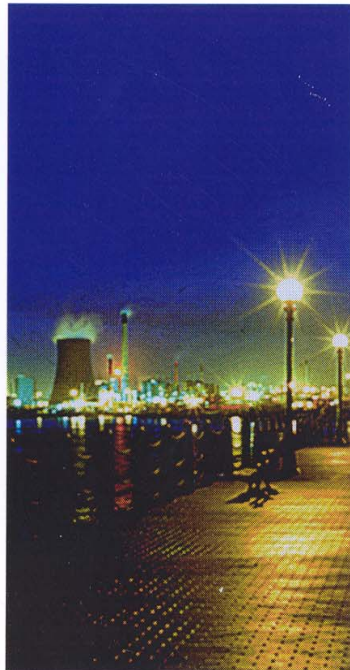




Air

Quality Review



STAGE 2/3 2000

CONTENTS

1. INTRODUCTION	4
2. AIR QUALITY STANDARDS AND OBJECTIVES	7
3. LOCAL AIR QUALITY MANAGEMENT	9
NATIONAL APPROACH	9
ELLESMERE PORT AND NESTON BOROUGH'S LOCAL APPROACH	10
4. DESCRIPTION OF ELLESMERE PORT AND NESTON	12
5. METHODOLOGY	14
EMISSIONS INVENTORY	14
MODELLING	16
MONITORING	21
6. REVIEW OF INDIVIDUAL AIR QUALITY OBJECTIVE POLLUTANTS	24
EMISSIONS INVENTORY	24
COMPARISON OF MODELLED DATA WITH MONITORING DATA	24
7. BENZENE (C ₆ H ₆)	25
8. 1,3-BUTADIENE (C ₄ H ₆)	29
9. CARBON MONOXIDE (CO)	32
10. LEAD (Pb)	37
11. NITROGEN DIOXIDE (NO ₂)	41
12. PARTICULATES (PM ₁₀)	45
13. SULPHUR DIOXIDE (SO ₂)	48
14. CONCLUSION	53
15. GLOSSARY	55
16. APPENDIX A	56
17. APPENDIX B	57

FIGURES

Figure 1 OVERALL TIMETABLE (DECEMBER 1999-2003).....	6
Figure 2 AIR QUALITY MANAGEMENT PROCEDURE	11
Figure 5 Predicted 2003 annual Benzene concentrations for the whole EPNBC area (NAQS objective - annual mean - 16.25 $\mu\text{g}/\text{m}^3$)	26
Figure 6 Small scale map areas of 2003 Predicted Benzene concentrations in EPNBC area (NAQS objective - annual mean - 16.25 $\mu\text{g}/\text{m}^3$)	26
Figure 7 Predicted 2003 annual 1,3-Butadiene concentrations for the whole EPNBC area (NAQS objective - annual mean - 2.25 $\mu\text{g}/\text{m}^3$)	30
Figure 8 Small scale map areas of 2003 Predicted 1,3-Butadiene concentrations in EPNBC area (NAQS objective - annual mean - 2.25 $\mu\text{g}/\text{m}^3$)	30
Figure 9 Predicted 2004 hour mean CO concentrations for the whole EPNBC area (NAQS objective - running 8 hour mean - 11.6 mg/m^3)	33
Figure 10 Small-scale map areas of 2003 predicted 8-hour mean CO concentrations in EPNBC area (NAQS objective - running 8 hour mean - 11.6 mg/m^3).....	33
Figure 11 NO ₂ AND CO HOURLY VARIATION IN LIVERPOOL THROUGHOUT THE DAY.	34
Figure 12 NO ₂ AND CO CORRELATION	35
Figure 13 NO ₂ and CO hourly variations in Ellesmere Port and Neston borough throughout the day	35
Figure 14 Predicted 2004 annual Lead concentrations for the whole EPNBC area (NAQS objective - annual mean - 0.5 $\mu\text{g}/\text{m}^3$).....	38
Figure 15 Small scale map areas for 2004 predicted annual Lead concentrations in EPNBC area (NAQS objective - annual mean - 0.5 $\mu\text{g}/\text{m}^3$ by end 2004)	38
Figure 16 Small-scale map areas of 2008 predicted annual Lead concentrations in EPNBC area (NAQS objective - annual mean - 0.25 $\mu\text{g}/\text{m}^3$ by end 2008).....	39
Figure 17 Predicted 1-hour mean 2005 NO ₂ concentrations for the whole EPNBC area (NAQS objective - 1 hour mean - 200 $\mu\text{g}/\text{m}^3$ 99.8 th percentile)	42
Figure 18 Small-scale map areas of Predicted 2005 1-hour mean NO ₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 200 $\mu\text{g}/\text{m}^3$ 99.8 th percentile by end 2005).....	42
Figure 19 Small-scale map areas of predicted 2005 annual mean NO ₂ concentrations in EPNBC area (NAQS objective - annual mean - 40 $\mu\text{g}/\text{m}^3$ by end 2005)	43
Figure 20 Predicted 2004 24-hour mean PM ₁₀ concentrations for the whole EPNBC area (NAQS objective - 24 hour mean - 50 $\mu\text{g}/\text{m}^3$).....	46
Figure 21 Small-scale map areas of 2004 predicted 24-hour mean PM ₁₀ concentrations in EPNBC area (NAQS objective - 24 hour mean - 50 $\mu\text{g}/\text{m}^3$ by end 2004)	46
Figure 22 Predicted 2005 15-minute mean SO ₂ concentrations for the whole EPNBC area (NAQS objective - 15 minute mean - 266 $\mu\text{g}/\text{m}^3$, 99.9 th percentile).....	49
Figure 23 Small-scale map areas of 2005 predicted 15-minute mean SO ₂ concentrations in EPNBC area (NAQS objective - 15-minute mean - 266 $\mu\text{g}/\text{m}^3$, 99.9 th Percentile by 2005)	49
Figure 24 Small-scale map areas of 2004 predicted 1 hour mean SO ₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 350 $\mu\text{g}/\text{m}^3$, 99.7 th Percentile by 2004)	50
Figure 25 Small-scale map areas of 2004 predicted 24-hour mean SO ₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 125 $\mu\text{g}/\text{m}^3$, 98.9 th Percentile by 2004)	50

TABLES

Table 1 SUMMARY OF THE REVISED OBJECTIVES ADOPTED IN THE AIR QUALITY REGULATIONS 2000 ..	8
Table 2 Estimated Maximum Model error for NAQS objectives.	20
Table 3 Cheshire Benzene Emissions (tonnes per year)	25
Table 4 Ellesmere Port and Neston Borough Benzene Emissions (tonnes per year)	25
Table 5 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	27
Table 6 Cheshire 1,3-Butadiene emissions (tonnes per year)	29
Table 7 Ellesmere Port and Neston Borough 1,3-Butadiene emissions (tonnes per year)	29
Table 8 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	31
Table 9 Cheshire CO emissions (tonnes per year)	32
Table 10 Ellesmere Port and Neston Borough CO Emissions (tonnes per year)	32
Table 11 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	36
Table 12 Cheshire Lead Emissions (tonnes per year)	37
Table 13 Ellesmere Port and Neston Borough Lead Emissions (tonnes per year)	37
Table 14 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	40
Table 15 Cheshire NO ₂ Emissions (tonnes per year)	41
Table 16 Ellesmere Port and Neston Borough NO ₂ Emissions (tonnes per year)	41
Table 17 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	44
Table 18 Cheshire PM ₁₀ Emissions (tonnes per year)	45
Table 19 Ellesmere Port and Neston Borough PM ₁₀ Emissions (tonnes per year)	45
Table 20 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	47
Table 21 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	47
Table 22 Cheshire SO ₂ emissions (tonnes per year)	48
Table 23 Ellesmere Port and Neston Borough SO ₂ emissions (tonnes per year)	48
Table 24 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	51
Table 25 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	51
Table 26 COMPARISON OF MODELLED DATA WITH MONITORING DATA.	52
Table 27 AIR QUALITY MONITORING SITES	61
Table 28 SITE DESCRIPTION AND SELECTION	63
Table 29 NO ₂ DIFFUSION TUBES	65
Table 30 BUBBLERS	66
Table 31 NOx-API	67
Table 32 TEOM Particulates	68
Table 33 SO ₂ -API	69
Table 34 OPSIS	70
Table 35 REFERENCES	71

1. INTRODUCTION

The Environment Act 1995 introduced a duty on local authorities to assess and manage air quality. The Act also required The Secretary of State to produce a National Air Quality Strategy to set out national policies with respect to the assessment and management of air quality.

The United Kingdom National Air Quality Strategy was published in March 1997 by the government. The principle objective was to set air quality management within the wider context of sustainable development. A revised strategy was published in January 1999 due to a change of government. The key changes related mainly to the particulates objectives, a recognition of the inability of local authorities to achieve the original objective. The European Daughter Directive standard was adopted as an interim measure to allow time for further research. Other changes saw the timetable for achieving the objectives for some pollutants being brought forward. The latest consultation document, released in August 1999, included the previous amendments but also introduced new objectives to take account of the effect of air quality on ecosystems.

The key elements of the strategy have remained constant and require authorities to:

- Bring air quality within the wider framework of sustainability
- Introduce a health based approach, taking into account risk
- Continue the "Polluter Pays" Principle
- Adopt a precautionary principle to safeguarding health
- Take account of the cost/benefit equation
- Review the strategy against scientific developments
- Ensure that action is taken at the most appropriate level
- Implement clear action plans

The National Air Quality Standards and Objectives were given legal effect by the introduction of Air Quality Regulations in 1997. It has been necessary, due to the above amendments to the National Strategy, to seek to introduce new regulations. The Air Quality (England) Regulations 2000 replace the previous regulations and guide this Review.

Local Authorities were originally under a non-statutory deadline to complete their reviews by December 1999. The Government has recognised that this deadline is no longer appropriate given the key changes to the air quality management regime. Local Authorities have, therefore, effectively been given an extension to December 2000. The National Strategy, The Environment Act 1995 and associated guidance are largely enabling. It is intended that they will provide the framework by which local authorities can take local action, determined by local circumstances. Ellesmere Port and Neston Borough Council has been actively working on assessing local air quality before the introduction of the original regime in December 1998.

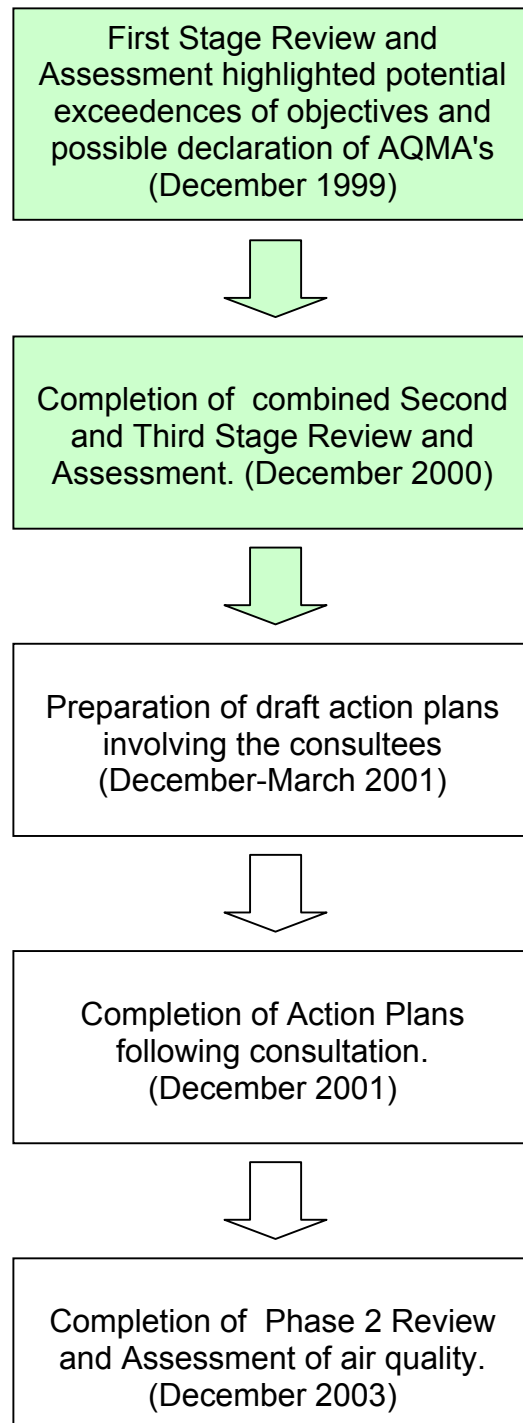
This review and assessment of air quality is only the initial step in the overall regime. Local Authorities are obliged to carry out to take a phased approach in reviewing air quality with a second round of reviews to be completed before 31 December 2003. The overall timetable is highlighted in Diagram 1.

The pollutants and their relevant sources contained within the National Air Quality Strategy are discussed within their own pollutant chapters. It should be noted that the Strategy is only concerned with outdoor, ambient air quality. It does not directly relate to indoor air quality but the ability of outdoor air quality to influence indoor air quality has been taken into account.

In addition this Review does not consider sources of offensive odour nor pollutants such as Carbon Dioxide directly related to Climate Change issues.

The Ordnance Survey mapping included within this *publication* is provided by Ellesmere Port & Neston Borough Council under licence from the Ordnance Survey in order to fulfil its public function to act as an environmental health authority. Anyone viewing this mapping should contact Ordnance Survey copyright for advice where they wish to licence Ordnance Survey for their own use.

Figure 1 OVERALL TIMETABLE (DECEMBER 1999-2003)



2. AIR QUALITY STANDARDS AND OBJECTIVES

The development of European and UK legislation has led to two main concepts in relation to air quality. The Air Quality Management regime refers continually to **standards** and **objectives**.

STANDARDS

The standards are designed to reflect a certain level of environmental quality in relation to health, expressed in terms of localised emissions.

OBJECTIVES

Objectives are policy targets. They:

- Reflect the desired level of air quality in a given area,
- Provide the policy drivers in relation to air quality,
- Refer to the permitted short term exceeding of levels defined by air quality legislation and time scales for achieving the desired levels.

These are:

- Designed to reflect the feasibility and practicality of achieving the desired levels.
- Include an element of economic appraisal, in order to prevent the situation whereby 100% compliance would require a disproportionately expensive remedial measure.
- Include averaging times, which take account of how quickly particular pollutants may cause an adverse effect.

All the standards and objectives are exposure based, they therefore relate to areas where people are likely to be exposed over the relevant time period, generally either one hour or as an annual mean.

OBJECTIVE LEVELS

Air Quality Objective levels have been specified based upon research by the Expert Panel on Air Quality Standards (EPAQS). They are designed to reflect the principle of rendering emissions harmless, i.e. the principle enshrined within The Environmental Protection Act 1990, which deals with industrial emissions. The standards and objectives are highlighted in Table 1.

Table 1 SUMMARY OF THE REVISED OBJECTIVES ADOPTED IN THE AIR QUALITY REGULATIONS 2000

Pollutant	Concentration Limit	Time Period of Measurement	Date by which Objective is Achieved
Benzene	16.25µg/m ³	running annual mean	December 31, 2003
1, 3-Butadiene	2.25µg/m ³	running annual mean	December 31, 2003
Carbon Monoxide	11.6 mg/m ³	running 8-hour mean	December 31, 2003
Lead	0.5 µg/m ³ 0.25µg/m ³	annual mean annual mean	December 31, 2004 December 31, 2008
Nitrogen Dioxide	200µg/m ³	1 hour mean not to be exceeded more than 18 times a year	December 31, 2005
	40µg/m ³	annual mean	December 31, 2005
Particulates (PM ₁₀)	50 µg/m ³	24 hour mean not to be exceeded more than 35 times a year	December 31, 2004
	40µg/m ³	annual mean	December 31, 2004
Sulphur Dioxide	350µg/m ³	1 hour mean not to be exceeded more than 24 times a year	December 31, 2004
	125µg/m ³	24 hour mean not to be exceeded more than 3 times a year	December 31, 2004
	266µg/m ³	15 minute mean not to be exceeded more than 35 times a year	December 31, 2005

3. LOCAL AIR QUALITY MANAGEMENT

NATIONAL APPROACH

The review and assessment of air quality is one key step in local air quality management. It will identify what action needs to be taken to meet objective standards. It will:

- Dictate the need for air quality to be integrated into the local authority decision making process,
- Act as a benchmark for evaluating the effectiveness of action taken.

Local authorities are expected to target their resources to the areas of greatest priority where individuals are likely to be exposed over the averaging times of the objectives. This means that the risk of exposure to each pollutant must be a primary consideration; if no risk is evident then the authority does not have to proceed with the next stage of the review. The air quality management process outlined in Local Air Quality Management Guidance LAQM.G1 (00) is summarised in Figure 2.

The review process has been undertaken using a **three staged** approach. The staged approach has been adopted in order that the proportionality of the risk can be taken into account.

The **First Stage** was a simple screening process, which the Stage 1 Review, published in December 1999 (Reference Document 1), identified those areas requiring a more detailed and closer examination. The **Second Stage** involves simple modelling and estimation techniques, whilst the **Third Stage** can utilise more complex modelling and monitoring.

The Regulations allow the Local Authority to stop at any stage if the risk of exceeding an objective is negligible. If at the end of the review limits are likely to be exceeded then Air Quality Management Area (AQMA) must be declared. An AQMA is a defined area in which the Local Authority must actively try to reduce air quality. This will involve discussions and co-operation with other Local Authority Departments, for example Planning and Highways and consultees. If an AQMA is declared, the authority must produce a report within 12 months on the extent of the exceeded limits and how the matter can be addressed, where possible.

The air quality management process will, therefore, require the involvement of the whole community, hence the need for regular consultation with the key players in the local community and surrounding authorities. The Consultees for this Authority are listed below;

- The Secretary of State
- The Environment Agency;
- All neighbouring Local Authorities i.e. The Metropolitan Borough of Wirral and all Local Authorities in Cheshire;
- Cheshire County Council;
- Other public authorities as appropriate; and
- Bodies representing local business interests and other organisations as appropriate.

ELLESMERE PORT AND NESTON BOROUGH'S LOCAL APPROACH

In recognition of the complexity of the polluting processes within the Borough identified by the Stage 1 Review and recognising local air pollution as a locally sensitive issue, the decision was made to proceed directly from Stage 1 to a detailed Stage 3 Review.

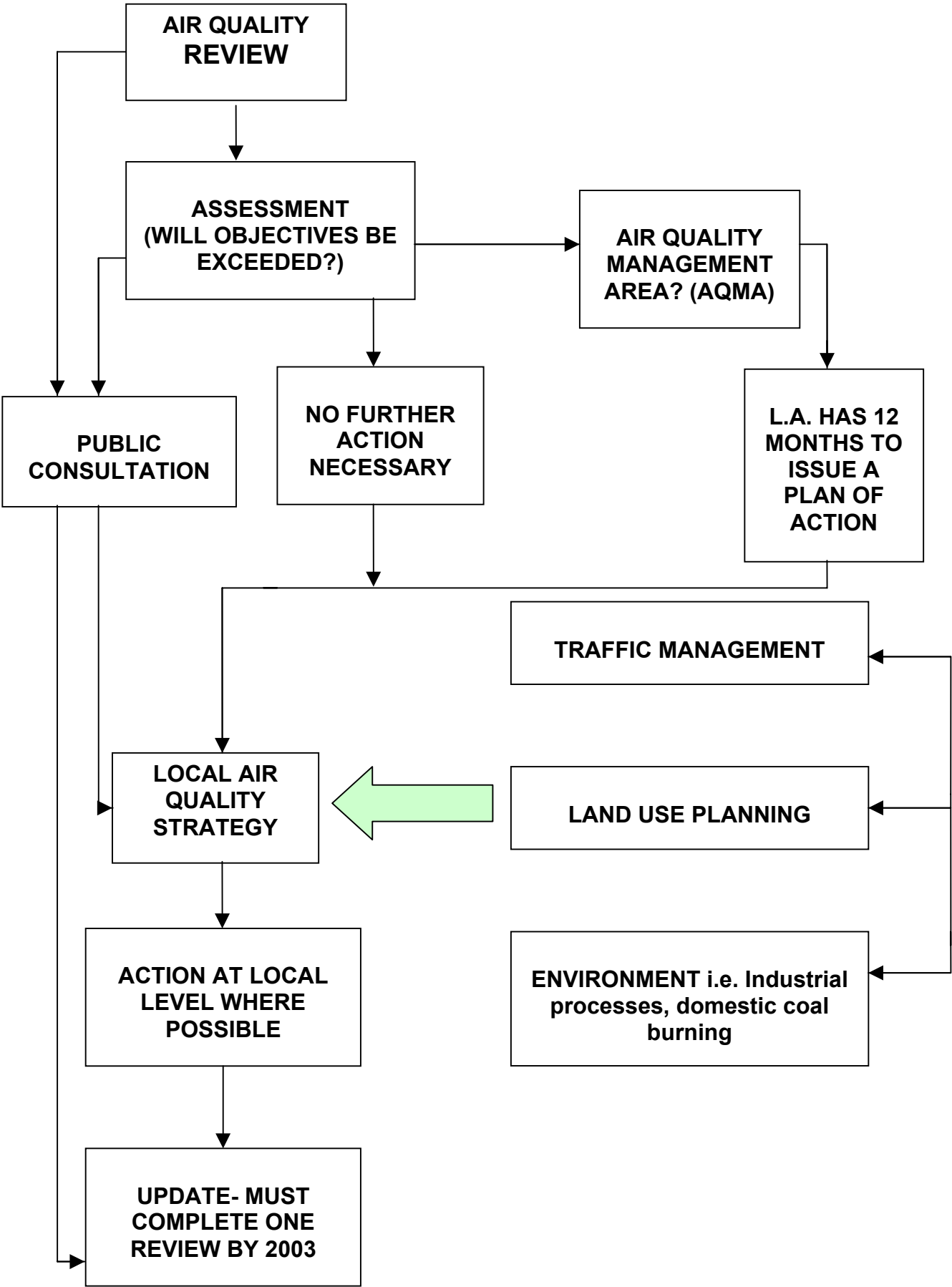
Throughout the detailed Review process which has involved the development of a local inventory, sophisticated and indicative monitoring and complex Modelling, information has been collated on any existing or proposed significant sources of pollution. In addition where works to reduce local pollutants are in progress, these reductions have also been included.

This document is the Ellesmere Port and Neston Borough Council Stage 3 technical review of air quality to meet both local needs and the Air Quality Regulations 2000.

The Local Authority established a Local Air Quality Forum in February 2000. This Forum will form the main part of the consultation process involved in finalising this Review and exceed the minimum requirements of the legislation and guidance. The membership of the Air Quality Forum is listed in Appendix A.

It is intended to produce and publish an Air Quality Strategy for Ellesmere Port and Neston. This will provide the framework for delivering the necessary action points, whilst ensuring that related policies are run on a complimentary basis.

Figure 2 AIR QUALITY MANAGEMENT PROCEDURE



Stage 2/3 Air Quality Review: December 2000

4. DESCRIPTION OF ELLESMERE PORT AND NESTON

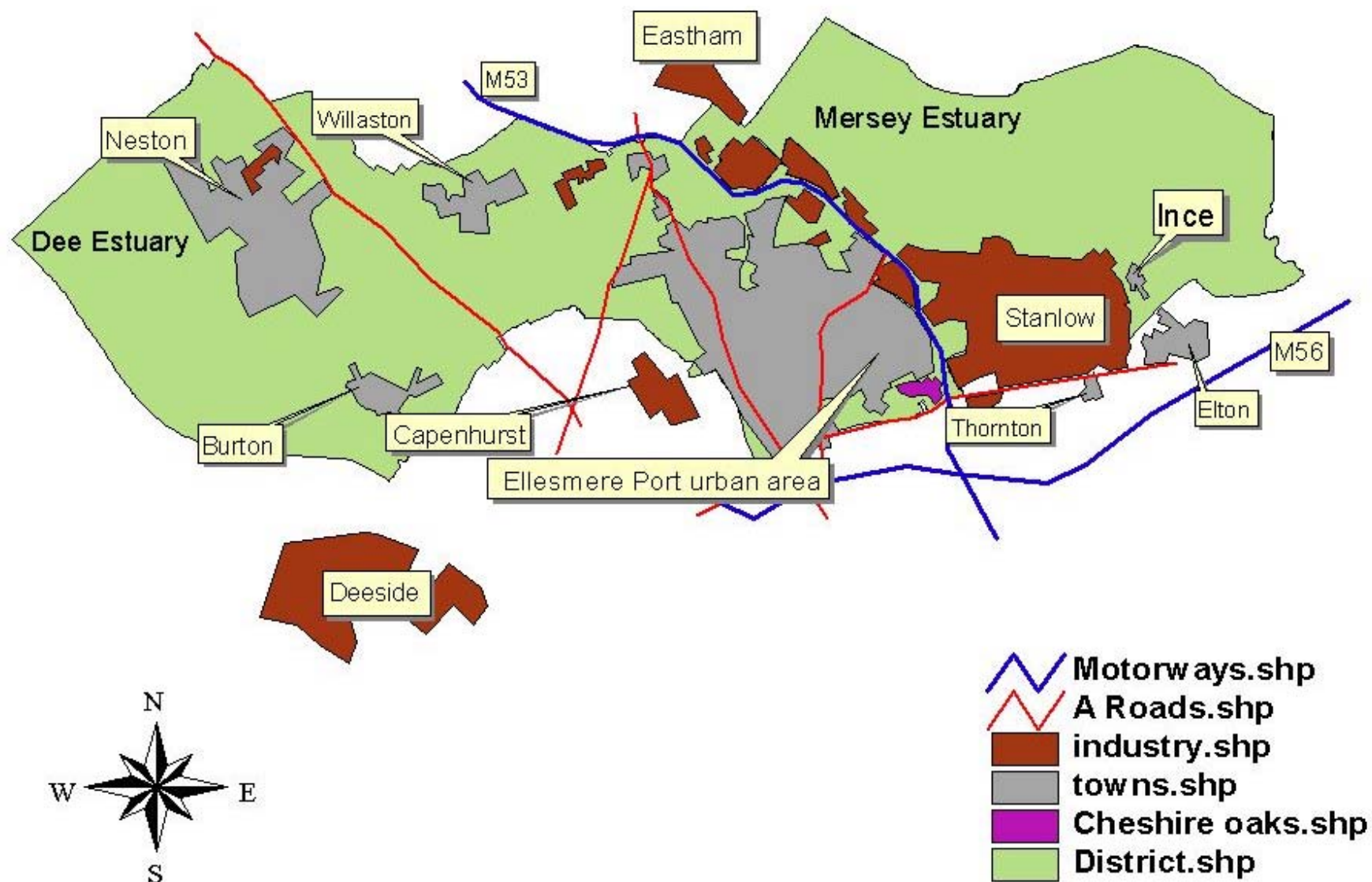
The Borough of Ellesmere Port and Neston extends across the southern part of the Wirral peninsula from the Mersey to the Dee, covering 33 square miles and having a population of approximately 81,200. The town of Ellesmere Port is the largest urban area in the Borough and starts where the Manchester Ship Canal and the Mersey are joined by the Shropshire Union Canal. The Borough itself is largely smoke controlled, with 19 Smoke Control Areas being set up between 1952 and 1982 leaving Neston and other small areas able to burn coal.

The M53 motorway runs around the north and east of Ellesmere Port, close to residential and shopping areas. The M56 motorway skims the Borough boundary to the south east and runs north easterly. To the north and east of Ellesmere Port there are a number of industrial sites including an oil refinery and associated petro-chemical complex, a car assembly plant, and a chemical waste incinerator.

In the Borough there are approximately 57 Authorised industrial processes which, under the provisions of the Environmental Protection Act 1990, are authorised for integrated pollution control requirements by the Environment Agency (Part A) or for pollution control purposes by the Borough Council (Part B). Industrial sources are therefore a key air quality consideration.

There remains a significant potential for development within the Borough of Ellesmere Port and Neston. The developments relate mainly to retail employment and residential use. The effect of these planned developments will have to be taken into account, particularly the potential for an increase in industrial emissions and vehicle movements. This issue is addressed in the conclusions to this Review. A map of the Borough is presented as Figure 3.

Figure 3 Map of the Borough including Industrial areas, towns and main roads.



5. METHODOLOGY

Government guidance document, "Framework for Review and Assessment of Air Quality (LAQM). G1 (00) advocates a phased approach to the review and assessment.

LAQM. TG4 (00) is the technical document that outlines how this approach should be implemented.

The process followed in this review is derived from these documents, which splits the review into three stages.

The **first stage** involves an exercise requiring the collation of specific information on key pollutants to inform the review. The **second stage** involves a further screen of the significant sources identified by stage one using modelling tools. Road transport, industrial emissions, domestic solid fuel use and areas of dust emissions have all been assessed. The **third stage** involves a review of the pollutants and detailed modelling exercise for all the pollutants with the aid of an Emissions Inventory.

In order for the third stage review to be completed it is necessary to collate all the possible emission sources and their relevant concentrations into an Emissions Inventory. This in turn is fed into the Atmospheric Dispersion Modelling Software (ADMS), which calculates ground level concentrations of the pollutants. The ground level concentrations are then validated against known locally monitored data.

Information has been gathered from a variety of sources. Specific assessment tools have been developed with the Atmospheric Research and Information Centre (ARIC) and Cambridge Environmental Research Consultants (CERC). The accuracy of the information used must, however, be evaluated in order that a degree of confidence can be attached to the decisions made. Each specific assessment tool i.e. Emissions Inventory, Modelling and monitored data has, therefore, been addressed in turn.

EMISSIONS INVENTORY

An Emissions Inventory (Reference Document 2) has been compiled by ARIC on behalf of the Council and in conjunction with other Cheshire District Councils. The contents of the Inventory, which was completed in February 2000 collates emissions data for the period 1998, which is classified as the baseline year in this Review. It was necessary to compile data for an entire year. 1998 is a starting point by which improvements can be measured. It allows the magnitude and spatial distribution of emissions across the area to be investigated. It also enables the relative importance of different sources of air pollution to be examined. A detailed description of the Inventory can be found in Reference Document 2.

The emissions data has a further role in providing the basic data for dispersion modelling exercises using the Council's ADMS software described in Section 2 below. In conjunction with transport models, it also provides the basis for forecasting air quality and determining the effects of changes in land use planning and transportation policies.

The atmospheric emissions inventory is therefore of key significance:

- As the basis for undertaking air quality reviews as described by the National Air Quality Strategy and enshrined in the Environment Act 1995;
- For assessing the impact of new development and the changes to road infrastructure and their use or identifying the environmental benefits of proposed urban change;
- For developing air quality management plans; and
- To provide input to dispersion modelling which can be used to guide or refine air quality monitoring networks

The inventory includes emissions of all the following National Air Quality Strategy pollutants excluding ozone:

- Sulphur Dioxide (SO₂)
- Oxides of Nitrogen (NO_x)
- Carbon Monoxide (CO)
- Particulate matter less than 10 µm (microns) aerodynamic diameter (PM₁₀)
- Benzene (C₆H₆)
- 1,3-Butadiene (C₄H₆)
- Lead (Pb)

In addition to these pollutants, emission estimates have also been made for total non-methane volatile organic compounds (VOCs) and total suspended particulate (TSP).

Emission estimates for VOCs and TSP have been made, as these are important pollutant groups associated with those listed above. Emission estimates for Ellesmere Port and Neston Borough has been made for individual sources in the following source categories:

- Road transport
- Part A processes
- Part B processes
- Industrial and commercial combustion plants
- Residential combustion
- Other transport sources including railway sources, aviation and shipping

MAIN CONCLUSIONS OF THE 1998 CHESHIRE EMISSIONS INVENTORY THAT INFLUENCE THIS REVIEW

Road transport sources account for the largest proportions of emissions of many pollutants included in the Inventory. This is particularly the case for NO_x (58%), CO (83%), PM₁₀ (22%), benzene (61%) and 1,3-butadiene (72%)

Almost all emissions of combustion products i.e. NO_x, CO and SO₂, are related to Part A processes operating in the Borough of Ellesmere Port and Neston.

The largest emitter of SO₂ (accounting for 60% of the total point source emissions of SO₂) is the petrochemical refinery at Stanlow operating within Ellesmere Port. Other industrial emitters of this pollutant operate within the Borough also contribute significant amounts of SO₂, however one of these companies is due to cease emitting this pollutant once their Combined Heat and Power plant fully comes on line in 2000.

MODELLING

AIR DISPERSION MODELLING (ADMS)

The ADMS-Urban system is a comprehensive software package for air quality investigation and scenario planning. It is widely used by Local Authorities for the Air Quality Review and Assessment procedure, and has also been applied across departments as part of transport, planning and economic development strategies.

The model takes as input parameters:

- Roads, and their associated traffic flows, broken down into light and heavy vehicle categories
- Industrial sources, with their emission rates in grams per second
- Grid sources, from the National Atmospheric Emissions Inventory, which give background levels of emissions
- Meteorological data appropriate to the area being studied

Up to 4000 sources can be modelled at any one time, so that scenarios ranging from county and region wide studies to single street or factory investigations can be investigated. Emissions data can be input directly as modelling parameters, or via an emission inventory toolkit.

The output can be defined as concentrations at specific points (e.g. sites where monitoring equipment is located) or as concentration contour plots across a wider area. These contour plots are based on an intelligent gridding system that increases the sampling rate around roads. The location of receptor points, and interpolation of contours, is to within 1 metre on the map.

AIR DISPERSION MODELLING IN CHESHIRE

In April 2000, the Cheshire Authorities jointly commissioned CERC to carry out modelling for all the Districts, taking the inventory input data from the ARIC inventory. CERC were asked to carry out preliminary Model run of Cheshire to determine areas, which may not meet the NAQS. Those areas were then modelled in more detail. Ellesmere Port and Neston Borough was modelled in detail from the outset. However further remodelling using different meteorological data for local comparisons and recent emissions and stack data etc. has been carried out by the Environmental Health Section.

The Cheshire Emissions Inventory collated by ARIC has been generated in an ADMS-Urban format. This contains:

- Major road sources i.e. roads with more than 10000 vehicles per day
- Major industrial sources which are classified as either point, area or line sources
- Grid sources which are calculated by aggregation of the sources not modelled explicitly.

The rationale for aggregation of the minor sources onto grid squares is that these sources will not cause localised pollution problems (as their emissions are too low) but need to be considered as part of the general background pollution of an area. The use of an underlying network of grids containing an aggregation of these sources achieves this compromise. The grid size used is usually 1km, to maintain compatibility with the National Atmospheric Emission Inventory.

VALIDATION.

The Consultants CERC satisfied themselves that the emissions data was accurate, and that the model parameters had been properly defined. ADMS-Urban's gridding functions were then used to generate a map of the pollution levels across the Borough.

Maps of future concentrations have been prepared using estimated emission rates detailed in the emissions inventory work compiled by ARIC or agreed by the Council.

Meteorological data from Manchester Ringway 1998 and Speke 1975, for comparison, were used to carry out preliminary model runs to examine concentrations at specific points on the map. This allowed validation of the stage 3 model against monitoring carried out by the Council, and highlighted any major errors or omissions in the Emissions Inventory. The outputs of this stage, including conversions, assumptions, validation etc. form the basis of the model validation document (Reference Document 3). Investigation into the accuracy of the Model for all the pollutants has been carried out and the results are detailed in Table 2.

A summary of the logic and assumptions applied in the modelling exercise are detailed below.

THE MAIN CONCLUSIONS OF ELLESMERE PORT AND NESTON BOROUGH COUNCIL'S MODEL VALIDATION.

This summary draws information from monitoring results to assist in drawing modelling conclusions. It is recommended that this Section be read in conjunction with the appropriate modelling Section.

Benzene (C₆H₆)

Validation of benzene modelling results was by comparison with our own monitoring data (Table 5). Current monitoring sites are located at the edge of the main source of benzene and fall outside the area of highest benzene concentrations predicted by the model. The comparison indicates that the benzene diffusion tube results of 1.5 – 2.5 µg/m³ are about 30% higher than the model prediction.

The model at present does not contain any input from background benzene concentrations as these are not available. Data from our remote rural monitoring site (NG) and the lowest monitored values (site MM, Table 5) indicates that the background level is probably between 0.7 – 1.2 µg/m³. If this background level was added to all modelled data the predicted concentrations would be very similar to monitored data.

Therefore until further validation is available we have assumed that the model underestimates benzene concentrations by 30%.

1,3-Butadiene (C₄H₆)

We have only recently initiated butadiene monitoring within the Borough and insufficient results are available for meaningful model validation (Table 8). The initial results may indicate that butadiene concentrations are probably well below the NAQS objective. The model does not contain any input of background butadiene levels as these were unavailable.

Therefore in this case model validation is not possible and a worst case assumption is made that the model under-predicts by 50%.

Carbon Monoxide (CO)

Ellesmere Port and Neston Borough Council has no local Carbon monoxide monitoring data. Comparison of the estimated CO levels (obtained from the correlation between NO₂ and CO concentrations in Liverpool and Manchester) with model predictions indicates a maximum error of +/- 70% (Table 11). CERC validation for CO using data for all Cheshire is limited to only 2 monitoring stations. These indicate the model underestimates CO concentrations by about 50%.

Therefore model validation is not possible and a worst case error of +/- 60% has been assumed as the average of the above estimated errors.

Lead (Pb)

Lead monitoring is limited to a site located at Elton operated by Stanger Science, an independent Consultant, working on behalf of the DETR. This site is outside the area of maximum lead concentrations predicted by the model. The monitored value is 4 times less than the modelled value at this location (Table 14). It is not possible to use this comparison to validate the model, as the values at this location are very low and probably represent background concentrations. The monitored value at Elton is within the range for four rural sites elsewhere in the country (0.004 to 0.026 $\mu\text{g}/\text{m}^3$, NETCEN web site www.aeat.co.uk/netcen/airqual).

Model validation is not possible and worst case error of a 50% under-prediction error has been assumed.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is monitored at over 120 sites in Cheshire allowing a large data set for validation. Model validation by CERC using monitoring data for the whole of Cheshire indicated that background levels used for the model might be higher than the real background and as such may give a bias to results. Comparison of the annual means indicates that the model under-predicts by as much as 50% monitored values that are close to the NAQS objective (Table 17). Similarly the model under-predicts values for the 1-hour mean by about 25%.

Therefore we have set as worst case of a 50% under-prediction for the annual mean and a 25% under-prediction for the 1-hour mean for the modelling results.

Particulates (PM_{10})

Comparison of the model prediction with our own annual mean data indicates that the model under-predicts values by about 33% (Table 20). The comparison between modelled data and monitored data for the 24-hour means indicates the model under-reads by 46% (Table 21).

Therefore we have set an error of a worst case under-prediction of 50% for the modelling results.

Sulphur Dioxide (SO_2)

CERC modelling for Cheshire County indicates that the 99.9th percentile of the 15-minute mean levels is within error of about $\pm 50\%$. The 15-minute NAQS objective is the standard that is most at risk of being exceeded in the Borough.

Comparison of the modelling data with the monitoring data for Ellesmere Port and Neston Borough area (Table 24) indicate that the model under-predicts by about 50% for the 15 minute mean.

Therefore we have set an error of a worst case under-prediction of 50% for the modelling results.

Table 2 Estimated Maximum Model error for NAQS objectives.

Pollutant	Limit µg/m3	Averaging period	Exceed. Per Year (1)	Perc. (2)	Target Date	Estimated max Model Error	Model value Of Concern (4)
Benzene	16.25	Running annual mean	N/A	N/A	Dec. 2003	30% under-read	11.4 µg/m3
1,3-Butadiene	2.24	Running annual mean	N/A	N/A	Dec. 2003	50% under-read	1.12 µg/m3
Carbon Monoxide	11.6 mg/m3	Running 8-hour mean	N/A	N/A	Dec. 2003	+/- 60%	4.64 mg/m3
Sulphur Dioxide	350	1-Hour mean	24	99.71	Dec. 2004	50% under-read	175 µg/m3
	125	24-Hour mean	3	98.9	Dec. 2004	50% under-read	62.5 µg/m3
	266	15-Minute mean	35	99.9	Dec. 2005	50% under-read	133 µg/m3
Nitrogen Dioxide	200	1-Hour mean	18	99.78	Dec. 2005	25% under-read	150 µg/m3
	40	Annual mean	N/A	N/A	Dec. 2005	50% under-read(3)	20 µg/m3
Particulates (PM10)	50	24-Hour running mean	35	90.14	Dec. 2004	50% under-read	25 µg/m3
	40	Annual mean	N/A	N/A	Dec. 2004	33% under-read	27 µg/m3
Lead	0.5	Annual mean	N/A	N/A	Dec. 2005	+/- 50%	0.25 µg/m3
	0.25	Annual mean	N/A	N/A	Dec. 2008	+/- 50%	0.113 µg/m3

1 Number of permitted exceedences per year.

2 Percentile represented by number of permitted exceedences.

3 At values near to NAQS objective.

4 Predicted model value above which further scrutiny was carried out.

MONITORING

The Council has historically operated a passive and active monitoring network for various pollutants. All monitoring equipment, locations and their results including relevant operating manuals and Quality Assurance / Quality Control (QA/QC) Procedures are presented in Appendix B and their locations are highlighted in Figure 4.

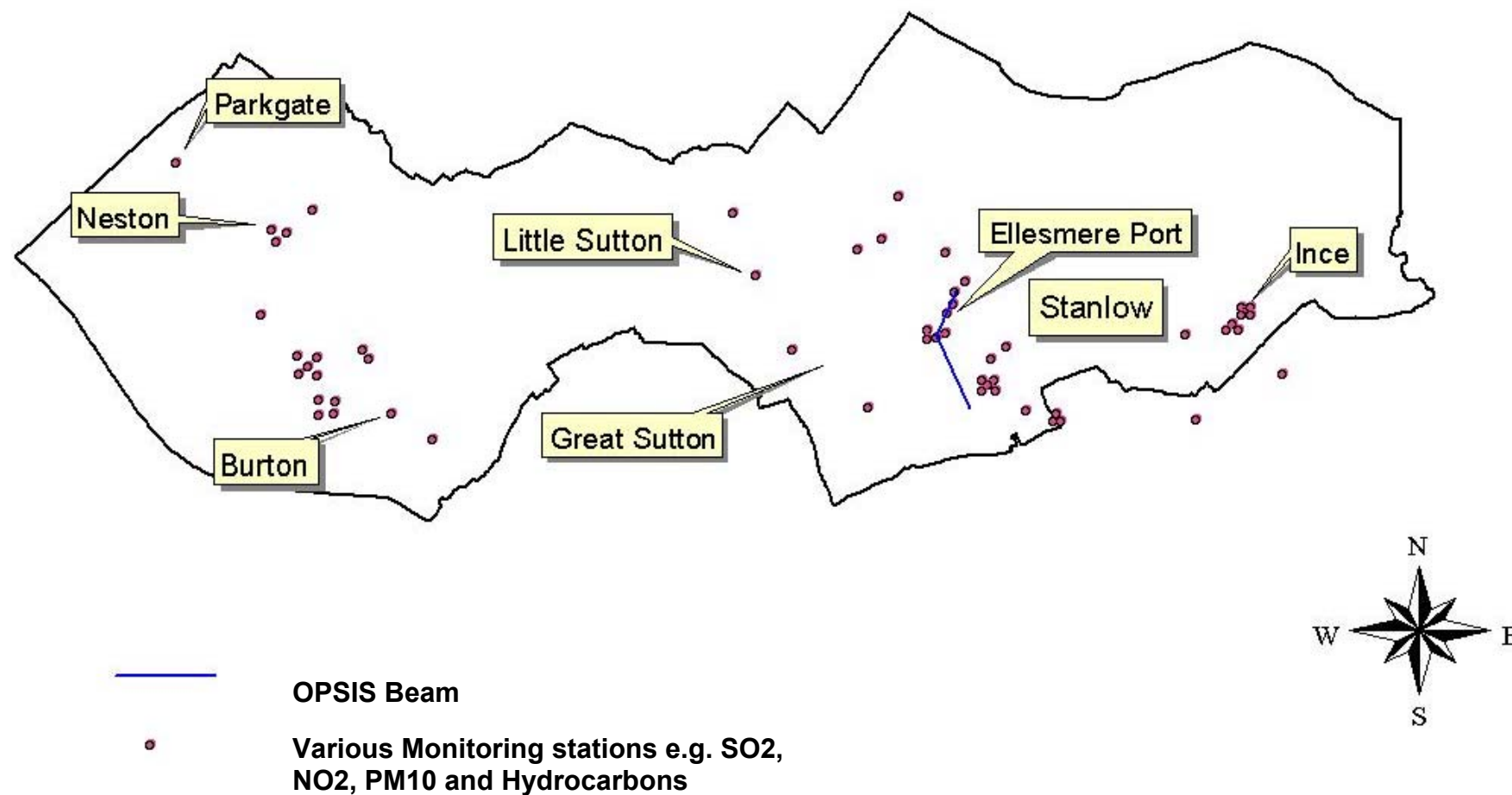
The Nitrogen Oxide network was initially set up 1986 as part of a larger survey organised by The Cheshire Chief Environmental Health Officers Pollution Group (CCEHOPG). This network was expanded in 1993 with additional sites being utilised in the UK National Nitrogen dioxide Survey. The Smoke and Sulphur dioxide network was established in 1962 to provide information to surveys operated by the Cheshire Authorities.

The OPSIS air quality monitoring system was installed in October 1995 and has been running continuously since this date. OPSIS is a system for monitoring air pollution using a beam of ultra violet to visible wavelength light. Pollutant absorption by the light path allows the system to calculate pollutant concentrations. The Council operates 2 OPSIS beams, which covers the eastern side of the residential part of the Borough.

The results obtained from the 'real time' and diffusion monitoring systems can be treated with confidence. This assisted the Council greatly in completing the Stage 3 Review. Such 'real time' information was needed to examine the air quality levels against short-term objectives. The sites were chosen to provide base line information in areas of population. The results do not, therefore, relate to the areas that are likely to be affected by specific emission sources.

In order to address these issues the Council invested further in 2 'real time' mobile laboratories in February 1999 to compliment the OPSIS system. The systems originally had the capability to monitor particulates, nitrogen dioxide, sulphur dioxides with meteorological sensors on one mobile unit. The capability of one of the mobile laboratories located at Stanney Grange School has recently been enhanced to include an AirmoVoc Gas Chromatograph and AirmoMedor Mercaptan Monitor. The laboratories and OPSIS provide the 'real time' information, which can be used to 'benchmark' local air quality against the air quality standards (particularly the short-term objectives) and the various AUN Sites. It also provides the Council with the capability to assess 'hot-spot' issues and the effect of any subsequent development.

Figure 4 Map of Borough highlighting monitoring sites.



6. REVIEW OF INDIVIDUAL AIR QUALITY OBJECTIVE POLLUTANTS

The Stage 1 Review and Assessment of Air Quality highlighted all pollutants namely; benzene, 1,3 butadiene, carbon monoxide, lead, nitrogen dioxide, particulates and sulphur dioxide as requiring further detailed investigation by way of a stage 2 and 3 review. This resulted in all of the aforementioned pollutants undergoing a detailed modelling study using ADMS (Urban) software.

The Sections that follow summarise the nature of the individual pollutant and the Inventory, Monitoring and Modelling information on a pollutant specific basis.

Pollutants are discussed in the following order:

- benzene
- 1,3-butadiene
- carbon monoxide
- lead
- nitrogen dioxide
- particulates
- sulphur dioxide

Each pollutant section has been split into three categories. These are Emissions Inventory, modelling and monitoring.

EMISSIONS INVENTORY

An annual tonnage has been calculated for each pollutant for the year of the Inventory i.e. 1998. This has been calculated pro rata for the year 2003, 2004 and 2005 depending on the pollutant and used in the modelling study.

The headings used in the Inventory are Roads, Part A, Part B, Boilers, Petrol Stations, Domestic, Rail and Shipping. These are considered to be the main categories encompassing most, if not all, of the pollutants that require investigation. Some of the categories do not emit the pollutant, or are of negligible quantities, that their total has not been collated. These are classified as insignificant (insig.).

COMPARISON OF MODELLED DATA WITH MONITORING DATA

Ellesmere Port and Neston Borough Council has compared monitored values for all sites with the Model predictions at the same locations. The purpose of this is to demonstrate the accuracy of the Model. A positive symbol indicates that the Model is under predicting by the percentage shown. Similarly a negative symbol shows that the Model is over predicting. This is covered in more detail in the validation Section.

7. BENZENE (C₆H₆)

INTRODUCTION

Benzene is a recognised genotoxic human carcinogen; it is therefore not possible to state an absolute safe level for ambient air concentrations of benzene. The EPAQS standard is, however, designed to reflect a level at which there is an exceedingly small risk to health. Exposure to benzene should be kept as low as practicable. The main atmospheric source of benzene is the combustion and distribution of petrol, of which it is a minor constituent. Transport sources, the industrial refining and distribution of petrol are likely to be the main sources of concern.

**The National Air Quality objective is a running annual mean level of 16.25µg/m³
This standard must be met by December 2003.**

EMISSIONS INVENTORY

The tables below show the 1998 mass emissions and estimated 2005 emissions of benzene both locally and across Cheshire.

Table 3 Cheshire Benzene Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	563	343	181	Insig.	1	23	15	Insig.	Insig.
Estimated 2005	418	198	181	Insig.	1	23	15	Insig.	Insig.

Table 4 Ellesmere Port and Neston Borough Benzene Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	215	30	180	Insig.	1	2.5	1.5	Insig.	Insig.
Estimated 2005	202	17	180	Insig.	1	2.5	1.5	Insig.	Insig.

Within Cheshire benzene is emitted from two sources namely vehicles and Industry. The primary source of benzene in Ellesmere Port and Neston Borough is emitted from a petrochemical refinery, located at Stanlow to the east of the Borough. This is a Part A process regulated by the Environment Agency. The Inventory of Sources and Releases indicates a mass emission from the entire site of 180 Tonnes in 1998. The Council has worked with the refinery to break the emissions down into individual sources, which have been modelled using ADMS (Urban). Up to date figures, giving a total benzene emission of 135 Tonnes, have been used in this study for 1999 along with benzene emissions from vehicles.

RESULTS OF MODELLING

Figure 5 Predicted 2003 annual Benzene concentrations for the whole EPNBC area (NAQS objective - annual mean - $16.25 \mu\text{g}/\text{m}^3$)

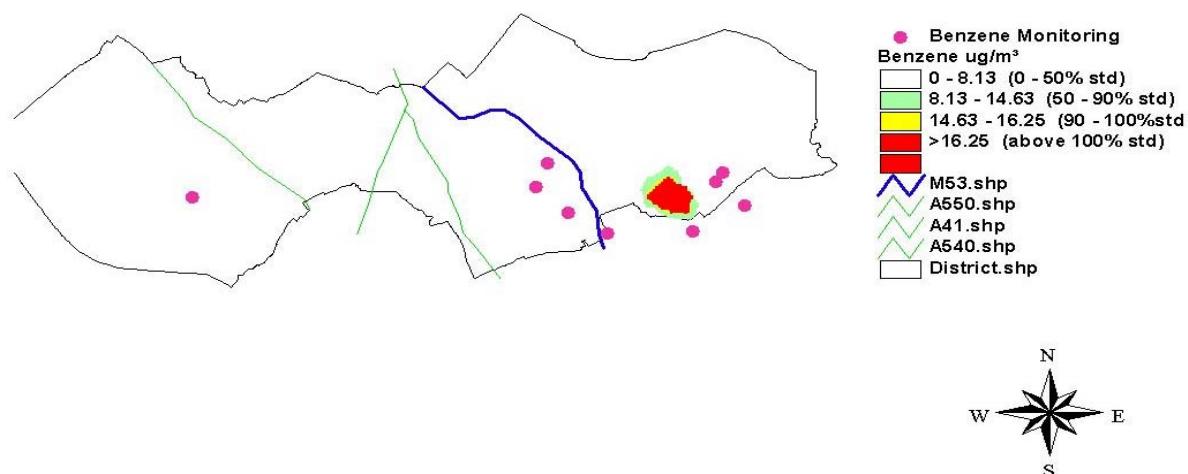
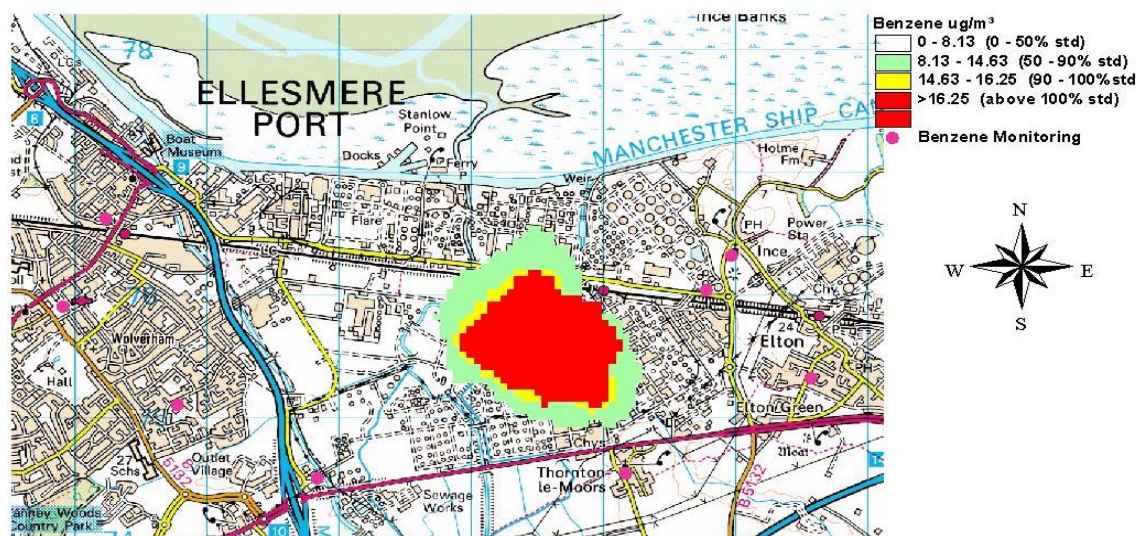


Figure 6 Small scale map areas of 2003 Predicted Benzene concentrations in EPNBC area (NAQS objective - annual mean - $16.25 \mu\text{g}/\text{m}^3$)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Modelling results indicate a predicted 2003 highest level ($45 \mu\text{g}/\text{m}^3$) of benzene centred on the source within the refinery site. Although this is in excess of the NAQS objective there is no relevant public exposure within the boundary of the refinery site. (The objective is a running annual mean and therefore applicable at background locations where the public might be regularly exposed e.g. at the building facades of residential properties, schools, hospitals, libraries etc.)

Background levels are not available for modelling purposes, therefore, the model shows a level of underprediction. The Council is carrying out monitoring to determine a background level. Initial results show this level to be between $0.5\text{--}1.0 \mu\text{g}/\text{m}^3$ and as such will not effect the overall conclusion from the modelling.

MONITORING

The Council has initiated a network of monitoring sites across the Borough using diffusion tubes. Chester City Council has monitored for Benzene using similar technology at Elton village on the outskirts of Ellesmere Port and Neston Borough since 1998. The results of monitoring are tabulated in Table 5 along with the same receptor plot levels indicated by the model. This allows comparison of monitored data against predicted levels. Monitoring results are limited at present but support the findings from the modelling exercise.

Table 5 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	Annual	Average	No of analyses	% monitoring results of modelled result
		Model $\mu\text{g}/\text{m}^3$	Monitor $\mu\text{g}/\text{m}^3$		
EPNBC					
SG	Stanney Grange School	1.15	2	3	+74
JG	Joseph Groome Towers	0.946	1.6	3	+70
NG	Ness Gardens,	0.212	1.4	4	+560 *
OS	Oil Sites Rd. Stanlow	2.13	2.2	1	+3
LR	Library Roof	1.02	1.7	4	+66
MM	M53, Stanney Mill La.	1.6	0.9	1	-44
VI	Village Hall, Ince	1.36	1.5	1	+11

* As mentioned previously in the validation section the Model at present does not include a background level for this pollutant. The Environmental Health Section is currently working to establish a background level at Ness Gardens, which will be utilised by the Model. Once a background is added this result will be more comparable.

CONCLUSION

- Benzene is emitted from vehicles and industry. There is a significant industrial source of benzene within the Borough.
- The Model predicts benzene exceedences from an industrial source, however these are not in areas of relevant public exposure. There are no exceedences related to roads and vehicular transport.
- The Model predicts that the standard is not exceeded in areas relevant to public exposure.
- Monitoring data in areas relevant to public exposure confirm that the NAQS objective is not exceeded in those areas.
- The Model is slightly under predicting the level due to no background benzene levels being included in the Model.
- **Air Quality Management Areas are not required.**

8. 1,3-BUTADIENE (C₄H₆)

INTRODUCTION

The main sources of atmospheric 1,3-butadiene is through the combustion of petrol and other fossil fuels and from some specific authorised processes, such as the production of synthetic rubber for tyres, which use large quantities of 1,3-butadiene. However, 1,3-butadiene is efficiently removed by catalytic converters on motor vehicles, which is likely to have a marked effect on the reduction of the levels in the atmosphere.

Currently there is a relative small amount of data available about the precise effects on human health. However, the data that is available does show 1,3-butadiene to be a potential genotoxic carcinogen.

**The National Air Quality objective is a running annual mean level of 2.25µg/m³
This standard must be met by December 2003.**

EMISSIONS INVENTORY

The tables below show the 1998 mass emissions and estimated 2005 emissions of 1,3-butadiene both locally and across Cheshire.

Table 6 Cheshire 1,3-Butadiene emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	129	93	36	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.
Predicted 2005	97	61	36	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.

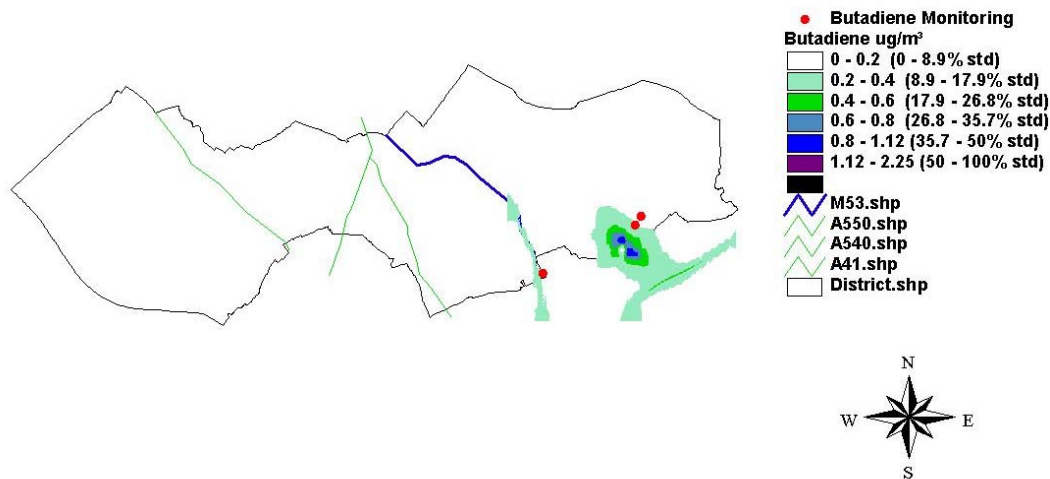
Table 7 Ellesmere Port and Neston Borough 1,3-Butadiene emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Dom.	Rail	Ship
Baseline 1998	44.1	8.1	36	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.
Predicted 2005	41.3	5.3	36	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.

1,3-butadiene is emitted from vehicles and industry within the Cheshire area, however the primary source of 1,3- Butadiene within this Borough is emitted from the Stanlow Refinery to the east of the Borough. This is a Part A process regulated by the Environment Agency. The Inventory of Sources and Releases indicates a mass emission from the entire site of 36 Tonnes in 1998 and 1999. However the Council has worked with the refinery to break the 1998 emissions down into individual sources which have been modelled using ADMS (Urban). Vehicular emissions of 1,3-butadiene has also been included in the study.

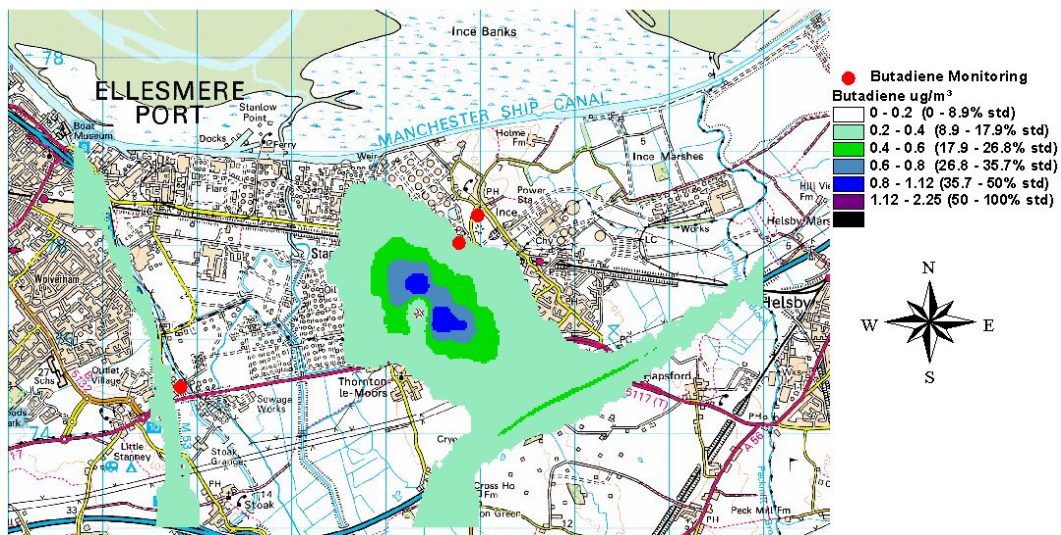
RESULTS OF MODELLING

Figure 7 Predicted 2003 annual 1,3-Butadiene concentrations for the whole EPNBC area (NAQS objective - annual mean - 2.25 $\mu\text{g}/\text{m}^3$)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Figure 8 Small scale map areas of 2003 Predicted 1,3-Butadiene concentrations in EPNBC area (NAQS objective - annual mean - 2.25 $\mu\text{g}/\text{m}^3$)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Modelling results indicate that the NAQS objective is not exceeded anywhere within the Borough. Background levels are not available for modelling purposes; therefore, the model shows a level of underprediction. The Council is carrying out monitoring to determine a background level. The background levels are expected to be very low and should not effect the overall conclusions from the modelling.

MONITORING

The Council has initiated a network of monitoring sites across the Borough using 1,3-butadiene diffusion tubes in order to validate the Model predictions. Chester City Council has also installed similar technology at Thornton-le-Moors village on the outskirts of Ellesmere Port and Neston Borough. Initial results of monitoring are tabulated in Table 8 along with the same receptor plot levels indicated by the model. This allows comparison of monitored data against predicted levels.

Table 8 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	Annual	Average	No of analyses	% monitoring results of modelled results
		Model $\mu\text{g}/\text{m}^3$	Monitor $\mu\text{g}/\text{m}^3$		
EPNBC					
MM	M53 Café, St. Mill Lane	0.144	<0.023	1	-84
OS	Oil Sites Road	0.234	<0.023	1	-90
VI	Village Hall, Ince	0.152	<0.023	1	-85

As yet the Council has only limited monitoring information i.e. 1 month result to base its judgement on. Information from the DETR's Monitoring Helpdesk indicates that 1,3-butadiene diffusion tubes are new technology, still undergoing validation and testing and are known to over predict. Validation of the model prediction using a more accurate technique i.e. Gas Chromatography is planned for the future at locations in the Borough.

CONCLUSION

- 1,3-butadiene is emitted from vehicles and Industry. There is a significant industrial source of 1,3-butadiene within the Borough.
- The model does not predict exceedences of 1,3-butadiene at any point within the Borough.
- Validation of the modelling predictions using accurate monitoring techniques is required.
- Limited monitoring data indicates that the model is over predicting the level.
- **Air Quality Management Areas are not required at present. The situation will be reassessed in 2001 when further monitoring data is available.**

9. CARBON MONOXIDE (CO)

INTRODUCTION

At today's typical ambient levels the effect is slight, but carbon monoxide can interfere with the delivery of oxygen to the heart or brain. It can therefore exacerbate the condition of people already suffering from similar medical conditions. It is formed from the incomplete combustion of carbon containing fuels. The main source is currently road transport.

**The National Air Quality objective is a running 8-hour mean level of 11.6 mg/m³
This standard must be met by December 2003.**

EMISSIONS INVENTORY

The tables below show the 1998 mass emissions and estimated 2005 emissions of carbon monoxide both locally and across Cheshire.

Table 9 Cheshire CO emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	52597	43826	7338	58	52	0	1247	64	12
Predicted 2005	31638	23965	7338	56	47	0	127	93	12

Table 10 Ellesmere Port and Neston Borough CO Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	5148	3311	1837	Insig.	0.24	0	Insig.	Insig.	Insig.
Predicted 2005	3647	1810	1837	Insig.	0.18	0	Insig.	Insig.	Insig.

The results indicate that roads are the major source of CO emissions in Cheshire. However industry does make a significant contribution locally in the Ellesmere Port and Neston Borough area.

RESULTS OF MODELLING

Figure 9 Predicted 2004 hour mean CO concentrations for the whole EPNBC area (NAQS objective - running 8 hour mean - 11.6 mg/m³)

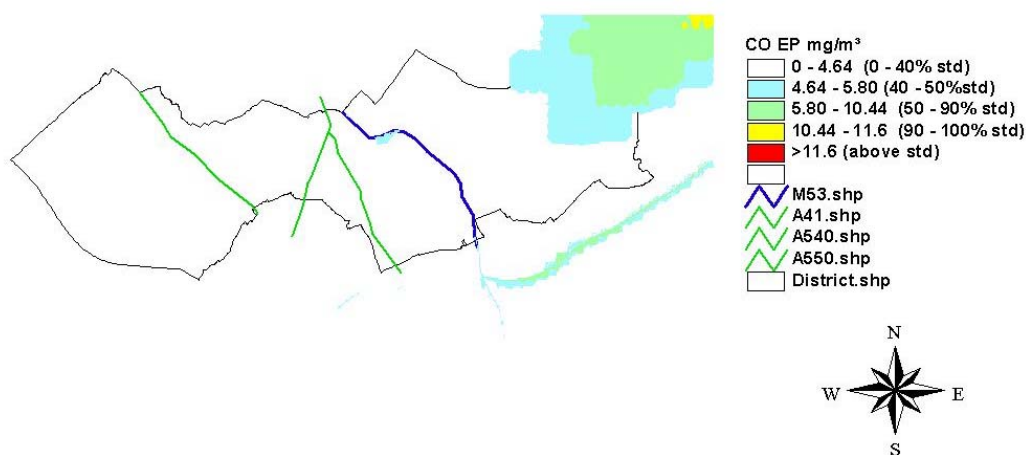


Figure 10 Small-scale map areas of 2003 predicted 8-hour mean CO concentrations in EPNBC area (NAQS objective - running 8 hour mean - 11.6 mg/m³)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Modelling results indicate a highest level of CO (50-90% of the standard), in small discrete areas associated with the M53 motorway. NAQS objectives are not exceeded anywhere within the Borough.

The modelling has been carried out on a Borough wide scale and has not modelled localised emissions at junctions and busy minor roads. This will be carried out in the future and is discussed in the conclusions section to this Review.

MONITORING

Monitoring of this pollutant has not been carried out within the Borough, however the Council has compared results with AUN Sites in Liverpool City centre, (Figure 9) and Manchester City Centres, which continuously monitors for nitrogen oxides and carbon monoxide. Results show a relationship between the two pollutants. This correlation, (Figure 10) has been used to give estimates of annual CO mean concentrations based on the NO₂ diffusion tube data. Eight hour running means are estimated by DETR advised conversion factors. The relationship between Ellesmere Port and Neston Borough's NO₂ and CO results are compared in Figure 11.

The results of monitoring are tabulated in Table 11 along with the same receptor plot levels indicated by the model. This allows comparison of monitored data against calculated levels and similarly the accuracy of the ADMS Model.

Figure 11 NO₂ AND CO HOURLY VARIATION IN LIVERPOOL THROUGHOUT THE DAY.

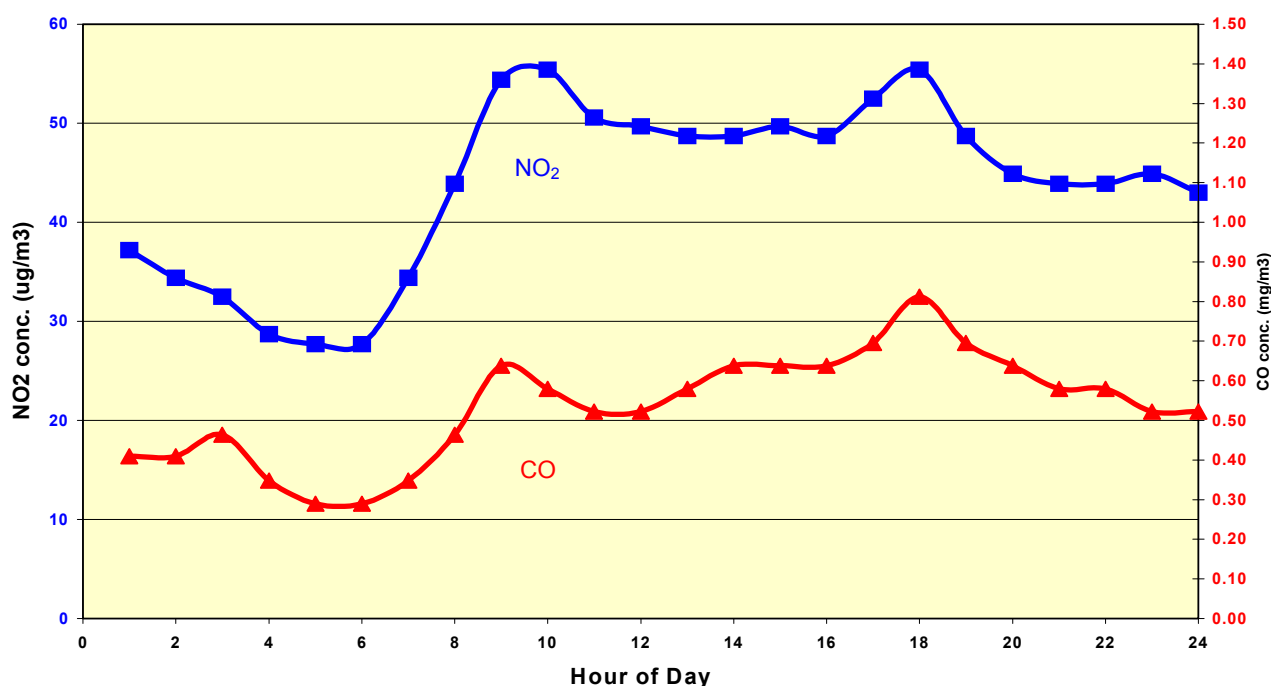


Figure 12 NO₂ AND CO CORRELATION

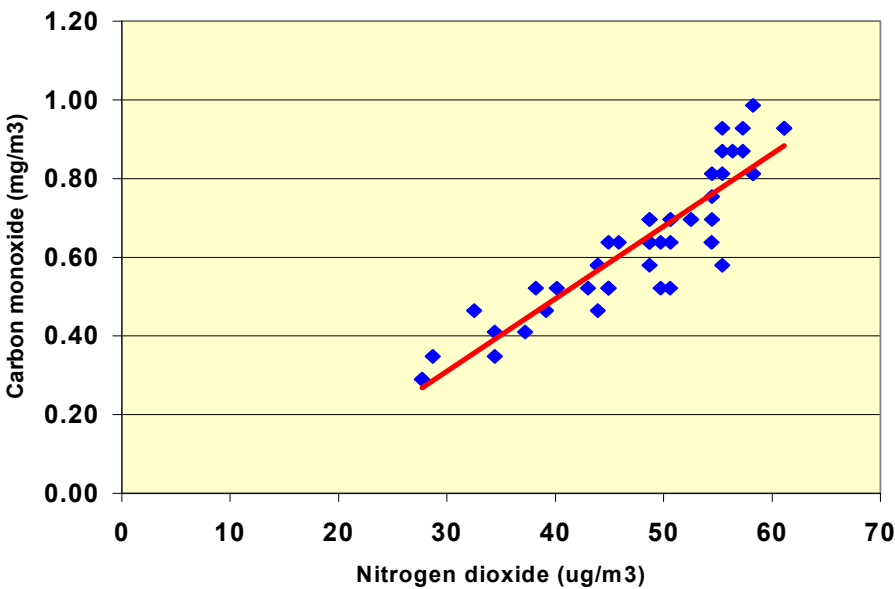


Figure 13 NO₂ and CO hourly variations in Ellesmere Port and Neston borough throughout the day

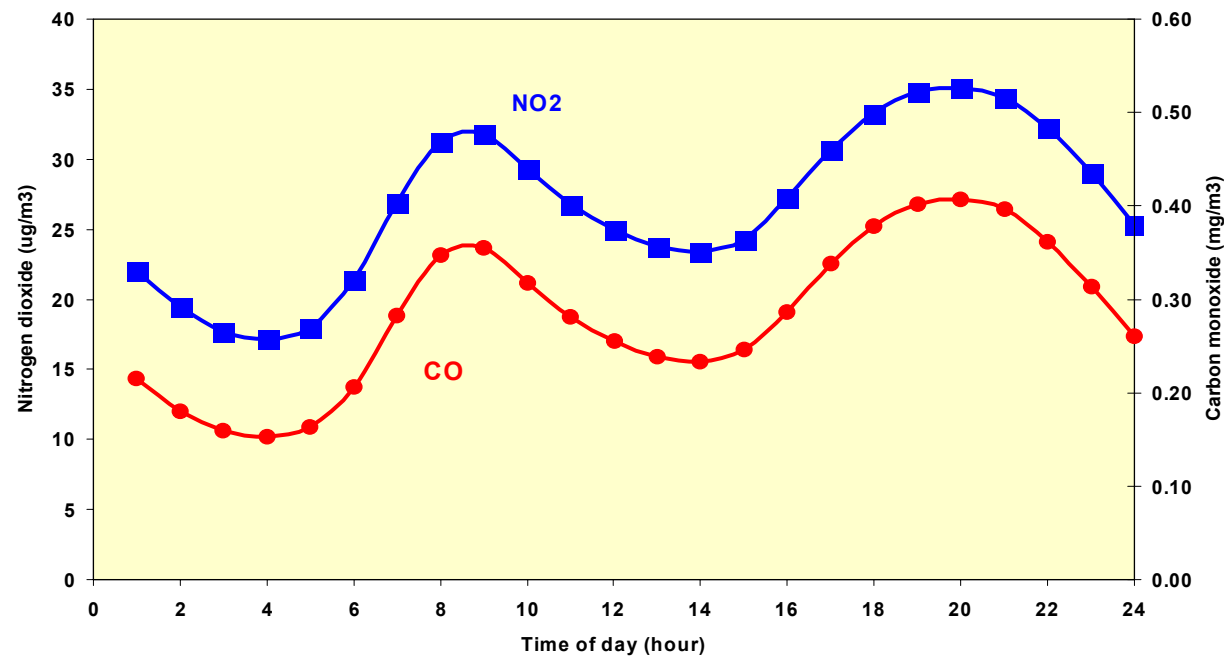


Table 11 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	8 Hour	Average	% monitoring results of modelled results
		Model mg/m ³	Monitors mg/m ³	
EPNBC				
BH	Boat Hse, Parkgate	1.78	<1	-44
BS	Bus Station, E Port	3.52	3.4	-3
CH	Cheshire Oaks, E Port	4.27	2.5	-41
CT	Childer Thornton	2.97	2.1	-29
CO	Civic Way, E port	3.49	4.3	-23
HQ	Harp Quayside, Neston	2.03	<1	-50
LW	Leven Walk, E port	3.71	2.1	-43
MR	Milton Road, Wolverham	3.92	2.5	-36
ML	Mudhouse Lane, Burton	2.47	0.7	-72
NG	Ness Gardens, Ness	2.15	1.4	-35
NC	Neston Cemetry, Neston	1.97	0.7	-64
NH	Church/ High St, Neston	2.03	3.5	+72
NR	Neston Road, Burton	2.36	0.7	-70
NT	Neston Town Hall, Neston	2.02	3.4	+68
OS	Oil Sites Road, E Port	4.01	3.0	-25
PW	Prince/Whitby Rd, E port	3.62	5.5	+52
RB	Rexham/Bowater, E Port	3.59	6.0	+67
WL	Websters Lane, E Port	3.43	1.6	-53

CONCLUSION

- Vehicles and industry makes a significant contribution to carbon monoxide within the Borough.
- The model does not predict exceedences of carbon monoxide at any point within the Borough.
- **Air Quality Management Areas are not required.**

10. LEAD (Pb)

INTRODUCTION

Airborne lead is absorbed into the body through the lungs and accumulates particularly in bone, teeth, skin and muscle. The effects of low levels of exposure to lead on health relate to effects on the central nervous system and, in particular, on the development of the brain.

The main source of air borne Lead is through the manufacture of batteries, pigments, alloys, plastics and ammunition. In the past it was widely mixed with organic compounds within petrol, however, this has now largely ceased with the increase in the use of unleaded petrol.

The National Air Quality objective is an annual mean level of $0.5\mu\text{g}/\text{m}^3$, which must be met by December 2004. An annual mean level of $0.25\mu\text{g}/\text{m}^3$ must be met by December 2008.

EMISSIONS INVENTORY

The tables below show the 1998 mass emissions and estimated 2005 emissions of lead both locally and across Cheshire.

Table 12 Cheshire Lead Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	84.13	Insig.	84	0.13	Insig.	Insig.	Insig.	Insig.	Insig.
Predicted 2005	84.13	Insig.	84	0.13	Insig.	Insig.	Insig.	Insig.	Insig.

Table 13 Ellesmere Port and Neston Borough Lead Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	84	Insig.	84	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.
Predicted 2005	84	Insig.	84	Insig.	Insig.	Insig.	Insig.	Insig.	Insig.

The results show that the main contributor of lead both in Cheshire and locally is from industry. It is associated with leaded petrol for export and this is expected to decline in future years. The emission value indicated in the table for 2005 is probably an over estimate.

RESULTS OF MODELLING

Figure 14 Predicted 2004 annual Lead concentrations for the whole EPNBC area (NAQS objective - annual mean - $0.5 \mu\text{g}/\text{m}^3$)

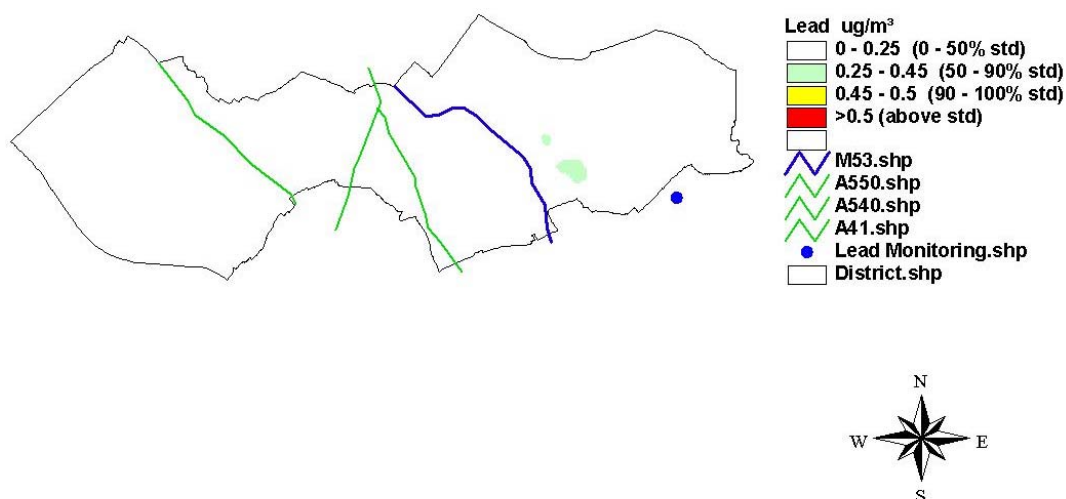
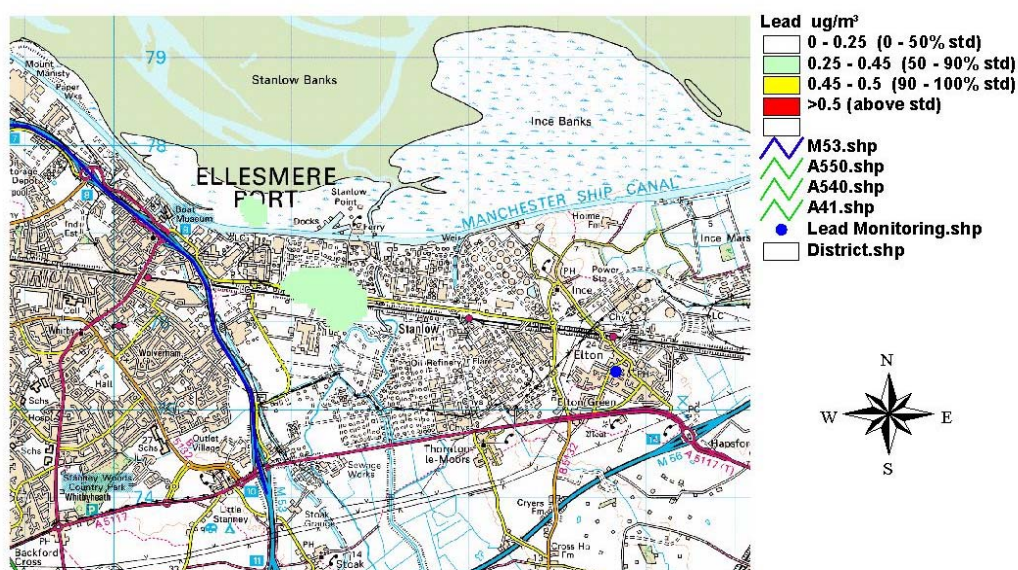


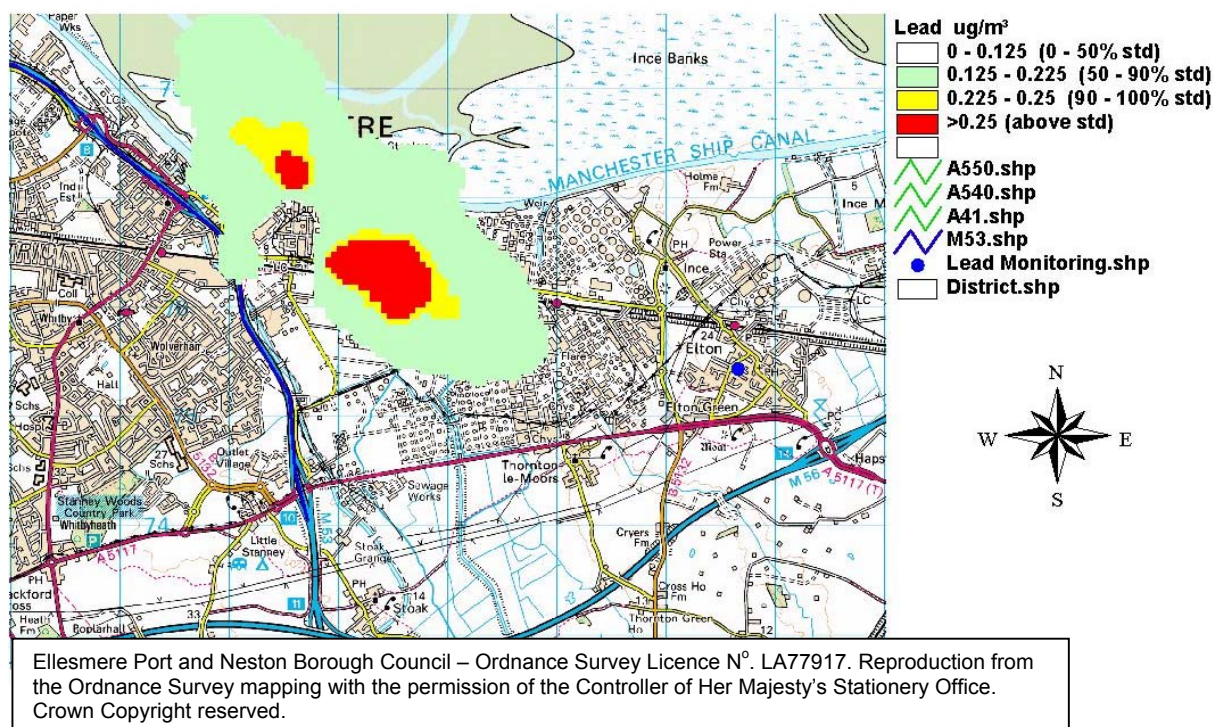
Figure 15 Small scale map areas for 2004 predicted annual Lead concentrations in EPNBC area (NAQS objective - annual mean - $0.5 \mu\text{g}/\text{m}^3$ by end 2004)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Modelling results indicate that the NAQS objective is not exceeded anywhere within the Borough.

Figure 16 Small-scale map areas of 2008 predicted annual Lead concentrations in EPNBC area (NAQS objective - annual mean - $0.25 \mu\text{g}/\text{m}^3$ by end 2008)



Modelling results indicate a highest level ($0.426 \mu\text{g}/\text{m}^3$) of lead centred on the source. Although this exceeds the NAQS objective, the exceedences are within the boundary of industrial areas.

MONITORING

There are currently no up to date monitoring results within the Borough, which could be used to validate the model's accuracy. However Stanger Science, an independent consultancy who have been commissioned by the DETR, have initiated monitoring within the Elton area, which is just to the east of the Borough. The results of monitoring are tabulated in Table 14 along with the predicted levels indicated by the model. This allows comparison of monitored data against calculated levels.

Table 14 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	Annual	Average	% monitoring results of modelled results
		Model $\mu\text{g}/\text{m}^3$	Monitor $\mu\text{g}/\text{m}^3$	
EPNBC PB	Elton Village	0.058	0.014	-76

CONCLUSION

- Industry is the main contributor of lead within the Borough.
- The model does not predict exceedences of lead at any point within the Borough for 2004.
- Model predictions for 2008 show exceedences of the NAQS objective, however these areas located within an industrial area
- There is only limited monitoring data to confirm the model predictions.
- The model is over predicting levels and as such gives a worse case scenario.
- Further validation will require monitoring closer to the source.
- Manufacturing of lead at the Part A process may decrease in future years.
- **Air Quality Management Areas are not required.**

11. NITROGEN DIOXIDE (NO₂)

INTRODUCTION

High exposures can affect the way that the lungs and airways function. There remains concern that it may also increase the risk of respiratory problems and reactivity to natural allergens. It can have short and long-term health affects; a one-hour and annual mean level has therefore been specified. All combustion processes produce oxides of nitrogen. This is a mixture of NO and NO₂. Road transport is thought to account for about 50% of total UK emissions.

NO is quickly converted to NO₂ in the atmosphere and NO₂ is the gas of interest as it is the more toxic of the two.

The National Air Quality objective is a 1-hour mean of 200µg/m³ not to be exceeded more than 18 times a year and an annual mean level of 40µg/m³. These objectives must be met by December 2005.

EMISSIONS INVENTORY

The tables below show the 1998 mass emissions and estimated 2005 emissions of NO₂ both locally and across Cheshire.

Table 15 Cheshire NO₂ Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	26640	15346	9642	235	213	0	837	266	101
Predicted 2005	18935	7656	9642	98	185	0	854	399	101

Table 16 Ellesmere Port and Neston Borough NO₂ Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	8653.3	1059	7468	125	1.3	0	Insig.	Insig.	Insig.
Predicted 2005	8122	528	7468	125	1	0	Insig.	Insig.	Insig.

The results indicate that roads are the major source of NO₂ emissions in Cheshire. However industry is also a major contributor locally in the Borough of Ellesmere Port and Neston.

RESULTS OF MODELLING

Figure 17 Predicted 1-hour mean 2005 NO₂ concentrations for the whole EPNBC area (NAQS objective - 1 hour mean - 200 µg/m³ 99.8th percentile)

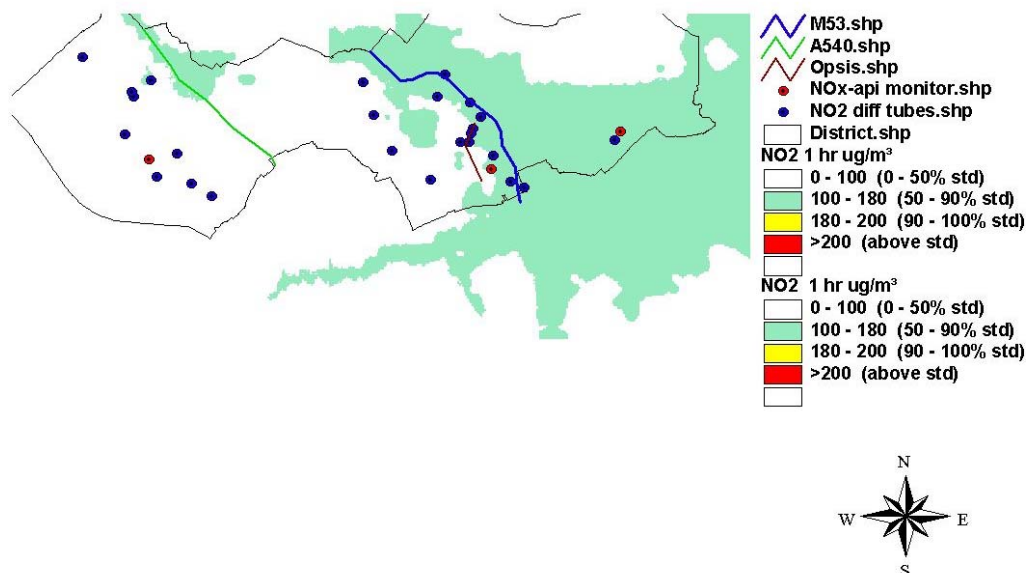
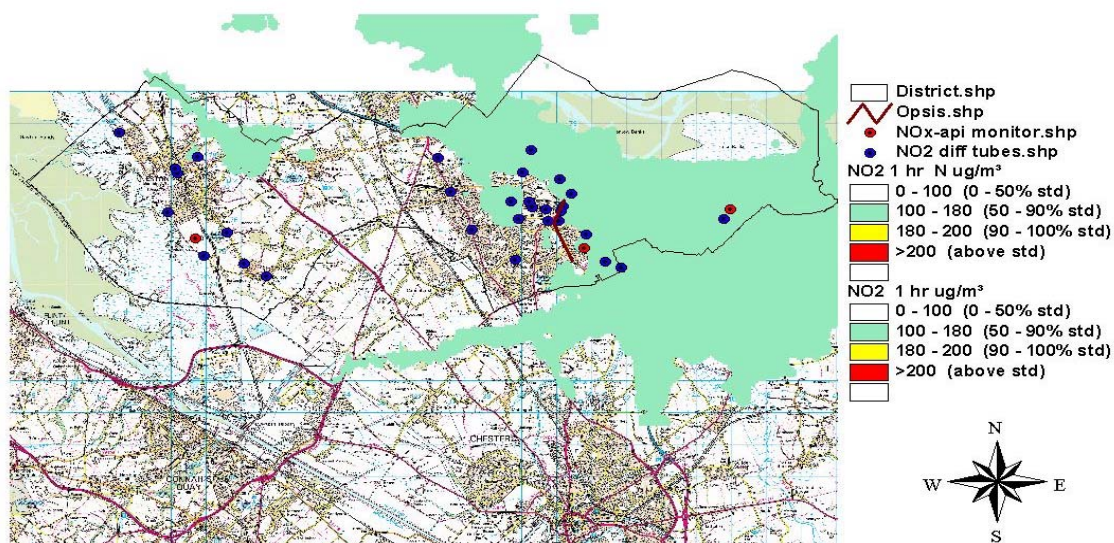
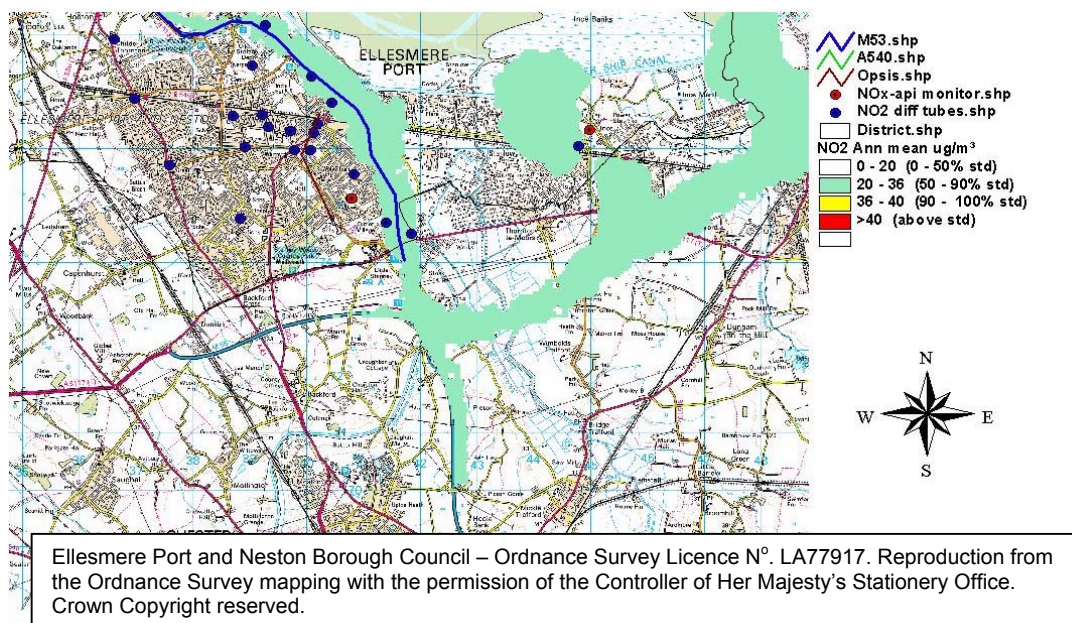


Figure 18 Small-scale map areas of Predicted 2005 1-hour mean NO₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 200µg/m³ 99.8th percentile by end 2005)



Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

Figure 19 Small-scale map areas of predicted 2005 annual mean NO₂ concentrations in EPNBC area (NAQS objective - annual mean - 40µg/m³ by end 2005)



Modelling results for both objectives indicate a highest level of NO₂ (50-90% of the standard), in areas associated with the M53 and industrial areas to the east of the Borough. NAQS objectives are not exceeded anywhere within the Borough.

The modelling has been carried out on a Borough wide scale and as such has not modelled localised emissions at junctions and busy minor roads.

MONITORING

The Borough Council monitors this pollutant using both 'real time' monitoring equipment and diffusion tubes. Monitoring sites have been established since the early 1990's and are currently spread across the entire Borough. The results of monitoring are tabulated in Table 17 along with the same receptor plot levels indicated by the model. This allows comparison of monitored data against predicted levels.

For the 1-hour objective, the Model and estimated monitoring results are in close agreement i.e. -40% for 1 hour and +65% for annual results.

For the annual average objective, the Model is significantly underpredicting the monitored values at specific sites highlighted in red. Monitored values indicate that several roadside locations are close to, or just exceed the NAQS objective.

Table 17 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code EPNBC	Monitoring Site Name	Model $\mu\text{g}/\text{m}^3$		Est. Monitor $\mu\text{g}/\text{m}^3$		% 1Hr Monitored Results of Modelled Results	%Annual Monitored Results of Modelled Results
		1hr	Annual	1hr	Annual		
BH	Boat Hse, Parkgate	91.7	12	55.6	15.9	-40	+32
BS	Bus Station, E Port	100	18.7	121.6	34.7	+21.6	+85
CH	Cheshire Oaks, E Port	115	20.7	97.8	27.9	-15	+35
CT	Childer Thornton	95	14.9	91.2	26	-4	+75
CO	Civic Way, E port	100	18.1	133.3	38.1	+33	+110
HQ	Harp Quayside, Neston	93	12.6	49.3	14.1	-47	+12
LW	Leven Walk, E port	100	17.3	75.4	25.8	-25	+49
MR	Milton Road, E Port	102	19.3	97.5	27.9	-5	+45
ML	Mudhouse Lane, Burton	89	11.9	59.4	17.0	-33	+43
NG	Ness Gardens, Ness	94	12	73.6	21	-22	+75
NC	N. Cemetry, Neston	101	14.1	58.8	16.8	-42	+19
NH	Church/ High St, Neston	101	14	117.8	33.6	+17	+140
NR	Neston Road, Burton	89	11.9	62.8	17.9	-29	+50
NT	Neston Town Hall,	102	14.1	121.7	34.8	+19	+147
OS	Oil Sites Road, E Port	113	20	115.2	32.9	+2	+65
PW	Prince/Whitby Rd	99.8	21.2	164.8	47.1	+65	+122
RB	Rexham/Bowater	126	22.1	177.3	50.7	+41	+129
RD (1)	Racal Deca, Burton	90	11.7	74	11	-17	-6
SG (1)	Stanney Grange School	101	18.9	111	19	+10	<1
WL	Websters Lane, E Port	95	17	75.4	21.5	-21	+26

CONCLUSION

- NO₂ is emitted from vehicles and industrial sources within the Borough. Raised levels are noted along the M53 motorway.
- The Model does not predict Nitrogen dioxide exceedences at any point within the Borough.
- The Model does not agree with monitored data, which is either approaching or exceeding the objective for annual levels. The Model tends to underpredict by a factor of 50% at these levels.
- The Model prediction for 1 hour NO₂ correlates well with estimated monitoring data.
- The model is under predicting annual Nitrogen dioxide levels, in some cases by a factor of 100%.
- **Air Quality Management Areas are not considered appropriate. The situation will be reassessed before the second round of Reviews in December 2003.**

12. PARTICULATES (PM₁₀)

BACKGROUND

Particulate air pollution is associated with a range of effects on health including the respiratory and cardiovascular systems, asthma and mortality. Further research is being undertaken on the effect of particle size. Particulates comprise of a range of materials arising from a variety of sources. They are generally considered to consist of primary particles arising from combustion sources; secondary particles are formed by chemical reactions in the atmosphere and coarse particles.

The National Air Quality objective is a 24-hour mean of 50µg/m³ not to be exceeded more than 35 times a year and an annual mean level of 40µg/m³. These objectives must be met by December 2004.

EMISSIONS INVENTORY

Table 18 Cheshire PM₁₀ Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	2053	457	1048	270	26	0	241	9	2
Predicted 2005	1851	253	1048	262	25	0	246	15	2

Table 19 Ellesmere Port and Neston Borough PM₁₀ Emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	542.4	30.4	470	26	Insig.	0	16	Insig.	Insig.
Predicted 2005 *	522.5	17	470	19	Insig.	0	16.5	Insig.	Insig.

* As all objectives except particulates must be achieved by 2005, all tables have used this year for comparison. However the 2005 figure has been calculated on a pro rata basis for 2004 in the Review.

The results indicate that roads contribute marginally to particulate emissions in Cheshire. However industry does make a significant contribution within Cheshire and locally in the Ellesmere Port and Neston Borough area.

RESULTS OF MODELLING

Figure 20 Predicted 2004 24-hour mean PM₁₀ concentrations for the whole EPNBC area (NAQS objective - 24 hour mean - 50 µg/m³)

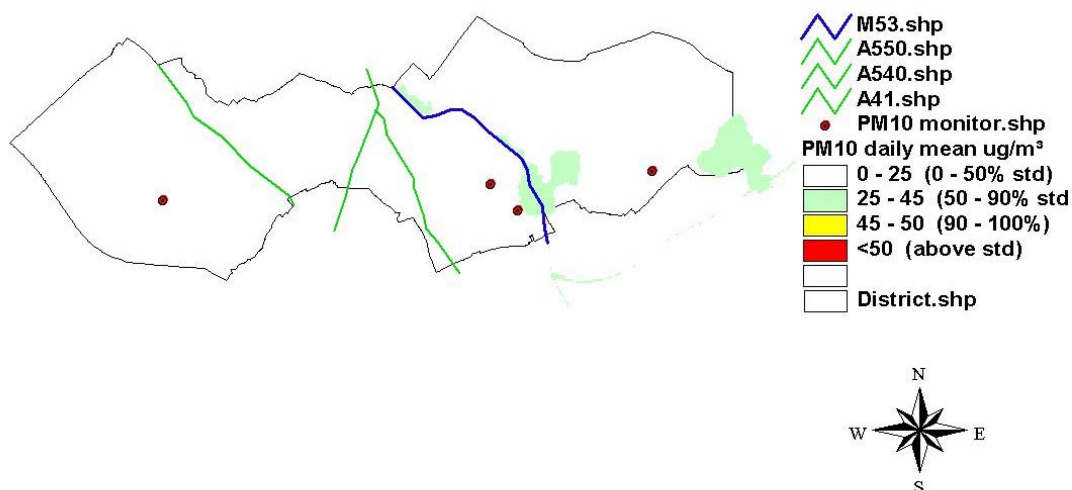
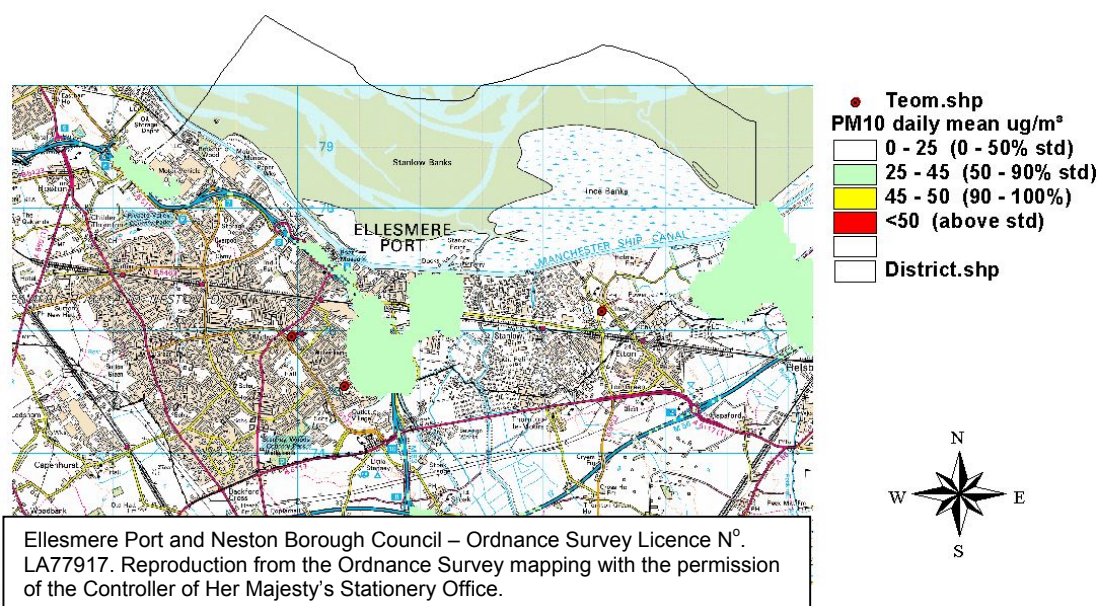


Figure 21 Small-scale map areas of 2004 predicted 24-hour mean PM₁₀ concentrations in EPNBC area (NAQS objective - 24 hour mean - 50µg/m³ by end 2004)



The annual mean objective is below 50% of the 24 hour mean NAQS objective and as such a map has not been presented in this Review.

Modelling results indicate that the NAQS objective is not exceeded anywhere within the Borough.

MONITORING

The Borough Council monitors this pollutant using 'real time' monitoring equipment. A network of monitoring has been carried out since the mid 1990's. The results of monitoring are tabulated in Table 20 and 21 along with the same receptor plot levels indicated by the model. This allows comparison of monitored data against predicted levels.

Table 20 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code EPNBC	Monitoring Site Name	Annual	Average	% monitoring results of Modelling results
		Model $\mu\text{g}/\text{m}^3$	Monitors $\mu\text{g}/\text{m}^3$	
RD	Denhall Lane, Burton	13.5	17.3	+28
SG	Stanney Grange School	15.2	18.1	+19
LR	Library Roof, E Port	14.2	21.5	+51

Table 21 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code EPNBC	Monitoring Site Name	90.1	%tile	% monitoring results of modelling results
		Model $\mu\text{g}/\text{m}^3$	Monitors $\mu\text{g}/\text{m}^3$	
RD	Denhall Lane, Burton	21.4	29.2	+36
SG	Stanney Grange School	23.7	32.15	+36
LR	Library Roof, E Port	22.9	38.2	+67

CONCLUSION

- There are significant industrial sources of particulates within the Borough.
- The Model does not predict particulate exceedences at any point within the Borough. The Model predicts that the standard is not exceeded in areas relevant to public exposure.
- Monitoring data in areas relevant to public exposure confirm the model predictions in those areas.
- **Air Quality Management Areas are not required.**

13. SULPHUR DIOXIDE (SO₂)

INTRODUCTION

Sulphur dioxide acts as an irritant when it is inhaled, because of its acidic nature, and high concentrations may cause breathing difficulties in people exposed. Recent studies have shown that people suffering from respiratory ailments may be especially susceptible to the adverse effects of sulphur dioxide and that, within the range of concentrations that occur in pollution episodes, it may provoke attacks of asthma for example.

The main source in the UK is the combustion of sulphur containing fossil fuels, principally coal and heavy oils.

The National Air Quality objectives are: a 1 hour mean of 350 µg/m³ not to be exceeded more than 24 times per year, a 24 hour mean of 125µg/m³ not to be exceeded more than 3 times a year and a 15 minute mean of 266µg/m³ not to be exceeded more than 35 times a year.

The objectives for the 1 hour and 24 hour mean must be met by December 2004. The objective for the 15-minute mean must be met by December 2005.

EMISSIONS INVENTORY

Table 22 Cheshire SO₂ emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	34753	402	32558	149	600	0	855	149	40
Predicted 2005	34582	334	32558	11	585	0	873	181	40

Table 23 Ellesmere Port and Neston Borough SO₂ emissions (tonnes per year)

Year	Total	Roads	Part A	Part B	Boilers	Petrol stations	Domestic	Rail	Ship
Baseline 1998	26427.5	27.5	26400	Insig.	Insig.	0	Insig.	Insig.	Insig.
Predictd 2005	26422.8	22.8	26400	Insig.	Insig.	0	Insig.	Insig.	Insig.

The results show that 94% of sulphur dioxide emissions in Cheshire are emitted from Industrial processes, all of which are Environment Agency regulated processes. 81% of the industrial emissions are emitted from processes located in the Borough of Ellesmere Port and Neston. Minor quantities are emitted from boilers and vehicles.

RESULTS OF MODELLING

Figure 22 Predicted 2005 15-minute mean SO₂ concentrations for the whole EPNBC area (NAQS objective - 15 minute mean - 266 µg/m³, 99.9th percentile)

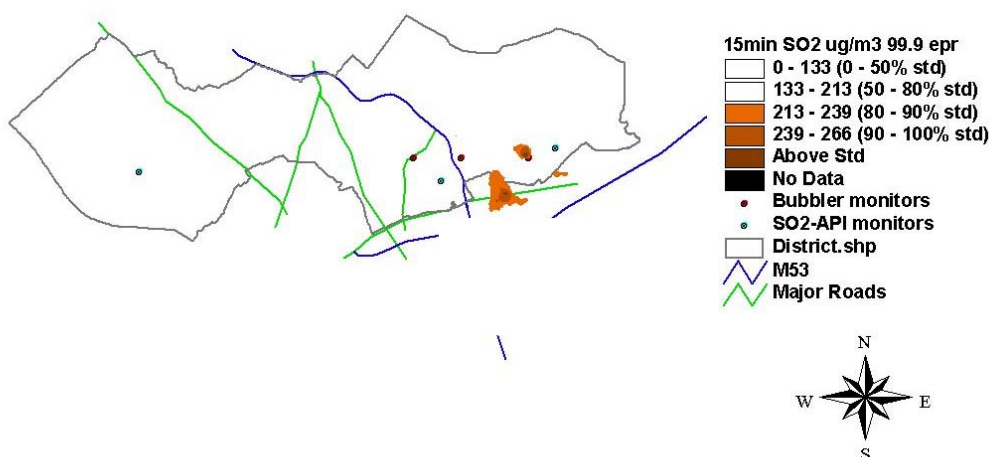


Figure 23 Small-scale map areas of 2005 predicted 15-minute mean SO₂ concentrations in EPNBC area (NAQS objective - 15-minute mean - 266 µg/m³, 99.9th Percentile by 2005)

Ellesmere Port and Neston Borough Council – Ordnance Survey Licence N°. LA77917. Reproduction from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

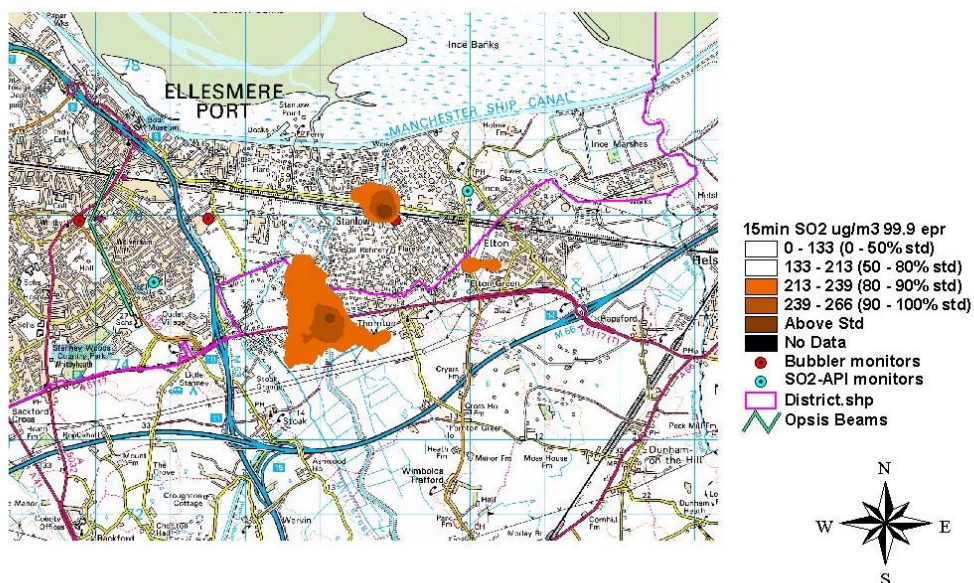


Figure 24 Small-scale map areas of 2004 predicted 1 hour mean SO₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 350 µg/m³, 99.7th Percentile by 2004)

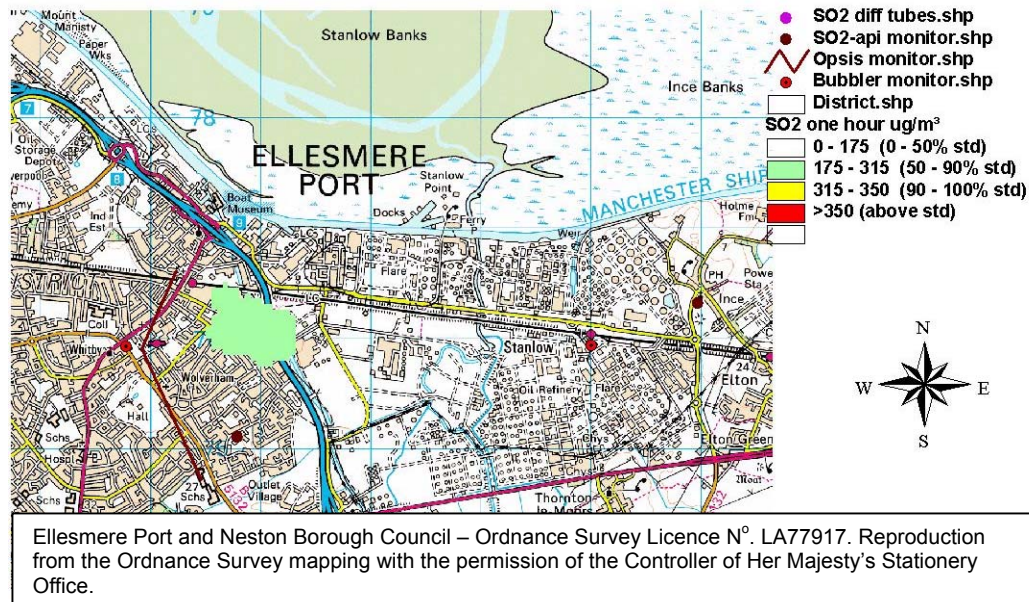
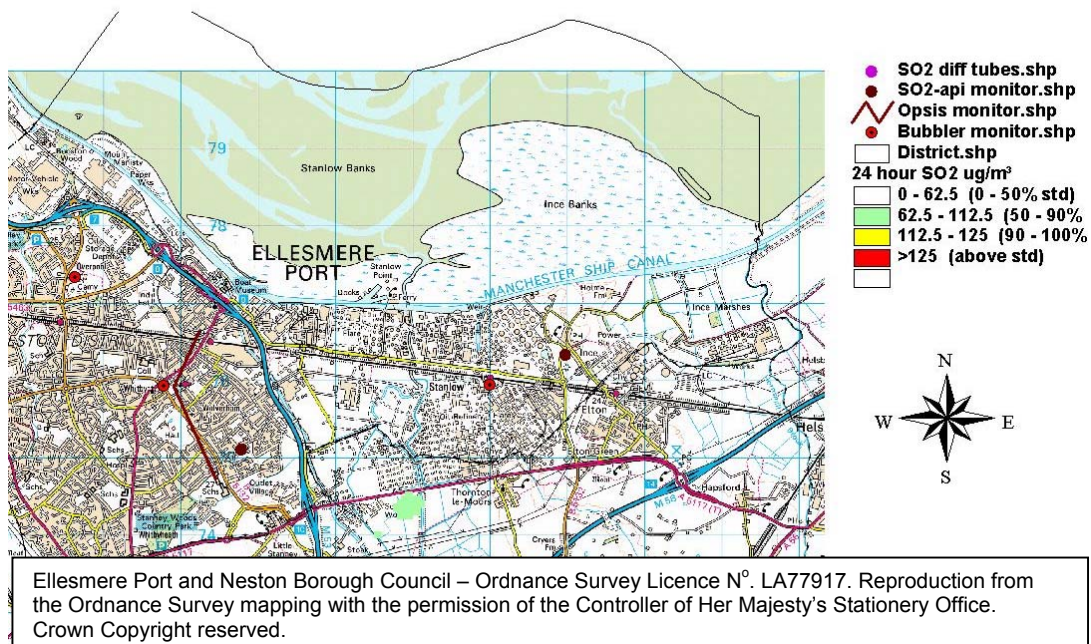


Figure 25 Small-scale map areas of 2004 predicted 24-hour mean SO₂ concentrations in EPNBC area (NAQS objective - 1 hour mean - 125 µg/m³, 98.9th Percentile by 2004)



MONITORING

The Borough Council monitors this pollutant using both 'real time' monitoring equipment, Bubblers and Diffusion tubes. A network of monitoring has been carried out since the early 90's and is currently spread across the entire Borough. The results of monitoring are tabulated in Tables 24, 25 and 26 along with the accompanying receptor plot levels indicated by the model. This allows comparison of monitored data against calculated levels and similarly accuracy of the ADMS Model.

Table 24 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	15 min.	35 exc's	% monitoring results of modelled results
		Model $\mu\text{g}/\text{m}^3$	Monitors $\mu\text{g}/\text{m}^3$	
EPNBC				
RD	Racal Decca, Burton	84.7	100	+18
CO	Civic Way, E Port	131	138	+5
NO	Neston Town Hall Office	83.4	159	+90
OC	Overpool Com Centre	107	216	+101
SG	Stanney Grange school	118	205	+74
JG (2)	Joseph G Towers	147	156	+6
SH (2)	Stanney High School	126	148	+18

Table 25 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	1 hr	24 exc's	% monitoring results of modelled results
		Model $\mu\text{g}/\text{m}^3$	Monitors $\mu\text{g}/\text{m}^3$	
EPNBC				
RD	Racal Decca, Burton	44	82	+86
CO	Civic Way, E Port	92.4	99	+7
NO	Neston Town Hall Office	52	114	+119
OC	Overpool Com Centre	71	156	+120
SG	Stanney Grange school	83.9	165	+97
JG (2)	Joseph G Towers	110	123	+12
SH (2)	Stanney High School	76	119	+57

Table 26 COMPARISON OF MODELLED DATA WITH MONITORING DATA.

Site Code	Monitoring Site Name	24 hr	3 exc's	% Monitoring results of modelled results
		Model $\mu\text{g}/\text{m}^3$	Monitors $\mu\text{g}/\text{m}^3$	
EPNBC				
RD	Racal Decca, Burton	12.5	6.7	-46
CO	Civic Way, E Port	29.7	52.8	+78
NO	Neston Town Hall Office	15.3	41.1	+168
SG	Stanney Grange school	31	48.54	+56
JG(2)	Joseph G Towers	51.7	62	+20
SH (2)	Stanney High School	33.2	59	+78

CONCLUSION

- There are significant industrial sources of sulphur dioxide within the Borough.
- The Model does not predict sulphur dioxide exceedences at any point of relevant exposure within the Borough.
- The 15 minute mean Model indicates a small area (highlighted orange/brown), located on an industrial area, which is just above the standard and as such is an area of concern. However, this location is not an area of relevant public exposure.
- The Model predicts that the standard is not exceeded in areas relevant to public exposure.
- Monitoring data in areas relevant to public exposure confirm the model predictions in those areas.
- The model is slightly under predicting the level.
- **Air Quality Management Areas are not required.**

14. CONCLUSION

OVERVIEW

The initial step in the Review and Assessment of Air Quality has been completed in accordance with all the technical guidance issued by the DETR.

It is possible to conclude on the strength of the modelling results that there are areas of the Borough which will exceed the air quality objectives for benzene, 1,3-butadiene and lead, however the exceedences cover industrial areas where there is no expectation of the general public being exposed for the relevant averaging time. All other pollutant objectives will be achieved. The results show that the exceedences are due to industrial emissions.

However work carried out by the Environmental Health Section has shown that this review is not the end but merely the start of a process which will require further work and monitoring to be carried out over the next couple of years until the second review of air quality (December 2003) is required.

The results of the Review and Assessment are listed below, with actions needed to clarify the situation of each pollutant. The Council will be providing an Air Quality Strategy early Spring 2001 which will encompass all the work in a single document. As part of the second round of reviews it is imperative that the Council continues to improve and update the Emission's Inventory and similarly the Council's ADMS (Urban) Model and continue monitoring to provide public assurance.

BENZENE

Air Quality Management Areas are not required.

Action Plan.

- Model verification is required in the highlighted area of the Model results by monitoring using a combination of benzene diffusion tubes and Gas Chromatograph.
- Establish a background level for the Model.

1,3-BUTADIENE

Air Quality Management Areas are not required.

Action Plan.

- Model verification is required in the highlighted area of the Model results by monitoring using a combination of 1,3-butadiene diffusion tubes and Gas Chromatograph.
- Establish a background level for the Model.

CARBON MONOXIDE

Air Quality Management Areas are not required.

Action Plan.

- Focussed modelling on heavily trafficked roads.
- Liaison with Joint Highways Authority and obtain up to date traffic counts.
- Validate Model with indicative monitoring.
- Validate the relationship between CO and NO₂ locally for our own assurance.
- Expectation is that problem NO₂ areas will be shown up before CO.

LEAD

Air Quality Management Areas are not required.

Action Plan.

- Model verification is required in the highlighted area of the Model results by monitoring.

NITROGEN DIOXIDE

Air Quality Management Areas are not required.

Action Plan.

- Focussed modelling on heavily trafficked roads.
- Liaison with Joint Highways Authority and obtain up to date traffic counts.
- Validate Model with indicative monitoring.
- Increased monitoring sites to establish a local background level for the Model.

PARTICULATES

Air Quality Management Areas are not required.

Action Plan.

- Focused modelling on heavily trafficked roads.
- Focused monitoring at selected areas.

SULPHUR DIOXIDE

Air Quality Management Areas are not required.

Action Plan.

- Increased monitoring sites to validate the Model.

15. GLOSSARY

$\mu\text{g}/\text{m}^3$	Microgrammes per cubic metre - a metric measure of concentration ($1\mu\text{g} = 1\text{millionth}$ of a gramme)
mg/m^3	Milligrammes per cubic metre - a metric measure of concentration ($1\text{mg} = 1\text{thousandth}$ of a gramme)
ADMS	A complex third stage computer modelling program
ARIC	The consultancy employed to carry out the compilation of the Emissions Inventory database
AUN	Automatic Urban Network monitoring system
CERC	The consultancy who performed the initial modelling study
Emissions Inventory	A detailed list of local emission sources (such as industrial, domestic and road sources) that is used for ADMS (urban) modelling
Environment Agency	The Government Agency responsible for the protection of the environment
EPAQS	Expert Panel on Air Quality Standards - a group who help to draw up the health-based air quality objectives
Greenhouse Gas	A gas that may contribute to global warming
Integrated Pollution Control	Environmental Management Regime that controls emissions from industrial processes to protect the air, land and water environments
LAQM	Local Air Quality Management
NETCEN	Air quality specialists (part of AEA Technology) who are Government Consultants
Part A Process	An industrial site inspected by the Environment Agency
Part B Process	An industrial site inspected by the Local Authority
Polluter Pays Principle	Principle whereby the company producing pollution should remediate
Pollution Specific Guidance LAQM.TG4.(00)	Technical guidance on how to carry out the review of air quality provided by the Government
Smoke Control Areas	An area in which only authorised fuels can be burnt
Sustainability	Principle that seeks to protect the environment for future generations
TEOM	Tapered Element Oscillating Microbalance
99th Percentile	Concentration that is exceeded for 1% of the time
OP SIS	A method for monitoring pollution using light adsorption
VOC	Volatile Organic Compound
Real Time Data	Information collected which is up to date and current

16. APPENDIX A

AIR QUALITY FORUM MEMBERSHIP

Air Products Limited
Associated Octel Co. Limited
British Nuclear Fuels plc
Bridgewater Paper Company Limited
Cabot Carbon Limited
Cheshire County Council
Citizen's Advice Bureau
Cleanaway Limited
Community Action Project
Communities Against Toxics
Ellesmere Port and Neston Borough Council
Ellesmere Port Chamber of Commerce
Ellesmere Port and Neston Health Improvement Team
Ellesmere Port and Neston Primary Care Group
Environment Agency
Friends of the Earth
Heads in the Sand
Kemira Agro UK Limited
Local Care Forum
Local Education Representatives
Manchester Port Health Authority
Member of Parliament
Member of European Parliament
Neston and Ellesmere Port Federation of Tenants
and Residents Association
Neston Civic Society
Parkgate Civic Society
Shell UK Limited
South Cheshire Health Authority
South Wirral Against Pollution
SRB Steering Group
Trades Council
Urenco (Capenhurst) Limited
Van Leer Limited
Vauxhall Motors
Women's Institute

17. APPENDIX B

AIR QUALITY MONITORING IN ELLESMERE PORT AND NESTON BOROUGH

The appropriate DETR air quality monitoring guidelines were consulted for the air quality monitoring activities of the council.

EPNBC AIR QUALITY MONITORING SITES

Table 27 - Shows details of the air quality monitoring sites located in the EPNBC area. This table includes:

Site address.

Site code used by EPNBC

Ordnance Survey map grid reference.

Air quality monitoring equipment located at the monitoring site.

The air pollutants monitored at the site.

The monitoring time frequency of the equipment at the site.

The generic classification of the monitoring site.

The dates air quality monitoring occurred at the site.

Table 28 – Shows details of the air quality monitoring site maintenance and security, basis for selection and a brief description of the site.

EPNBC AIR QUALITY MONITORING EQUIPMENT

Nitrogen dioxide (NO₂) diffusion tubes.

The Borough Council utilises NO₂ diffusion tubes for monitoring traffic emissions at several monitoring sites (Table 1) within the EPNBC area.

Tubes are located at monitoring sites for either 4 or 5 week periods and are changed in accordance with the National Network calendar

Four sites are part of UK Nitrogen dioxide Survey carried out by NETCEN:

<u>Our site reference</u>	<u>UK NO₂ Survey reference</u>
CO	81113
CT	81114
MW	81115
WL	81116

Nitrogen dioxide tubes are purchased from and analysed by Casella GMSS Ltd, Scotscroft Building, Towers 2000 Business Park, Didsbury, Manchester M20 2RY.

Table 29 – Shows details of data recording, accuracy, precision and bias of NO₂.

Smoke and sulphur dioxide bubblers

The Borough Council currently operates two smoke and SO₂ bubblers (site references CO and NT). A third bubbler was operated at site reference OC between 1968 – 1996.

The data from the bubbler at site CO forms part of the UK Smoke and SO₂ Network carried out by NETCEN (NETCEN Site reference code 1130012).

Table 30 - Shows details of service and maintenance, data recording, accuracy, precision, documents and bias of the Smoke and SO₂ bubblers.

OP SIS-DOAS (RC150).

The Borough Council currently operates two Opsis AB Differential Optical Absorption Spectroscopy (DOAS) monitoring equipment (see Table 1 for details).

Table 31 – Shows details of the service and maintenance, calibration, data recording, accuracy, precision, documents and bias of the Opsis DOAS equipment.

The data is stored and manipulated in the Airviro Air Quality Data Management System.

TEOM particulate monitor (R&P TEOM-Series 1400a)

The Borough Council currently operates three R&P TEOM Series 1400a particulate monitors for the determination of PM₁₀ (see Table 1 for details).

Table 32 - Shows details of the service and maintenance, calibration, data recording, accuracy, precision, documents and bias of the TEOM Series 1400a monitoring equipment.

The data is stored and manipulated in the Airviro Air Quality Data Management System. The data from the TEOMs located in the Mobile units (Table 1) are also stored in the ETS plc Retriever Air Quality data management system as back up.

SO₂ chemiluminescent monitor (API-SO₂ Model 100A)

The Borough Council currently operates two API SO₂ Series 100 monitors for the determination of sulphur dioxide (see Table 1 for details).

Table 33 - Shows details of the service and maintenance, calibration, data recording, accuracy, precision, documents and bias of the monitoring API SO₂ Series 100 equipment.

The data is stored and manipulated in the Airviro Air Quality Data Management System. The data are also stored in the ETS plc Retriever Air Quality data management system.

Nitrogen oxides monitor (API-NO/NO₂/NO_x Model 200A)

The Borough Council currently operates two API NO/NO₂/NO_x Series 200A monitors for the determination of sulphur dioxide (see Table 1 for details).

Table 34 - Shows details of the service and maintenance, calibration, data recording, accuracy, precision, documents and bias of the monitoring API NO/NO₂/NO_x Series 200A equipment. The data is stored and manipulated in the Airviro Air Quality Data Management System. The data are also stored in the ETS plc Retriever Air Quality data management system as back up.

THIRD PARTY MONITORING EQUIPMENT

Benzene diffusion tubes

Data from diffusion tube benzene monitoring carried out by neighbouring Chester City Council at Elton is included in this review.

Lead monitoring

Lead data from a Partisol 2000 operated by Stranger Science and Environment is included in this review.

Calibration Gases

Calibration gases for the OPSIS-DOAS, API SO₂ 100A and API NO_x 200A monitors were obtained from either the National Physical Laboratory or Messer UK Limited. All calibration gases were supplied with certificates of analysis, which have been filed.

AIR QUALITY DATA MANAGEMENT

INDIC AIRVIRO SYSTEM

Air Quality data collected by the on-line monitors is down loaded automatically into the Indico Airviro Air Quality Data management System (obtained from the Swedish Meteorological and Hydrological Institute - SMHI). This is located in the Council Offices.

This is a comprehensive air quality data management system, which can be used to manipulate the data. The full range of data management processes available are described in the Airviro User's Documentation (ref. A.V.1) and include:

- Validation and adjustment of raw data.
- Presentation of data graphically as time series and other plot (e.g. diurnal variation, rolling averages).
- Calculation of hourly, daily and annual averages.
- Determination of air quality standard exceedences.

The Airviro system is also used to carry out certain system checks remotely. E.g. Opsis DOAS beam light level checks.

DATA MANIPULATION IN AIRVIRO

OPSIS - Air quality data from Opsis-DOAS monitoring equipment is collected as $\mu\text{g}/\text{m}^3$.

TEOM – PM_{10} particulate data is collected as $\mu\text{g}/\text{m}^3$.

API SO₂ Series 100A – This monitor collects air quality data as ppb values and is stored in the Airviro database as raw values. These are then converted to $\mu\text{g}/\text{m}^3$ using 2.66 as a conversion factor.

API NO/NO₂/NO_x Series 200A – This monitor collects air quality data as ppb values and is stored in the Airviro database as raw values. These are then converted to $\mu\text{g}/\text{m}^3$ using 1.91 as a conversion factor.

RETRIEVER

Retriever is an Air Quality Data Management system that was supplied by ETS plc when the mobile units and monitoring equipment they contain was purchased.

Retriever is located at the Council Offices and can be used to remotely call up the mobile unit dataloggers to download up to 20 days stored data from the mobiles TEOM, API SO₂ and API NO_x monitors.

Retriever software is also installed on a portable PC which can be used to download data from the mobiles, on site.

Data collected into retriever can be imported into Airviro and is used as a back-up data collection system in case Airviro fails to collect data from the mobiles remotely.

Table 27 AIR QUALITY MONITORING SITES

Monitoring Site	Third party	Site code	Grid reference	Monitor	Pollutants monitored	Frequency	Type	Monitoring period
Opsis beam 1, Joseph Groome Towers to Library roof, Ellesmere Port		JGLR	340258 376602 to 339947 375889	OPSIS-DOAS	SO ₂ , NO, NO ₂ , NO _x O ₃ , Benzene,	15 minutes	Urban background	From Oct 1995
Opsis beam 2, Stanney La. High School roof to Library roof, Ellesmere Port		SHLR	340482 374751 to 339947 375889	OPSIS-DOAS	SO ₂ , NO, NO ₂ , NO _x O ₃ , Benzene,	15 min.	Urban background	From Oct 1995
Library roof, Civic Way, Ellesmere Port		LR	339947 375889	R&P TEOM-Series 1400a	PM ₁₀ (particulates)	15 min.	Urban background	From Oct 1995
				Diffusion tube	Benz	Monthly av.		From June 2000
Neston Office (Env. Health)		NO	329191 377567	Bubbler	SO ₂ and smoke	Daily av.	Urban centre	From 1977
Overpool Community Centre, Ellesmere Port		OC	338572 377216	Bubbler	SO ₂ and smoke	Daily av.	Urban background	1968 to 1996
Council Offices, Civic Way, Ellesmere Port		CO	339783 375934	Bubbler	SO ₂ and smoke	Daily av.	Urban background	From 1964
Racal Decca, Denhall Lane Burton (Mobile lab 1)		RD	329660 375401	R&P TEOM-Series 1400a	PM ₁₀ (particulates)	15 min.	Rural	Nov 1998 to May 2000
				API-SO ₂ Model 100A	SO ₂	15 min.	Rural	
				API-NO _x Model 200A	NO _x , NO ₂ , NO	15 min.	Rural	
				Diffusion tube	SO ₂	Monthly av.	Rural	May to Aug 2000
Stanney Grange School (Mobile lab 2)		SG	340742 375023	R&P TEOM-Series 1400a	PM ₁₀ (particulates)	15 min.	Urban industrial	From Jan 1999
				API-SO ₂ Model 100A	SO ₂	15 min.	Urban industrial	
				API-NO _x Model 200A	NO _x , NO ₂ , NO	15 min.	Urban industrial	
				Diffusion tube	NO ₂ , Benz	Monthly av.	Urban industrial	From Feb 2000
Elton Community Centre	Yes	PbE	n/a	Partisol 2000	Lead	Daily av.	Urban industrial	From Feb 2000
Pool Lane, Elton	Yes	BPL	n/a	Diffusion tube	Benz	Monthly av.	Urban industrial	From Apr 1998

TABLE 27 (contd.)

Monitoring Site	Third party	Site code	Grid reference	Monitor	Pollutants monitored	Frequency	Type	Monitoring period
Ness Gardens, Burton Rd., Ness		NG	330603 375605	Diffusion tube	NO ₂ , Benz	Monthly av.	Rural	1990 to Nov 2000
Council Offices, Civic Way, Ellesmere Port		CO	339783 375934	Diffusion tube	NO ₂	Monthly av.	Roadside	From 1990
Stanlow, Oil Sites Rd., Ellesmere Port		OS	344806 375992	Diffusion tube	NO ₂ , Benz, But	Monthly av.	Special-industrial	From 1990 (Benz from Sep 2000)
Milton Rd., Wolverham, Ellesmere Port		MR	340843 375509	Diffusion tube	NO ₂	Monthly av.	Urban background	From 1990
New School La., Childer Thornton		CT	336582 377895	Diffusion tube	NO ₂	Monthly av.	Suburban	1990 to Dec 2000
Websters La., Gt. Sutton, Ellesmere Port		WL	338837 374776	Diffusion tube	NO ₂	Monthly av.	Suburban	From 1990
Neston Cemetery, Park Rd., Neston		NC	329677 377988	Diffusion tube	NO ₂	Monthly av.	Suburban	Mar 1997 to Dec 1998
Boat house, North Parade, Parkgate		BH	327499 378846	Diffusion tube	NO ₂	Monthly av.	Suburban	Mar 1997 to Dec 1998
The Harp, Quayside, Little Neston		HQ	329021 375992	Diffusion tube	NO ₂	Monthly av.	Rural	Mar 1997 to Dec 1998
Neston Road, Burton		NR	331072 374550	Diffusion tube	NO ₂	Monthly av.	Suburban	Mar 1997 to Dec 1998
Mudhouse Lane, Burton		ML	332486 374719	Diffusion tube	NO ₂	Monthly av.	Suburban	Mar 1997 to Dec 1998
Princes Rd./Whitby Rd.		PW	340184 376430	Diffusion tube	NO ₂	Monthly av.	Roadside	From Feb 1999
Cheshire Oaks Car Park		CH	341391 374750	Diffusion tube	NO ₂	Monthly av.	Special-Car park	Feb 1999 to Aug 2000
Ellesmere Port Bus Station, Civic Way		BS	340030 375916	Diffusion tube	NO ₂	Monthly av.	Special-Bus Sta.	Feb 1999 to Nov 2000
Neston Town Hall, Neston		NT	329128 377594	Diffusion tube	NO ₂	Monthly av.	Kerbside	From Feb 1999
Church, High Street, Neston		NH	329204 377438	Diffusion tube	NO ₂	Monthly av.	Kerbside	From Feb 1999
Joseph Groom Towers		JG	340258 356602	Diffusion tube	Benz	Monthly av.	Urban background	June to Aug 2000
M53 Café, Stanney Mill Lane		MM	341893 374493	Diffusion tube	NO ₂ , Benz, But	Monthly av.	Urban	From Sep 2000
Denhall Lane (Marsh)		DL	329997 374825	Diffusion tube	NO ₂ , SO ₂	Monthly av.	Rural	From Sep 2000
Village Hall, Ince		VI	344961 376311	Diffusion tube	Benz, But	Monthly av.	Special -Indust.	From Sep 2000
Leven Walk		LW	339040 377434	Diffusion tube	NO ₂	Monthly av.	Urban industrial	Feb 1999 to Aug 2000
Rexam/Bowater		RB	339324 378104	Diffusion tube	NO ₂	Monthly av.	Special-industrial	From Feb 1999

Table 28 SITE DESCRIPTION AND SELECTION

Site code	Site description	Basis for site selection	Site Maintenance and Security
NG	Kerbside of rural road.	Background concentration monitoring	Not applicable
CO	Kerbside of main road through E. Port town centre.	Busy road junction	Not applicable
OS	Kerbside of road through petrochemical complex.	Monitor at industrial location	Not applicable
MR	Kerbside of residential area.	Urban. Motorway + Industry within 500m	Not applicable
CT	Kerbside of urban area outside school.	Adjacent to trunk road	Not applicable
WL	Kerbside of residential area.	Urban background	Not applicable
NC	Centre of suburban area	Background concentration monitoring	Not applicable
BH	Kerbside of rural road	Background concentration monitoring	Not applicable
HQ	Kerbside of rural road	Background concentration monitoring	Not applicable
NR	Kerbside of remote rural road.	Background concentration monitoring	Not applicable
ML	Kerbside of remote rural road.	Background concentration monitoring	Not applicable
PW	Kerbside of residential urban area.	Busy road junction	Not applicable
CH	Car park of large shopping mall	New Development - parking emissions	Not applicable
BS	Kerbside of bus station in town centre.	Monitor public transport emissions	Not applicable
NT	Kerbside of main road through town centre.	Busy road junction	Not applicable
NH	Kerbside of main road through town centre.	Busy road junction	Not applicable
JG	Top of residential tower block	Validation of OPSIS	Not applicable
MM	Near M53 motorway and industrial site	Traffic / Industry	Not applicable
DL	Remote rural location on Dee estuary	Background concentration monitoring	Not applicable
VI	Ince village near oil refinery	Industrial impact on village	Not applicable
LW	Kerbside of residential area.	Within plume footprint of industry	Not applicable
RB	Kerbside of road on industrial site.	Industry / Motorway	Not applicable

TABLE 28 (contd.)

Site code	Site description	Basis for site selection	Site Maintenance and Security
JGLR	800 m light beam path length (see Fig.).	Urban background. Open path fence-line to monitor pollutants from industry (East)	Access to J.Groome Towers and Library restricted to authorised personnel. Site maintained by EPNBC.
SHLR	1200 m light beam path length (see Fig.).	Urban background. Open path fence-line to monitor pollutants from industry (East)	Access to High School and Library restricted to authorised personnel Site maintained by EPNBC.
LR	Library roof in Ellesmere Port town centre.	Urban background at height	Access to Library roof restricted to authorised personnel.
NO	Council sub-office in town centre.	SO2 loading outside smoke control zone	Access to office by locked door.
OC	Community centre - suburban	SO2 loading edge of smoke control zone	
CO	Third floor council offices in E. Port town centre.	Town centre smoke control zone	
RD	Radio mast station on Dee Estuary Rural countryside location.	Rural. Assessment of possible regional pollution from outside borough	Remote location monitored by CCTV. Equipment in locked steel cabin. Site maintained by EPNBC.
SG	Primary school grounds in residential area.	Urban background. Within 800 m of M53 Within 1 km of edge of industrial area	Site enclosed by high steel fence. Access via padlocked steel gate. Equipment in locked steel cabin.
PbE	Elton community centre	East of known industrial lead source	Not known - third party
BPL	Elton village near oil refinery	Monitor industrial emissions	Not known - third party

Table 29 NO₂ DIFFUSION TUBES

Monitor parameter	Details.
Method	Triethanolamine Passive Diffusion tubes. Tubes obtained from GMSS Casella, Didsbury, Manchester, M20 2RY. GMSS are a UKAS accredited laboratory. Tubes are set up in accordance with National Network calendar
Service	Not applicable
Maintenance	Not applicable
Calibration	GMSS tube analysis QA is monitored and compared with other laboratories. The laboratory is classed as Good with no action required. - Ref A.N.1.
Accuracy	+/- 10-11% - Ref A.N.1. +/- 10% - Ref. A.N.2. Overall accuracy taken as +/- 25% - Ref. A.N.2.
Precision	About 10% (based on replicate analysis) - Ref. A.N.1. About 7% (based on comparison with chemiluminescence) - Ref. A.N.1. About 10.3% - Ref. A.N.2.
Detection limit	2 ug/m ³ for a 4 week incubation - Ref. A.N.1
Data processing	Results are stored electronically in EXCEL spreadsheets and as hardcopy in files. Maximum running annual mean estimated as 1.1 times the annual mean - (ref. LAQM.TG4(00)) The 99.8th percentile of hourly means was estimated as:- 5 times the annual mean for background sites. 3.5 times the annual mean for roadside/kerbside sites. (ref. LAQM.TG4(00))
References and Technical Guidance	
A.N.1.	Literature on NO ₂ diffusion tubes obtained from GMSS (Casella) - UKAS Accredited.
A.N.2.	Validation of Nitrogen dioxide diffusion tube methodology. Stephen Moorcroft et al. Prepared by Stanger Science and NETCEN. Report No. ? Available on web:- www.aeat.co.uk/netcen/airqual/reports/valid
LAQM.TG4(00)	Review and Assessment : Pollutant Specific Guidance

Table 30 BUBBLERS

Monitor parameter	Details.
Method	Active sampling of SO ₂ by bubbling ambient air through hydrogen peroxide solution, followed by analysis of acidified solution. Operation of bubblers is carried out by EPNBC officers as in manual - Ref A.S.1. Analysis of Smoke and SO ₂ is carried out by EPNBC officers as in manual - Ref. A.S.1. The SO ₂ is determined by the total acidity titration method.
Service	Routine servicing, maintenance and operation of the operational bubblers is carried out by EPNBC officers as described in instruction manual - Ref. A.S.1 Kemtronix (UK) Ltd. services the smokestain reflectometer annually. AEA Technology carries out a quality audit on the bubbler at location CO and on the Smoke and SO ₂ laboratory analysis procedures and equipment.
Maintenance	See Servicing above.
Calibration	Kemtronix (UK) Ltd. calibrates the smokestain reflectometer when serviced. AEA Technology carry out a quality control audit on the bubbler at location CO, smokestain reflectometer, and SO ₂ laboratory analysis reagents, procedures and equipment every two years.
Accuracy	Smokestain relectometer +/- 1.5 divisions (source Kemtronic service reports) The titration method for SO ₂ analysis is known to under-estimate SO ₂ values particularly when at high concentrations. (ref. LAQM.TG4(00)) Estimated as +/- 10% for SO ₂ measurements (LAQM.TG1(00))
Precision	Estimated as +/- 4 µg/m ³ for SO ₂ measuerments by total acidity measurements. (LAQM.TG1(00))
Detection limit	6 µg/m ³
Data processing	Results are stored electronically in EXCEL spreadsheets and as hardcopy in files. Maximum daily mean concentration multiplied by 1.25 (ref. LAQM.TG4(00)) 99.9th percentile of 15-min means estimated from 1.8962 times Max daily mean. 99.7th percentile of 1 hour means estimated from 1.3691 times max daily mean (ref. LAQM.TG4(00)).
References and Technical Guidance	
A.S.1.	Instruction Manual: UK Smoke and Sulphur dioxide Networks. Prepared for DETR by AEA Technology. Report No. AEAT-1806 Available on web:- www.aeat.co.uk/netcen/airqual/reports/smkman/shead.html
LAQM.TG1(00)	Review and Assessment : Monitoring Air Quality
LAQM.TG4(00)	Review and Assessment : Pollution Specific Guidance

Table 31 NO_x-API

Monitor parameter	Details
Method	Chemiluminescent NO/NO ₂ /NO _x Analysis method. Equipment - Advanced Pollution Instrumentation Inc. (API) Chemiluminescent NO/NO ₂ /NO _x Analyser model 200A. See Operating Manual for further details (ref. A.B.1).
Service	This equipment is serviced every six months under a Service Contract with ETS plc Servicing is carried out according to the Site Operation Manual (ref. A.T.2)
Maintenance	General maintenance is carried out by EPNBC officers according to the Site Operation Manual (ref. A.T.2) The service contract with Enviro Technology Services plc includes a 48 hour call out breakdown service.
Calibration	Carried out by ETS plc during service visits according to the Site Operation Manual(ref. A.T.2.)
Accuracy	An Accuracy of +/- 8% has been estimated for NO ₂ measurements with these monitors. (ref. LAQM.TG1(00)) Accuracy testing is carried out by EPNBC officers every two weeks according to Site Operation Manual (ref. A.T.2) These results indicated the accuracy was unstable and drifted with a negative bias between servicing and calibration of up to 25%. This is a known feature of this instrument.
Precision	Reported as +/- 0.5% (ref. A.B.1) Estimated as +/- 6.7 µg/m ³ for NO ₂ (ref. LAQM.TG1(00))
Detection limit	0.76 µg/m ³ for NO ₂ (ref. A.B.1)
Data processing	The Air Quality data is calculated by the monitor and stored locally in the instrument datalogger. The data is periodically (at least twice per day) down loaded into the Airviro Air Quality Data management system (from SMHI). The data are also manually downloaded every 20 days into the Retriever data management system (from ETS plc) as back-up. Data was adjusted to account for the drift in accuracy of the instrument.
References and Technical Guidance	
A.B.1.	API Chemiluminescent NO/NO ₂ /NO _x Analyser Model 200A Instruction Manual. API instruction manual 02246-D (8/22/97)
A.T.2.	Ellesmere Port & Neston Borough Council Air Quality Monitoring Station Site Operation Manual Issue 1 - Jan 2000. Prepared by Enviro Technology Services plc.
LAQM.TG1(00)	Review and Assessment: Monitoring Air Quality.

Table 32 TEOM Particulates

Monitor parameter	Details
Method	Tapered Element Oscillating Microbalance for particulate (PM10) analysis. Equipment Rupprecht & Patashnick Co., Inc. TEOM Series 1400a. See Operating Manual for further details (ref. A.T.1).
Service	This equipment is serviced every six months under a Service Contract with Enviro Technology Services plc. Servicing is carried out according to the Site Operation Manual (ref. A.T.2)
Maintenance	General maintenance is carried out by EPNBC officers according to the Site Operation Manual (ref. A.T.2) The service contract with Enviro Technology Services plc includes a 48 hour call out breakdown service.
Calibration	This equipment does not require frequent calibration Ko Confirmation test with pre-weighed calibration filter.
Accuracy	Has been estimated as +/- 2.5% (ref. A.T.1.)
Precision	About +/- 4 µg/m3 (ref. LAQM.TG1(00))
Detection limit	5 µg/m3 (ref. A.T.1)
Data processing	The Air Quality data is calculated by the monitor and stored locally in the instrument datalogger. The data is periodically (at least twice per day) down loaded into the Airviro Air Quality Data management system (from SMHI). See Appendix B. The data from the TEOM monitors located in the Mobile units is also manually downloaded every 20 days into the Retriever data management system as back up. See section Appendix B. TEOM data was multiplied by 1.3 to be comparable with Gravimetric analyser data which is the method on which the NAQS objective are based (ref. LAQM.TG(00))
References and Technical Guidance	
A.T.1.	TEOM Series 1400a Ambient Particulate (PM-10) Monitor (AB Serial numbers) Operating Manual revision B. Rupprecht & Patashnick Co. Inc. part no 42-003347.
A.T.2.	Ellesmere Port & Neston Borough Council Air Quality Monitoring Station Site Operation Manual Issue 1 - Jan 2000. Prepared by Enviro Technology Services plc.
A.T.3.	TEOM Series 1400a Ambient Particulate (PM-10) Monitor (AB Serial numbers) Service Manual revision B. Rupprecht & Patashnick Co. Inc. part no 42-003348.
LAQM.TG1(00)	Review and Assessment: Monitoring Air Quality.
LAQM.TG4(00)	Review and Assessment: Pollution Specific Guidance.

Table 33 SO₂-API

Monitor parameter	Details
Method	Sulphur dioxide fluorescent analysis method. Equipment - Advanced Pollution Instrumentation Inc. (API) SO ₂ Fluorescent analyser model 100A. See Operating Manual for further details (ref. A.A.1).
Service	This equipment is serviced every six months under a Service Contract with ETS plc. Servicing is carried out according to the Site Operation Manual (ref. A.T.2) based on the manufacturers instruction manual (ref. A.A.1)
Maintenance	General maintenance is carried out by EPNBC officers according to the Site Operation Manual (ref. A.T.2) The service contract with ETS plc includes a 48-hour call out breakdown service.
Calibration	Carried out by ETS plc during service visits according to the Site Operation Manual (ref. A.T.2.)
Accuracy	An accuracy of +/- 1% is reported for these monitors (ref. LAQM.TG1(00)). Accuracy testing is carried out by EPNBC officers every two weeks according to Site Operation Manual (ref. A.T.2) These results indicated the accuracy was +/- 5% and that the instrument was stable with no positive or negative bias.
Precision	The precision has been reported as +/- 3.2 µg/m ³ (ref. LAQM.TG1(00))
Detection limit	Reported as 1.1 µg/m ³ (ref. A.A.1)
Data processing	The Air Quality data is calculated by the monitor and stored locally in the instrument datalogger. The data is periodically (at least twice per day) downloaded into the Airviro Air Quality Data management system (from SMHI). The data are also manually downloaded every 20 days into the Retriever data management system as back up.
References and Technical Guidance	
A.A.1.	API SO ₂ Fluorescent analyser Model 100A Instruction Manual. API instruction manual 02164 REV.C (12/30/96)
A.T.2.	Ellesmere Port & Neston Borough Council Air Quality Monitoring Station Site Operation Manual Issue 1 - Jan 2000. Prepared by Enviro Technology Services plc.
LAQM.TG1(00)	Review and Assessment: Monitoring Air Quality.

Table 34 OPSIS

Monitor parameter	Details
Method	Differential Optical Absorption Spectroscopy (DOAS) using OPSIS Opto-Analyser AR500
Service	The Opsis DOAS monitors are serviced by Enviro Technology plc every 3 months under a service contract. The servicing is carried out according to the manufacturers recommended procedure (ref. A.O.1) All service records from Enviro Technology plc are kept on file.
Maintenance	Weekly maintenance checks (light levels, system check, site inspection and cleaning) are carried out by EPNBC officers according to QA/QC manual (ref A.O.1). Other maintenance checks (including lamp changes every six months) are carried out by Enviro Technology plc during service visits
Calibration	Carried out by Enviro Technology plc according to QA/QC manual (ref. A.O.1) during service visits
Accuracy	Accuracy audit testing is carried out by Enviro Technology plc according to QA/QC manual (ref. A.O.1) during service visits. The accuracy of the instrument is estimated as +/- 50%.
Precision	Precision testing is carried out by EPNBC officers every two weeks according to QA/QC manual (ref. A.O.1).
Detection limit	Beam 1 (800m path length) NO ₂ = 2.9 µg/m ³ , SO ₂ = 4 µg/m ³ , Benzene = 2 µg/m ³ Beam 2 (1200m path length) NO ₂ = 2 µg/m ³ , SO ₂ = 2.7 µg/m ³ , Benzene = 1.4 µg/m ³
Data processing	Air Quality data is calculated by the Opsis monitor and stored locally in the Opsis datalogger. The data is downloaded automatically 3 times a day into the Airviro air quality data management System (from SMHI).
References and Technical Guidance	
A.O.1.	Quality Assurance and Quality Control using Opsis Analysers for Air Quality Monitoring. Opsis AB manual QA/QC ver 1.1.
A.O.2.	Opto-Analyser AR500 for Air Quality Monitoring: Hardware operating manual. Opsis AB manual AR500.
A.O.3.	Emitter/Receiver ER150 User's Manual. Opsis AB manual ER150.
A.O.4.	Opsis Software for Opto-Analysers Version 7: User's manual. Opsis AB Software Manual.

Table 35 REFERENCES

Ref.	Document
Doc. 1	Stage 1 Review of Air Quality for Ellesmere Port and Neston Borough
Doc. 2	ARIC Emissions Inventory
Doc. 3	CERC ADMS Modelling Study
LAQM.TG1(00)	Review and Assessment: Monitoring Air Quality
A.O.1.	Quality Assurance and Quality Control using Opsis Analysers for Air Quality Monitoring. Opsis AB manual QA/QC ver 1.1.
A.O.2.	Opto-Analyser AR500 for Air Quality Monitoring: Hardware operating manual. Opsis AB manual AR500.
A.O.3.	Emitter/Receiver ER150 User's Manual. Opsis AB manual ER150.
A.O.4.	Opsis Software for Opto-Analysers Version 7: User's manual. Opsis AB Software Manual.
A.B.1.	API Chemiluminescent NO/NO ₂ /NO _x Analyser Model 200A Instruction Manual. API instruction manual 02246-D (8/22/97)
A.T.2.	Ellesmere Port & Neston Borough Council Air Quality Monitoring Station Site Operation Manual Issue 1 - Jan 2000. Prepared by Enviro Technology Services plc.
A.N.1.	Literature on NO ₂ diffusion tubes obtained from GMSS (Casella) - UKAS Accredited.
A.N.2.	Validation of Nitrogen dioxide diffusion tube methodology. Stephen Moorcroft et al. Prepared by Stanger Science and NETCEN. Report No. ? Available on web:- www.aeat.co.uk/netcen/airqual/reports/valid
A.T.1.	TEOM Series 1400a Ambient Particulate (PM-10) Monitor (AB Serial numbers) Operating Manual revision B. Rupprecht & Patashnick Co. Inc. part no 42-003347.
A.T.3.	TEOM Series 1400a Ambient Particulate (PM-10) Monitor (AB Serial numbers) Service Manual revision B. Rupprecht & Patashnick Co. Inc. part no 42-003348.
A.A.1.	API SO ₂ Fluorescent analyser Model 100A Instruction Manual. API instruction manual 02164 REV.C (12/30/96)
A.S.1.	Instruction Manual: UK Smoke and Sulphur dioxide Networks. Prepared for DETR by AEA Technology. Report No. AEAT-1806 Available on web:- www.aeat.co.uk/netcen/airqual/reports/smkman/shead.html
A.V.1.	SMHI Airviro User Documentation. Airviro manual obtained from SMHI.