Summary

This is the Third Stage Review and Assessment of Air Quality within the Wrexham County Borough Council area. It has been carried out in order to determine whether there is a significant risk of the air quality standards and objectives for PM_{10} and Sulphur dioxide being exceeded. Sulphur dioxide and particulates from domestic solid fuel sources were considered to be a potential issue in the areas of Llay, Chirk and Brymbo / Broughton.

It was decided that there was insufficient monitoring data to be confident that the Air Quality Objectives would not be breached. The report focuses on the areas highlighted during the Second Stage Review and Assessment completed in 2002. It assesses the impact of the pollutants PM_{10} and SO_2 associated with local domestic coal burning and also PM_{10} in relation to a local industry.

The Local Authority has adopted a precautionary approach by investigating those locations where the highest pollution concentrations are likely and where public exposure is relevant.

The Stage 3 Assessment has indicated elevated particulate emissions from local domestic coal burning in the village of Llay. The results of the investigation indicate that the air quality standard and objective for particulate emissions in Llay may be exceeded.

The Public Protection Department of Wrexham County Borough Council will recommend the declaration of an Air Quality Management Area for Llay. This will include the production of a Stage 4 Report and the implementation of an Air Quality Action Plan during 2002.

Contents

1.0 Introduction

1.01 Wrexham County Borough Council's Stage 2 Air Quality Review and Assessment report indicated that further investigation was required in order to determine the likelihood of the 2005 Air Quality Objectives for particles (PM_{10}) and sulphur dioxide (SO_2) being exceeded in residential areas where local domestic coal burning is prevalent.

1.02 This report, in conjunction with the completed Stage 1 and Stage 2 Reports, provide the framework for the future review of air quality and form the basis for recommendations regarding the management of air quality in the County Borough.

1.03 Full details of the local authority's review and assessment of the seven pollutants described in the National Air Quality Strategy can be found in the Stage 1 and Stage 2 Reports. Additional detailed information on sulphur dioxide is contained in this Report.

1.1 The National Air Quality Strategy and Local Air Quality Management

1.1.1 The key elements of the Strategy are health-based Air Quality Standards and Objectives. The Standards are based on an assessment of the effect of each pollutant on public health, and reflect recommendations made by the Expert Panel on Air Quality Standards (EPAQS). The Air Quality Regulations 2000 prescribe air quality objectives to be achieved in respect of benzene, nitrogen dioxide (NO_2), sulphur dioxide, particulates (PM_{10}), carbon monoxide, lead and 1,3 butadiene. These are listed in Table 1.

1.1.2 The Welsh Assembly Government is responsible for air quality strategy, policy and secondary legislation to improve and protect ambient air quality, and to protect the health of the people and the environment. This includes the responsibility for meeting the Air Quality objectives.

1.1.3 A consultation paper in December 2001 sought views on the proposals to supplement the present air quality objectives for carbon monoxide and benzene taking account of expert advice and new European limit values, set new long term objectives for particles (PM_{10}); and introduce, for the first time, an objective for polycyclic aromatic hydrocarbons.

1.1.4 The Welsh Air Quality Forum is a collaborative body made up of representatives from all 22 Local Authorities in Wales. The Forum established the Air Quality Monitoring Database for Wales. All 22 local authorities carry out air quality monitoring.

1.1.5 Air quality is generally good in most areas of Wales. Data from the Welsh Air Quality database indicate that most sites complied with

the National Air Quality Objectives except for fine particles (PM_{10}) and ozone (0_3). Some areas experience higher levels of pollutants (PM_{10} and 0_3) throughout the year, depending on meteorology, topography and specific activities within the area. Cardiff, Neath Port Talbot and Swansea have identified specific problems related to traffic emissions.

1.1.6 The Air Quality Limit Values (Wales) Regulations 2001 came into force on the 19 July 2001. The Regulations relate to such areas as:-

- The requirement for air quality assessment and management relating to limit values for sulphur dioxide, nitrogen dioxide, oxides of nitrogen, particulate matter and lead (the "relevant pollutants").

- The Welsh Assembly Government has a duty to take the measures necessary to ensure that concentrations of the relevant pollutants do not exceed the limit values.

- Wales has been classified into zones and Wrexham falls within the North Wales zone. Results from the air quality monitoring station in Wrexham will provide information to the Welsh Assembly Government to determine if the air quality meets the threshold levels which have been set.

- The Welsh Assembly Government is required to formulate action plans indicating measures to be taken, in the short term, where there is a risk that the limit values for relevant pollutants, or the alert levels for sulphur dioxide and nitrogen dioxide, will be exceeded.

- Up to date information on the ambient air quality concentration of each pollutant is routinely made available to the public.

1.1.7 Local authorities must determine whether the prescribed air quality objectives are likely to be achieved in their areas by the end of 2005. The Department of the Environment, Food and Rural Affairs, DEFRA (formerly known as the Department of the Environment, Transport and the Regions) and the Welsh Assembly Government (prior to that the Welsh Office), have produced detailed guidance notes on Local Air Quality Management. This guidance has been followed in compiling this report.

Table 1. ***The Standards and Objectives of the Air Quality Strategy***
Source: Air Quality (Wales) Regulations 2000

NATIONAL AIR QUALITY STRATEGY		
Pollutant	**Standard**	**Objective to be achieved by**
Benzene	16.25 micrograms per cubic metre or less when expressed as a running annual mean	31 December 2003
1,3 – Butadiene	2.25 micrograms per cubic metre or less, when expressed as a running annual mean	31 December 2003
Carbon Monoxide	11.6 milligrams per cubic metre or less, when expressed as a running 8 hour mean	31 December 2003
Lead	0.5 micrograms per cubic metre or less, when expressed as an annual average	31 December 2004
	0.25 micrograms per cubic metre or less, when expressed as an annual average	31 December 2008
Nitrogen dioxide	200 micrograms per cubic metre or less, when expressed as an hourly mean, not to be exceeded more than 18 times a year	31 December 2005
	40 micrograms per cubic metre or less, when expressed as an annual average	31 December 2005
Particles (PM_{10})	50 micrograms per cubic metre or less when expressed as a 24 hour mean, not to be exceeded more than 35 times a year	31 December 2004
	40 micrograms per cubic metre or less, when expressed as an annual mean	31 December 2004
Sulphur dioxide	266 micrograms per cubic metre or less when expressed as a 15 minute mean, not to be exceeded more than 35 times a year	31 December 2005
	350 micrograms per cubic metre or less when expressed as an hourly mean, not to be exceeded more than 24 times a year	31 December 2004
	125 micrograms per cubic metre or less when expressed as a 24 hour mean, not to be exceeded more than three times a year	31 December 2004

2.0 Wrexham County Borough Council Air Quality Management

2.0.1 The Public Protection Department has continued to develop and expand the programme of air quality monitoring described in detail in the Second Stage Review and Assessment Report.

- Up until February 2001 there were 11 nitrogen dioxide diffusion tube monitoring sites within the County Borough. This figure has since increased to 15.

- The most recent benzene monitoring tube is located in the vicinity of the Llwyneinion special waste site, near Rhos. A detailed survey of emissions from this site by AEA Technology on behalf of the Environment Agency Wales is currently ongoing. The results of this survey will be incorporated into the Councils Air Quality Strategy and any future reviews.

- With effect from March 2002, a NETCEN Air Quality Monitoring Site has become operational in Wrexham town. The monitoring station currently monitors continuously for PM_{10}, nitrogen dioxide, sulphur dioxide and carbon monoxide. In the future this may be extended to cover other pollutants. The monitoring data from the site links into the UK Automatic Urban and Rural Networks (AURN) currently managed and co-ordinated by Stanger Science and Environment for DEFRA. Officers from the Council's Public Protection Department, Environmental Protection Section are responsible for management of the site on behalf of NETCEN.

3.0 Summary of the Stage 2 Review and Assessment and Details of the Stage 3 Methodology

3.1 Focus Areas of the Second Stage Review and Assessment

3.1.1 The Stage 2 Review and Assessment focused on the following areas:-

- NO_2 and PM_{10} from road traffic sources were assessed, using the Design Manual For Roads And Bridges model. The review and assessment process demonstrated that the predicted emissions from traffic growth in the Wrexham area will probably have a limited impact on air quality over the next three years. The predictions were carried out to determine a worst case situation. The exceedence of the PM_{10} and the NO_2 objective from road traffic sources is unlikely at any relevant locations. This situation will continue to be reviewed as part of the air quality strategy.

- NO_2 , PM_{10} and SO_2 emissions from industrial sources were also considered. Updated emissions data from the processes highlighted in the Stage 1 Assessment was input into the relevant nomograms (as described in LAQM.TG4(00) May 2000) and it was concluded that only one site warranted further investigation, this being the Kronospan Site at Maesgwyn Farm, Holyhead Road, Chirk. The majority of the processes highlighted by the Stage 1 Assessment were located on the Wrexham Industrial Estate and recent ambient air quality monitoring (3 months) undertaken by Gibb Environmental, as part of a planning proposal for a “Waste to Energy Plant” on the Industrial Estate indicated that the air quality on and around the Wrexham Industrial Estate was of a satisfactory standard.

- Particulates arising as a result of landfilling and mineral extraction operations were assessed, however their impact was felt to be insignificant.

- SO_2 and PM_{10} from domestic solid fuel sources were considered to be a potential issue in the areas of Llay, Chirk and Brymbo / Broughton. It was decided that there was insufficient monitoring data to be confident that the Air Quality Objectives would be met.

- The Stage 2 Assessment has indicated that the background air quality will continue to improve up to 2005.

3.2 Methodology of the Third Stage Air Quality Review and Assessment

3.2.1 The Third Stage Review and Assessment has followed the guidance set out in Local Air Quality Management Technical Guidance Note TG4(00).

3.2.2 This Third Stage Review and Assessment is intended to provide accurate predictions of future pollutant concentrations within the area. It is designed to focus upon those locations where the maximum impact is expected to occur, bearing in mind the potential for public exposure. Further descriptions of the methodology used are contained within the PM_{10} and the SO_2 chapters.

3.2.3 Modelling of emissions has not been carried out at this stage. It will be considered as part of the Stage 4 Assessment, if it is felt that modelling would usefully contribute to the development of a proportionate and balanced action plan.

3.4 Sources of information used in this report

Internal (WCBC)	Public Protection Department – Environmental Protection Section. Planning Department – Policy/Implementation Housing Department. Transport and Engineering Services Department
External	The Environment Agency The Operators of Part A and B processes Neighbouring Local Authorities Community Councils Department for Environment, Food and Rural Affairs The Welsh Assembly Government Brymbo Developments Limited

References

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Department of the Environment, Transport and the Regions (2000), 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland Working Together for Clean Air'. The Stationary Office

Department of the Environment, Transport and the Regions (1999), Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 'Air Quality'. The Stationary Office

Review and Assessment: Pollution Specific Guidance, LAQM. TG4(00)

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Wrexham Air Quality Strategy; Air Quality Review Stage 1 Report, Wrexham County Borough Council 1998

Home Energy Conservation Act 1995 (HECA): Third Report, 2000/01. Wrexham County Borough Council

The Air Quality Limit Values (Wales) Regulations 2001, National Assembly for Wales, Statutory Instrument 2001 No.2683(W.224)

Air Quality Strategy: Particles, Benzene, Carbon Monoxide and Polycyclic Aromatic Hydrocarbons, Department for Environment Food and Rural Affairs Web site :www.defra.gov.uk/environment/consult/airqual

4.0 Fine Particulates (PM_{10})

4.1 Description and Source

4.1.1 A detailed description is contained in the Stage 2 Review and Assessment document. This section should be read in conjunction with that report.

4.1.2 In UK towns and cities, past concentrations of particulates in the form of smog, from the burning of coal during the winter months on domestic fires, was responsible for high mortality amongst the elderly and chronically ill. In 1956 the Clean Air Act introduced the concept of smoke control areas. In the town of Wrexham the majority of households are situated within smoke control areas. These have proved to be a most effective way of reducing ground level particulate (smoke) concentrations within the main urban area.

4.1.3 There is growing evidence that it is the finer fraction of particles $PM_{2.5}$ or smaller, that has the greater significance for health. Particles with a diameter of less than about 4 microns penetrate deeply into the lungs and therefore can cause aggravation to susceptible individuals who suffer from respiratory or cardiovascular disease. Particulates can also affect asthmatics and trigger hay fever and eczema.

Standard and Objectives for PM_{10}
The Government has adopted a running 24-hour average of 50 ug/m^3 Air Quality Standard, with an objective for the Standard to be achieved as the annual 99th percentile of daily maximum running 24-hour averages (that is no more than 35 days exceeding the Standard in a year), by the end of 2004. The annual mean is 40ug/m^3

4.2 Stage 3 Review and Assessment of PM_{10}

4.2.1 The Third Stage Review and Assessment of PM_{10} focuses on the following areas:-

- The monitoring of PM10 directly attributable to coal burning in Llay
- The contribution of PM_{10} attributable to the Kronospan factory site and also coal burning in Chirk.
- An assessment of coal burning within the Brymbo / Broughton areas.

4.3 Background Concentrations

4.3.1 As there is limited data from local monitoring, information regarding the background concentrations of PM_{10} within the area have been obtained from the NETCEN web site.

Local regional data indicates a **particulate background concentration of 17.6 - 20 ug/m^3** on the air quality web site (1996) http:/www.aeat.co.uk/netcen/airqual

4.4 Assessment of Domestic Solid Fuel Burning

4.4.1 UK estimates of atmospheric smoke suggests that 37% originates from domestic sources. Smoke is made up of unburned particles of carbon (soot), tar particles, hydrocarbons and sulphur dioxide. Smoke from domestic chimneys is emitted at low level and is less likely to be dispersed in the atmosphere. Smoke can have a significant impact on air quality as a source of SO_2 and PM_{10}.

4.4.2 Solid fuel burning for domestic heating has largely been replaced by alternative fuels throughout most of the United Kingdom. However, Wrexham is a traditional coal mining area and there are still a significant number of properties which burn solid fuel.

4.4.3 Approximately two thirds of the housing areas within the town of Wrexham are covered by Smoke Control Areas. The Department is concerned about elevated levels of PM_{10} which may arise due to coal burning in the urban villages which surround the town.

4.4.4 Figures taken from the Home Energy Conservation Act 1995 (HECA): Third Report, 2000/2001 state that of the 51,783 homes within the Wrexham County Borough Council area approximately 5,400 properties still burn solid fuel. Of this figure approximately 28% are private sector houses and the remaining 72% are public sector houses (1997 Data). Figures for the year 2000 suggest that the number of public sector properties burning solid fuel has fallen from 3,892 (1997 Data) to 2,750 (April 2000). Also during the financial year April 2000 to March 2001 another 600 new heating systems were installed into Council owned properties; of these systems approximately 90% were gas fuel systems.

4.4.5 Initially there were concerns about the number of households burning coal in the areas, which were eligible for the concessionary coal scheme. This was discussed with the Coal Authority and they confirmed that 20 households receive concessionary coal and an additional 7 properties receive concessionary smokeless fuel in Llay. In Chirk 5 people receive normal coal and 2 receive smokeless coal, and in the Brymbo area 2 receive bituminous coal and 1 household receives smokeless fuel. This is a very small number which would not solely account for elevated levels of PM10. In general the local residents who have coal fires use a larger quantity of normal coal than they would smokeless fuel. Although smokeless coal has a higher calorific value it is perceived to be more expensive to use.

4.5 General Methodology

4.5.1 In order to assess the significance of coal burning, particulate monitors were placed in each of the highlighted areas. As the majority of the properties still burning coal are council houses, details of numbers and locations were obtained from the Estate Offices of the Housing Department of Wrexham County Borough Council. In areas where private sector properties were thought to still be burning coal evening visits were made to quantify the potential figures.

4.5.2 Efforts were made to contact coal merchants in the Wrexham County Borough area. However the information provided was sparse and there were concerns about why the Council wanted this information.

4.5.3 The results of this preliminary investigation indicated that the areas in question were relatively small and closely defined. It was therefore decided not to follow the methodology described in LAQM.TG2(00).

4.5.4 PM_{10} monitoring is fundamentally different from the measurement of gaseous pollutants, and the methods are generally less accurate than those for gaseous pollutants. A wide variety of different sampling and detection methodologies are available for ambient particulate measurements.

4.5.5 As the results were needed for the Stage 3 Review and Assessment the equipment selected had to be capable of providing results of acceptable accuracy and precision. It was decided that we would use the Partisol-Plus, model 2025, gravimetric sampler. The Partisol-Plus, model 2025 is a sequential air sampler has been designed to meet the regulatory monitoring requirements of $PM_{2.5}$ and PM_{10} and other particulate sampling methods in the USA, Europe and other countries.

4.5.6 This piece of equipment holds the USEPA reference designation for the sampling of PM_{10} . It also contains an aerodynamically tested PM_{10} inlet head and an accurate flow control system.

4.5.7 Details of the filter handling procedures are contained within Appendix 2. All of the filter handling and weighing was undertaken by an experienced member of staff. The pre and post conditioning and the weighing of the filters was undertaken at the Trading Standards Laboratory, Ruthin Road, Wrexham. The laboratory is NAMAS accredited.

4.5.8 The monitoring points in each of the areas are considered to be relevant locations in terms of public exposure. The monitoring positions were selected using the guidance contained in LAQM.TG4(00).

4.6 Methodology and Results of the PM_{10} Monitoring in Llay.

4.6.1 The main area of concern in terms of coal burning in Llay was an area of the Council housing estate which currently does not have access to the local gas supply. Approximately 330 houses in the estate still burn solid fuel. The location of these properties is indicated on a map contained within Appendix 1. Although this is a large estate when compared to others in the Wrexham Area, it is small compared to estates in major urban conurbations. The layout of this estate is based around a series of circular avenues, creating the potential for poor dispersion and a canyon effect.

4.6.2 The PM_{10} sampler in Llay was positioned at the Housing Estate Office, which is a former council house located in the centre of the coal burning area of the housing estate. The site has not undergone any changes during the monitoring period. The sampler has been sited in as open an area as possible. The position of the monitoring equipment is indicated on a map contained within Appendix 1.

4.6.3 The particulate monitoring in Llay, using the Partisol Plus machine started on 26 July 2001 and ended on 12 February 2002. During this 202 day period 159 readings were taken. This is a data capture rate of approximately 79%. During the monitoring period 35 failures of the 24 hour mean were recorded. The mean level, for the monitoring period was 36.17$\mu g/m^3$. It is considered that all of these exceedences of the PM_{10} limit values are directly attributable to the coal burning in the central area of the council housing estate.

4.6.4 The first exceedence of the 24 hour mean value of 50 $\mu g/m^3$ occurred on 25 September 2001. From the beginning of the monitoring period until mid August the average daily mean was 11 μg/m3. During this period it is unlikely that coal burning would have been taking place. From mid August to 21 September the average daily mean increased to 20$\mu g/m^3$, this probably indicates that some coal burning had started to take place. From 21 September onwards the average daily mean was 45.2$\mu g/m^3$.

4.6.5 The most notable period occurred between 28 December 2001 and 11 January 2002 when 11 exceedences of the 24 hour mean were recorded. The average daily mean through this short period was 69.7$\mu g/m^3$.

4.6.6 Visits were also made to the area during late afternoon and early evening periods. The distinct odour of coal burning was noted in the area on each occasion and smoke from the chimneys in the area was failing to disperse resulting in individual plumes from the various chimneys falling straight back to ground level.

4.6.7 Two filters from the Partisol Plus sampling equipment, which was located in Llay have been analysed using a Scanning Electron Microscopy (SEM). The analysis has revealed that the particulate on the filter originates from coal burning.

4.7 Methodology and Results of the PM_{10} Sampling in Chirk

4.7.1 In Chirk two sources of PM_{10} were highlighted :-

i) Emissions of PM_{10} from coal burning in the area.

ii) Fugitive emissions of wood particles from the Kronospan factory, located at the Maesgwyn Farm Site. The factory manufactures MDF and Fibreboard.

4.7.2 Approximately 180 of the Council properties in Chirk still burn solid fuel, as do approximately 120 private sector dwellings. The majority of the private dwellings which still burn solid fuel are located within the Maes Y Waen estate, the Trevor Road, Shepherds Lane and the Castle Road areas of the town. The location of these dwellings are indicated on a map contained within Appendix 1. It is similar in some respects to Llay, where the layout of some of the estates appear to encourage poor dispersal. In addition topographical features also play a part as Chirk is located in a steep sided valley. Poor dispersion of emissions from the Kronospan site has been noted over the last few years.

4.7.3 The Kronospan Ltd site at Maesgwyn Farm, Holyhead Road, Chirk manufactures chipboard and MDF. The plant holds both a Part A and a Part B Authorisation. The location of the Kronospan site is indicated on the map of Chirk within Appendix 1.

4.7.4 PM_{10} sampling in Chirk was undertaken using a Partisol Plus machine. The equipment was located in the garden of a residential property, 1 West View, Chirk. The site is indicated on a map contained within Appendix 1.This location was chosen because it was central, on the edge of the coal burning areas of the town and opposite the Kronospan site. The monitoring began on 4 August 2001 and ended on 12 February 2002. During this 192 day period 164 readings were taken. This equates to a data capture rate of approximately 85.5%. The average daily mean throughout the period was 25.4$\mu g/m^3$ and 20 failures were recorded.

4.7.5 The first failure occurred on 13 October 2001.The number of failures of the 24 hour mean in Chirk is significantly influenced by the monitoring period between 29 December 2001 and 11 January 2002 when 10 failures were noted. The average daily mean during this 14 day period was 56.25$\mu g/m^3$.

4.7.6 Filters from the Partisol Plus machine have also been analysed in order to distinguish between the particulate arising from coal burning and the wood particles from the Kronospan site. Scanning Electron Microscopy has concluded that the major source of PM_{10} in Chirk is the domestic burning of solid fuel. Very small quantities of wood dusts were present on the filters.

4.8 Methodology and Results of the PM_{10} Monitoring in Brymbo and Broughton

4.8.1 The other area of interest in terms of coal burning is Brymbo and the surrounding areas of New Broughton, Southsea, Caego, Moss, Tan-Y-Fron and Pentre Broughton. Monitoring had been undertaken by this Department between June and September 1997 and from November 1998 to February 1999. The monitoring was undertaken using a Partisol 2000 Air Sampler. Episodes of elevated levels of PM_{10} were recorded during the winter months. However since this monitoring was undertaken, upgrading work to the central heating systems of a large number of council properties has taken place.

4.8.2 Of the 1300 public sector properties located in the Brymbo / Broughton area 293 had open fires (March 2000 figure). However between April 2000 and March 2001, 220 central heating systems were installed and of these only 7 use solid fuel as a source of energy. This means that the number of Council properties still burning coal, throughout the area has fallen to less than 100. Therefore it is likely that the significance of coal burning in this area has fallen and hence it is very unlikely that the air quality objective for PM_{10} will be exceeded.

4.8.3 Due to financial and time constraint, and the fact that the objective was very unlikely to be exceeded, the Council has relied upon monitoring information supplied by Brymbo Developments Limited (BDL) and the Transport and Engineering Services Department of Wrexham County Borough Council. Brymbo Developments Limited have undertaken particulate monitoring at various locations in the Brymbo area, in order to establish background levels in the vicinity prior to the forthcoming redevelopment of the former steelworks site.

4.8.4 The monitoring by both BDL and the Transport and Engineering Services Department has been undertaken using a Turnkey OSIRIS airborne particle monitor. The Company claims that the instruments are sensitive to airborne concentrations down to a fraction of a microgram per cubic metre and as such they meet the sensitivity requirements of the new European Directives and DEFRA guidelines for PM_{10}.

4.9.5 The monitoring began on 30 May 2001 and is continuing. There has been an approximate data capture rate of 93.5%. Two exceedences of the 24 hour limit value for particulate have been recorded; up to 18 March 2002. This monitoring will continue for the foreseeable future in order to assess the impact of the proposed construction work on the local community.

4.9.6 The recorded monthly averages can be seen below. It should be noted that all figures have been converted to gravimetric values:-

Month	24 Hour Average ($\mu g/m^3$)
May	**12.35**
June	**14.47**
July	**19.70**
August	**14.70**
September	**15.40**
October	**19.24**
November	**13.50**
December	**13.40**
January	**15.92**
February	**16.37**
March	**23.00**
Overall Average	**16.20**

4.8.7 Although the Public Protection Department has had little control over how the monitoring was undertaken it is satisfied with the quality of the data.

4.9 Comments

4.9.1 Due to time constraints the particulate monitoring at Llay and Chirk was undertaken over a 6 month period rather than the recommended 12 months. The data capture rate for Chirk was 85.5% and for Llay 79%. These are slightly below the values discussed in LAQM.TG4(00). The Council is however satisfied with the quality of the data.

4.9.2 Due to the compact nature of the areas in question, no modelling has been undertaken.

4.9.3 Exceedences from the Llay and Chirk data have been compared to the values obtained at Brymbo, and the 24 hour average PM_{10} levels from the automatic site at Liverpool, which is the nearest air quality monitoring station in the national network. Between 10 October 2001 and 21 February 2002 only 2 exceedences of the 50$\mu g/m^3$ 24 hour average have occurred at the Liverpool site. These were on 11 and 12 December 2001. Exceedences of the air quality objective value were also recorded in both Llay and Chirk on the 12 December and also between 1 and 10 January 2002 there were daily exceedences of the 24 hour limit value. However, in Liverpool no exceedences were noted and the daily average during this period was 29.3$\mu g/m^3$. A comparison of local monitoring data exceedences and the information from the Liverpool site can be found in Appendix 4.

4.10 Conclusions and Recommendations

As a result of the Third Stage Review and Assessment the following have been highlighted:-

4.10.1 The PM_{10} monitoring, which was undertaken for 6 months, in Llay recorded 35 failures of the 24 hour mean standard for particulate. Therefore it is the Council's intention to consider declaring an Air Quality Management Area. A number of options will be evaluated to improve the local air quality, including the declaration of a Smoke Control Area.

4.10.2 The particulate monitoring in Chirk noted 20 failures of the 24 hour PM_{10} limit during the 6 month monitoring period. In order to assess whether the amount of coal burning in this area is going to result in more than 35 annual failures of the 24 hour mean standard, the following information has been considered:-

4.10.3 A doubling of the 20 breaches recorded during the 6 month monitoring period would give a figure of 40 failures. However this number is likely to be a significant overestimate of the true picture. Therefore it has been assumed that during the months of June, July and August very little coal is burnt. This, to a certain degree, is supported by the PM10 monitoring results for August 2001 where the average daily mean was below 15 $\mu g/m^3$ and results from other areas of the County Borough. Using this premise a figure of 30 failures a year is obtained. This is below the 35 exceedences per year limit.

4.10.4 Therefore it has been decided not to declare an Air Quality Management area in Chirk.

4.10.5 In order to improve local air quality consideration will be given to declaring a Smoke Control Area in Chirk.

4.10.6 A campaign to encourage the use of smokeless fuels throughout the Wrexham County Borough Council Area will also be initiated.

4.10.7 To maintain the air quality in the Brymbo / Broughton area the Public Protection Department will continue to receive monitoring results from BDL for the Brymbo area and to possibly undertake independent monitoring using the Councils equipment.

4.10.8 The Public Protection Department will undertake further particulate monitoring in both Llay and Chirk, this will include:-

a) additional ambient monitoring in the vicinity of Llay and Chirk using the Partisol Plus monitors.

b) obtaining representative local weather data (wind speed and direction, temperature inversions, atmospheric stability, temperature).

c) comparison of the results with the data obtained from the permanent air quality monitoring station in Victoria Road, Wrexham and the Liverpool monitoring site.

5.0 Sulphur Dioxide (SO_2)

5.1 Introduction

5.1.1 The results of the Stage 2 Review and Assessment indicated potentially significant sources of SO_2 in the urban villages of Chirk and Llay which required further investigation in order to quantify the situation.

5.1.2 Air pollution episodes, where sudden increases in the ground level concentration of smoke and sulphur dioxide occur, have been associated with acute effects on health.

Standard and Objectives for Sulphur Dioxide
The current provisional Standard for sulphur dioxide is a 100ppb (266ug/m^3) as a 15-minute mean measured as the 99.9th percentile in a calendar year (35 exceedences from 35,040 measurements) to be achieved by 2005.
A 1-hour mean objective of 132ppb (350ug/m^3) to be exceeded no more than 24 times a year and a 24 hour mean objective of 47ppb (125ug/m^3) not to be exceeded more than 3 times a year. Objectives to be achieved by 2004.

5.1.3 The analysis of 1995 National air quality data has indicated that high SO_2 levels were caused by plumes from smaller combustion plant point sources and diffuse low level sources, associated with areas where coal remains a popular domestic heating fuel.

5.2 Stage 3 Review and Assessment of SO_2

5.2.1 The Third Stage Review and Assessment of SO_2 focuses on the following areas :-

- The monitoring of SO_2 directly attributable to coal burning in Llay
- The contribution of SO_2 attributable to coal burning in Chirk.

5.3 Background Levels

Local regional data indicates an SO_2 background concentration of 6.71 – 10.36 ug/m^3 according to information on the air quality internet site (www.aeat.co.uk/netcen/airqual).

5.3.1 It should be noted that the 1996 sulphur dioxide map from the NETCEN web site indicates that SO_2 levels in the County Borough are higher than those which have been measured locally. From the map, the levels of SO_2 vary between 12.1-15ppb (32.2-39.9ug/m^3) in the main urban area and along the main roads to between 8.1-12ppb (21.5-31.9ug/m^3) in the remainder of the urban villages/towns surrounding Wrexham. Local monitoring results indicate levels which are nearer to local regional levels (according to information on the air quality internet site www.aeat.co.uk/netcen/airqual) which indicates an SO_2 background concentration of 6.71 – 10.36 ug/m^3 .

5.3.2 NETCEN was contacted during the Stage 1 Review and Assessment and the high SO_2 levels indicated for Wrexham were queried. It was acknowledged by NETCEN that some of the information for SO_2 levels may have been out of date at the time of producing the map. Indeed Brymbo Steelworks, which would have been a major point source of SO_2 emissions, has been closed for a number of years.

5.4 Assessment of Domestic Solid Fuel Burning

5.4.1 UK estimates of atmospheric smoke suggests that 37% originates from domestic sources. Smoke is made up of unburned particles of carbon (soot), tar particles, hydrocarbons and sulphur dioxide. Smoke from domestic chimneys is emitted at low level and is less likely to be dispersed in the atmosphere. Smoke can have a significant impact on air quality as a source of SO_2 and PM_{10}.

5.4.2 Solid fuel burning for domestic heating has largely been replaced by alternative fuels throughout most of the United Kingdom. However, Wrexham is a traditional coal mining area and there is still a significant number of properties which burn solid fuel.

5.4.3 Approximately two thirds of the housing areas within the town of Wrexham are covered by Smoke Control Areas. The Department is concerned about elevated levels of SO_2 which may arise due to coal burning in the urban villages which surround the town.

5.4.4 Figures taken from the Home Energy Conservation Act 1995 (HECA): Third Report, 2000/2001 state that of the 51,783 homes within the Wrexham County Borough Council area approximately 5,400 properties still burn solid fuel. Of this figure approximately 28% are private sector houses the remaining 72% are public sector houses (1997 Data). Figures for the year 2000 suggest that the number of public sector properties burning solid fuel has fallen from 3,892 (1997 Data) to 2,750 (April 2000). Also during the financial year April 2000 to March 2001 another 600 new heating systems were installed into Council owned properties; of these systems approximately 90% were gas fuel systems.

5.4.5 Initially there were concerns about the number of households in the areas which were eligible for the concessionary coal scheme. This was discussed with the Coal Authority and they confirmed that 20 households receive concessionary coal and an additional 7 properties receive concessionary smokeless fuel in Llay. In Chirk 5 people receive normal coal and 2 receive smokeless coal and in the Brymbo area 2 receive bituminous coal and 1 household receives smokeless fuel. People receive a larger quantity of normal coal than they would smokeless fuel, however smokeless coal has a higher calorific value.

5.5 General Methodology

5.5.1 In order to assess the significance of coal burning, sulphur dioxide monitors were placed in each of the highlighted areas. As the majority of the properties still burning coal are council houses details in terms of numbers and locations were obtained from the Estate Offices of the Housing Department of Wrexham County Borough Council. In areas where private sector properties were thought to still be burning coal evening visits were made to quantify the potential figures.

5.5.2 Efforts were made to contact coal merchants in the Wrexham County Borough area, however the information provided was sparse and there were concerns about why the Council wanted this information. Therefore as we felt that as the areas we were dealing with were relatively small and defined it was decided not to follow the methodology described in LAQM.TG2(00).

5.5.3 As the results were needed for a Stage 3 Review and Assessment the equipment selected had to be capable of providing results of acceptable accuracy and precision. It was decided to use UV florescent samplers (Monitor Labs 8850 analyser) with a filtered UV source and a PMT detection system. The results were recorded on an automatic data logger and transmitted to ETI (the monitoring company) via a modem. This type of sampling method is deemed as an appropriate method in LAQM.TG4(00).

5.5.4 The monitoring was undertaken by ETI Environment Technology and the results were presented to Wrexham County Borough Council in terms of the 24 hour, the 1 hour and the 15 minute objectives.

5.5.5 The monitoring points in each of the areas were considered to be relevant locations in terms of public exposure. The monitoring positions were selected using the guidance contained in LAQM.TG4(00).

5.6 Methodology and Results of the Sulphur Dioxide Monitoring in Llay.

5.6.1 A large number of the Council properties in Llay still burn solid fuel, this is mainly due to the fact that there is no mains gas supply accessible in these areas of Llay.

5.6.2 For operational reasons the monitoring equipment was located at the Community centre in Llay, which is approximately 50 metres from the site of the particulate monitor. Details of the quality control and the operational procedures used/followed can be found in Appendix 3.

5.6.3 The monitoring period in Llay was from 24 July 2001 to 31 December 2001. During this period there was a 96% data capture rate.

5.6.4 In terms of the 24 hour averages there were no exceedences of the 125μg/m^3 limit value. The lowest value recorded was 1.33 μg/m^3, and the highest level recorded throughout the period was 54.8μg/m^3. The daily average throughout the monitoring period was 10.7μg/m^3.

5.6.5 In general the levels noted in Llay were higher than those recorded in Chirk, particularly during the winter months.

Month	**Average 24 hour mean (μg/m^3)**
July	**4.15**
August	**7.45**
September	**12.24**
October	**8.50**
November	**13.40**
December	**18.50**

5.6.6 No exceedences of the 1 hour mean limit value of 350μg/m^3 were recorded. The values varied between 0.53 and 131 μg/m^3.

5.6.7 With reference to the 15 minute mean value of 266μg/m^3 again there were no exceedences. The levels recorded varied from 0.26 to 174.5μg/m^3.

5.7 Methodology and Results of the SO_2 Monitoring in Chirk

5.7.1 Approximately 180 of the Council properties in Chirk still burn solid fuel, as do approximately 120 private sector dwellings. The majority of the private dwellings which still burn solid fuel are located within the Maes Y Waen estate, the Trevor Road, Shepherds Lane and the Castle Road areas of the town. The location of these dwellings are indicated on a map contained within Appendix 1.

5.7.2 The monitoring equipment was located in the garden of 1 West View in Chirk. The particulate monitoring equipment was also placed at this location.

5.7.3 The monitoring period in Chirk was from 3 August 2001 to 3 January 2002. During this period there was a 98% data capture rate.

5.7.4 The results of the sulphur dioxide monitoring undertaken in Chirk are discussed below:-

In terms of the 24 hour averages there were no exceedences of the 125μg/m^3 limit value. The lowest value recorded was 1.86 μg/m^3, and the highest level recorded throughout the period was 60μg/m^3. The daily average throughout the monitoring period was 8.51μg/m^3.

The daily monthly averages showed little variation, with the exception of December when the figure was slightly higher.

Month	Average 24 hour mean ($\mu g/m^3$)
August	**8.70**
September	**7.13**
October	**5.02**
November	**8.25**
December	**13.40**

No exceedences of the 1 hour mean limit value of 350$\mu g/m^3$ were recorded. The values varied between 0.266 and 190.45 $\mu g/m^3$.

With reference to the 15 minute mean value of 266$\mu g/m^3$ again there were no exceedences. The levels recorded varied from 0.8 to 203.5$\mu g/m^3$.

5.8 Comments

5.8.1 Due to financial and time constraints only 5 months of monitoring were completed. No sulphur dioxide monitoring was undertaken in Brymbo. This was also due to financial and time restrictions. The reason that the Brymbo area was not targeted was the fact that the majority of the heating systems in the Council's housing stock had been converted from solid fuel to gas. If the recent particulate monitoring results had indicated a potential problem efforts would have been made to undertake continuous SO_2 monitoring. However, as there were very few exceedences of the PM_{10} limit value it is considered that domestic coal burning is no longer a significant issue in this area. Therefore there is no reason to give further consideration to SO_2 monitoring at this time.

5.9 Conclusions and Recommendations

5.9.1 There were no breeches of any of the sulphur dioxide limit values in either Llay or Chirk. Although elevated levels of PM_{10} have been demonstrated sulphur dioxide did not appear to be significantly influenced by local coal burning. Therefore, at the present time, the Council does not intend to proceed any further with the monitoring of SO_2.

6.0 Discussions and conclusions

6.0.1 Although the perception of Wrexham County Borough may be that of any industrial mining town, much has changed within the last twenty years. The local pits have closed and the majority of industry in the area can be described as light industrial. In proportion to the whole community very few households use coal as a source of domestic heating.

6.0.2 The Stage1 Review and Assessment indicated that the number of potential domestic coal burning households fell below the trigger level required to carry out a Stage 2 assessment. The Stage 2 Assessment revealed a significant shortfall in local monitoring data for particulates and sulphur dioxide in areas where clusters of residential properties still burn coal. Therefore it was necessary to undertake a Stage 3 Review and Assessment in order to determine the significance of coal burning in these areas.

6.0.3 It is well known that during the winter months cold stable weather conditions can give rise to pollutants close to ground, near to sources and inhibit their dispersion (Environment Agency 2000). These atmospheric conditions gave rise to the sooty or smoky fogs, which were prevalent in the early Twentieth Century, most notably the London Fogs of 1952. The particulate pollution resulting from domestic coal burning, recorded in Llay and to some extent in Chirk could not be compared in terms of severity to these past events. However, they are created by the same type of conditions.

6.0.4 Recent olfactory assessments of these emissions have been undertaken on a number of occasions. These have demonstrated a reduction in the air quality, affecting very localised areas in both Llay and Chirk. A characteristic sooty odour was witnessed accompanied by the grounding of the individual chimney plumes only metres from each property.

6.0.5 There were no breaches of any of the sulphur dioxide limit values in either Llay or Chirk. Although elevated levels of PM_{10} have been demonstrated, sulphur dioxide levels do not appear to be significantly influenced by local coal burning in this case. Therefore, at the present time, the Council does not intend to proceed any further with the monitoring of SO_2.

6.0.6 It is rare for local authorities in England, Scotland or Ireland to carry out a Stage 3 Review and Assessment on the basis of domestic coal burning. No other Local Authority in Wales has carried out a stage 3 Review and Assessment to investigate local coal burning.

6.0.7 It is clear from the results of the monitoring that at an intra-local level domestic coal burning may be more significant than previously thought. This is an issue that may warrant further examination and a review of the current methodology/guidance.

6.0.8 The Public Protection Department of Wrexham County Borough Council, will consider the declaration of an Air Quality Management

Area in Llay. If the Council do decide to declare an AQMA a Stage 4 Report will be produced and an Air Quality Action Plan will be implemented. This would contain a cost / benefit analysis of the various options available to ensure reduction of the current winter PM10 levels to meet current objective standards.

7.0 Recommendations For Future Reviews and Assessments

7.1 This report has identified a number of recommendations for future reviews and assessments.

These will include :-

- Consideration of the appropriateness of declaring an Air Quality Management Area in Llay.

- Assessing the costs and benefits of declaring Smoke Control Areas in Llay and Chirk. Also assessing the need to designate Smoke Control Areas in other towns or villages within the Wrexham County Borough Council Area.

- The Council has recently purchased 2 Partisol Plus Particulate samplers and it is anticipated that the monitoring of PM_{10} will resume in both Chirk and Llay in August 2002.

- The initiation of a campaign promoting the use of smokeless fuels throughout the Wrexham area.

- Continuing to receive monitoring data from Brymbo Developments Limited and the Transport and Engineering Services Department of the Council. If it is considered necessary monitoring will also be undertaken by the Public Protection Department.

- This Department will continue to liaise with the Wrexham County Borough Council Housing Department regarding the conversion of council properties heating systems from solid fuel to gas. An assessment of funding options / grant aid for such schemes will also be completed.

- At this moment in time no further action is to be taken in terms of sulphur dioxide as it is considered that the levels in the areas of concern are considerably below the emission limit values.

Also :-

The current air quality monitoring carried out as part of Wrexham County Borough Council's Air Quality Strategy will continue and will be expanded in those areas where further monitoring is required.

- The new continuous air quality monitoring station was commissioned and became operational on 1 March 2002.

- The local air quality strategy will be reviewed to account for the conclusions drawn as a result of the Stage Three Review and Assessment.

- The findings of the Stage Three Review and Assessment will also be reviewed on receipt of new or updated information.

- Progress of the Home Energy Conservation Programme, within the Wrexham County Borough Council area, will continue to be monitored.

- Future developments will have the potential to affect traffic flows and impact on emission levels. The impact of such development will need to be considered at the planning stage and procedures for dealing with such issues will be reviewed with Officers from the Public Protection Department.

- The Public Protection Department will produce Wrexham's Air Quality Strategy Document 2002