NORTH LINCOLNSHIRE COUNCIL

AIR QUALITY REVIEW & ASSESSMENT

Stage One Report

NORTH LINCOLNSHIRE COUNCIL

Executive Summary

The recently published United Kingdom National Air Quality Strategy details Air Quality Objectives in relation to seven pollutants which the Government seeks to achieve throughout the country by the year 2005.

Local Authorities are required to assess air quality in their area against these Air Quality Objectives. Where levels of pollutants exceed the Air Quality Objectives and are likely to continue to do so in 2005, Local Authorities must determine what their approach will be to air quality management and the measures they propose to take to improve air quality.

The assessment of air quality is to be carried out in 3 stages, this report being the first stage review. It is intended to identify the principal sources of polluting emissions likely to affect air quality in North Lincolnshire and determine what further work is required to assess whether there is a risk that levels of any of the seven pollutants under consideration may breach the Air Quality Objectives in 2005.

There are a number of major industrial sites in North Lincolnshire, the largest of which are the British Steel complex in Scunthorpe and the Lindsey and Conoco Oil Refineries in Killingholme. In addition, there are 6 power stations in North Lincolnshire will another 3 proposed. Many of the Local Authorities surrounding North Lincolnshire also have significant industrial sites in their areas which are taken in to account in this report.

The report identifies that there are sources of all seven of the pollutants under consideration in North Lincolnshire and therefore it will be necessary to carry out a second and/or third stage review and assessment on all of the pollutants.

Locations where the highest concentrations of all the pollutants are likely to occur are identified in this report and it is in these areas particularly that further assessment work will be focused.

Although traffic is a major source of pollution in many towns and cities, it is less significant in North Lincolnshire where traffic flows are not as high. The report identifies that the impact of traffic will only need to be considered in relation to oxides of nitrogen and fine particulate matter (PM^{10}) on certain defined roads.

The Second and Third Stage Review and Assessments are to completed by the end of December 1999.

Comments on this report should be forwarded to Mr E Lodge, Director of Environment and Public Protection, PO Box 42, Church Square House, Scunthorpe, North Lincolnshire, DN15 6XQ.

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1.0 Introduction

1.1 Background

Issues such as global warming, ozone depletion and acid rain have demonstrated to everyone that the atmosphere surrounding our planet is very sensitive to our activities and we cannot continue to use it as a dustbin for all the gaseous waste we produce.

Many pollutants are known to have an adverse effect on health even if they are only present at very low levels and much research has been carried out in recent years to determine what is an acceptable level of a pollutant in the atmosphere. There is concern that air pollution may, for example, be a factor in the rise of childhood asthma which has increased by about 50% in the last 30 years.

Although air pollution has been recognised for many centuries, it is only since the 1950's that any real attempt has been made to control it. Prior to this, it was often considered that all that was required was to discharge pollutants from as high a chimney as possible so that they would be diluted and blown away.

Historically, the major air pollution problem has been smoke and sulphur dioxide from the burning of coal on domestic fires. This led to the common occurrence of smog (a mixture of smoke and fog) in most of our cities. A particularly severe smog in London in 1952 lasted five days and resulted in 4,700 extra deaths.

This incident led to a move to try and improve air quality and resulted in the Clean Air Act 1956. To combat the problem of domestic coal burning, the concept of Smoke Control Areas was introduced, whereby only smokeless fuel was allowed to be used on domestic fires.

In Scunthorpe, the first Smoke Control Area came into operation in June 1961 covering the Riddings area of Scunthorpe. Twelve further areas were declared between 1961 and 1981 to cover the whole of Scunthorpe. Bottesford and an area to the west of Scunthorpe were covered by a further three Smoke Control Areas between 1961 and 1963.

The improvement in air quality that resulted in Scunthorpe from the introduction of Smoke Control Areas was dramatic, as shown in Figure 1. Levels of smoke and sulphur dioxide (the principal pollutants from coal burning) decreased by twenty-fold and ten-fold respectively over this period.
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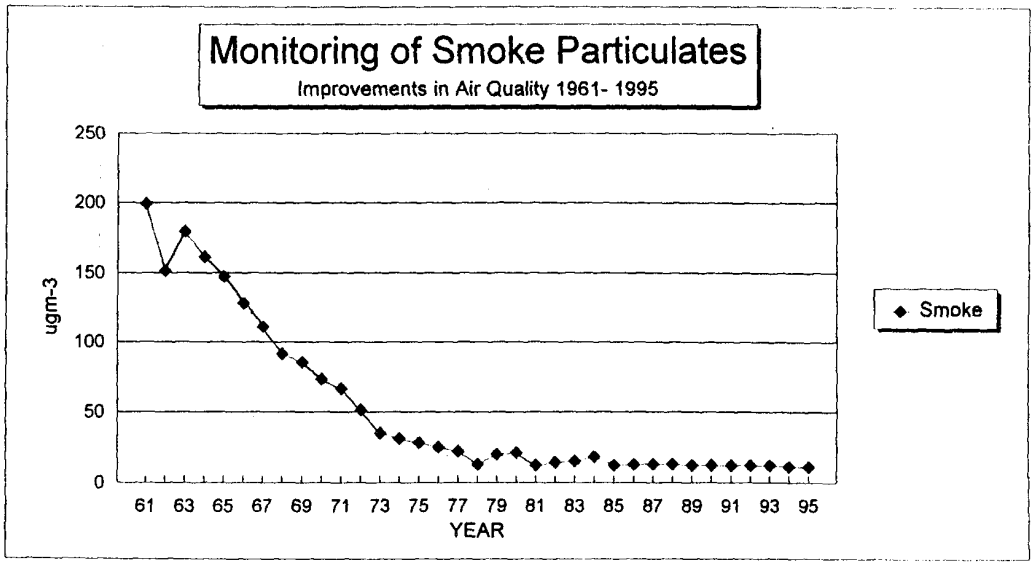
The Clean Air Acts of 1956 and 1968 also introduced controls to clean up emissions from industrial premises by prohibiting dark smoke from chimneys and preventing the burning of waste materials.

Figure 1
Reduction of airborne smoke between 1961-1995



Up to this point in time, the main sources of air pollution were from domestic coal burning and industry. Our increasing dependence on motor vehicles has, however, introduced new problems. Now pollutants such as benzene and oxides of nitrogen are becoming more important as are secondary pollutants such as ozone, which contribute to the photochemical haze that covers many cities in summertime.

The Government has recognised that a national strategy is necessary to comprehensively tackle and manage air quality. Local authorities have been given a key role to monitor and assess air pollution in their local area and to develop a strategy to continually improve air quality. This report represents the First Stage in this process.

1.2 UK National Air Quality Strategy

To tackle air pollution effectively, action is necessary at both a national and local level.

At a national level, the Government have developed the United Kingdom National Air Quality Strategy which was published in March 1997. This sets out a strategy for the management and improvement of air quality which can be applied across the whole of the country. It identifies seven priority pollutants which local authorities are required to monitor and assess in their area.

The seven pollutants are:-

- Sulphur Dioxide
- Nitrogen Dioxide
- Particles (PM10)
- Carbon Monoxide
- Lead
- 1, 3 Butadiene
- Benzene

These particular pollutants have been chosen because they are all commonly present in the air and they all can have a detrimental effect on human health. Although the strategy is based on the effects on human health and not on detrimental effects on wildlife and the environment as a whole, the targets set will nevertheless help to reduce impacts on these as well.

An expert panel on Air Quality Standards (EPAQS) was set up to advise on the establishment of air quality standards for the UK based on the best available scientific and medical evidence of the effects of air pollution on human health and the wider environment.

This panel determined for each of the seven pollutants a target level to aim for, below which no significant risk to health is posed. Using these standards as a basis for determining what is acceptable air quality, the Government set Air Quality Objectives for each of the pollutants which should be achieved by the year 2005. These standards and objectives are detailed in Table 1, below.

Table 1 -
Air Quality Standards & Objectives

Pollutant	**Air Quality Standard**	**Measured As**	**Specific Objective to be achieved by 2005**
Benzene	5 ppb	running annual mean	as air quality standard
1,3 Butadiene	1 ppb	running annual mean	as air quality standard
Carbon Monoxide	10 ppm	running 8 hour mean	as air quality standard
Lead	0.5μg/m³	annual mean	as air quality standard
Nitrogen Dioxide	150 ppb 21 ppb	1 hour mean annual mean	as air quality standard as air quality standard
Particles (PM10)	50μg/m³	running 24 hour mean	50μg/m³ 99th percentile
Sulphur dioxide	100 ppb	15 minute mean	100 ppb 99.9th percentile

ppm= parts per million ppb= parts per billion

μg/m3 = micrograms per cubic metre

As the Air Quality Objectives have been developed with a view to protecting human health, local authorities are required to have regard to locations where individuals are likely to be exposed over the averaging period of the prescribed objective.

This has been defined within the guidance as follows:-

- for objectives with short averaging times (i.e. for sulphur dioxide and nitrogen dioxide) reviews and assessments should be focused on any non-occupational, near ground level outdoor location given that exposures over such short averaging times are potentially likely.

- for objectives with longer averaging times, reviews and assessments should be focused on the following near ground outdoor locations: background locations; roadside locations ; and other areas of elevated pollutant concentrations where a person might reasonably be expected to be exposed (e.g. in the vicinity of housing ,schools or hospitals etc) over the relevant averaging time of the objective.

Although it is difficult to predict exactly how air quality will change over the next few years, it is likely that with all new national measures in place, such as new vehicle and fuel standards and further controls on industrial emissions, there is still a good possibility that the objectives for a number of pollutants will not be achieved. This is where local action is vital to identify where the objectives are likely to be breached and where action at a local level will be required.

1.3 Local Air Quality Monitoring & Assessment

Every Local Authority is required to review and assess the present and likely future air quality in their areas. The primary objectives of such a review are:-

- to identify those areas at a local level where national policies and instruments appear unlikely in themselves to deliver the national air quality objectives by the end of the year 2005.

- To ensure that air quality considerations are integrated in to local authorities decision making processes such as land use planning and traffic management.

In assessing the present state of air quality in North Lincolnshire, this is to be carried out as a three stage approach.

First Stage

This requires local authorities to consider all sources of pollutants of concern within its area, which could have a significant impact locally. Such a review should include:-

- Details of existing and predicted levels of traffic flow which, by the year 2005, could generate significant quantities of a pollutant of concern.

- Details of major industrial sources of pollution in the area.

- Details of any other significant sources of pollution.

On the basis of this information, the local authority should be able to identify if there are localities of industrial and transport sources in their area which have the potential to emit such a quantity of a pollutant that the air quality objectives might be breached at that location.

Second Stage

A local authority will progress to the second stage if the data search suggests that concentrations of pollutants within its area may breach air quality objectives. It requires Councils to select a number of locations in its area where the highest likely concentrations of each air pollutant (highlighted by the first stage review), are likely to occur. At these locations, the local authority needs to measure the concentrations of these pollutants to assess whether there is a significant risk of the air quality objectives not being achieved, in which case they need to progress to the third stage.

Third Stage

Local authorities progressing to the third stage need to use sophisticated modelling and monitoring techniques to produce an accurate and detailed assessment of air quality within the areas of concern. It is expected that the third stage review will be completed by December 1999.

If after all three stages of the review and assessment has been completed, it is determined that any of the Air Quality Objectives are not being met in a part of North Lincolnshire, the Local Authority must declare that particular area as an Air Quality Management Area. Such “hotspots” could be as small as a single road or it could include the majority or whole of North Lincolnshire. Within an Air Quality Management area, local authorities will need to determine an action plan to reduce levels of pollution to below the air quality objectives.

2.0 Local Sources of Pollution

2.1 Industrial Sources of Pollutants in North Lincolnshire

Two regulatory regimes exist in England and Wales for the control of emissions from industrial premises.

Part 'A' processes are large industrial processes such as power stations, steel works and refineries which are controlled by authorisations issued by the Environment Agency. These industries have the potential to have emissions to air, land and water.

Part 'B' processes tend to be slightly smaller industrial sites where the only significant emissions are to air. These are controlled by local authorities.

2.1.1 Part 'A' Processes

There are 20 Part 'A' processes in North Lincolnshire. The locations of these companies are shown in figure 2.

Major industry in North Lincolnshire is largely concentrated in two areas. The first is centred around Scunthorpe where British Steel and related companies exist. The other is at Killingholme where there are two oil refineries and two power stations.

Appendix 1 provides details of each of the Part 'A' processes and includes which of the seven pollutants being assessed they are likely to produce.

2.1.2 Part 'B' Processes

There are 108 industrial processes that are authorised by North Lincolnshire Council in relation to emissions to air. Only 30 of these processes have potential significant emissions of one or more of the seven pollutants of concern. The locations of these companies are shown in Figure 3.

Appendix 2 details what potential emissions each of the companies may have.

The majority of Part 'B' companies are similarly located in the industrial areas of Scunthorpe, Flixborough and Killingholme.

Figure 2
Major Industrial Premises (Schedule 'A' Processes) in North Lincolnshire

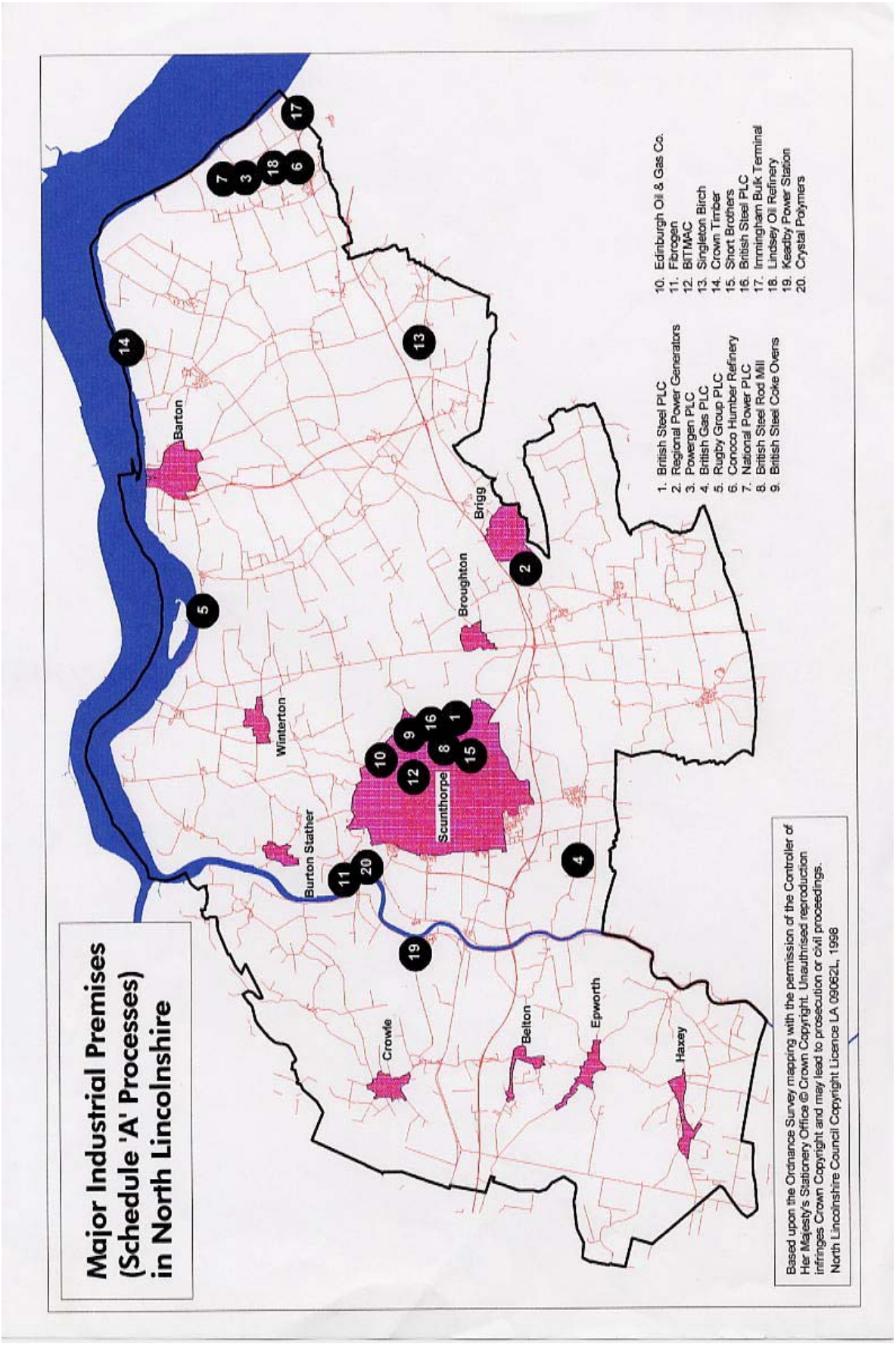
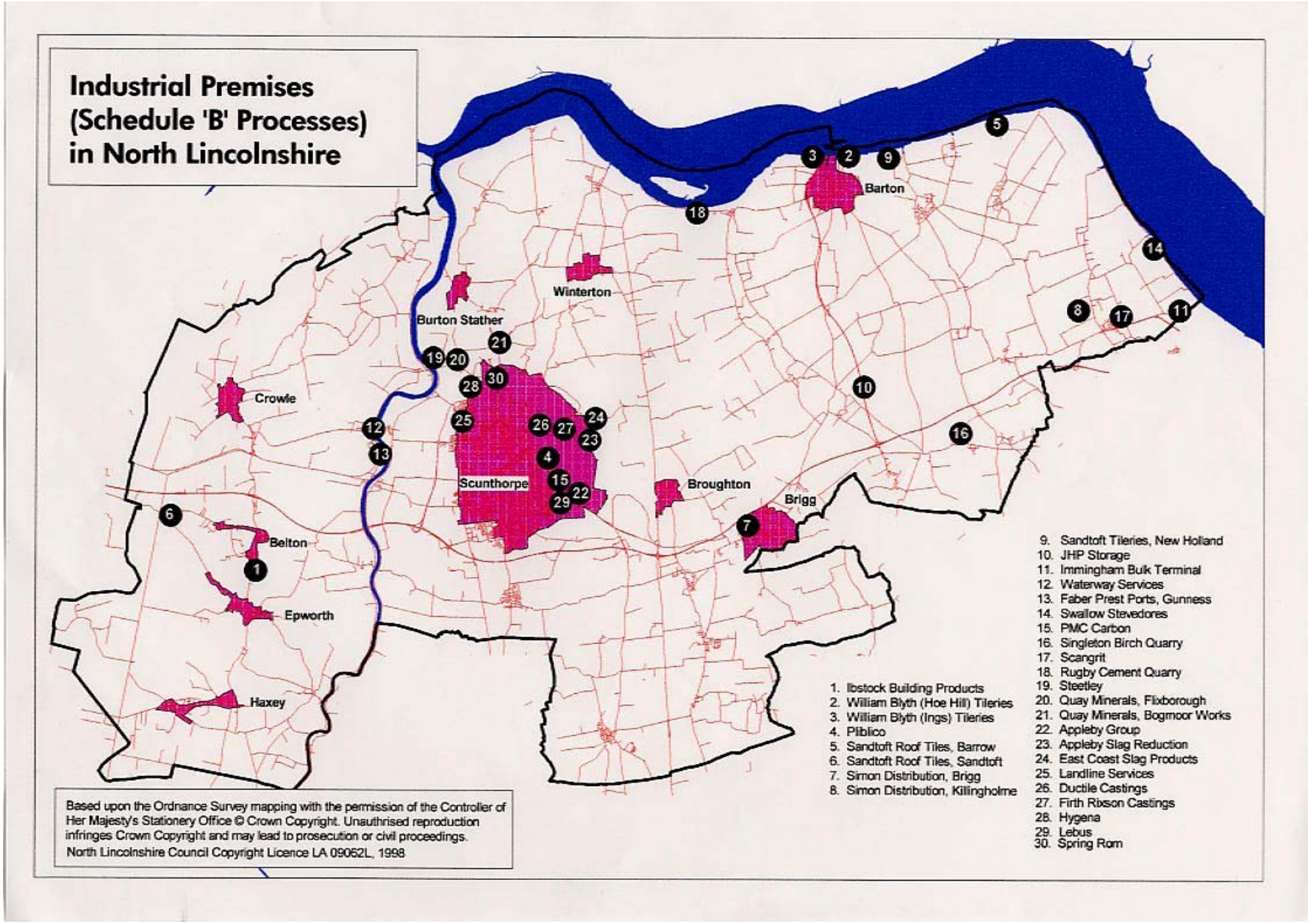


Figure 3
Industrial Premises (Schedule 'B' Processes) in North Lincolnshire


Industrial Premises
(Schedule 'B' Processes)
in North Lincolnshire
Barton
Winterton
Burton Stather
Crowle
Scunthorpe
Broughton
Brigg
Belton
Epworth
Haxey
1. Ibstock Building Products
2. William Blyth (Hoe Hill) Tileries
3. William Blyth (Ings) Tileries
4. Pliblico
5. Sandtoft Roof Tiles, Barrow
6. Sandtoft Roof Tiles, Sandtoft
7. Simon Distribution, Brigg
8. Simon Distribution, Killingholme
9. Sandtoft Tileries, New Holland
10. JHP Storage
11. Immingham Bulk Terminal
12. Waterway Services
13. Faber Prest Ports, Gunness
14. Swallow Stevedores
15. PMC Carbon
16. Singleton Birch Quarry
17. Scangrit
18. Rugby Cement Quarry
19. Steetley
20. Quay Minerals, Flixborough
21. Quay Minerals, Bogmoor Works
22. Appleby Group
23. Appleby Slag Reduction
24. East Coast Slag Products
25. Landline Services
26. Ductile Castings
27. Firth Rixson Castings
28. Hygena
29. Lebus
30. Spring Rom
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2.2 Industrial Sources of Pollution Close to North Lincolnshire

Air pollution can be dispersed over large areas and can exert its influence many kilometres away from where it originates.

For the purpose of this review and assessment it is necessary to take into account the following industries outside of North Lincolnshire:

- power stations within 80 km of the North Lincolnshire boundary
- other Part 'A' processes within 30 km of North Lincolnshire
- Part 'B' processes within 10km of North Lincolnshire

Doncaster, East Riding of Yorkshire, Hull and North East Lincolnshire Councils have provided details of industrial premises in their areas. Relevant companies close to the boundary of North Lincolnshire Council are shown in Appendices 3 and 4 .

2.3 Planned Industrial Developments

To consider fully the impact of industry and traffic on air quality in North Lincolnshire up to the year 2005, there is a need to consider not only the effect of existing developments but also proposed or likely new developments.

In this respect, it is known that the following developments are to take place in the area.

2.3.1 Ravensthorpe Power Station

A 450MW power station is proposed by ABB Energy Development Company Limited on land adjacent to and to the east of the British Steel Scunthorpe works.

It will use natural gas to generate electricity. The combustion of natural gas (methane) results in emissions to the atmosphere of water vapour, carbon dioxide, carbon monoxide, nitrogen oxides and small amounts of sulphur dioxide and particulates.

Air pollution dispersion modelling has been carried out in relation to the proposal which will be considered in the Stage 2 and 3 Air Quality Report.

2.3.2 Keadby II Power Station

A 680MW Combined Cycle Gas Turbine (CCGT) power station already exists at Keadby. A further similar sized CCGT power station has been approved adjacent to this site. Work on the construction of the new power station has been deferred for the time being.

2.3.3 Humber International Terminal, Immingham

A new deep sea facility is to be constructed by Associated British Ports on the border of North Lincolnshire at Immingham. The Project will commence in 1999 and be completed by 2001.

The development will allow for the shipment of bulk oil and gas in to the facility which is likely to encourage companies who are significant end users of such products to move in to the area.

2.3.4 New Gas Powered Power Station , North Killingholme

A 1200 Megawatt gas fired power station is proposed by Southern Energy Development (Europe) Ltd on land at Rosper Road, North Killingholme.
The project when commenced will take two years to construct.

2.3.5 Lysaghts Enterprise Park

The former steelworks site is the subject of a major reclamation programme. The area will be redeveloped for light to medium industry.

Some potentially polluting industries may be located in the future in this area although it is unlikely that their impact on future air quality will be significant.

2.3.6 Municipal Waste Incinerator, Goole

A planning application has been submitted to the East Riding of Yorkshire Council to build a large municipal waste incinerator in Goole. The application is due to be determined in Summer 1999.

2.4 Traffic Flows in North Lincolnshire

Of the seven pollutants under consideration in this review, exhaust fumes from petrol and diesel fuelled vehicles contribute to all of them.

A considerable amount of data has been obtained throughout the country over the past few years on the relationship between traffic flows and roadside levels of pollutants. Based on this knowledge, the pollutant specific guidance issued by the DETR requires local authorities for the purposes of stage one of the review process to consider that traffic will on its own have a significant impact on air quality only where the following traffic flows are exceeded:-

Nitrogen Dioxide	Existing or planned roads with a current or projected annual average daily traffic flow of greater than 20,000 in 2005
Particulates (PM^{10})	As above but greater than 25,000 vehicles
Carbon Monoxide	As above but greater than 50,000 vehicles

The traffic flows on North Lincolnshire roads in 1996 are illustrated overleaf. Table 2 shows the annual daily traffic flows for 1998 and the projected likely flows in 2005.

Currently traffic flows in excess of 20,000 vehicles per day are only found on the M180 motorway, A18, and on Ashby Road and Brigg Road in Scunthorpe.

Projected flows to the year 2005 suggest that only a small number of additional roads in Scunthorpe (ie Oswald Road and Burringham Road) may reach flows of 20,000 vehicles per day.

There are no roads in North Lincolnshire that are likely to exceed an annual average daily traffic flow of 50,000 vehicles in 2005.

Figure 4 –
Traffic Flows in North Lincolnshire 1996

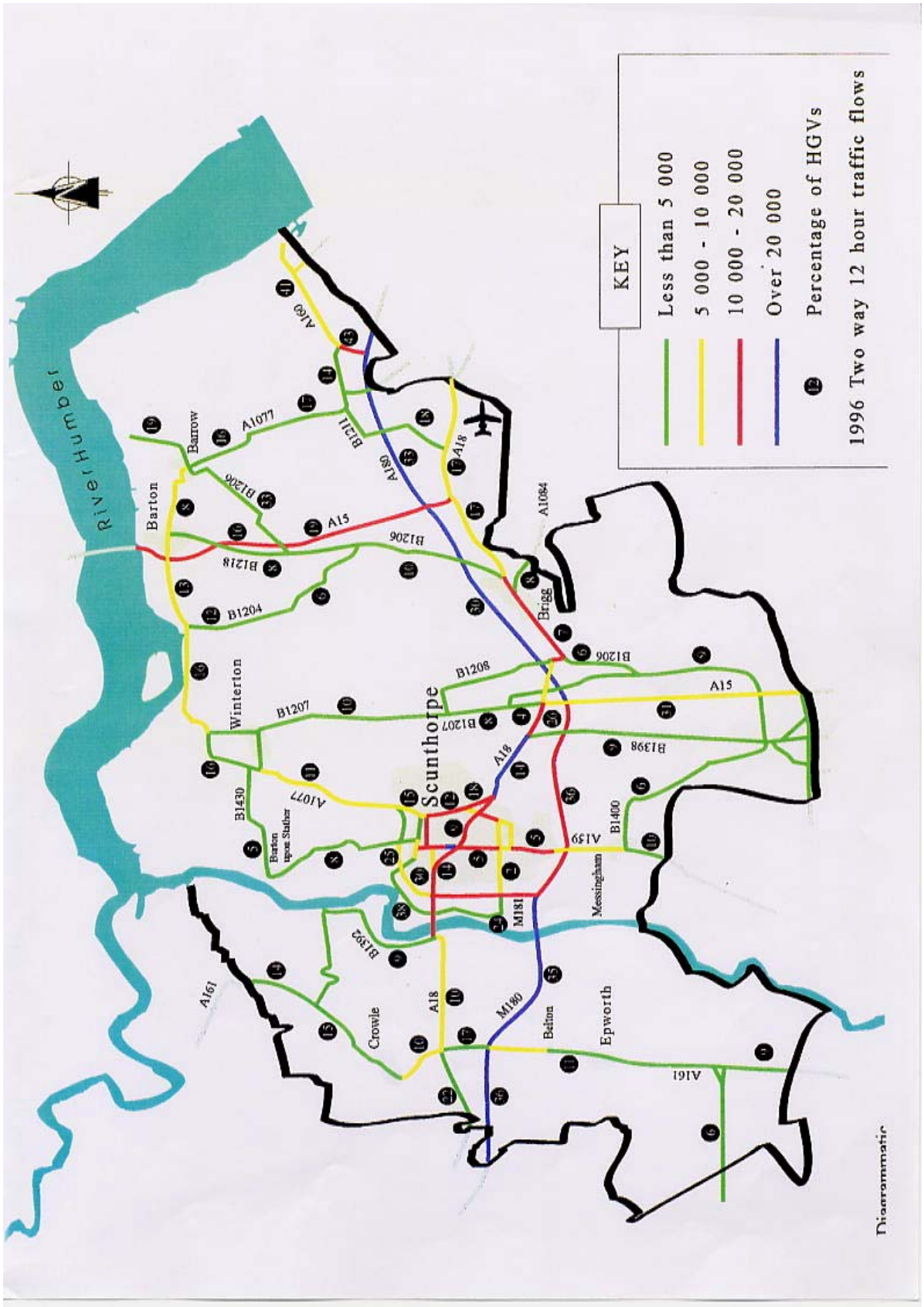

KEY
Less than 5 000
5 000 - 10 000
10 000 - 20 000
Over 20 000
Percentage of HGVs
1996 Two way 12 hour traffic flows
River Humber
Barton
Barrow
A1077
B1211
A160
A18
A1084
B1206
A15
B1218
B1204
Brigg
Winterton
B1208
B1207
Scunthorpe
A1077
B1430
Barton upon Humber
A18
B1398
A15
A1136
B1400
M181
Messingham
B1392
A161
Crowle
A18
M180
Belton
Epworth
A161
Diagrammatic

Table 2 -
Existing & Predicted Traffic Flows On Major Roads in North Lincolnshire

Road Name	Location	Link	1996 AADT Flow	Predicted 2005 AADT Flow
Brigg Road A1029	South of Station Road	Between Rowland Rd & Station Rd	23,000	28,200
Mortal Ash Hill A18	Ashbyville Rdbt East of A1029	Between A1029 & B1398	29,000	39,300
Mortal Ash Hill A18	East of B1398 @ Manby Wood Lay-By	Between B1398 & Briggate Lodge	20,200	24,100
Ashby Road	Civic Centre (Pittwood House)	Between A18 & Rowland Road	26,300	29,600
Ashby Road	North of Lydbrook Street	Between A18 & Rowland Road	23,500	26,500
A180	East of Barnetby Top	Between M180 Junction 4 of A160	28,700	37,500
M180	Sandtoft	Between Junctions 1 & 2	33,900	47,600
M180	Beltoft Overbridge	Between Junctions 2 & 3	28,000	35,100
M180	Scunthorpe	Between Junctions 3 & 4	19,600	25,500
M180	Wrawby	Between Junctions 4 & 5	24,900	29,800
A18	War Memorial Roundabout	Barnard Avenue, Brigg	19,300	27,300
A18	Queensway	West of A1029 Brigg Road	21,310	26,200
A18	North Lindsey College	Kingsway	14,436	17,700
A18	Railway Bridge	Kingsway	18,900	23,200
A18	West of Berkeley Roundabout	Between M181 & Berkeley Roundabout	19,300	23,700
A159	Ashby Road	North of A159 Burringham Road	16,650	20,400
A159	Burringham Road	Between Messingham Road & Ashby Road	16,900	20,800
B1450	Ashby High Street	East of A159 Ashby Road	13,700	16,800
C221	Scotter Road	South of Berkeley Rdbt at railway Bridge	14,900	18,300
	Frodingham Road	North of Doncaster Road	14,200	17,400
	Oswald Road	North of Station Road	17,200	20,700

3.0 Review & Assessment of Pollutants

3.1 Review & Assessment of Benzene

3.1.1 Sources

About 66% of benzene emissions comes from its presence and partial combustion in petrol engines. The amount of benzene in petrol is regulated to an upper limit of 5% by EC legislation, although currently it comprises about 2% by volume in the Uk. A further 5% of emissions comes from the storage and distribution of petrol and 1% from oil refining. Cigarette smoking is an important source for smokers.

3.1.2 Health Effects

Benzene is known from studies of workers exposed to high benzene levels to be carcinogenic and toxic.

Workers exposed to high concentrations of benzene (in the region of 100 ppm) have increased risk of leukaemia. Persistent exposure to high concentrations also causes damage to bone marrow and neurotoxic symptoms.

3.1.3 Air Quality Objective

An objective of 5 ppb (5 parts per billion) has been set expressed as a running annual average.

The Expert Panel on Air Quality Standards considered that at this level, there would be an exceedingly small risk to health but recommended that exposure to benzene should be kept as low as possible with a target level of 1 ppb.

3.1.4 National Trends for Benzene

Average benzene concentrations in rural areas are expected to be in the range 0.34-0.81 ppb.

In urban areas, results for 9 city sites between 1994 and 1996 showed annual mean benzene concentrations of between 0.7-1.7 ppb.

3.1.5 Stage One Review and Assessment

For the purposes of a First Stage Review, Local Authorities are required to identify those existing or proposed processes which have the potential either singly or together to emit significant quantities of benzene which will be in existence or operational by the end of 2005 and for which there is a potential for exposure of individuals in relevant locations.

These can be assumed to be:-

- One or more Part A or Part B processes which are potential significant sources of benzene.

- Planned developments of the above types in the locality

There are 5 Part 'A' processes in North Lincolnshire which are potential sources of benzene. These are shown in Figure 4. There are no Part 'B' processes that use or produce benzene.

An examination of the authorisation for Edinburgh oil and gas issued by the Environment Agency shows that this company does not have any releases of benzene.

British Steel Coke Ovens produce coke, coke oven gas, crude tar and benzole. Tar and benzole can give rise to emissions of benzene (benzole is composed of 70% benzene)

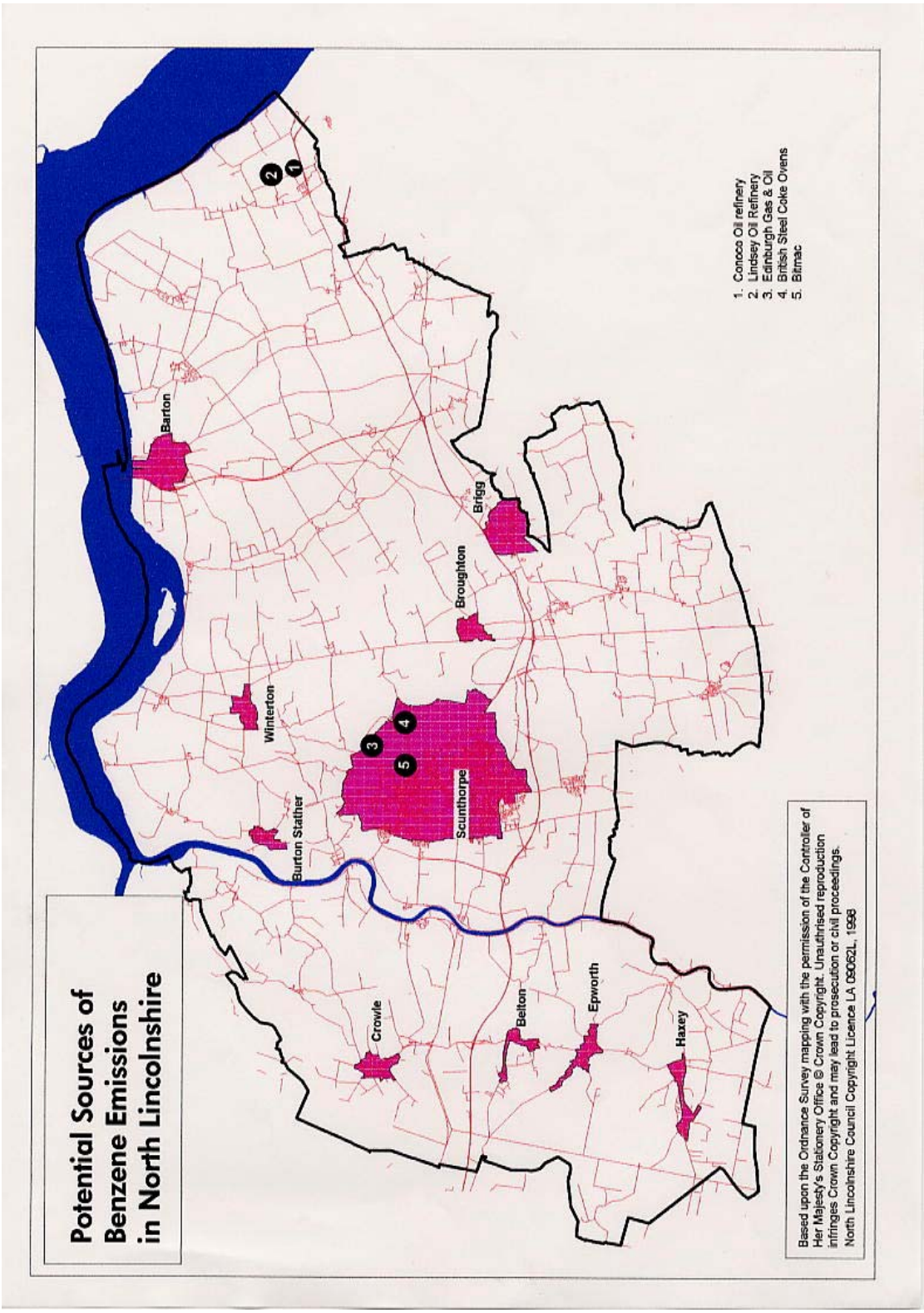
Bitmac Ltd process crude tar from the coke ovens to produce pitch and a range of oils. Benzene is identified as a potential fugitive emission from the crude tar, light oil and carbolic oil storage areas.

The oil refineries can give rise to fugitive emissions of benzene from the fuel storage and loading areas.

There are in addition, a number of Part 'A' registered companies identified in Appendix 3 outside of North Lincolnshire whose processes may also involve a release of benzene.

These are:
Allied Colloids, Grimsby
Associated Petroleum Terminals, Immingham
Coal Products Ltd., Immingham
Courtaulds Fibres Ltd., Grimsby
Cray Valley, Stallingborough
Harlow Chemical Co., Stallingborough
Immingham Storage Co., Immingham
Novartis Grimsby
Synthomer Ltd., Stallingborough
Technical Absorbents, Great Coates
Tioxide materials, Grimsby
Croda Chemicals, Rawcliffe Bridge
BP Chemicals, Saltend
Hodgson Chemicals, Beverley
Croda Chemicals, Wheatley, Doncaster

Figure 5 –
Potential Sources of Benzene Emissions in North Lincolnshire



3.1.6 Conclusion of the Stage One Review for Benzene

As there are a number of industrial sites in North Lincolnshire and close to its boundary that may have emissions of benzene, it will be necessary to carry out a second stage review and assessment.

3.1.7 Areas identified for further assessment

The two localities where the highest concentrations of benzene are likely to occur are:-

- North and South Killingholme due to the presence of Lindsey and Conoco Oil Refineries and the presence also of a number of potential nearby sources of benzene in North East Lincolnshire.

- In Scunthorpe at the nearest residential properties to Bitmac and British Steel Coke Ovens.

An assessment of benzene will therefore be carried out at these locations in the second stage review.

Monitoring of benzene by the use of an optical instrument (OPSIS) which measures air pollution over the length of a light beam several hundred yards long has been used in Killingholme since 1996.

From August 1998 a project to monitor benzene at 10 sites in the Killingholme/Immingham area by diffusion tubes has also been commenced.

The results to date indicate that benzene levels are well below the current Air Quality Objective of 5 parts per billion (ppb) at all residential properties in the Killingholme area, but these will be considered in more detail in the second stage review.

3.2 Review and Assessment of 1,3 Butadiene

3.2.1 Sources

1-3 butadiene is a colourless gas at normal temperature and pressures.

Over 75% of 1,3 butadiene in the atmosphere originates from emissions from road vehicles where it is formed in the combustion of petrol and diesel (particularly petrol). Vehicles fitted with catalytic convertors only emit about a twentieth of the amount of 1,3 butadiene compared to non-catalyst cars. It is also an important industrial chemical, being used in the manufacture of synthetic rubber for tyres. Combustion of fossil fuels by industry and in the home also generates the gas.

3.2.2 Health Effects

Evidence from workers exposed to high levels of butadiene suggest that it may be carcinogenic.

At the much lower levels of 1,3 butadiene that may occur in the external air, no useful data is available on its effects on humans.

3.2.3 Air Quality Objective

A level of 1 ppb (one part per billion) for 1,3 butadiene has been set to be achieved as a running annual mean.

3.2.4 National Trends for 1-3 Butadiene

The chemicals in petrol from which 1-3 butadiene is formed have been present in increasing proportions in petrol over the last decade and levels of 1,3 butadiene may therefore have been rising. It is, however, efficiently removed by catalytic converters and hence this should reverse any upward trend.

There has been very little monitoring of this gas nationally. Currently twelve sites in the UK measure 1,3 butadiene on an hourly basis.

Annual average concentrations in urban areas are normally in the range 0.1-0.4 ppb with heavily congested areas possibly between 1.7-2.7 ppb.

It is unlikely that in 2005 the Air Quality objective for 1,3 butadiene will be exceeded in even the most busy or congested roads in our major cities. Only those authorities with major industrial processes, which handle, store or emit 1,3 butadiene may have elevated levels in the close proximity to these sources.

3.2.5 Stage One Review and Assessment for 1-3 Butadiene

For the purposes of the first stage review, local Authorities are required to identify the following:-

- Part 'A' or Part 'B' processes which are significant sources of 1,3 butadiene.

- Planned developments of the above mentioned types in the locality.

There are no significant Part 'B' processes in the area which give rise to 1,3 butadiene and no known planned developments.

There are however 4 Part 'A' processes that are potential sources of 1,3 butadiene in North Lincolnshire which are shown in figure 5.

The oil refineries produce some 1,3 butadiene in the butane streams but this is saturated and incorporated in to the process and should not give rise to any significant emissions. Petrol and diesel themselves do not contain 1,3 butadiene.

Trace quantities of 1,3 butadiene may be produced in the coke ovens but no analysis has been carried out for this as far as can be ascertained. Edinburgh Oil and Gas produce no 1,3 butadiene.

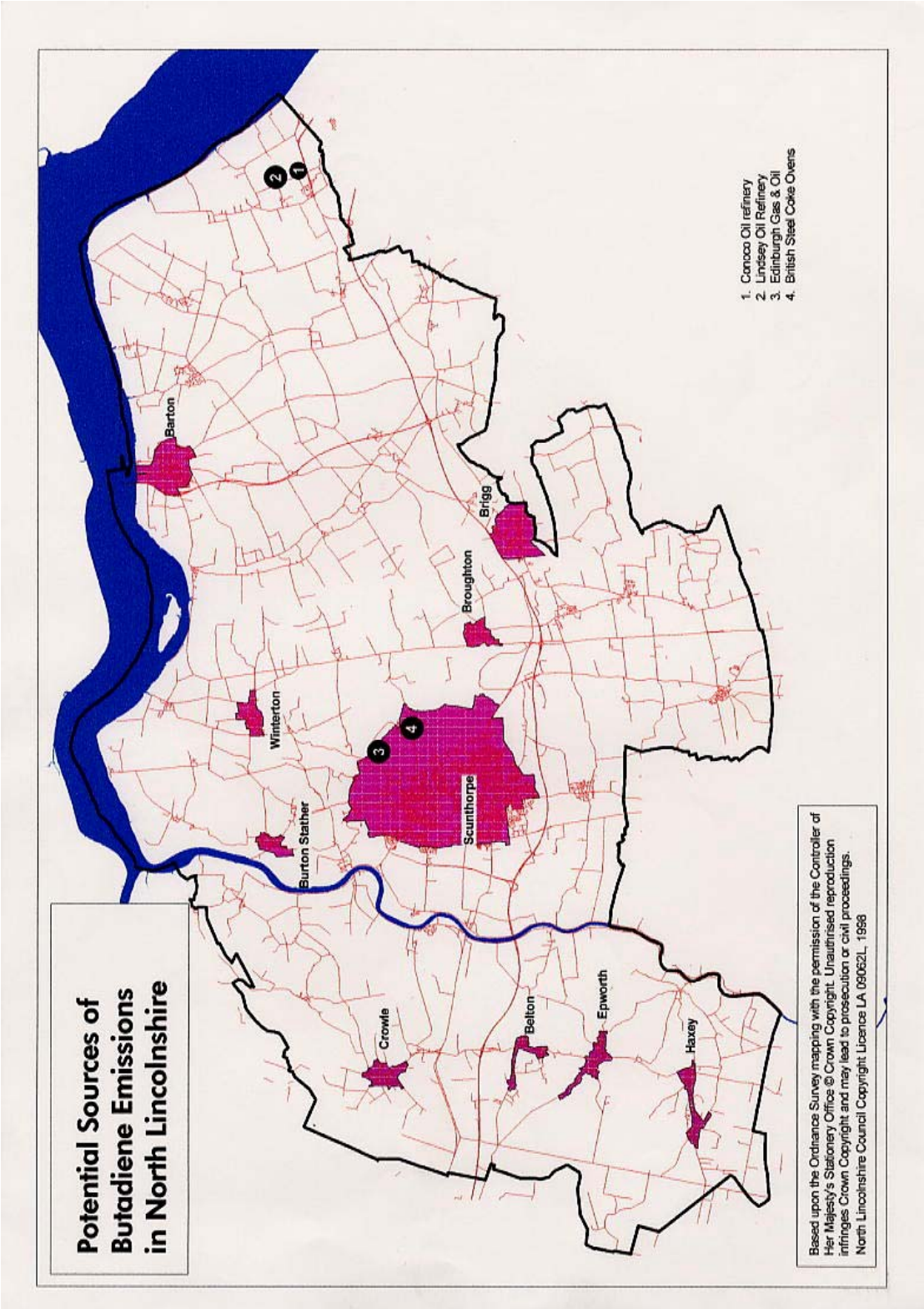
A number of companies in neighbouring authorities may be potential sources of 1,3 butadiene which are detailed in Appendices 3 and 4. The gas is however removed very quickly from the atmosphere by chemical reactions, which prevent it, being dispersed far from its source. It is extremely unlikely therefore that potential sources of 1,3 butadiene outside of North .Lincolnshire could give rise to elevated levels of the pollutant in our area.

The National Air Quality Strategy provides details of estimated annual mean 1,3 butadiene levels in the country. For North Lincolnshire, it suggests that 1,3 butadiene concentrations will range from 0.1 –0.2 ppb in rural areas to 0.2-0.3 ppb in Scunthorpe and Killingholme. These levels are less than a third of the air quality objective.

3.2.6 Conclusions of the Stage One review for 1-3 Butadiene

Although it is extremely unlikely that levels of 1, 3 butadiene in North Lincolnshire will breach the air quality objective, it would be preferable to carry out some further assessment to verify this. Guidance provided by the DETR suggests that as ambient monitoring of 1,3 butadiene is expensive and difficult to carry out , Local Authorities whose first stage assessment indicates that the risk of exceeding the objective for 1, 3 butadiene is not negligible should undertake a third stage review and assessment. Some further consideration will therefore be given to this pollutant at this stage.

Figure 6 –
Potential Sources of Butadiene Emissions in North Lincolnshire



3.3 Review and Assessment of Lead

3.3.1 Sources

Lead is used as an additive in petrol in the form of tetraethyl lead. In 1996, approximately 76% of lead emissions were from this source. It has however a number of important industrial applications. It is used in the manufacture of batteries and as a pigment in paints and glazes. It is also used in alloys and in tank lining and piping.

3.3.2 Health Effects

Continual exposure of children to lead can cause mental retardation and behavioural problems. There is some evidence that for adults, it can have an effect on blood pressure, the central nervous systems, kidneys and joints.

3.3.3 Air Quality Objective

The air quality objective for lead is 0.5 μg/m³ (i.e. half of one millionth of a gram of lead per cubic metre of air) expressed as an annual average. The long averaging period for lead is because its health effects are only significant where exposure occurs over a long period.

3.3.4 National trends for lead

In the United Kingdom, lead levels have been falling since 1970 with the gradual reduction in the amount of allowable lead in petrol and the introduction of unleaded fuel. This has given rise to a fourfold decrease in lead levels over this period. All petrol engine vehicles built after 1993 have to be catalyst equipped and therefore must run on unleaded petrol. The downward trend in levels of atmospheric lead is therefore likely to continue.
From nationally available statistics, it is known that lead levels in rural areas are now less than 0.05μg/m³ (i.e less than $1/10^{th}$ of the standard). In urban areas, levels are generally below 0.1μg/m³ (less than $1/5^{th}$ of the standard). Close to lead works and other significant industrial users of lead, levels of lead may exceed 1μg/m³. Only local authorities with significant industrial sources of lead are likely to exceed the air quantity objective.

3.3.5 Stage One Review and Assessment for lead

For the purposes of the stage one review and assessment, Local Authorities are required to identify:

- Part A authorised processes with the potential to emit significant quantities of lead.

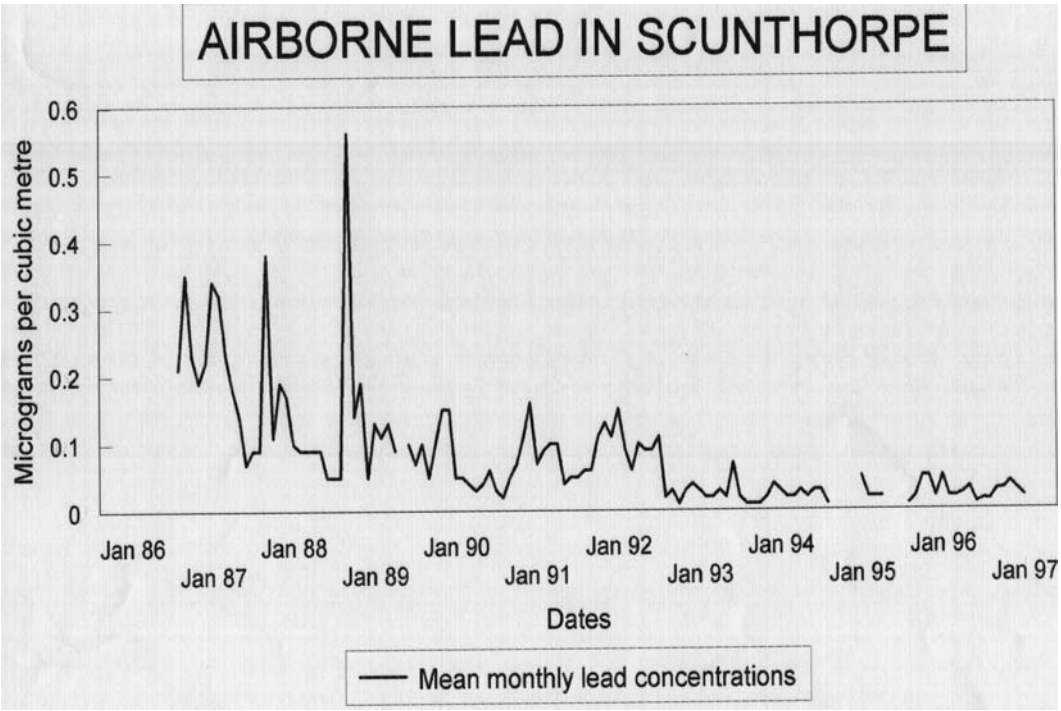
- Part B processes, or a number of such processes in close proximity, which collectively can emit significant quantities of lead.

- Industrial or other sites with non-prescribed processes with the potential to emit significant quantities of lead.

- Planned developments of the above mentioned types on the locality.

Local Authorities are also required to collate information on urban background concentrations of lead due to dispersed road traffic sources. Concentrations of lead have been measured at Cottage Beck Road Scunthorpe since 1986. These results are summarised graphically in Figure 7 below:-

Figure 7 -



It is evident that lead concentrations have dropped from approximately 0.3μg/m3 in 1996 to only 0.05μg/m3 in 1997. This reflects the change from leaded to unleaded fuels.

There are 4 Part 'A' processes in North Lincolnshire which using the criteria in the DETR pollutant specific guidance may have emissions to air of lead. One is British Steel in Scunthorpe where leaded steels are produced in the BOS plant. The other 3 relate to crude oil handling at the two refineries and Edinburgh Oil and Gas. The latter company does not use lead on their site and although the refineries add the compound tetraethyl lead to petrol to enhance the octane rating, this practice will cease at the end of the year with the withdrawal of leaded fuels.

There are a number of Part 'B' processes that are involved in the melting of ferrous metals i.e. Ductile Castings, Firth Rixson Castings and Caparo Merchant Bar but none of these produce emissions of lead to air. Jotun Paints on the Flixborough Industrial Estate does however manufacture some leaded paints and its emissions need to be considered. Outside of North Lincolnshire, there are several processes in each of the local authority areas of Hull, North

East Lincolnshire and Doncaster which could potentially release lead. These are detailed in Appendix 3 and 4.

3.3.6 Conclusion of the Stage One review for lead

As there is a potential source of lead emissions in North Lincolnshire and a number of sites in adjacent authorities, it will be necessary to carry out a second stage review and assessment.

3.3.7 Areas identified for Second Stage Assessment

The locality where the highest likely concentration of lead is likely to occur will to be the east (downwind) of British Steel where a number of scattered residential properties exist. British Steel carried out some monitoring of lead in the vicinity of their plant in 1997. These results will be taken in to account as part of the Second Stage Review of lead. The potential for sources outside North Lincolnshire. to influence air quality in our area will also be considered.

3.4 Review and Assessment of Fine Particles (PM^{10})

3.4.1 Sources

Fine particulate matter is composed of a complex mixture of both organic and inorganic particles.

38% of fine particles arise from industrial sources, 24% from road transport (principally diesel engines), 16% from power stations and 17% from domestic and other low level contribution. Windblown dust from soils and stockpiles also contribute to the total as do airborne spores and pollen grains.

3.4.2 Health Effects

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) in diameter (ie less than one hundred thousandth of a metre) will penetrate deep into the lungs when inhaled. It is this smaller diameter fraction of the dust that is specified in the Air Quality standards as it represents the greatest risk to health. The term PM10 therefore relates to particulate matter below 10 microns in diameter.

Studies that have taken place has shown that small particles aggravate a range of respiratory and other problems. This gives rise to particular problems for sensitive groups such as asthmatics. It has been suggested that the rise in such allergic disorders as hay fever and eczema is also in some way linked to particulate matter in the air, although there is no clear evidence to support this at the present time.

3.4.3 Air Quality Objective

A standard of 50 $\mu g/m^3$ (50 micrograms of dust per cubic metre of air) has been adopted measured as a running 24 hour mean.

It was considered that because of events such as bonfire night when particulate levels are likely to rise that it might not be possible to achieve this standard on every day of the year and hence an air quality objective has been set to achieve the standard for 99% of the time, i.e. this allows for 1% of readings to exceed the standard.

3.4.4 National Trends for PM^{10}

Monitoring equipment to accurately measure the PM^{10} fraction of particulate matter has only been available since 1992 and hence little historical data is available.

Levels of PM^{10} in most urban areas tend to range between 10 and 45 $\mu g/m^3$ with peak daily averages ranging from 70 to 160 $\mu g/m^3$.

The trend over the next few years should be for particulate levels to drop. In particular, EC particulate limits for new diesel vehicles which came into effect in 1996 and 1997 will half emissions relative to previous standards. Controls on industrial emissions have also been tightened and more processes are being brought within control.

The Government expects that with all the new measures in place nationally, there may still be a problem in meeting the Air Quality Objective in areas where there are congested roads, uncontrolled domestic fuel burning or significant industrial sources.

A significant proportion of the current PM^{10} is due to the secondary formation of particulate sulphates and nitrates in the atmosphere which results from the oxidation of sulphur and nitrogen oxides. Levels of secondary particles have been estimated over the county as a whole and are shown in Figure 8.

By the end of 2005, reductions in emissions of sulphur dioxide and nitrogen dioxide will lead to a fall in the concentration of secondary particles. It is likely that the annual mean concentration of secondary particles in 2005 will be only 70% of that in 1996.

3.4.5 Stage One Review and Assessment for PM^{10}

The Local Authority is required to identify those existing or proposed processes which have the potential singly or together, to emit significant quantities of PM10 which are expected to be in existence or operation by the end of 2005 and for which there is a potential for exposure of individuals in relevant locations.

For the purpose of a First Stage review the Guidance suggests that this can be assumed to consist of:-

- Urban areas for which the annual average regional background due to secondary particles is greater than 8 $\mu g/m_3$

- Emissions from low level dispersed sources greater than 10 tonnes in any 1 Km x 1 Km grid square or an average of 5 tonnes in several adjacent squares.

- One or more existing or planned roads with a projected annual average daily traffic flow of greater than 25,000 vehicles.

- One or more Part A or Part B processes which are significant potential sources of PM^{10}.

- Any industrial process that emits significant quantities of dust in the form of PM^{10} from uncontrolled or fugitive sources within the plant.

Figure 8 –
Estimated Background Concentrations of Secondary Particles

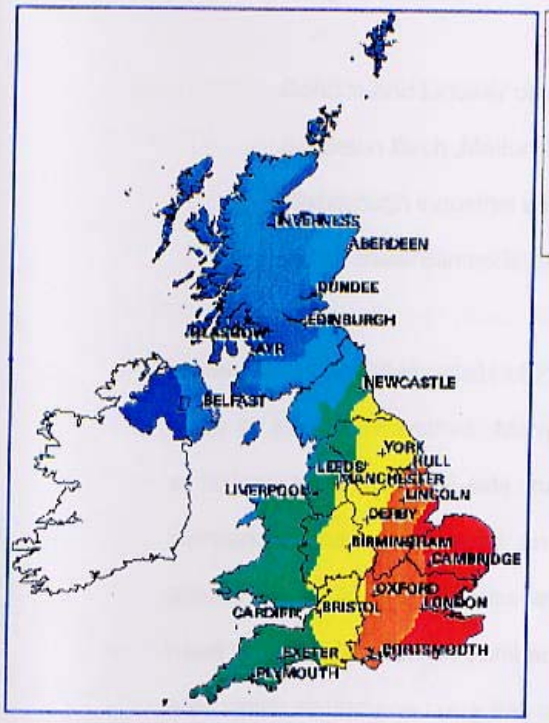
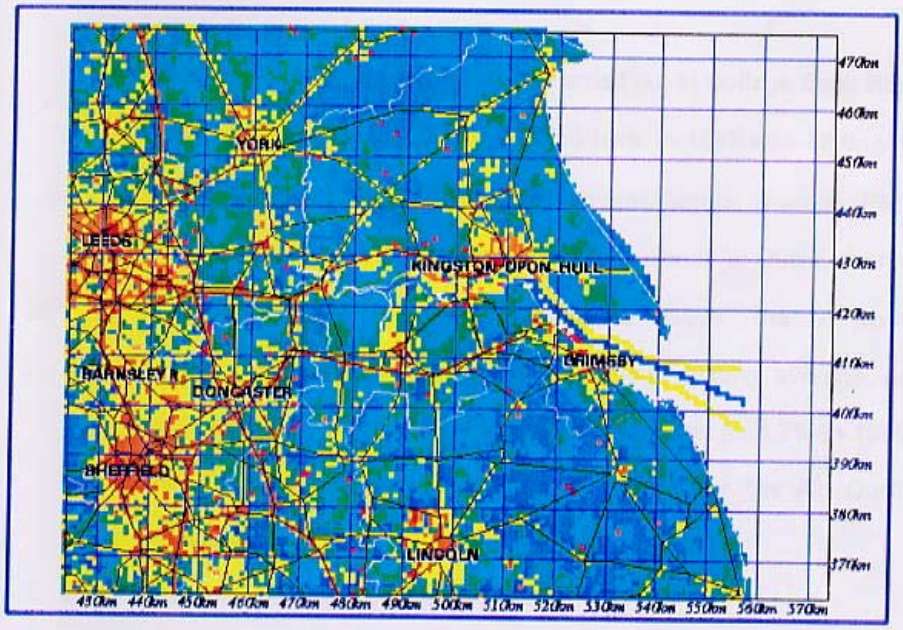


Figure 8

Estimated background concentrations of secondary particles



Emissions in tonnes/1x1km

- < 0.010
- 0.010 - 0.099
- 0.100 - 0.199
- 0.200 - 0.499
- 0.500 - 1.999
- 2.000 - 9.999
- >= 10.000

Figure 9
Estimated total emissions of PM10 particles

Figure 9 –
Estimated Total Emissions of PM^{10} Particles

These are dealt with in detail below:-

- **Secondary Particulate Background Concentrations**

From Figure 8, it is evident that the estimated background concentration of secondary particles in the North Lincolnshire area is approximately 11$\mu g/m^3$. This factor on its own will mean that a second stage Review and assessment of particulates will need to be carried out.

- **Particle Emission Estimates**

From the National Air Quality Information Archive provided by NETCEN on the Internet, emissions of PM^{10} from road transport in North Lincolnshire are estimated to be within the range 0.001 to 0.009 tonnes per 1 km by 1 km grid in the rural areas and 0.1 - 2 tonnes in the urban areas. The M180 motorway has slightly higher emissions of between 2 and 5 tonnes. Domestic emissions of PM10 are in the range 0.005 to 0.199 tonnes per 1km by 1km grid in the rural areas and 0.2 to 1 tonne in urban areas.

Based on these estimates, it is unlikely that emissions of PM10 from low level dispersed sources will be greater than 10 Tonnes in any 1km by 1km grid or more than 5 Tonnes in any adjoining squares.

- **Traffic Flows**

From section 1.4, roads with a projected annual average daily traffic flow of greater than 25,000 vehicles in 2005 are:-

M180 motorway
A18 through Brigg
A18 Queensway, Scunthorpe
Brigg Road, Scunthorpe
Ashby Road, Scunthorpe

- **Part 'A' and Part ' B ' processes**

From the National Air Quality Archive, a map of the estimated total emissions of PM10 particles in our region is illustrated in Figure 9. Areas coloured red indicate where emissions per 1 km by 1 km grid exceed 10 tonnes annually. In North Lincolnshire, these areas coincide with major Part 'A' processes

ie Rugby Cement, South Ferriby
Conoco and Lindsey Oil Refineries at Killingholme
Singleton Birch, Melton Ross
Flixborough Industrial Estate
British Steel/ Bitmac/ Short Brothers, Scunthorpe

Appendix 1-4 provides details of Part 'A' and Part 'B' processes in and close to North Lincolnshire. Many of these have possible significant emissions to air of particulate matter. There are a large number of companies who operate coal and coke handling processes in and around the docks and wharves and fugitive emissions from these will need to be considered. A number of quarries are also present in the area which similarly can give rise to significant emissions.

Monitoring of PM^{10} levels has been carried out at Cottage Beck Road since 1995. The annual average PM^{10} level in 1997 was 18.6μg/m3 and was 21.2μg/m3 in 1998 The estimated annual average PM^{10} concentration for North Lincolnshire on the National Air Quality Archive is 20.1-22.5μg/m3 which shows good correlation. The 50 μg/m3 objective for PM^{10} expressed, as a 24-hour running average was however breached for 1.1% of the time in 1997 and for 2.6% in 1998. These are both greater than the 1% allowed by the Air Quality Objective.

3.4.6 Conclusions from the first stage review for PM^{10}

As the annual average background due to secondary particles in North Lincolnshire is greater than 8 μg /m3 and there are also significant industrial sites and roads to consider, a second stage review and assessment of levels of PM^{10} will be required.

3.4.7 Areas identified for further assessment

For the Second stage review, locations need to be selected where the highest likely concentration of particulates are likely to occur.

From 3.4.5 above, there are both industrial sources and traffic sources that need to be considered.

The government has established an Airborne Particle Expert Group (APEG) to advise on sources of PM^{10} and likely concentrations in the future. Their conclusions are expected at the end of 1998. Advice to local Authorities on the stage two review and assessment of particles will be provided in the light of the APEG conclusions. It would appear appropriate to determine an assessment strategy for particles when further guidance is available.

3.5 Review & Assessment of Sulphur Dioxide

3.5.1 Sources

Sulphur dioxide arises principally from the burning of coal and oil. Historically domestic coal burning has been the main source of sulphur dioxide. Over the last 20 – 30 years, domestic coal burning has decreased dramatically and the majority of sulphur dioxide arises now from coal fired power stations and industrial combustion plant.

Road vehicles are not a significant source of sulphur dioxide, although diesels emit greater quantities than petrol engines. Low sulphur diesel is now readily available and will replace ordinary diesel over the next few years.

3.5.2 Health Effects

Studies indicate that levels above 100 parts per billion (ppb) cause changes in lung function and aggravation of bronchitis and respiratory ailments by causing constriction of the bronchus. An increase in wheeze, breathlessness during exercise and a chronic cough have also be noted.

3.5.3 Air Quality Standard

The standard has been set at 100 ppb (parts per billion) measured as a 15 minute mean. The Air Quality Objective is to achieve this standard at the 99.9^{th} percentile level, i.e. this allows for a breach of the standard for 0.1% of the time. In terms of 15 minute readings taken over a year, it will allow for 35 such readings to exceed the 100 ppb standard. A 15 minute measurement period has been set as the effects of sulphur dioxide on the airways may occur very rapidly and a very short averaging period is therefore necessary to take this in to account.

3.5.4 National Trends of Sulphur Dioxide

Sulphur dioxide levels have been reducing since the 1960's, particularly with the introduction of smoke control areas for domestic fires.

A small number of large power stations such as Drax near Selby have now fitted equipment to remove the majority of sulphur dioxide from their flue gases, which will also help to reduce levels.

The United Kingdom was a signatory to the Sulphur Protocol in 1994 which committed the UK to reduce its total sulphur dioxide emissions by 50% by 2000, 70% by 2005 and 80% by 2010, based on emissions in 1980. It is likely that these targets will be met.

Exceedances of the 100 ppb standard occur most frequently in industrial and domestic coal burning areas. High levels of sulphur dioxide are not just found in large urban areas but also small communities where coal and oil are used on domestic appliances.

Almost all sulphur dioxide monitoring sites in the UK show exceedances of the 100 ppb at least several times per year.

3.5.5 Stage One Review and Assessment of Sulphur Dioxide

For the purpose of the Stage One review, Local Authorities are required to collate information on the following:-

- Information on current urban background concentrations of sulphur dioxide from locally sited measurements or from national maps.

- Part 'A' or Part 'B' processes that may be potential significant sources of sulphur dioxide.

- Solid fuel or fuel oil combustion systems with a thermal power greater than 5MW.

- Any 1km x 1km grid square in the authorities area for which maximum low level (i.e. domestic combustion and other short stack) emissions are greater than 25Kg per hour or 40 tonnes per year of sulphur dioxide.

Current urban background concentrations

Monitoring of sulphur dioxide is currently carried out at Killingholme and Scunthorpe by continuous analysers. Annual background concentrations are in the region of 6-7 ppb at these sites. The Air Quality Information Archive suggests that background levels in our area should be in the region of 4-6ppb. Both sites show several short periods of exceedance of the 100ppb standard. At Killingholme, 100ppb was exceeded on 3 occasions in 1998. At Scunthorpe, levels of sulphur dioxide above 100ppb were recorded for short periods on 11 days.

Part 'A' and Part 'B' processes

15 out of 18 of the Part 'A' processes in the North Lincolnshire area shown in appendix 1 are potential significant sources of sulphur dioxide.

The most important sources of sulphur dioxide outside of North Lincolnshire are the Trent Valley (Cottam ,High Manton and West Burton) and the Aire Valley (Drax, Eggborough and Ferrybridge) Power Stations. Figure 10 taken from the Air Quality Information archive on the Internet shows point source emissions of sulphur dioxide in 1996, where it is evident that the greatest emissions are from these sources(the circular darker regions on the map show the site and relative size of the emissions). The Trent Valley Power Stations were implicated in two short pollution incidences that affected Scunthorpe in July 1998.

In North Lincolnshire, the map identifies three main areas for point emissions of sulphur dioxide ie the refineries at Killingholme , British Steel at Scunthorpe and Rugby Cement at South Ferriby.

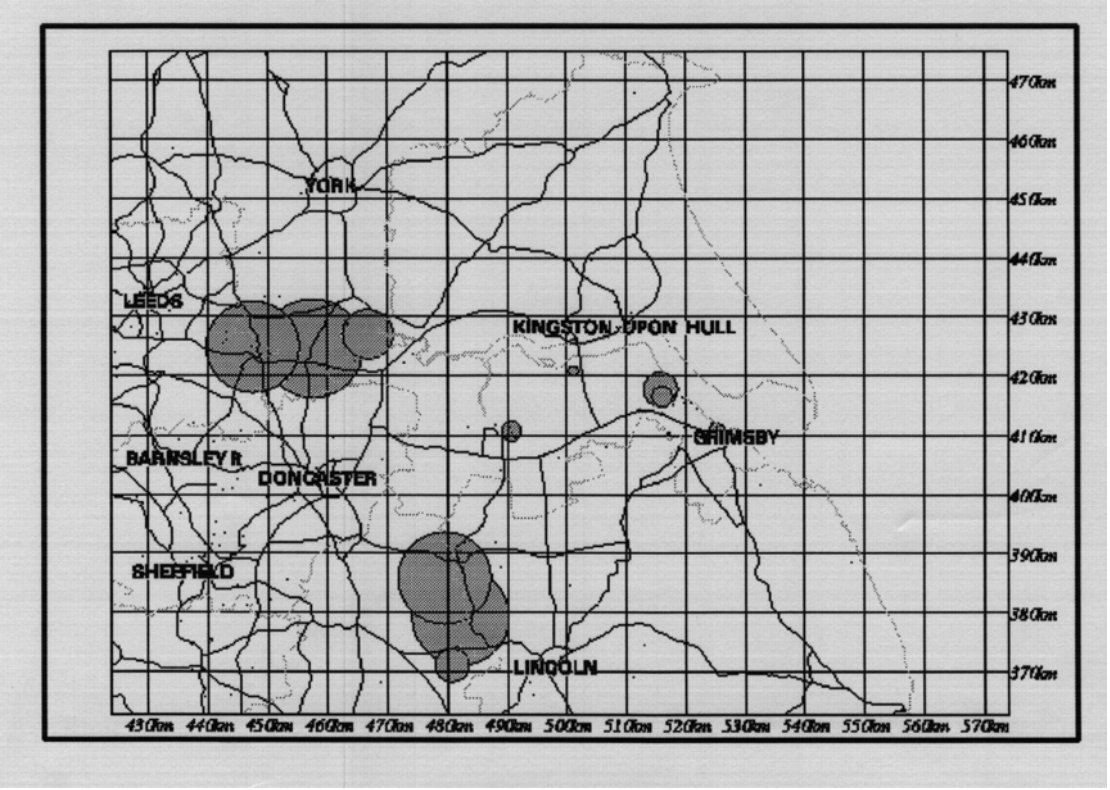
Solid fuel or fuel oil combustion systems

The only site not listed in Appendices 1-4 that has a combustion system greater than 5MW is the Scunthorpe and General Hospital. This heating system is however gas fuelled and uses oil only as a standby fuel.

Low level emissions

Information available on the Air Quality Information Archive suggests that domestic emissions of sulphur dioxide in North Lincolnshire are below 2 tonnes per 1km by 1km grid.

Figure 10
Point source emissions of sulphur dioxide 1996



3.5.6 Conclusion of the Stage One Review for Sulphur Dioxide.

Paragraph 3.5.5 identified that there are significant industrial sources of Sulphur dioxide within and close to North Lincolnshire. It will be necessary therefore to carry out a second stage review and assessment for sulphur dioxide.

3.5.7 Areas identified for further assessment

The impact of all of the industrial sources of sulphur dioxide in and close to the boundary of North Lincolnshire will need to be considered. This is to be carried out in the second stage review by a combination of both ambient monitoring using automatic analysers and diffusion tubes and the assessment of air pollution modelling that has been carried out locally.

3.6 Review and Assessment of Nitrogen Dioxide

3.6.1 Sources

During all combustion processes, nitrogen in the air or in the fuel is oxidised to form nitrogen oxides. These gases are released in to the atmosphere mainly as nitric oxide (NO) where they are oxidised to nitrogen dioxide (NO_2) by reaction with ozone and oxygen in the air.

Road vehicles are the greatest producers of nitrogen oxides accounting for almost half of the total. Power Stations contribute approximately 25% of the total emissions with the rest largely arising from domestic, industrial and commercial combustion.

In most areas, nitrogen dioxide accumulations are highest in urban areas close to heavily trafficked roads.

3.6.2 Health Effects

Nitrogen dioxide is a respiratory irritant. It affects the 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.

3.6.3 Air Quality Objective

As nitrogen dioxide can cause adverse effects with high exposure for short periods or at much lower concentrations if these are present over longer periods of time, two air quality objectives have been set to cover these possibilities.

- An objective of 150 ppb not to be exceeded over any one hour period.

- An objective of 21ppb not to be exceeded as an annual mean.

3.6.4 National trends for Nitrogen Dioxide

The highest levels of nitrogen dioxide are likely to be found close to heavily congested roads. Nitrogen dioxide levels have gradually increased over the last decade due to increased road traffic. Improved vehicle design with a greater proportion of vehicles having catalytic converters is expected however to reduce nitrogen dioxide levels to approximately 70% of 1996 values by 2005. Any location with an annual mean nitrogen dioxide level of 30 ppb or below in 1996 should be below 21 ppb by 2005. 1997 was the first year that a reduction in nitrogen dioxide levels was noted nationally and this trend should continue to 2005.

3.6.5 Stage One Review and Assessment of Nitrogen Dioxide

For the purposes of the Stage One Review, the following can be considered to give rise to potentially significant quantities of nitrogen dioxide.

- Any area where an annual mean urban background nitrogen dioxide concentration of 30ppb was exceeded in 1996.

- One or more existing or planned roads with a projected annual average daily traffic flow of greater than 20000 vehicles in 2005.

- One or more Part 'A' or Part 'B' processes indicated to be a potential significant source of oxides of nitrogen.

- An indication that existing sources acting in combination may exceed a current annual mean of 30ppb.

Monitoring of nitrogen dioxide by diffusion tubes has been carried out at 8 sites in Scunthorpe, Brigg and Killingholme for several years and a further 20 sites have been added in 1998. The results of the long term monitoring are shown in Table 3 below

Table 3
Nitrogen Dioxide Monitoring 1996-1998
Annual Mean NO2 (ppb)

Location	1996	1997	1998
Britannia Corner, Scunthorpe	30	25	27
Digby Street, Scunthorpe	21	18	16
West Common Lane, Scunthorpe	21	8	18
Gloucester Ave, Scunthorpe	19	18	16
Bigby Street, Brigg	19	18	17
Station Road, Brigg	16	17	15
Brigg Background	13	11	11
School Road, Killingholme	21	14	14

There has been a gradual fall in nitrogen dioxide levels over the last 3 years at the above locations. The more heavily trafficked site at Britannia Corner has however significantly higher levels of nitrogen dioxide than the other sites and shows less of a downward trend.

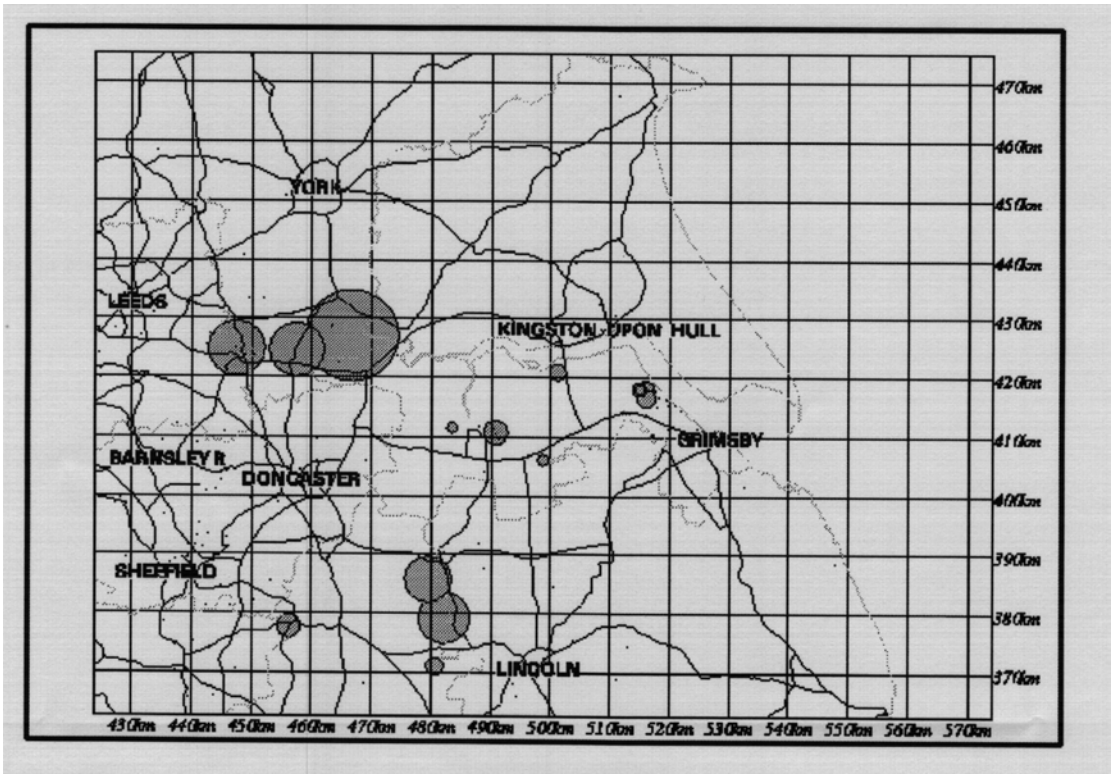
From section 1.4, roads likely to have an annual average daily traffic flow in excess of 20,000 vehicles in 2005 are:-

- M180 motorway
- A18
- Ashby Road, Scunthorpe
- Brigg Road, Scunthorpe
- Oswald Road, Scunthorpe
- Burringham Road, Scunthorpe

Appendix 1-4 details the industrial process operating in or close to North Lincolnshire. All of the Part 'A' processes in North Lincolnshire are emitters of oxides of nitrogen, as are large numbers of the Part 'A' processes in adjacent authorities.

Figure 11 (obtained from the Air Quality Information Archive website) shows the main point sources of nitrogen dioxide in the area. The largest producers of the gas are the Aire Valley and Trent Valley Power Stations. Five sites in North Lincolnshire are identified on the map ie British Steel, Keadby Power Station, Rugby Cement, Brigg Power Station and the refineries and power stations in Killingholme.

Figure 11
Point source emissions of Oxides of Nitrogen 1996



3.6.6 Conclusions of the Stage One review for Nitrogen Dioxide

As there are significant sources of nitrogen dioxide from both industry and traffic in North Lincolnshire, it will be necessary to carry out a second stage review and assessment.

3.6.7 Areas identified for further assessment

The localities where residential accommodation is likely to be exposed to the greatest concentrations of nitrogen dioxide are:-

a) Homes adjacent to the A18 on the Kingsway, Queensway in Scunthorpe and Wrawby Road in Brigg.
b) Homes adjacent to Ashby Road, Brigg Road, Oswald Road and Burringham Road in Scunthorpe.
c) Homes close to significant industrial sources, particularly those detailed in the report. Assessment of these sites will be carried out by monitoring (using both diffusion tubes and automatic analysers) and calculations will be carried out using the Environment Agency's publication "Guidance for Estimating the Air Quality Impact of Stationary Sources".

3.7 Carbon Monoxide

3.7.1 Sources

Carbon Monoxide is a gas, which is produced whenever organic materials undergo incomplete combustion. In general, the more efficient the combustion process, the lower the carbon monoxide emission.

The most common source of carbon monoxide is from petrol engined vehicles which account for 71% of emissions. Other sources include diesel vehicles, domestic fires and industry. For smokers, their major source of exposure to carbon monoxide is cigarettes.

3.7.2 Health effects

Carbon Monoxide is colourless and odourless and life-threatening concentrations can be breathed without giving any warning to the victim. Carbon Monoxide exerts its effect by substituting for oxygen in the blood and by blocking essential biochemical reactions in cells.

Adults who have existing blood flow problems are likely to be a particular risk if exposed to carbon monoxide. Low levels of carbon monoxide can give rise to breathlessness and reduced mental ability.

3.7.3 Air Quality Standard

The air quality standard for carbon monoxide is 10ppm (10 parts per million) measured as a running 8 hour average.

At this level, persons with circulatory problems should not be exposed to potential harm. Smokers in general will be exposed to a greater concentration than this and additional exposure to 10ppm carbon monoxide in the external air will have no detrimental effect.

3.7.4 Nation Trends for Carbon Monoxide

As the main source of carbon monoxide is from motor vehicles, concentration are likely to be highest near to heavily trafficked areas. When vehicles are cold or the engine is idling, the engine is less efficient and hence carbon monoxide levels will be at their greatest where traffic flow is reduced as in rush hours or near traffic lights. Away from roads, carbon monoxide concentrations fall away rapidly.

Carbon monoxide emissions increased by approximately 13% from 1970 to 1990 but since then improved engine design and the use of catalytic converters have led to a gradual reduction.

Measurements taken throughout the country suggest that the mean urban concentration of carbon monoxide rarely exceeds 1 ppm (i.e. one tenth of the

standard). At city sites in London, Glasgow, Manchester etc., the standard of 10ppm is normally exceeded on one or two days per year.

In Hull in 1997, the highest hourly recorded carbon monoxide reading was 3.8 ppm and in Sheffield (in the City Centre and at Tinsley, over the same year the highest readings were 6.3 ppm and 4.8 ppm respectively.

From the Air Quality Information Archive, current urban levels of carbon monoxide in North Lincolnshire are estimated to be below 0.2 ppm and between 0.2 and 0.4 ppm in Scunthorpe. No carbon monoxide monitoring has been carried out by the Local Authority.

3.7.5 Stage One Review & Assessment for Carbon Monoxide

For the purpose of the first stage review and assessment, the following have the potential to experience elevated levels of carbon monoxide.

- Road links with current or projected annual average daily traffic flows of greater than 50,000 vehicles.

- Part 'A' processes with the potential to emit significant quantities of carbon monoxide.

- Planned developments of the above mentioned types in the locality, including those that will increase traffic flow.

There are no roads in North Lincolnshire with a traffic flow of over 50,000 vehicles.

There are however a number of large industrial premises identified in Appendix 1 of the pollutant specific guidance which might give some rise to significant quantities of carbon monoxide. From the National Air Quality Information Archive, the largest point sources of carbon monoxide in the region are the Aire Valley and Trent Valley power stations.

The greatest source of carbon monoxide in North Lincolnshire is British Steel at Scunthorpe where carbon monoxide is produced in the blast furnaces, coke ovens, sinter plant etc. 25% of blast furnaces gas, for example consists of carbon monoxide.

The oil refineries and power stations within North Lincolnshire are also potential sources of carbon monoxide.

3.7.6 Conclusions of the Stage One Review for Carbon Monoxide

There are no roads with traffic flows in excess of 50000 vehicles a day in North Lincolnshire and hence no further assessment of traffic in relation to carbon monoxide emissions needs to be carried out. There are however a number of industrial sources of carbon monoxide and a Stage Two Review and Assessment will therefore need to be carried out.

3.7.7 Areas identified for further assessment

Industrial sites which are significant sources of carbon monoxide will be assessed using the procedure outlined in the DETR Pollutant Specific guidance. This will involve estimating the maximum ground level concentrations from the stacks and the size of the impact footprints for the current year and for 2005.

4.0 Conclusion

The purpose of the Stage One Review and Assessment is to determine if there are significant sources of any of the seven pollutants of concern in or close to the boundaries of North Lincolnshire such that the possibility that any of the Air Quality Objectives being exceeded cannot be considered as negligible.

For carbon monoxide, lead, benzene and 1,3 butadie it is unlikely that the Air Quality Objective will be breached but nevertheless, there are sources of each of these pollutants in North Lincolnshire and a further (Stage 2) assessment will be required to confirm that concentrations of pollutants at the most sensitive sites will be below the Objective.

For PM10, sulphur dioxide and nitrogen dioxide, the Air Quality Objective is currently being exceeded at some monitoring positions and a Stage 2 and possibly Stage 3 review will have to be carried out.

References & Sources of Information

Publications

United Kingdom National Air Quality Strategy
Review and Assessment of Air Quality – Pollutant Specific Guidance (DETR)
Framework for the review and assessment of Air Quality (DETR)
National Air Quality Information Archive (http://www.aeat.co.uk/netcen/airqual)
North Lincs Council – Transport Policies and Programme 1998/1999 & 1999/2000
North Lincs Council – An assessment of air quality in North Lincolnshire

Outside organisations

Directorate of Environment Services – Doncaster MBC
Directorate of Public Protection and Housing Services – E Riding of Yorkshire Council
Environmental Health Services – Hull City Council
Directorate of Environment, Housing and Social Services – North East Lincolnshire Council
The Environment Agency (Anglian Region)
The Environment Agency (Midlands Region)
British Steel, Scunthorpe
Lindsey Oil Refinery, North Killingholme
Conoco Oil Refinery, South Killingholme

North Lincolnshire Council

Directorate of Environment and Public Protection
- Pollution an Public Health
- Transportation Planning
- Business Regeneration
- Development Control

Appendix 1
Part A Processes in North Lincolnshire
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Brigg Power Station	CCGT Power Station	1.3 (b)					X	X	
Powergen North Killingholme	CCGT Power Station	1.3 (b)					X	X	
National Power Plc North Killingholme	CCGT Power Station	1.3 (b)					X	X	
Keadby Power Station	CCGT Power Station	1.3 (b)					X	X	
Fibrogen Flixborough	Power Station	1.3 (a)						X	X
British Steel Scunthorpe	Boiler Plant	1.3 (a)						X	X
Edinburgh Oil & Gas Scunthorpe	Crude Oil Handling	1.4 (a)	X	X	X		X	X	X
British Steel Coke Ovens	Coke Production	1.2	X	X			X	X	X
British Steel Plc	Iron & Steelmaking	2.1				X	X	X	X
British Steel Rod Mill	Steel Mill	2.1				X	X	X	X
Short Brothers Scunthorpe	Steel Slab Splitting	2.1				X	X	X	X
Rugby Group South Ferriby	Cement Manufacturer	3.1					X	X	X
Singleton Birch	Lime Works	3.1					X	X	X
Conoco Humber Refinery South Killingholme	Crude Oil Handling	1.4	X	X	X		X	X	X
Lindsey Oil Refinery South Killingholme	Crude Oil Handling	1.4	X	X	X		X	X	X
Crystal Polymers Flixborough	Plastics Manufacture	4.2					X	X	X
Bitmac	Tar & Oil Processing	6.3	X				X	X	X
Immingham Bulk Terminal Immingham Dock	Bulk Iron Ore Handling & Storage	2.1 (a)							X
Crown Timber	Timber Process	6.7							
Howarth Timber & Doors	Timber Process	6.7							

Appendix 2
Part B Processes in North Lincolnshire
Potential Emissions to Air

	Process	Process Guidance No	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Ibstock Building Products Belton	Ceramics & Refactory Production	3.2					X		
William Blyth Hoe Hill Works Barton	Manufacture of Clay & Refactory Products	3.2					X		
William Blyth Ings Tileries Barton	Manufacture of Clay & Refactory Products	3.2					X		
Plibrico Scunthorpe	Manufacture of Refractory Processes	3.2					X		
Sandtoft Roof Tiles Barrow Haven	Clay & Refactory Processes	3.2					X		
Sandtoft Tileries Sandtoft	Maufacture of Roof Tiles	3.2					X		
Sandtoft Tileries New Holland	Maufacture of Roof Tiles	3.2					X		
Simon Distribution Brigg	Storage of Coal, Coke & Products	3.5							X
Simon Distribution North Killingholme (Warehouse B)	Handling & Storage of Petroleum Coke	3.5							X
Simon Distribution North Kilingholme (Warehouse J)	Handling & Storage of Petroleum Coke	3.5							X
Simon Distribution North Killingholme (Warehouse K)	Handling & Storage of Petroleum Coke	3.5							X
Simon Distribution North Killingholme (Budmo Warehouse)	Handling & Storage of Petroleum Coke	3.5							X
JHP Storage Elsham	Handling & Storage of Petroleum Coke	3.5							X
British Steel Immingham Bulk Terminal South Killingholme	Storage of Petroleum Coke	3.5							X
Waterway Services Keadby	Storage of Petroleum Coke	3.5							X

Appendix 2
Part B Processes in North Lincolnshire
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Faber Prest Ports Gunness Whart Althorpe	Storage of Coal & Coke Products	3.5							x
Swallow Stevedores North Killingholme	Processing Graphite Petroleum & Metallurgical Coke	3.5							X
PMC Carbon Scunthorpe	Processing Graphite Petrolem & Metallurgical Coke	3.5							x
Singleton Birch Melton Ross Quarry Kirmington	Crushing Hardcore	3.8							x
Scangrti South Killingholme	Minerals Handling & Processing	3.8							x
Rugby Cement Middlegate Quarry	Quarrying of Minerals	3.8							X
Steetley Bentonite & Absorbants Ltd Flixborough	Handling & Processing of Minerals	3.8							x
Quay Minerals Flixborough	Handling & Processing of Minerals	3.8							X
Quay Minerals Bagnor Works Flixborough	Screening and Drying of Materials	3.8							x
Appleby Group Scunthorpe	Processing of Blast Furnace Slag	3.8							x
Appleby Slag Reduction Limited Yarborough Quarry Santon	Screening & Crushing of Slag Products	3.8							x
East Coast Slag Products	Crushing & Screening of Slag	3.8							X
Ductile Castings Scunthorpe	Melting of ferrous metals	2.1			x				
Firth Rixson Castings Scunthorpe	Melting of ferrous metals	2.1			x				
L.S.D Transport Gunness	Coal Handling	3.5							x

Appendix 2
Part B Processes in North Lincolnshire
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Anglo Coal Gunness	Coal Handling	3.5							X
Quay Minerals Flixborough Wharf	Minerals Handling	3.8							X
New Holland Bulk Terminal New Holland	Coal Handling	3.8							X
Landline Services Scunthorpe	Quarry Process	3.8							X
Jotun Powder Coatings Flixborough	Manufacture of Coating Powder	6.9							X
Caparo Merchant Bar Scunthorpe	Reheat & Retreatment Furnace	1.11					X		X

Appendix 3
Part A Processes in Adjacent Local Authority Areas
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Allied Colloids Grimsby	Organic Chemicals	4.2	X	X	X		X	X	X
Associated Petroleum Terminal Immingham	Crude Oil Handling	1.4	X	X	X		X	X	X
B.G Cogen Ltd Grimsby	Combustion plant	1.3A						X	X
BOC Gases Stallingborough									
Coal Products Ltd Immingham	Carbonisation Process	1.2	X	X			X	X	X
Courtaulds Fibres Ltd Grimsby	Combustion Plant	1.3A						X	X
Courtaulds Fibres Ltd Grimsby	Inorganic Manufacture	4.5			X	X	X	X	X
Courtaulds Fibres Ltd Grimsby	Organic Chemicals	4.2	X	X			X	X	X
Cray Valley Stallingborough	Organic Chemicals	4.2	X	X			X	X	X
Harlow Chemical Co. Stallingborough	Organic Chemicals	4.2							
Humber Power Ltd Stallingborough	Combustion plant	1.3A						X	X
Hydro Agri (UK) Ltd Immingham	Combustion plant	1.3A						X	X
Immingham Storage Co Immingham	Crude Oil Handling	1.4	X	X	X		X	X	X
Millennium Inorganic Chemicals Stallingborough	Combustion plant	1.3A						X	X
Novartis Grimsby	Organic Chemicals	4.2	X	X			X	X	X
Synthoner Ltd Stallingborough	Petro-chemical	4.1	X	X		X	X	X	X
Technical Absorbants Great Coates	Organic Chemicals	4.2	X	X			X	X	X
Tioxide Materials Grimsby	Organic Chemicals	4.2	X	X			X	X	X

Appendix 3
Part A Processes in Adjacent Local Authority Areas
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Croda Chemicals Rawcliffe Bridge Goole	Chemical Processes	4.2	X	X			X	X	X
Miracle Garden Care Howden Bridge	Fertiliser Manufacture	4.6					X	X	X
Kemira Chemicals Ltd Goole	Manufacture of ferric nitrate/sulphate	4.5(c)				X	X	X	X
B.P.E.O Easington	Combustion process	1.3					X	X	
B.P.E.O Easington	Natural gas reforming process	1.1				X	X	X	
British Gas Easington	Natural gas reforming process	1.1				X	X	X	
British Gas Easington	Combustion process	1.3							
BP Chemicals Saltend	Combustion process	1.3					X	X	
BP Chemicals Saltend	Organic Chemical processes	4.2 (c) (d)	X	X			X	X	X
BP Chemicals Saltend	Inorganic processes	4.5 (a) (c)				X	X	X	X
Hodgson Chemicals Beverley	Organic processes	4.2	X	X			X	X	X
Hodgson Chemicals Beverley	Inorganic processes	4.5				X	X	X	X
British Aerospace Brough	Cadmium Plating	2.2				X	X	X	X
Croda Chemicals Wheatley Doncaster	Organica Chemicals	1.4 (a)	X	X	X		X	X	X
Hepworth Refractories Austerfield Doncaster	Ceramics	3.6					X	X	X
M & J Polymers Old Denaby Doncaster	Tar and Bitaman process	6.3 (b)					X	X	X
Polypipe Ltd Warmsworth Doncaster	Inorganic Chemical Process	4.5 (f)			X	X	X	X	X

Appendix 3
Part A Processes in Adjacent Local Authority Areas
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Premier Profiles Ltd Doncaster	Inorganic Chemical Process	4.5 (f)				X	X	X	X
Peglers Ltd Balby Doncaster	Galvanising	2.2					X	X	X
Drax Power Station	Power Station	1.3 (a)					X	X	X
Ferrybridge Power Station	Power Station	1.3 (a)					X	X	X
Eggborough Power Station	Power Station	1.3 (a)					X	X	X
West Burton Power Station	Power Station	1.3 (a)					X	X	X
Cottan Power Station	Power Station	1.3 (a)					X	X	X
High Manton Power Station	Power Station	1.3 (a)					X	X	X
Croda Universal Ltd Hull	Organic processes	4.2 (a)	X	X			X	X	X
Holliday Pigments Ltd Hull	Acid Process	4.3 (a)					X	X	X
Hodgson Chemicals Hull	Organic processes	4.2 (a)	X	X			X	X	X
J L SEATON & Co hull	Organic processes	4.2 (a)	X	X			X	X	X

Appendix 4
Part B Processes in Adjacent Local Authority Areas
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Shipham & Co Ltd Hull	Melting of non-ferrous metal	2/7			X		X		
Hygena Components Ltd Hull	Melting of non-ferrous metal	2/7			X		X		
T H Dick & Co Hull	Refining Iron	2/3			X				
Caradon Ideal Hull	Hot Blast Cupola	2/5			X		X		
Starkeys Technicast Ltd Hull	Cold Blast Cupola	2/5			X		X		
J H Fenner & Co Hull	Rubber Process	6/28		X					X
Donaldsons Filter Comp Hull	Di-isocyannte Process	6/28		X					X
British Fuels Storage Hull	Solid Fuel Storage	3/5							X
W H Draper Hull	Aluminium Reclamation	2/1			X				
Conoco Ltd Immingham Dock	Coal Handling	3/5							X
Colin Booth Ltd Immingham	Coal Handling	3/5							X
Dunlop Oil & Marine Grimsby	Rubber Process	1/5		X					X
Doncaster Coated stone Kirk Sandall Doncaster	Roadstone Coating	3.15							X
Hatfield Colliery Stainforth	Coal Process	3.5							X
Flogates Goole	Heavy Clay Goods	3.2					X		
Sandtoft Roof Tiles Broomfleet	Heavy Clay Goods	3.2					X		
RMC Roadstone Melton	Roadstone Coating	3.15							X
Appleby Abrasives Ltd Melton	Mineral process	3.15							X
Croxton & Gary Ltd Melton	Mineral Process	3.5							X
W Clifford Watts Ltd Swinescaif Quarry South Cave	Quarry Process	3.8							X
Global Shipping Immingham	Coal Handling	3/5							X

Appendix 4
Part B Processes in Adjacent Local Authority Areas
Potential Emissions to Air

	Process	Process Guidance No.	Benzene	1,3 Butadiene	Lead	Carbon Monoxide	Sulphur Dioxide	Nitrogen Dioxide	PM10
Grimsby & Immingham Stevedores Immingham	Coal Handling	3/5							X
Grimsby Coated Stone Grimsby	Roadstone Coating	3/15							X
Hargreaves Industrial Ltd	Coal Handling	3/5							X
Humberside Sea & Land Ltd Immingham	Coal Handling	3/5							X
SSM Coal Ltd Immingham	Coal Handling	3/5							X
Swallow Stevedores Immingham	Coal Handling	3/5							X
Swallow Stevedores Grimsby	Coal Handling	3/5							X

For more information about Air Quality issues within North Lincolnshire please contact the Environmental Protection Unit on 01724 297619 or by email at belinda.hoey@north lincs.gov.uk

www.northlincs.gov.uk