with a chemiluminescent analyser at the Union Street automatic monitoring station since 2000. A bias correction factor between the diffusion tubes and the chemiluminescent analyser has

been calculated for the three years since. The bias correction factors were calculated using the methodology laid out in Box 6.4 of Technical Guidance LAQM.TG(03) (Ref. 4).

The results of the cross comparison of diffusion tube and automatic monitoring results are displayed in Table 11.

Table 11 Cross Comparison of NO_2 Concentrations from the Union Street, Aberdeen Co-located Diffusion Tubes and Automatic NO_2 monitoring site

Union Street	Annual Mean of the three Diffusion Tube Concentrations (µg/m^3) (Dm)	Annual Mean Chemiluminescent Concentration (µg/m^3) (Cm)	Bias Adjustment Factor (Cm/Dm)	Diffusion Tube Bias (Dm-Cm)/Cm
2000	31.12	49.8	1.59	-37.5 %
2001	41.46	54.93	1.32	-24.5 %
2002	37.78	49.49	1.31	-23.7 %

The diffusion tubes therefore under predicted the ambient NO_2 concentration in comparison with the chemiluminescent analysers during 2000, 2001 and 2002. A factor of 1.59 has been be applied to diffusion tube results for 2000, a factor of 1.32 applied to results from 2001 and a factor of 1.31 to results from 2002, reported in Section 6.2.2.

6.2.2 Monitoring Results

Moray Council has conducted monitoring of NO_2 using diffusion tubes at ten sites since 2000. The site locations and descriptions are presented in Table 12. The locations are plotted on Figure 2 in Appendix 2.

Table 12 NO_2 Diffusion Tube Monitoring Sites in Moray since 1999

Site	Location	Classification	Ordnance Survey Grid Reference
Elgin 1	Lamp Post West Park Court	Kerbside	NJ212626
Elgin 2	Junction East & Maisondieu Rd	Kerbside	NJ224627
Elgin 3	99-101 Maisondieu Road	Roadside	NJ223627
Elgin 4	26-28 Priory Place	Urban Background	NJ223626
Elgin 5	Main Street New Elgin	Kerbside	NJ223618
Fochabers 1	50A High Street	Kerbside	NJ345588
Fochabers 2	Sunndach George Street	Urban Background	NJ343587
Forres	Tolbooth, High Street	Roadside	NJ034587
Keith 1	106 Moss Street	Roadside	NJ433507
Keith 2	87 Moss Street	Roadside	NJ432507

The monitoring locations were selected to provide monitoring data from several key areas within Moray:

- monitoring at the most heavily trafficked roads within Elgin town centre at Elgin1, Elgin2, Elgin3 and Elgin5;
- Urban Background concentration at Elgin4 and Fochabers2; and
- monitoring on the main roads through the other towns and villages within Morayshire at Fochabers1, Forres, Keith1 and Keith2.

The NO_2 concentrations measured at these sites are presented in Table 13. The concentrations have been adjusted for laboratory bias.

Table 13 NO_2 Monitoring Results

Monitoring Site	Annual Mean NO_2 Concentration ($\mu g/m^3$)			Data Capture Rate (%)		
	2000	2001	2002	2000	2001	2002
Elgin 1	19.8	17.1	23.4	92	100	83
Elgin 2	13.8	12.3	15.9	100	100	83
Elgin 3	9.5	7.6	10.5	100	92	83
Elgin 4	7.0	6.2	6.9	100	100	83
Elgin 5	20.7	9.1	14.1	8	92	58
Fochabers 1	16.6	16.1	21.6	92	92	83
Fochabers 2	4.9	4.3	4.1	83	67	75
Forres	11.1	10.6	12.6	100	100	83
Keith 1	15.0	14.8	18.6	100	92	83
Keith 2	14.0	12.0	15.5	100	100	83

The monitoring results indicate that the NO_2 concentrations are well below the NAQS annual mean objective for NO_2. The data capture rates for the diffusion tubes vary with all but two sites having a data capture rate greater than 83% between 2000 and 2002.

There is no overall downward trend in NO_2 concentration between 2000 and 2002. The concentrations monitored at the kerbside and roadside monitoring sites on the arterial routes in Moray have increased, whilst the concentrations measured at the background sites and those at the outlying towns and villages have remained fairly constant.

The technical guidance LAQM.TG(03) (Ref. 4) suggests that meeting the 2005 annual mean objective is expected to be more demanding than meeting the hourly mean objective. No hourly monitoring data is available for Moray. As the annual mean objective has been met it is considered unlikely that the hourly mean objective will be exceeded.

The additional NO_2 sampling carried out by SEPA revealed that for the period of the study ambient air levels of NO_2 in Rothes did not exceeded the limits set out in the Air Quality Objectives (Ref. 9). Maximum hourly concentrations of recorded NO_2 were less than 17% of the 1 hour mean limit. Rothes is situated on the A941, which is not the busiest road in Moray, but it is in an area with a high density of distilleries. The values recorded may not be fully representative of the NO_2 concentrations expected around busy junctions along the A96, but give supporting evidence of compliance with the NO_2 objectives throughout Morayshire.

The annual mean concentration is expected to decrease by a further 9% between 2002 and 2005 at roadside and kerbside locations, mainly due to improvements in engine efficiency and technology (Ref. 4).

The monitored concentrations presented in Table 14 indicate that it is unlikely that there will be any exceedence of NAQS objectives for NO_2.

While monitoring has been chosen to check concentrations at potential hot-spots, road traffic and industrial sources are considered further in Sections 6.3 and 6.4.

6.3 Road Traffic

In the first round stage 1 Air Quality Review Study no consideration was made to emissions from road traffic in Moray. The Supplementary Air Quality Report First Stage Review and Assessment Report (Ref. 8) carried out assessment using the nomograms contained in Technical guidance document LAQM.TG(00) (Ref. 12). After consultation with Moray Council Roads Department two road junctions, Spey Bay and South College Street, Elgin, were analysed and were predicted to have emissions unlikely to cause an exceedence of air quality objectives for NO_2.

A revised version of DMRB has been issued which provides a more conservative assessment of road traffic emissions (Ref. 10) In addition the DMRB model has been found to underestimate significantly the pollutant concentrations in street canyons. Technical guidance LAQM.TG(03) (Ref. 4) suggests therefore that traffic flows of as low as 10,000 vehicles per day can cause an exceedence of air quality objectives within congested conditions.

A table of annual average daily traffic flow and average vehicle speeds for the roads in Moray is included in Appendix 4.

Since the last round of Review and Assessment there have been no new roads constructed, although a significant increase in traffic on existing roads was predicted by 2005 due to

proposed employment and industrial developments. The construction of the Fochabers / Mosstodloch bypass anticipated to commence in 2003 (Ref. 8) is subject to a Public Inquiry scheduled for late 2003. Any increased traffic impacts as a result of this development can therefore not be determined until after the public inquiry. An assessment was made of the most heavily trafficked junctions within Moray. Technical Guidance LAQM.TG(03) (Ref. 4) indicates that for areas with a predicted 2005 background concentration of less than 15 $\mu g/m^3$ consideration should be made of all roads and junctions with an Annual Average Daily Total (AADT) greater than 10,000. Two junctions and one roundabout were assessed using DMRB. The roads assessed included the most heavily trafficked road in Moray, namely the A96. Two roads correspond to those investigated in the Supplementary Air Quality Report (Ref. 8). Spey Bay represents a road junction with a high proportion, 12%, of Heavy Goods Vehicles. North College Street junction in Elgin indicates a busy junction within an urban centre. Queen Street roundabout in Elgin also exhibited a predicted total traffic flow for 2010 greater than 10,000 AADT so is included within the DMRB assessment.

The traffic flows at junctions assessed in the DMRB assessment are shown in Table 14, and the roads are highlighted on the map Figure 3 in Appendix 2.

Table 14 Traffic Flows at Junctions Assessed using DMRB Assessment

Junction	Traffic Flow AADT 1998	2005	2010	% Heavy Goods Vehicles	Nearest Receptor
A96 N College St, Elgin	18374	21681	23151	8	10 m
A96 Spey Bay Junction, Fochabers	12006	14167	15128	12	100 m
A96 Queen St roundabout, Elgin	18374	21682	23151	8	10 m
	8669	10230	10923	8	
	518	612	661	7	

In order to ensure that no underestimation was made of the emissions from road traffic, the receptors were assumed to be within 5 metres of each junction. The assessment considered average traffic speeds of 10 and 20 miles per hour (mph) to account for the slowing of traffic at the junction.

A summary of the results of the assessment is presented in Table 15 with the full assessment contained in Appendix 5.

Table 15 Summary of DMRB Assessment of Roads within Moray

Road / Junction	Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$) at 10 mph		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$) at 20 mph	
	2005	2010	2005	2010
A96 North College St, Elgin	20.29	15.89	17.29	13.54
A96 Spey Bay Junction, Fochabers	18.84	14.72	15.88	12.40
A96 Queen Street Roundabout, Elgin	25.95	20.52	22.18	17.50

The results of the DMRB assessments therefore indicate that no road traffic emissions were identified as likely to cause an exceedence of the annual mean NAQS objective for NO_2. As the roads considered represent worst case roads, no other roads within Moray are expected to cause exceedence of NAQS objectives for NO_2.

6.4 Industrial Sources

In the first round of Review and Assessment it was concluded that it was unlikely that emissions from any industrial processes would result in an exceedence of NAQS objectives for NO_2.

SEPA was consulted (Ref. 7) as to whether there have been any new industrial processes or significant changes to emissions from existing processes since the last Review and Assessment (A copy of the correspondence is included in Appendix 2). The SEPA response highlighted an increase in operating capacity of the animal carcass incineration process at Douglas Brae Knackery in Keith. This results from the installation of two additional incinerators in 2001 and 2002 respectively. However, SEPA confirmed compliance of emission limit values and that there is unlikely to be any exceedence of NAQS objectives for NO_2 as a result of emissions from industrial processors in Moray. A list of SEPA regulated processes is provided in Appendix 6.

6.5 Air Traffic

There are no airports exceeding the 10 million people per annum limit set out in the technical guidance LAQM.TG(03) (Ref. 4) situated within Moray therefore no assessment of emissions from air traffic has been made. Moray Council has communicated that concerns have been raised by local residents in the form of a petition and complaints regarding atmospheric pollution from the two RAF airbases (Appendix 1. Correspondence). No emissions data for either RAF airfield is available for assessment. However Moray Council has gained approval from Committee to monitor aircraft odour and further monitoring of air quality with a view to determining the impact of aircraft emissions. In January 2003 Moray

Council installed two NO_2 diffusion tubes to monitor air quality around RAF Lossiemouth. One is located at 1 Merryton Court in close proximity to the boundary of RAF Lossiemouth and one is placed at 27 James Street on the east side of Lossiemouth. Preliminary results for NO_2 concentrations have been low (Appendix 1 Correspondence).

6.6 Conclusion

Monitoring of NO_2 undertaken throughout the Moray Council area indicates that the NAQS objective is unlikely to be exceeded in urban locations. It is therefore concluded that ambient NO_2 concentrations are unlikely to exceed NAQS objective levels.

No emissions sources were identified that are considered likely to cause a localised exceedence of the NAQS objective for nitrogen dioxide.

It is therefore considered unlikely that there will be any exceedence of the NAQS objective for nitrogen dioxide.

A Detailed Assessment for nitrogen dioxide is not required for the Moray Council area.

7 REVIEW AND ASSESSMENT OF SULPHUR DIOXIDE

The principal source of emissions of sulphur dioxide (SO_2) is from coal-fired power stations and other industrial combustion sources. Emissions from motor vehicles are minimal in comparison.

The first round Supplementary Review and Assessment of air quality within the Moray Council area (Ref. 8) concluded that it was unlikely that there would be an exceedence of air quality objectives for SO_2. The Scottish Executive accepted this conclusion.

There are three air quality objectives for SO_2, an hourly mean objective, a 24-hour objective and a 15-minute mean objective, set out in the Air Quality Regulations 2000. The objectives are presented in Table 16.

Table 16 Air Quality Objectives for Sulphur Dioxide

Concentration	Measured As	Date to be Achieved by
350 μg/m^3 not to be exceeded more than 24 times per 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

The predicted ground level concentration therefore should not exceed 350 μg/m^3 on more than 24 hourly periods by the end of 2005. In addition, the predicted 24-hour mean value should not exceed 125 μg/m^3 on more than three occasions by the end of 2004, and the 15-minute mean level should not exceed 266 μg/m^3 on more than 35 occasions per year by the end of 2005.

An assessment of the impact of emission sources of NO_2 and available monitoring data is made in Sections 7.1 to 7.7.

7.1 Background Concentration

NETCEN has mapped estimated annual mean background concentrations for SO_2 during 2001 (Ref. 6). The map is included in Appendix 3.

The estimated annual mean SO_2 concentration in Moray in 2001 is below 2 μg/m^3. Technical guidance LAQM.TG(03) (Ref.4) suggests that the annual mean SO_2 background concentration at the end of 2004 and 2005 will be 75% of the 2001 concentration. The background annual mean concentration during 2004 and 2005 is therefore predicted to be

less than 2 µg/m^3. The annual mean background concentration of SO_2, calculated from the NETCEN 1 X 1 km^2 background concentration database (Ref. 6), averaged for the Moray area in 2001 is 0.659 µg/m^3. Using the factor of 0.75 given in the technical guidance LAQM.TG(03) (Ref. 1) the annual mean background SO_2 concentration for Moray in 2004 is 0.494 µg / m^3.

7.2 Monitoring Data

Moray Council does not undertake any automatic continuous monitoring of SO_2 comparable with the 15 minute mean and 1 hour mean objectives. The Council has monitored since January 1999 using passive diffusion tubes. The diffusion tube technique is not validated and as the monitoring averaging period is 4 weeks the results are not comparable with NAQS objectives for SO_2. The monitoring results can therefore be used as an indicator of air quality but, not directly compared with NAQS objectives.

The diffusion tube monitoring results are presented in Table 17. The monitoring locations are plotted in Figure 2 of Appendix 2.

Table 17 Annual Mean SO_2 Concentrations and Capture Rates

	Annual Mean SO_2 Concentration (µg/m^3)			Data Capture Rate (%)		
	2000	2001	2002	2000	2001	2002
Priory Place, Elgin	1.75	14.16	0.98	100	100	100
Spey Drive, Rothes	4.10	12.82	2.35	100	92	100

The results therefore indicate that the highest SO_2 concentrations are measured in the town of Elgin. The results although not directly comparable are substantially lower than any of the NAQS objectives for SO_2.

No quality assurance or validation is available for the diffusion tubes therefore no conclusions for Moray Council have been taken from its results.

Additional automatic monitoring of SO_2 was conducted by SEPA during two periods in February and May 2002 at Rothes. The location was chosen because it is in an area with a high density of distilleries and residential areas where there will be relevant public exposure. The result of local topography is that the area is prone to inversion layers which accentuate the impact of atmospheric emissions at ground level. The results from this study are not directly comparable to the air quality objectives but provide supplementary evidence of low SO_2 values. Throughout the monitoring periods the SO_2 peak levels did not exceed 6% of the 15-minute mean limit, 5% of the 1 hour mean limit and 5% of the 24-hour mean limit. These figures support the view that SO_2 levels are unlikely to be exceeded within urban areas of Moray (Ref. 9).

The neighbouring Councils of Aberdeenshire and Aberdeen City both undertake SO_2 monitoring.

Aberdeen City Council operates an automatic real-time analyser which gives results which are directly comparable with the NAQS objectives for SO_2. The monitoring station in Aberdeen is positioned to measure urban area emissions therefore the results from these sites will not be applicable to all the Moray Council area. The results from the Aberdeen monitoring station recorded no exceedences between 2000 and 2002 of any of the NAQS objectives.

Since Aberdeen is subjected to higher concentrations than would be expected within the Moray Council area, particularly from industrial sources, then it can be concluded that the ambient SO_2 concentrations within the Moray Council area is unlikely to exceed NAQS objective levels for SO_2.

Any potential exceedence of the NAQS objective for SO_2 is therefore expected to be due to pollution hotspots. The emissions sources with the potential to cause pollution hotspots of SO_2 are industrial sources and domestic/commercial coal burning. These are considered in Sections 7.3 and 7.5.

7.3 Industrial Sources

In the first round of Review and Assessment it was concluded that it was unlikely that emissions from any industrial processes were likely to result in an exceedence of NAQS objectives for SO_2.

SEPA was consulted (Ref. 7) as to whether there have been any new industrial processes or significant changes to emissions from existing processes. A copy of the correspondence is included in Appendix 2.

SEPA correspondence stated that the only industrial processor in Moray regulated for SO_2 concentrations is a road stone coating process, namely Ennstone Thistle Ltd located in Elgin. A list of SEPA regulated processes is provided in Appendix 6.

SEPA correspondence confirmed that currently there is “no significant non-compliance with emission limit values” at any of the SEPA-regulated sites within the Moray area.

It is therefore concluded that there will be no exceedence of NAQS objectives for SO_2 as a result of emissions from either industrial process.

7.4 Domestic Coal Burning

Technical guidance LAQM.TG(03) (Ref. 4) indicates that local exceedences of SO_2 objectives may occur in areas of concentrated coal burning. Concentrated areas are defined as those with more than 100 properties coal burning in an area of 500m by 500m.

It is expected that the only areas where a sufficient density of coal burning houses exist will be in areas of old council housing stock i.e. those built circa 1950 or pre-world war II. Modern housing is unlikely to be built with coal fires except in individual circumstances.

A survey undertaken by Moray Council Housing Service for 2002/03 suggests that there are no areas of concentrated coal burning. The survey only included current Council housing stock at that time and did not include former council housing. It is assumed that former housing stock, have been converted to gas or electric heating by the owners.

The areas with the highest densities of coal burning properties found within Moray are presented in Table 18, and mapped in Figure 4 in Appendix 2.

Table 18 Density of Coal-burning Properties within Moray

Area	Number of Coal Burning Properties	Approximate area (km^2)	Number of properties per 0.25 km^2
Burghead	61	0.32 km^2	48
Forres	82	3.46 km^2	6
Lossiemouth	85	1.74 km^2	13

From the information available, the number of coal burning properties therefore does not exceed 100 houses per 0.25 km^2, given as the density limit in the technical guidance LAQM.TG(03) (Ref. 4). It is therefore considered unlikely that there will be any exceedence of NAQS objectives for SO_2 as a result of emissions from domestic coal burning.

7.5 Small Boilers

An inventory of small boilers within Moray burning coal or oil with a thermal throughput greater than 5 megawatts (MW) was undertaken by Entec UK on behalf of the Scottish Executive in 2000 (Ref. 11). One small boiler was identified at Grampian University Hospital Trust. The nearest sensitive receptor where relevant public exposure might be expected is the hospital grounds themselves. The predicted SO_2 concentration for the 15 minutes mean (adjusted for a 5 $\mu g/m^3$ background concentration) was 212 $\mu g/m^3$, which is below the 15 minute mean objective level for SO_2. The modelled 1 hour mean SO_2 concentration (adjusted for a 5 $\mu g/m^3$ background concentration) is 158 μgm^3, which is also below the 1 hour SO_2 mean objective of 350 $\mu g/m^3$.

It is therefore considered unlikely that there will be any exceedence of NAQS SO_2 objectives as a result of emissions from small boiler plant.

7.6 Shipping

Technical guidance LAQM.TG(03) (Ref. 4) states that where shipping movements exceed 5000 per year there is the potential for an exceedence of the 15-minute NAQS objective. It must be established whether or not there is relevant exposure within 1km of the berths and main areas of manoeuvring. A review of shipping movements should be confined to large ships such as cross-channel ferries and container ships.

There are residential areas within 1 km of the ports in Moray so the potential for relevant exposure exists. However the majority of harbours and ports in Moray Council area along the south bank of the Moray Firth are small and have no significant shipping movements. Buckie is the largest port with some cargo ship operations. The technical guidance LAQM.TG(03) (Ref. 4) states that a review of shipping should be confined to cross-channel ferries, Ro-Ro, container ships and cruise liners therefore no assessment of emissions from shipping has been made.

7.7 Railways

The only passenger rail line through the Moray Council area is the main line connecting Inverness to Aberdeen. The line passes through three stations within the Moray Council area, at Elgin, Keith and Forres.

Technical guidance LAQM.TG (03) (Ref. 4) states that there is potential for an exceedence of NAQS objectives for SO_2 where locomotives are stationary with their engines running for periods of 15-minutes or more. Where this is true for on more than two occasions per day then Local authorities are instructed to progress to a detailed assessment.

Consultation with Scotrail confirmed that the trains serving these lines are mainly diesel with newer trains fitted with Euro 3 standard engines. Scotrail stated that trains would not be expected to be stationary for periods of 15 minutes or longer at any location within Moray Council. All Scotrail trains are fitted with automatic engine shutdown mechanisms when the driver removes his key from the control panel.

It is considered unlikely that there will be stationary locomotives with their engines running for periods of 15 minutes at any location within the Moray region due to the fact that there are no terminal stations.

It is therefore unlikely that there will be an exceedence of the 15-minute objective for SO_2 as a result of emissions from railway locomotives.

7.8 Conclusion

Monitoring of SO_2 undertaken by Aberdeen Council indicates that NAQS objectives are unlikely to be exceeded in urban background locations where there is no significant influence of industrial emissions. Ambient SO_2 concentrations in Moray are unlikely to be higher than those measured within Aberdeen. It is therefore concluded that ambient SO_2 concentrations are unlikely to exceed NAQS objective levels.

No emissions sources were identified that are considered likely to cause a localised exceedence of the NAQS objectives for SO_2.

It is therefore considered unlikely that there will be any exceedence of the NAQS objectives for SO_2.

A Detailed Assessment for SO_2 is therefore not required for Moray.

8 REVIEW AND ASSESSMENT FOR PARTICLES (PM_{10})

PM_{10} comprises a variety of substances of less than 10 microns (µm) in diameter.

PM_{10} is produced from a variety of sources. The principal sources are road transport, combustion processes and quarrying and mining. PM_{10} can also arise from a variety of natural sources including sea salt, pollen grains and biological particles.

PM_{10} can be classified as being either primary or secondary. Primary sources are released directly into the atmosphere from combustion processes, whilst secondary sources are formed by chemical reaction in the atmosphere. The formation of secondary particles can occur a distance away from their origin. The smaller particles (<2 µg/m^3) are defined as fine whilst larger diameter particles (2-10 µg/m^3) are defined as being coarse.

In the first round of Review and Assessment the Supplementary Air Quality Report for the Moray Council area (Ref. 8) concluded that it was unlikely that there would be an exceedence of air quality objectives for PM_{10}. The Scottish Executive accepted this conclusion.

There are two air quality objectives for PM_{10} set out in the Air Quality Regulations 2000, an annual mean objective and a daily mean objective. In addition, the Scottish Executive has set in place stricter objectives to be achieved by 2010. The objectives are presented in Table 19.

Table 19 Air Quality Objectives for Particles

Concentration	Measured As	Date to be Achieved by
40 µg/m^3	Annual mean	31.12.2004
18 µg/m^3	Annual mean	31.12.2010
50 µg/m^3 not to be exceeded more than 35 times per year	24-hour mean	31.12.2004
50 µg/m^3 not to be exceeded more than 7 times a year	24-hour mean	31.12.2010

The predicted annual mean concentration therefore should not exceed 40 µg/m^3 by the end of 2004 and 18 µg/m^3 by the end of 2010. In addition it should be predicted that there will be fewer than 35 24-hourly exceedences of 50 µg/m^3 in a year by the end of 2004 and less than 7 by the end of 2010.

An assessment of the impact of emission sources of PM_{10} and available monitoring data is made in Sections 8.1 to 8.7.

8.1 Background Concentration

NETCEN has mapped estimated annual mean background concentrations for primary PM_{10} concentrations during 2001, 2004 and 2010 and secondary PM_{10} concentrations for 2001 (Ref. 6). The maps are included in Appendix 3.

The estimated primary annual mean PM_{10} concentration in 2001 is below 15 $\mu g/m^3$. The maximum predicted annual mean background concentration, taken from the NETCEN 1 x 1 km^2 background concentration database (Ref. 6), occurring within Moray area for 2001 is 14.2 $\mu g/m^3$. The factors provided in Box.8.7 of the Technical Guidance LAQM.TG (03) (Ref. 4) were used to calculate the background PM_{10} concentrations for 2004 and 2010. The background concentration is predicted to be below 15$\mu g/m^3$ in 2004 and 2010. The annual mean primary PM_{10} estimation in 2010 averaged for the whole of the Moray region, calculated from the NETCEN 1 x 1 km^2 background concentration database (Ref. 6) gives a value of 11.5 $\mu g/m^3$.

The estimated secondary annual mean concentration in 2001 was below 3 $\mu g/m^3$. It is assumed that secondary PM_{10} concentration will remain constant until 2010.

The total background concentration during 2004 is therefore predicted to be below 18 $\mu g/m^3$ in both 2004 and 2010.

The predicted background concentration is fairly uniform throughout the council area.

8.2 Monitoring Data

Moray Council does not undertake any monitoring of PM_{10}.

The closest national network monitoring site to Moray is in Aberdeen. The monitoring site in Aberdeen is classified as an Urban Background site. Concentrations within Moray are unlikely to be as high as those measured at Aberdeen due to larger traffic flows in Aberdeen. The annual mean concentrations and number of exceedences of the 24-hour mean objective measured at Aberdeen are presented in Table 20.

Table 20 Annual Mean PM_{10} Concentrations measured at Aberdeen National Monitoring Site

	2000	2001
Annual mean concentration ($\mu g/m^3$)	19	15
No. of 24-hour mean exceedences	3	2

The PM_{10} is monitored at Aberdeen using a Tapered Oscillating Element Microbalance (TEOM) analyser. TEOM analysers have been found to underestimate PM_{10} concentration in

comparison to gravimetric monitoring techniques. The TEOM concentrations have therefore been factored by 1.3 to account for the under-estimation and to compare with the objectives, which are based on gravimetric methods. The analyser continuously measures the PM_{10} concentration and averages the concentration over hourly periods. The 24-hour concentration is then averaged.

The concentrations measured at the Aberdeen site are slightly higher, particularly during 2001, than the predicted background annual mean concentration for Moray from the NETCEN maps. The concentrations measured indicate that the ambient concentrations will meet both 2004 and 2010 objectives for PM_{10}. Urban ambient concentrations within Moray will be expected to be lower than those measured at Aberdeen.

Any exceedence of the NAQS objective for PM_{10} will therefore be a result of a pollution hotspot. The emissions sources that could cause a pollution hot-spot are therefore considered in the following sections.

8.3 Road Traffic

In the First Round Stage 1 Review and Assessment report (Ref. 8) consideration was made of emissions from roads in Moray. Assessment was made using the nomograms contained in Technical Guidance document LAQM.TG(00) (Ref. 4) and the model laid out in the Design Manual for Roads and Bridges (DMRB model) (Ref. 10). No roads were predicted to have emissions likely to cause an exceedence of air quality objectives for PM_{10}.

A revised version of DMRB (Ref.12) has been issued for LAQM in 2003 which provides a more conservative assessment of road traffic emissions Technical guidance LAQM.TG(03) (Ref. 4) states that busy roads or junctions should be assessed using the DMRB model. Busy roads and junctions are those with a combined AADT flow in excess of 10,000 vehicles per day in 2004 and an AADT flow of 5,000 vehicles per day in 2010.

A table of annual average daily traffic flow and average vehicle speeds for the roads in Moray is included in Appendix 4.

Whilst there have been no new roads constructed since the last Review and Assessment, significant increases in traffic on some existing roads was predicted by 2005 due to planned employment developments. The construction of the Fochabers / Mosstodloch bypass anticipated to commence in 2003 (Ref. 8) is subject to a Public Inquiry scheduled for late 2003. Any increased traffic impacts as a result of this development can therefore not be determined until after the public inquiry. An assessment was made of the most heavily trafficked junctions within Moray. All junctions along the most heavily trafficked road in Moray, namely the A96, were monitored. Two junctions and one roundabout were assessed

using DMRB. Traffic flows for assessed junctions are shown in Table 21. The roads are highlighted on the map in Figure 3 in Appendix 2.

Table 21 Roundabout and Junctions Assessed Using DMRB Assessment

Junction	Traffic Flow AADT 1998	2004	2010	% Heavy Goods Vehicles	Nearest Receptor
A96 N College St, Elgin	18374	21314	23151	8	10 m
A96 Spey Bay Junction, Fochabers	12006	13927	15128	12	100 m
A96 Queen St roundabout, Elgin	18374	21314	23151	8	10 m
	8669	10056	10923	8	
	518	601	661	7	

In order to ensure that no underestimation was made of the emissions from road traffic the receptors were assumed to be within 5 metres of each junction. The assessment considered average traffic speeds of 10 and 20 miles per hour (mph) to account for the slowing of traffic at the roundabout.

A summary of the results of the assessment for 2004 is presented in Table 22 and a summary of the assessment for 2010 in Table 23. The full DMRB assessment is contained within Appendix 5.

Table 22 Summary of 2004 PM_{10} DMRB Assessment of Roads within Moray

Road / Junction	Traffic Speed 10 mph		Traffic Speed 20 mph	
	Annual Mean Concentration ($\mu g/m^3$)	Number of 24-hour mean Exceedences	Annual Mean Concentration ($\mu g/m^3$)	Number of 24-hour mean Exceedences
A96 N College St, Elgin	26.02	15	22.67	8
A96 Spey Bay Junction, Fochabers	23.34	11	21.36	6
A96 Queen St roundabout, Elgin	31.55	34	26.55	17

Table 23 Summary of 2010 PM_{10} DMRB Assessment of Road Traffic Emissions within Moray

Road / Junction	Traffic Speed 10 mph		Traffic Speed 20 mph	
	Annual Mean Concentration ($\mu g/m^3$)	Number of 24-hour mean Exceedences	Annual Mean Concentration ($\mu g/m^3$)	Number of 24-hour mean Exceedences
A96 N College St, Elgin	20.70	5	18.97	3
A96 Spey Bay Junction, Fochabers	19.63	3	18.11	2
A96 Queen St roundabout, Elgin	23.78	10	21.20	6

The results of the DMRB assessments therefore indicate that by the end of 2004 the annual mean PM_{10} objective is unlikely to be exceeded as a result of road traffic emissions. The fixed 24-hour objective is exceeded for the Queen Street Roundabout in Elgin when considering traffic travelling at low speeds. Queen Street is the busiest road junction featured in the traffic survey and 34 exceedences of the 24 hour objective were predicted compared to the permissible level of 35. The DMRB assessment for 2010 predicts that there will be exceedences of the annual mean PM_{10} objective at all three junctions. The 24 hour objective of 7 exceedences of 50 $\mu g/m^3$ by 2010 is exceeded at Queen Street Roundabout, which predicts 10 exceedences for traffic travelling at 10 mph.

8.4 Industrial Sources

Information provided by SEPA correspondence (Ref. 7) indicates that landfills, quarries and their associated industry will be the principal industrial contributors to PM_{10} within the Moray Council area. A list of SEPA regulated processes is provided in Appendix 6.

SEPA correspondence (Ref. 7) confirmed that monitoring undertaken by SEPA in the Moray Council area indicates that there is unlikely to be any exceedence of NAQS objectives for PM_{10} as a result of emissions from industrial processors. SEPA stated that monitoring is only conducted as point sources for various aspects of the quarrying processes and this will not necessarily correlate to overall PM_{10} emission from the quarry area itself. SEPA correspondence (Ref. 7) confirmed that there is currently "no significant non-compliance with any emission limit values" at any of the SEPA-regulated sites within the Moray locality.

8.5 Solid Fuel Burning

Technical guidance LAQM.TG(03) (Ref. 4) states that local exceedences of PM_{10} objectives may occur in areas of concentrated coal burning. Concentrated areas are defined as those with more than 50 properties burning solid fuel in an area of 500m by 500m.

It is expected that only areas where a sufficient density of coal burning houses exist will be in areas of old council housing stock i.e. those built circa 1950 or pre-world war II. Modern housing is unlikely to be built with coal fires except in individual circumstances.

A survey undertaken by Moray Council Housing Service in 2002 suggests that there are no areas of concentrated solid fuel burning. The survey only included current Council housing stock at that time and did not include former council housing. It is assumed that former housing stock, roughly one third of total Council housing stock prior to private sales, have been converted to gas or electric heating by the owners.

The highest densities of coal burning properties found within Moray are presented in Table 24, and mapped in Figure 4 in Appendix 2.

Table 24 Density of Coal-burning properties within Moray

Area	Number of Coal Burning Properties	Approximate area (km^2)	Number of properties per 0.25 km^2
Burghead	61	0.32 km^2	48
Forres	82	3.46 km^2	6
Lossiemouth	85	1.74 km^2	13

From the information available, the number of coal burning properties does not exceed 50 houses per 0.25 km^2. However, Burghead does have a high coal burning property density of around 48 houses per 0.25 km^2.

8.6 Quarries and Dust Emitting Processes

Emissions from quarries and dust emitting processes are difficult to approximate, as they are fugitive and cannot be quantified without detailed information. An inventory of quarries and dust emitted processes predicted to be in operation in 2004 and 2010 was undertaken. A list of processes identified is included in Appendix 6.

Technical guidance LAQM.TG(03) (Ref.4) indicates that where receptors exist within a distance of between 200m and 1 km from the source a detailed assessment may be required where the background PM_{10} concentration for 2004 is greater than 27 $\mu g/m^3$. As the 2004 and 2010 background concentration for Moray was established to be below 18 $\mu g/m^3$ there is no further need for consideration.

8.7 Air Traffic

There are no airports exceeding the 10 million people per annum limit set out in the technical guidance LAQM.TG(03) (ref.4) situated within Moray therefore no assessment of

emissions from air traffic has been made. Moray Council has communicated that concerns have been raised by local residents in the form of a petition and complaints regarding atmospheric pollution from the two RAF airbases (Appendix 1. Correspondence). No emissions data for either RAF airfield is available for assessment. However Moray Council has gained approval from Committee to monitor aircraft odour and further monitoring of air quality with a view to determining the impact of aircraft emissions.

8.8 Conclusion

Monitoring of PM_{10} undertaken at the Aberdeen national network monitoring site indicates that the NAQS objectives for PM_{10} are unlikely to be exceeded in urban locations. It is therefore concluded that ambient PM_{10} concentrations are unlikely to exceed NAQS objective levels.

It is considered unlikely that there will be any exceedence of NAQS objectives for PM_{10} as a result of emissions from domestic coal burning alone.

No industrial or domestic coal burning emissions sources were identified that are considered likely to cause a localised exceedence of the NAQS objective for PM_{10} in 2004, or 2010.

The NAQS annual mean objective for PM_{10} set by the Scottish Executive for 2010 is likely to be exceeded at a few locations, namely busy road junctions.

It is therefore considered likely that there will be exceedences of the NAQS objective for PM_{10} in 2010.

A Detailed Assessment for PM_{10} is required for Moray Council.

9 CONCLUSIONS

An assessment has been made of the seven pollutants contained within the National Air Quality Strategy and the ambient ground level concentrations of each pollutant assessed against the NAQS objectives for each pollutant. The conclusions of the assessment were as follows:

- The ambient CO concentration is unlikely to exceed the NAQS objective by the end of 2003. No pollutant hotspots from industrial or road traffic emissions sources were predicted. It is therefore concluded that there will be no exceedence of the NAQS objective for CO within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient benzene concentration is unlikely to exceed the NAQS objective by the end of 2003 or 2010. No pollutant hotspots from industrial, road traffic, fuel depots or petrol station emissions sources were predicted. It is therefore concluded that there will be no exceedence of the NAQS objective for benzene within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient 1,3-butadiene concentration is unlikely to exceed the NAQS objective by the end of 2003. No pollutant hotspots from industrial sources were predicted. It is therefore concluded that there will be no exceedence of the NAQS objective for 1,3-butadiene within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient lead concentration is unlikely to exceed the NAQS objective by the end of 2004 or 2008. No pollutant hotspots from industrial emissions sources were predicted. It is therefore concluded that there will be no exceedence of the NAQS objective for lead within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient NO_2 concentration is unlikely to exceed the NAQS objectives by the end of 2005. No pollutant hotspots from industrial, road traffic or any other emissions sources were predicted. It is therefore concluded that there will be no exceedence of the NAQS objectives for NO_2 within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient SO_2 concentration is unlikely to exceed the respective NAQS objectives by the end of 2004 and 2005. No pollutant hotspots from industrial or combustion processes were predicted. It is therefore concluded that there will be no exceedence

of the NAQS objectives for SO_2 within Moray and it is deemed unnecessary to progress to a Detailed Assessment.

- The ambient PM_{10} concentration is unlikely to exceed the NAQS objectives by the end of 2004. No pollutant hotspots from industrial sources were predicted to cause an exceedence of 2004 or 2010 objectives. The 2010 NAQS objectives are however predicted to be exceeded at some busy road junctions. In accordance with the Technical Guidance LAQM.TG(03) (Ref. 4) it is deemed necessary to progress to a Detailed Assessment for PM_{10} at this stage.

A Detailed Assessment is therefore required for PM_{10} for the Moray Council area to be submitted to the Scottish Executive by the end of April 2004.

Moray Council will be required to continue its assessment of air quality for all other pollutants and to produce an annual progress report for the Scottish Executive by the end of April 2004.

10 REFERENCES

Ref. 1 Air Quality Strategy for England, Scotland, Wales and Northern Ireland, January 2000

Ref. 2 Air Quality Regulations, 2000

Ref. 3 Air Quality (Scotland) Amendment Regulations 2002

Ref. 4 Local Air Quality Management, Technical Guidance LAQM.TG(03), February 2003

Ref.5 Air Quality Review Study for Moray Council, Stage 1, June 1998, Cordah Report MOR.001

Ref.6 Background Concentration Maps, AEA Technology: www.airquality.co.uk/archive/laqm/tools/php

Ref.7 SEPA Personal Communication (correspondence)

Ref.8 Supplementary Air Quality Report First Stage Review and Assessment, 2000

Ref.9 Rothes Ambient Air Study, SEPA Field Chemistry, August 2002, +Report TR-020805B_M

Ref.10 Design Manual for Roads and Bridges, Volume 11, 2000

Ref.11 ENTEC Report / Scottish Executive, 2000

Ref. 12 Local Air Quality Management, Technical Guidance LAQM.TG(00), 2000