Executive Summary

As part of the National Air Quality Strategy, North Lincolnshire Council has undertaken an Updating and Screening Assessment (USA) of air quality within its boundaries, to build on and update the Authority's earlier first round Air Quality Review and Assessment.

The intention of this report is to carry out a Detailed Review and Assessment of those pollutants identified in the first stage of the USA as having the potential to exceed the relevant Air Quality Objectives.

The first stage of the USA indicated that a detailed review and assessment was required for the following pollutants in the following areas:

- Industrial emissions of PM_{10} and benzene in the Scunthorpe area.
- Emissions of PM_{10} from quarries and landfills in the Croxton/Barnetby area.
- Emissions of PM_{10} and SO_2 from domestic solid fuel burning in Keadby.
- Industrial emissions of SO_2 and benzene in the Killingholme area.

The detailed review and assessment is based on additional monitoring undertaken following submission of the first stage of the USA to DEFRA in May 2003 and reference to modelling made available by local industry.

Diffusion tube surveys have commenced in both the Scunthorpe and Killingholme areas to enable assessment of benzene concentrations against the annual mean Air Quality Objective for 2010.

The Environment Agency has carried out monitoring for PM_{10} in the Croxton/Barnetby area. The data gathered will be used to assess likely compliance with the PM_{10} objectives for 2004.

An air quality monitoring station has been relocated to Keadby to monitor for SO_2 and PM_{10} concentrations to allow assessment against the range of Air Quality Objectives for 2004 and 2005. Additional monitoring of SO_2 at Killingholme has also been undertaken to assess likelihood of compliance with the 15 minute mean objective for 2004.

An air pollution modelling study has been undertaken by Corus UK Ltd for PM_{10} emissions from the integrated steel works at Scunthorpe as part of the IPPC permit application submitted to the Environment Agency. The findings of this study, along with monitoring data, have been used to assess whether the daily and annual mean objectives for 2004 will be breached.

This report recommends the following for each pollutant:

Benzene

- Gather further data in both Scunthorpe and Killingholme and review and report findings in the next annual Progress Report.

Sulphur Dioxide

- Gather further data at Keadby and review and report findings in the next annual Progress Report.
- No further action is required in respect of sulphur dioxide at Killingholme.
- No further action is required in connection with stationary railway locomotives at Scunthorpe Station.

PM_{10}

- An Air Quality Management Area or Areas shall be defined and then designated for the Scunthorpe area where there is likely exceedence of the of the Air Quality Objectives.
- Gather additional PM_{10} data at Keadby and subsequently review and report conclusions in the next annual Progress Report.
- No further action is required in respect of PM_{10} in Croxton/Barnetby.

In addition to the above recommendations, an annual review of all pollutants for which National Air Quality Objectives exist, including those not required to be assessed in this report, will be conducted to re-assess the continuing validity of conclusions from previous air quality reports.

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1.0 Introduction

The concept of Local Air Quality Management was introduced under Part IV of the Environment Act 1995 ('The Act'). Section 82 of the Act placed a duty on all Local Authorities to review air quality in their area.

In 1997 The National Air Quality Strategy (NAQS) was published. This laid down a number of proposed Air Quality Objectives that were to be achieved by 2005. The Air Quality Objectives were subsequently formalised in the Air Quality Regulations 1997 ('The Regulations').

Air Quality Objectives can be defined as the Governments medium term objectives. They are based on Air Quality Standards set by the Expert Panel on Air Quality Standards (EPAQS) and are the maximum acceptable level of a pollutant in the air that will not present a risk to the health of the most susceptible groups in the population. The Air Quality Objectives include date(s) by which the Standards must be achieved. The length of time to achieve the Standard for each pollutant takes into account the costs to industry, the expected rate of improvements in available technology and the health effects on the country's population.

In January 1999 the Government consulted on proposals to revise the NAQS. This amended strategy was subsequently included in the Air Quality (England) Regulations 2000. The new Air Quality Objectives reduced the pollutant concentration for some pollutants and brought forward the compliance date for others.

The Air Quality (England) Regulations 2000 set Air Quality Objectives for seven pollutants which must be achieved by varying dates, the latest being 31st December 2010. The Air Quality Objectives for the seven pollutants are listed in Table 1.

To assist Local Authorities, DEFRA have produced policy and technical guidance documents. Local Authorities must have regard to this guidance when conducting their Review & Assessment of Air Quality. Policy Guidance LAQM.PG(03) proposes that a two step approach should be adopted by Local Authorities. The Updating and Screening Assessment (USA) is the first stage and involves the identification of those aspects that have changed following the first round of review and assessment and that may require further assessment. Where the need for further assessment is identified a Detailed Assessment is undertaken for pollutants at specific locations using sophisticated models and monitoring data.

Where a Detailed Assessment indicates that an Objective is unlikely to be achieved, the area must be designated an Air Quality Management Area. The Authority must then develop and implement a local action plan setting out measures that aim to reduce pollution levels.

Table 1
Objectives in the Air Quality (England) Regulations 2000

Pollutant	Objective		To be Achieved By
	Concentration	**Measured as**	
Particles *(1) PM_{10}	50μg/m^3 * (2)	24-Hour Mean not to be exceeded more than 35 times a year.	31/12/2004
	50μg/m^3	***24-Hour Mean not to be exceeded more than 7 times a year***	***31/12/2010***
	40μg/m^3	Annual Mean	31/12/2004
	20μg/m^3	***Annual Mean***	***31/12/2010***
Nitrogen Dioxide	200μg/m^3	1-Hour Mean not to be exceeded more than 18 times a year.	31/12/2005
	40μg/m^3	Annual Mean	31/12/2005
Sulphur Dioxide	350μg/m^3	1-Hour Mean not to be exceeded more than 24 times a year.	31/12/2004
	125μg/m^3	24-Hour Mean not to be exceeded more than 3 times a year.	31/12/2004
	266μg/m^3	15-Minute Mean not to be exceeded more than 35 times a year.	31/12/2005
Carbon Monoxide	10.0mg/m^3 *(3)	Maximum Daily Running 8-Hour Mean	31/12/2003
Benzene	16.25μg/m^3	Running Annual Mean	31/12/2003
	5μg/m^3	Annual Mean	31/01/2010
1,3-Butadiene	2.25μg/m^3	Running Annual Mean	31/12/2003
Lead	0.5μg/m^3	Annual Mean	31/12/2004
	0.25μg/m^3	Annual Mean	31/12/2008

*(1) "PM_{10}" - Particulate Matter less than 10 microns in diameter.
*(2) "μg/m^3" - micrograms per cubic metre.
*(3) "mg/m^3" - milligrams per cubic metre.

Proposed new objectives

2.0 Background to North Lincolnshire

North Lincolnshire is an area of around 85,000 hectares located on the southern side of the Humber estuary and occupying tracts of land on either side of the River Trent. The administrative area of North Lincolnshire was created in March 1995 by Parliamentary Order and on 1st April 1996 the new Unitary Authority area of North Lincolnshire came into being.

North Lincolnshire covers a large, mainly agricultural area. The pattern of settlements in the area reflects this with market towns surrounded by many small villages. An important exception to this is the substantial urban area of Scunthorpe and the adjoining town of Bottesford.

North Lincolnshire has a population of around 153,000. Approximately half of people live in Scunthorpe and the adjacent town of Bottesford. Overall, 71 percent of the population live in this main urban area and other towns.

The local economy of North Lincolnshire was built on traditional industries such as steel manufacturing and related industries and agriculture. More recently there has been the establishment of two oil refineries and the introduction of several gas fired power stations.

The M180 motorway and several primary and strategic routes, including the A18 and A15, are located within North Lincolnshire. By rail there are regular freight movements to and from Scunthorpe Steelworks and Humber port related industries. North Lincolnshire is well positioned to take advantage of water transport. Along the banks of the Humber and the Trent there are several wharf facilities.

3.0 Conclusions and Recommendations from Second Round of Air Quality Review and Assessment - Updating and Screening Assessment

Updating and Screening Assessment for each Pollutant:

- **Carbon Monoxide** — A Detailed Review & Assessment was not required.
- **Benzene** — A Detailed Review & Assessment was required for industrial emissions in the Scunthorpe and Killingholme areas.
- **1, 3-Butadiene** — A Detailed Review & Assessment was not required.
- **Lead** — A Detailed Review & Assessment was not required.
- **Nitrogen Dioxide** — A Detailed Review & Assessment was not required.
- **Sulphur Dioxide** — A Detailed Review & Assessment was required for industrial emissions in the Killingholme area and emissions from domestic solid fuel burning in Keadby.
- **PM_{10}** — A Detailed Review & Assessment was required for industrial emissions in Scunthorpe, emissions from quarries and landfill sites in the Croxton / Barnetby area and emissions from domestic solid fuel burning in Keadby.

4.0 Purpose of this Report

North Lincolnshire Council, under the Environment Act 1995, is required to review and update its assessment of air quality first completed in December 2001. The first step of the second round review and assessment, the Updating and Screening Assessment (USA), was submitted to DEFRA in May 2003.

As stated in Section 3 overleaf, the USA identified that a Detailed Review and Assessment was required for a number of pollutants at various locations throughout the district. The purpose of this report is to present the findings of the Detailed Review and Assessment carried out in light of the USA and, in doing so, to collate and analyse, in detail, the latest monitoring data and air pollution modelling studies available.

The second round Detailed Review and Assessment has been carried out in accordance with the technical guidance LAQM.TG(03) issued by DEFRA. The individual methods of assessment for each of the pollutants considered in this report are discussed in greater detail in the following dedicated sections and are based on the pollutant specific guidance detailed in LAQM.TG(03).

To determine the scope of the Review & Assessment advice contained within paragraph 1.19 of the technical guidance has been followed, which states:

"The Regulations make clear that likely exceedences of the objectives should be assessed in relation to ***'the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present'***. Reviews and assessments should thus be focused on those locations where members of the public are likely to **be regularly present and are likely to be exposed over the averaging period of the objective**. Authorities should **not** consider exceedences of the objectives at any location **where relevant public exposure would not be realistic**."

A note to this paragraph suggests that land designated in the local plan or with a current planning permission for residential development, but not currently developed, should reasonably be considered as being a location with relevant exposure.

The report seeks to identify, with confidence, the pollutants and the areas within North Lincolnshire that are likely to exceed the air quality objectives by the relevant future years and beyond. From this, the Authority will be able to determine those areas it intends to declare as an Air Quality Management Area (AQMA).

5.0 Detailed Review & Assessment of Benzene

5.1 Introduction

Benzene (C_6H_6) is an aromatic volatile organic compound (VOC) and is a minor constituent of petrol. The maximum benzene content of petrol has now reduced to 1% in accordance with EU legislation. The main source of benzene emissions to the atmosphere is from the refining, distribution and combustion of petrol. Benzene is emitted in vehicle exhaust fume as unburned fuel and also as a product of the decomposition of other aromatic compounds present in the fuel.

5.2 The Health Effects of Benzene

Benzene has long been known to be both toxic and carcinogenic. People exposed to high concentrations of benzene have an increased risk of non-lymphocytic leukaemia.

5.3 Air Quality Objectives for Benzene

The Air Quality Objective for benzene included in the National Air Quality Strategy and Air Quality (England) Regulations 2000 is:

- **Air quality objective for benzene: 2003**

  Running annual mean of 16.25μg/m^3 to be achieved by 31 December 2003.

- **Air quality objective for benzene: 2010**

  Annual mean of 5μg/m^3 to be achieved by 2010.

5.4 Conclusions of the Updating and Screening Assessment (USA)

The USA concluded that all locations within North Lincolnshire were likely to meet the air quality objective for 2003.

Killingholme - With respect to the air quality objective for 2010, the USA indicated that a detailed assessment should be carried out for benzene at Killingholme. This conclusion was drawn following a review of historical monitoring data obtained from an "OPSIS" monitor located at South Killingholme which highlighted the potential for exceedences. (The OPSIS monitor is no longer in use).

Historical monitoring data was also available from a benzene passive diffusion tube study carried out during 1998 to 1999 in North and South Killingholme. Although the diffusion tube survey did not indicate likely exceedence of the 2010 objective, it was decided to take a precautionary approach and proceed to a Detailed Review and Assessment based on the historical "OPSIS" data. Monitoring was carried out in the Killingholme area due to the proximity of two petroleum refineries.

Scunthorpe - The USA also concluded that a Detailed Review and Assessment should be undertaken in Scunthorpe in relation to the 2010 objective. Although no previous monitoring data is available for the Scunthorpe area, using the nomograms in guidance document LAGM.TG(03), the screening assessment identified two significant industrial emitters of benzene close enough to relevant receptors to warrant a detailed review and assessment.

5.5 Method of Detailed Review and Assessment for Benzene

Guidance provided in LAQM.TG(03), paragraph 3.50, states that "measured data are expected to give a more accurate indication of benzene concentrations than modelling studies. This is particularly the case where fugitive emissions are of greatest significance."

The air quality objective for benzene by 2010 is an annual mean. Both passive and continuous samplers can therefore be considered for monitoring, as both will provide data that can readily be used to assess the likelihood of exceedences of the objective.

Paragraph 3.51 goes on to confirm that passive diffusion tube analysis is an acceptable method of monitoring benzene levels provided that suitable QA/QC controls are in place and that the monitoring takes place over a relevant period of time. The relevant monitoring period is preferably twelve months, although six or even three months may be acceptable under certain circumstances.

Passive diffusion tubes are relatively inexpensive when compared with other monitoring methods available. As such, more locations can be monitored allowing greater spatial definition of any hotspots of potential exceedences.

Quality assurance and quality control (QA/QC) measures were considered and implemented in accordance with the guidance offered in Annex 1 of LAQM. TG(03), to promote confidence in the monitoring results. To this end, the selection criteria for the laboratory to supply and analyse the diffusion tubes, included UKAS accreditation and membership of the WASP (Workplace Analysis Scheme for Proficiency) scheme. The laboratory selected for supply and analysis was Harwell Scientifics. QA/QC is discussed further in Appendix 4.

Killingholme - For the diffusion tube survey in the Killingholme area, twenty-one sites were identified as monitoring locations. Of these sites, eight are on the boundaries of the two petroleum refinery sites, eleven are located at relevant receptors (residential areas), and two are located away from the vicinity of the petroleum refineries to provide information on other contributors and background levels. In addition, triplicate tubes were co-located at two of the sites (one boundary and one relevant receptor). The exposure period for the tubes is one month. The Killingholme diffusion tube locations are shown on Map 1, Appendix 1.

Scunthorpe - For the Scunthorpe area diffusion tube survey, eighteen sites were identified, including thirteen relevant receptor locations, three locations on the

boundary of the steelworks and tar and bitumen plant, and two located away from these industrial sources to assess contributions from other sources and background. In addition, triplicate tubes were co-located at three sites (one boundary and two relevant receptors). The exposure period for the tubes is one month. The Scunthorpe diffusion tube locations are shown on Map 2, Appendix 1.

LAQM.TG(03) recommends that monitoring should preferably take place over twelve months, although shorter monitoring periods can provide useful information if measured concentrations greatly exceed or are well below the air quality objective. It is proposed that the monitoring will be carried out for a period of twelve months. However, the survey only commenced at the beginning of December 2003 and, as such, only four months data is available at the time of this report.

5.6 Monitoring Data for Benzene

The monitoring data gathered to date from the two surveys described above for Killingholme and Scunthorpe are summarised, respectively, in Tables 5.1 and 5.2 below. The complete data sets for the survey are available in Appendix 2.

Table 5.1 -
Summary of Benzene Concentrations Recorded at Killingholme

Site Location and Reference	Site Type	Mean Concentration over monitoring period $\mu g/m^3$)
1. Eastfield Road/ Baptist Chapel Lane	Receptor	1.96
2. Faulding Lane/ Baptist Chapel Lane	Receptor	1.58
3. Eastfield Road	Boundary	3.64
4. Eastfield Road/ Humber Road	Boundary	5.02
5. Humber Road	Receptor	2.28
6. Primitive Chapel Lane/ Humber Road	Receptor	1.90
7. Staple Road	Receptor	1.71
8. Greengate Road	Receptor	1.83
9. Clarkes Road	Receptor	1.06
10. Nicholson Road (3 tubes)	Receptor	1.68
11. Nicholson Road	Receptor	1.42
12. Nicholson Road	Receptor	1.43
13. Eastfield Road/ Nicholson Road	Boundary	2.41
14. Eastfield Road	Boundary	3.10
15. Chase Hill Road/ Eastfield Road	Boundary	1.38
16. Brick Lane, East Halton	Receptor	2.36
17. Scrub Lane, East Halton	Receptor	1.37
18. Eastfield Road/ Staple Road	Boundary	3.20
19. Marsh Lane	Receptor	2.58
20. Station Road/ Rosper Road	Boundary	4.26
21. Humber Road (3 tubes)	Boundary	4.90
22. Humber Road	Boundary	8.02
23. Humber Road	Boundary	8.94
24. A180	Traffic	1.46
25. Kettleby Lane, Wrawby	North Lincolnshire background	1.53

Table 5.2 -
Summary of Benzene Concentrations Recorded at Scunthorpe

Site Location and Reference	Site Type	Mean Concentration over monitoring period μg/m^3)
26. Brigg Road/ Rowland Road (3 tubes)	Boundary	2.51
27. Brigg Road/ Rowland Road	Boundary	2.46
28. Brigg Road/ Rowland Road	Boundary	2.45
29. Queens Street/ Rowland Road (3 tubes)	Receptor	2.15
30. Queens Street/ Rowland Road	Receptor	2.42
31. Queens Street/ Rowland Road	Receptor	2.05
32. Cottage Beck Road/ Warwick Road	Receptor	2.62
33. Cottage Beck Road/ Ashby Road	Receptor	2.71
34. Ashby Road/ Lydbrook	Scunthorpe background	2.45
35. Cemetery Road/ Fairmont Crescent	Receptor	1.85
36. Warwick Road/ Lilac Avenue	Receptor	2.39
37. Lilac Avenue	Receptor	2.15
38. Healy Road/ Rutland Road	Receptor	1.80
39. Brigg Road/ Grange Lane North	Boundary	3.48
40. Thompson Road/ Station Road	Receptor	1.67
41. Brigg Road/ Station Road	Industrial and traffic	2.62
42. High Street East/ Dawes Lane	Boundary	3.49
43. Dawes Lane, Santon (3 tubes)	Receptor & boundary	4.02
44. Dawes Lane, Santon	Receptor & boundary	4.41
45. Dawes Lane, Santon	Receptor & boundary	4.47
46. Dawes Lane, Santon	Receptor	2.68
47. Trafford Street/ Cross Street	Receptor	3.10
48. Kings Court/ Chapel Street	Receptor	2.05
49. Crosby Road/ Chapel Street	Receptor	2.08
50. Blank tube	Control	0.23

5.7 Provisional Results of Benzene Surveys

The data gathered to date indicates there are no likely exceedences of the annual mean air quality objective for 2010 of 5μg/m^3 at relevant receptors, based on the average measured concentrations of benzene over four months. However, individual monthly concentrations at certain locations have been above 5μg/m^3 and have shown significant variance. Therefore, it is proposed to continue with the monitoring exercise to gain 12 months of data to allow a more representative and accurate indication of the annual mean.

5.8 Conclusion and Recommendation for Benzene

The limited information gathered through the passive diffusion tube surveys in Killingholme and Scunthorpe does not identify a need, at this time, to declare an Air Quality Management Area in respect of benzene at any location in North Lincolnshire. However, it is recommended that the current benzene diffusion tube survey be continued to obtain data over a twelve month period with the results and conclusions being reported in the next annual Progress Report.

6. Detailed Review and Assessment of Sulphur Dioxide

6.1 Introduction

Sulphur dioxide (SO_2) is a gas at normal temperature and pressure. It dissolves in water to produce an acidic solution which is then readily oxidised to sulphuric acid (H_2SO_4) causing acid rain. The principal source of sulphur dioxide is the combustion of fossil fuels such as coal and oil that contain sulphur. Before the Clean Air Act 1956, the main source of sulphur dioxide emissions was the use of coal in domestic, commercial and industrial sectors. There were also many power stations located within or adjacent to towns and cities. Today cleaner fuels have replaced coal, and power generation is concentrated in larger, more efficient stations located in rural areas.

6.2 The Health Effects of Sulphur Dioxide

Studies indicate that levels of sulphur dioxide above 100ppb can cause changes in lung function and aggravation of bronchitis plus respiratory ailments by causing constriction of the bronchus. An increase in wheezing, breathlessness during exercise and a chronic cough have also been noted.

6.3 Air Quality Objectives for Sulphur Dioxide

The Objective for sulphur dioxide in the National Air Quality Strategy and Air Quality (England) Regulations 2000 are:

- 266$\mu g/m^3$ (100ppb), measured as the 99.9th percentile of 15 minute means in a calendar year to be achieved by 2005. The number of allowable exceedences in a year is 35.
- 350$\mu g/m^3$ (132ppb), measured as a 1-hour mean (allowing up to 24 exceedences per year) (99.7th percentile)
- 125$\mu g/m^3$ (47ppb), measured as a 24-hour mean (allowing up to 3 exceedences per year) (99.2nd percentile)

6.4 Conclusions of the Updating and Screening Assessment (USA)

The USA concluded that a detailed assessment should be carried out to determine the likelihood of exceeding the air quality objectives for sulphur dioxide at Killingholme and Keadby.

Killingholme - Identified as having the potential to exceed the objectives for sulphur dioxide due to the presence of the two petroleum refineries. Although historical monitoring data indicated that the air quality objectives were likely to be met, it was determined that insufficient data was available when the USA was carried out to

confirm this to be the case. In addition, modelling studies undertaken by both refineries highlighted the potential for exceedences of the objectives, and as such the USA recommended that further investigation be carried out in this area.

Keadby - Application of the screening tool in LAQM.TG(03) (par. 7.27), which considers the number of solid fuel burning dwellings within a set area, identified the village of Keadby as requiring further consideration in relation to the sulphur dioxide objectives. No historical monitoring data in relation to sulphur dioxide levels in Keadby was available at the time of the USA to confirm the likelihood of exceedence. As such, the USA recommended that a Detailed Review and Assessment be undertaken at this location.

Scunthorpe - The USA also recommended that further consideration be given in relation to stationary railway locomotives at Scunthorpe Railway Station taking into account further information from the service provider.

6.5 Method of Detailed Review and Assessment for Sulphur Dioxide

LAQM.TG(03), par. 7.37, confirms that measured data is expected to provide a more accurate picture of sulphur dioxide concentrations than modelling, providing that appropriate QA/QC procedures are in place to ensure confidence in the data.

The 2004 and 2005 air quality objectives for sulphur dioxide have three different time weightings, including 24-hour mean, 1-hour mean and 15-minute mean. There is therefore a preference for the use of continuous samplers to allow comparison over all of the reference periods. LAQM.TG(03), par. 7.38, recommends the use of UV fluorescent sampling. It further advises that monitoring should be carried out over a whole calendar year, with at least 90% data capture.

Monitoring data was therefore gathered using UV fluorescence at both Killingholme and at Keadby. The locations of the monitoring stations are shown on Maps 3 and 4, Appendix 1, respectively. These sites were chosen taking account of the guidance offered in Annex 1 of LAQM.TG(03).

To promote confidence in the monitoring data for North Lincolnshire, the Council is part of the Calibration Club operated by NETCEN. Air quality monitoring sites are audited at 6 monthly intervals and data fully ratified in accordance with procedures for the Automated Urban & Rural Network Sites (AURN).

The monitoring station at Killingholme has been at it's current location (South Killingholme Primary School) since February 2003 and, therefore, more than 12 months data is now available, as recommended by LAQM.TG(03). The station at Keadby was relocated to its current site in January 2004. As such, only three months data is available. However, this period covers the season when domestic solid fuel use, the reason behind the detailed assessment, is likely to be at its greatest. Therefore, although the monitoring period is limited in duration, it is considered that the data collected is sufficient to give a reasonable indication of the likelihood of compliance with the air quality objectives

6.6 Monitoring Data for Sulphur Dioxide

The monitoring data gathered to date from the two monitoring stations described above for Killingholme and Keadby are summarised, respectively, in Tables 6.1 and 6.2 below. The complete data sets for the survey are available in Appendix 3.

Table 6.1 -
Summary of Sulphur Dioxide Concentrations Recorded at Killingholme

Period	No. of Exceedences of 15 Minute Mean of 266μg/m^3	No. of Exceedences of 1 Hour Mean of 350μg/m^3	No. of Exceedences of 24 Hour Mean of 125μg/m^3
1 Mar 03 to 29 Feb 04	0	0	0

Table 6.2 -
Summary of Sulphur Dioxide Concentrations Recorded at Keadby

Period	No. of Exceedences of 15 Minute Mean of 266μg/m^3	99.9th percentile of 15 min Means (ppb)	No. of Exceedences of 1 Hour Mean of 350μg/m^3	No. of Exceedences of 24 Hour Mean of 125μg/m^3
12 Jan 04 to 14 April 04	0(E)	29(C)	0(E)	0(C)

(C) – Concentration (E) – Exceedences

The data capture for the Killingholme site over the above period was 97.7% and therefore complies with the level of data capture recommended in LAQM.TG(03) of 90%. For the Keadby station, the data capture was 89.4% and as such falls just below the recommended level of 90%. The data reported here for the Keadby site has also not been ratified and as such can only be treated as provisional data.

6.7 Results of Sulphur Dioxide Monitoring

Killingholme - The results of the monitoring at Killingholme gives a positive indication that that the air quality objectives for 2004 (1-hour and 24-hour mean) and 2005 (15-minute mean) will not be exceeded.

Keadby - The monitoring data undertaken at Keadby has not yet been ratified. In addition, the data only covers a three month period, with less than 90% data capture. The results of the monitoring therefore provide a limited indication of the likelihood of the potential for exceedence of the any of the air quality objectives for sulphur dioxide in relation to domestic solid fuel burning in the Keadby area. However, it is worthy of note that the limited period of monitoring has taken place over the months when the greatest likelihood of exceedences would be expected. To date the provisional data identifies no exceedences.

6.8 Conclusions and Recommendations for Sulphur Dioxide

The information gathered from the monitoring station at Killingholme indicates that the air quality objectives for sulphur dioxide (2004 and 2005) are likely to be complied with. It is recommended therefore that no air quality management area should be declared as a result of sulphur dioxide levels in Killingholme.

The information gathered to date from the monitoring station at Keadby does not show a need to declare an air quality management area for sulphur dioxide. However, sufficient data has not yet been gathered and ratified to allow a robust conclusion. It is recommended therefore that monitoring be continued at Keadby with the results and conclusions being reported in the next annual Progress Report.

Information provided by the operator regarding stationary railway locomotives at Scunthorpe Station has confirmed that it is not normal practice for locomotives to be stationary for 15 minutes or longer, within 15 metres of a relevant location. Having regard to the guidance offered in LAQM.TG(03), Box 7.2, it is considered that no further action is required in relation to sulphur dioxide levels at this location.

7.0 Detailed Review and Assessment for PM_{10}

7.1 Introduction

Fine particles (PM_{10}), unlike individual gaseous pollutants, are composed of a wide range of substances arising from a variety of sources. Particles in the U.K. may be regarded as having three predominant source types.

Primary	Produced by combustion processes, mainly road traffic.
Secondary	Mainly sulphates and nitrates, formed by chemical reactions in the atmosphere.
Coarse	Suspended soils and dusts, sea-salt, biological particles from construction work.

Nationally, road traffic accounts for 25% of PM_{10} emissions, rising to 30-40% in city centres.

7.2 The Health Effects of PM_{10}

In recent years the emphasis with regard to particulate matter has centred on the size of the particles. Material that is less than 10 microns (μm), i.e. one hundred thousandth of a metre, in diameter will penetrate deep into the lungs when inhaled and consequently presents the greatest risk to human health.

Small particles aggravate a range of respiratory and other medical conditions giving rise to particular problems for sensitive groups such as asthmatics. It has been suggested that the rise in allergic disorders, such as hay fever and eczema, are linked to particulate matter in the air, although there is no clear evidence to support this at present.

The National Air Quality Standards (NAQS) detail PM_{10} as the most appropriate measure of particulate matter in the environment, due to its likely health effects

7.3 Air Quality Objectives for PM_{10}: 2004

The objectives for PM_{10} detailed in the Air Quality Strategy for 2004 are:

- A measured 24-hour mean of 50μg/m^3, which allows for 35 exceedences in a year. Conversely, this may be defined as the 90th percentile of less than 50μg/m^3.
- An annual mean not exceeding 40μg/m^3.

Proposed new objectives for PM_{10} will be incorporated into the Regulations and subsequently replace the existing objectives. The proposed new objectives are: -

- A measured 24-hour mean of 50μg/m^3, which allows for 7 exceedences in a year. Conversely the 98th percentile can represent this.

- An annual mean not exceeding 20μg/m^3.

The proposed objectives will be considered in this report as an indication of whether or not North Lincolnshire will be able to meet the objectives when they become part of the Regulations.

7.4 Conclusions of the Updating and Screening Assessment (USA)

The USA concluded that a detailed assessment should be carried out to determine the likelihood of exceeding the air quality objectives for PM_{10} at Scunthorpe, Keadby and the Croxton/Barnetby area.

Scunthorpe - Scunthorpe was identified as having the potential to exceed the objectives for PM_{10} due to the presence of a number of industrial sources associated with the integrated steelworks. Historical monitoring data, considered as part of the USA, indicated that the air quality objectives were unlikely to be met. In addition, an air quality modelling study undertaken by Corus, the principal operator on the steelworks site, highlighted the potential for exceedences of the objectives and, as such, the USA recommended that further investigation be carried out in this area.

Keadby - Application of the screening tool in LAQM.TG(03) (par. 8.58 to 8.63), which considers the density of solid fuel burning dwellings within a set area, identified the village of Keadby as requiring further consideration in relation to the PM_{10} objectives. No historical monitoring data in relation to PM_{10} levels in Keadby was available at the time of the USA to confirm the likelihood of exceedence. As such, the USA recommended that a Detailed Review and Assessment be undertaken at this location.

Croxton/Barnetby - The screening tool for fugitive emissions (par. 8.67), which considers the separation distance between fugitive sources and relevant receptors, identified the areas around the quarrying and landfill activities in the Barnetby area (principally in the village of Croxton) as having the potential to exceed the air quality objectives for PM_{10}. No historical data for PM_{10} levels was available at the time of the USA to confirm the likelihood of any exceedance. As such, the USA recommended that a Detailed Review and Assessment be carried out at this location for PM_{10}.

7.5 Method of Detailed Review and Assessment for PM_{10}

LAQM.TG(03), par. 8.78, confirms that measured data is expected to provide a more accurate indication of PM_{10} concentrations than modelling, providing that appropriate QA/QC procedures are in place to ensure confidence in the data.

The 2004 and (proposed) 2010 air quality objectives for PM_{10} use two different time weightings, including 24-hour mean and annual mean. There is therefore a

preference for the use of continuous samplers to allow comparison over both these reference periods. Annex 1 of LAQM.TG(03), par. A1.21, advises that automatic fixed-point monitors, such as a TEOM, are an acceptable monitoring method for Detailed Assessments, provided that the results are adjusted to estimate gravimetric equivalent concentrations. Par. 8.79 further advises that monitoring should preferably be carried out over a whole calendar year, with at least 90% data capture.

Monitoring data was therefore gathered using TEOM monitors at both Scunthorpe and at Keadby. The locations of the monitoring stations are shown on Maps 5, 6 and 4, Appendix 1. These sites were chosen taking account of the guidance offered in Annex 1 of LAQM.TG(03).

To promote confidence in the monitoring results, quality assurance and quality control (QA/QC) measures were considered and implemented in accordance with the guidance offered in Annex 1 of LAQM. TG(03). QA/QC is discussed further in Appendix 4.

Scunthorpe - Historical monitoring data is available for Scunthorpe from 1998. Until March 2004, the TEOM was located at Cottage Beck Road (Map 5, Appendix 1). However, this location was deemed to be unrepresentative for relevant receptors of PM_{10}, as it was sited on an industrial estate where long-term exposure was unlikely. From April 2004, the TEOM in Scunthorpe has been relocated to Rowland Road (Map 6, Appendix 1), which is a similar distance from the integrated steelworks as the previous site, but also close to residential premises.

In addition to the monitoring data, a modelling study carried out by Corus UK Limited as part of their permit application to the Environment Agency, under the Pollution Prevention Control Act 1999, has been incorporated into this detailed review and assessment. This modelling study has been accepted by the Environment Agency as being a fair estimate of PM_{10} levels affecting the Scunthorpe and surrounding area from the integrated steelworks. Details of the model and methodology used can be seen in Appendix 3.

Keadby - The monitoring station at Keadby (Map 4, Appendix 1) was relocated to its current site in January 2004. As such, only three months data is available. However, this period covers the season when domestic solid fuel use, the reason behind the detailed assessment, is likely to be at its greatest. Therefore, although the monitoring period is limited in duration, it is considered that the data collected is sufficient to give a reasonable indication of the likelihood of compliance with the air quality objectives.

Croxton/Barnetby - PM_{10} levels at Croxton close to the quarrying and landfill activities were monitored by the Environment Agency using a TEOM between 21 January 2004 and 14 April 2004. The location of the Environment Agency's monitoring station is shown on Map 7, Appendix 1.

7.6 Monitoring Data for PM_{10}

The monitoring data gathered to date from the council's monitoring stations described above for Scunthorpe and Keadby are summarised in Tables 7.1, 7.2 and 7.3 below. The complete data sets for the survey are available in Appendix 4.

Table 7.1 -
Summary of PM_{10} Concentrations Recorded at Cottage Beck Road, Scunthorpe

Period	Ann Mean	No. of Exceedences of 24-Hr Mean 50$\mu g/m^3$ grav	Predicted 2004 ($\mu g/m^3$ grav)	Predicted 2010 ($\mu g/m^3$ grav)
2000	27 (C)	33 (E)	23 (C)	20 (C)
2001	32 (C)	51 (E)	30 (C)	26 (C)
2002	25 (C)	48 (E)	31 (C)	27 (C)
2003	39 (C)	95(E)	38.5 (C)	35 (C)

(C) – Concentration (E) – Exceedences

Table 7.2 -
Summary of PM_{10} Concentrations Recorded at Keadby

Period	Period Mean ($\mu g/m^3$ grav)	Est Ann Mean 2004	90th% of 24hr Means (2004 obj) ($\mu g/m^3$ grav)	No. of Exceedences of 24-Hr Mean 50$\mu g/m^3$ grav
12 Jan 04 to 14 Apr 04	22	27	39.1	1

(C) – Concentration (E) – Exceedences

The data capture for the Scunthorpe site for 2003 was 98.6%. For the Keadby station, the data capture was 92.4%. The data sets therefore comply with the recommended level of data capture recommended in LAQM.TG(03).

The Environment Agency's National Compliance Assessment Service (NCAS) deployed its mobile monitoring facility (MMF) at Croxton. The MMF was on site between 21 January 2004 and 14 April 2004 (85 days) to investigate ambient air quality in the vicinity of the quarrying and landfill operations at Singleton Birch Limited.

The MMF was equipped with a PM_{10} monitor using the TEOM method of detection. A summary of this data is listed in Table 7.3 below. A copy of the Environment Agency's report can be found in Appendix 5.

Table 7.3 –
Summary of MMF monitoring of PM_{10} Recorded at Croxton

Period	Period Mean ($\mu g/m^3$ grav)	Estimated Annual Mean	No. of Exceedences over period of 24hr Mean 50$\mu g/m^3$ grav	Predicted no. of exceedences of 24-hour mean for 2004
21 Jan 04 to 14 Apr 04	23.9(C)	23.9(C)	2(E)	9(E)

C – Concentration E – Exceedence

7.7 Results of PM_{10} Monitoring

7.7.1 Scunthorpe - The results of the PM_{10} monitoring in Scunthorpe in 2003 indicate that there will be a likely exceedence of the 24-hour mean air quality objective for 2004.

However, whilst the PM_{10} data in general indicates that the annual mean objective for 2004 will not be exceeded data for the calendar year 2003 indicated that compliance was marginal. It is acknowledged however that this year was particularly unusual in relation to the levels of PM_{10} measured nationally.

With regards to the proposed 24-hour and annual mean air quality objectives for 2010, the current data suggests that there is likely exceedence of both the proposed objectives.

7.7.2 Keadby – The monitoring data gathered in Keadby has not yet been ratified. In addition, the data only covers a three-month period. The results of the monitoring can therefore only provide a limited indication of the potential for exceedence of the any of the air quality objectives for PM_{10} in relation to domestic solid fuel burning in the Keadby area.

However, it is worthy of note that the limited period of monitoring has taken place over the months when the greatest likelihood of exceedences would be expected. To date the provisional data identifies only one exceedence of the 24-hour mean concentration out of a permissible thirty-five for 2004 and seven for 2010.

7.7.3 Croxton – Although the monitoring data obtained for the Croxton area is for a limited duration, i.e. 21 January 2004 to 14 April 2004, the data has been ratified. As the data has been ratified, it is possible to estimate the likelihood of exceedence of the air quality objectives at this location.

The ratified data, shows only two exceedences over the measurement period, which when extrapolated over the remainder of the year indicates that there will be approximately nine exceedences in total. This number of projected exceedences of the 24-hour mean is well below the objective for 2004. The predicted annual mean is also well within annual mean objective for 2004.

7.8 Results of PM_{10} Modelling Study for Scunthorpe Integrated Steelworks

This section presents the PM_{10} air concentrations predicted by the Atmospheric Dispersion Modelling (ADMS) version 3.1 (Beta 1) model. It is a summary of the results of a modelling study submitted by Corus UK Limited to the Environment Agency as part of their current IPPC Permit application. The Corus UK Limited report is reproduced in full in Appendix 3.

7.8.1 Model Predictions of 24-Hour Mean Concentrations

The ADMS 3 model was run to predict the current levels of PM_{10} within Scunthorpe and the surrounding area for the 24-hour mean concentrations to allow assessment against the 24-hour mean air quality objective for 2004 of 50$\mu g/m^3$ (not to be exceeded more than 35 times per year).

The model results indicate that 24-hour mean PM_{10} objective will be exceeded at a number of relevant residential receptors surrounding the integrated steelworks, particularly those residential areas along the eastern fringe of Scunthorpe town and isolated dwellings to the south and west of the integrated steelworks.

7.8.2 Verification of Model Predictions of 24-Hour Mean Concentrations

The predictions of 90th percentiles of 24-hour mean concentrations by the ADMS 3 dispersion model were compared with actual monitoring data from the Cottage Beck Road site for the years 1998,1999 and 2000. The modelled concentration at Cottage Beck Road of 49$\mu g/m^3$ shows reasonable correlation with the actual monitoring data for that site for 1998, 1999 and 2000 (52$\mu g/m^3$, 55$\mu g/m^3$ and 49$\mu g/m^3$, respectively), although there is a degree of under prediction. In addition, it is noted that ratified monitoring data published following the modelling study for 2001, 2002 and 2003 are all greater than the modelled concentration for Cottage Beck Road.

7.8.3 Model Predictions of the Annual Mean Concentrations

The ADMS 3 model prediction of the annual mean concentration for PM_{10} within the Scunthorpe area shows compliance with the annual mean PM_{10} air quality objective for 2004 (40$\mu g/m^3$) at all relevant receptor locations.

7.8.4 Verification of Model Predictions of the Annual Mean Concentrations

The model prediction of the annual mean concentration for PM_{10} was compared with the actual monitoring data from the Cottage Beck Road site for the years 1998, 1999 and 2000. The modelled concentration at Cottage Beck Road of 29$\mu g/m^3$ shows close correlation with the actual monitored data for 1998, 1999 and 2000 (28$\mu g/m^3$, 29$\mu g/m^3$ and 28$\mu g/m^3$, respectively). There is, however, a degree of under prediction when the modelled annual concentration is compared with the ratified monitoring data, published following the modelling study, for 2001, 2002 and 2003. It should be noted, however, that both modelled and monitored annual concentrations are below the annual mean air quality objective.

7.9 Conclusions of Monitoring and Modelling Results for PM_{10}

7.9.1 24-Hour Mean Air Quality Objective 2004

Scunthorpe - Both monitoring and modelling results for the 24-hour mean concentrations of PM_{10} indicate that there will be likely exceedence of the 24-hour mean air quality objective for 2004 in areas surrounding the Scunthorpe integrated steelworks. An Air Quality Management Area will therefore have to be designated for the area surrounding the integrated steelworks taking account of the location of the relevant receptors.

Keadby - With regards to Keadby, the monitoring data gathered to date is limited in terms of the time period involved. In addition, the data has not yet been ratified. It is therefore not possible to draw any definitive conclusion on the likelihood of compliance with the 24-hour mean air quality objective (2004) at this location, although the provisional results tend towards an indication that there will be compliance.

It is proposed, therefore, that the situation at Keadby, in respect of the 24-hour mean objective for PM_{10}, will be reviewed in due course, once adequate data is available.

Croxton/Barnetby – The data for Croxton/Barnetby has been ratified, although it is of limited duration. However, the predicted number of exceedences from the ratified data is only a quarter of the permissible number of exceedences for 2004.

It is concluded, therefore, that there is no need to declare an air quality management area for the Croxton/Barnetby area as a result of the 24-hour mean air quality objective for 2004.

7.9.2 Annual Mean Air Quality Objective for 2004

The monitoring or modelling results indicate that all locations within North Lincolnshire will comply with the annual mean air quality objective.

However, with regards to Keadby, the monitoring data gathered to date is limited in terms of the time period involved. In addition, the data has not yet been ratified. It is therefore not possible to draw any definitive conclusion on the likelihood of compliance with the annual mean air quality objective at this location. It is proposed, therefore, that the situation at Keadby, in respect of the annual mean objective for PM_{10}, will be reviewed and reported in due course, once adequate data is available.

7.9.3 Proposed Air Quality Objectives for 2010

The monitoring data available at present indicates that there is a likelihood that the annual mean air quality objective for 2010 ($20\mu g/m^3$) will be exceeded at all the locations considered in this report.

With regards to the proposed 24-hour mean air quality objective for 2010 ($50\mu g/m^3$,

not to be exceeded more than 7 times per annum), the monitoring data suggests that there may also be difficulties at all locations considered in this report, with the exception of Keadby (for which there is only limited data available).

The likelihood of compliance with the 2010 air quality objectives will therefore be kept under review and reported in due course.

7.10 Recommendations for PM_{10}

- An Air Quality Management Area shall be defined and then designated for the Scunthorpe area where there is likely exceedence of the Air Quality Objectives.

- Additional PM_{10} data for Keadby will be collected and reviewed for reporting conclusions in the next annual Progress Report.

- There is no need for further action in respect of PM_{10} in Croxton/Barnetby at this time.

8.0 Recommendation for Each Pollutant

Benzene

- Complete diffusion tube surveys in both Scunthorpe and Killingholme and review and report findings in the next annual Progress Report.

Sulphur Dioxide

- Monitoring to be continued at Keadby and review and report findings in the next annual Progress Report.

- No need to declare an Air Quality Management Area in respect of sulphur dioxide at Killingholme.

- No further action is required in connection with stationary railway locomotives at Scunthorpe Station.

PM_{10}

- An Air Quality Management Area or Areas shall be defined and then designated for the Scunthorpe area where there is likely exceedence of the Air Quality Objectives.

- Gather additional PM_{10} data at Keadby and subsequently review and report conclusions in the next annual Progress Report.

- No need to declare an Air Quality Management Area in respect of PM_{10} in Croxton / Barnetby.

9.0 References and Sources of Information

Local Air Quality Management Technical Guidance, LAQM.TG(03), issued by the DEFRA.

Local Air Quality Management Policy Guidance, LAQM.PG(03), issued by the DEFRA.

NETCEN Air Quality Archive, www.airquality.co.uk/archive/index.php

North Lincolnshire Council's Round Two Air Quality Review and Assessment – Updating and Screening Assessment

Corus UK Limited IPPC Permit Application, August 2001 - Dispersion Modelling of PM_{10} Emissions from Scunthorpe Integrated Steelworks.

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