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ENVIRONMENTAL CONSULTANCY
AND INFORMATION SYSTEMS

LAQM Updating and Screening Assessment 2006

A Report for Shetland Island Council

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EXECUTIVE SUMMARY

An Updating and Screening Assessment has been conducted for Shetland Islands Council for 2006. The pollutants considered in this assessment are carbon monoxide, benzene, 1-3-butadiene, nitrogen dioxide, sulphur dioxide and particulate material (PM_{10}).

The assessment has determined that there is no risk of exceeding the national air quality objectives for carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and PM_{10}. Accordingly, there is no requirement for Shetland Islands Council to proceed to a Detailed Assessment for these pollutants.

The assessment has shown that there may be a risk of exceeding the 15-minute SO_2 objective as a result of emissions from a proposed fish factory. Since this development is going through the planning process, there is no requirement to conduct a Detailed Assessment at this time. It is recommended that there is regular consultation between the Council and the developers to discuss mitigation measures and measures to minimise the air quality impact with assessments provided to demonstrate compliance with air quality objectives.

1 INTRODUCTION

1. BMT Cordah Ltd has been commissioned by Shetland Islands Council to carry out the 2006 Local Air Quality Management (LAQM) Updating and Screening Assessment (U&SA). The report has been completed in conjunction with personnel from Shetland Islands Council.

2. The Environment Act 1995 and subsequent regulations require local authorities to assess compliance of air quality in their area with the standards and objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2000[1] (NAQS). For local authorities within Scotland further regulations are set out in the Air Quality (Scotland) Regulations 2000 and Air Quality (Scotland) Amendment Regulations 2002.

3. The LAQM framework requires that local authorities carry out regular reviews of air quality. The first round of Review and Assessment commenced in 2000 and comprised a four stage approach to the assessment of air quality.

4. The Review and Assessment process was revised in 2003 and now comprises two phases. The first phase of the Review and Assessment is an Updating and Screening Assessment (U&SA). The U&SA considers any changes that have occurred in pollutant emissions and sources since the last round of Review and Assessment that may affect air quality. The second phase is either a Detailed Assessment or a Progress Report depending upon the outcome of the Updating and Screening Assessment.

5. The LAQM guidance requires that a Detailed Assessment be carried out at any location where a risk of exceeding an air quality objective at a location with relevant public exposure is identified. 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 (AQMA).

6. The aim of this U&SA is to provide an update on air quality issues within the Shetland Islands Council area since the last U&SA in 2003. The assessment uses updated information for industrial, transport, commercial and domestic atmospheric emissions combined with current monitoring data to identify areas where there is potential for exceeding the NAQS air quality objectives.

7. The report follows guidance set out in LAQM.TG(03) technical guidance[2], LAQM.PG(04) policy guidance[3] and subsequent guidance amendments[4], hereafter referred to as the “technical guidance”.

8. The NAQS details assessment criteria for eight pollutants in the form of atmospheric concentration levels for which an objective deadline is set. Of the eight pollutants identified only seven are required to be assessed by local authorities, ozone being addressed at a national level. The pollutants contained within the National Air Quality Strategy (NAQS) and their relevant objectives for Scotland are shown in Table 1.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Working together for clean air, Defra, January 2000
[2] Part IV of the Environment Act 1995, Local air quality management technical guidance, LAQM.TG(03), Defra et al, January 2003.
[3] Part IV of the Environment Act 1995, Local air quality management policy guidance, LAQM.PG(03), Defra et al, January 2003.
[4] Part IV of the Environment Act 1995, Local air quality management technical guidance update, LAQM.TG(03) – update: January 2006, Defra et al, January 2006.

Table 1: Pollutant Objectives outlined in the NAQS

Pollutant	Air Quality Objective			Date to be achieved by
	Concentration	Measured as	Equivalent percentile	
Benzene	16.25 µg/m^3	running annual mean	-	31 / 12 / 2003
	3.25 µg/m^3	running annual mean	-	31 / 12 / 2010
1,3-butadiene	2.25 µg/m^3	running annual mean	-	31 / 12 / 2003
Carbon monoxide (CO)	10 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 (NO_2)	200 µg/m^3 not to be exceeded more than 18 times per year	1-hour mean	99.79th percentile of 1-hour means	31 / 12 / 2005
	40 µg/m^3	annual mean	-	31 / 12 / 2005
Particulate (PM_{10})	50 µg/m^3 not to be exceeded more than 35 times a year	24-hour mean	90.4th percentile of 24-hour-means	31 / 12 / 2004
	40 µg/m^3	annual mean	-	31 / 12 / 2004
	50 µg/m^3 not to be exceeded more than 7 times a year	24-hour mean	98th percentile of 24-hour-means	31 / 12 / 2010
	18 µg/m^3	annual mean	-	31 / 12 / 2010
Sulphur dioxide (SO_2)	125 µg/m^3 not to be exceeded more than 3 times a year	24-hour mean	99th percentile of 24-hour means	31 / 12 / 2004
	350 µg/m^3 not to be exceeded more than 24 times a year	1-hour mean	99.7th percentile of 1-hour means	31 / 12 / 2004
	266 µg/m^3 not to be exceeded more than 35 times a year	15-minute mean	99.9th percentile of 15-minute means	31 / 12 / 2005

Shetland Islands Council area

9. All information in Paragraphs 10 – 12 taken from www.visitshetland.com.

Population and urban centres

10. The Shetland Islands consists of over 100 islands (fifteen of which are inhabited) with a population of approximately 22,500. The largest island is known as the Mainland, and its southernmost tip, Sumburgh Head, is around 100 miles north of the Scottish mainland. Shetland's largest town, Lerwick, has a population of 7500 is located at a latitude of approximately 60ºN. The remaining population is scattered across the islands is smaller settlements. A map of the Shetland Islands is shown in Figure A1.

Topography

11. The Shetland Islands have a combined land mass of approximately 560 square miles with the main islands being the Mainland, Yell and Unst. The islands are mostly gently sloping hills reaching heights of between 210 to 270m. The highest point is Ronas Hill at 450m. The coastline of the Shetland Islands is around 900 miles and consists of cliffs, caves and sea lochs or voes.

Meteorology

12. Prevailing southerly Atlantic depressions keep the Shetland Islands in a mild, temperate maritime climate. Long hours (19) of daylight in summer are contrasted with a minimum of 6 hours sunlight in winter. Average annual rainfall is 1037mm, with almost three quarters of this rain falling in winter. Shetland is a windy place, with wind speeds averaging 15mph over a year.

Summary of previous assessments

13. Shetland Islands Council produced their last U&SA of air quality in August 2003[5]. This report concluded that there was no likelihood of exceeding any NAQS objectives at any location in the Shetland Islands.

Inventory of industrial activities

14. Some of the principal sectors of the Shetland economy are the oil industry, fishing and fish farming, agriculture and textiles. The Sullom Voe oil terminal in the north of the Mainland handles around 25 million tonnes of oil each year from the North Sea and Atlantic Ocean. Combustion and petrochemical processes occur at this site. There is also an oil fired power station, a waste to energy plant and oil recovery plant in the Lerwick area. Other industrial processes include incineration, quarrying and mineral processes.

15. An inventory of all industrial sites regulated by the Scottish Environment Protection Agency (SEPA) is presented in Appendix A.

[5] Local Air Quality Management – Updating and Screening Assessment. Shetland Islands Council, August 2003.

Description of road network

16. The road network across the Shetland's consists of A class roads with numerous lower classed roads including many which are single track. The A970 runs between the northern and southern extremities of the Mainland. Due to the low population, the network is not heavily trafficked. Higher volumes of traffic are present on the main road through Lerwick.

17. Shetland Islands Council has supplied their most recent road traffic count information for locations in and around Lerwick as shown in Figure A2. The count data were obtained over 1 month periods and are provided in the format of Annual Average Daily Traffic (AADT) in Table 2.

Table 2: Shetland Road Traffic Count Data

Location	AADT
1. A970	7092
2. Gremista 1	6806
3. Gremista 2	5140
4. Holmsgarth Road 1	11050
5. Ladies Drive	1090
6. Holmsgarth Road 2	11633
7. North Road	13081
8. Esplanade	8027
9. North Lochside	7618
10. South Road 1	10898
11. South Road 2	8155

Description of other transport

18. There are numerous inter-island ferry services linking the various islands. The main ports include Lerwick and Scalloway, from where inter-island ferries and fishing activity takes place. Large ferries from Norway and the Scottish mainland make use of Lerwick harbour. Additionally, there is a large port at the Sullom Voe oil terminal, used by numerous oil tankers.

19. The main airport serving the Shetland Islands is at Sumburgh, in the south of the Mainland. There are some smaller airports on the outlying islands, with a low number of flight movements.

2 U&SA OF CARBON MONOXIDE

20. The NAQS objective for CO for Scottish local authorities is;

    - the maximum 8-hour running mean not to exceed 10mg/m^3 by 31st December 2003.

21. The main source of CO in the UK is road traffic. Given that road traffic in Shetland is generally light and that there are no other significant sources of CO in the islands, there have been no CO air quality issues in the Shetland Islands.

Monitoring data

22. Shetland Islands Council does not undertake any monitoring for CO.

23. There are eight locations in Scotland which monitor for CO and are part of the national Automatic Urban and Rural Network (AURN). None of these sites recorded an exceedence of the NAQS objective for CO in 2005[6]. It is likely that the majority, if not all, of these sites are exposed to greater ambient concentration of CO than is present in Shetland given that many of them are located close to roads with high traffic volume.

Background Concentrations

24. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[7]. CO background concentrations in Shetland are presented in Figure B1. This figure demonstrates that background CO concentrations in Shetland are low, below 0.08mg/m^3 across the majority of the islands with slightly more elevated concentrations, between 0.08 and 0.1mg/m^3, around Lerwick.

Transport sources

Very busy roads or junctions in built up areas

25. The technical guidance advises that exceedences of the CO objectives are only likely at locations close to “very busy” roads or junctions in built up areas. “Very busy” is defined as roads with a daily traffic flow of at least 80,000 vehicles per day. The measured traffic flows provided by Shetland Islands Council show that traffic volume is considerably less than 80,000 vehicles per day. It is therefore highly unlikely that there would be exceedences of the CO objectives at these types of locations.

It is concluded that there is no potential for exceeding the NAQS objectives for CO at any location in the Shetland Islands.

[6] http://www.airquality.co.uk/archive/data_and_statistics.php
[7] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04

3 U&SA OF BENZENE

26. There are two objectives for benzene, one to be met by the end of 2003 and one to be met by the end of 2010. A more stringent objective applies in Scotland in 2010 compared to the objective in England and Wales. The objectives for benzene are;

- the running annual mean not to exceed 16.25µg/m^3 (5ppb) by 31st December 2003; and
- the running annual mean not to exceed 3.25µg/m^3 (1ppb) by 31st December 2010.

Monitoring data outside an AQMA

27. Monitoring of benzene was conducted by BP Exploration in the local community around the Sullom Voe Oil Terminal[8]. The monitoring utilised passive diffusion tube samplers which were exposed at 10 locations in periods of 14 days between 10 February and 29 July 2005 (24 weeks). The monitoring locations closest to the terminal are shown in Figure A3.

28. Benzene diffusion tubes were analysed by the National Physical Laboratory (NPL) who are accredited by the UK Accreditation Service. The uncertainty for benzene measurements quoted by the NPL is ±21% at a 95% confidence level.

29. The results of the benzene monitoring conducted by BP Exploration are presented in Table 3. Benzene concentrations in Table 3 are reported in ppb for consistency with the BP monitoring report.

Table 3: Monitored benzene concentrations around Sullom Voe Terminal

Monitoring Location	Average concentration (10/02/05 – 29/07/05), ppb	Average concentration (10/02/05 – 29/07/05) + 21%, ppb	Maximum 2 week concentration, ppb	Maximum 2 week concentration + 21%, ppb
1. Effluent Outfall, Skaw Taing	0.3	0.4	0.5	0.6
2. Garth House, Graven, Mossbank	0.4	0.5	0.9	1.1
3. Pund, Mossbank	0.3	0.4	0.4	0.5
4. Brough, Toft, Mossbank	0.3	0.4	0.5	0.6
5. Vistavird, Brae	0.2	0.2	0.3	0.4
6. Mulla, Voe	0.2	0.2	0.4	0.5
7. Runnadale, Ollaberry	0.3	0.4	0.6	0.7
8. Findlins House, Hillswick	0.2	0.2	0.4	0.5
9. Waterside	0.2	0.2	0.4	0.5
10. West Yell, Yell	0.2	0.2	0.4	0.5

30. The monitoring shows that there has been no measured exceedence of the annual mean objective of 1ppb in the area surrounding the Sullom Voe Oil Terminal. The maximum measured period mean concentration was 0.4ppb, less than half of the objective of 1ppb. The maximum measured 2 week mean concentration was 0.9ppb.

[8] Ambient Atmospheric Survey in the Community around the Sullom Voe Oil Terminal, Shetland. BP Exploration Operating Company Ltd, October 2005.

31. There are no exceedences of the annual mean objective after adding the maximum uncertainty of 21% to the measured results. The maximum period mean concentration after adding 21% is then 0.5ppb with the maximum 2 week mean concentration 1.1ppb.

32. Monitoring of benzene did not occur a full year, and so the results are not directly applicable against the annual mean objective. Given that the highest 24 week mean concentration is 0.4ppb (0.5ppb including a 21% uncertainty increase) it is unlikely that there would be an exceedence of the benzene objectives around the Sullom Voe Oil Terminal.

Background Concentrations

33. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[9]. Benzene background concentrations in Shetland are presented in Figure B2. This figure demonstrates that background benzene concentrations in Shetland are low, below 0.04µg/m^3 across the majority of the islands with elevated concentrations, up to 0.1µg/m^3, in Lerwick. The background concentration maps do not show any elevation in the background benzene concentration around the Sullom Voe terminal.

Monitoring data within an AQMA

34. There are no AQMAs for benzene within the Shetland Islands.

Transport sources

Very busy roads or junctions in built up areas

35. The technical guidance advises that exceedences of the benzene objectives may occur at locations close to "very busy" roads or junctions in built up areas. "Very busy" is defined as roads with a daily traffic flow of at least 80,000 vehicles per day. The measured traffic flows provided by Shetland Islands Council show that traffic volume is considerably less than 80,000 vehicles per day. It is therefore highly unlikely that there would be exceedences of the benzene objectives at this type of locations.

Industrial sources

New industrial sources

36. No new industrial processes which are significant emitters of benzene have commenced operation in the Shetland Islands since the last round of Review and Assessment.

Industrial sources with substantially increased emissions, or new relevant exposure

37. The largest industrial source of benzene in the Shetland Islands is the Sullom Voe oil terminal. The operators of Sullom Voe, BP, report their annual emissions to atmosphere to SEPA who publish the information on the national Scottish Pollutant Release Inventory (SPRI)[10]. For the last two years for

[9] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04
[10] Scottish Pollutant Release Inventory, http://www.sepa.org.uk/spri/index.htm

which data is available (2002 and 2004), emissions of methane and non-methane VOCs are reported to have reduced from 521 to 214 tonnes per year for methane and 20,800 to 16,750 tonnes for non-methane VOCs. It is likely, therefore, that there will also have been a corresponding reduction in benzene emissions, although benzene is not reported in the SPRI.

Petrol stations

38. The technical guidance advises that there could be exceedences of the NAQS objectives for benzene at locations around petrol stations which are close to "busy roads". "Busy roads" are defined as roads with a traffic volume of greater than 30,000 vehicles per day. As shown in Figure A2, there are no roads in Shetland with such a large traffic flow, and so there is no risk of exceeding the NAQS objectives for benzene at such sources.

Major fuel storage depots (petroleum only)

39. There is one major fuel storage depot in the Shetland Islands, located in Lerwick, at a distance of approximately 40m from the closest residential dwelling. A screening assessment of benzene emissions was conducted following the technical guidance and making use of a spreadsheet provided on the LAQM website[11]. The spreadsheet uses the distance between source and receptor and the height or release, to calculate the total annual benzene emissions which would result in the ambient concentration at the receptor being half of either the 2003 or 2010 benzene objectives. This annual emission rate is then compared to the actual annual emissions from the depot to determine whether there is a risk of exceeding these benzene objectives.

40. There is no single emission point from the tanks, with emissions coming from points such as vents or leaks. It is estimated that emissions will occur from a height of 5m. The spreadsheet calculates that an annual emission of 0.32 tonnes would result in an ambient concentration of half the 2003 objective at 40m, while an annual emission of 0.04 tonnes would result in an ambient concentration of half the 2010 objective at 40m. The Local Authority Support Helpdesk provided emissions estimates for the Shetland fuel depot and estimated that 0.0025 tonnes of benzene is emitted annually. It is clear that this is below the threshold for both the 2003 and 2010 objectives, and it is unlikely that there will be any exceedences of the benzene objectives as a result of emissions from this fuel depot.

It is concluded that there is no potential for exceeding the NAQS objectives for benzene at any location in the Shetland Islands.

[11] www.airquality.co.uk/archive/laqm/tools.php?tool=emission

4 U&SA OF 1,3-BUTADIENE

41. The objective for 1,3-butadiene for all local authorities, contained within the Air Quality Regulations 2000 and Amendment Regulations 2002 is;

    - the running annual mean not to exceed 2.25μg/m^3 (1ppb) by 31st December 2003.

Monitoring data

42. Monitoring of 1,3-butadiene was conducted by BP Exploration in the local community around the Sullom Voe Oil Terminal[12]. The monitoring utilised passive diffusion tube samplers which were exposed at 10 locations in periods of 14 days between 10 February and 29 July 2005 (24 weeks). The monitoring locations closest to the terminal are shown in Figure A3.

43. 1,3-butadiene diffusion tubes were analysed by the NPL who are accredited by the UK Accreditation Service. The uncertainty for 1,3-butadiene measurements quoted by the NPL is ±30% at a 95% confidence level.

44. The results of the 1,3-butadiene monitoring conducted by BP Exploration are presented in Table 4. 1,3-butadiene concentrations in Table 4 are reported in ppb for consistency with the BP monitoring report.

Table 4: Monitored 1,3-butadiene concentrations around Sullom Voe Terminal

Monitoring Location	Average concentration (10/02/05 – 29/07/05), ppb	Average concentration (10/02/05 – 29/07/05) + 30%, ppb	Maximum 2 week concentration, ppb	Maximum 2 week concentration + 30%, ppb
1. Effluent Outfall, Skaw Taing	0.2	0.3	0.4	0.5
2. Garth House, Graven, Mossbank	0.2	0.3	0.3	0.4
3. Pund, Mossbank	0.2	0.3	0.3	0.4
4. Brough, Toft, Mossbank	0.3	0.4	0.3	0.4
5. Vistavird, Brae	0.1	0.1	0.1	0.1
6. Mulla, Voe	<0.05	<0.05	<0.05	<0.05
7. Runnadale, Ollaberry	0.1	0.1	0.1	0.1
8. Findlins House, Hillswick	<0.05	<0.05	<0.05	<0.05
9. Waterside	0.2	0.3	0.2	0.3
10. West Yell, Yell	0.2	0.3	0.3	0.4

45. The monitoring shows that there has been no measured exceedence of the annual mean objective of 1ppb in the area surrounding the Sullom Voe Oil Terminal. The maximum measured period mean concentration was 0.3ppb, less than half of the objective of 1ppb. The maximum measured 2 week mean concentration was 0.4ppb.

46. There are no exceedences of the annual mean objective after adding the maximum uncertainty of 30% to the measured results. The maximum period mean concentration is then 0.4ppb with the maximum 2 week mean concentration 0.5ppb.

[12] Ambient Atmospheric Survey in the Community around the Sullom Voe Oil Terminal, Shetland. BP Exploration Operating Company Ltd, October 2005.

47. Monitoring of 1,3-butadiene did not occur a full year, and so the results are not directly applicable against the annual mean objective. Given that the highest 24 week mean concentration is 0.3ppb (0.4ppb including a 30% uncertainty increase) it is unlikely that there would be an exceedence of the 1,3-butadiene objective around the Sullom Voe Oil Terminal.

Background Concentrations

48. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[13]. 1,3-Butadiene background concentrations in Shetland are presented in Figure B3. This figure demonstrates that background 1,3-butadiene concentrations in Shetland are low, below 0.01µg/m^3 across the majority of the islands with elevated concentrations, up to 0.02µg/m^3, in Lerwick. The background concentration maps do not show any elevation in the background 1,3-butadiene concentration around the Sullom Voe terminal.

Industrial sources

49. No new industrial processes which are significant emitters of 1,3-butadiene have commenced operation in the Shetland Islands since the last round of Review and Assessment.

Industrial sources with substantially increased emissions, or new relevant exposure

50. The largest industrial source of 1,3-butadiene in the Shetland Islands is the Sullom Voe oil terminal. The operators of Sullom Voe, BP, report their annual emissions to atmosphere to SEPA who publish the information on the national Scottish Pollutant Release Inventory (SPRI)[14]. For the last two years for which data is available (2002 and 2004), emissions of methane and non-methane VOCs are reported to have reduced from 521 to 214 tonnes per year for methane and 20,800 to 16,750 tonnes for non-methane VOCs. It is likely, therefore, that there will also have been a corresponding reduction in 1,3-butadiene emissions, although 1,3-butadiene is not reported in the SPRI.

It is concluded that there is no potential for exceeding the NAQS objectives for 1,3-butadiene at any location in the Shetland Islands.

[13] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04
[14] Scottish Pollutant Release Inventory, http://www.sepa.org.uk/spri/index.htm

5 U&SA OF LEAD

51. Two objectives for lead for all local authorities are contained within the Air Quality Regulations 2000 and Amendment Regulations 2002. The objectives are:

- the annual mean concentration not to exceed 0.5µg/m^3 by 31st December 2004; and
- the annual mean concentration not to exceed 0.25µg/m^3 by 31st December 2008.

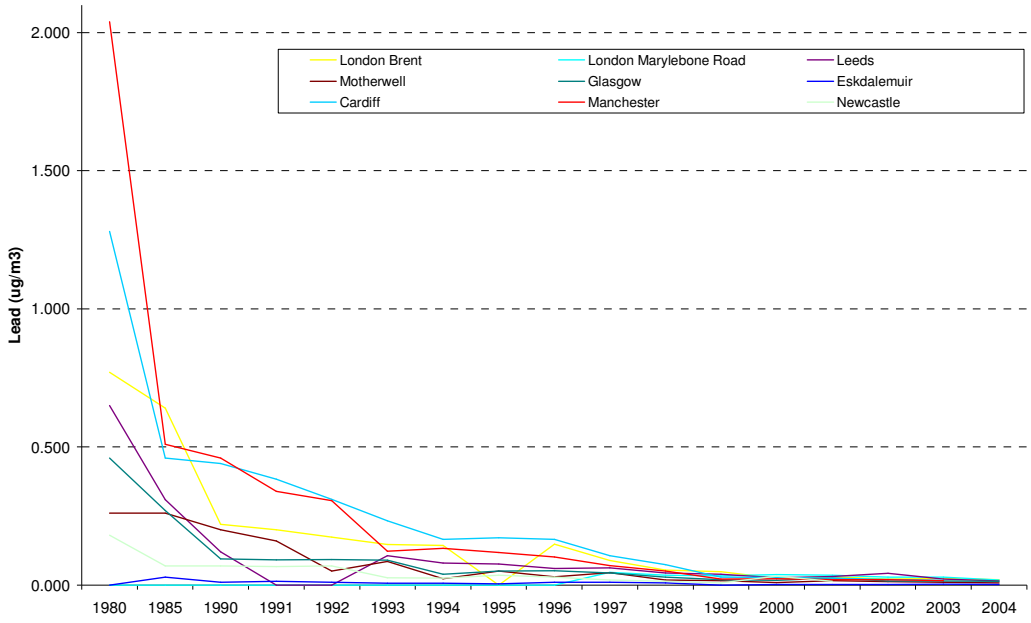
Monitoring data

52. There is no monitoring for lead carried out within the Shetland Islands. The use of lead within petrol was banned from 2000, with the result that lead emissions occur from a small number of industrial processes.

53. Monitoring of lead does occur at a number of locations across the UK. The results from this monitoring can be obtained from the national air quality website[15]. Monitoring sites are located at places where ambient lead concentrations may have been elevated in the past. Such locations include areas with high volume of road traffic or close to 'traditional' heavy industries which were large sources of lead.

54. Chart 1 shows the results from monitoring at a number of these locations since 1980. It is clear that there has been a large decrease in lead concentrations with ambient lead concentrations in 2004, the last year for which data is available, below 0.1µg/m^3 at all locations. Ambient concentrations of lead in Shetland are also likely to be below 0.1µg/m^3, under the NAQS objective.

Chart 1: UK Lead Concentrations, 1980 – 2004



[15] http://www.airquality.co.uk/archive/data_and_statistics.php

Industrial sources

New industrial sources

55. No new industrial sources which are significant sources of lead commenced operation in the Shetland Islands since the last round of Review and Assessment.

Industrial sources with substantially increased emissions, or new relevant exposure

56. There are no significant industrial sources of lead in the Shetland Islands.

It is concluded that there is no potential for exceeding the NAQS objectives for lead at any location in the Shetland Islands.

6 U&SA OF NITROGEN DIOXIDE

57. Two objectives for NO_2 for all local authorities are contained within the Air Quality Regulations 2000 and Amendment Regulations 2002. The objectives are:

    - the annual mean concentration not to exceed 40µg/m^3 (21ppb) by 31st December 2005; and
    - the 1-hour mean concentration not to exceed 200µg/m^3 (105ppb) on more than 18 occasions by 31st December 2005.

58. The same two objectives for NO_2 are contained within the 2nd EU Daughter Directive[16] for Air Quality with an objective deadline of 31st December 2010.

Monitoring data

Monitoring data outside an AQMA

59. There is no regular monitoring of NO_2 carried out by Shetland Islands Council, however monitoring takes place periodically at different locations across the Shetland Islands. This monitoring is to satisfy a condition imposed by SEPA in the authorisation permit for the Shetland Energy Recovery plant.

60. Monitoring for NO_2 was conducted using passive diffusion tubes at a number of locations which are shown in Figure A4. The tubes were exposed for periods of one month on either two or three occasion per year, so the results are not comparable against the NAQS objectives which require either an annual mean or an hourly mean. The maximum measured one month mean in 2005 was 6.9µg/m^3 at Bressay, considerably below the annual mean objective.

61. Monitoring of NO_2 was conducted by BP Exploration in the local community around the Sullom Voe Oil Terminal[17]. The monitoring utilised passive diffusion tube samplers which were exposed at 10 locations in periods of 28 days between 10 February and 29 July 2005 (24 weeks). The monitoring locations closest to the terminal are shown in Figure A3.

62. NO_2 diffusion tubes were analysed by Analytical Data Services Ltd who are accredited by the UK Accreditation Service. The uncertainty for NO_2 measurements is ±15% at a 95% confidence level.

63. The results of the NO_2 monitoring conducted by BP Exploration are presented in Table 5. NO_2 concentrations in Table 5 are reported in ppb for consistency with the BP monitoring report.

[16] 2nd EU Daughter Directive
[17] Ambient Atmospheric Survey in the Community around the Sullom Voe Oil Terminal, Shetland. BP Exploration Operating Company Ltd, October 2005.

Table 5: Monitored NO_2 concentrations around Sullom Voe Terminal

Monitoring Location	Average concentration (10/02/05 – 29/07/05), ppb	Average concentration (10/02/05 – 29/07/05) + 30%, ppb	Maximum 4 week concentration, ppb	Maximum 4 week concentration + 30%, ppb
1. Effluent Outfall, Skaw Taing	1	1.2	2	2.3
2. Garth House, Graven, Mossbank	2	2.3	4	4.6
3. Pund, Mossbank	1	1.2	2	2.3
4. Brough, Toft, Mossbank	2	2.3	3	3.5
5. Vistavird, Brae	1	1.2	2	2.3
6. Mulla, Voe	1	1.2	1	1.2
7. Runnadale, Ollaberry	1	1.2	1	1.2
8. Findlins House, Hillswick	1	1.2	1	1.2
9. Waterside	1	1.2	2	2.3
10. West Yell, Yell	2	2.3	2	2.3

64. The monitoring shows that there has been no measured exceedence of the annual mean objective of 21ppb in the area surrounding the Sullom Voe Oil Terminal. The maximum measured period mean concentration was 2ppb, significantly less than the objective. The maximum measured 2 week mean concentration was 4ppb.

65. There are no exceedences of the annual mean objective after adding the maximum uncertainty of 15% to the measured results. The maximum period mean concentration is then 2.3ppb with the maximum 2 week mean concentration 4.6ppb.

66. Monitoring of NO_2 did not occur a full year, and so the results are not directly applicable against the annual mean objective. Given that the highest 24 week mean concentration is significantly below the annual mean objective, it is unlikely that there would be any exceedences of the annual mean objective for NO_2 around the Sullom Voe Oil Terminal. There is no guidance on the relationship between the NO_2 annual mean and 1-hour mean objectives at industrial sites, so it is not possible to estimate a likely 1-hour mean concentration from the monitoring data available.

Monitoring data within an AQMA

67. There is no AQMA for NO_2 on the Shetland Islands.

Background Concentrations

68. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[18]. Background concentrations for both NO_x and NO_2 in Shetland are presented in Figure B4 and B5. This figure demonstrates that background NO_x and NO_2 concentrations in Shetland are mainly between 1 and 2µg/m^3 with elevated concentrations in Lerwick. Background NO_x concentrations in Lerwick reach a maximum of approximately 5µg/m^3 with NO_2 background concentrations a maximum of 4µg/m^3.

[18] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04

Transport sources

Narrow congested streets with residential properties close to the kerb

69. The technical guidance advises that exceedences of the NAQS objectives for NO_2 may occur at receptors within 5m of narrow congested streets, as the combination of slow moving traffic and reduced air dispersion lead to elevated NO_2 concentrations. The technical guidance advises that exceedences are only likely near roads with an AADT of greater than 10,000 vehicles. None of the roads in Lerwick with an AADT greater than 10,000 are narrow, congested roads, so it is unlikely that there will be any exceedences of the NAQS objectives at these locations.

Junctions

70. The technical guidance advises that there is a risk of exceeding the annual mean NO_2 objectives at receptors within 10m of busy junctions, with "busy" defined as more than 10,000 vehicles per day. The junction of Holmsgarth Road, North Road and North Lochside in Lerwick is the busiest junction on the Shetland Islands and is shown in detail in Figure A5. Shetland Islands Council have identified a number of receptors which are within 10m of this junction. The inner red lines in Figure A5 highlight the kerbs of the roads, while the outer lines mark 10m from the road edge. The DMRB assessment was carried out at the two closest receptors to the junction, marked Receptor 1 and Receptor 2.

71. A DMRB assessment of road traffic emissions was conducted using DMRB version 1.02. Required input data for a DMRB assessment are the year of assessment, background concentration for NO_2, the AADT on each road link, the average vehicle speed, the road type, the percentage of light and heavy vehicles on the road and the distance from the road centre to the receptor points.

72. Background NO_2 and NO_X concentrations were taken from the maps shown in Figure B4 and B5. The concentration of pollutants in each grid square is calculated from emission estimates from all sources within that grid, so care must be taken to avoid double counting of road emissions during the DMRB assessment. For example, the background concentration for the grid square which contains the junction should not be used, as road emissions from this junction were already included when the background grid square concentration was calculated. Background concentrations of $3\mu g/m^3$ for NO_2 and $4\mu g/m^3$ for NO_X were used for locations in Lerwick, which are at the higher end of background concentrations. These background concentrations will contribute to a 'worst case' estimate of pollutant concentrations.

73. The average vehicle speed at the junction is set at 20mph (32kph), to account for vehicles moving below the national speed limit on the approach and departure from the junction.

74. The road type is set to DMRB class A, "motorways and A roads". DMRB uses an internal database to provide a more detailed breakdown of the type of vehicles using each road class. Class A has a higher proportion of heavier vehicles which are more commonly found on motorways and A class roads than on urban roads. While it is recognised that the road is wholly within an urban area, it was considered more appropriate to use class A since it is the principal route north to south through Shetland, and would be used by all heavy vehicles which access the islands by sea. This will again be the worst case estimate of road traffic emissions.

75. The percentages of heavy vehicles and light vehicles using the roads were taken from road transport statistics published by the Department of Trade and Industry[19]. These show that across the UK, approximately 7% of vehicles using A class roads are HGVs.

76. Following the DMRB instructions[20], the junction was simplified to two road links, with the sections of road with the most similar traffic flows, Holmsgarth Road and North Road, considered as one link, hereafter referred to as Link 1. The traffic flow from North Road was used for Link 1 when assessing Receptor 1, as the receptor is closest to the North Road section, while traffic flow on Holmsgarth Road was used when assessing Receptor 2 for the same reason.

77. The results from the DMRB screening assessment are presented in Table 6. They show that predicted NO_2 annual mean concentrations are significantly below the annual mean objective.

Table 6: Predicted NO_2 Concentrations from the DMRB Assessment

Receptor	Distance from Link 1	Distance from Link 2	Predicted NO_2 Annual Mean ($\mu g/m^3$)
Receptor 1	7.5m	17.5m	14.6
Receptor 2	11	19	13.3

Busy streets where people may spend one hour or more close to traffic

78. There is the risk of exceeding the 1-hour mean objective for NO_2 at busy street locations where people spend one hour or more close to traffic. Such streets are often those with many shops or outdoor cafes and bars. A "busy" street is one with more than 10,000 vehicles per day.

79. In Lerwick, the main shopping street and streets with outdoor cafes or bars are located around the harbour area. Table 2 shows that the main road through this area, the Esplanade, has a daily traffic volume of less than 10,000 vehicles. In addition, the streets and cafes where people may be outdoors for up to an hour are located more than 10m from the Esplanade. There is therefore, little likelihood of exceeding the 1-hour mean NO_2 objective.

Roads with high flows of buses and / or HGVs

80. There are no roads in the Shetlands Islands where there is a high proportion of buses and/or HGVs, "high" being greater than 25%.

New roads to constructed or proposed since the previous round of R&A

81. There have been no new roads constructed or proposed since the last round of Review and Assessment.

Roads with significantly changed traffic flows, or new relevant exposure

82. No roads in the Shetland Islands have experiences a significantly changed traffic flow (greater than 25%) since the last round of Review and Assessment. No new receptors have been introduced close to roads with more than 10,000 vehicles per day since the last round R&A.

[19] DtI Road Transport Stats
[20] DMRB instructions

Bus stations

83. The technical guidance advises that exceedences of the 1-hour mean NO_2 objective could occur near bus stations with more than 1000 bus movements per day. The main bus station in Lerwick does not have more than 1000 bus movements per day, so it is unlikely that the 1-hour mean NO_2 objective would be exceeded.

Aircraft

84. The main airport serving the Shetland Islands is at Sumburgh, at the south of the Shetland Mainland. The technical guidance advises that NO_2 objectives could be breached at airports which are used by more than 5 million passengers per year (mppa) (100,000 tonnes of freight equates to 1mppa).

85. The most recent statistics for Shetland are provided for 2004 in Shetland in Statistics[21]. In 2004, 123,163 passengers passed through Sumburgh airport which also handled 1,074 tonnes of freight. It is clear therefore that this is considerably less than the 5mppa required before there is a risk of exceeding NO_2 objectives.

86. There are other regional airports around the Shetland Islands including Tingwall, Scatsta and Unst, which are served by inter-island air travel. Passenger numbers and freight using these airports is considerably less than at Sumburgh.

Industrial sources

New industrial sources

87. While there have been no new industrial sources with significant NO_2 emissions in the Shetland Islands since the last round of R&A, Shetland Islands Council have identified two processes for assessment in the U&SA. These processes are a proposed fish factory in the north of the Mainland, near the Sullom Voe terminal, and the Energy Recovery plant in Lerwick.

88. For the fish farm, an air quality assessment was submitted to Shetland Islands Council as part of the application process[22]. The study found that emissions of NO_2 would occur from road transport during the construction and operation phases of the development, from shipping as fish is delivered and fishmeal and oil are exported, and from two boiler stacks and two drier stacks.

89. The assessment concluded that the impact of emissions from road transport and shipping are likely to be insignificant. The study included atmospheric dispersion modelling to determine the impact of emissions from the boiler and drier stacks. It concluded that there are no predicted exceedences of the NO_2 objectives at sensitive receptors, although exceedences of the 1-hour mean objective are predicted in the immediate vicinity of the factory.

90. It is considered likely that the conclusions of the air quality assessment for NO_2 are valid, and that there will be no exceedences of the NO_2 objectives as a result of emissions from the boiler and drier stacks.

[21] Shetland in Statistics, Shetland Islands Council Economic Development Unit, 2005.
[22] Chapter 14 Air Quality, Proposed Fish Factory Environmental Statement. Natural Capital Ltd, SVN & SIC, November 2005.

91. Shetland Islands Council operate an Energy Recovery plant near Lerwick which commenced operation in 2000. As part of the original environmental assessment, atmospheric dispersion modelling was conducted in 1995 and 1998 to determine the impact of emissions from the plant's incinerator on ground level pollutant concentrations[23]. The report concluded that there would be no exceedences of air quality objectives. In 2005, Shetland Islands Council conducted a review of the environmental impacts of the plant, for air quality taking into account changes in legislation and control of atmospheric emissions, to determine if the plant was still in compliance with NAQS objectives.

92. The dispersion modelling studies of 1995 and 1998 used an in-house dispersion model, which would be much more limited than dispersion models which are currently available. The model predictions were compared against NO_2 monitoring undertaken since the plant became operational, and the model predictions were considered "robust". Given the relatively low measured NO_2 concentrations, it is likely that these conclusions are valid, and that there will be no exceedences of the NO_2 objectives.

Industrial sources with substantially increased emissions, or new relevant exposure

93. The technical guidance states that existing industrial sources that have increased their emissions by more than 30% need to be reassessed since the increase in emissions could result in exceedences of the NO_2 objectives. Similarly, if any new receptors have been introduced close to industrial processes with significant emissions, objectives could be exceeded. There have been no such increases in industrial emissions, or new exposure close to existing sources, in the Shetland Islands.

It is concluded that there is no potential for exceeding the NAQS objectives for NO_2 at any location in the Shetland Islands.

[23] Environmental Statement and Air Quality Dispersion Modelling for the Lerwick Energy Recovery Plant, Entec Ltd, 1995/1998.

7 U&SA OF SULPHUR DIOXIDE

94. Three objectives for SO_2 for all local authorities are contained within the Air Quality Regulations 2000 and Amendment Regulations 2002. The objectives are:

- the 24-hour mean concentration not to exceed 125μg/m^3 (47ppb) on more than 3 occasions by 31st December 2004;
- the 1-hour mean concentration not to exceed 350μg/m^3 (132ppb) on more than 24 occasions by 31st December 2004; and
- the 15-minute mean concentration not to exceed 266μg/m^3 (100ppb) on more than 35 occasions by 31st December 2004.

Monitoring data

Monitoring data inside/outside an AQMA

95. There are no AQMAs for SO_2 in the Shetland Islands. There is no regular monitoring of SO_2 carried out by Shetland Islands Council, however monitoring takes place periodically at several locations.

96. Shetland Islands Council has conducted monitoring for SO_2 using passive diffusion tubes at a number of locations. These locations are shown in Figure A4. This monitoring technique is not recommended by the technical guidance for R&A purposes, since the exposure period required does no allow comparison against any of the SO_2 objectives. The tubes were exposed for periods of one month on either two or three occasion per year. The maximum measured one month mean in 2005 was 3.2μg/m^3 at the Lerwick power station.

97. Monitoring of SO_2 was conducted by BP Exploration in the local community around the Sullom Voe Oil Terminal[24]. The monitoring utilised passive diffusion tube samplers which were exposed at 10 locations in periods of 28 days between 10 February and 29 July 2005 (24 weeks). The monitoring locations closest to the terminal are shown in Figure A3.

98. SO_2 diffusion tubes were analysed by Analytical Data Services Ltd who are accredited by the UK Accreditation Service. The uncertainty for SO_2 measurements is ±15% at a 95% confidence level.

99. The results of the SO_2 monitoring conducted by BP Exploration are presented in Table 6. The SO_2 concentrations in Table 6 are reported in ppb for consistency with the BP monitoring report.

[24] Ambient Atmospheric Survey in the Community around the Sullom Voe Oil Terminal, Shetland. BP Exploration Operating Company Ltd, October 2005.

Table 7: Monitored SO_2 concentrations around Sullom Voe Terminal

Monitoring Location	Average concentration (10/02/05 – 29/07/05), ppb	Average concentration (10/02/05 – 29/07/05) + 30%, ppb	Maximum 4 week concentration, ppb	Maximum 4 week concentration + 30%, ppb
1. Effluent Outfall, Skaw Taing	2	2.3	3	3.5
2. Garth House, Graven, Mossbank	2	2.3	8	9.2
3. Pund, Mossbank	1	1.2	1	1.2
4. Brough, Toft, Mossbank	2	2.3	3	3.5
5. Vistavird, Brae	2	2.3	3	3.5
6. Mulla, Voe	1	1.2	1	1.2
7. Runnadale, Ollaberry	3	3.5	8	9.2
8. Findlins House, Hillswick	2	2.3	3	3.5
9. Waterside	2	2.3	3	3.5
10. West Yell, Yell	1	1.2	1	1.2

100. The longest period for which there is an objective in the NAQS is 24 hours, so the results of the SO_2 monitoring cannot be compared against any objective. The measured concentrations, including accounting for 15% uncertainty, are lower than 3.5ppb for the 24 week mean concentration, with a maximum 4 week mean concentration of 9.2ppb.

Background concentrations

101. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[25]. Background concentrations for SO_2 in Shetland are presented in Figure B5. The SO_2 data on the website is only available for 2001. Following the technical guidance, 2005 SO_2 concentrations are assumed to be 75% of 2001 concentrations. This figure demonstrates that background SO_2 concentrations in Shetland are generally below 5µg/m^3. There are two areas of elevated background SO_2 concentrations; in Lerwick and at Sullom Voe. In Lerwick, background SO_2 concentrations reach a maximum of 13µg/m^3 while around Sullom Voe, background SO_2 concentrations reach a maximum of 17µg/m^3.

Industrial sources

New industrial sources

102. While there have been no new industrial sources with significant SO_2 emissions in the Shetland Islands since the last round of R&A, Shetland Islands Council have identified two processes for assessment in this U&SA. These processes are a proposed fish factory in the north of the Mainland, near the Sullom Voe Terminal, and the Energy Recovery plant in Lerwick.

103. For the fish farm, an air quality assessment was submitted to Shetland Islands Council as part of the application process[26]. The study identified emissions of SO_2 occurring from shipping as fish is delivered and fishmeal and oil are exported, and from two boiler stacks and two drier stacks.

[25] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04
[26] Chapter 14 Air Quality, Proposed Fish Factory Environmental Statement. Natural Capital Ltd, SVN & SIC, November 2005.

104. The assessment concluded that the impact of emissions from shipping are likely to be insignificant as only a small number of vessels (5) would visit the factory each week. The study included atmospheric dispersion modelling to determine the impact of emissions from the boiler and drier stacks. It concluded that there are no predicted exceedences of the SO_2 objectives at sensitive receptors. Exceedences of all three SO_2 objectives are predicted in the immediate vicinity of the factory. The nearest receptors are located approximately 500m from the factory.

105. The study does not report predicted SO_2 concentrations at sensitive receptors, instead reporting the maximum predicted concentration and then presenting concentration contour plots. The maximum predicted concentrations exceed all three SO_2 objectives, however, these maximum concentrations occur on-site where there are no sensitive receptors and the objectives do not apply. The concentration contour plots included in the air quality study indicate that it is unlikely that the 1-hour and 24-hour mean SO_2 objectives will be exceeded at receptors, although the concentration contour plots did not confirm compliance with the 15-minute mean objective at receptors.

106. Shetland Islands Council Environmental Health Officers requested further information from the developers regarding the 15-minute mean objective. The consultants who conducted the dispersion modelling have confirmed that the study has indicated that the 15-minute mean objective will not be met at some receptors close to the proposed fish factory[27]. This has been attributed to the dispersion modelling being undertaken assuming heavy fuel oil is used in the boilers and no abatement measures being in place to reduce SO_2 emissions. The consultants have advised that alternative fuel sources and abatement techniques will be investigated to reduce the SO_2 impact at receptors. Until a modelling study based on use of improved fuel or abatement techniques is presented to the Council, it is not possible to determine that the SO_2 objectives will be met.

107. A further screening assessment of SO_2 emissions was carried out for this U&SA following the technical guidance and using a spreadsheet provided on the LAQM website[28]. The spreadsheet uses information on the stack height, stack diameter, annual SO_2 emission rate and building height to calculate an effective stack height and a maximum emission rate which would result in the 99.9th percentile of 15-minute mean SO_2 concentrations being less than 133µg/m^3 (half the objective). If the total annual emissions from the plant exceed the calculated maximum emission rate, there may be a risk of exceeding the 15-minute mean SO_2 objective. The input data and results of the screening assessment are presented in Table 8. All input data is taken from the air quality impact assessment submitted to the Council.

Table 8: SO_2 screening assessment for the proposed fish factory

Stack Height (m)	Stack Diameter (m)	Building Height (m)	Predicted Maximum Emission Rate (tonnes/year)	Process Emission Rate (tonnes/year)
29	0.72	10	117	409 (from 12.98g/s)

108. The screening assessment shows that the total annual emissions from one boiler stack exceed the maximum emission rate calculated by the spreadsheet for compliance with the 15-minute mean objective. The assessment does not take into account the cumulative impact of emissions from all four stacks. This screening assessment confirms that if the emission rate of SO_2 from the fish factory is that quoted in the air quality impact assessment it is likely that there will be exceedences of the SO_2 15-minute mean objective.

109. A submission was also made to the Council regarding emissions from an incineration stack which is part of the Councils Energy Recovery plant in Lerwick. The original air quality assessment for this process was conducted in 1995 and updated in 1998 and concluded that there would be no exceedences of air quality objectives. The plant became operational in 2000, and Shetland Islands

[27] Email correspondence, Natural Capital Ltd to J Leach (Shetland Islands Council), May 2006.
[28] http://www.airquality.co.uk/archive/laqm/tools.php?tool=emission

Council desired a review of all environmental impacts taking into account changes in air quality legislation and control of atmospheric emissions, to determine if the plant was still in compliance.

110. A dispersion modelling study was conducted in 1995 and 1998 using a more limited dispersion model than is currently available. This model did not predict any exceedences of the SO_2 objectives, although no assessment was made against the 24-hour or 15-minute objectives. While modelling has not been repeated using a more advanced dispersion model, the original model predictions were compared against SO_2 monitoring since the plant became operational, and the study considers the model predictions "robust". While it is not possible to assess directly against the 24-hour and 15-minute objectives without conducting advanced modelling, given the low measured SO_2 concentrations and original modelling results, it is unlikely that there will be exceedences of SO_2 objectives due to emissions from the Energy Recovery plant.

Industrial sources with substantially increased emissions, or new relevant exposure

111. The technical guidance states that existing industrial sources that have increased their emissions by more than 30% need to be reassessed since the increase in emissions could result in exceedences of the SO_2 objectives. Similarly, if any new receptors have been introduced close to industrial processes with significant emissions, objectives could be exceeded. There have been no such increases in industrial emissions, or new exposure close to existing sources, in the Shetland Islands.

Domestic sources

Areas of domestic coal burning

112. The U&SA completed in 2003 concluded that there were no areas of domestic fuel burning in Shetland that would result in the potential for exceeding SO_2 objectives. Lerwick has the highest population density on the islands, however, the vast majority of households in Lerwick use alternative heating sources including heating supplied by the Lerwick Heat from Waste plant. The conclusions of the original U&SA, that there is no risk of exceeding the SO_2 objectives as a result of domestic fuel burning, remain valid.

Small boilers > 5MW(thermal)

113. There is a risk of exceeding the 15-minute mean SO_2 objective from emissions from boilers burning fuel oil or coal larger than 5MW. The previous U&SA concluded that it was unlikely that there would be any exceedences of this objective in Shetland. Since 2003, regulations have limited the sulphur content of fuel oil to a maximum of 1%, meaning that single sources are unlikely to have a significant impact.

114. The technical guidance recommends that buildings where there may be such boilers are universities, hospitals and other large institutional buildings and there are very few such buildings in the Shetland Islands. There is unlikely to be exceedences of the 15-minute mean SO_2 objective in the Shetland Islands as a result of emissions from boilers.

Transport sources

Shipping

115. The use of high sulphur fuels in large ships means that there is a risk of exceeding the 15-minute mean objective for SO_2 close to busy ports and harbours. The technical guidance advises that there is a risk of exceeding the 15-minute objective at two locations;

- locations within 250m of berths and manoeuvring areas with 5,000 to 15,000 ship movements per year; and

- locations within 1km of berths and manoeuvring areas with more than 15,000 movements per year.

116. There are three main harbours and ports in Shetland; Lerwick Harbour, Scalloway Harbour and the Sullom Voe Oil Terminal Harbour. The number of arrivals at Scalloway Harbour has been below 500 for the past 5 years, and there is no risk of exceeding the 15-minute mean objective with such a low number of shipping movements[29]. Similarly, the number of shipping movements at Sullom Voe Oil Terminal has been less than 500 for the past three years[30], and there is no risk of exceeding the objectives at this location with low shipping numbers.

117. The number of arrivals at Lerwick Harbour over the last three years is presented in Table 8. Only large ships will have engines of sufficient size to have a significant impact on SO_2 concentrations. Accordingly, fishing vessels and yachts have not been included in this table.

Table 9: Number of Arrivals at Lerwick Harbour

Ship Type	2003	2004	2005
General	1254	1136	1081
Oil Tankers	90	92	87
Oil Rig Tenders	179	251	366
Other Vessels	1002	1004	986
Cruise Ships	48	47	48
Fish Factory Ships and Related Vessels	2	1	18
Total Arrivals	2586	2531	2575

118. Table 9 shows that there are just over 5000 ship movements in Lerwick Harbour per year, since arrivals and departures count as a movement each. For 2005 this figure includes 2067 arrivals for which the ship type is not specified ('General' and 'Other'). A proportion of these arrivals will be large passenger ferries, which have significant sulphur emissions. Ferries from the Scottish mainland arrive daily, while there are approximately three arrivals per week from Iceland and Scandinavian countries between April and September. This will account for approximately 450 arrivals (900 movements) per year. It is unlikely that the remaining 1500+ arrivals will be large such with high sulphur emissions, and many are likely to be local ships including the Lerwick-Bressay inter-island ferry.

119. Shetland Islands Council provided Figure A6 showing receptors within 250m (red circles) and 1km (green circles) of berthing and manoeuvring areas. It is clear, therefore, that there are receptors located within 250m of the shipping areas where there could be a risk of exceeding the SO_2 15-minute mean objective.

[29] Shetland in Statistics 2005. Shetland Islands Council Economic Development Unit, 2005.
[30] Email correspondence, BP to J Leach (Shetland Islands Council), February 2006.

120. The technical guidance published in 2006 contains information on local authorities in the UK who have proceeded to Detailed Assessments for SO_2 emissions from shipping. The only authority to declare an AQMA for SO_2 is Dover District Council, while all others have not identified exceedences of the SO_2 15-minute objective. Those who did not identify SO_2 exceedences include Aberdeen (7600 vessel movements, receptors at 50m) and Portsmouth (25,000 movements, receptors at 40m). Both these harbours have more vessel movements than Lerwick and receptors as close as any receptors at Lerwick. Other authorities who did not identify SO_2 exceedences after conducting Detailed Assessments are Dumfries and Galloway, Isle of Wight and Southampton. While there is an AQMA for SO_2 at Dover, there are 25,000 vessel movements and ships leave their engines running while in dock as they have a short turn around time. IN 2004, there were no measured exceedences of the SO_2 15-minute mean objective at two monitoring sites at the AQMA boundary.

121. Given that there are only slightly over 5000 vessel movements at Lerwick harbour, that not all these ships may be of sufficient size to have large SO_2 emissions, and that other local authorities with higher shipping movements in their harbours have not identified SO_2 exceedences, it is unlikely that there will be exceedences of the SO_2 15-minute mean objective at Lerwick.

Railway locomotives

122. There is no railway network on the Shetland Islands.

It is concluded that there is potential for exceeding the NAQS objectives for SO_2 as a result of emissions from the proposed fish factory if heavy fuel oil is the fuel type used. As this process is a proposed development, there is no need to proceed to a Detailed Assessment at this time. It is recommended that there is close consultation between the Council and the developers to discuss any mitigation measures proposed to minimise the air quality impact of SO_2 emissions, with assessments provided to demonstrate compliance with SO_2 objectives.

8 U&SA OF PARTICULATES

123. There are two objectives for PM_{10}, an annual mean objective and a 24-hour mean objective. The annual mean objective for 2010 in Scotland is more stringent than the objective in the rest of the UK. The objectives that apply in Scotland are;

- an annual mean objective of 40µg/m^3 by 31st December 2004 and an annual mean objective of 18µg/m^3 by 31st December 2010; and
- the 24-hour mean concentration not to exceed 50µg/m^3 on more than 35 occasions by 31st December 2004 or on more than 7 occasions by 31st December 2010.

Monitoring data inside/outside an AQMA

124. There is no AQMA for PM_{10} in the Shetland Islands, and the Council does not conduct any monitoring for PM_{10}.

Background Concentrations

125. Background air pollutant concentration maps for all NAQS pollutants except lead are available from the LAQM website[31]. Background concentrations for PM_{10} in Shetland in 2005 are presented in Figure B6. This figure shows that background PM_{10} concentrations across most of the Shetlands are between 7 and 10µg/m^3. Concentrations are higher in Lerwick where background PM_{10} concentrations are between 10 and 13µg/m^3.

Transport sources

Busy roads and junctions in Scotland/ Roads close to the objective during the second round of Review and Assessment

126. The technical guidance advises that there is a risk of exceeding the annual mean PM_{10} objectives at receptors within 10m of busy roads and junctions, with "busy" defined as more than 10,000 vehicles per day. No assessment of PM_{10} emissions from road traffic on any road was conducted during the last U&SA. This was based on the assumption that no roads have a traffic flow of greater than 10,000 vehicles per day. The recent traffic flow information provided by Shetland Islands Council shows a number of roads in Lerwick where the traffic flow is greater than 10,000 vehicles per day. Roads and junctions with traffic flow greater than 10,000 vehicles per day are listed in Table 10.

[31] http://www.airquality.co.uk/archive/laqm/tools.php?tool=background04

Table 10: Roads with greater than 10,000 AADT

Road	AADT
1. Holmsgarth Road at Power Station	11050
2. Holmsgarth Road north of junction	11633
3. North Road at Gilbertson Road	13081
4. South Road at Kentergrad Road	10898

127. All locations where traffic flow has been measured at greater than 10,000 vehicles per day lie on the A970 as it passes through Lerwick. The junction of Holmsgarth Road, North Road and North Lochside in Lerwick is the busiest junction on the Shetland Islands and is shown in detail in Figure A5. Shetland Islands Council has identified a number of receptors which are within 10m of this junction. The inner red lines in Figure A5 highlight the kerbs of the roads, while the outer lines mark 10m from the road edge.

128. A DMRB assessment of road traffic emissions was therefore conducted using DMRB version 1.02. Required input data for a DMRB assessment are the year of assessment, background concentration for PM_{10}, the Annual Average Daily Traffic (AADT) on each road link under examination, the average vehicle speed, the road type, the percentage of light and heavy vehicles on the road, and the distance from the road centre to the receptor points.

129. The same methodology used for the NO_2 assessment at the junction was also used for the PM_{10} assessment. The background concentration used was 11µg/m^3, which is around the highest PM_{10} background concentration in Shetland, contributing to a 'worst-case' DMRB assessment.

130. For all other roads, PM_{10} concentrations were predicted for receptors at a distance of 10m and 5m from the road centre. Figures A5 shows the closest receptor to any of the roads in Table 10 is approximately 7.5m from the road centre. Predicted concentrations at a distance of 5m from the road are therefore greater than concentrations which would be expected at a receptor.

131. The results from the DMRB screening assessment are presented in Table 11. They show that predicted PM_{10} concentrations are below the annual mean objective at all locations. The highest predicted concentration is 16.6µg/m^3 at the closest receptor to the junction.

Table 11: Predicted NO_2 Concentrations from the DMRB Assessment

Receptor	Distance from Link 1 (m)	Distance from Link 2 (m)	Predicted NO_2 Annual Mean ($\mu g/m^3$)
Junction Receptor 1	7.5	17.5	16.6
Junction Receptor 2	11	19	15.8
Holmsgarth Road at Power Station	10	--	13.4
Holmsgarth Road at Power Station	5	--	13.7
Holmsgarth Road north of junction	10	--	13.6
Holmsgarth Road north of junction	5	--	13.8
North Road at Gilbertson Road	10	--	14.2
North Road at Gilbertson Road	5	--	13.9
South Road at Kentergrad Road	10	--	13.4
South Road at Kentergrad Road	5	--	13.7

132. Given that background PM_{10} concentrations are expected to decline between 2005 and 2010, it is likely that PM_{10} concentrations at the locations discussed above will meet the 2010 annual mean PM_{10} objective.

Roads with high flows of buses and / or HGVs

133. There are no roads in the Shetlands Islands where there is a high proportion of buses and/or HGVs, "high" being greater than 20%.

New roads to constructed or proposed since the previous round of R&A

134. There have been no new roads constructed or proposed since the last round of Review and Assessment.

Roads with significantly changed traffic flows, or new relevant exposure

135. No roads in the Shetland Islands have experiences a significantly changed traffic flow (greater than 25%) since the last round of Review and Assessment. No new receptors have been introduced close to roads with more than 10,000 vehicles per day since the last round R&A.

Aircraft

136. The main airport serving the Shetland Islands is at Sumburgh, at the south of the Shetland Mainland. The technical guidance advises that PM_{10} objectives could be breached at airports which are used by more than 10 million passengers per year (mppa) (100,000 tonnes of freight equates to 1mppa).

137. As discussed in the aircraft section for NO_2, the number of passengers using aircraft in Shetland is considerably less than the number required before there would be any air quality issues.

Industrial sources

New industrial sources

138. While there have been no new industrial sources with significant PM_{10} emissions in the Shetland Islands since the last round of R&A, Shetland Islands Council have identified one processes for assessment in this U&SA with significant PM_{10} emissions. This process is a proposed fish factory in the north of the Mainland, near the Sullom Voe Oil Terminal.

139. An air quality assessment was submitted to Shetland Islands Council as part of the application process for the fish factory. The study identified emissions of PM_{10} during construction, from road transport once the process is operational and from two boiler stacks and two drier stacks.

140. During construction, creation of dust and PM_{10} is likely to occur as a result of a number of construction activities including raw material handling and HGV movements. The study identified areas within 200m downwind of the site as most likely to experience PM_{10} impact as a result of such activities. With few potential receptors in this area, and proposed mitigation to limit dust nuisance, the study concluded that any impact would be insignificant.

141. The impact on ambient PM_{10} levels as a result of an increase in road traffic during the operational phase will be slight, since only a small increase in traffic volume will occur in an area with low PM_{10} background. The study conducted atmospheric dispersion modelling to determine the impact of emissions from the boiler and drier stacks and concluded that there would be no exceedences of the PM_{10} objectives at sensitive receptors.

142. The study does not report predicted PM_{10} concentrations at sensitive receptors, instead reporting the maximum predicted concentration and then presenting concentration contour plots. The maximum predicted concentration do exceed the 2010 annual mean, and 24-hour mean objectives, in Scotland, however, the point of maximum concentration occurs on-site where there are no sensitive receptors and the objectives do not apply. The concentration contour plots included in the air quality study indicate that it is unlikely that the PM_{10} objectives will be exceeded at sensitive receptors. At the nearest receptors, the predicted PM_{10} concentrations as a result of emissions from the fish factory are around 0.5µg/m^3 for the annual mean and 2µg/m^3 for the 24-hour mean concentration. Added to background concentrations of 11.2µg/m^3 and 22.4µg/m^3 (annual mean and 24-hour mean background concentrations) gives predicted PM_{10} concentrations of 11.7µg/m^3 for the annual mean concentration and 24.4µg/m^3 for the 24-hour mean concentration.

Industrial sources with substantially increased emissions, or new relevant exposure

143. The technical guidance indicates that existing industrial sources that have increased their emissions by more than 30% need to be reassessed since the increase in emissions could result in exceedences of the PM_{10} objectives. Similarly, if any new receptors have been introduced close to industrial processes with significant emissions, objectives could be exceeded. There have been no such increases in industrial emissions, or new exposure close to existing sources, in the Shetland Islands.

Quarries / landfill sites / opencast coal / handling of dusty cargo at ports etc.

144. There are 15 processes listed in the SEPA registers and shown in Table A1 which are either quarries, crushing processes or conduct some kind of mineral process. The last U&SA concluded that it was unlikely that PM_{10} objectives would be exceeded close to any of these processes. There has been no new sources commenced operation since the last U&SA. The technical guidance states that there

would be a risk of exceeding the PM_{10} objectives at receptors within 200m of quarrying activity if background PM_{10} concentrations are 16µg/m^3 and below. Given that most of the processes on Shetland are not large scale operation, that the background PM_{10} levels in Shetland considerably below 16µg/m^3 (Figure B7) and that no dust complaints have been received about any processes, it is considered that there is little likelihood of exceeding the PM_{10} objectives.

Domestic sources

Areas of domestic coal burning

145. The U&SA completed in 2003 concluded that there were no areas of domestic fuel burning in Shetland that would result in the potential for exceeding PM_{10} objectives. Lerwick has the highest population density on the islands and the vast majority of households in Lerwick use alternative heating sources including heating supplied by the Lerwick Heat from Waste plant. The conclusions of the original U&SA, that there is no risk of exceeding the PM_{10} objectives as a result of domestic fuel burning, remain valid.

It is concluded that there is no potential for exceeding the NAQS objectives for PM_{10} at any location in the Shetland Islands.

9 CONCLUSIONS

146. An Updating and Screening Assessment has been conducted for Shetland Islands Council for 2006. The pollutants considered in this assessment are carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide, sulphur dioxide and particulate material (PM_{10}).

147. The assessment has determined that there is no risk of exceeding any of the national air quality objectives for carbon monoxide, benzene, 1,3-butadiene, nitrogen dioxide and PM_{10}. Accordingly, there is no requirement for Shetland Islands Council to proceed to a Detailed Assessment for these pollutants.

148. The assessment has shown that there may be a risk of exceeding the 15-minute SO_2 objective as a result of emissions from a proposed fish factory. Since this is only a proposed development, there is requirement to proceed to a Detailed Assessment at this stage. It is recommended that there is close consultation between the Council and the developers to discuss any mitigation measures proposed to minimise the air quality impact of SO_2 emissions, with assessments provided to demonstrate compliance with SO_2 objectives.

Site/Operator	Process Description	Process Type	SEPA Authorisation
Scottish and Southern Energy Plc	Combustion process	IPC	IPC/N/50001
BP Exploration Operating Company Ltd	Petroleum process	IPC	IPC/N/50008/V02
Fortum O&M(UK) Ltd	Combustion process	IPC	IPC/N/50009V
Shetland Islands Council	Energy Recovery Plant/Incinerator	IPC	IPC/N/50011
S O E S Ltd	Recovery of oil by distillation	IPC	IPC/N/50016/V03
Shetland Islands Council	Waste Management Facility	Part A	PPC/N/0050027
Sand Fish Processing Factory	Slaughtering of Scottish Atlantic salmon and Ensiling of reject fish and offal from the process	Part A	PPC/N/0050034
Shetland Catch Ltd	Packing, processing and freezing of pelagic fish	Part A	PPC/N/0050035
Lerwick Fish Traders Ltd	Harvesting of Scottish salmosalar aqua cultivated around the Shetland Isles by stunning and slitting gills	Part A	PPC/N/0050036
Shetland Fish Products Ltd	Treating and Processing Materials intended for the production of food products from animal raw materials (other than milk) with a finished product production capacity greater than 75 tonnes per day	Part A	PPC/N/0050037
Shetland Oiltools Ltd	Recovery of oil by distillation Burning fuel manufactured from waste	Part A	PPC/A/1000167
Shetland Islands Council	Incineration of hazardous waste	Part A	PPC/A/1003141
Veolia Environmental Services	Disposal of hazardous waste	Part A	PPC/A/1003203
H&C Dickie Ltd	Crushing and screening process	Part B	PPC/B/1000019
H&C Dickie Ltd	Mobile plant for crushing and screening of minerals	Part B	PPC/B/1000020
Garriock Bros Ltd	Mobile Plant	Part B	PPC/B/1003172
CEBO UK Ltd	Bulk loading and storage of oilwell cement	Part B	PPC/N/0060031
Sullom Mine	Mineral process	Part B	PPC/N/0060033
Shetland Islands Council	Crushing and coating roadstone	Part B	PPC/N/0060035
Brindister Quarry	Crushing and screening and ready-mix concrete batching and block formation	Part B	PPC/N/0060069
Saga Seafoods Ltd	Ensiling fish and fish offal	Part B	PPC/N/0060071
Staney Hill Quarry	Mobile Crusher and Screens	Part B	PPC/N/0060082
Garrick Bros Ltd	Crushing, grinding or size reduction with machinery designed for that purpose	APC	APC/N/220012
Garrick Bros Ltd	Crushing, grinding or size reduction with machinery designed for that purpose	APC	APC/N/220013
BP Fuels Marketing Ltd	Petroleum process	APC	APC/N/220031
Lerwick Fish traders Ltd	Acid process	APC	APC/N/220001
Sullom mine	Other Mineral Processes	APC	APC/N/50090
MK Leslie, Staney Hill Quarry	Other Mineral Processes	APC	APC/N/50091/V01
Guther Quarry	Other Mineral Processes	APC	APC/N/50092/V01
Setters Quarry	Other Mineral Processes	APC	APC/N/50098/V01
Staney Hill Quarry	Other Mineral Processes	APC	APC/N/50168/V01
Sullom mine	Other Mineral Processes	APC	APC/N/50180