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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 2008. The Air Quality Objectives for the seven pollutants are listed in Table 1. Where an Objective is unlikely to be achieved within North Lincolnshire the area must be designated an Air Quality Management Area. The Authority must then develop and implement a local action plan setting out measures to reduce pollution levels.

To assist Local Authorities the Department of Environment, Transport and the Regions (DETR) produced general and technical guidance documents. Local Authorities must have regard to this guidance when conducting their Review & Assessment of Air Quality. The first guidance note produced entitled the "Framework for Review & Assessment of Air Quality" proposed that a phased approach should be adopted by Local Authorities. The three stages involve the initial identification and screening of potential pollutant sources, followed by a more detailed examination of the pollutants, using actual monitored or modelled data and finally the use of more sophisticated modelling and monitoring techniques.

This is designed so that Local Authorities only undertake that work which is necessary to determine the air quality in their area and comply with their duties under the Act.

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

Pollutant	Objective		To be Achieved by
	Concentration	Measured as	
Particles PM_{10} *(1)	50μg/m^3 *(2)	24-Hour Mean not to be exceeded more than 35 times a year.	31/12/2004
	40μg/m^3	Annual Mean	31/12/2004
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	11.6mg/m^3 *(3)	Running 8-Hour Mean	31/12/2003
Benzene	16.25μg/m^3	Running Annual Mean	31/12/2003
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.

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.

Almost half of North Lincolnshire's population, approximately 73,250 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 Purpose of this Report

The Stage 1 Review & Assessment published in December 1998 identified the need to conduct a Second Stage Review & Assessment for all the pollutants contained within the Air Quality (England) Regulations 2000. Assessment is required where there is a risk that pollutant concentrations will exceed those prescribed in the above regulations. The purpose of this report is to present the findings of the Stage 2 Review & Assessment in respect of the seven pollutants identified by the Stage 1 report as likely to breach the Air Quality Objectives.

For the purposes of this report all potentially significant pollutant sources identified in the Stage 1 Review & Assessment have been considered. This includes Part A and B processes within 15 and 10 kilometres of the authority boundary respectively as these could impact on the air quality of North Lincolnshire.

To determine the scope of the Stage 2 Review & Assessment the Pollutant Specific Guidance LAQM.TG4 (00) issued by the DETR has been followed. Paragraph 1.17 states:

"The Air Quality Regulations 2000 provide that the achievement or likely achievement of the objectives is to be determined by reference 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****. For the purposes of determining the focus of the review and assessment, local authorities should have regard to 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****."*

4.0 Review & Assessment of PM_{10}

4.1 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.

4.2 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

4.3 Air Quality Objective for PM_{10}

The objective for PM_{10} detailed in the 1997 strategy and Regulations was $50\mu g/m^3$ measured as the 99^{th} percentile of the daily maximum running 24- hour average. The objective was to be achieved by 2005.

The NAQS has now produced two revised Air Quality Objectives to be achieved by the end of 2004.

A measured 24-hour mean of $50\mu g/m^3$ which allows for 35 exceedences in a year (and conversely may be defined as a 90.4^{th} percentile of less than $50\mu g/m^3$.) Notwithstanding the above the annual mean must not exceed $40\mu g/m^3$.

4.4 The National Perspective

The revised NAQS concludes that concentrations of PM_{10} being recorded at monitoring stations across the U.K. are likely to exceed the 1997 strategy objectives at most locations.

Policies already in place should lead to a significant reduction in PM_{10} levels by the end of 2004 however the 99^{th} percentile level in large city conurbations and in the vicinity of some types of industrial plant is likely to exceed the 1997 objective.

4.5 Conclusions of the Stage 1 Review & Assessment for PM_{10}

The Stage 1 Review & Assessment concluded that there are significant sources of PM_{10} from both industry and traffic in North Lincolnshire. The sources of PM_{10} are-

a) M180 motorway, the A18 through Brigg and the A18 Queensway, Ashby Road and Brigg Road in Scunthorpe.
b) Part A processes in Scunthorpe, Killingholme and South Ferriby.
c) Part B processes in Scunthorpe and Killingholme.

From the information collated on PM_{10}. It was decided to carry out a Stage 2 Review & Assessment.

4.6 Stage 2 Review & Assessment

Assessment of these sites has been carried out by monitoring, using automatic analysers, and by calculation. For the assessment of the impact from transport the spreadsheet version of “Design Manual for Roads and Bridges”(DMRB), which is published on the Internet by Stanger Science and Environment (www.stanger.co.uk/airqual/modelhlp) has been used. The Environment Agencies publication “Guidance for Estimating the Air Quality Impact of Stationary Sources”(GSS) has been used for industrial sources.

4.7 Transport Sources

The Stage 1 Review & Assessment identified those roads within North Lincolnshire with a daily traffic flow in excess of 25,000 vehicles per day by the year 2005. Since publication of the Stage 1 Review & Assessment the Pollutant Specific Guidance LAQM.TG4 (00) has been published recommending that all roads with a daily traffic flow in excess of 5,000 vehicles be considered.

4.7.1 DMRB Results

Appendix 1 contains a table listing all the roads with a predicted daily traffic flow greater than 5,000 in the year 2004 where public exposure, for a significant length of time, is likely.

In order to determine the roads for which a Stage 2 Review & Assessment was necessary a Stage 1 assessment was conducted in accordance with the method detailed in Box 8.3 of the Pollutant Specific Guidance LAQM.TG4 (00).

For the roads under consideration the level of PM_{10} in the year 2004 was calculated using the DMRB model [(1)]. The results are given in Table 2.
[(1)] Stanger Science and Environment website

Table 2
DMRB Data - Annual Mean PM_{10} Concentrations ($\mu g/m^3$)

Road	Distance from receptor to road midpoint (m)	Predicted hourly traffic flow for 2004	Ave. Speed (km/h)	% of HGVs	Back – ground PM_{10} for 2004 ($\mu g/m^3$)	Predicted Annual Mean PM_{10} for 2004 ($\mu g/m^3$)	
						Kerbside	30m
A1077 North of Ferry Road West	4.5	686	45.4	30.6	22.5	26.8	24.5
A1077 N. of Frod'ham Gr. Rdbt	4.5	686	45.4	30.6	22.5	26.8	24.5
Cottage Beck Rd W. of Brigg Road	3.5	233	47.6	11.7	22.5	23.7	22.8
E. of Frodingham Grange Rdbt	4.0	773	43.4	13.3	22.5	25.7	23.8
Queensway West of Stockshill Road	4.5	632	61.0	12.7	22.5	24.4	23.4
Winterton Road N. of Glebe Rd Rdbt	4.0	327	52.5	13.6	22.5	23.8	23.0
Winterton Road N. of Warren Road	4.0	287	52.5	21.3	22.5	24.0	23.1
Ferriby Road East of Gravel Pit Lane	3.75	246	51.0	12.0	22.5	23.5	22.9

The Pollutant Specific Guidance LAQM.TG4 (00) states in section 8.56 "*Where the total annual mean concentration is predicted to be greater than 28$\mu g/m^3$ there is a risk of the objective being exceeded, and the Authority should proceed to the Stage 3 Review & Assessment.*"

From the results table above, it can be seen that the annual mean PM_{10} concentrations at both kerbside and background locations do not exceed $28\mu g/m^{3.}$
The Authority is satisfied at present that there is no need to progress to a Stage 3 Review & Assessment for PM_{10}.in relation to road sources.

4.7.2 Real Time Monitoring

4.7.2.1 Britannia Corner

In order to further quantify the effect of pollution generated by traffic, in the area of Oswald Road a monitoring station was placed at Britannia Corner public conveniences in 1999. (See Appendix 3 for the location.) It was equipped with a continuous NO_x monitor, using the chemiluminesence principle of detection and a PM_{10} monitor using the TEOM method of detection.

Table 3 –
Annual Mean Concentration of PM_{10} & Number of Exceedences Recorded at Britannia Corner

Year	Annual Mean Concentration ($\mu g/m^3$, TEOM)	Annual Mean Concentration ($\mu g/m^3$, gravimetric)	No. of Exceedences of 24-Hourly Mean Concentration of $50\mu g/m^3$, gravimetric
2000*	18	23	3

* February 2000 to October 2000

The gravimetric concentration is derived from the TEOM concentration using the methodology described in Box 8.1 of the Pollutant Specific Guidance LAQM.TG4 (00). From the continuous monitoring data the authority is satisfied that both the Annual Mean and the 99.8^{th} Percentile of 24-Hour Means, Air Quality Objectives are unlikely to be exceeded in 2004.

4.8 Industrial Sources / Commercial Sources

4.8.1 Scunthorpe

There are seven Part A and three Part B processes in Scunthorpe identified as potential sources of PM_{10} in the Stage 1 Review & Assessment. Four of the Part A processes are related to the Corus steel works site, (formerly British Steel). The other three Part A processes are Edinburgh Oil & Gas, Heckett Multiserv and Bitmac. The three Part B processes are Caparo Merchant Bar, PMC Carbon and the Appleby Group.

4.8.1.1 Corus (British Steel) & Caparo Merchant Bar

The individual authorised processes operating on the Corus site in Scunthorpe with the potential to emit PM_{10} are the Coke Ovens, Boiler Plant and Iron & Steel making sections. Together these form an intensively developed industrial area.

Caparo Merchant Bar utilises coke oven gas for the re-heating of steel billets and is positioned on the Corus steelworks site. Information supplied to the Environment Agency for publication in the pollution inventory on the Internet suggests that the total release of PM_{10} from all four processes was approximately 1240 tonnes in 1999.

4.8.1.1.1 Real Time Monitoring

4.8.1.1.2 Cottage Beck Road

To quantify the effect of pollution generated by Corus and other industries a monitoring station was placed at North Lincolnshire Council's Commercial Services Depot on Cottage Beck Road at the end of 1997. (See Appendix 3 for the location.) It was equipped with a continuous SO_2 monitor and a PM_{10} monitor using the TEOM method of detection. This site is part of the Automated Urban and Rural Network (AURN) and the data from this site can be viewed on the Internet (www.aeat.co.uk/netcen/airqual/). The PM_{10} concentrations have already been converted from TEOM to gravimetric. A summary of this data is listed in Table 4.

Table 4 –
Annual Mean Concentration of PM_{10} & Number of Exceedences Recorded at Cottage Beck Road

Year	Annual Mean Concentration ($\mu g/m^3$, gravimetric)	No. of Exceedences of 24-Hourly Mean Concentration of $50\mu g/m^3$, gravimetric
1998	21	11
1999	23	22
2000*	22	8

* Up to June 2000

From the continuous monitoring data the Authority is satisfied that both the Annual Mean and the 99.8th Percentile of 24-Hour Means, Air Quality Objectives are unlikely to be exceeded in 2004 at this location. As the Corus steelworks cover such a large area this review & assessment shall also consider monitoring data collected and supplied by Corus.

4.8.1.1.3 Monitoring by Corus

Corus currently operate four monitoring sites equipped with a PM_{10} monitor using the TEOM method of detection. These sites are Santon, A18 Gate, Broughton substation and the blast furnace substation. The PM_{10} concentrations have been converted from TEOM to gravimetric using the methodology described in Box 8.1 in the Pollutant Specific Guidance LAQM.TG4 (00). A summary of this data is listed in Table 5.

Table 5 –
Annual Mean Concentrations of PM_{10} & Number of Exceedences Recorded at Corus Monitoring Sites

Site[1]	Annual Mean Concentration ($\mu g/m^3$, gravimetric)	No. of Exceedences of 24-Hourly Mean Concentration of $50\mu g/m^3$, gravimetric
Santon	<40	2
A18 Gate	<40	2
Blast Furnace	>40	73
Broughton	>40	27

[1] All information is for 2000.

The annual mean concentrations have been estimated from data supplied in graphical form (See Appendix 2.). The graphs indicate that the Annual Mean Air Quality Objective is likely to be exceeded in 2004 at the blast furnace and Broughton substations and the 24-Hour Mean Air Quality Objective is likely to be exceeded at the blast furnace substation. However both locations are well within the works boundary and consequently are not considered a risk to sensitive receptors. The other two monitoring stations are both positioned on the boundary of the steelworks and indicate that it is very unlikely the Air Quality Objective for PM_{10} will be exceeded in 2004. The PM_{10} concentrations will decrease over distance from the steelworks; this is also supported by data from the Cottage Beck Road site. The Authority does not propose to progress to a Stage 3 Review & Assessment of PM_{10} from this source.

4.8.1.2 Heckett Multiserv (Process formerly operated by Short Brothers)

Heckett Multiserv operates a slab slitting process enabling steel slabs to be cut to specialist sizes for Corus. Steel slabs are cut into both single and multi sections providing Corus with a greater product range.

From the pollution inventory published on the Internet by the Environment Agency the total release of PM_{10} from the Company was less than 1 tonne in 1999. Due to the proximity of the company to Corus it is not considered to be a significant source of PM_{10} and shall not be considered further.

4.8.1.3 Koppers UK (Formerly Bitmac)

Koppers UK refines crude tar that is a by-product of the coke ovens operated by Corus. Crude tar is a mixture of hydrocarbons, fine carbonaceous material and water, containing dissolved aluminium chloride, phenols, hydrogen cyanide and hydrogen sulphide. The process produces pitch, light oil, carbolic oil, naphthalene oil, wash oil, anthracene oil and base oil.

From the pollution inventory published on the Internet by the Environment Agency the total release of PM_{10} was less than 1 tonne in 1999. Once again considering the proximity of the company to Corus it is not a significant source of PM_{10} and so shall not be considered further.

4.8.1.4 Edinburgh Oil & Gas

Edinburgh Oil & Gas are situated on Crosby Warren. It is a single well operation producing sweet crude oil.

The pollution inventory published on the Internet by the Environment Agency lists no emissions data for PM_{10} from the Company and is unlikely therefore to be a significant source. Production in 1992 was approximately 120 barrels per day and projections at the time indicated that production would have reached uneconomic levels by 1993 /1994. At present the well is still operating but it is assumed it has only a short-term future. Edinburgh Oil & Gas shall not be considered further in relation to PM_{10}.

4.8.1.5 PMC Carbon

PMC Carbon is situated on Brigg Road in Scunthorpe importing Calcined Petroleum Coke, Metallurgical Coke Breeze and Graphite. These are stored on the site prior to processing. Dry raw material is stored within warehouses, processed on screening/crushing plants and then packed into a range of bags and size fractions. Wet raw materials are stored outside, dried in a rotary drier before being processed in the same way as the dry raw material.

The emissions of PM_{10} from the company arise from a combination of material handling and low-level ducts / vents.

Paragraph 8.37 in the Pollutant Specific Guidance LAQM.TG4 (00) suggests that only sources closer than 200 metres to properties need to be investigated further if the 2004 annual mean background concentration is below 25$\mu g/m^3$.

The predicted 2004 annual mean background concentration of PM_{10} in Scunthorpe is 22.5$\mu g/m^3$. (See Appendix 5 for the map of background concentrations.

As the nearest property to PMC Carbon is approximately 550metres away it is not necessary to consider this source further.

4.8.1.6 Appleby Group

The Appleby Group operates two processes in Scunthorpe drying, crushing and screening blast furnace slag.

Emissions of PM_{10} arise from a combination of material handling and low-level ducts / vents.

Paragraph 8.37 in the Pollutant Specific Guidance LAQM.TG4 (00) suggests that only sources closer than 200 metres to properties need to be investigated further if the 2004 annual mean background concentration is below 25$\mu g/m^3$.

The predicted 2004 annual mean background concentration of PM_{10} in Scunthorpe is 22.5$\mu g/m^3$. (See Appendix 5 for the map of background concentrations.

As the nearest property to the site is over 500metres away it is not necessary to consider this source further.

4.9.1 Killingholme

There are two Part A processes in the Killingholme area identified as potential sources of PM_{10} in the Stage 1 Review & Assessment. These are the two oil refineries operated by Conoco and Lindsey Oil Refinery.

4.9.1.1 Dispersion Modelling

Records supplied by the Companies to the Environment Agency include dispersion modelling for PM_{10} emissions in the vicinity of the Killingholme Refineries carried out in 2000.

4.9.1.1.1 Lindsey Oil Refinery

The model used by Lindsey Oil Refinery for the study was ADMS-3. The ADMS-3 model was used to predict the annual mean concentration and the 90.4th percentile of 24-hour mean concentrations of PM_{10}. The study considered the worst case scenario that all particulate matter released was in the PM_{10} range. The results were -

Annual Mean Concentration of PM_{10} ……21.5$\mu g/m^3$
90.4th percentile of 24 Hour Means of PM_{10} …..……..44.2$\mu g/m^3$

4.9.1.1.2 Conoco Oil Refinery

The model used by Conoco Oil Refinery for the study was AERMOD. The AERMOD model was used to predict the annual mean concentration and the 90.4^{th} percentile of 24-hour mean concentrations of PM_{10}. The study considered the worst case scenario that all particulate matter released was in the PM_{10} range. The results were -

Annual Mean Concentration of PM_{10} ……25.4μg/m^3
90.4^{th} percentile of 24 Hour Means of PM_{10} …..……..45.8μg/m^3

4.9.1.2 Combining the Predicted Emissions from the Refineries

The predicted levels from the individual sources take account of the predicted background concentration of PM_{10} in 2004 and are lower than the Air Quality Objectives for $PM_{10.}$ Their combined effect however may exceed the Air Quality Objective for PM_{10}, however the maximum PM_{10} concentrations are very unlikely to occur at the same time and location. The locations of the two refineries and their location in relation to populated areas would indicate that irrespective of the above there will be no need to conduct a Stage 3 Review and Assessment.

4.10.1 South Ferriby

4.10.1.1 Rugby Cement

One of the Part A processes located in North Lincolnshire identified as a potential significant source of PM_{10} was the cement works operated by Rugby Cement in South Ferriby.

The impact on the air quality of the surrounding area was calculated using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS).

The variables used in the model are listed in Table 6. The production conditions considered for the model were both kilns in operation, each at maximum daily production rate. This would represent the worst case scenario.

Table 6 -
Rugby Cement – Variables Used for GSS

	Annual Mean
Met Type	Type 2, East Coast
Surface Roughness	0.1
Stack Height (m)	91.4
Stack Radius (m)	1.35
Release Temperature, T_{rel} (Kelvins, K)	366
Efflux Heat, Q (MW)	11
Efflux Momentum, M (m^4/s^2)	2767
Emission Rate (g/sec)[1]	6.7
90th Percentile of Process Contribution ($\mu g/m^3$)	0.64
Distance (m)	1200
90th Percentile of 2004 Background PM_{10} ($\mu g/m^3$)[2]	22.5

[1]Estimated from the amount in tonnes released per year. [2]See Appendix 5 for a map of Background PM_{10} Concentrations.

The methodology contained in paragraphs 8.59 – 8.60 of the Pollutant Specific Guidance LAQM.TG4 (00) provides the following result.

Total 90th Percentile Concentration of PM_{10}……..….41$\mu g/m^3$

This is less than the Air Quality Objective of 50$\mu g/m^3$ for the 24-hour mean. In relation to PM_{10} there is no need to proceed to a Stage 3 review & Assessment.

4.11.1 Uncontrolled / Fugitive Sources

In North Lincolnshire there are a number of Part B processes which have been identified as potential uncontrolled / fugitive sources of PM_{10}. These are either from quarrying or stockpiling/storage operations. The sources are as follows-

Table 7 –
Uncontrolled / Fugitive Sources of PM_{10}

Simon Distribution – Brigg	Steetley Bentonite – Flixborough
Simon Distribution – North Killingholme	Quay Minerals – Flixborough
Immingham Bulk Terminal – South Killingholme	Jotun Powder Coatings – Flixborough
Scangrit – South Killingholme	LSD Transport – Gunness
Singleton Birch – Melton Ross	Anglo Coal – Gunness
JHP Storage – Elsham	New Holland Bulk Terminal
Rugby Cement – Middlegate Quarry	Landline Services – Scunthorpe
Waterway Services – Keadby	

Paragraph 8.37 in the Pollutant Specific Guidance LAQM.TG4 (00) suggests that only sources closer than 200 metres to properties need to be investigated further if the 2004 annual mean background concentration is below 25$\mu g/m^3$.

The predicted 2004 annual mean background concentration of PM_{10} in Scunthorpe is 22.5$\mu g/m^3$. (See Appendix 5 for the map of background concentrations.

The sources listed above are all greater than 200metres from any relevant locations and so shall not be considered further.

4.12 Conclusions for PM_{10}

From the results of the monitoring and screening exercises in the Stage 2 Review & Assessment it is unlikely that the Air Quality Objectives for PM_{10} will be breached.

Therefore it is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of PM_{10}.

5.0 Review & Assessment of Nitrogen Dioxide

5.1 Introduction

Nitrogen Dioxide (NO_2) and Nitrogen Oxide (NO) are commonly referred to as Oxides of Nitrogen (NO_x) and are produced by all combustion processes. Currently road transport accounts for about 50% of the total UK emissions; electricity generation contributes about 20% and the industrial and commercial sectors contribute about 17%.

5.2 The Health Effects of Nitrogen Dioxide

Nitrogen Dioxide is known to have an adverse effect on human health. It is a respiratory irritant. It affects airways and reduces lung function giving feelings of breathlessness during exercise and increasing the likelihood of coughing and other respiratory problems. Asthmatics as a group can be particularly affected by even short exposure to high levels of Nitrogen Dioxide.

5.3 Air Quality Objective for Nitrogen Dioxide

The objective for Nitrogen Dioxide, included in the 1997 Strategy and Regulations, is 150ppb (287$\mu g/m^3$) measured as an hourly mean and 21ppb (40$\mu g/m^3$) when expressed as an annual mean. The objective was to be achieved by the end of 2005.

The Objectives take account of the both the effects caused by short-term exposure to high levels and long term exposure to lower concentrations. The recent NAQS (National Air Quality Strategy) proposed the following revised objective.

- 200$\mu g/m^3$ (104ppb) measured as an hourly mean, which can be exceeded up to 18 times a year (and conversely may be defined as a 99.8^{th} percentile of less than 200$\mu g/m^3$)

- 40$\mu g/m^3$ expressed as an annual mean. The Air Quality (England) Regulations 2000 state a compliance date of the end of 2005.

5.4 The National Perspective

Conclusions drawn from the 1997 NAQS suggested that to meet the 2005 objectives a reduction in NO_x emissions over and above that achieved by national measures would be required.

The recent NAQS consultation document states that whilst existing policies and other measures, such as technological advances, are likely to have a significant effect on Nitrogen Dioxide levels in 2005, they are unlikely themselves to lead to the 1997 strategy objectives being met at all busy roadside locations.

Traffic management measures, as identified in the Integrated Transport White Papers, are likely to be needed in some heavily trafficked urban areas if the objective is to be met in all locations.

5.5 Conclusions of the Stage 1 Review & Assessment for Nitrogen Dioxide

The Stage 1 Review & Assessment concluded that there are significant sources of Nitrogen Dioxide from both industry and traffic in North Lincolnshire. The localities where residential accommodation is likely to be exposed to the greatest concentrations of Nitrogen Dioxide are homes adjacent / close to-

a) The A18 on the Kingsway and Queensway, Ashby Road, Brigg Road, Oswald Road and Burringham Road in Scunthorpe.
b) Wrawby Road in Brigg.
c) Part A processes in Scunthorpe, Killingholme and South Ferriby.

Given the above it was decided to carry out a Stage 2 Review & Assessment of Nitrogen Dioxide.

5.6 Stage 2 Review & Assessment

Assessment of the above sites has been carried out by monitoring, using diffusion tubes, automatic analysers, and calculation. To assess the impact of transport the spreadsheet version of “Design Manual for Roads and Bridges”(DMRB)[(1)] was used. The Environment Agencies publication “Guidance for Estimating the Air Quality Impact of Stationary Sources”(GSS) has been used for industrial sources.

[(1)] www.stanger.co.uk/airqual/modelhlp

5.7 Transport Sources

5.7.1 Diffusion Tube Monitoring Results

Table 8 lists the results from the diffusion tube monitoring at the sites identified in the Stage 1 Review & Assessment. Four further sites subsequently identified by diffusion tube monitoring as likely to exceed the air quality objectives are also included. See Appendix 1 and Appendix 3 respectively for full results and location maps.

Table 8 –
Diffusion Tube Data - Annual Mean NO_2 Concentrations ($\mu g/m^3$)

	Site Type	1996	1997	1998	1999	2000[3]	2005
Britannia Corner, Scunthorpe	Kerbside	57	49	52	57	55	49
Mary Street, Scunthorpe	Kerbside			41[2]	55	57	47
Queensway, Scunthorpe	Kerbside			45[2]	44	39	38
Brigg Road, Scunthorpe	Kerbside			44[2]	52	48	45
Ashby Road, Scunthorpe	Kerbside			41[2]	49	41	42
Barnard Avenue, Brigg	Kerbside			47[2]	50	47	43
Manby Road, S. Killingholme	Kerbside			53[1]	55	54	47
End Clough Ln, N. Killingholme	Kerbside			32[1]	50	50	41

[1]Monitoring started Aug 1998, [2]Monitoring started July 1998, [3]Up to August 2000.

The Annual Mean Concentrations for 2005 have been extrapolated from the 1999 data using the method recommended in the Pollutant Specific Guidance document LAQM.TG4 (00). The predicted reductions in Nitrogen Dioxide concentrations seen above result from the technological improvements that will occur to road vehicles etc.

The diffusion tube data indicates that the annual mean air quality objective for Nitrogen Dioxide of 40$\mu g/m^3$ is unlikely to be achieved in all the above locations with the exception of Queensway in Scunthorpe.

From section 6.47 in the Pollutant Specific Guidance document LAQM.TG4 (00) states-

"For the purposes of the Stage 2 Review & Assessment it may be assumed that the 99.8th percentile of 1 hour mean NO_2 concentrations will not exceed 5 times the predicted annual mean concentrations at background sites, and 3.5 times the predicted annual mean concentrations at roadside / kerbside sites. It is unlikely that the 1 hour mean objective will be exceeded if the annual average objective is not breached, providing that ***road transport*** *is the predominant source of NO_x emissions in the area."*

For all the sites listed in Table 8 road transport is the predominant source of NO_2. From the predicted 2005 Annual Mean NO_2 concentrations the maximum values of the 99.8th percentile at these sites are shown in Table 9.

Table 9 –
Predicted 99.8th Percentile of 1-Hour Mean NO_2 Concentrations ($\mu g/m^3$)

	Site Type	Annual Mean NO_2 Concentrations	99.8th Percentile of 1-Hour Mean NO_2 Concentrations
Britannia Corner, Scunthorpe	Kerbside	49	172
Mary Street, Scunthorpe	Kerbside	47	165
Queensway, Scunthorpe	Kerbside	38	133
Brigg Road, Scunthorpe	Kerbside	45	158
Ashby Road, Scunthorpe	Kerbside	42	147
Manby Road, S. Killingholme	Kerbside	47	165
End Clough Ln, N. Killingholme	Kerbside	41	144

The diffusion tube data indicates that the air quality objective of 99.8th Percentile of 1-Hour Means for Nitrogen Dioxide of 200$\mu g/m^3$ is unlikely to be breached in all these locations.

5.7.2 DMRB Results

Not all roads highlighted as potentially significant sources of Nitrogen Dioxide were included in the diffusion tube network survey. For these additional sites the levels of NO_2 in 2005 have been calculated using the DMRB model found on the Stanger Science and Environment website.

Table 10 –
DMRB Data - Annual Mean NO_2 Concentrations ($\mu g/m^3$)

Road	Distance from receptor to road midpoint (m)	Predicted hourly traffic flow for 2005	Ave. Speed (km/h)	% of HGVs	Back – ground NO_x for 2005 ($\mu g/m^3$)	Predicted Annual Mean NO_2 for 2005 ($\mu g/m^3$)	
						Kerbside	30m
A18 Wrawby Road, Brigg	6	624	61.8	4.1	20	24	19
A18 Kingsway, Scunthorpe	4.25	649	64.8	7.0	30	32	26
A18 Queensway, Scunthorpe	9	638	61.0	12.8	30	33	28
Ashby Road, Scunthorpe	7.25	1099	43.8	3.5	30	31	26
Brigg Road, Scunthorpe	4.6	842	52.3	9.2	30	36	30
Burringham Road, Scunthorpe	4.6	586	51.0	0.9	30	25	21

Using the relationship outlined in section 6.47 of the Pollutant Specific Guidance document LAQM.TG4 (00) the predicted 2005 Annual Mean NO_2 Concentrations are used to predict the maximum likely values of the 99.8th percentile at these sites-

Table 11 –
Predicted 99.8th Percentile of 1-Hour Mean NO_2 Concentrations ($\mu g/m^3$)

	Site Type	Annual Mean NO_2 Concentrations	99.8th Percentile of 1-Hour Mean NO_2 Concentrations
A18 Wrawby Road, Brigg	Kerbside	24	84
A18 Kingsway, Scunthorpe	Kerbside	32	112
A18 Queensway, Scunthorpe	Kerbside	33	116
Ashby Road, Scunthorpe	Kerbside	31	109
Brigg Road, Scunthorpe	Kerbside	36	126
Burringham Road, Scunthorpe	Kerbside	25	88

The DMRB data also indicates that the air quality objective of the 99.8th Percentile of 1-Hour Means for Nitrogen Dioxide of 200$\mu g/m^3$ is unlikely to be breached in all these locations.

5.7.3 Real Time Monitoring

5.7.3.1 Britannia Corner

To further quantify the effect of pollution generated by traffic, in the Oswald Road area a monitoring station was placed at Britannia Corner public conveniences in 1999. (See Appendix 3 for the location.) It was equipped with a continuous NO_x monitor, using the chemiluminesence principle of detection and a PM_{10} monitor using the TEOM method of detection.

Table 12 –
Number of Exceedences Recorded at Britannia Corner

Year	Annual Mean Concentration ($\mu g/m^3$)	No. of Exceedences of 1-Hour Mean Concentration of 200$\mu g/m^3$
2000*	27	0

* February 2000 to August 2000

From the continuous monitoring data the Authority is satisfied that both the Annual Mean and the 99.8th Percentile of 1-Hour Means are unlikely to be exceeded in the year 2005. Unfortunately this contradicts the results obtained from the diffusion tube survey at Britannia Corner. Diffusion tubes are sited much closer to the kerb compared to the continuous monitoring station, accounting for

the discrepancy in concentrations. Diffusion tubes positioned around the continuous monitoring station show a much closer correlation with the continuous monitor, supporting the theory that the difference is caused by position relative to the kerb. Data from these diffusion tubes are listed in Table 13 –

Table 13 –
Diffusion Tube Data - Annual Mean NO_2 Concentrations ($\mu g/m^3$) at Britannia Corner Monitoring Site

	Site Type	Annual Mean Concentration in 2000[1] ($\mu g/m^3$)
Britannia Corner, Scunthorpe (Toilet 1)	Kerbside	25
Britannia Corner, Scunthorpe (Toilet 2)	Kerbside	37
Britannia Corner, Scunthorpe (Toilet 3)	Kerbside	37

[1]Monitoring started March 2000

5.7.4 Consideration of Monitoring and Modelling Together

5.7.4.1 Queensway, Scunthorpe

The DMRB model and data from the diffusion tube show that the Nitrogen Dioxide objectives will not be breached. As both predicted and measured levels of Nitrogen Dioxide in this location are almost equal the results can be considered with confidence.

The 99.8th percentile is significantly below the objective and it is unlikely therefore that pedestrians will be at risk from the short-term effects of NO_2. The residential properties located on Queensway are set back from the pavement posing little risk from the long term effects of NO_2 as it will disperse over distance from the pavement to the dwellings.

The actual annual mean concentration of NO_2 at locations where people will be for extended periods, i.e. at home, will be less than that predicted. There is no need therefore to proceed to a Stage 3 Review & Assessment in respect of Nitrogen Dioxide at this location.

5.7.4.2 Kingsway and Burringham Road, Scunthorpe

The DMRB model indicates that the objectives for Nitrogen Dioxide are unlikely to be breached in this location and a Stage 3 Review & Assessment is unnecessary.

5.7.4.3 Brigg / Station Road, Scunthorpe

The diffusion tube data shows that the Annual Mean Nitrogen Dioxide objective is likely to be breached in the above location whilst the DMRB model predicts the objective will not be breached. Under the circumstances a cautious approach should be adopted. A Stage 3 Review & Assessment will therefore be conducted.

5.7.4.4 Ashby Road, Scunthorpe

The diffusion tube data shows that the Annual Mean Nitrogen Dioxide objective is likely to be breached in the above location whilst the DMRB model predicts the objective will not be breached. Under the circumstances a cautious approach should be adopted, a Stage 3 Review & Assessment will therefore be conducted.

5.7.4.6 Oswald Road / Britannia Corner, Scunthorpe

The predicted annual mean concentration from the diffusion tube at Britannia corner shows that this air quality objective will be breached whilst the data from the continuous monitor indicates that this will not be the case. Again it is best to adopt a cautious approach and conduct a Stage 3 Review & Assessment.

5.7.4.7 Mary Street, Scunthorpe

The diffusion tube data shows that the Annual Mean Nitrogen Dioxide objective is likely to be breached in this location, therefore a Stage 3 Review & Assessment will be conducted.

5.7.4.8 Wrawby Road, Brigg

The DMRB model shows that the Nitrogen Dioxide objectives are unlikely to be breached in this location and so there is no need to proceed to a Stage 3 Review & Assessment.

5.7.4.10 Clough Lane, North Killingholme

The Clough Lane monitoring site is positioned at a T-junction; there are no buildings on either side of the road and few pedestrians, if any. The NO_2 produced here by idling vehicles waiting to turn into Rosper Road is likely to disperse more quickly than if a canyon effect were present. Any NO_2 slow to disperse will not cause long or short-term exposure to the public due to its remote position. It is not necessary therefore to proceed to a Stage 3 Review & Assessment.

5.7.4.2 Manby Road, South Killingholme

The Manby Road monitoring site is in the middle of a dual carriageway; there are only a few buildings on one side of the road and low numbers of pedestrians. The NO_2 produced here by idling vehicles waiting to enter or leave the Calor Gas depot is likely to disperse more quickly than if a canyon effect were present. Any NO_2 slow to disperse will not cause long or short-term exposure to the public due to its position in the central reservation. It is not necessary to proceed to a Stage 3 Review & Assessment in respect of this site.

5.8 Industrial / Commercial Sources

5.8.1 Scunthorpe

Seven Part A processes in Scunthorpe were identified as potential sources of Nitrogen Dioxide in the Stage 1 Review & Assessment. Four of these are related to the Corus Steelworks site, (formerly British Steel). The other three are Edinburgh Oil & Gas, Short Brothers and Bitmac.

5.8.1.1 Corus (British Steel)

The individual authorised processes operating on the Corus site in Scunthorpe with the potential to emit Nitrogen Dioxide are the Coke Ovens, Boiler Plant and Iron & Steel making sections. Together these form an intensively developed industrial area.

The Stage 2 Review & Assessment requires evaluation of the above sources using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS). Due to the high number of stacks under consideration GSS was inappropriate. Multiple source modelling is therefore necessary and will be considered as part of the Stage 3 Review and Assessment of Nitrogen Dioxide.

5.8.1.2 Edinburgh Oil & Gas

Edinburgh Oil & Gas are situated on Crosby Warren. It is a single well operation producing sweet crude oil.

The pollution inventory published on the Internet by the Environment Agency details the total release of Oxides of Nitrogen (NO_X) from the Company was less than 10 tonnes in 1999. This assumes the worst case scenario, i.e. that all Oxides of Nitrogen were in the form of Nitrogen Dioxide and the total release was 10 tonnes in 1999.

Production in 1992 was approximately 120 barrels per day and projections at the time indicated that production would have reached uneconomic levels by 1993/1994. At present the well is still operating but it is assumed it has only a short-term future. Having considered the location of the company, adjacent to Corus, and its potential for closure it is not considered a significant source of Nitrogen Dioxide and shall not be considered further.

5.8.1.3 Heckett Multiserv (Process formerly operated by Short Brothers)

Heckett Multiserv operates a slab slitting process enabling steel slabs to be cut to specialist sizes for Corus. Steel slabs are cut into both single and multi sections providing Corus with a greater product range.

From the pollution inventory published on the Internet by the Environment Agency the total release of Oxides of Nitrogen (NO_X) from the company was less than 10 tonnes in 1999. This assumes the worst case scenario, i.e. that all Oxides of Nitrogen were in the form of Nitrogen Dioxide and the total release was 10 tonnes in 1999. Having considered the proximity of the company to Corus and its polluting potential it is not considered a significant source of Nitrogen Dioxide and shall not be considered further.

5.8.1.4 Koppers UK (Formerly Bitmac)

Koppers UK refines crude tar that is a by-product of the coke ovens operated by Corus. Crude tar is a mixture of hydrocarbons, fine carbonaceous material and water, containing dissolved aluminium chloride, phenols, hydrogen cyanide and hydrogen sulphide. The process produces pitch, light oil, carbolic oil, naphthalene oil, wash oil, anthracene oil and base oil.

From the pollution inventory published on the Internet by the Environment Agency the total release of Oxides of Nitrogen (NO_X) was 17.2 tonnes in 1999. For this assessment the most pessimistic case was considered, in that all Oxides of Nitrogen were in the form of Nitrogen Dioxide. The nomogram in Figure 6.3 of the Pollutant Specific Guidance document LAQM.TG4 (00) requires a stack height of over 10 metres to comply with the Air Quality Objectives for Nitrogen Dioxide. The actual stack height is well in excess of this and consequently this source shall not be considered further.

5.8.2 Killingholme

There are four Part A processes in the Killingholme area identified as potential sources of Nitrogen Dioxide in the Stage 1 Review & Assessment. These include two CCGT power stations operated by Powergen and National Power plus two oil refineries operated by Conoco and Lindsey Oil Refinery.

North Lincolnshire Council has operated an "OPSIS" long path, ultra violet light continuous monitoring device at Killingholme since February 1997. This equipment measures Nitrogen Dioxide concentrations along a 230metre path. (See Appendix 3 for location.) The annual mean and the 99.8th percentile of hourly means recorded are given in Table 14 (See Appendix 2 for graph of yearly data.).

Table 14 –
Nitrogen Dioxide Concentrations at Killingholme

Year	Annual Mean (μg/m^3)	99.8th Percentile of Hourly Means (μg/m^3)
1997[1]	35	125
1998	43	185
1999	33	108
2000[2]	36	117

[1]Monitoring started Feb 1997, [2]Up to Oct 2000

From the above table it can be seen that the annual mean objective for Nitrogen Dioxide (40μg/m^3) has been breached once in four years of monitoring,. this result was distorted over a short period when a maximum hourly mean of 978μg/m^3 was recorded.
The 99.8th percentile of hourly means has never been breached during the period of monitoring.

For completeness the annual mean and the 99.8th percentile concentrations for 1999 have been corrected for 2005 using the method recommended in the Pollutant Specific Guidance document LAQM.TG4 (00) giving values of-

Annual Mean Nitrogen Dioxide concentration…….27μg/m^3
99.8th Percentile of hourly means…….89μg/m^3

The results of applying the methodology recommended in the draft Pollutant Specific Guidance document show that neither objective will be breached in 2005 in Killingholme.

5.8.3 South Ferriby

One of the Part A processes located in North Lincolnshire identified as a potential significant source of Nitrogen Dioxide was the cement works operated by Rugby Cement in South Ferriby.

The impact on the air quality of the surrounding area was calculated using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS).

The variables used in the model are listed below. The production conditions considered for the model were both kilns in operation, each at maximum daily production rate. This would represent the worst case scenario.

Table 15 -
Rugby Cement – Variables Used for GSS

	Annual Mean	**99.8th Percentile**
Met Type	Type 2, East Coast	Type 2, East Coast
Surface Roughness	0.1	0.1
Stack Height (m)	91.4	91.4
Stack Radius (m)	1.35	1.35
Release Temperature, T_{rel} (Kelvins, K)	366	366
Efflux Heat, Q (MW)	11	11
Efflux Momentum, M (m^4/s^2)	2767	2767
Emission Rate (g/sec)	68.2	68.2
Process Contribution ($\mu g/m^3$)	2	67
Distance (m)	1200	850
*2005 Background NO_x ($\mu g/m^3$)	20	20

*See Appendix 5 for map of Background NO_x Concentrations.

The methodology contained in paragraphs 6.51 – 6.53 of LAQM.TG4 (00) provides the following result.

Annual Mean Nitrogen Dioxide concentration…..…….18$\mu g/m^3$
99.8th Percentile of hourly means……...…127$\mu g/m^3$

From the above calculation it can be concluded that the cement works will not breach either the annual or 1 hour objectives. For this source of Nitrogen Dioxide there is no need to proceed to a Stage 3 Review & Assessment.

5.9 Conclusions for Nitrogen Dioxide

From the results of the monitoring and screening exercises in the Stage 2 Review & Assessment a Stage 3 Review & Assessment will need to be conducted for the following locations and processes –

a) The area in the town centre around Britannia Corner, Mary Street and Oswald Road in Scunthorpe.

b) The vicinity of Brigg Road and Station Road in Scunthorpe.

c) Ashby Road in Scunthorpe.

d) Corus (Formerly British Steel) in Scunthorpe.

6.0 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 1956 Clean Air Act 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 100 ppb 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 detailed in the 1997 Strategy and Regulations was 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. As there are 35,040 15-minute periods in a year and 0.1% of these periods can exceed 266$\mu g/m^3$ the number of allowable exceedences in a year is 35.

The revised National Air Quality Strategy sets out two further objectives to be achieved by the end of 2004.

- 350$\mu g/m^3$ (132ppb) measured as a 1-hour mean (allowing up to 24 exceedences per year)
- 125$\mu g/m^3$ (47ppb) measured as a 24-hour mean (allowing up to 3 exceedences per year).

6.4 The National Perspective

Sulphur dioxide emissions have been significantly reduced since the 1960's with national emissions falling by 55% between 1990 and 1997. The main sources of emissions are fossil-fuelled power stations, which in 1996 contributed 62% towards the national total. The U.K. is under obligation to achieve the EC's Air Quality Daughter Directive limit values by the 1st January 2005.

6.6 Conclusions of the Stage 1 Review & Assessment for Sulphur Dioxide

The Stage 1 Review & Assessment concluded that there are significant sources of Sulphur Dioxide from industry in North Lincolnshire. The localities where residential accommodation is likely to be exposed to the greatest concentrations of Sulphur Dioxide are homes adjacent / close to-

a) Part A processes in Scunthorpe, Killingholme and South Ferriby.
b) Part B processes in Scunthorpe and Barton upon Humber.

In North Lincolnshire the only combustion plant >5MWth not included in a Part A or B process is the heating system in Scunthorpe and General Hospital. However as this system is gas fuelled and uses oil only as a standby fuel. In the past year there has been no need to use the oil therefore it shall not be considered further.

Domestic sources of Sulphur Dioxide are not considered significant in any part of North Lincolnshire as there are no residential areas where the number of houses in a 1 km^2 area burning coal or solid smokeless fuels exceeds 300.

Given the above it was decided to carry out a Stage 2 Review & Assessment of Sulphur Dioxide in relation to industrial sources only.

6.7 Stage 2 Review & Assessment

6.8 Scunthorpe Part A Processes

There are six Part A processes in Scunthorpe identified as potential sources of Sulphur Dioxide in the Stage 1 Review & Assessment. Three of these are related to the Corus Steelworks site, (formerly British Steel). The other three are Edinburgh Oil & Gas, Short Brothers and Bitmac.

6.8.1 Corus (British Steel)

The individual authorised processes operating on the Corus site in Scunthorpe with a potential to emit Sulphur Dioxide are the Coke Ovens and Iron & Steel making sections. Together these form an intensively developed industrial area.

The Stage 2 Review & Assessment requires evaluation of the above sources using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS). Due to the high number of stacks under consideration GSS was inappropriate. Multiple source modelling is therefore necessary.

6.8.1.1 Real Time Monitoring

To quantify the effect of pollution generated by Corus and other industries a monitoring station was placed at North Lincolnshire Council's Commercial Services Depot on Cottage Beck Road at the end of 1997. (See Appendix 3 for the location.) It was equipped with a continuous SO_2 monitor, using the chemiluminesence principle of detection and a PM_{10} monitor using the TEOM method of detection. This site is part of the Automated Urban and Rural Network (AURN) and the data from this site can be viewed on the Internet (www.aeat.co.uk/netcen/airqual/). A summary of this data is listed in the Table 16.

Table 16 –
Sulphur Dioxide Concentrations Recorded at Cottage Beck Road

Year	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
1998	25	1	0
1999	18	2	0
2000*	27	1	0

* Up to June 2000

From the continuous monitoring data the Authority is satisfied that the three Air Quality Objectives for Sulphur Dioxide are unlikely to be exceeded in 2004/5. However the potential maximum concentrations of Sulphur Dioxide may not necessarily occur at the monitoring site on Cottage Beck Road.

6.8.1.2 Dispersion Modelling

Records supplied to the Environment Agency by Corus in 1999 include dispersion modelling for Sulphur Dioxide emissions in the vicinity of the Scunthorpe Steelworks. The ADMS 2 model considered sources of Sulphur Dioxide including the Central Power Station, Dawes Lane Coke Ovens, Appleby Coke Ovens, the Heavy Section Mill, the Rod Mill and the Sinter Plant. The ADMS-2 model was used to predict the location of the maximum 15 Minute Mean concentration of Sulphur Dioxide for Low Sulphur Heavy Fuel Oil (HFO) and Heavy Fuel Oil where appropriate. The concentration of Sulphur Dioxide was also predicted at the location of the monitoring site on Cottage Beck Road.
For use of HFO the predicted 15-minute mean concentrations of Sulphur Dioxide from the steelworks were-

99.9th percentile of 15 minute means of Sulphur Dioxide at the peak concentration. ….152μg/m^3
99.9th percentile of 15 minute means of Sulphur Dioxide at Cottage Beck Road monitoring site. ….137μg/m^3

These predicted levels only take account of the emissions from the steelworks.

The estimated annual mean background Sulphur Dioxide concentration for 1996 in Scunthorpe is 16μg/m^3 (Obtained from Netcen via the Internet, see Appendix 4.)

Using the Pollutant Specific Guidance Document LAQM.TG (00) it can be assumed that background annual mean Sulphur Dioxide concentrations at the end of both 2004 and 2005 will be **half of the 1996 value.**

However from section 7.37 of the Pollutant Specific Guidance for assessment of the 15 minute mean objective the predicted 99.9th percentile of 15-minute means from the stacks should be added to **twice the estimated annual mean background concentration.** The predicted 15-minute mean concentrations of Sulphur Dioxide from the use of HFO will be-

99.9th percentile of 15 minute means of Sulphur Dioxide at the peak concentration. ….168μg/m^3
99.9th percentile of 15 minute means of Sulphur Dioxide at Cottage Beck Road monitoring site. ….153μg/m^3

Both of which are well below the 15-minute mean objective of 266μg/m^3.

6.8.2 Edinburgh Oil & Gas

Edinburgh Oil & Gas are situated on Crosby Warren. It is a single well operation producing sweet crude oil.

The pollution inventory published on the Internet by the Environment Agency states that the total release of Sulphur Dioxide was not recorded, it is assumed therefore that the company is not considered a significant emitter of Sulphur Dioxide. Production in 1992 was approximately 120 barrels per day and projections at the time indicated that production would have reached uneconomic levels by 1993/1994. At present the well is still operating but it is assumed it has only a short-term future. Consequently the Authority do not propose to consider the company further.

6.8.3 Heckett Multiserv (Process formerly operated by Short Brothers)

Heckett Multiserv operates a slab slitting process enabling steel slabs to be cut to specialist sizes for Corus. Steel slabs are cut into both single and multi sections providing Corus with a greater product range.

From the pollution inventory published on the Internet by the Environment Agency the total release of Sulphur Dioxide from the company was less than 10 tonnes in 1999. This assumes the worst case scenario, i.e. that the total release was 10 tonnes in 1999. Having considered the proximity of the company to Corus and its polluting potential it is not considered a significant source of Sulphur Dioxide and shall not be considered further.

6.8.4 Koppers UK (Formerly Bitmac)

Koppers UK refines crude tar that is a by-product of the coke ovens operated by Corus. Crude tar is a mixture of hydrocarbons, fine carbonaceous material and water, containing dissolved aluminium chloride, phenols, hydrogen cyanide and hydrogen sulphide. The process produces pitch, light oil, carbolic oil, naphthalene oil, wash oil, anthracene oil and base oil.

From the pollution inventory published on the Internet by the Environment Agency the total release of Sulphur Dioxide was 19.95 tonnes in 1999. The nomogram shown in Figure 7.1 of the Pollutant Specific Guidance document LAQM.TG4 (00) requires a stack height of over 10 metres to comply with the Air Quality Objectives for Sulphur Dioxide. The actual stack height is well in excess of this and consequently this source shall not be considered further.

6.9 Scunthorpe Part B Processes

The Stage 1 Review & Assessment identified one Part B process, Plibrico Ltd., in Scunthorpe with the potential to emit Sulphur Dioxide.

6.9.1 Plibrico Ltd.

Plibrico Ltd. operates a process for the crushing, drying and screening of minerals for packaging as a dry material or a refractory product.

Table 7.2 in the Pollutant Specific Guidance Document LAQM.TG4 (00) extrapolates the average release of Sulphur Dioxide as 2.54 tonnes a year. Guidance for clay processes was used as it was similar to the type of industrial activity carried out by Plibrico.

The nomogram shown in Figure 7.1 of the Pollutant Specific Guidance shows that the approximate stack height of 10 metres and diameter of 0.5 metres will produce an annual emission of 25 tonnes. This is well in excess of the estimated 2.54 tonnes per year and consequently this source need not be considered further since the Air Quality Objectives for Sulphur Dioxide are unlikely to be exceeded.

6.10 Part A Processes in Killingholme

There are four Part A processes in the Killingholme area identified as potential sources of Sulphur Dioxide in the Stage 1 Review & Assessment. These include two CCGT power stations operated by Powergen and National Power plus two oil refineries operated by Conoco and Lindsey Oil Refinery.

A national dispersion modelling exercise of existing Part A processes in the U.K. has been undertaken by NETCEN for the DETR to predict the 99.9th percentile of 15-minute means by the end of 2005. This information can be accessed via the Internet (www.aeat.co.uk/netcen/airqual/). From section 7.12 of the Pollutant Specific Guidance LAQM.TG4 (00) "*For most areas of the U.K., it is recommended that the authority should* ***consider emissions from these Part A processes in further detail*** *if the predicted 99.9th percentile is* ***above 160μg/m^3***."

The 99.9th percentile of 15-minute means by the end of 2005 in the Killingholme area is 250μg/m^3. (See Appendix 5.) This is below the Air Quality Objective of 266μg/m^3 but above 160μg/m^3 therefore these sources will be considered further.

6.10.1 Air Dispersion Modelling of Releases from IPC processes in the Humberside Zone of Industrial Polluting Sources (ZIPS)

The Environment Agency published the above report in March 2000. It considers the contribution to levels of Nitrogen Dioxide and Sulphur Dioxide made by Agency regulated industrial processes (Part A Processes.) in the Humberside region. Included in this are the Part A processes in the area of Killingholme.

The model used by the Environment Agency for this study was ADMS-3. The ADMS-3 model was used to predict both long and short-term concentrations of Sulphur Dioxide. As well as considering industrial sources on the banks of the Humber it also included effects from the coal-fired power stations in the Trent and Aire valleys. It was assumed that the power stations were operating at planned 2005 release limits but that other processes were operating at current release levels.
The differences in concentrations between the model values and the short-term objective of a 15-Minute Mean of 266μg/m^{3}are minimal. The highest concentrations for the long-term objective of a 24-Hour Mean of 125μg/m^3 are approximately 13/14μg/m^3.

The report concluded that currently there is some potential for exceedences of the short-term air quality objective. However it is noted that because of the nature of the model and the sources modelled it represents a worst case scenario which is unlikely to occur. If planned improvements and other likely reductions to

significant industry within and around the ZIPS were considered and evaluated in the model the maximum concentration would be reduced.

From the above information it can be seen that the Air Quality Objectives for Sulphur Dioxide are likely to be achieved by 2004/5.

Therefore a Stage 3 Review & Assessment for the sources of Sulphur Dioxide in the Killingholme area will not be necessary.

6.11 Part A Processes in South Ferriby

6.11.1 Rugby Cement

One of the Part A processes located in North Lincolnshire identified as a potential significant source of Sulphur Dioxide was the cement works operated by Rugby Cement in South Ferriby.

The impact on the air quality of the surrounding area was calculated using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS).

The variables used in the model are listed below. The production conditions considered for the model were both kilns in operation, each at maximum daily production rate. This would represent the worst case scenario.

Table 17 -
Rugby Cement – Variables Used for GSS

	Annual Mean	**99.9th Percentile**
Met Type	Type 2, East Coast	Type 2, East Coast
Surface Roughness	0.1	0.1
Stack Height (m)	91.4	91.4
Stack Radius (m)	1.35	1.35
Release Temperature, T_{rel} (Kelvins, K)	366	366
Efflux Heat, Q (MW)	11	11
Efflux Momentum, M (m^4/s^2)	2767	2767
Emission Rate (g/sec)	79.7	79.7
Process Contribution ($\mu g/m^3$)	2	84
Distance (m)	1200	850
*2004/5 Background SO_2 ($\mu g/m^3$)	16	16

*See Appendix 5 for map of Background SO_2 Concentrations.

Using the methodology contained in paragraphs 7.35 – 7.37 of the Pollutant Specific Guidance LAQM.TG4 (00) the maximum predicted Sulphur Dioxide concentrations arising from the cement works are-

99.9th Percentile of 15 minute means……..……...130μg/m3
99.7th Percentile of hourly means…….……86μg/m3
99th Percentile of 24 hour means……. 28μg/m3

From the above calculation the Authority is satisfied that the cement works will not breach any of the Air Quality Objectives for Sulphur Dioxide. For this source of Sulphur Dioxide there is no need to proceed to a Stage 3 review & Assessment.

6.12 Part B Processes in Barton upon Humber

6.12.1 William Blyth, Hoe Hill Works & Ings Lane Tileries

Both the Hoe Hill works and the Ings Lane Tileries operate processes for the manufacture of heavy clay and refractory products.

From Table 7.2 in the Pollutant Specific Guidance Document LAQM.TG4 (00) the average release of Sulphur Dioxide is 2.54 tonnes a year for clay processes. The nomogram shown in Figure 7.1 of the Pollutant Specific Guidance shows that the approximate stack height of 10 metres and diameter of 0.5 metres will produce an annual emission of 25 tonnes from the Hoe Hill Works. The approximate stack height of 10 metres and diameter of 0.5 metres will produce an annual emission of 25 tonnes from the Ings Lane Tileries. Both of these are well in excess of the estimated 2.54 tonnes per year so this source shall not be considered further since the Air Quality Objectives for Sulphur Dioxide is very unlikely to be exceeded.

6.13 Conclusions for Sulphur Dioxide

From the information presented in the Stage 2 Review & Assessment the Air Quality Objectives for Sulphur Dioxide are likely to be achieved within the specified time limits in all areas.

Therefore it is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of Sulphur Dioxide.

7.0 Review & Assessment of Carbon Monoxide (CO)

7.1 Introduction

Carbon Monoxide is produced by the incomplete combustion of fossil fuels or organic compounds that contain carbon. The principal source of Carbon Monoxide in the U.K. is currently road traffic, accounting for 75% in 1997. The greatest concentrations of Carbon Monoxide are found by busy roads or in enclosed spaces, for example multi-storey car parks.

7.2 The Health Effects of Carbon Monoxide

Carbon Monoxide is colourless and odourless and can be inhaled without giving any warning to the recipient. In large enough concentrations Carbon Monoxide can kill. It does so by substituting itself for oxygen in the blood and also by blocking essential biochemical reactions in cells.
People with existing blood flow problems are likely to be at particular risk if exposed to Carbon Monoxide. Lower levels can cause breathlessness and impair mental abilities.

7.3 Air Quality Objective for Carbon Monoxide

The objective for Carbon Monoxide contained in the 1997 Strategy and Air Quality Regulations was 11.6mg/m^3 (10ppm) when measured as a running 8-hour mean. This was to be achieved by 2005.

The National Air Quality Strategy (NAQS) proposed a new objective of 11.6mg/m^3, measured as a running 8-hour mean to be achieved by December 2003. This objective is included in the Air Quality (England) Regulations 2000.

7.4 The National Perspective

In 1997 petrol fuelled vehicles accounted for 71% of the total emissions and 95% of the road traffic emissions in the U.K. In comparison diesel fuelled vehicles contributed only 3% of the total emissions. Emissions of Carbon Monoxide have been declining since 1990 and fell by 33% in 1990 and 1997. It is expected that existing national policies will achieve the national air quality objective for Carbon Monoxide by 31st December 2003, as proposed in the NAQS.

7.5 Conclusions of the Stage 1 Review & Assessment for Carbon Monoxide

The Stage 1 Review & Assessment concluded that there are significant sources of Carbon Monoxide from industry in North Lincolnshire. These sources are-

- Part A processes in Scunthorpe.

It was decided to carry out a Stage 2 Review & Assessment of Carbon Monoxide.

7.6 Stage 2 Review & Assessment

The Stage 1 Review & Assessment of the above sites was carried out prior to publication of the Pollutant Specific Guidance LAQM.TG4 (00). The number and location of the sites identified is valid but requires further screening to be carried out before commencing with the Stage 2 Review & Assessment proper.

7.7 Industrial Sources in Scunthorpe

There are three Part A processes in Scunthorpe identified as potential sources of Carbon Monoxide in the Stage 1 Review & Assessment. Two of the Part A processes are related to the Corus Steelworks (formerly British Steel). The other process is Short Brothers.

7.7.1 Corus (British Steel)

The individual authorised processes operating on the Corus site in Scunthorpe with the potential to emit Carbon Monoxide is the Iron & Steel making sections.

The impact on the air quality of the surrounding area was calculated using the Environment Agency's "Guidance For Estimating The Air Quality Impact Of Stationary Sources" (GSS). The variables used in the model are listed below.

Table 18 -
Corus – Variables Used for GSS

	100th Percentile of 1-hour averages from the Iron & Steel Making Section	**100th Percentile of 1-hour averages from the Rod Mill**
Met Type	Type 2, East Coast	Type 2, East Coast
Surface Roughness	1	1
Stack Height (m)	107	69.4
Stack Radius (m)	3.2	1.45
Release Temperature, T_{rel} (Kelvins, K)	433	763
Efflux Heat, Q (MW)	74	14
Efflux Momentum, M (m^4/s^2)	7751	245
Emission Rate (g/sec)	4380	1.36
Process Contribution (mg/m^3)	3.29	0.004
Distance (m)	750	350
*2003 Background CO (mg/m^3)	0.42	0.42

*See Appendix 4 for map of Background CO Concentrations.

The temporal statistic of the Air Quality Objective for Carbon Monoxide is a running 8-hour mean. Using the methodology contained in chapter 4 of the Guidance for Estimating the Air Quality Impact of Stationary Sources the 100th percentile of 1-hour averages has been converted to a running 8-hour mean giving -

Iron & Steel Making Section 8-hour running mean……2.3mg/m^3
Rod Mill 8-hour running mean……..0.003mg/m^3

Taking a conservative approach as suggested in the Pollutant Specific Guidance LAQM.TG4 (00) the maximum 8-hour running mean is the sum from both sources added to the predicted 2003 annual mean background concentration.

Maximum 8-hour running mean concentration in 2003……2.7mg/m^3

This is approximately a quarter of the Air Quality Objective for Carbon Monoxide of 11.6mg/m^3 therefore this source of Carbon Monoxide shall not be considered further.

7.7.2 Heckett Multiserv (Process formerly operated by Short Brothers)

Heckett Multiserv operates a slab slitting process enabling steel slabs to be cut to specialist sizes for Corus. Steel slabs are cut into both single and multi sections providing Corus with a greater product range.

From the pollution inventory published on the Internet by the Environment Agency the total release of Carbon Monoxide was less than 10 tonnes in 1999. Considering the proximity of the company to Corus it is not a significant source of Carbon Monoxide and so it shall not be considered further.

7.8 Conclusions for Carbon Monoxide

From the information presented in the Stage 2 Review & Assessment the Air Quality Objective for Carbon Monoxide is very unlikely to be exceeded.

Therefore it is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of Carbon Monoxide.

8.0 Review & Assessment of Benzene

8.1 Introduction

Benzene (C_6H_6) is an aromatic volatile organic compound (VOC) and is a minor constituent of petrol (approx. 2% by volume). The main source of Benzene emissions to the atmosphere is from the distribution and combustion of petrol. Combustion of petrol used in vehicles is the greatest single source accounting for approximately 65% of total emissions. 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.

8.2 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 leukaemia and other cancers. Persistent exposure to high concentrations also causes damage to bone marrow and neurotoxic symptoms.

8.3 Air Quality Objective for Benzene

The Air Quality Objective for Benzene included in the 1997 Strategy and Air Quality Regulations was 16.25$\mu g/m^3$ (5ppb), measured as a running annual mean to be achieved by 2005.

The recent National Air Quality Strategy (NAQS) also proposed a running annual mean of 16.25$\mu g/m^3$ but brought forward the compliance date to the end of 2003. This is included in the Air Quality (England) Regulations 2000.

8.4 The National Perspective

Existing national policies are expected to deliver the Air Quality Objective for Benzene by the end of 2003. Data contained in the annex of the Air Quality Strategy consultation document indicates that the 16.25$\mu g/m^3$ objective will be achieved at the road side of all major roads in the U.K. by 2003 (paragraph A.34). For this reason the Review & Assessment for Benzene shall concentrate on industrial sources.

8.5 Conclusions of the Stage 1 Review & Assessment for Benzene

The Stage 1 Review & Assessment concluded that there are significant sources of Benzene from industry in North Lincolnshire. The localities where residential accommodation is likely to be exposed to the greatest concentrations of Benzene are-

a) North and South Killingholme due to the presence of two oil refineries, Lindsey Oil Refinery (LOR) and Conoco, and a number of potential nearby sources of Benzene in the neighbouring authority of North East Lincolnshire.
b) Scunthorpe at the nearest residential properties to Bitmac and the Corus (formally British Steel) Coke Ovens.

It was decided to carry out a Stage 2 Review & Assessment of Benzene.

8.6 Stage 2 Review & Assessment

Assessment of the identified sites has been carried out both by monitoring, using diffusion tubes and an "OPSIS" long path, ultra violet light continuous monitor and by calculation. For the calculations the Pollutant Specific Guidance Document LAQM.TG (00) has been used.

8.7 North & South Killingholme

8.7.1 Diffusion Tube Monitoring Results

Listed in Table 19 are the results from the diffusion tube monitoring carried out in the Killingholme area from August 1998 to July 1999 (A map showing their locations can be found in Appendix 3 and the full results in Appendix 1).

Table 19 -
Diffusion Tube Data – Annual Mean Benzene Concentrations ($\mu g/m^3$)

Location	Annual Mean Concentration ($\mu g/m^3$)	Running Annual Mean Concentration ($\mu g/m^3$)
Top Road, East Halton	0.12	0.14
Clough Road, N. Killingholme	0.12	0.14
Station Road, S. Killingholme	0.22	0.24
Rosper Road, S. Killingholme	0.18	0.20
Church Lane, N. Killingholme	0.12	0.14
Staple Road, S. Killingholme	0.09	0.10
Humber Road, S. Killingholme	0.18	0.20
Homestead Park, Immingham	0.09	0.10
St. Andrews Court, Immingham	0.09	0.10
Baptist Chapel Lane, S. Killingholme	0.09	0.10

The Running Annual Mean Concentrations have been calculated using the method given in paragraph 3.19 in the Pollutant Specific Guidance Document LAQM.TG (00).

The diffusion tube data indicates that the Air Quality Objective for Benzene of 16.25μg/m^3 expressed as a Running Annual Mean is likely to be achieved by 2003

8.7.2 Real Time Monitoring

8.7.2.1 South Killingholme

To further quantify and support the information gained from the diffusion tube survey of Benzene this review considered the data from the "OPSIS" monitor located at South Killingholme since February 1997(See Appendix 3 for the location.). The equipment measures Benzene concentrations along a 230metre path The annual means and calculated maximum running annual means are given in Table 20 (See Appendix 2 for graphs of yearly data.).

Table 20 -
Benzene Concentrations at South Killingholme

Year	Annual Mean Concentration (μg/m^3)	Running Annual Mean Concentration (μg/m^3)
1997	6.8	7.5
1998	9.9	10.9
1999	8.2	9.0
2000[1]	7.2	7.9

[1]Up to October.

The above data shows much higher concentrations than that measured by the diffusion tube survey. However taking the most cautious approach and considering the "OPSIS" data to be the most accurate it can be seen that the Air Quality Objective of 16.25μg/m^3 expressed as a Running Annual Mean is very unlikely to be breached. Therefore it will not be necessary to proceed with a Stage 3 Review & Assessment for Benzene in this location.

8.8 Scunthorpe

There are two Part A processes in Scunthorpe identified as potential sources of Benzene in the Stage 1 Review & Assessment. These are Corus (formerly British Steel) Coke Ovens, and Bitmac.

8.8.1 Corus Coke Ovens

In order to assess the potential significance of Benzene emissions from the six coke oven stacks the details listed in Table 21 were considered. From data available on the stack dimensions and the maximum yearly emissions it is unlikely that the Air Quality Objective for Benzene will be breached. The

emissions have been calculated using the nomogram in Figure 3.1 in the Pollutant Specific Guidance LAQM.TG (00).

Table 21 -
Corus Coke Oven Plant – Stack Emission Data

		Stack Dia. (m)	Stack Height, U_{ACT} (m)	Height of Tallest Building Within 5 Stack Heights, H (m)	Effective Stack Height, U_{EFF} (m)	Maximum Emission Allowed (t/year)
Dawes Lane	Main Stack	3.35	76.0	49.3	44	25
	Ammonia Inc.	1.75	56.0	-	56	25
	Flare Stack	1.0	76.0	-	76	45
Appleby	1&2 Batteries	3.0	74.2	30	73	45
	3&4 Batteries	3.0	74.2	-	74	45
	Flare Stack	1.0	47.7	21	44	15

Where applicable the effective stack height (U_{EFF}) has been calculated to compensate for the effects of adjacent buildings.
From the pollution inventory published on the Internet by the Environment Agency the total release of Benzene was 28 tonnes in 1999. Whilst the total exceeds the individual allowable emission listed in the table above the 28 tonnes of Benzene was a combination of the individual releases from each stack. It is unlikely that these individual releases would exceed the allowable emissions hence the Air Quality Objective for Benzene will not be exceeded in 2003. Benzene emissions from the coke ovens will therefore not be considered further.

8.8.2 Koppers UK (Formerly Bitmac)

The process at Koppers UK refines crude tar that is a by-product of the coke ovens operated by Corus.
From the pollution inventory published on the Internet by the Environment Agency the total release of Benzene was 1.8 tonnes in 1999. The nomogram shown in Figure 3.1 of the Pollutant Specific Guidance Document LAQM.TG4 (00) shows a required stack height of over 10 metres is needed to comply with the Air Quality Objectives for Benzene. As the actual stack height is well in excess of this, this source shall not be considered further.

8.9 Conclusions for Benzene

From the information presented in the Stage 2 Review & Assessment the Air Quality Objective for Benzene is currently being met and there is no reason why this will not be the case at the end of 2003.

In conclusion there is no need to progress to a Stage 3 Review & Assessment in respect of Benzene.

9.0 Review & Assessment of 1,3-Butadiene (C_4H_6)

9.1 Introduction

Like Benzene 1,3-Butadiene is a Volatile Organic Compound (VOC) usually emitted to the atmosphere by the combustion of petrol and diesel fuel It is not a constituent part of the fuel but is produced by the combustion of olefins that are present in the fuel.
1,3-Butadiene is also used in industry, for example in the manufacture of synthetic rubber, notwithstanding locations in close proximity to such processes the major source of 1,3-Butadiene is from vehicles.

9.2 The Health Effects of 1,3-Butadiene

Short-term exposure to high concentrations of 1,3-Butadiene (several million ppb) can cause irritation of the eyes, nose, throat and skin. Other disorders include diseases of the blood and nervous system.
Long-term exposure at much lower concentrations is by far the greatest concern in the U.K. This can increase the chance of cancers of the lymphoid system and blood forming tissues, lymphomas and leukaemia.

9.3 Air Quality Objective for 1,3-Butadiene

The Objective to be achieved by 2005 in the 1997 Strategy and Air Quality Regulations was 2.25$\mu g/m^3$ (1ppb) measured as a running annual mean. The National Air Quality Strategy (NAQS) proposed a revised deadline of December 2003 to achieve the objective of 2.25$\mu g/m^3$ (1ppb), measured as a running annual mean. . This new objective is included in the Air Quality (England) Regulations 2000.

9.4 The National Perspective

Current national policies in the U.K. expected to achieve the air quality objective for 1,3-Butadiene in 2005. The technical annex of the Air Quality Strategy consultation document shows that in the U.K. the 2.25 $\mu g/m^3$ running annual mean concentration will be achieved adjacent to all roads and at urban and background locations by 2003.

9.5 Conclusions of the Stage 1 Review & Assessment for 1,3-Butadiene

The Stage 1 Review & Assessment concluded that whilst it is unlikely that concentrations of 1,3-Butadiene will breach the Air Quality Objectives in North Lincolnshire the following potentially significant sources exist

- Part A processes in Scunthorpe and Killingholme.

It was decided to carry out a Stage 2 Review & Assessment of 1,3-Butadiene.

9.6 Stage 2 Review & Assessment

The Stage 1 Review & Assessment of the above sites was carried out before the publication of the Pollutant Specific Guidance LAQM.TG4 (00). The number and location of the sites identified is still valid but a further screening process is required prior to commencing with the Stage 2 Review & Assessment proper.

9.7 Industrial Sources in Scunthorpe

There are two Part A processes in Scunthorpe identified as potential sources of 1,3-Butadiene in the Stage 1 Review & Assessment. One is the Coke Ovens operated by Corus (formerly British Steel) and the other process is Edinburgh Oil & Gas.

9.7.1 Corus Coke Ovens and Edinburgh Oil & Gas

The pollution inventory published on the Internet by the Environment Agency contains no value for the total release of 1,3-Butadiene from any of the above sources. It is assumed therefore that they are not significant emitters of 1,3-Butadiene and shall not be considered further.

9.8 Industrial Sources in Killingholme

There are two oil refineries, Lindsey Oil Refinery (LOR) and Conoco of which both have the potential to emit 1,3-Butadiene.

9.8.1 Dispersion Modelling

Records supplied to the Environment Agency by the refineries in 2000 included dispersion modelling for 1,3-Butadiene emissions in the vicinity of the Killingholme refineries.

9.8.1.1 Lindsey Oil Refinery

The report produced for Lindsey Oil Refinery states that:

"*Sources of 1,3-Butadiene are not sufficiently well identified to allow them to be modelled. Lindsey Oil Refinery indicate that 0.95 tonnes per year are released from the site, compared to an estimated fugitive emission of 57 tonnes per year of Benzene. Modelling of Benzene releases explicitly indicates that the Benzene*

levels will be less than 10% of the air quality guideline. The air quality standard for 1,3-Butadiene is a factor of 7 more stringent than that for Benzene; however emissions of 1,3-Butadiene are a factor of 60 lower than Benzene. It is therefore expected that 1,3-Butadiene concentrations will be well within the Air Quality Objective."

9.8.1.2 Conoco Oil Refinery

The model used by Conoco Oil Refinery for the study was AERMOD. The model was used to predict the annual mean concentration of 1,3-Butadiene.

The modelling results indicate a maximum contribution from the refinery to the annual mean concentration of 0.001μg/m^3. Using the methodology in the Pollutant Specific Guidance LAQM.TG4 (00) this is equivalent to a maximum running annual mean of only 0.0011μg/m^3. Combining this with the predicted 2003 background concentration of 1,3-Butadiene, using the methodology in the Pollutant Specific Guidance, the total is 0.085μg/m^3.
2003 background concentrations are derived from the 1996 background map published on the internet by NETCEN (See Appendix 4.)

9.8.2 Combining the Predicted Emissions from the Refineries

Emissions of 1,3-Butadiene from the refineries are extremely low, even if the two sources combined it is still unlikely that the maximum annual mean concentration would exceed 2.25μg/m^3. Therefore these sources shall not be considered further.

9.9 Conclusions for 1,3-Butadiene

From the information presented in the Stage 2 Review & Assessment the Air Quality Objective for 1,3-Butadiene is very unlikely to be exceeded.

It is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of 1,3-Butadiene.

10.0 Review & Assessment of Lead (Pb)

10.1 Introduction

Lead (Pb) has many industrial applications either in its elemental form or in alloys or compounds. It is the most widely used of the non-ferrous metals. The largest use of lead is in the manufacture of batteries and it is also used as a pigment in paints and glazes. Lead is added to petrol as the compound tetraethyl lead to increase the octane rating although this is now very uncommon because of the rapidly increased use of unleaded petrol in the last decade.

10.2 The Health Effects of Lead

Lead is a cumulative poison to the central nervous system. In children it can cause behavioural problems and mental retardation and there is some evidence it can affect the kidneys, joints and blood pressure in adults.

10.3 Air Quality Objective for Lead

The objective for Lead included in the 1997 strategy was 0.5$\mu g/m^3$ measured as a running annual mean to be achieved by 2005. The National Air Quality Strategy proposed the following new objective

- 0.5$\mu g/m^3$ measured as an annual mean to be achieved by 31st December 2004
- 0.25$\mu g/m^3$ measured as an annual mean to be achieved by 31st December 2008.

10.4 The National Perspective

In 1997 it was concluded that the increasing use of unleaded petrol would result in a reduction in emissions from petrol vehicles of approximately 80% by the end of 2005 when compared to 1995 levels. This would produce concentrations of approximately 0.1-0.2$\mu g/m^3$ in most urban areas. The ban on sales of leaded petrol in January 2000 should ensure that the annual mean concentrations of lead are well below the Air Quality Objective by 2004.

10.5 Conclusions of the Stage 1 Review & Assessment for Lead

The Stage 1 Review & Assessment identified the potential sources of Lead from industry in North Lincolnshire as

- Part A processes in Scunthorpe and Killingholme.

- Part B processes in Scunthorpe

It was decided to carry out a Stage 2 Review & Assessment of Lead with respect to the two oil refineries and Corus.

10.6 Stage 2 Review & Assessment

10.7 Industrial Sources in Scunthorpe

The Part A processes identified in Scunthorpe are Corus (formerly British Steel) where leaded steels are produced and Edinburgh Oil and Gas. The latter does not use lead and shall not be considered further. The Part B processes identified in Scunthorpe are Ductile Castings, Firth Rixson Castings and Caparo Merchant Bar however since they do not produce emissions to air they shall not be considered further.

10.7.1 Corus (British Steel)

The Stage 1 Review & Assessment of the sites considered was carried out before the publication of the Pollutant Specific Guidance LAQM.TG4 (00). The number and location of the sites identified is still valid but there is a further screening process required prior to commencing with the Stage 2 Review & Assessment proper.
From the pollution inventory published on the Internet by the Environment Agency the total release of Lead to air was less than 5.4 tonnes in 1999. The nomogram shown in Figure 5.1 of the Pollutant Specific Guidance document LAQM.TG4 (00) shows a stack height of approximately 70 metres is needed to comply with the Air Quality Objectives for Lead. As the actual height of the Sinter Plant Main Stack is 107metres and 2.5 times taller than the tallest adjacent building this source shall not be considered further.

10.8 Industrial Sources in Killingholme

The two Part A processes in Killingholme are Conoco and Lindsey Oil Refinery. The refineries used to add the compound tetraethyl lead to petrol to enhance the octane rating. With the withdrawal of leaded fuels this practise has ceased and so these sources shall not be considered further.

10.9 Conclusions for Lead

From the information presented in the Stage 2 Review & Assessment the Air Quality Objectives for Lead are very unlikely to be exceeded.

Therefore it is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of Lead.

11.0 Planned Industrial Developments

Sites identified in the Stage 1 Review & Assessment as under proposition of construction will be evaluated to assess their potential impact on the air quality in North Lincolnshire. The proposed processes are:

- Keadby II Power Station
- Ravensthorpe Power Station
- Humber International Terminal, Immingham
- New Gas Fired Power Station, South Killingholme
- Lysaghts Enterprise Park
- Municipal Waste Incinerator, Goole

In addition to the processes identified in the Stage 1 Review & Assessment an additional site has been proposed for industrial development, namely: -

- Rugby Cement Combined Heat and Power plant, South Ferriby

11.1 Keadby II Power Station

Keadby is currently the site of a 680 MW Combined Cycle Gas Turbine (CCGT) power station and it is proposed to construct a further unit at the same site. It has not been considered in the main body of the Stage 2 Review & Assessment since its position means that emissions are unlikely to occur in a relevant location. It shall be considered briefly here for completeness. For the purposes of this assessment the worst case scenario has been considered i.e. operation the same as the current power station. This can be assumed because with advances in technology the new power station is likely to be considerably cleaner than the current process. The main pollutants emitted from this type of process are Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NO_x). The estimated emission quantities taken from the Keadby 1 Environmental Statement are in Table 22. and relate to the use of distillate fuel.

Table 22 –
Predicted emissions from Keadby II CCGT Power Station

Stack Height	80m
Efflux Velocity	25m/s
Stack Exit Temperature	413K
Exhaust Volumetric Flow	2409819m^3/hr
SO_2 Rate	0.042kg/s
NO_x Rate	0.080kg/s

Using the methodology from the Pollutant Specific Guidance LAQM.TG4 (00) the above figures give the following emission rates:

Sulphur Dioxide Emission Rate……1324.5 Tonnes/Year
Nitrogen Dioxide Emission Rate……...2522 Tonnes/Year

Compared with the annual allowances for Sulphur Dioxide and Nitrogen Dioxide of 1350 and 1800 Tonnes/Year respectively it can be seen that whilst the Sulphur Dioxide Level is within the annual limit it will be necessary to consider Nitrogen Dioxide further.

Using the process figures stated in Table 22 and the procedure in the Guidance for Estimating the Air Quality Impact of Stationary Sources (GSS), the normalised ground level concentration (NGLC) for distance from stack and process contribution of Nitrogen Dioxide can be calculated. The results of this method can be seen below:

	Annual Mean	**99.9th percentile**
Process Contribution	0.88$\mu g/m^3$	32$\mu g/m^3$
Distance From Source	1320m	1200m

Assuming the 2005 background concentration of NO_x to be 30$\mu g/m^3$, the effect of the process will be to raise this concentration to 31$\mu g/m^3$. Using the methodology contained in paragraphs 6.51 – 6.53 of the Pollutant Specific Guidance LAQM.TG4 (00) the maximum impact of the process is:

Annual Mean Nitrogen Dioxide concentration……19$\mu g/m^3$
99.8th Percentile of Hourly Means……90$\mu g/m^3$

From the above calculation it can be seen that the power station will not breach either the annual or 1 hour objectives, even considering the worst case scenario of both power stations having their highest pollutant concentrations in the same place at the same time. For this source of Nitrogen Dioxide there is no need to proceed to a Stage 3 Review & Assessment.

11.2 Ravensthorpe Power Station

AAB Energy Development Ltd proposes to build a 450 MW power station on land adjacent to the Corus (British Steel) Scunthorpe site. The station will produce Electricity through the combustion of natural gas.
The combustion of natural gas is liable to produce quantities of Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}).
For the purpose of this review Carbon Monoxide and PM_{10} have been discounted, as the combustion in modern processes is more complete due to an excess of air, thus reducing emissions

As there is no information available relating to the emissions or layout of this plant, it is assumed that the site is a scaled version of other Combined Cycle Gas Turbine Power stations in the area.
The site is the smallest proposed CCGT station in the area, $^2/_3$ the size of Keadby II power station and 64% the size of the proposed Conoco development. It is estimated that emissions will be similarly lower then the corresponding larger developments. Predictions indicate that the larger sites will not have a detrimental effect on the quality of air in the region, and consequently the impact of this smaller site is not expected to significantly affect the overall air quality in the region.

From the available information on this site a further review at stage three will not be necessary due to its small size, relative to other sites in the region. It is not expected to produce disproportionately large volumes of specified substances.

11.3 Humber International Terminal, Immingham

This site is to be constructed primarily for the loading and unloading of tanker vessels with oil and gas products by the Conoco and Lindsey Oil Refineries. The loading and unloading of oil and petrochemicals produces a potential for the release to atmosphere of all seven specified substances.

The potential for the release of these substances is, however, minimised as associated British Ports are planning to retrofit all existing loading and unloading platforms with vapour recovery equipment. It is expected that this process will be extended to the new facility thus drastically reducing the potential for vapour release to atmosphere. The planned location for the terminal is remote thus the contribution to ambient levels of specified substances is not likely to be significant and further consideration of this site is not required.

11.4 Gas Fired Power Station, South Killingholme

It is proposed that a 700 MW power station be built by Conoco on land adjacent to the Conoco refinery at South Killingholme. The station will produce Electricity through the combustion of natural gas and refinery off-gas. Processes that operate by the combustion of gas are liable to produce quantities of Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide and Particulate Matter (PM_{10}). For the purpose of this review Carbon Monoxide and PM_{10} will again be discounted due to efficiencies with modern combustion. An estimation of the potential quantities of Sulphur Dioxide and Nitrogen Dioxide from the Conoco Environmental Statement calculations can be seen in Tables 23 and 24:

Table 23 -
Potential NO_2 Emissions from South Killingholme Power Station

Ambient NO_2 levels in the South Killingholme area.	20μg/m^3
Worst case NO_2 Annual Mean (Using Refinery Off-Gas).	1.28μg/m^3 (at 1166m)
NO_2 Hourly Mean (Worst case + Ambient)	21.28μg/m^3

All SO_2 values quoted relate to the use of refinery off-gas. The use of natural gas will produce negligible emissions of SO_2.

Table 24 -
Potential SO_2 Emissions from South Killingholme Power Station

1-Hour Mean Concentration	28.23μg/m^3 (at 762metres)
24-Hour Mean Concentration	13.32μg/m^3 (at 1044metres)
15-Minute Mean Concentration	33.88μg/m^3 (at 762metres)

As all of the above values are within the concentration objectives it will not be necessary to continue to a stage three review for the Conoco South Killingholme Refinery Power Station.

11.5 Lysaghts Enterprise Park

Whilst this site was identified in the Stage 1 Review & Assessment as potentially detrimental to air quality, it is unlikely to have a large impact as mainly light industry will be attracted to the site which is not generally heavily polluting. The main impact from the site is likely to be the increase in traffic in the area and whilst some polluting industries may relocate in the future the impact on the overall air quality is likely to be minimal.
Due to the unlikely potential for the detrimental affect on air quality further assessment of this site is not necessary.

11.6 Energy from Waste Plant (EFW), Goole

The proposed EFW plant in Goole is liable to give rise to varying quantities of Carbon Monoxide, Sulphur Dioxide, Nitrogen Dioxide and PM_{10} due to the variation of waste in the feed stock for the furnace. It is not envisaged that these emissions will have a great detrimental effect on the quality of air in North Lincolnshire due to the following points:

a) The prevailing wind is likely to carry any emissions away from the region on most occasions.

b) The area likely to be most affected by the proposed incinerator is largely rural with relatively little industry and as such is more able to buffer the effects of the emissions.
c) Although the distance of the EFW plant from the border of North Lincolnshire is small, emissions entering the region will be largely diluted and well dispersed before reaching areas where people are likely to be exposed for a relevant period of time. Therefore the impact of the pollutants will be reduced to a negligible amount.

For these reasons it is unlikely that this development will need any further consideration in a Stage Three Review & Assessment.

11.7 Rugby Cement Combined Heat and Power plant, South Ferriby

Rugby Cement are proposing to build a 13.8 MW gas fired combined heat and power station to provide electricity and drying heat for the South Ferriby Works. Figures required for calculating pollutants for the site are all taken from the environmental report submitted by Viridian Power Resources on behalf of Rugby Cement. The main pollutants from this development are Carbon Monoxide and Nitrogen Dioxide and their estimated impact can be seen below.

Table 25 -
Predicted Emissions from Rugby Cement Combined Heat and Power Plant

Stack Height	49m
Flue Diameter (4/stack)	0.915m
Effective Flue Diameter	1.83m
NO_X Emission Rate	5.8g/s
CO Emission Rate	18.7g/s

Using these figures the following annual emission rates can be calculated:

NO_x Emission Rate…….183tonnes/year
CO Emission Rate……..589tonnes/year

Following the methodology in the Pollutant Specific Guidance LAQM.TG4 (00) the annual allowances for CO and NO_x are:

NO_x Allowable Emission Rate…….250tonnes/year
CO Allowable Emission Rate…….4000tonnes/year

It can be seen from these figures that both pollutants are within the annual allowances so the process will not require further consideration. The power station will also produce some of the heat required by other parts of the process

and consequently there will be a corresponding reduction in emissions from those parts of the site, further reducing the overall impact of the plant

11.8 Conclusions for Planned Developments

From the results of the screening exercises in the Stage 2 Review & Assessment it is unlikely that the Air Quality Objectives will be breached due to future developments.

In conclusion there is no need to progress to a Stage 3 Review & Assessment in respect of Planned Developments.

12.0 Pollutant Sources Outside of North Lincolnshire

12.1 Introduction

The Stage 1 Review & Assessment identified over seventy Part A and Part B processes outside of North Lincolnshire which could impact on the air quality within North Lincolnshire. Most of these are situated on the banks of the Humber Estuary in or near to Hull or Grimsby.

Since the Stage 1 Review & Assessment was written the Pollutant Specific Guidance LAQM.TG4 (00) has been published. It states that for Benzene, Lead, 1,3-Butadiene and PM_{10} emissions from stacks should only be considered where they are within 5km, and for 1km for fugitive emissions. Stack emissions for Carbon Monoxide, Sulphur Dioxide and Nitrogen Dioxide should be considered within 15k. Processes situated further from the boundaries of North Lincolnshire than that detailed above are not considered significant and will not be considered further in respect of that pollutant.

In relation to Part A processes if no releases are reported in the Emission Inventory published by the Environment Agency or the releases are below release threshold (BRT), the process is not considered to be a significant source of that pollutant.

Table 26 -
Release Thresholds

PM_{10}	<1t
Nitrogen Dioxide	<10t
Sulphur Dioxide	<10t
Carbon Monoxide	<10t
Benzene	<100kg
1,3-Butadiene	<100kg
Lead	<20kg

12.2 Part A Processes

In Table 27 the Part A processes identified in the Stage 1 Review & Assessment that are less than 15km from Authority boundary are listed with their approximate distance from North Lincolnshire and the emission details. These details are used to determine if they are a significant source of each pollutant.

Table 27 -
Part A Processes in Adjacent Local Authority Areas

Company	Process	Distance From NLC Boundary	Potential Releases above BRT	Fugitive or Stack Emission?	Significant Source?
Associated Petroleum Terminal	Crude Oil Handling	1km	None	Fugitive	No
BG Cogen Ltd	Combustion Plant	10km	None	Stack	No
BOC Gases		7km	None	Fugitive	No
Coal Products Ltd	Carbonisation Process	1km	None	Stack	No
Arcordis Fibres	Various	8km	See Section 12.2.1	Stack	No
Cray Valley	Organic Chemicals	7km	None	Stack	No
Harlow Chemical Co.	Organic Chemicals	7km	None	Stack	No
Humber Power Ltd	Combustion Plant	8km	See Section 12.2.1	Stack	No
Hydro-Agri Ltd	Combustion Plant	8km	See Section 12.2.1	Stack	No
Immingham Storage Co.	Crude Oil Handling	1km	None	Fugitive	No
Millennium Inorganic Chemicals	Combustion Plant	7km	See Sections 12.2.1 and 12.2.2	Stack	No
Novartis	Organic Chemicals	8km	See Section 12.2.1	Stack	No
Synthomer Ltd	Petro-chemical	7km	See Section 12.2.1	Stack	No
Technical Absorbents	Organic Chemicals	9km	None	Fugitive	No
Huntsman-Tioxide	Organic Chemicals	9km	See Sections 12.2.1 and 12.2.2	Stack	No
Croda Chemicals	Chemical Process	6km	None	Fugitive	No
Miracle Garden Care	Fertiliser Manufacture	7km	None	Fugitive	No
Kemira Chemicals	Ferric/Nitrate/ Sulphates	6km	None	Fugitive	No
BP Chemicals	Various	5km	None	Stack	No
British Aerospace	Cadmium Plating	2km	None	Fugitive	No
Croda	Organic	5km	See Section	Stack	No

Chemicals	Chemicals		12.2.3		
Company	**Process**	**Distance From NLC Boundary**	**Potential Releases above BRT**	**Fugitive or Stack Emission?**	**Significant Source?**
Hepworth Refractories	Ceramics	5km	See Section 12.2.3	Stack	No
M&J Polymers	Tar & Bitumen Process	10km	None	Fugitive	No
Polypipe Ltd	Inorganic Chemical Process	10km	None	Fugitive	No
Premier Profiles	Inorganic Chemical Process	10km	None	Fugitive	No
Peglers Ltd	Galvanising	10km	None	Fugitive	No
Croda Universal Ltd	Organic Process	5km	CO – 95.2t NO_2 – 44.3t	Fugitive	No
Holliday Pigments Ltd	Acid Process	5km	None	Fugitive	No
Hodgson Chemicals	Organic Process	5km	None	Fugitive	No
JL Seaton & Co	Organic Process	5km	None	Fugitive	No

12.2.1 Air Dispersion Modelling of Releases from IPC processes in the Humberside Zone of Industrial Polluting Sources (ZIPS)

The Environment Agency published the above report in March 2000. It considers the contribution to levels of Nitrogen Dioxide and Sulphur Dioxide made by Agency regulated industrial processes (Part A Processes.) in the Humberside region. Included within the report are the following Part A processes: Arcordis Fibres, Humber Power, Hydro-Agri, Millennium Inorganic Chemicals, Novartis, Synthomer and Huntsman Tioxide in the area of Grimsby.

The highest concentration of Sulphur Dioxide obtained from the model was approaching the objective level of 266$\mu g/m^3$ for the short-term objective expressed as 15-Minute Mean. The highest concentration for the long-term objective was 13/14$\mu g/m^3$ expressed as a 24-Hour Mean compared to an objective of 125$\mu g/m^3$.

The highest concentration of the short-term objective for Nitrogen Dioxide obtained from the model was approximately 45$\mu g/m^3$ expressed as a 1-Hour Mean compared to an objective of 200$\mu g/m^3$. The highest concentration for the long-term objective was 6$\mu g/m^3$ expressed as an Annual Mean compared to an objective of 40$\mu g/m^3$.

The report concluded that currently there is potential for some exceedences of the short-term air quality objective for Sulphur Dioxide. However it is noted that because of the nature of the model and the sources modelled it considers the worst case scenario which unlikely to occur in reality. If planned and other likely reductions to other significant industry within and around the ZIPS were included the concentrations would be lower.

From the above information it can be seen that the Air Quality Objectives for Sulphur Dioxide and Nitrogen Dioxide are likely to be achieved by 2004/5.

Therefore these sources can be seen to be unlikely to have a significant impact on the air quality of North Lincolnshire.

12.2.2 Millennium Inorganic Chemicals and Huntsman Tioxide

These two processes are potential sources of Carbon Monoxide although Government guidance suggests that Carbon Monoxide is a local rather than trans-boundary pollutant. It is unlikely that processes outside of North Lincolnshire will have an impact on the air quality within the area with respect to Carbon Monoxide so this source will not be considered further.

12.2.3 Croda Chemicals and Hepworth Refractories

Croda Chemicals is likely to emit potentially significant quantities of both Sulphur Dioxide and Nitrogen Dioxide and Hepworth Refractories could emit a significant amount of Sulphur Dioxide. From the Stage 2 Review & Assessment published by Doncaster Metropolitan Borough Council the impact of the surrounding area of the above Part A processes was calculated using the Environment Agency's "Guidance for Estimating the Air Quality Impact of Stationary Sources" (GSS). The following results were found for Sulphur Dioxide:

Sulphur Dioxide - Croda Chemicals

99.9th Percentile of 15 minute means……11.92μg/m^3
99.7th Percentile of hourly means……..…11.9μg/m^3
99th Percentile of 24 hour means……..…. 6.4μg/m^3

Nitrogen Dioxide – Croda Chemicals

Annual mean concentration……..14.0μg/m^3
99.8th Percentile of hourly means……..…41.9μg/m^3

Sulphur Dioxide - Hepworth Refractories

99.9th Percentile of 15 minute means……..75.5μg/m3
99.7th Percentile of hourly means……51.15μg/m3
99th Percentile of 24 hour means……..43.2μg/m3

From the above results it can be seen that neither process is likely to have an impact on the air quality of North Lincolnshire.

12.3 Part B Processes

In Table 28 the Part B processes identified in the Stage 1 Review & Assessment less than 15km from Authority boundary are listed with their approximate distance from North Lincolnshire and the emission details. These details are used to determine if they are significant source of each pollutant.

Table 28 -
Part B Processes in Adjacent Local Authority Areas

Company	Process	Distance From NLC Boundary	Potential Releases	Fugitive or Stack Emission?	Significant Source?
Shipham & Co Ltd	Melting Non-Ferrous Metal	5km	Lead & SO_2	Fugitive	No
Hygena Components Ltd	Melting Non-Ferrous Metal	5km	Lead & SO_2	Fugitive	No
TH Dick & Co	Refining Iron	5km	Lead	Fugitive	No
Caradon Ideal	Hot Blast Cupola	5km	Lead & SO_2	Fugitive	No
Starkeys Technicast	Cold Blast Cupola	5km	Lead & SO_2	Fugitive	No
JH Fenner & Co	Rubber Process	5km	1,3-Butadiene & PM_{10}	Fugitive	No
Donaldsons Filter Co	Diisocyannate Process	5km	1,3-Butadiene & PM_{10}	Fugitive	No
British Fuels Storage	Solid Fuel Storage	5km	PM_{10}	Fugitive	No
WH Draper	Aluminium Storage	5km	Lead	Fugitive	No
Conoco Ltd	Coal Handling	1km	PM_{10}	Fugitive	No
Colin Booth Ltd	Coal Handling	1km	PM_{10}	Fugitive	No
Dunlop Oil & Marine	Rubber Process	8km	1,3-Butadiene & PM_{10}	Fugitive	No
Doncaster Coated Stone	Roadstone Coating	10km	PM_{10}	Fugitive	No

Company	Process	Distance From NLC Boundary	Potential Releases	Fugitive or Stack Emission?	Significant Source?
Hatfield Colliery	Coal Process	10km	PM_{10}	Fugitive	No
W Clifford Watts Ltd	Quarry Process	5km	PM_{10}	Fugitive	No
Global Shipping	Coal Process	1km	PM_{10}	Fugitive	No
Grimsby & Immingham Stevedores	Coal Process	1km	PM_{10}	Fugitive	No
Grimsby Coated Stone	Roadstone Coating	1km	PM_{10}	Fugitive	No
Hargreaves Industrial	Coal Process	1km	PM_{10}	Fugitive	No
Humberside Sea & Land Ltd	Coal Process	1km	PM_{10}	Fugitive	No
SSM Coal	Coal Process	1km	PM_{10}	Fugitive	No
Swallow Stevedores	Coal Process	1km	PM_{10}	Fugitive	No
Swallow Stevedores	Coal Process	8km	PM_{10}	Fugitive	No

12.4 Conclusions for Pollutant Sources Outside of North Lincolnshire

From the information presented in the Stage 2 Review & Assessment the Air Quality Objectives for each of the seven pollutants is unlikely to have a significant impact on the air quality within North Lincolnshire.

Therefore it is concluded that there is no need to progress to a Stage 3 Review & Assessment in respect of pollutant sources outside of North Lincolnshire.

13.0 Recommendations for Each Pollutant

PM_{10}

A Stage 3 Review & Assessment is not required.

Nitrogen Dioxide

A Stage 3 Review & Assessment be conducted for the following locations and processes –

e) The area in the town centre around Britannia Corner, Mary Street and Oswald Road in Scunthorpe.

f) The vicinity of Brigg Road and Station Road in Scunthorpe.

g) Ashby Road in Scunthorpe.

h) Corus (Formerly British Steel) in Scunthorpe.

Sulphur Dioxide

A Stage 3 Review & Assessment is not required.

Carbon Monoxide

A Stage 3 Review & Assessment is not required.

Benzene

A Stage 3 Review & Assessment is not required.

1,3-Butadiene

A Stage 3 Review & Assessment is not required.

Lead

A Stage 3 Review & Assessment is not required.

References and Sources of Information

The Pollutant Specific Guidance LAQM.TG4 (00) issued by the DETR.

Review & Assessment of Air Quality for the purposes of Part IV of the Environment Act 1995 issued y the DETR.

Framework for Review & Assessment of Air Quality LAQM.G(00).

Stanger Science & Environment Internet website, www.stanger.co.uk/airqual-modelhlp

The Environment Agency Internet website, www.environment-agency.gov.uk

DETR Internet website, www.aeat.co.uk/netcen/airqual

Stage 1 Air Quality Review & Assessment - North Lincolnshire Council.

North Lincolnshire Profile - North Lincolnshire Council.

Local Transport Plan, Technical Annex - North Lincolnshire Council.

Stage 2 Air Quality Review & Assessment - North East Lincolnshire Council.

Stage 2 Air Quality Review & Assessment – Doncaster Metropolitan Borough Council.

The Environment Agency National Centre for Risk Analysis & Options Appraisal, Guidance for Estimating the Air Quality Impact of Stationary Sources (GSS). GN24, 1998.

Lindsey Oil Refinery – Atmospheric Dispersion Modelling Study, July 2000.

Conoco – Atmospheric Dispersion Modelling Study, 2000.

Corus – Scunthorpe Site Dispersion Modelling – SO_2 Emissions. April 1999.

Corus – Scunthorpe Site TEOM Monitoring Data, 2000.

Appendix 1

Tables

All Traffic Flows Over 5,000 Vehicles per Day

Road	Projected		Projected		Road Width (m)	Average Speed (km/h)
	2004 AADT	2004 % HGV	2005 AADT	2005 % HGV		
Barton Upon Humber						
Barrow Road, East of Falkland Way	8839	3.6%	9081	3.4%	6.6	52.5
Barrow Road, West of Falkland Way	9566	5.4%	9900	5.2%	6.6	52.5
Ferriby Road, East of B1218	9796	7.0%	9823	7.0%	7.0	48.3
Ferriby Road, West of B1218	9768	6.1%	9776	6.0%	11.0	48.3
Holydyke @ Fire Station, Barton	13993	5.0%	14521	4.7%	8.5	48.3
Market Place, East of Whitecross St	8477	4.1%	8631	3.8%	12.5	48.3
Market Place, West of Whitecross St	10469	4.4%	10637	4.2%	9.5	48.3
Bottesford						
Messingham Rd. North of B1501	8485	2.9%	8396	2.9%	11.0	47.3
Messingham Rd. Nth of Rochdale Rd	9695	4.0%	9755	4.0%	11.0	47.3
Messingham Rd. South of B1501	14056	4.4%	14266	4.3%	11.0	47.3
Messingham Rd. Sth of Rochdale Rd	8856	3.0%	8832	3.0%	11.0	47.3
Sth of Valley View Drive	7978	4.8%	8051	4.7%	11.0	47.3
Yaddlethorpe Xrd. Nth of Manor Rd	11411	3.8%	11509	3.7%	12.0	41.8
Yaddlethorpe Xrd. Sth of Manor Rd	10399	4.8%	10596	4.8%	12.0	41.8
Brigg						
Barnard Avenue East of Wesley Road	25868	3.2%	27495	2.9%	12.0	37.0
Barnard Avenue West of Wesley Road	27909	2.6%	29665	2.3%	12.5	37.0
Bigby Street @ War Memorial	6878	1.3%	6896	1.1%	10.5	61.8
Old Courts Road, Sth of Barnard Ave	7982	0.6%	8271	0.5%	5.5	24.1
Wrawby Road @ War Memorial	14593	4.5%	14987	4.1%	12.0	61.8
Messingham						
North of B1400 Brigg Road	5249	2.2%	5217	1.9%	12.0	46.3
Scunthorpe						
A1077 Nth of Ferry Road West	16475	30.6%	17235	30.9%	9.0	45.4
A1077 N of Frodingham Grange Rdbt	16475	30.6%	17235	30.9%	9.0	45.4
Ashby High Street, East of A159	12530	3.9%	12605	3.7%	7.0	42.8
Ashby High St, W of Grange Lane Sth	10893	5.2%	11202	5.1%	7.0	42.8
Ashby Rd Sth of West Common Lane	11567	4.0%	11319	4.0%	14.5	43.8
Ashby Rd Sth of Rowland Road	26066	3.6%	26384	3.5%	14.5	43.8
Between Ashby Rd & Burringham Rd	13125	4.0%	12975	4.0%	9.5	40.2
Brigg Rd @ Highways Depot	22036	11.2%	23059	10.9%	9.5	57.0
Brigg Rd @ Railway Bridge	20126	9.3%	20202	9.2%	9.5	52.3
Brigg Rd Nth of Cottage Beck Road	18844	9.9%	18953	9.9%	9.5	57.0
Brigg Rd Nth of Grange Lane North	20768	11.0%	21154	10.8%	9.5	57.0
Brigg Rd Nth of Queensway	25891	9.8%	27564	9.5%	9.5	57.0
Brigg Rd Nth of Station Road	16145	10.7%	15943	10.7%	9.5	52.3
Brigg Rd Sth of Cottage Beck Road	19935	10.0%	20218	9.8%	9.5	57.0
Brigg Rd Sth of Station Road	18284	11.7%	18195	11.9%	9.5	52.3
Burringham Rd, East of Scotter Road	10576	1.2%	10807	1.1%	9.5	51.0
Burringham Rd, West of A159	8115	2.4%	8141	2.3%	9.5	51.0
Burringham Rd, West of Scotter Road	13387	1.0%	14073	0.9%	9.5	51.0
Chancel Rd, East of Cambridge Ave	7259	6.0%	7024	6.0%	6.5	50.7
Chancel Rd, East of Messingham Rd	9943	3.5%	10034	3.3%	6.5	50.7
Church Lane, West of Howdens Hill	6815	2.9%	6892	2.9%	7.0	48.3
Cottage Beck Rd, E of Cemetery Rd	7180	6.0%	7214	6.0%	7.0	47.6
Cottage Beck Rd, West of Brigg Rd	5594	11.7%	5651	12.0%	7.0	47.6
Cottage Beck Rd, W of Cemetery Rd	7647	6.0%	7677	6.0%	7.0	47.6
Doncaster Road @ A18 Rdbt	9056	2.8%	8984	2.7%	6.0	63.7
Doncaster Road, W of Oswald Road	11422	4.4%	11628	4.3%	7.0	63.7
East of Frodingham Grange Rdbt	18561	13.3%	18789	13.2%	8.0	43.4
East Common Lane, East of A18	7770	4.0%	7897	4.0%	6.5	46.5

Road	Projected		Projected		Road Width (m)	Average Speed (km/h)
	2004 AADT	2004 % HGV				
Ferry Road West of Avenue Vivian	6122	4.0%	6001	4.0%	6.5	55.3
Frodingham Road Nth of Doncaster Rd	16872	1.2%	17263	1.1%	6.5	40.2
Glebe Road, West of A1029 Rdbt	15257	2.3%	15266	2.1%	7.5	40.2
Grange Lane Sth, @ School	24769	8.7%	26456	8.8%	7.5	47.0
Grange Lane Sth, N of Ashby High St	24474	4.4%	25404	4.3%	7.5	47.0
Grange Lane Sth, S of Ashby High St	16842	4.2%	17357	4.0%	7.5	47.0
High Street, East of Oswald Road	6538	10.2%	6676	10.2%	6.0	40.7
Howdens Hill @ Railway Line	21101	5.0%	20669	5.0%	7.0	40.2
Kingsway @ North Lindsey College	15232	7.4%	15579	7.0%	9.5	64.8
Kingsway @ Railway Bridge	23523	8.7%	24186	8.5%	9.5	64.8
Luneberg Way, South of A1077	14597	0.7%	15562	0.6%	7.5	59.7
Mary Street, East of Oswald Road	6248	9.4%	6233	9.5%	6.0	40.4
Messingham Rd, S of Burringham Rd	9626	6.7%	9529	7.0%	7.5	47.3
Moorwell Road, East of A159	7814	4.5%	8052	4.4%	7.0	51.5
Old Brumby Street, East of A159	5833	3.0%	5870	3.0%	7.0	42.2
Old Crosby, West of Normanby Road	11010	3.4%	11274	3.3%	7.0	42.0
Oswald Rd, North of Mary Street	9991	8.7%	9859	8.8%	7.0	32.2
Oswald Rd, North of Station Road	14437	7.0%	14325	7.0%	7.0	32.2
Oswald Rd, South of Cliff Gardens	16703	8.8%	16603	9.2%	7.0	32.2
Oswald Rd, South of Doncaster Road	14531	3.4%	14781	3.2%	7.0	32.2
Oswald Rd, South of Mary Street	12544	9.0%	12341	9.2%	7.0	32.2
Queensway, East of Grange Lane Nth	23528	7.9%	24307	7.7%	18.0	61.0
Queensway, Nth of East Common Ln	17655	6.9%	18110	6.6%	18.0	61.0
Queensway, West of Brigg Road	32801	2.9%	35044	2.6%	18.0	61.0
Queensway, West of Stockshill Road	15163	12.7%	15320	12.8%	18.0	61.0
Rowland Rd, East of Ashby Road	10780	2.3%	10997	2.1%	7.0	47.6
Scotter Rd @ Railway Viaduct	15458	8.0%	15678	8.0%	7.0	53.6
Scotter Rd, North of Burringham Road	28445	4.1%	29904	3.9%	7.5	56.3
Scotter Rd, North of West Common Ln	20404	6.0%	21154	6.0%	7.5	64.5
Scotter Rd, Sth of Brumby Wood Lane	19573	5.7%	19949	5.6%	7.5	56.3
Scotter Rd, South of Burringham Road	19550	4.4%	20442	4.2%	7.5	56.3
Scotter Rd, South of West Common Ln	22939	6.0%	23845	6.0%	7.5	56.3
Station Road, East of Carlton Street	9266	5.7%	9065	5.8%	7.5	41.8
Station Road, East of Oswald Road	11771	2.4%	11938	2.3%	7.0	41.8
Station Road, West of Brigg Road	9251	7.5%	9022	7.9%	7.0	41.8
Station Road, West of Carlton Street	7926	5.1%	7795	5.2%	7.5	41.8
West Common Lane @ Ashby Road	6583	3.0%	6576	3.0%	7.5	46.0
West Common Lane @ Scotter Road	5745	3.5%	5948	3.4%	7.5	46.0
West of Berkeley Circle	18913	9.3%	18964	9.0%	7.5	46.0
Winterton Road, Nth of Glebe Rd Rdbt	7843	13.6%	7988	13.3%	8.0	52.5
Winterton Road, Nth of Warren Road	6879	21.3%	6934	22.9%	8.0	52.5
Winterton Road, Sth of Warren Road	7825	7.9%	7946	7.9%	8.0	52.5
South Ferriby						
Ferriby Road, East of Gravel Pit Lane	5910	12.0%	5862	12.0%	7.5	52.5
Ferriby Road, West of Forkdale Road	16638	3.8%	17587	3.5%	7.5	52.5
Ferriby Road, West of Gravel Pit Lane	6011	13.6%	5986	13.8%	7.5	52.5
West of Cement Works, South Ferriby	6083	9.3%	6127	9.1%	7.5	52.5

NITROGEN DIOXIDE SURVEY IN W. SCUNTHORPE - 1998

Month	SP Britannia Pub Brit. Corner SC/W/1	LP8 Sheffield Street Scunthorpe SC/W/2	LP27 W. Common Ln Scunthorpe SC/W/3	LP14 Gloucester Ave. Scunthorpe SC/W/4
January	NR	NR	NR	NR
February	45	28	34	30
March	46	28	32	30
April	NR	NR	NR	NR
May	50	30	37	30
June	58	27	27	27
July	46	24	25	22
August	51	29	25	23
September	48	32	40	37
October	57	33	37	34
November	81	51	57	50
December	67	43	47	45
Average	**55**	**33**	**36**	**33**

NITROGEN DIOXIDE SURVEY IN W. SCUNTHORPE - 1999

Month	SP Britannia Pub Brit. Corner SC/W/1	LP8 Sheffield Street Scunthorpe SC/W/2	LP27 W. Common Ln Scunthorpe SC/W/3	LP14 Gloucester Ave. Scunthorpe SC/W/4
January	51	32	34	37
February	59	36	37	34
March	53	36	35	32
April	56	34	36	30
May	50	24	27	26
June	53	24	23	24
July	44	25	34	25
August	51	29	34	26
September	NR	35	38	33
October	62	38	42	36
November	68	NR	39	35
December	76	46	44	42
Average	**57**	**33**	**35**	**32**

NITROGEN DIOXIDE SURVEY IN W. SCUNTHORPE - 2000

Month	SP Britannia Pub Brit. Corner SC/W/1	LP8 Sheffield Street Scunthorpe SC/W/2	LP27 W. Common Ln Scunthorpe SC/W/3	LP14 Gloucester Ave. Scunthorpe SC/W/4
January	75	49	49	47
February	62	37	36	34
March	59	42	39	35
April	53	38	31	35
May	51	29	30	27
June	41	25	NR	13
July	41	26	NR	23
August	55	34	32	25
September				
October				
November				
December				
Average	**55**	**35**	**36**	**30**

Carried out by Rotherham Met. Boro' Council – Env. Health Lab. Services **Units** NO_2 Conc. in $\mu g/m^3$
Note NR = Not Returned, SP = Signpost, DP = Drainpipe, LP = Lamp Post

NITROGEN DIOXIDE SURVEY IN EAST SCUNTHORPE - 1998

Month	LP1 Mary St. Scpe E/1	LP18 Brigg Rd Scpe E/2	LP13 Ashby Rd Scpe E/3	LP25 Old Brumby St, Scpe E/4	LP4 Sluice Rd S Ferriby E/5	LP72 Queens-way Scpe E/6	LP44 Sluice Rd S Ferriby E/7	LP14 Bridge St Brigg E/8	LP16 Barnard Avenue Brigg E/9
January	NR	NR	NR	NR	NR	NR	NR	NR	NR
February	NR	NR	NR	NR	NR	NR	NR	NR	NR
March	NR	NR	NR	NR	NR	NR	NR	NR	NR
April	NR	NR	NR	NR	NR	NR	NR	NR	NR
May	NR	NR	NR	NR	NR	NR	NR	NR	NR
June	NR	NR	NR	NR	NR	NR	NR	NR	NR
July	28	34	31	20	21	34	28	NR	30
August	39	41	39	30	30	NR	42	NR	46
September	44	49	42	NR	NR	50	43	32	53
October	46	46	44	34	30	47	41	34	48
November	37	38	35	35	42	45	31	NR	45
December	54	54	57	42	49	50	52	40	58
Average	**41**	**44**	**41**	**32**	**34**	**45**	**40**	**35**	**47**

NITROGEN DIOXIDE SURVEY IN EAST SCUNTHORPE - 1999

Month	LP1 Mary St. Scpe E/1	LP18 Brigg Rd Scpe E/2	LP13 Ashby Rd Scpe E/3	LP25 Old Brumby St, Scpe E/4	LP4 Sluice Rd S Ferriby E/5	LP72 Queens-way Scpe E/6	LP44 Sluice Rd S Ferriby E/7	LP14 Bridge St Brigg E/8	LP16 Barnard Avenue Brigg E/9
January	47	44	51	35	33	44	36	36	39
February	61	55	53	61	47	58	48	60	44
March	58	60	55	57	51	55	50	47	55
April	53	50	43	41	41	39	41	49	48
May	50	58	NR	45	45	36	50	NR	47
June	44	38	36	41	39	NR	36	29	52
July	40	42	NR	45	43	23	42	36	37
August	56	57	47	NR	49	44	44	41	44
September	55	55	43	38	36	NR	41	44	51
October	55	51	42	42	38	NR	40	43	NR
November	64	59	59	55	45	54	44	49	NR
December	72	57	56	61	46	NR	47	41	57
Average	**55**	**52**	**49**	**47**	**43**	**44**	**43**	**43**	**47**

NITROGEN DIOXIDE SURVEY IN EAST SCUNTHORPE - 2000

Month	LP1 Mary St. Scpe E/1	LP18 Brigg Rd Scpe E/2	LP13 Ashby Rd Scpe E/3	LP25 Old Brumby St, Scpe E/4	LP4 Sluice Rd S Ferriby E/5	LP72 Queens-way Scpe E/6	LP44 Sluice Rd S Ferriby E/7	LP14 Bridge St Brigg E/8	LP16 Barnard Avenue Brigg E/9
January	89	64	NR	57	48	NR	39	58	59
February	61	45	46	55	45	NR	45	65	NR
March	62	53	52	42	36	56	42	54	53
April	60	46	41	47	32	35	24	39	45
May	44	46	38	41	23	36	33	37	39
June	46	37	NR	29	26	31	29	37	42
July	42	43	28	37	26	34	31	33	48
August	50	50	38	41	33	39	34	40	43
September									
October									
November									
December									
Average	**57**	**48**	**41**	**44**	**34**	**39**	**35**	**45**	**47**

NITROGEN DIOXIDE SURVEY IN BRIGG AREA - 1998

Month	Kerb Hewson House Brigg GF/WS/1	DP Hewson House Brigg GF/WS/2	Workshop Hewson House Brigg GF/WS/3	14 St Crispins Close N. Killingholme GF/WS/4
January	47	38	29	34
February	39	40	30	37
March	47	40	29	30
April	30	27	19	23
May	29	25	19	17
June	21	4	14	19
July	22	20	13	NR
August	30	24	13	40
September	32	31	26	20
October	31	31	22	24
November	42	42	30	25
December	37	40	32	35
Average	**34**	**30**	**23**	**28**

NITROGEN DIOXIDE SURVEY IN BRIGG AREA - 1999

Month	Kerb Hewson House Brigg GF/WS/1	DP Hewson House Brigg GF/WS/2	Workshop Hewson House Brigg GF/WS/3	14 St Crispins Close N. Killingholme GF/WS/4
January	33	32	23	27
February	34	40	27	31
March	29	34	19	30
April	24	28	15	21
May	19	20	14	21
June	19	18	15	18
July	20	17	13	18
August	26	24	17	20
September	23	20	17	7
October	24	NR	20	18
November	NR	37	27	21
December	45	37	19	26
Average	27	28	19	22

NITROGEN DIOXIDE SURVEY IN BRIGG AREA - 2000

Month	Kerb Hewson House Brigg GF/WS/1	DP Hewson House Brigg GF/WS/2	Workshop Hewson House Brigg GF/WS/3	14 St Crispins Close N. Killingholme GF/WS/4
January	49	46	39	31
February	40	31	25	85
March	39	37	31	69
April	24	24	10	17
May	20	19	13	13
June	18	18	11	26
July	20	22	16	16
August	21	23	17	13
September				
October				
November				
December				
Average	**29**	**28**	**20**	**34**

Carried out by Rotherham Met. Boro' Council – Env. Health Lab. Services **Units** NO_2 Conc. in $\mu g/m^3$
Note NR = Not Returned, SP = Signpost, DP = Drainpipe, LP = Lamp Post

NITROGEN DIOXIDE SURVEY IN KILLINGHOLME AREA - 1998

Month	LP43 Top Road E Halton K/1	LP1 Clough Rd. N. Kill K/2	FP Station Rd S. Kill K/3	LP2 Rosper Rd S. Kill K/4	LP9 Church Ln N. Kill K/5	LP2 Staple Rd S. Kill K/6	LP5 Humber Rd S. Kill K/7	SP Chase-hill Rd N. Kill K/8	FP Rosper Rd S. Kill K/9	SP Clough Rd N. Kill K/10	LP10 Baptist Chapel Ln S. Kill K/11	LP18 Manby Rd S. Kill K/12
January	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
February	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
March	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
April	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
May	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
June	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
July	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
August	26	26	NR	47	27	24	41	NR	NR	22	25	27
September	30	33	29	54	36	34	49	28	29	31	19	59
October	25	46	57	65	32	37	49	26	29	33	24	60
November	30	41	51	45	30	40	34	37	32	37	27	43
December	34	NR	87	72	37	46	25	38	30	38	24	74
Average	**29**	**37**	**56**	**57**	**32**	**36**	**40**	**32**	**30**	**32**	**24**	**53**

NITROGEN DIOXIDE SURVEY IN KILLINGHOLME AREA - 1999

Month	LP43 Top Road E Halton K/1	LP1 Clough Rd. N. Kill K/2	FP Station Rd S. Kill K/3	LP2 Rosper Rd S. Kill K/4	LP9 Church Ln N. Kill K/5	LP2 Staple Rd S. Kill K/6	LP5 Humber Rd S. Kill K/7	SP Chase-hill Rd N. Kill K/8	FP Rosper Rd S. Kill K/9	SP Clough Rd N. Kill K/10	LP10 Baptist Chapel Ln S. Kill K/11	LP18 Manby Rd S. Kill K/12
January	27	55	67	58	34	36	40	29	31	33	24	53
February	29	46	54	71	33	38	51	28	34	37	25	63
March	30	33	55	28	32	37	45	29	39	46	24	64
April	NR	22	43	41	32	23	43	21	20	44	19	46
May	24	35	44	35	29	NR	42	26	17	45	20	48
June	23	27	28	35	21	21	28	18	14	39	16	41
July	18	NR	26	45	28	NR	40	21	25	42	20	50
August	23	29	28	45	28	NR	48	25	21	47	22	52
September	31	31	3	42	35	32	NR	26	21	NR	20	47
October	NR	36	43	56	37	29	NR	27	39	50	21	54
November	30	56	63	60	33	NR	54	33	61	126	27	73
December	36	NR	73	53	36	28	51	40	91	44	24	72
Average	**27**	**37**	**44**	**47**	**32**	**31**	**44**	**27**	**34**	**50**	**22**	**55**

NITROGEN DIOXIDE SURVEY IN KILLINGHOLME AREA - 2000

Month	LP43 Top Road E Halton K/1	LP1 Clough Rd. N. Kill K/2	FP Station Rd S. Kill K/3	LP2 Rosper Rd S. Kill K/4	LP9 Church Ln N. Kill K/5	LP2 Staple Rd S. Kill K/6	LP5 Humber Rd S. Kill K/7	SP Chase-hill Rd N. Kill K/8	FP Rosper Rd S. Kill K/9	SP Clough Rd N. Kill K/10	LP10 Baptist Chapel Ln S. Kill K/11	LP18 Manby Rd S. Kill K/12
January	37	45	67	72	32	45	51	35	105	59	27	71
February	31	42	65	26	33	10	54	36	59	38	25	60
March	31	34	36	24	38	38	65	36	52	59	35	75
April	23	34	22	35	22	27	27	24	24	50	20	41
May	23	29	21	33	25	39	NR	22	28	49	17	49
June	20	23	NR	30	20	NR	31	24	26	45	15	42
July	21	16	19	31	21	19	33	21	21	49	17	40
August	NR	23	31	14	27	NR	19	31	33	NR	21	56
September												
October												
November												

December												
Average	**27**	**31**	**37**	**33**	**27**	**30**	**40**	**29**	**44**	**50**	**22**	**54**

Summary of NO_2 Diffusion Tube Data

	Site Type	1996	1997	1998	1999	2000[5]	2005[6]
Britannia Corner, Scunthorpe	Kerbside	57	48	52	57	55	**49**
Britannia Corner, Scunthorpe (Toilet 1)	Kerbside					25[4]	21
Britannia Corner, Scunthorpe (Toilet 2)	Kerbside					37[4]	32
Britannia Corner, Scunthorpe (Toilet 3)	Kerbside					37[4]	32
Digby Street, Scunthorpe	Background	40	34	31			
Mary Street, Scunthorpe	Kerbside			41[3]	55	57	**47**
Station Road, Scunthorpe	Kerbside			44[3]	52	48	**45**
Ashby Road, Scunthorpe	Kerbside			41[3]	49	41	**42**
Old Brumby Street, Scunthorpe	Kerbside			32[3]	47	44	40
Queensway, Scunthorpe	Kerbside			45[3]	44	39	38
West Common Lane, Scunthorpe	Kerbside	40	34	34	35	36	30
Sheffield Street, Scunthorpe	Kerbside			33[1]	33	35	28
Gloucester Avenue, Scunthorpe	Background	36	34	31	32	30	27
Barnard Avenue, Brigg	Kerbside			47[3]	47	47	40
Bridge Street, Brigg	Kerbside	36	34	35	43	45	37
Hewson House, Brigg	Kerbside			30[1]	28	28	24
Hewson House, Brigg (Kerbside)	Kerbside	31	33	29	27	29	23
Hewson House, Brigg (Workshop)	Background	25	21	21	19	20	16
St Crispins Walk, Brigg	Background			28[1]	22	34	18
Sluice Road (East), South Ferriby	Kerbside			40[3]	43	35	37
Sluice Road (West), South Ferriby	Kerbside			34[3]	43	34	37
School Road, S. Killingholme	Background	40	28	28			
Manby Road, S. Killingholme	Kerbside			53[2]	55	54	**47**
Rosper Road, S. Killingholme	Background			57[2]	47	33	39
Rosper Road Lay-by, S. Killingholme	Background			30[2]	34	44	28
Station Road, S. Killingholme	Background			56[2]	44	37	36
Humber Road, S. Killingholme	Kerbside			40[2]	44	40	38
Staple Road, S. Killingholme	Background			36[2]	31	30	25
Baptist Chapel Lane, S. Killingholme	Background			24[2]	22	22	18
Clough Lane, N. Killingholme	Background			37[2]	37	31	30
Sign Opp. Clough Ln, N. Killingholme	Kerbside			32[2]	50	50	**41**
Chasehill Road, N. Killingholme	Background			30[2]	27	29	22
Church Lane, N. Killingholme	Background			32[2]	32	27	27
Top Road, East Halton	Background			29[2]	27	27	23

[1]Monitoring started Feb 1998, [2]Monitoring started Aug 1998, [3]Monitoring started July 1998, [4]Monitoring started March 2000, [5]Up to August 2000, [6] Predicted NO_2 Concentrations made using the methodology in the Pollutant Specific Guidance LAQM.TG4 (00).

BENZENE SURVEY IN KILLINGHOLME AREA AUGUST 1998 – JULY 1999

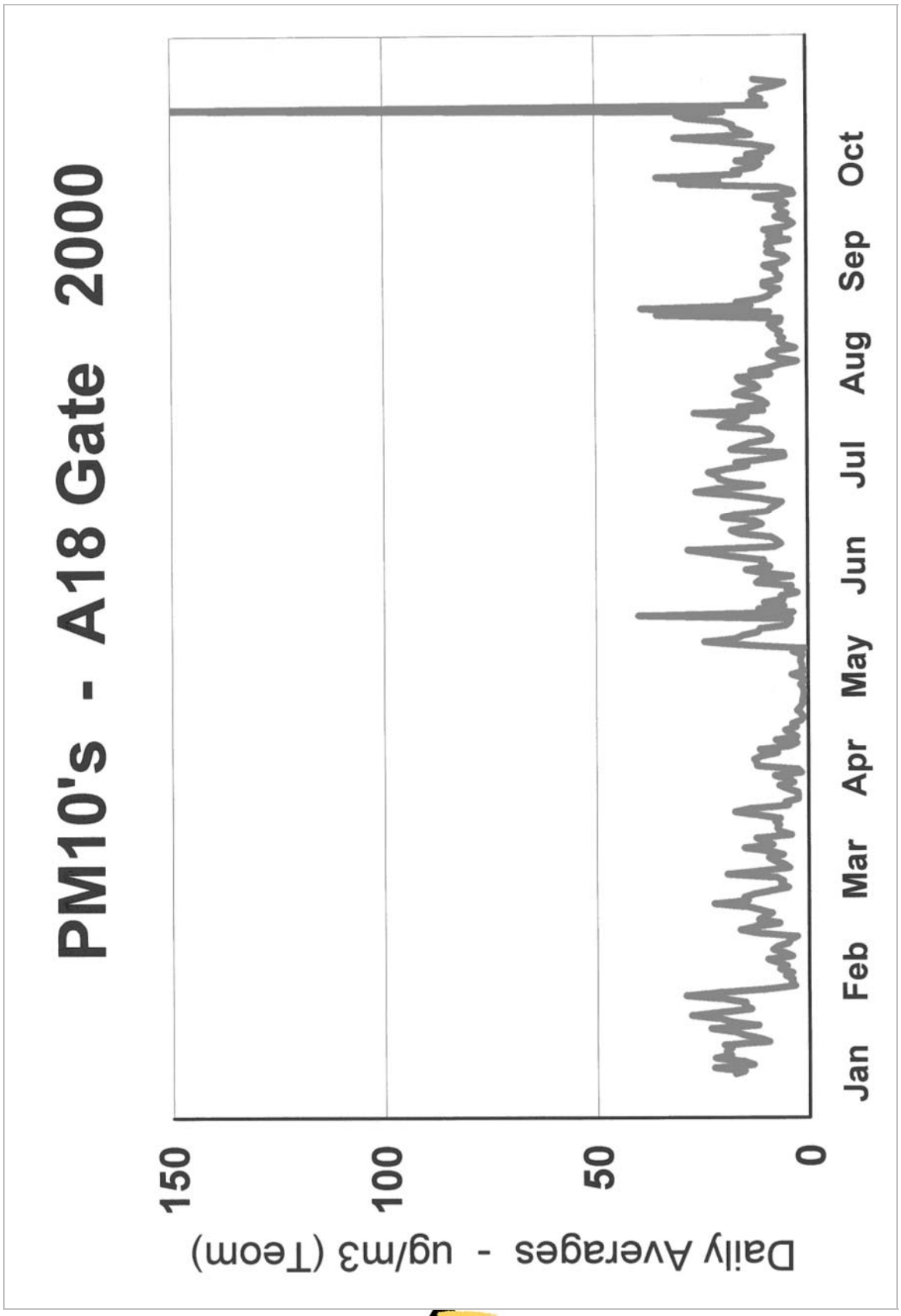
Method Benzene by thermal desorption/gc-ms
Tube packing Chromosorb 106 60/80
Carried out by Rotherham Met. Boro' Council – Env. Health Lab. Services
Units Benzene Concentration in ppb

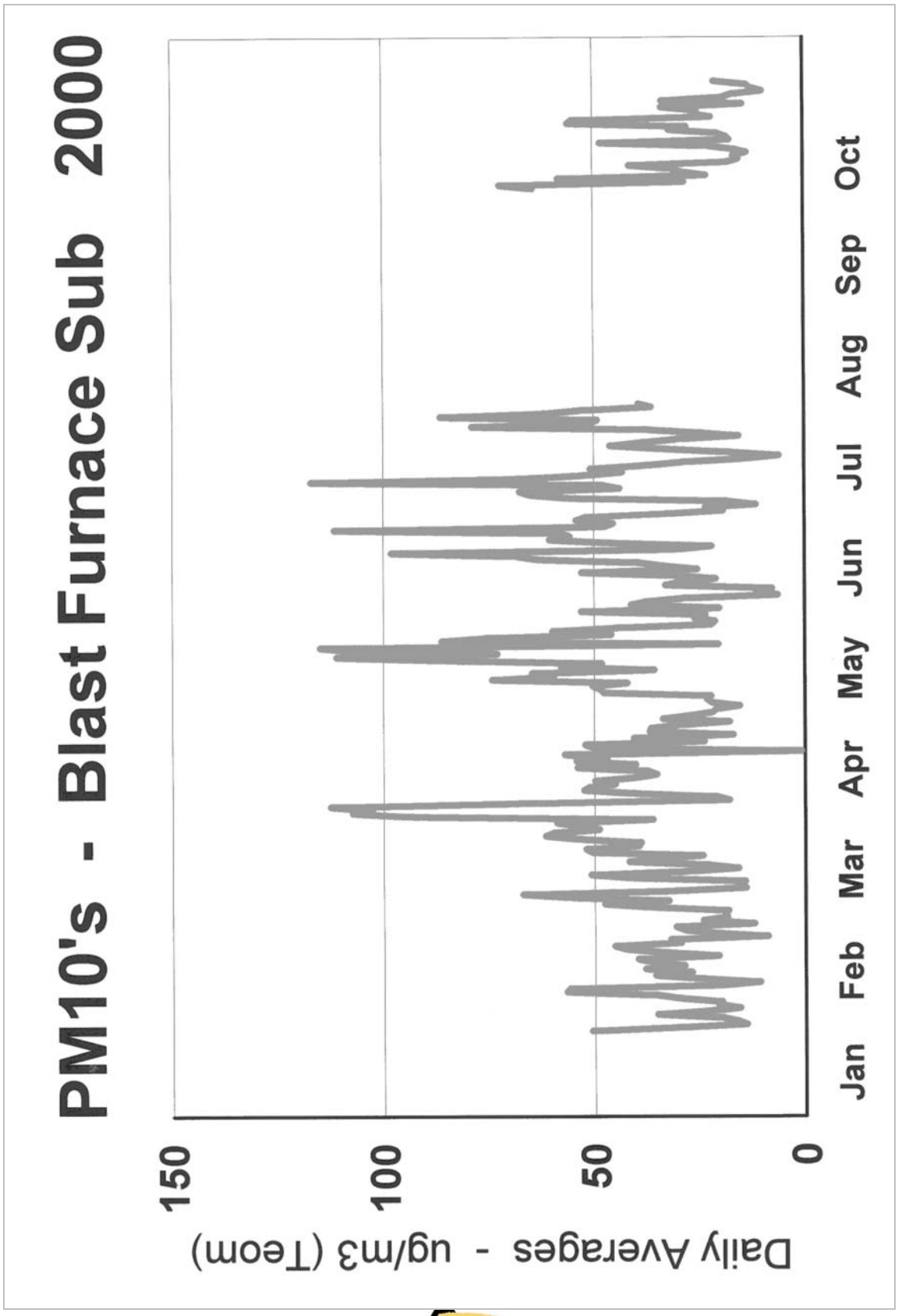
Year	Month	LP43 Top Rd E. Halton	LP1 Clough Rd N. Kill	FP Station Rd S. Kill	LP2 Rosper Rd S. Kill	LP9 Church Ln N. Kill	LP2 Staple Rd S. Kill	LP5 Hum-ber Rd S. Kill	Home-stead Park Imm	St Andrews Ct Imm	LP10 Baptist Chapel Ln S. Kill
1998	August	0.4	0.3	NR	0.5	0.4	0.4	0.4	0.4	0.3	0.4
	September	<0.1	0.2	<0.1	0.4	<0.1	0.3	0.2	0.1	0.2	0.5
	October	0.2	0.3	<0.1	0.2	<0.1	0.2	0.4	0.1	0.1	0.2
	November	0.7	0.8	1.6	1.5	0.8	0.7	0.7	0.3	0.4	0.6
	December	<0.1	NR	0.9	<0.1	0.4	<0.1	<0.1	0.3	<0.1	<0.1
1999	January	0.5	0.9	2.3	1.9	0.5	<0.1	0.5	0.4	0.3	0.5
	February	0.7	0.4	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1
	March	0.6	0.2	1	<0.1	0.3	0.4	0.5	0.2	0.3	0.2
	April	NR	0.3	0.7	0.7	1	0.4	1.3	0.7	0.8	0.4
	May	0.3	0.2	0.3	0.5	0.5	0.4	0.7	0.3	0.2	0.2
	June	0.3	0.2	0.3	0.5	0.5	0.4	0.6	0.2	0.2	0.2
	July	0.9	0.9	<0.1	0.6	NR	NR	0.9	0.6	NR	<0.1
	Average (ppb)	**0.4**	**0.4**	**0.7**	**0.6**	**0.4**	**0.3**	**0.6**	**0.3**	**0.3**	**0.3**
	Average ($\mu g/m^3$)	**1.42**	**1.39**	**2.22**	**1.92**	**1.39**	**1.03**	**1.87**	**1.00**	**0.89**	**0.95**

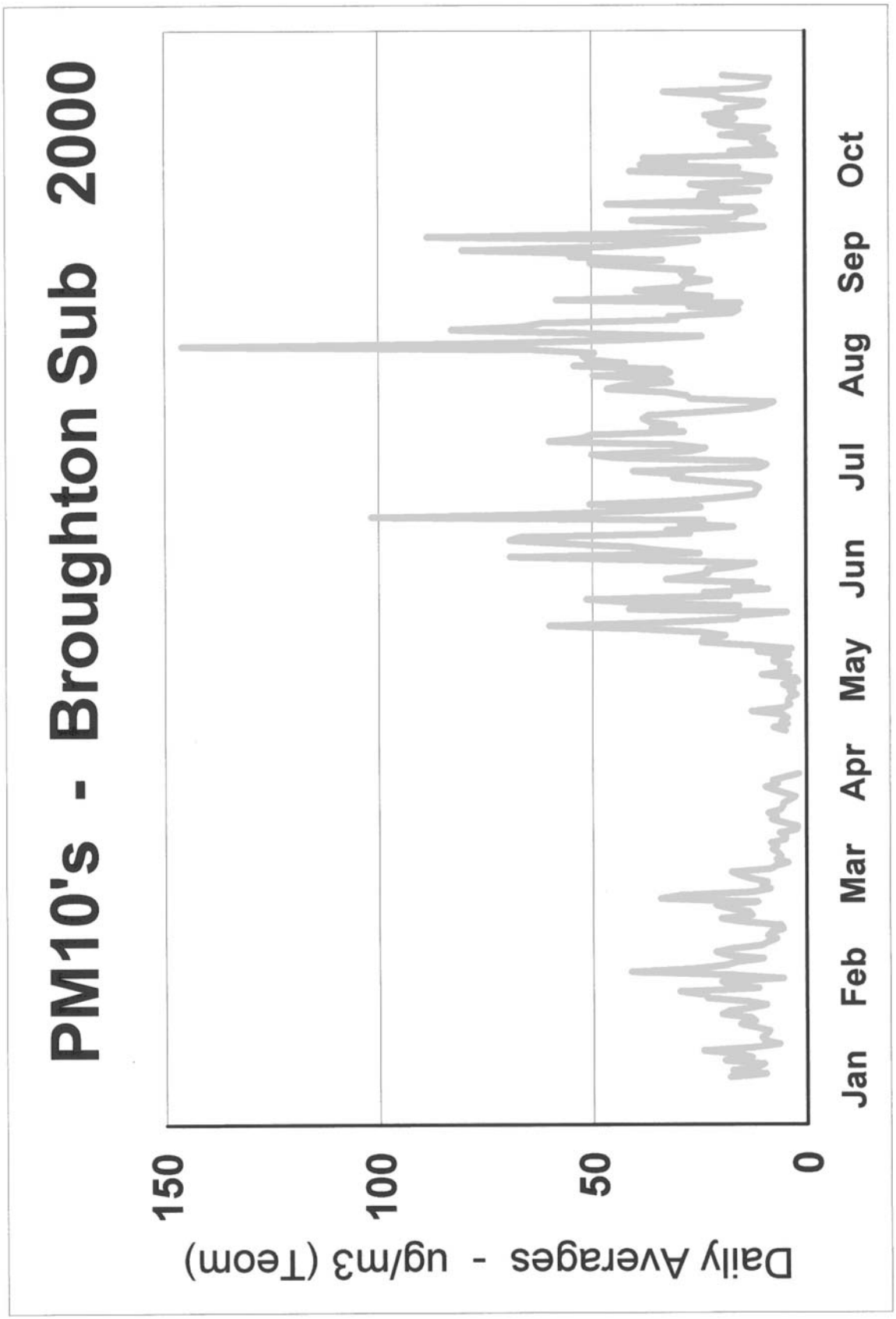
Note LP = Lamp Post
NR = Not Returned
Where Benzene concentration is given as <0.1 ppb it is assumed to be equal to 0.1ppb when calculating the average.
Conversion factor from ppb to $\mu g/m^3$ is 3.25 (From Pollutant Specific Guidance LAQM.TG4 (00))

Appendix 2

Graphs


PM10's - A18 Gate 2000
Daily Averages - ug/m3 (Teom)
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct


PM10's - Blast Furnace Sub 2000
Daily Averages - ug/m3 (Teom)
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct


PM10's - Broughton Sub 2000
Daily Averages - ug/m3 (Teom)
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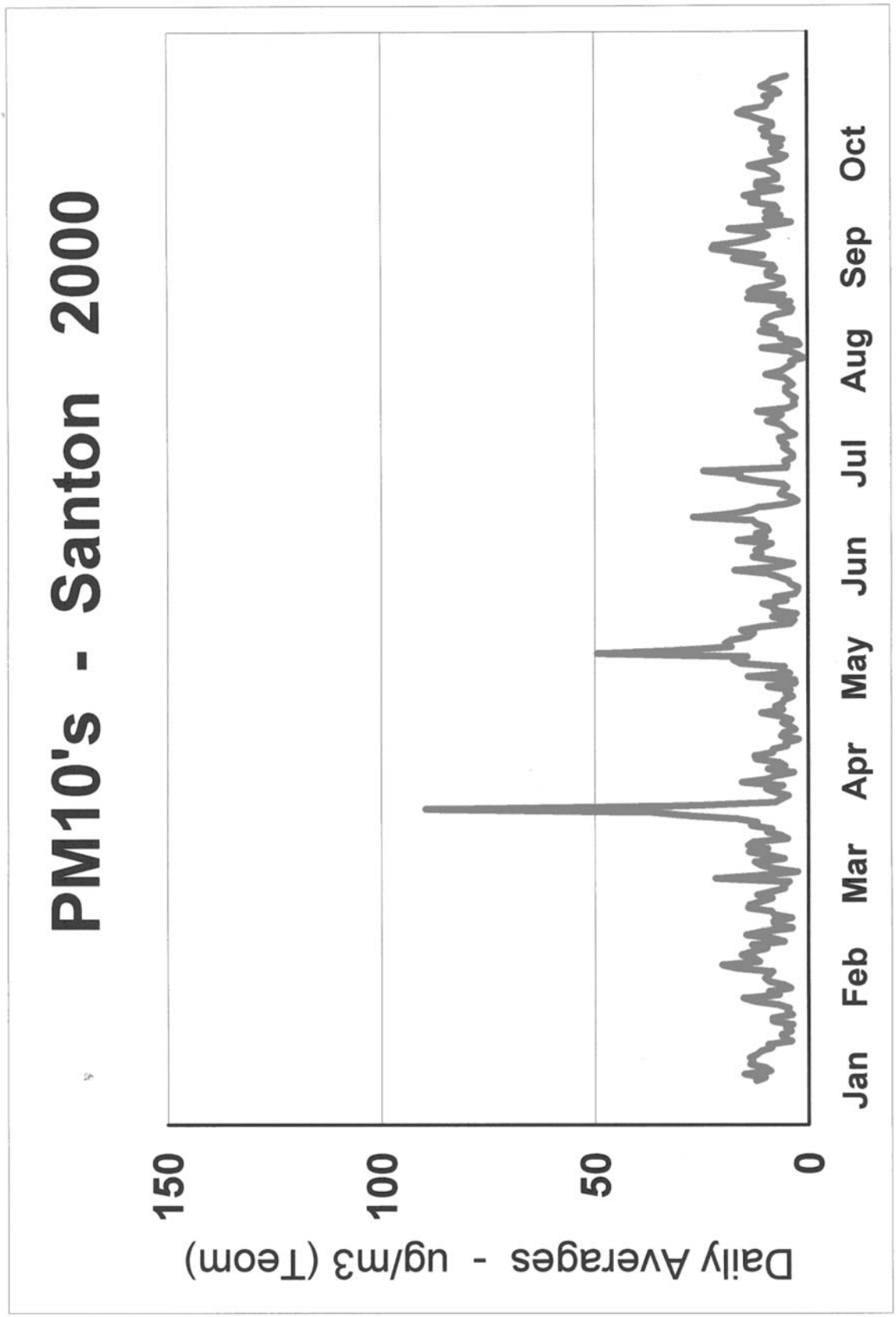
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct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Daily Averages - ug/m3 (Teom)
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100
50
0
Jan
Feb
Mar
Apr
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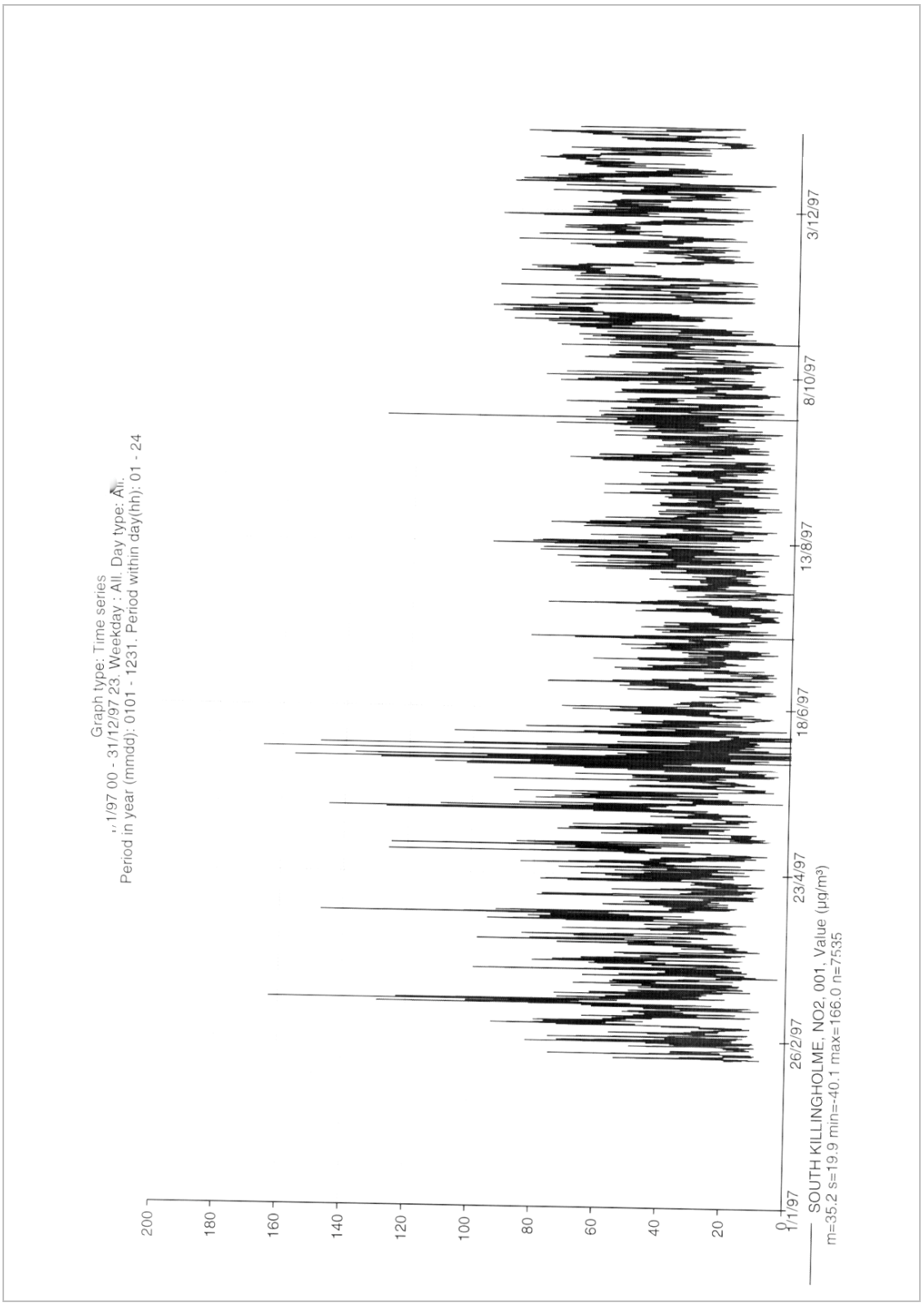
Jun
Jul
Aug
Sep
Oct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200
180
160
140
120
100
80
60
40
20
0
1/1/97
26/2/97
23/4/97
18/6/97
13/8/97
8/10/97
3/12/97
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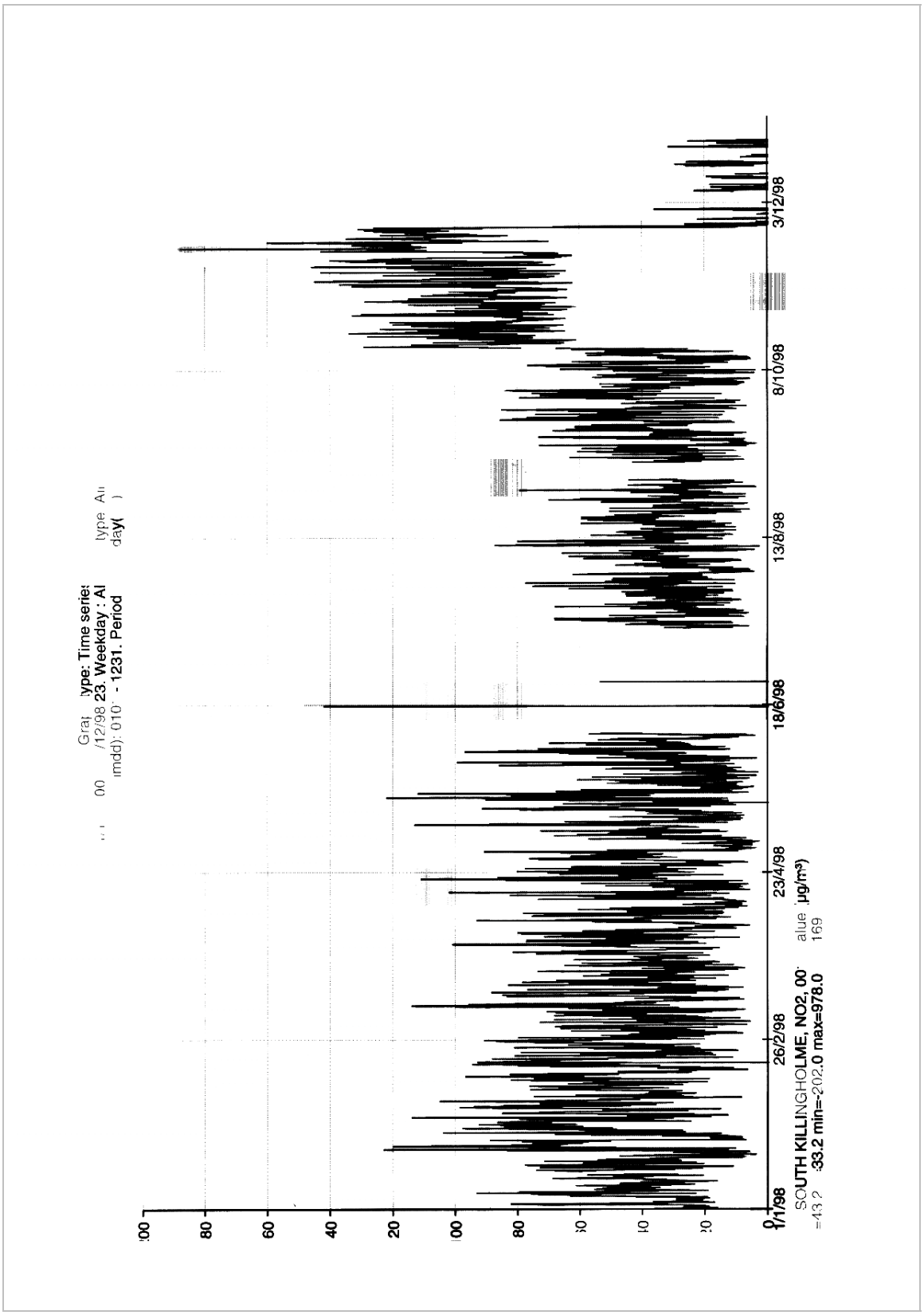
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23. Weekday : Al
- 1231. Period
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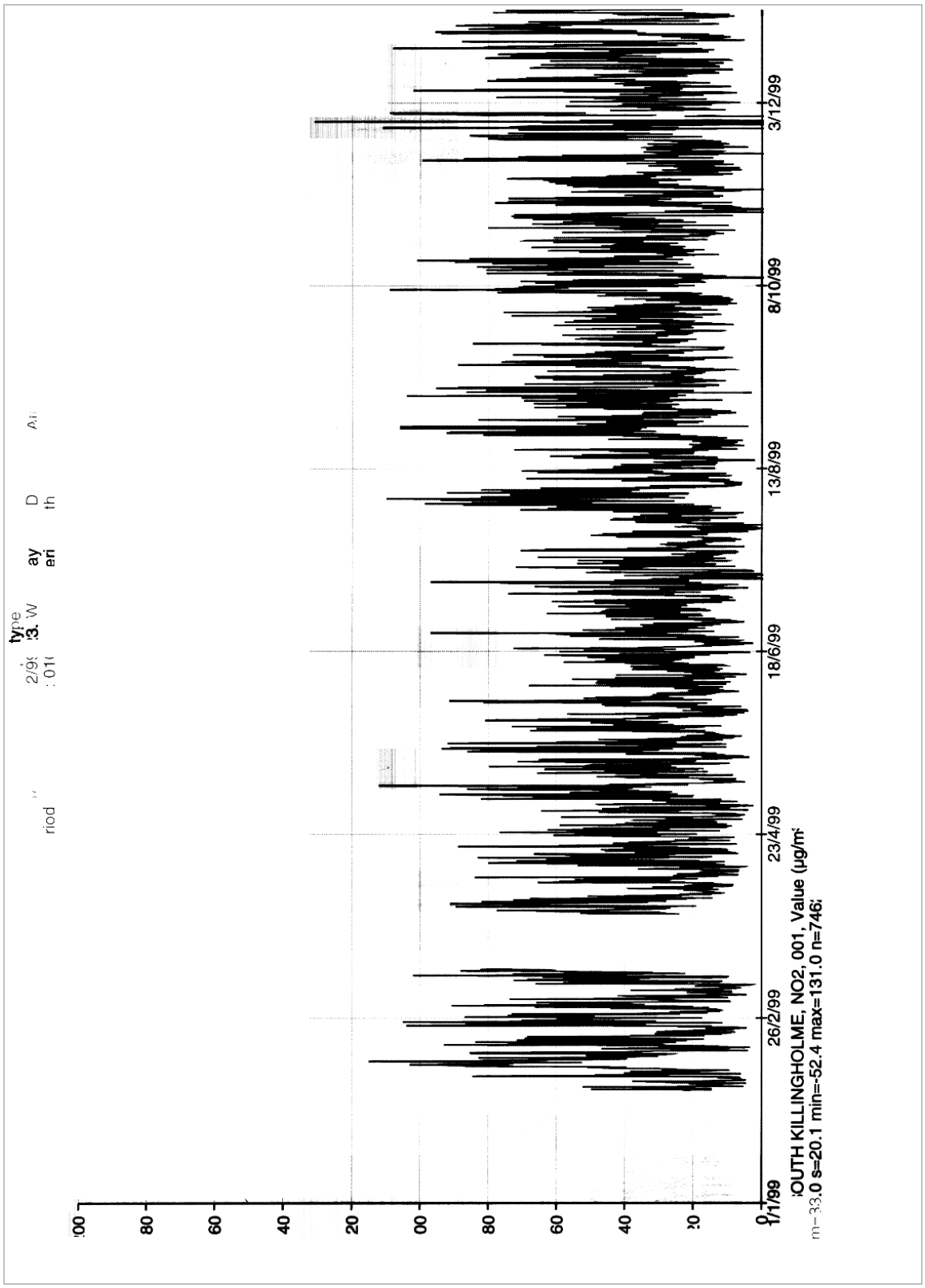
18/6/98
13/8/98
8/10/98
3/12/98
µg/m³)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23/4/99
18/6/99
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8/10/99
3/12/99
0
20
40
60
80
100
OUTH KILLINGHOLME, NO2, 001, Value (µg/m
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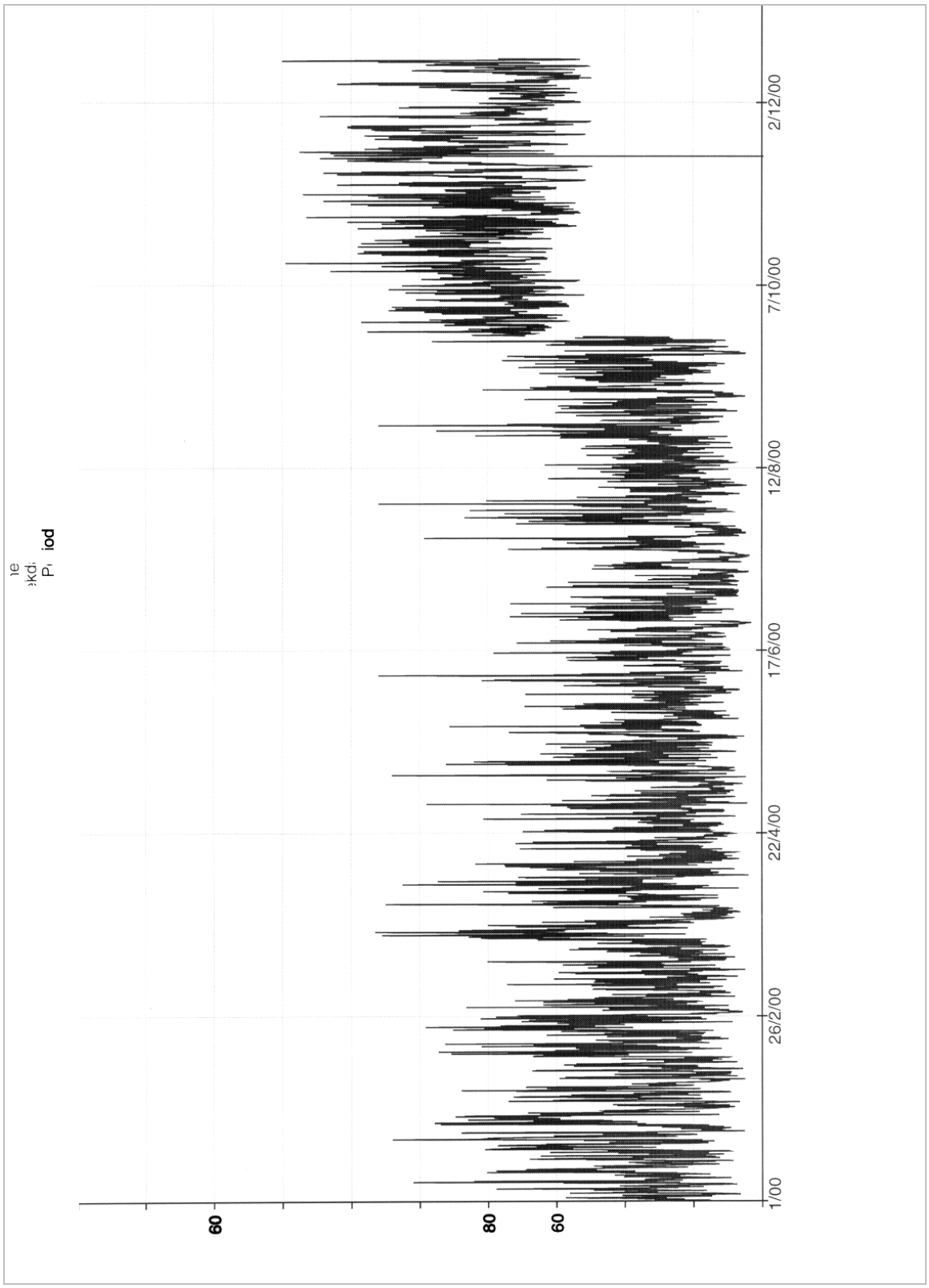
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17/6/00
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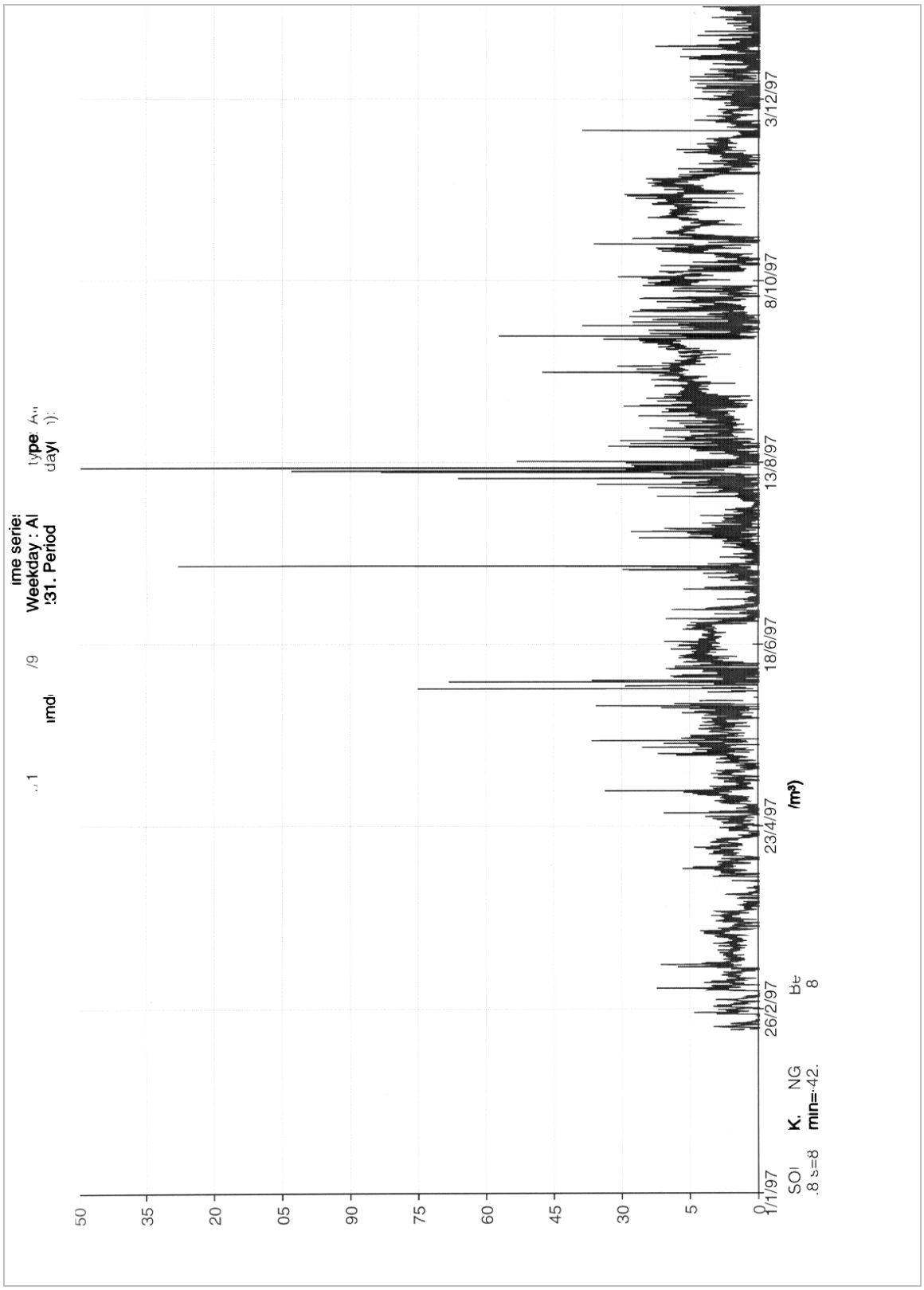
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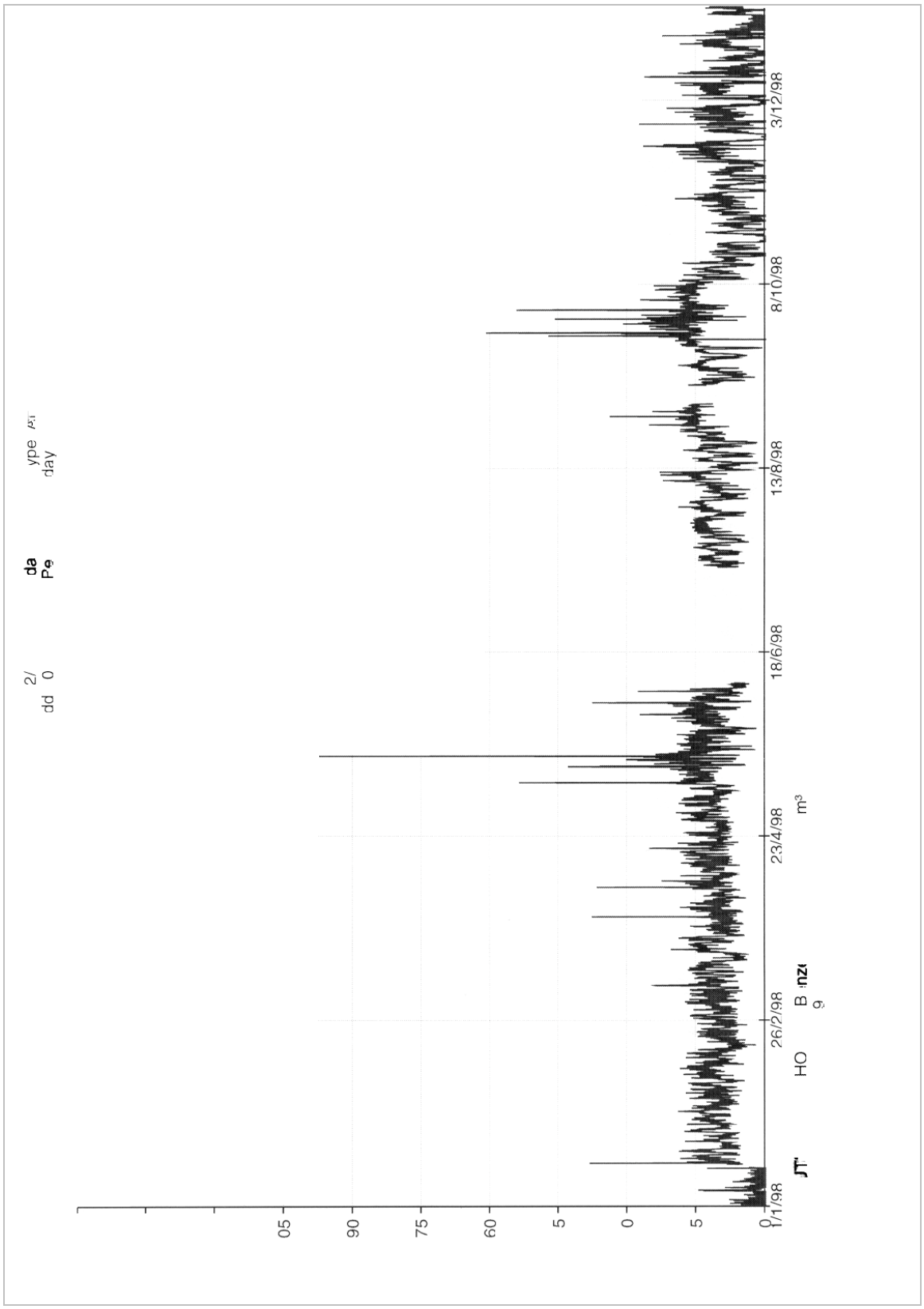
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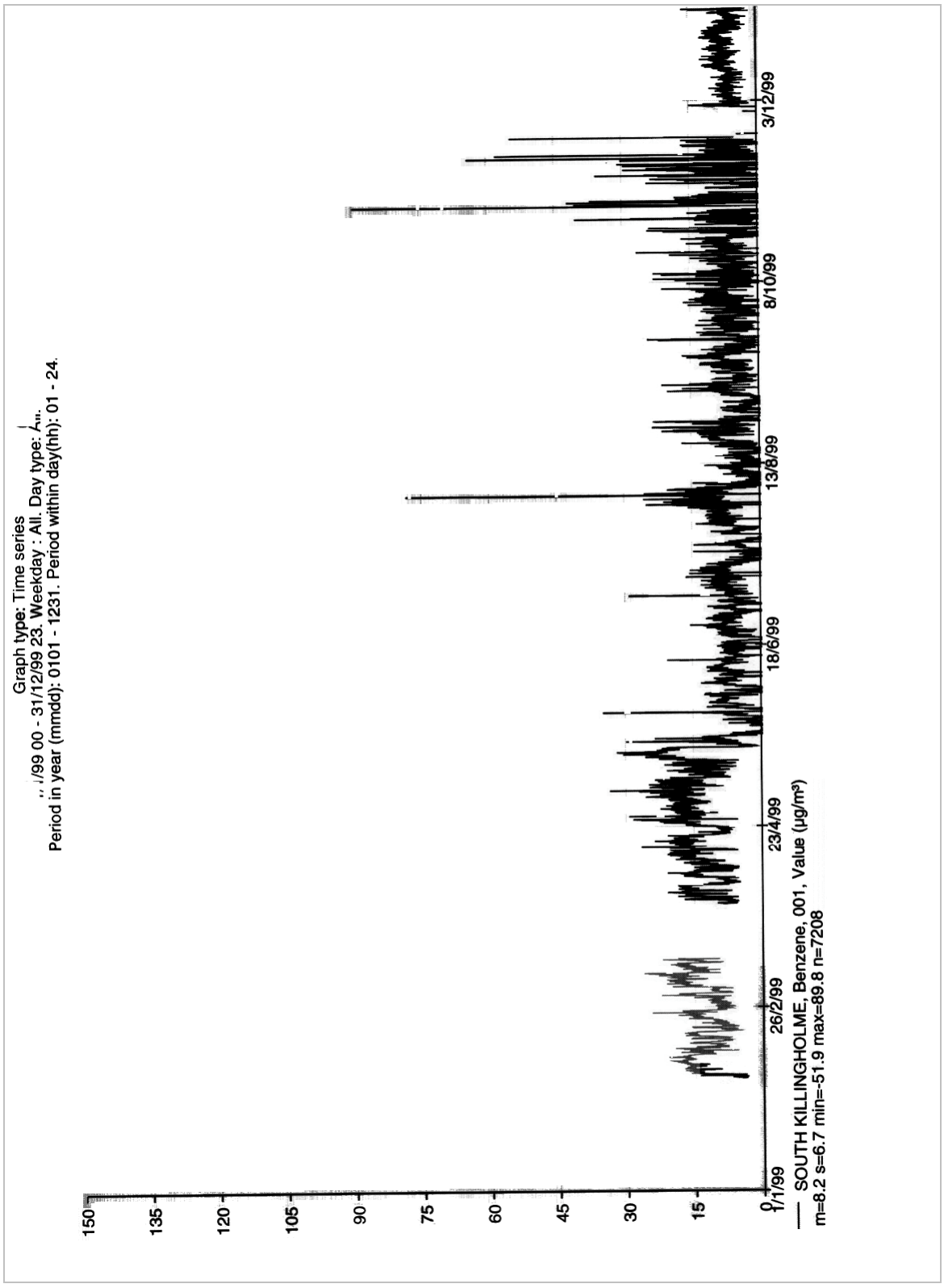
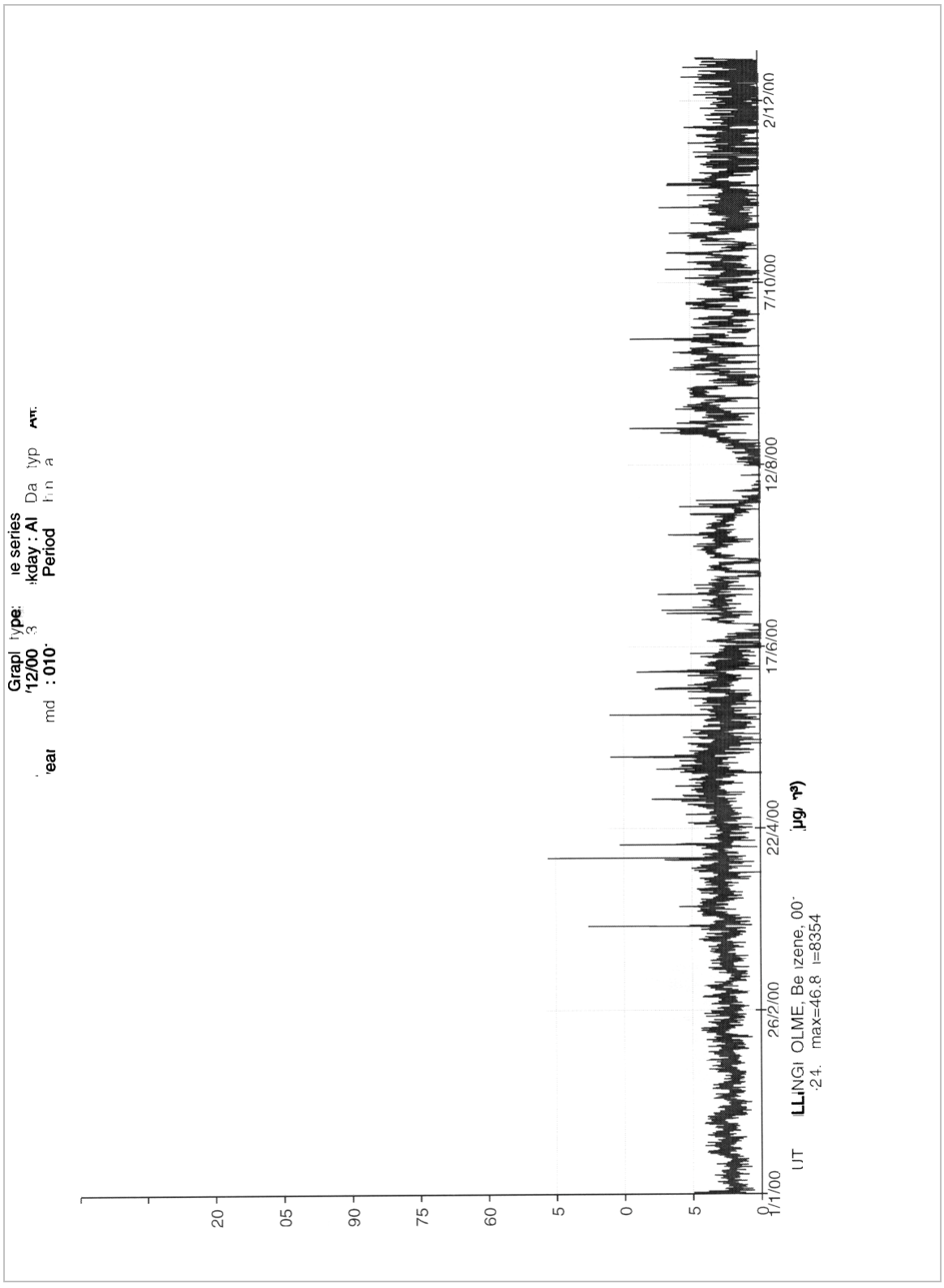
3/12/98
0
5
0
5
60
75
90
05
m³


Graph type: Time series
Period in year (mmdd): 0101 - 1231. Period within day(hh): 01 - 24.
150
135
120
105
90
75
60
45
30
15
0
1/1/99
26/2/99
23/4/99
18/6/99
13/8/99
8/10/99
3/12/99
SOUTH KILLINGHOLME, Benzene, 001, Value (µg/m³)
m=8.2 s=6.7 min=-51.9 max=89.8 n=7208


Graph type: ie series
'12/00 3 kday : Al Da typ
: 010 Period hr a
ear md
20
05
90
75
60
5
0
5
1/1/00
26/2/00
22/4/00
17/6/00
12/8/00
7/10/00
2/12/00
UT LLiNGi OLME, Be izene, 00
24. max=46.8 i=8354
(µg/m3)

Appendix 3

Maps

Department of the Environment Transport and the Regions

Automatic Urban and Rural Network Site Information Archive

HOME

Scunthorpe SITE LOCATION KEY DATA

North East South West

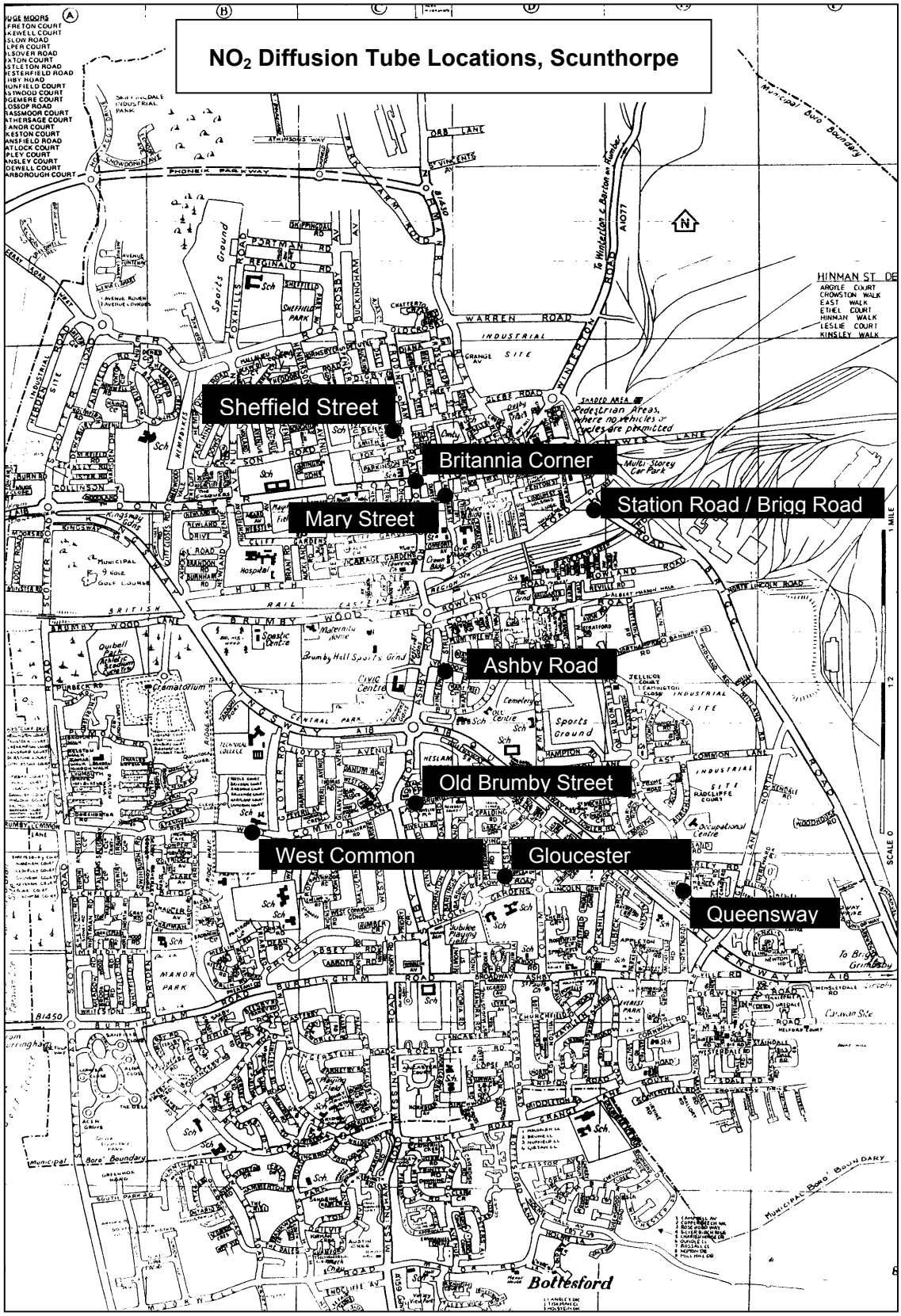
Click on any of the above to view in more detail.

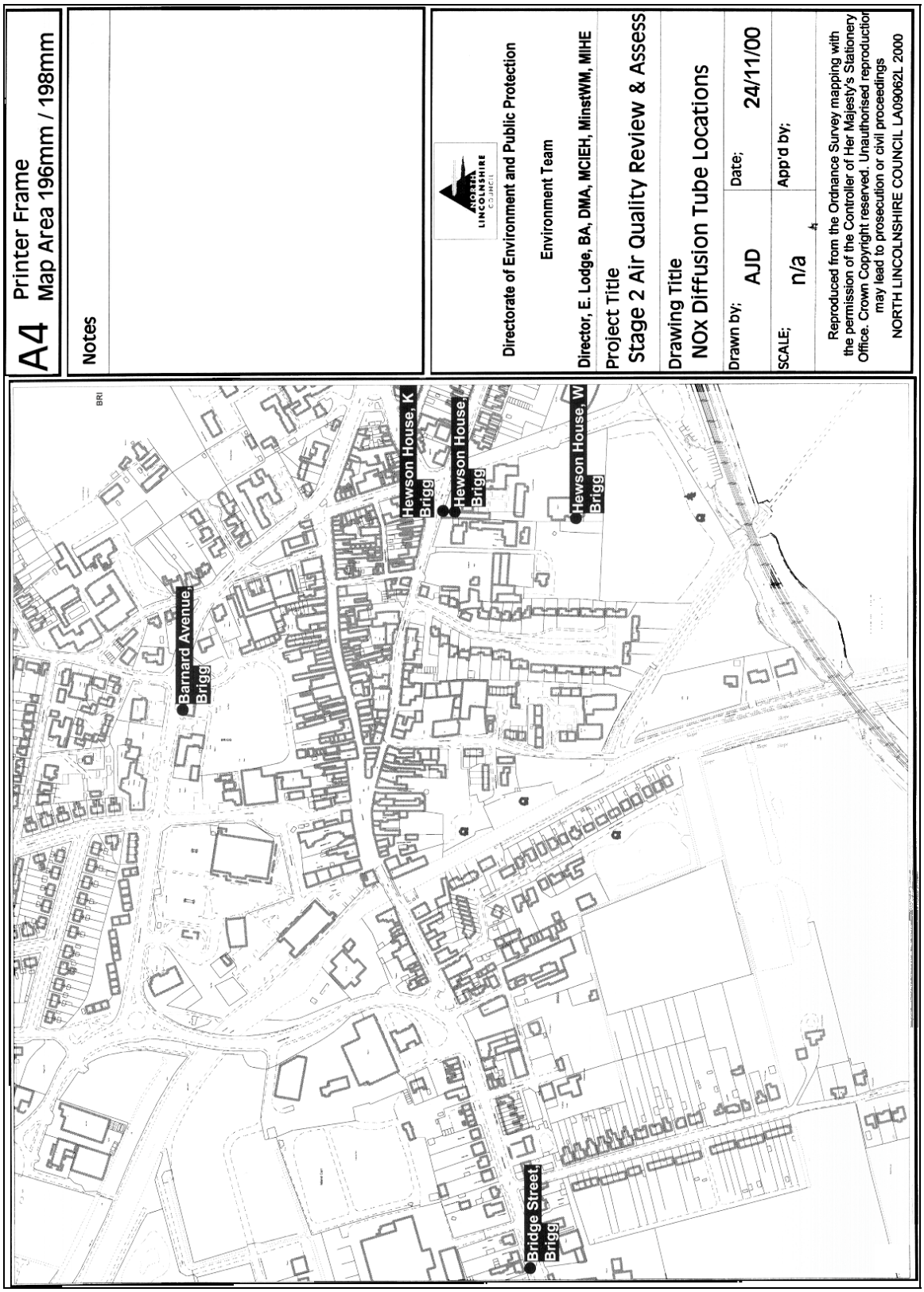
Site Address:
Commercial Services Dept, Cottage Beck Road, Scunthorpe

OS Grid Reference: SE905107
Site Type: Urban Industrial
Start Date: 15/12/97
Pollutants Measured: SO2,PM10

SITE DESCRIPTION

The monitoring site is located at first floor level (approx. 8 metres height) of the council's commercial depot. It is approximately 20 metres from Cottage Beck Road, and 100 metres from the busy Station Road. The British Steel complex lies approximately 500m to the east.


NO2 Diffusion Tube Locations, Scunthorpe
Sheffield Street
Britannia Corner
Station Road / Brigg Road
Mary Street
Ashby Road
Old Brumby Street
West Common
Gloucester
Queensway
Bottesford


A4 Printer Frame
Map Area 196mm / 198mm
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Directorate of Environment and Public Protection
Environment Team
Director, E. Lodge, BA, DMA, MCIEH, MinstWM, MIHE
Project Title
Stage 2 Air Quality Review & Assess
Drawing Title
NOx Diffusion Tube Locations
Drawn by; AJD
Date; 24/11/00
SCALE; n/a
App'd by;
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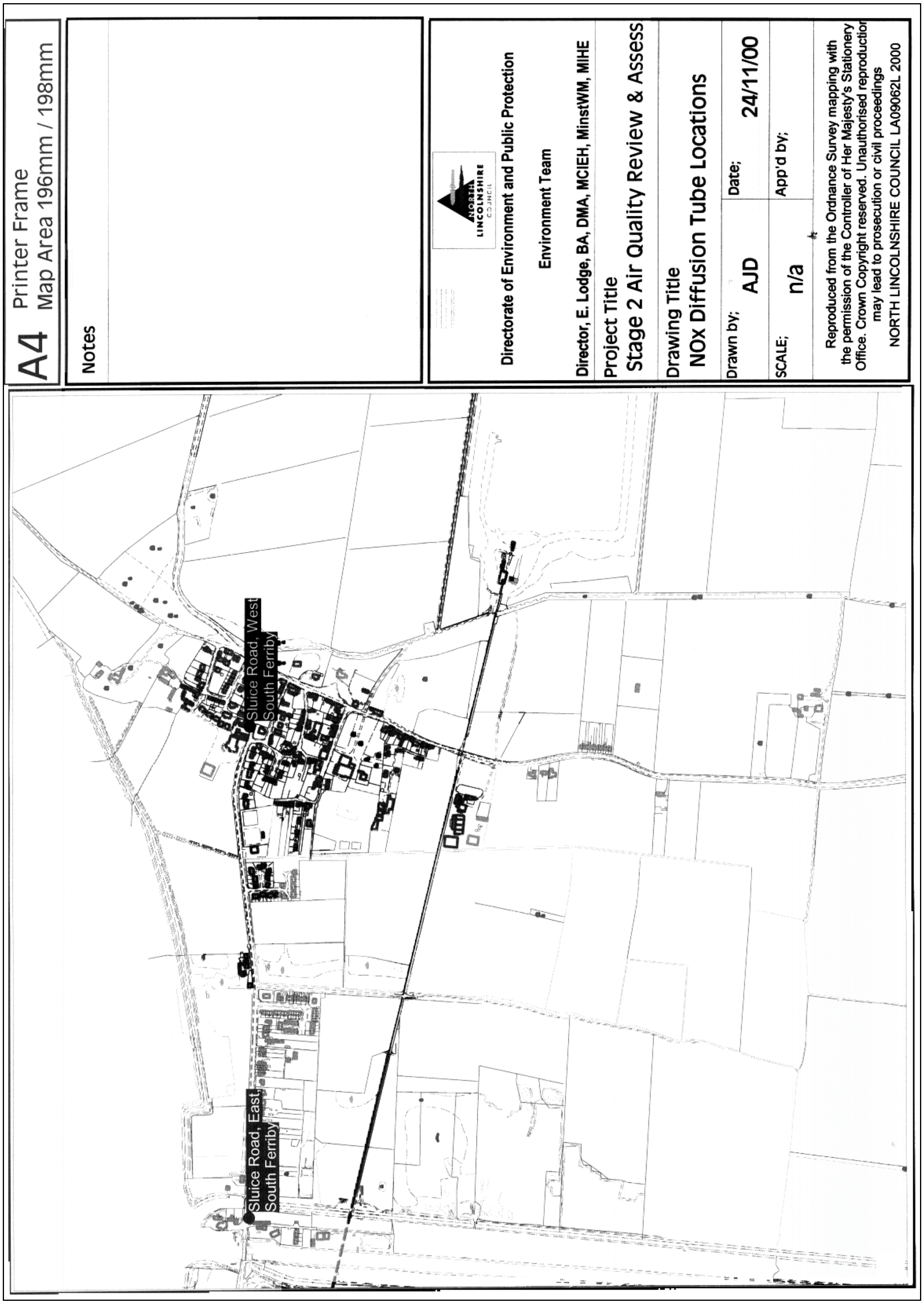
NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
Barnard Avenue, Brigg
Hewson House, K Brigg
Hewson House, Brigg
Hewson House, W Brigg
Bridge Street, Brigg


A4
Printer Frame
Map Area 196mm / 198mm
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NORTH LINCOLNSHIRE COUNCIL
Directorate of Environment and Public Protection
Environment Team
Director, E. Lodge, BA, DMA, MCIEH, MinstWM, MIHE
Project Title
Stage 2 Air Quality Review & Assess
Drawing Title
NOx Diffusion Tube Locations
Drawn by;
AJD
Date;
24/11/00
SCALE;
n/a
App'd by;
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NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
Sluice Road, West
South Ferriby
Sluice Road, East
South Ferriby


K2
K10
K1
K8
K3
GF/WS/4
K9
K5
K4
K6
K12
K7
K11
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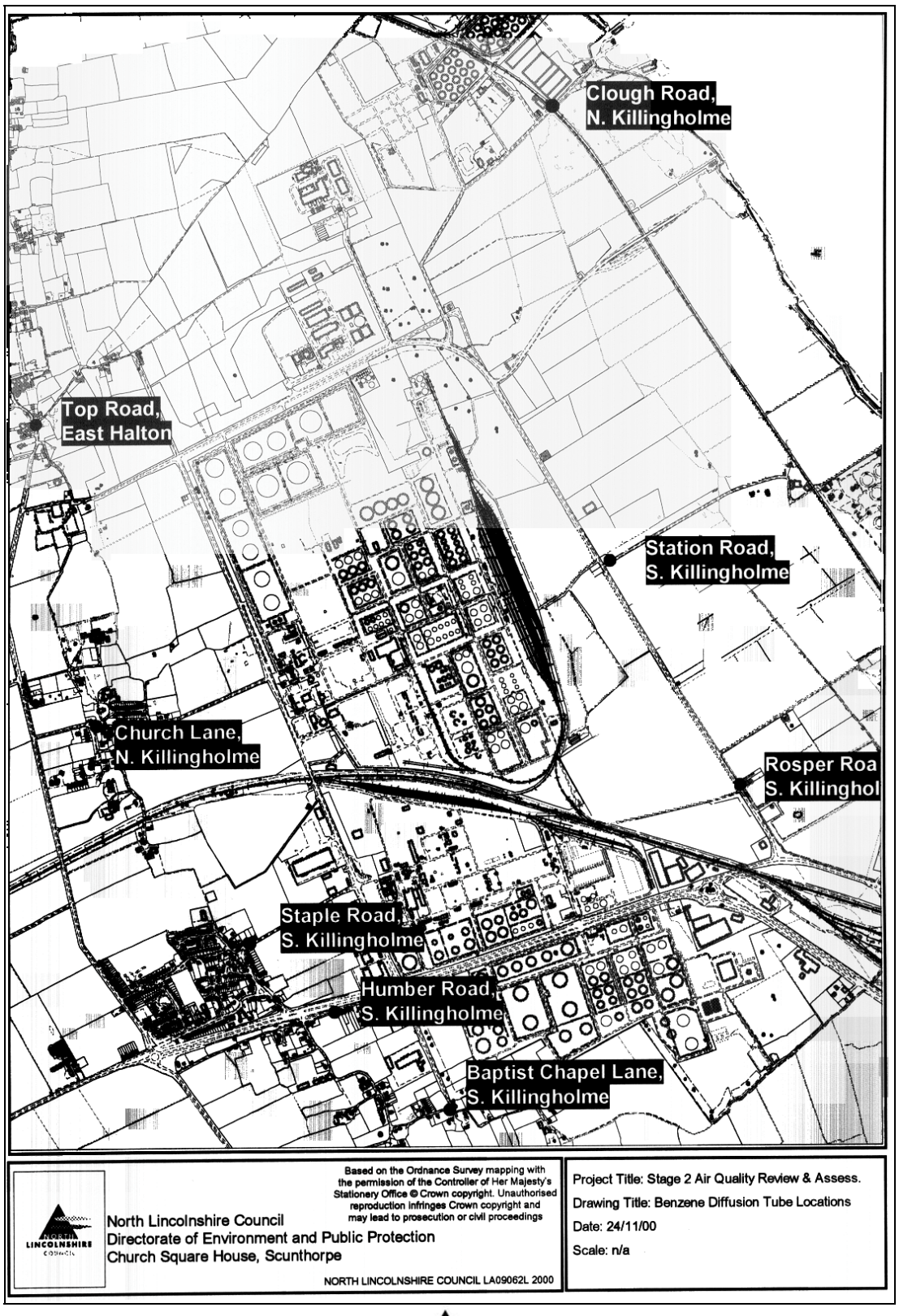
North Lincolnshire Council
Directorate of Environment and Public Protection
Church Square House, Scunthorpe
NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
Project Title: Stage 2 Air Quality Review & Assess.
Drawing Title: NOx Diffusion Tube Locations
Date: 10/11/00
Scale: n/a


Clough Road,
N. Killingholme
Top Road,
East Halton
Station Road,
S. Killingholme
Church Lane,
N. Killingholme
Rosper Roa
S. Killinghol
Staple Road,
S. Killingholme
Humber Road,
S. Killingholme
Baptist Chapel Lane,
S. Killingholme
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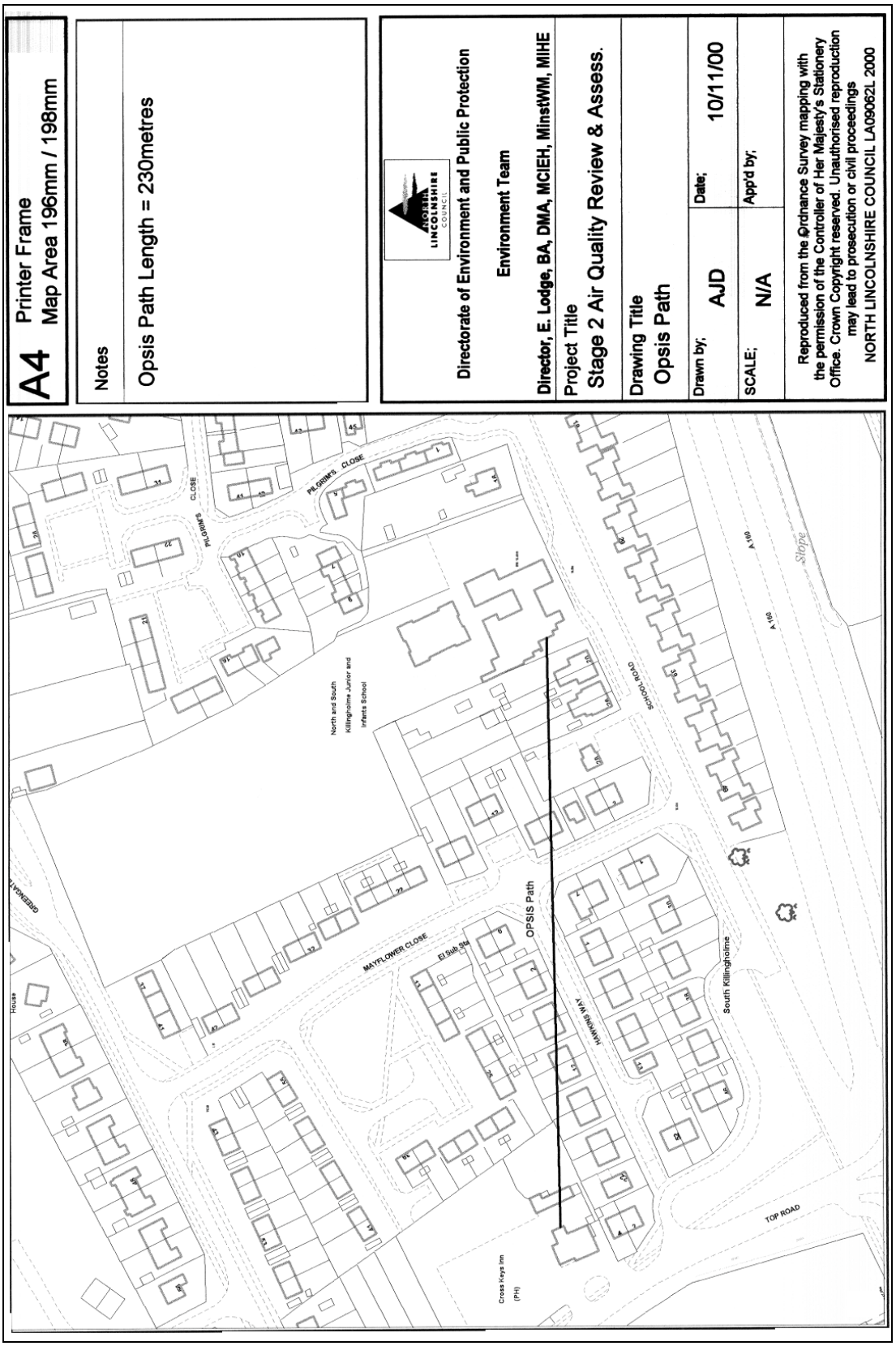
North Lincolnshire Council
Directorate of Environment and Public Protection
Church Square House, Scunthorpe
NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
Project Title: Stage 2 Air Quality Review & Assess.
Drawing Title: Benzene Diffusion Tube Locations
Date: 24/11/00
Scale: n/a


A4 Printer Frame
Map Area 196mm / 198mm
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Opsis Path Length = 230metres
NORTH LINCOLNSHIRE COUNCIL
Directorate of Environment and Public Protection
Environment Team
Director, E. Lodge, BA, DMA, MCIEH, MInstWM, MIHE
Project Title
Stage 2 Air Quality Review & Assess.
Drawing Title
Opsis Path
Drawn by; AJD
Date; 10/11/00
SCALE; N/A
App'd by;
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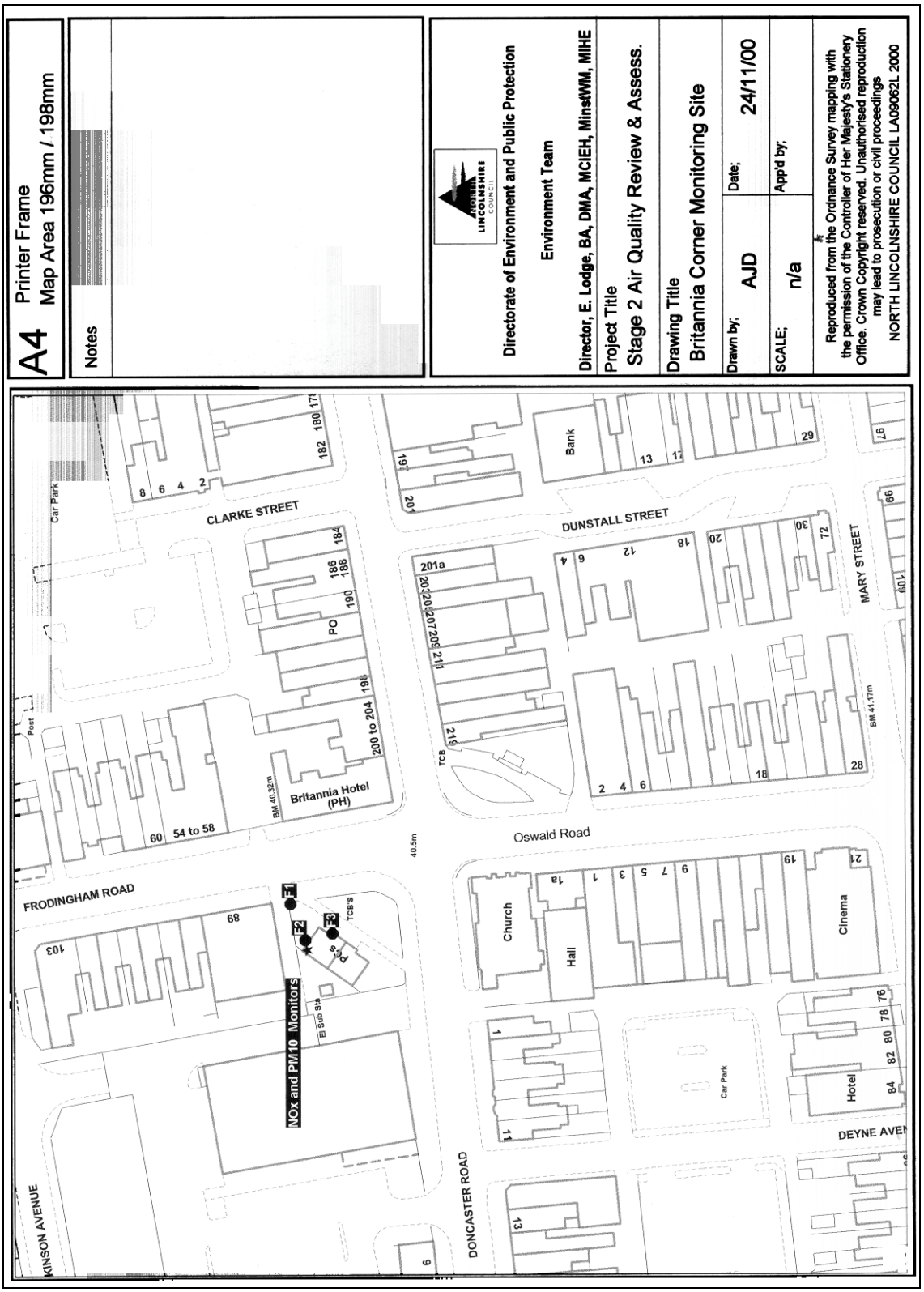
NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
OPSIS Path
PILGRIMS CLOSE
MAYFLOWER CLOSE
SCHOOL ROAD
HAWKINS WAY
TOP ROAD
North and South Killingholme Junior and Infants School
South Killingholme
Cross Keys Inn (PH)
A160
Slope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Map Area 196mm / 198mm
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Directorate of Environment and Public Protection
Environment Team
Director, E. Lodge, BA, DMA, MCIEH, MinstWM, MIHE
Project Title
Stage 2 Air Quality Review & Assess.
Drawing Title
Britannia Corner Monitoring Site
Drawn by; AJD
Date; 24/11/00
SCALE; n/a
App'd by;
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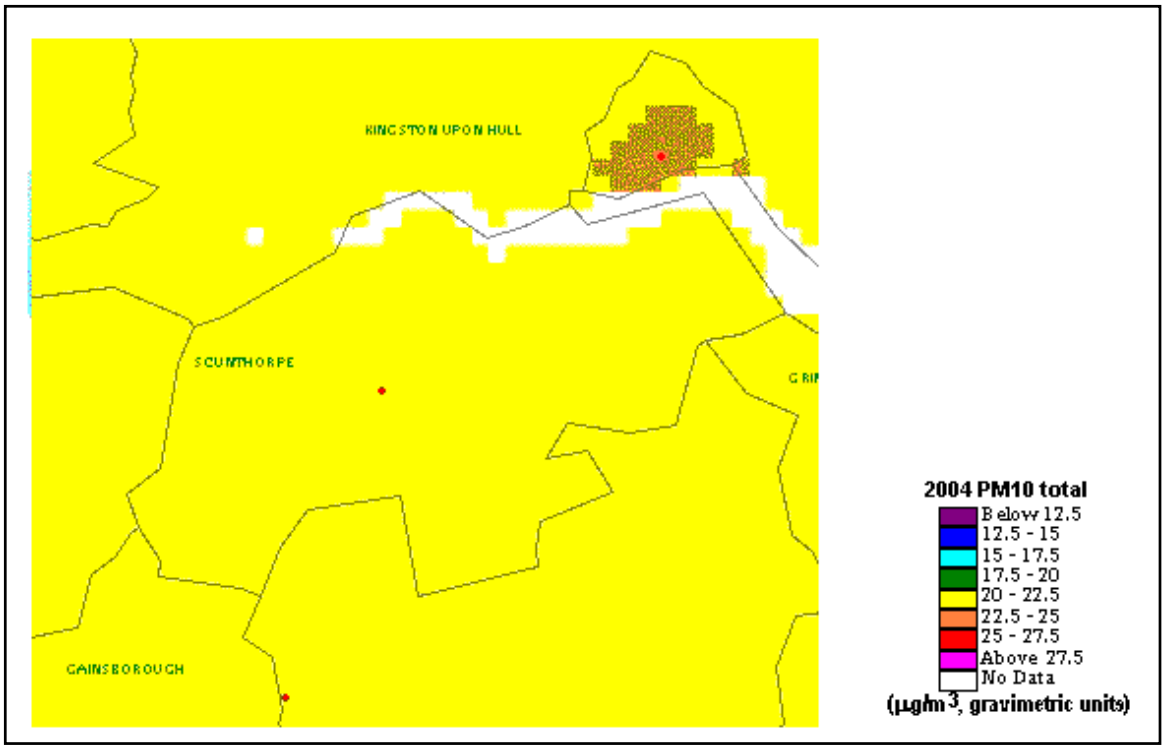
NORTH LINCOLNSHIRE COUNCIL LA09062L 2000
CLARKE STREET
DUNSTALL STREET
MARY STREET
FRODINGHAM ROAD
Oswald Road
DONCASTER ROAD
KINSON AVENUE
DEYNE AVE
Britannia Hotel (PH)
Bank
Church
Hall
Cinema
Hotel
Car Park
PO
TCB
TCB's
BM 40.32m
BM 41.17m
40.5m
NOx and PM10 Monitors
F1
F2
F3

Appendix 4

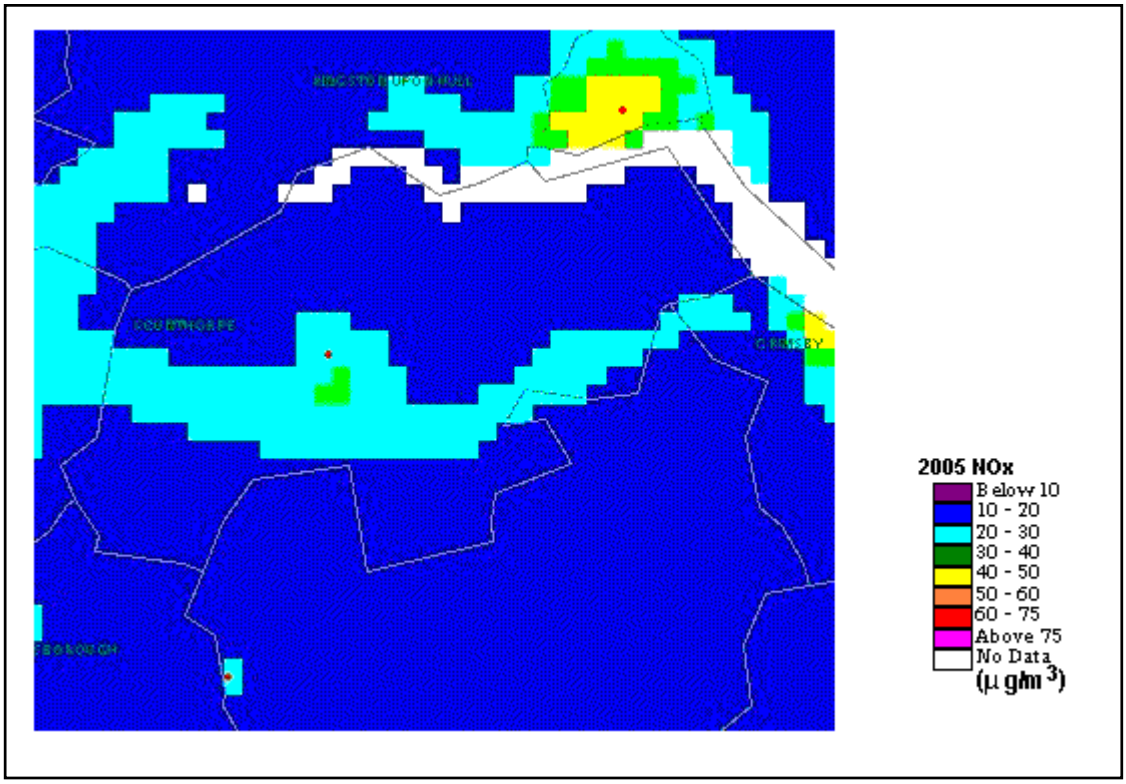
Background Concentrations

Annual Average of Total PM10 Concentrations, 2004



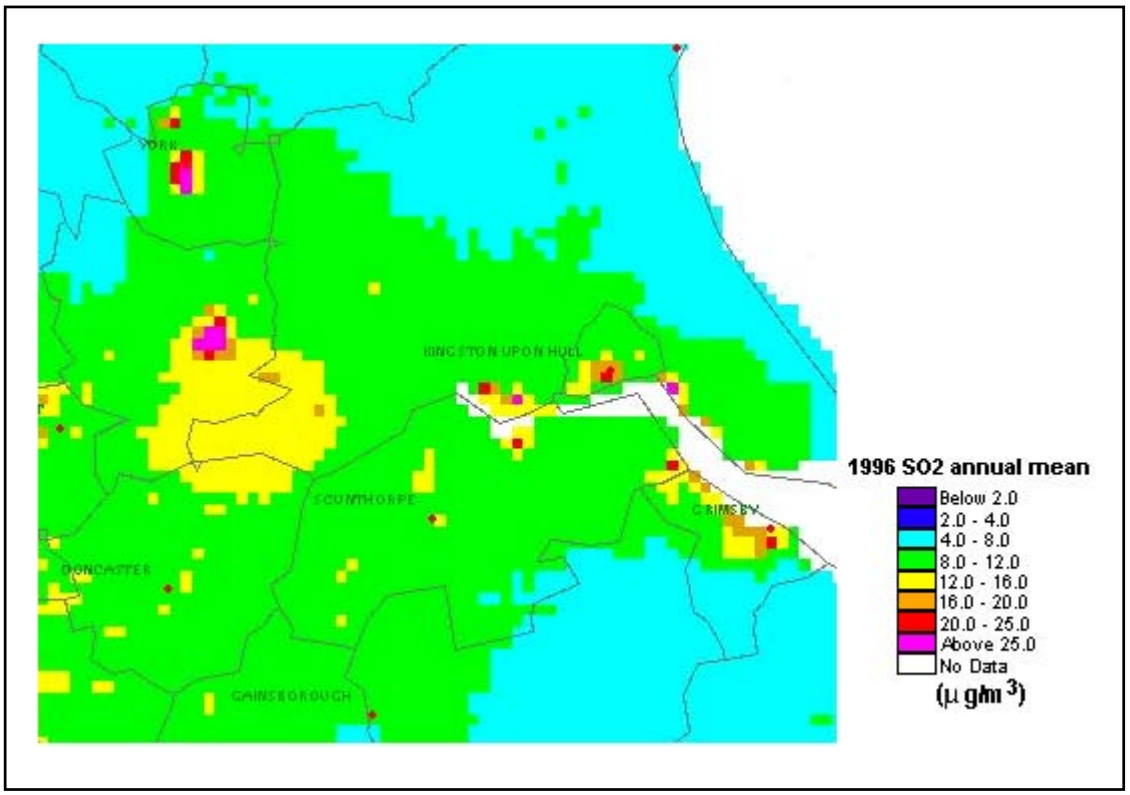
Map taken from Internet Site – www.aeat.uk/netcen/airqal

Annual Average of Total NO_X Concentrations, 2005



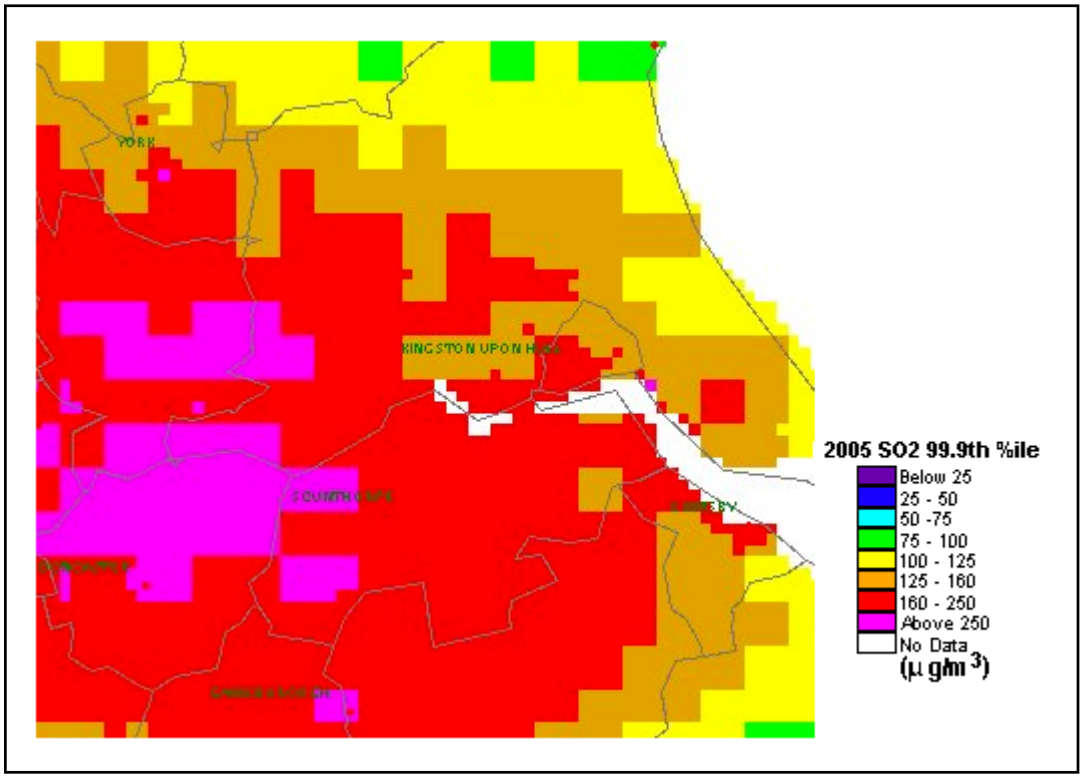
Map taken from Internet Site – www.aeat.uk/netcen/airqal

Annual Average of Background SO_2 Concentrations, 1996



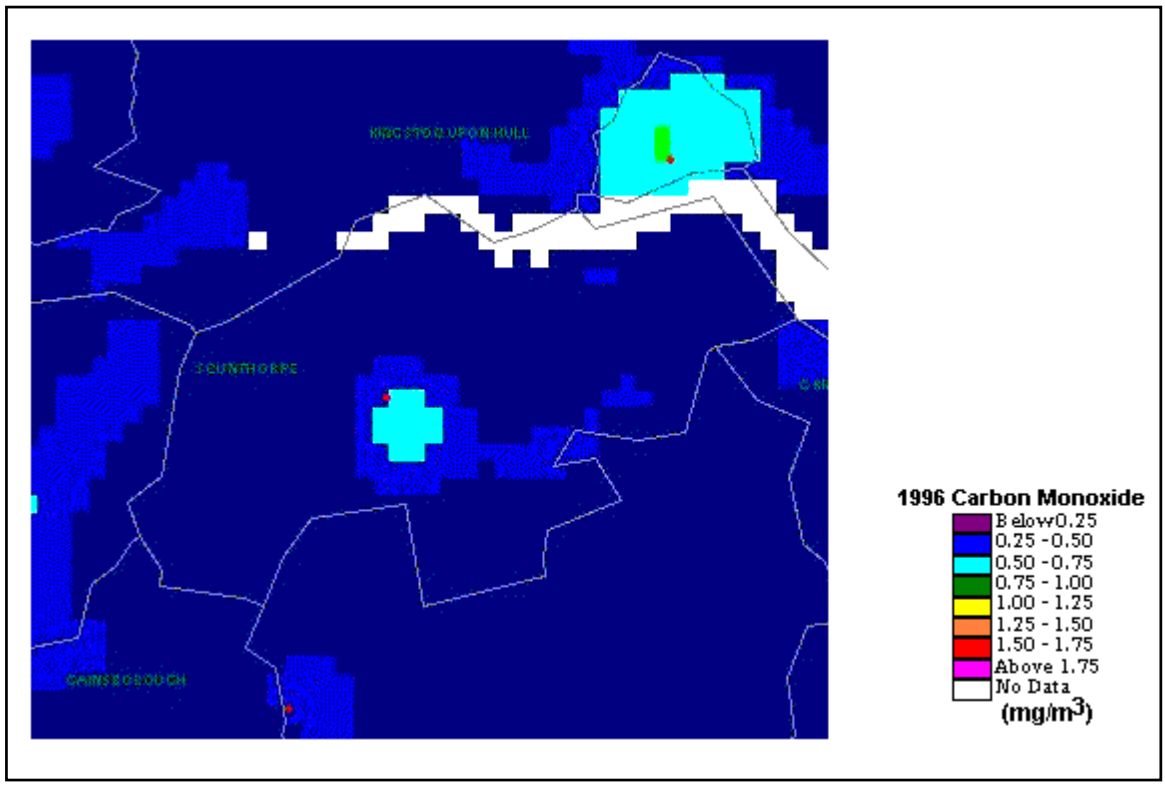
Map taken from Internet Site – www.aeat.uk/netcen/airqal

99.9th Percentile of SO_2 Concentrations, 2005



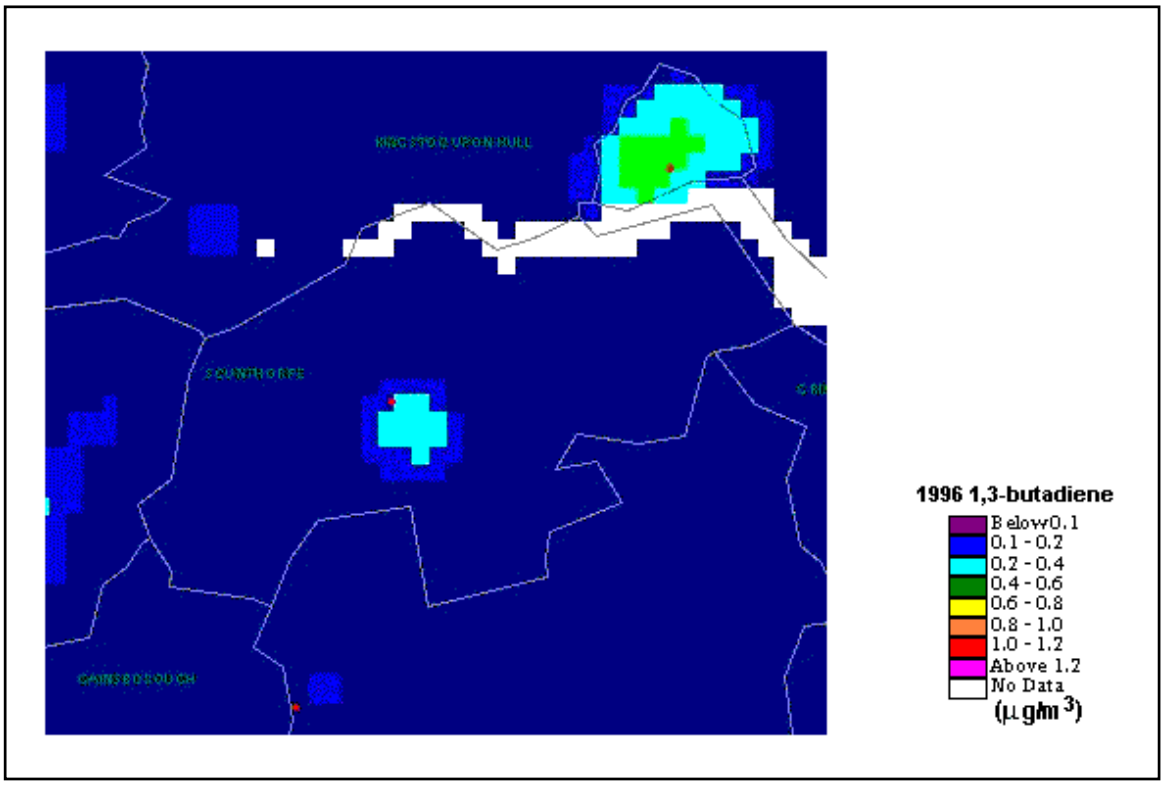
Map taken from Internet Site – www.aeat.uk/netcen/airqal

Annual Average of Carbon Monoxide Concentrations, 1996



Map taken from Internet Site – www.aeat.uk/netcen/airqal

Annual Average of 1,3-Butadiene Concentrations, 1996



Map taken from Internet Site – www.aeat.uk/netcen/airqal

Appendix 5

QA/QC

Britannia Corner, Scunthorpe Monitoring Station

- The monitoring station located at Britannia Corner is equipped with a continuous Nitrogen Dioxide monitor and a Tapered Element Oscillating Microbalance (TEOM) supplied by Signal Ambitech.

- The Nitrogen Dioxide monitor uses the chemiluminesence principle of detection. In this the real time chemiluminescent NO_x analyser uses chemiluminescent energy emitted when NO reacts with Ozone (O_3) in an evacuated chamber forming chemiluminescent Nitrogen Dioxide (NO_2). The chemiluminescent reaction is –

  $$NO + O_3 = NO_2 + e + O_2 \quad \text{where e = chemiluminescent energy}$$

  Light from the chemiluminescent NO_2 is incident upon a photomultiplier tube and amplifier that converts the light signal into a voltage. The strength of the analogue output voltage from the photomultiplier is proportional to the concentration of NO in the reaction chamber. One stream passes directly into the reaction chamber to measure the NO concentration whilst the other first passes through a heated molybdenum catalyst which reduces NO_2 to NO. The photomultiplier output is now proportional to the total Oxides of Nitrogen (NO_x). The Nitrogen Dioxide concentration in the ambient sample is determined from the NO_x and NO voltages by subtraction.

- The TEOM measures particulates by use of an inertial balance measuring the mass collected on an exchangeable filter cartridge by monitoring the corresponding frequency changes of a tapered element. The monitor is fitted with a PM_{10} inlet.

- Service and maintenance of the monitoring station is carried out by Signal Ambitech on behalf of the Authority. The site is serviced every six months together with remote maintenance check and reviews of the system conducted via remote PC access.

- The Nitrogen Dioxide monitor is manually calibrated at fortnightly intervals using zero air and 500ppb Nitrous Oxide in Nitrogen calibration gas. In addition the analyser performs a daily self-calibration routine. The results of both are logged and stored.

- The TEOM is also calibrated fortnightly and the filter is changed when the loading reaches 80% or every four weeks, whichever is the sooner.

- The calibration gas used is supplied by Messer UK Ltd and is certified and traceable.

- The data obtained from the monitoring station is ratified by applying the calibration and manual calibration zero and span factors and excluding from consideration any data affected by calibration procedures or abnormal circumstances such as power failures etc.

Cottage Beck Road, Scunthorpe Monitoring Station

- The monitoring station located at Cottage Beck Road is equipped with a continuous Sulphur Dioxide monitor and a Tapered Element Oscillating Microbalance (TEOM) supplied by Enviro Technology Services plc. Service and maintenance of the monitoring station is carried out by Enviro Technology Services plc on behalf of the Authority.

- Both the Sulphur Dioxide monitor and the TEOM are calibrated fortnightly and the TEOM filter changed when the loading reaches 80% or every four weeks, whichever is the sooner.

- As it is an affiliated AUN site the results of each calibration are sent to NETCEN and they check and ratify all data obtained from the monitors.

Killingholme School Monitoring Station

- An OPSIS long path, ultra violet light, continuous monitor is operated at this site. It is supplied by Enviro Technology Services plc. who carry out quarterly service and maintenance of the OPSIS on behalf of the Authority.

- The system utilises the Differential Optical Absorption Spectroscopy technique (DOAS), which makes use of a broadband light source. The light source is collimated by a parabolic mirror to a narrow beam that is shone over a path of 230metres.

- The pollutant species measured that are relevant to this report are Nitrogen Dioxide, Sulphur Dioxide and Benzene.

Nitrogen Dioxide Diffusion Tube Network

- **Introduction**

  Four of the diffusion tube sites within North Lincolnshire are also part of the UK Nitrogen Dioxide Diffusion Tube Network. This network provides the DETR with information on the spatial and temporal distribution of NO_2 in the UK urban environment. It is important that data from the network is of the highest possible quality. To ensure this laboratory performances are assessed on the basis of both the Workplace Analysis Scheme for Proficiency (WASP).

- **Workplace Analysis Scheme for Proficiency**

  WASP involves a monthly analysis of doped tubes, allowing assessment of overall uniformity of data throughout the year. Performance scores are assigned to the reported analysis results, on the basis of their difference from the known concentration of the analyte and the actual standard deviations.

  Results are classified as follows –

Good	≤ 2 Standard deviations from true analyte concentration.
Warning	2 - 3 Standard deviations from true analyte concentration.
Action	≥ 3 Standard deviations from true analyte concentration.

  North Lincolnshire Council employs Rotherham Metropolitan Borough Council Environmental Health Laboratory to analyse all the diffusion tubes located within the Authority. This laboratory's performance classification under WASP is ***Good;*** therefore results from North Lincolnshire Council's diffusion tube network can be used with confidence.

Appendix 6

Glossary of Terms

Glossary of Terms

AQMA	Air Quality Management Area. A legally defined area identified as one in which the statutory Air Quality Objectives will not be met. An action plan must be drawn up to improve air quality.
Air Quality Objective	An air quality standard that includes a date by which it must be achieved.
Air Quality Standard	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.
Average Time	The period of time over which a pollutant level must be measured and the average result calculated. This can be a different period for each pollutant and directly affects which locations can be considered relevant.
C_6H_6	Benzene.
CO	Carbon Monoxide.
DETR	Department of Environment, Transport and the Regions. The Government department responsible for U.K. air quality.
Emissions Inventory	A catalogue of the sources of a pollutant in an area, with information about their positions and the quantities emitted. Used in dispersion models.
EPAQS	The Expert Panel on Air Quality Standards. The U.K. group appointed by the government to set standards for maximum acceptable levels of pollutants.
Fugitive Emissions	Emissions of pollutants from a vent point other than a stack.
$\mu g/m^3$	Micrograms per cubic metre.
mg/m^3	Milligrams per cubic metre.
NAQS	National Air Quality Strategy.
NO	Nitrogen Oxide.

NO_2	Nitrogen Dioxide.
NO_X	Oxides of Nitrogen.
Part A Processes	An industrial process that is required to obtain authorisation from the Environment Agency. Regulation of the emissions to air is included in the authorised document.
Part B Processes	An industrial process that is required to obtain authorisation from the local authority in order to operate. Regulation of the emissions to air is included in the authorised document.
Particulates	Particles so small that they are suspended in the atmosphere, usually invisible, and small enough to be breathed in.
Pb	Lead.
Percentile	The percentage of items in a set of data lying above or below a particular value, e.g. concentration of a pollutant. For example for Nitrogen Dioxide the hourly mean of 200$\mu g/m^3$ can be exceeded up to 18 times a year. This is the equivalent of the 99.8th percentile being less than 200$\mu g/m^3$ because in one year there are 8760 hours of which 18 hours are 0.2% so 99.8% must be lower than the objective.
PM_{10}	Particulate matter less than 10 microns (millionths of a metre) in diameter.
Ppb	Parts per billion.
Ppm	Parts per million.
Relevant Locations	These can differ for each pollutant according to the averaging period considered. Relevant locations are those areas where the public might reasonably be exposed to a pollutant over its averaging time. Long averaging times such as a year mean relevant locations could include schools, houses, hospitals etc. Short averaging times widen the scope, as less exposure time is needed.
Running Mean	As an example the air quality standard for Carbon Monoxide is 11.6mg/m^3 as a running 8-Hour Mean. To assess measured levels against this standard it is necessary to calculate the average of eight consecutive

	hourly values, e.g. from midnight to 8:00a.m. then from 1:00a.m. to 9:00a.m. and so on throughout the period of interest. As each calculation of the "Running 8-Hour Mean" gives a result there will be 24 opportunities for the standard to be assessed each day. This will hold true for whether an 8-Hour, 24- Hour or Annual Running Mean is the time period under consideration.
SO_2	Sulphur Dioxide.
TEOM	Tapered Element Oscillating Microbalance. This is an instrument used for measuring concentrations of particulates by changes in the resonant frequency of an element on which a particle collection filter is mounted.
VOC	Volatile Organic Compound.
ZIPS	The Humberside Zone of Industrial Polluting Sources.

For more information about Air Quality issues within North Lincolnshire please contact the Scientific Officer for Air Quality on 01724 297620 (Fax. 01724 297643) or by email at adam.dawson@northlincs.gov.uk

NORTH LINCOLNSHIRE COUNCIL

www.northlincs.gov.uk

January 2001