Review and Assessment of Air Quality
City and County of Swansea

The Environment Act 1995: Part IV

Local Air Quality Management

Updating and Screening Assessment July 2004

Title	**Updating and Screening Assessment July 2004**

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Date	September 2004

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1. Executive Summary

This report contains the latest Updating and Screening Assessment of air quality within the City and County of Swansea. This process forms part of the process that has become known as the second round of review and assessment. The report focuses on each of the pollutants listed within the Air Quality (Wales) Regulations 2000 which themselves have been amended with the Air Quality (Amendment) (Wales) Regulations 2002. The pollutants considered are carbon monoxide, benzene, 1,3-butadeine, lead, sulphur dioxide, particulates PM_{10} and nitrogen dioxide.

The Environment Act 1995, Part IV established a national framework for air quality management that requires all local authorities to conduct air quality reviews of their areas having had regard to any guidance issued. If the reviews undertaken indicate that the objective for any of the identified pollutants will not be met by the date for compliance then an Air Quality Management Area must be declared.

The City and County of Swansea has already undertaken the first round of review and assessment which concluded that there was a requirement to declare the Hafod area as an Air Quality Management Area.

The second round of review and assessment is divided itself into two parts:

1. Updating and Screening (this report)
2. Detailed Assessment.

The Updating and Screening assessment looks at each pollutant in light of current guidance. Should any significant changes be identified that are likely to give rise to a breach of the objectives then a Detailed Assessment must be carried out for the identified pollutant.

Each pollutant has been assessed having regard to the latest technical guidance LAQM.TG(03). The conclusions reached are that the objectives for carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide will be met and that there is no requirement to proceed to a detailed assessment. However, there is evidence that the annual mean objective for nitrogen dioxide will continue to be exceeded within the existing Hafod Air Quality management Area as well as other areas identified that lie outside of the Hafod Air Quality Management Area. There is a requirement therefore, to proceed to a detailed assessment for nitrogen dioxide within these newly identified areas at risk of failing the objective standard.

It has also been concluded that whilst the objectives for particulate matter PM_{10} will be met by the objectives date in 2004, there are provisional objectives not as yet set in regulation for 2010 that see a significant tightening of the standards. It has been decided therefore to start work early in the assessment of compliance with the as yet provisional 2010 objective.

Progress reports will contain the results of these further investigations.

2. Introduction

2.1 The Swansea area

The City and County of Swansea unitary authority covers a mixed area of extensive coastline, open moorland, rural villages and the city of Swansea itself. The latest Census (June 2000) estimate for the population of Swansea is 230,300. The 2000 Census also indicates that 46,700 (20.3%) of the population were less than 17 years of age with 41,205 (17.9%) of the population being aged 65 or over.

To the west of the City of Swansea stands the gateway to the Gower Peninsula, an officially designated Area of Outstanding Beauty that boasts wide-open beaches and rugged shorelines. To the east of the City and County of Swansea lies the only major operational traditional "heavy industry" in the form of the Corus Steelworks complex at Port Talbot. Heavy industry has declined steadily within the boundaries of the authority during the last century. This former industrial activity has left its scares – most notably to the Lower Swansea Valley. From the early 1970's the areas once blighted by slag heaps have undergone extensive remediation and greening. New "light industry" and retail outlets have moved back into the Lower Swansea Valley following the establishment of Enterprise Zone's and industrial park's.

The major source of pollution is now vehicular. The topography of the Lower Swansea Valley is complex and it is thought that this aggravates pollution loading in the area.

Swansea is connected to major road and rail links. The M4 motorway travels through northern area of the authority, connecting Swansea with Carmarthenshire in the west and to Cardiff and Bristol to the east. The major artery routes of the A483, A4067 and A48 connect Swansea city centre with the M4 motorway junctions to the north. Local traffic also use these routes as primary routes into the city centre.

Swansea is well served with rail links to the majority of the UK. The Inter-City 125 service from London Paddington terminates at Swansea. Local services operate from Swansea to mid and West Wales. A major locomotive-servicing centre operates within Swansea at Landore Diesel Sheds, primarily to service the power units of the Inter City 125 service. As would be expected, the majority of diesel locomotives operated by First Great Western are also serviced and maintained at this facility.

The older and established areas of Swansea comprise of traditional terraced housing. These areas tend to be, but are not exclusively within approximately 3 miles of the city centre. Areas of high density terraced housing still exist around the centres of population established during the Industrial Revolution.

As would be expected, new housing provision tends to be either of detached or semi-detached and during the last 20 – 30 years these developments have mainly been located in areas greater than 3 miles away from the city centre.

3 Statutory Background

Part IV of the Environment Act 1995 required the production of a national strategy for air quality. The same Act places a duty on local authorities to carryout periodic reviews of air quality to determine if they will meet the objectives set out in the National Air Quality Strategy (NAQS). The National Air Quality Strategy was first published in March 1997 with the Air Quality Regulations providing the legal footing for the air quality objective's set out in the NAQS. The NAQS uses health-based standards to control the levels of seven designated air pollutants.

The NAQS has evolved over time and has seen the NAQS revised and republished as "The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air". The revision integrated European air quality standards into UK policy and, eventually legislation for both England and the devolved administrations. In Wales the Air Quality Regulations 1997 have been superseded by the Air Quality (Wales) Regulations 2000 which themselves have been amended with the Air Quality (Amendment) (Wales) Regulations 2002 and came into effect on 31st December 2002.

3.1 Previous Review and Assessment Works

The local authority review and assessment process is multi-staged. This Authority carried out its first stage review in 1999. The conclusion reached was to progress to a second and third stage review for Benzene, Particulate Matter (PM_{10}), Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2).

Along with all other local authorities, this authority has completed its stage 2 and stage 3 reviews. The third stage review and assessment concluded that despite the indication that the air quality objective for benzene would not be met that the declaration of an AQMA was not appropriate. Given the fundamental changes proposed to the Lower Swansea Valley's infrastructure and the technical improvements proposed in the reduction in the benzene content in fuel, it was recommended that a further benzene monitoring study be carried out for a period of at least 12 months. During the stage 3 process, it was determined that the authority would not breach the objectives laid down for Particulate Matter (PM_{10}) and Sulphur Dioxide (SO_2).

Section 83(1) of the Environment Act 1995 requires the Authority to designate as Air Quality Management Areas (AQMA's) those areas where it is likely that the standards for any of the identified pollutants would be exceeded. As a result of the detailed work carried out in the authorities' third stage review and assessment it was found that areas of the Hafod were likely to fail the NO_2 annual mean objective of 40μg/m^3 by the compliance date of 31st December 2005.

On the 12th September 2001 the Authority declared The Hafod Air Quality Management Area (NO_2), cited as the City & County of Swansea (Hafod Air Quality Management Area (NO_2)) Order 2001. The Order came into force on the 14th September 2001. Annexe 1 contains a map indicating the AQMA area.

The Stage 4 review required under Section 84(1) of the Environment Act 1995 confirmed the earlier findings and that the declaration of the Hafod AQMA was justified as several locations were projected to fail the nitrogen dioxide (NO_2) annual mean objective in 2005.

Section 84 of the Environment Act 1995 requires the formulation of a written plan in pursuit of the achievement of air quality standards and objectives within the designated AQMA and has become known as the "Action Plan". The City and County of Swansea have undertaken a considerable amount of work in formulating its Action Plan. At this current time, works remain ongoing in the formulation of the Action Plan for the Hafod AQMA.

3.2 Guidance

The Department for Environment, Food and Rural Affairs (DEFRA) has issued guidance documents to assist local authorities in conducting their duties under the Environment Act 1995. In accordance with Section 88(2) of the Environment Act 1995, local authorities are required to have regard to this guidance when carrying out any their duties under, or by virtue of Part IV of the Act.

Guidance has been issued in the form of Policy Guidance LAQM.PG (03) and Technical Guidance LAQM.TG (03).

LAQM.PG (03) replaces the second set of policy guidance documents published in March 2000 namely LAQM.G1(00), LAQM.G2(00), LAQM.G3 (00), and LAQM.G4(00).

LAQM.TG (03) replaces the guidance issued previously as LAQM.TG1 (00), TG2 (00), TG3 (00) and TG4 (00).

The new guidance sets out the legislative framework for local air quality management (LAQM). It is seen as an integral part of delivering the Air Quality

Objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000, The Air Quality (Wales) Regulations 2000 and the Air Quality (Wales) (Amendment) Regulations 2002.

Following the first round of review and assessments DEFRA and the Devolved Administrations commissioned a detailed evaluation of first round of reviews and assessments undertaken by local authorities. The main aim was to look at aspects of the LAQM process that worked well and aspects that could usefully be improved upon.

The formulation of the new guidance was the subject of considerable consultation and aims to build on the experiences of the first round of reviews and assessments.

LAQM.TG(03) suggests a checklist approach be adopted. Information on the methodology to be taken and the data required for assessment is provided on a pollutant by pollutant basis.

3.3 The Role of Local Authorities

In accordance with the current policy and technical guidance documents, the second round of review and assessments of air quality is to be carried out in two stages

- **An Updating and Screening Assessment –** intended to identify aspects that have changed since the first round of review and assessment carried out (from 1999 in Swansea's case) and identifying those that require further assessment; namely

- **A Detailed Assessment** of those pollutants that have been identified as requiring further work and investigation.

The remainder of this document focuses on producing the required Updating and Screening assessment for each of the 7 identified pollutants within the NAQS and the Air Quality (Wales) Regulations 2000 and Air Quality (Wales)(Amended) Regulations 2002. The following information is included:

- Introduction on the pollutant, health effects etc.
- Standard and objective
- A review of the existing information
- A review of monitoring results where applicable and if available,
- Consideration of any potential sources i.e. industrial or road transport
- Conclusion for each pollutant.

3.4 The Air Quality (Wales) Regulations 2000 as amended by the Air Quality(Amendment)(Wales) Regulations 2002

The 2000 and 2002 Regulations provide the statutory basis for the system of Local Air Quality Management (LAQM) and prescribe the standards and objectives to be achieved for those pollutants set in regulation. The Regulations also provide dates by which these standards and objectives are to be achieved. The 2002 Amendment Regulations introduce a second air quality objective for benzene of 5μg/m^3 or less, when expressed as an annual mean, to be achieved by 31st December 2010. The 2002 Amendment Regulations also alter the air quality objective for carbon monoxide (CO), which is to be achieved by 31st December 2003 to a maximum daily running 8 hour mean of 10mg/m^3 or less.

The pollutants set in regulation together with the target dates for compliance are set out in table 1 below. Table 1 also includes the permitted exceedences allowed under the regulations.

Pollutant	Air Quality Objective		Permitted Exceedences	Compliance Date
	Concentration	Measured As		
Benzene	16.25μg/m^3	Running Annual Mean	N/a	31/12/2003
	5μg/m^3	Annual Mean	N/a	31/12/2010
1,3-Butadiene	2.25μg/m^3	Running Annual Mean	N/a	31/12/2003
[1] Carbon Monoxide	10mg/ m^3	Max daily running eight hour mean	N/a	31/12/2003
Lead	0.5μg/m^3	Annual Mean	N/a	31/12/2004
	0.25μg/m^3	Annual Mean	N/a	31/12/2008
[2] Nitrogen Dioxide	200μg/m^3	1 Hour Mean	18	31/12/2005
	40μg/m^3	Annual Mean	N/a	31/12/2005
Particles PM_{10}	50μg/m^3	24 Hour mean	35	31/12/2004
	40μg/m^3	Annual Mean	N/a	31/12/2004
Sulphur Dioxide	350μg/m^3	1 hour Mean	24	31/12/2004
	125μg/m^3	24 Hour Mean	3	31/12/2004
	266μg/m^3	15 Minute mean	35	31/12/2005

Table 1 – Objectives included in the Air Quality (Wales) Regulations 2000 and Air Quality (Wales) (Amendment) Regulations 2002

[1] As amended by the Air Quality (Wales) (Amendment) Regulations 2002

[2] The objectives for nitrogen dioxide are provisional

3.5 UK Objectives not as yet set in Regulation

The new particles objectives (PM_{10}) for 2010 announced by the Welsh Assembly Government on the 18th September 2002 are provisional objectives and will not, for the time being, be included in Regulation for purposes of LAQM in Wales. These particle objectives may be set in regulation once the EU has decided its new limit value. Therefore, the City and County of Swansea are only required to review and assess PM_{10} particles as prescribed in the Air

Quality (Wales) Regulations 2000. However, both the guidance and Welsh Assembly Government recommends that local authorities include a provisional assessment of whether or not the new particles objectives are likely to be met in their reviews and assessments. The new provisional particles PM_{10} objectives are set out below in table 2.

Pollutant	Air Quality Objective		Permitted Exceedences	Compliance Date
	Concentration	Measured As		
Particles PM_{10}	$50\mu g/m^3$	24 Hour mean	7	31/12/2010
	$20\mu g/m^3$	Annual Mean	N/a	31/12/2010

Table 2 – Provisional Particles PM_{10} Objectives for 2010

4 Updating and Screening Assessment - Carbon Monoxide

4.1 Introduction

Carbon monoxide (CO) is a colourless and odourless gas resulting from the incomplete combustion of fossil fuels. The main source of carbon monoxide in the UK is road transport, which accounted for 67% of total releases in 2000. Annual emissions of carbon monoxide have been falling steadily since the 1970's and are expected to continue to do so. Current projections are that road transport emissions of CO will decline by a further 42% between 2000 - 2005 [1]

4.2 Health Effects

The formation of carboxyhaemoglobin in the blood of people exposed to high concentrations of carbon monoxide is the principal health concern. The formation of carboxyhaemoglobin reduces the capacity of the red blood cells to carry oxygen to the various parts of the body. The first sign of severe poisoning is loss of consciousness with subsequent inhalation of high concentrations leading to death.

In normal, exposed people, the levels of carboxyhaemoglobin found in the blood are below 1%. Non-smokers, exposed at rest to CO concentrations of 25-50 parts per million (ppm) might show carboxyhaemoglobin levels of 2-3%

[1] Source Technical Guidance LAQM.TG(03) Chapter 2 page 2-1

after several hours. Smokers on the other hand may have carboxyhaemoglobin levels between 4% and 15%.[2]

4.3 Standard and Objective

The Air Quality (Wales) Regulations 2000 were amended by the Air Quality (Amendment) (Wales) Regulations 2002 which came into force on 31st December 2002 to a maximum CO daily running eight hour mean of 10mg/m^3 to be achieved by 31st December 2003.

4.4 Review of Existing Information

4.4.1 Authorised Processes

The first round of review and assessment process did not identify any Part B processes within the authorities area with the potential to emit significant quantities of carbon monoxide. This situation remains the same with the Part B authorisations and also within the current A2 permits issued under the Integrated Pollution Prevention and Control (IPPC) regime regulated by this authority.

The first round review did, however, identify several Part A processes with the potential to emit significant quantities of CO. These are summarised below in table 3. The conclusion reached however was that the releases from these processes would not cause a breach of the Air Quality Regulations at the nearest receptor location.

[2] Source Expert Panel on Air Quality Standards – Carbon Monoxide

Process	Company	Address
Non ferrous	Alcoa manufacturing (GB) Ltd	Waunarlwydd Works, PO Box 68
Non ferrous	IMCO Recycling (UK) Ltd	Waunarlwydd Works, Swansea
Non Ferrous Inorganics	INCO Europe Ltd	Clydach Refinery, Clydach, Swansea
Non ferrous	ITW Limited	Signode Division, Queensway, Fforestfach Industrial Estate, Swansea
Inorganics	Viscose Closures Ltd	Ferryboat Close, Enterprise Park, Swansea.

Table 3 Part A Process with potential to emit significant quantities of carbon monoxide [3]

These processes are now regulated by the Environment Agency and have been issued with A1 permits under the IPPC regime. The details relating to the above processes have been checked on the public register for these A1 processes and the conclusion reached within the first round of review and assessment process remains the same.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

4.4.2 Road Transport Emissions

Guidance contained within LAQM.TG(03) requires that "very busy" roads or junctions in built up areas be identified to determine whether there is relevant exposure within 10m of the kerb or 20m in major conurbation's. Very busy roads are defined within LAQM.TG(03) as :

[3] Source – City and County of Swansea First Round Review and Assessment page 37

- Single carriageway roads with daily average traffic flows in excess of 80,000 vehicles per day
- Dual carriageway roads with daily average traffic flows which exceed 120,000 vehicles per day
- Motorways with daily average traffic flows of 140,000 vehicles per day

Information held by the City and County of Swansea indicates that traffic flows on even the busiest of roads (the A483 dual carriageway) are approximately half the qualifying criteria for the definition of a very busy single carriageway road. Even if traffic flows are combined at a junction, no carriageway or junction meets the criteria that would require that a detailed assessment be made.

4.4.3 Monitoring data within an AQMA

The City and County of Swansea operate the Morfa Groundhog station, which is located within the Hafod Air Quality Management Area. The station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. All equipment is housed within an air-conditioned unit and operates continuously. Carbon monoxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time CO analyser. Receptor locations are within 25m of the site.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

The CO 8-hour running mean data has been examined for 2001, 2002 and 2003 and the results are summarised below in table 4.

The 8-hour running means have been calculated from hourly average concentrations. The running 8-hour mean for a particular hour, is the mean of the hourly average concentrations for that hour and the preceding 7 hours. The average period is stepped forward by one hour for each value, so running mean values are given for the periods 00:00 – 07:59, 01:00 – 08:59 etc. There are, therefore, 24 possible 8-hour means in a day (calculated from hourly data). In order for a running average to be valid, 75% data capture is required i.e. 6 hourly averages out of every 8 must be valid. The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day.[4]

The hourly means have themselves been calculated by the OPSIS Reporter software package from 15-minute mean data. In order to form a valid 1-hour mean 75% data capture i.e. three out of every four 15 minute periods, was stipulated for the compilation of the hourly mean.

Year	Max 8-hour running mean
2001	5.6mg/m^3
2002	2.32 mg/m^3
2003	5.9 mg/m^3

Table 4 – CO 8-hour running mean data – Morfa Groundhog

4.4.4 Monitoring data from outside an AQMA

The City and County of Swansea operate the Swansea AURN and Morriston Groundhog stations, which are both located outside the Hafod Air Quality Management Area.

The Swansea AURN network is affiliated onto the UK National Monitoring Network and has a classification of an urban background site. The station has been operational in its present location since June 1995. All equipment is housed within an air-conditioned unit and operates continuously. Carbon monoxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time CO analyser.

The station is subject to full network QA/QC procedure's undertaken by NETCEN and AEA Technology on behalf of the Department of Environment, Food and Rural Affairs (DEFRA) and Welsh Assembly Government.

The Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Hafod AQMA boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45.

Carbon monoxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time CO analyser.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

[4] Source LAQM.TG(03) – Monitoring - Calculation of exceedence statistics, paragraph A1.104 page A1-37.

The CO 8-hour running mean data from both stations have been examined for 2001, 2002 and 2003 and the results are summarised below in table 5.

The 8-hour running means have been calculated from hourly average concentrations. The running 8-hour mean for a particular hour, is the mean of the hourly average concentrations for that hour and the preceding 7 hours. The average period is stepped forward by one hour for each value, so running mean values are given for the periods 00:00 – 07:59, 01:00 – 08:59 etc. There are, therefore, 24 possible 8-hour means in a day (calculated from hourly data). In order for a running average to be valid, 75% data capture is required i.e. 6 hourly averages out of every 8 must be valid. The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day.[5]

The hourly means have themselves been calculated by the OPSIS Reporter software package from 15-minute mean data. In order to form a valid 1-hour mean 75% data capture i.e. three out of every four 15 minute periods, was stipulated for the compilation of the hourly mean.

Year	Max 8-hour running mean	
	Swansea AURN *	Morriston Groundhog
2001	3.24 mg/m^3	5.28 mg/m^3
2002	2.72 mg/m^3	2.74 mg/m^3
2003	2.20 mg/m^3	2.51 mg/m^3

Table 5 - *CO 8-hour running mean data – Swansea AURN and Morriston Groundhog*

** Fully verified and ratified dataset provided by NETCEN / AEA Technology*

[5] Source LAQM.TG(03) – Monitoring – Calculation of exceedence statistics, paragraph A1.104 page A1-37.

4.5 Conclusion of USA for Carbon Monoxide

Having reviewed the information contained in the check list approach detailed in LAQM.TG(03) it is the opinion of this authority that the objective contained within the National Air Quality Strategy and the Air Quality (Amendment) (Wales) Regulations 2002 of a maximum daily 8-hour running mean of 10mg/m^3 were achieved at all locations within the boundaries of the authority at the objective date of 31st December 2003.

There is no requirement therefore to progress to a detailed assessment for carbon monoxide.

5 Updating and Screening Assessment for Benzene

5.1 Introduction

Benzene is a volatile organic compound. In the UK the main atmospheric source is the combustion and distribution of petrol. Diesel fuel is a relatively small source of benzene. The amount of benzene in petrol was, until the beginning of 2000, regulated by EU legislation to an upper limit of 5% by volume. In recent years it comprised on average 2% by volume in the UK. Since 1st January 2000, EU legislation has required that the amount of benzene in petrol be below 1% and is presently approximately 0.7% by volume for fuel sold in the UK.

The main outdoor sources of benzene remaining beyond 2005 are expected to be petrol engine vehicle exhausts together with the refining and distribution of petrol.[6]

5.2 Health effects of benzene

Benzene is a recognised genotoxic human carcinogen. Studies of industrial workers subjected to high levels of exposure have demonstrated an excess risk of leukaemia, which increased in relation to their working lifetime exposure. As benzene is a genotoxic carcinogen, no absolutely safe level can be specified for ambient air. The Expert Panel on Air Quality Standards (EPAQS) took into account the advice on the Committee of Carcinogenicity, that exposure should be kept as low as practicable and recommended a target of 3.25μg/m^3 as a

running annual mean. The UK Government and the Welsh Assembly Government included the EPAQS recommended target as a long-term policy aim.

5.3 Standard and Objective

The second EU Air Quality Daughter Directive, adopted in November 2000, sets a limit value for benzene in ambient air of 5μg/m^3 as an annual mean to be achieved by 1st January 2010.

The Welsh Assembly Government have therefore concluded that the benzene running annual mean objective of 16.25μg/m^3 as required by the Air Quality (Wales) Regulations 2000 and the NAQS to be achieved by 31st December 2003 should be strengthened. The Air Quality (Amendment)(Wales) Regulations 2002 introduce into the NAQS a new objective for benzene of 5μg/m^3 measured as an annual mean to be achieved by 31st December 2010.

5.4 Review of Existing Information

5.4.1 Authorised Processes

The first round of assessment identified no Part B processes with the potential to emit significant quantities of benzene. This situation remains the same with the Part B authorisations and also within the current A2 permits issued under the Integrated Pollution Prevention and Control (IPPC) regime regulated by this authority.

[6] Source The Air Quality Strategy for England, Scotland, Wales and Northern Ireland:Addendum

The first round assessment did however, identify several Part A processes both inside and outside of the authorities area, that had the potential to emit significant quantities of benzene. These are summarised below in table 6

Process	Company	Address
Pyrolosis, carbonisation etc.	Corus	Morfa Coke Oven Plant, Port Talbot Works
Pyrolosis, carbonisation etc.	Corus	Grange Oven Plant, Port Talbot Works
Pyrolosis, carbonisation etc.	Morganite Electrical Carbon Ltd	Upper Fforest Way, Morriston, Swansea
Pyrolosis, carbonisation etc.	Morganite Electrical Carbon Ltd	Clase Road, Morriston, Swansea
Crude Oil Handling	BOC Ltd	Langland Lane, Port Talbot
Crude Oil Handling	BP Oil UK	Llandarcy Refinery, Skewen
Petrochemicals	BP Chemical Ltd	Baglan Bay Works, Seaway Parade, Port Talbot
Organic Chemicals	Huntsman Corporation Ltd	Llanelli Chemical Plant, Heol-y-Bwlch, Bynea
Organic Chemicals	Quasar Chemicals Ltd	Unit 16 & 17 Millands Road Industrial estate, Neath

Table 6 – Part A processes identified with the potential to release significant quantities of benzene

Several of the processes outlined in table 6 have ceased to operate since the first round of assessments were complete i.e. BP Oil UK have closed the Llandarcy Refinery complex and Morganite Electrical Carbon Ltd have reduced from two sites to one.

The details held on the public register for the A1 permits issued by the Environment Agency under the Integrated Pollution Prevention and Control Regime have been examined. The overall conclusion of the first round of

assessment in that these processes were unlikely to contribute to a failure of the objective benzene objective remains valid.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

5.4.2 Major Petrol Terminals/ Fuel Storage Depots

There are no major petrol terminals or fuel storage depots within the authority's area.

5.4.3 Petrol Stations

Guidance contained within LAQM.TG(03) indicates that there is some evidence that petrol stations will emit sufficient benzene to put the 2010 5μg/m^3 objective at risk if the throughput exceeds 2000m^3 of petrol , especially if combined with higher levels from a nearby busy road. A busy road is defined as one with more than 30,000 vehicles per day. The guidance goes on to indicate that relevant exposure within 10 m of the fuel pumps should also be present if the above criterion is met.

There are several petrol filling stations within the authorities area with a throughput greater than 2000m^3. All are fitted with stage 1 petrol vapour recovery but none of these filling stations are equipped with stage 2 petrol vapour recovery. Two of these stations have been looked at in greater detail to establish if a detailed assessment is required. One petrol filling (Mumbles Road, Blackpill) station meets the above criteria (throughput, traffic flows and relevant exposure) to warrant further investigation. For the sake of completeness the

second station (Sketty Filling Station, Gower Road) partially meets the criteria (throughput and relevant exposure).

Upon further investigation it has been established that whilst both of these filling stations have dwellings located within 10m of the fuel pumps, these properties have been purchased by the fuel companies and have been left vacant. These arrangements were negotiated with the relevant fuel companies many years ago, partially to resolve noise nuisance complaints.

Consequently, there are no domestic dwellings within 10 meters of fuel delivery pumps at stations that meet the initial qualifying criteria.

5.4.4 Road Transport Sources

Guidance contained within LAQM.TG(03) requires that “very busy” roads or junctions in built up areas be identified to determine whether there is relevant exposure within 10m of the kerb or 20m in major conurbation’s. Very busy roads are defined within LAQM.TG(03) as:

- Single carriageway roads with daily average traffic flows in excess of 80,000 vehicles per day
- Dual carriageway roads with daily average traffic flows which exceed 120,000 vehicles per day
- Motorways with daily average traffic flows of 140,000 vehicles per day

Information held by the City and County of Swansea indicates that traffic flows on even the busiest of roads (the A483 dual carriageway) are approximately half the qualifying criteria for the definition of a very busy single carriageway road.

Even if traffic flows are combined at a junction, no carriageway or junction meets the criteria that would require that a detailed assessment be made. However, works have been undertaken to assess levels of benzene along a narrow congested road – Neath Road, Hafod. These works commenced with the use of passive BTEX tubes and are now undertaken continuously by way of open path measurement techniques along a 250m section of this congested highway. These measures are outlined in 5.4.5.1, 5.4.5.2 and 5.5 below.

5.4.5 BTEX Passive Diffusion Tube Monitoring

5.4.5.1 Previous BTEX Passive Diffusion Tube Monitoring

Whilst noting the then current guidance relating to road transport sources the conclusion of the first review was to recommend that a further assessment into the ambient levels of benzene be undertaken along the Neath Road corridor through the Hafod district. During the first phase pilot work undertaken jointly by the City & County of Swansea and Neath Port Talbot Borough Council, pairs of BTEX tubes were exposed for fortnightly periods. The tubes were analysed by S.J Analytical laboratory in Cardiff.

The auditors' comments on the first review and assessment report prepared by this authority drew the validity of these measurements into question. The results indicated elevated levels that went against national trends and contradicted the results obtained from similar studies.

5.4.5.2 Recent BTEX Passive Diffusion Tube Monitoring

Following the recommendations of the first round assessment process and to address the auditors concerns, a twelve month passive benzene BTEX diffusion tube study was established along Neath Road and the surrounding residential streets. Ten sites were established and pairs of diffusion tubes were exposed on a fortnightly basis. Harwell Scientifics, 551 South Becquerel Avenue, Harwell International Business centre, Didcot, Oxon were contracted for the supply and analysis of the chromosorb ATD tubes. The method of analysis is reproduced in Annexe 2 and reflects the procedures outlined in Harwell Scientifics Ltd in house method HS/GWI/3015.

A map showing the sample locations can be seen in Annexe 3. A summary of the results obtained can be seen in table 7. The limit of detection (LOD) was typically given as 0.4 $\mu g/m^3$. The overall uncertainty of results significantly above the LOD was calculated to be ± 19% for benzene. Table 7 also includes an indication of the worst case i.e. + 19%.

The survey commenced on the 3rd February 2003 and ceased on the 30th March 2004. Results obtained from the pair of BTEX tubes exposed at each site were averaged to provide a mean for the fortnightly sampling period. These fortnightly periods were then used to compile the annual mean shown in table 7.

Site	Location	Annual mean $\mu g/m^3$	Annual mean + 19% $\mu g/m^3$
1	28 Earl Street, Hafod	1.53	1.82
2	Junc. Earl Street, Hafod	1.81	2.15
3	1343a Neath Road, Hafod	2.17	2.58
4	Hafod Post Office, Neath Road	3.22	3.83
5	65 Aberdyberthi Street, Hafod	1.70	2.02
6	1-16 Morgan Street, Hafod	1.52	1.81
7	Tawe Street, Hafod	1.42	1.70
8	Bowen Street, Hafod	1.61	1.92
9	1315 Neath Road, Hafod	1.61	1.92
10	15 Vivian Street, Hafod	1.60	1.90

Table 7 Hafod BTEX survey - Annual means

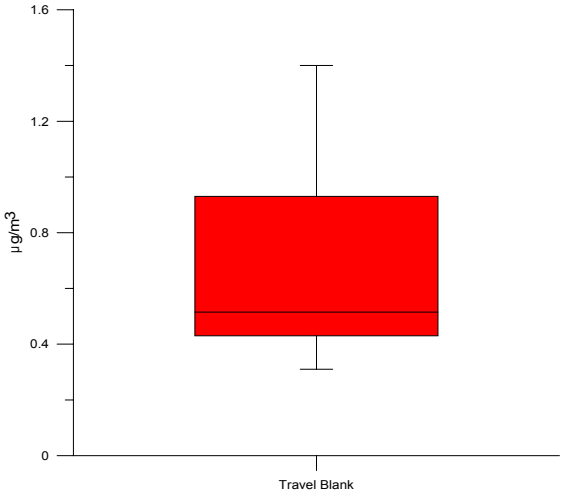
Data capture from the survey is detailed below in table 8. BTEX tubes were exposed for one fortnightly period (10th June to 24th June 2003) but these results were lost due to analytical problems within Harwell Scientifics. An additional exposure period was organised to ensure that 26 sample periods were obtained to formulate an annual mean.

Site	Periods Lost	% Data Capture
1	0	100
2	2	92.5
3	1	96.2
4	0	100
5	2	92.5
6	1	96.2
7	0	100
8	1	96.2
9	0	100
10	0	100

Table 8 – Hafod BTEX Survey - Data Capture Rates

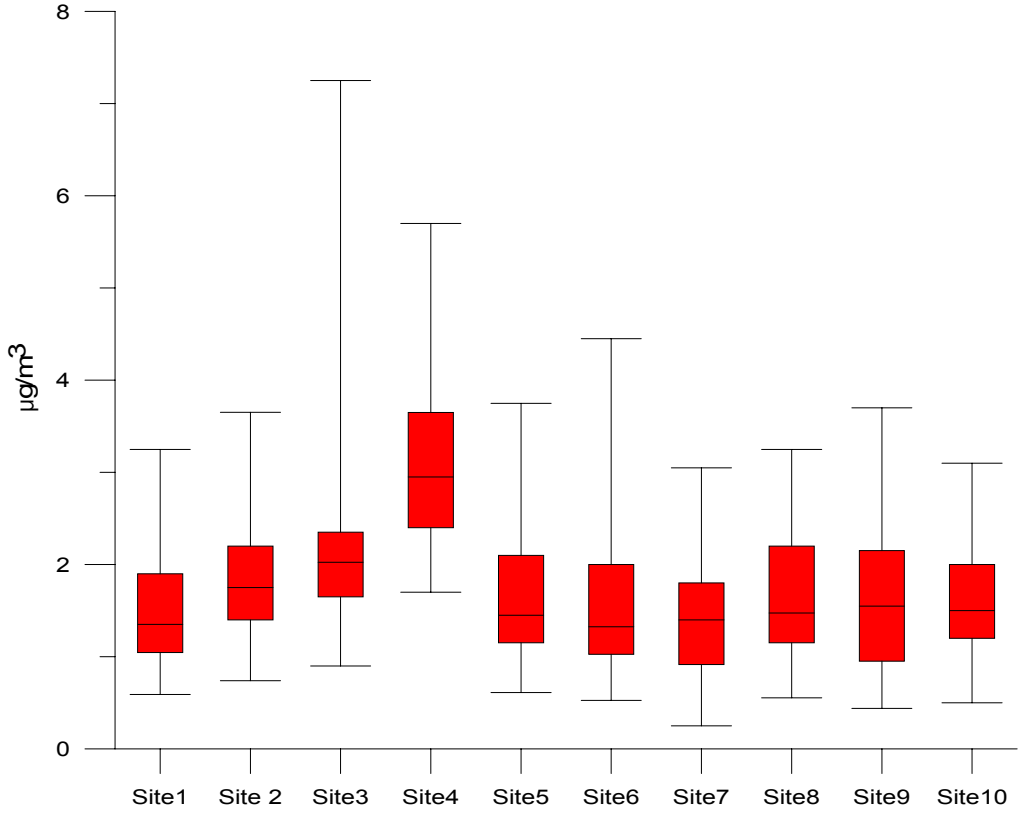
A Quality Control tube from an external standard source, with known analyte loading, was run with each sequence of samples. In addition, a travel blank was

supplied and analysed. A box-whisker plot illustrating the concentrations of benzene on this travel blank is given below as box whisker plot 1.



Box Whisker Plot 1 – Travel Blank benzene concentrations

A Box-Whisker plot showing the overall results obtained from the survey is shown below as box whisker plot 2.



Box-Whisker Plot 2 – Hafod BTEX Study February 2003 – March 2004

The annual means obtained have been projected forwards to 2010 using the correction factors contained within LAQM.TG(03). Box 3.4 (page 3-6) using 2003 data. The resultant predictions for 2010 are shown below as table 9.

Site	2003 Mean $\mu g/m^3$	Projected Mean 2010 $\mu g/m^3$
1	1.53	1.13
2	1.81	1.34
3	2.17	1.61
4	3.22	2.39
5	1.70	1.26
6	1.52	1.13
7	1.42	1.06
8	1.61	1.20
9	1.61	1.20
10	1.60	1.19

Table 9 Projected 2010 Means

5.5 OPSIS Hafod Differential Optical Absorption Spectroscopy (DOAS) – Real Time Benzene measurements.

It was recognised during the original review and assessment process of the need to provide real-time measurements of benzene along the congested Neath Road corridor. The section of Neath Road through the Hafod district does not see the traffic volumes identified both within the previous technical guidance and the current LAQM.TG(03) guidance that would indicate that benzene may be of concern.

This section of Neath Road has an annual average daily traffic flow (AADT) of approximately 18,000 vehicles. What distinguishes the section of Neath Road from other roads is the narrow and congested route that traffic is forced to take. The section of Neath Road from its junction at Normandy Roundabout to

Dyfatty lights has seen the introduction of numerous traffic calming measures. The Stage 3 review and assessment identified the need for real time benzene monitoring to be undertaken along this more congested section of Neath Road. This has now been realised with the provision of the OPSIS Hafod DOAS analyser.

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road. These measurements take place at first floor level - a height of approximately 3 - 4 metres and less than 0.5m away from the front facade of the terraced dwellings. The DOAS transmitter is fixed externally to the front wall of a terraced dwelling that fronts onto Neath Road at one end of the open path measurement. The receiver module is located on the front wall of another dwelling that also fronts onto Neath Road at the other end of the open path measurement length. The receiver focuses the light received and transmits the light via fibre optic cable into a spectra analyser.

The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants, as the carriageway is approximately 2 metres away from the front facade of these dwellings.

Valid data capture commenced on the 8th January 2004 at 16:00hrs

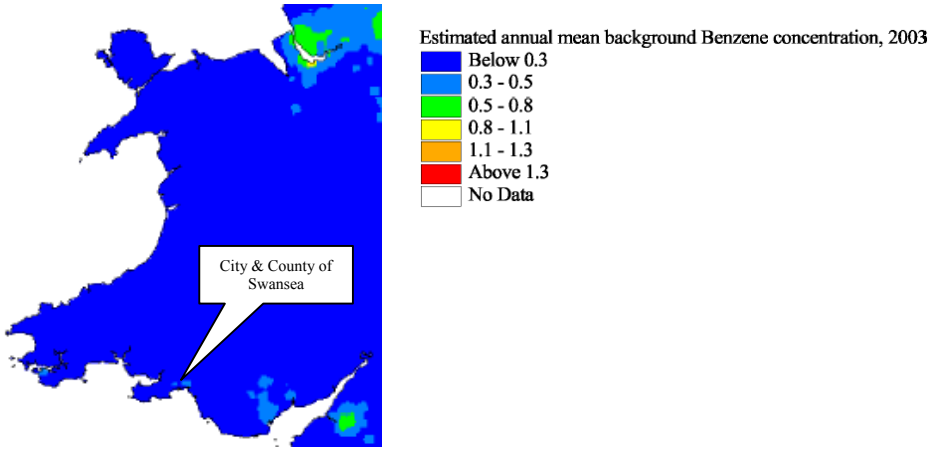
The current mean (9th January 2004 00:00 to 9th July 2004 24:00) is 4.35µg/m^3. This reflects measurements over a period of 6 months and does not include the majority of the winter months when meteorological conditions have been known to influence the conditions within the congested section of highway and the Lower Swansea Valley as a whole.

Annexe 4 contains the QA/QC manual for the OPSIS DOAS system. The system is operated and calibrated in accordance with the procedures laid down within this manual. The installation is serviced and maintained by Enviro Technology Services Plc on a 6-monthly basis.

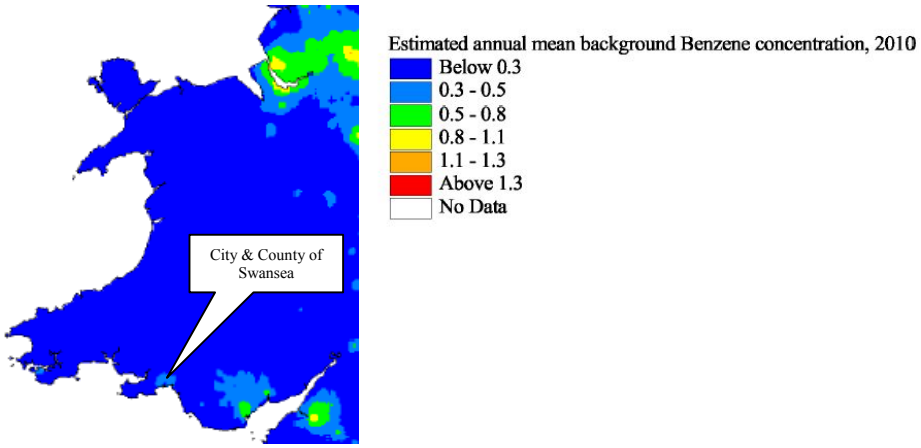
5.6 Background Mapping

Background maps have been downloaded from the Local Air Quality Management section of the National Atmospheric Emissions Inventory at http://www.airquality.co.uk/archive/laqm/laqm.php for the years 2003 and 2010. These have shown background concentrations below the objective in both 2003 and 2010.

Estimated background concentrations 2003 (in µg/m^3)



Estimated background concentrations 2010 (in µg/m^3)



5.7 Conclusions of USA for benzene

There are no indications at present to indicate that the annual mean objective of 5µg/m^3 will be exceeded at any location within the authority's area by the compliance date of the 31st December 2010. **There is therefore, no requirement to proceed to a detailed assessment for benzene**. However, it is evident that despite the information and guidance contained within LAQM.TG(03), that Neath Road through the Hafod district may be approaching the objective level.

It is therefore recommended that benzene continue to be monitored along the congested section of Neath Road, Hafod using the OPSIS Hafod DOAS open path monitoring system. Results will be reviewed when sufficient data is available to enable formulation of an annual mean.

6. Updating and Screening Assessment of 1,3-butadiene

6.1 Introduction

At normal ambient temperatures, 1,3-butadiene is a gas, and trace amounts can be found in the atmosphere that we breathe. The main source of 1,3-butadiene in the UK is emissions from motor vehicle exhausts. 1,3-butadiene is also used in industry, mainly for the production of synthetic rubber for tyres. It was also present in a number of commercial liquid petroleum gases.

The increasing number of vehicles fitted with three way catalysts will significantly reduce emissions of 1,3-butadiene in future years.

6.2 Health effects of 1,3-butadiene

There is evidence that workers exposed to 1,3-butadeine have a slightly higher than expected risk of cancers of the lymphoid system and bone marrow, lymphomas and leukaemia's. Laboratory studies have shown that 1,3-butadeine damages the genetic structures of the cell in rodents causing cancers. It is therefore, like benzene, a genotoxic carcinogen. In theory, it is not possible to determine an absolutely safe level for human exposure.

6.3 Standard and objective

The UK and Welsh Assembly Government have concluded that despite there being no absolutely safe level of exposure to 1,3-butadeine that a maximum

running annual mean concentration of 2.25μg/m^3 be achieved by the 31st December 2003

6.4 Review of Existing Information

6.4.1 Authorised Processes

The first round of assessment identified no Part B processes with the potential to emit significant quantities of 1,3-butadeine within the authorities area. This situation remains the same with the Part B authorisations and also within the current A2 permits issued under the Integrated Pollution Prevention and Control (IPPC) regime regulated by this authority.

The first round of assessment identified several Part A processes with the potential to emit significant quantities of 1,3-butadeine. These were all located within the Port Talbot area. There is no evidence to suggest that any of these processes regulated by the Environment Agency and issued with an A1 permit under the IPPC regime will cause an exceedence of the objective standard within this authority's area.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

6.4.2 Monitoring Data

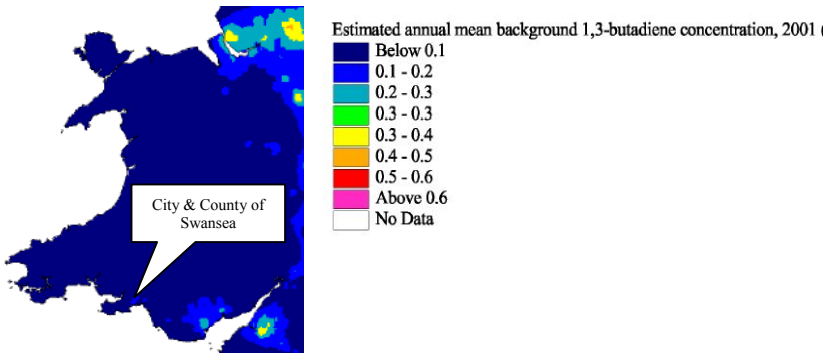
1,3-butadine is not monitored within the City & County of Swansea's area.

No data is available from the UK Air Quality Archive (http://www.airquality.co.uk/archive/autoinfo.php?zone_id=9) for the monitoring station formally operated by Neath Port Talbot County Borough Council at the Baglan Primary School hydrocarbon site. Similarly, only a very small amount of data is available for 2003 from the Cardiff Centre monitoring site for 1,3-butadeine (http://www.airquality.co.uk/archive/downloads/37776524.csv reference 37776).

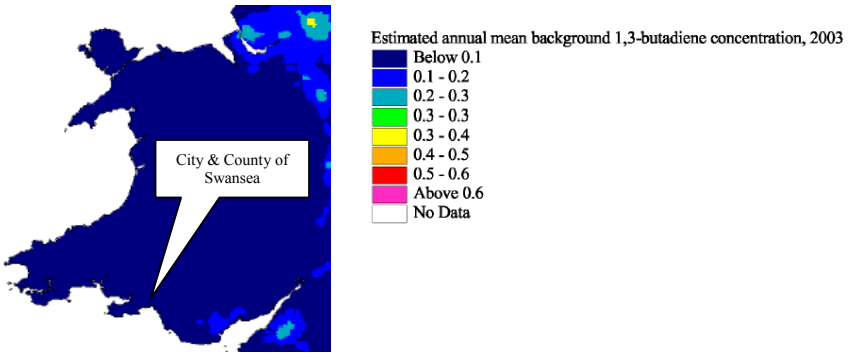
6.5 Background Mapping

Background maps have been downloaded from the Local Air Quality Management section of the National Atmospheric Emissions Inventory at http://www.airquality.co.uk/archive/laqm/laqm.php for the years 2001 and 2003. These have shown background concentrations below the objective level in both 2001 and 2003.

Estimated background concentrations of 1,3-butadeine in 2001 (in µg/m^3)



Estimated background concentrations 1,3-butadeine in 2003 (in μg/m^3)



6.6 Conclusion of USA for 1,3-butadeine

There are no indications at present to indicate that the annual mean objective of 2.25μg/m^3 was exceeded at any location within the authority's area at the compliance date of the 31st December 2003. **There is therefore, no requirement to proceed to a detailed assessment for 1,3-butadeine.**

7 Updating and Screening Assessment of Lead

7.1 Introduction

The agreement reached between the European Parliament and the Environment Council on the Directive on the Quality of petrol and Diesel Fuels (part of the Auto-Oil Programme) has led to the ban on sales of leaded petrol in the UK with effect from the 1st January 2000. Prior to this agreement lead was added to petrol as tetraeethyl lead (4 Star) for many years which led to road transport being responsible for the majority of lead released in the UK. Unleaded petrol was introduced into the UK in 1987. In 1995 petrol road transport was still responsible for the release of 1067 tonnes of lead into the atmosphere.

Emissions of lead are now restricted to a variety of industrial activities such as battery manufacture, pigments in paints and glazes, alloys, radiation shielding, tank lining and piping.

Detailed assessments of the potential impact of lead emissions from industrial processes have been undertaken by the Government and Devolved Administrations, based upon both monitoring and sector analysis studies. The former has included a 12-month monitoring survey in the vicinity of 30 key industrial sites in the UK, which has been used to supplement information already provided from the non-automatic monitoring networks. These monitoring data have generally indicated no exceedences of the objectives for 2004 and 2008, although locations in proximity to non-ferrous metal production and foundry processes were deemed to be at risk, and further monitoring is underway.

7.2 Health effects of lead

Lead can be absorbed into the body both through the lungs and through the stomach and intestines. People may be at risk of absorbing it when exposed either in the air, dust, and soil or as a contaminant in food and drink. Swansea's industrial history and legacy of contaminated land make these pathways a possibility.

Exposure to high concentrations of lead exhibit toxic biochemical effects that show themselves as acute or chronic damage to the nervous system, whilst also having the potential to damage kidney function, gastrointestinal tract and reproductive system. High exposure is now relatively easily prevented

Of greater concern are the more subtle effects caused by lower exposures, such as may occur from the presence of old lead mains drinking water pipes, paint and dust, and in the ambient air. The effects of intellectual development of children are the greatest concern. Children appear to be more susceptible to lead than adults, and may also absorb it to a greater extent when exposed.

7.3 Standard and Objective

The Welsh Assembly Government has adopted an annual mean concentration of $0.5\mu g/m^3$ as the air quality standard to be achieved by the 31st December 2004. In addition, a lower air quality objective of $0.25\mu g/m^3$ to be achieved by the 31st December 2008 has also been set.

7.4 Review of existing information

7.4.1 Authorised processes

There are no new processes either within the authority boundary or within neighbouring authorities that have the potential to emit significant quantities of lead from that reviewed during the first round of review and assessment process. There have been no significant changes to any of the existing processes.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

7.4.2 Monitoring Data

Ambient lead levels are no longer routinely monitored and measured within the authority's area**.**

The nearest monitoring station is located in Cardiff and annual mean data has been extracted from http://www.airquality.co.uk/archive/data/metals/metals_data.xls. These data show results for lead at kerbside sites in Cardiff from 1997 – 2002 within table 10.

Year	Annual Mean $\mu g/m^3$
1997	0.165
1998	0.107
1999	0.074
2000	0.029
2001	0.028
2002	0.025

Table 10 – Cardiff Lead Annual Mean Concentrations 1997 - 2002

As can be seen from table 10, levels at the kerbside sites in Cardiff are significantly below both the 2004 and 2008 objective levels.

7.5 Background mapping

There are no background maps available for the objective years of 2004 and 2008

7.6 Conclusion of Updating Screening Assessment for Lead

There are no indications at present to indicate that the annual mean objective of $0.5\mu g/m^3$ will be exceeded at any location within the authority's area at the compliance date of the 31st December 2004. Similarly, there are no indications that the objective of $0.25\mu g/m^3$ will be exceeded at any location within the authority's area at the compliance date of the 31st December 2008. **There is therefore, no requirement to proceed to a detailed assessment for lead.**

8 Updating and Screening Assessment for Sulphur Dioxide.

8.1 Introduction.

The main source of sulphur dioxide (SO_2) in the UK is from burning fossil fuels at power stations, which accounted for more than 71% of emissions in 2000. There are also significant emissions from other industrial combustion sources – locally in Swansea this is steel making. Domestic sources now only account for 4% of emissions but in traditional coal burning areas these can locally be much more significant. Road transport currently accounts for less than 1% of emissions.

Sulphur dioxide was one of the components of the dense fogs that occurred in industrial cities in the nineteenth century – most notably in London during 1950. These episodes led to the passing in 1956 of the UK's first Clean Air Act. This act saw a subsequent reduction in the use of coal as a domestic and industrial fuel in cities. However, there was a shift towards the siting of large coal-and-oil-burning power stations in rural areas. This has meant that sulphur dioxide may now be as much a rural as an urban pollutant.

8.2 Health effects of sulphur dioxide.

Exposure to accidental releases of sulphur dioxide at very high concentrations causes painful irritation of the eyes, nose, mouth and throat, and the acute chemical injury to the linings of the airways may cause severe difficulty in breathing, and even death.

The effects of sulphur dioxide found within ambient air are more relevant here. Studies have shown that healthy adults exposed to relatively high-prolonged concentrations show only minor changes to their lung function measurement. Sulphur dioxide causes its irritant effects by stimulating nerves in the linings of the nose, throat and the lung's airways. This causes a reflex cough, irritation and a feeling of chest tightness, and may lead to a narrowing of the airways. This is particularly likely to occur in people suffering from asthma and chronic lung disease, where the airways and linings are easily irritated. The effects of sulphur dioxide on sensitive and predisposed subjects appear almost immediately from the start of exposure.

8.3 Standards and Objectives

Due to its short-term health effects, the UK Government and Welsh Assembly Government have adopted a 15-minute mean of 266μg/m^3 as an air quality standard. The objective for the standard is not to be exceeded more than 35 times a year by the compliance date of the 31st December 2005. Additional objectives have been set which are equivalent to the EU limit values specified in the First Air Quality Daughter Directive. These are for a 1-hour mean objective of 350μg/m^3 not to be exceeded more than 24 times a year and a daily mean objective of 125μg/m^3 not to be exceeded more than 3 times a year. The 1-hour and daily mean objectives both have compliance dates of the 31st December 2004.

8.4 Review of Existing Information

The first round of review and assessment concluded that there were no indications that any of the objectives for sulphur dioxide would be breached at any location within the authority's area.

8.4.1 Authorised Processes

There are no new processes either within the authority boundary or within neighbouring authorities that have the potential to emit significant quantities of sulphur dioxide from that reviewed during the first round of review and assessment process. There have been no significant changes to any of the existing processes.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

8.4.2 Areas of Domestic Coal Burning

Swansea City Council, the predecessor to the City and County of Swansea, declared 5 Smoke Control Areas within the Port Tennant and St.Thomas areas.

Domestic consumption of coal has dramatically declined within Swansea over the last two decades not solely because of the declaration of the Smoke Control Areas but as part of the national trend away from coal to natural gas consumption as a domestic fuel.

Guidance within LAQM.TG(03) requires the identification of significant areas of domestic coal burning. Significant areas of domestic coal burning is given as a density of premises burning coal exceeding 100 per 500 by 500 meter area. There are no longer any areas within Swansea that have this density of domestic coal burning.

The actual number of properties within the City and County of Swansea's area that burn solid fuel as the primary fuel for central heating is given as 4,398 within the 1997 Welsh Household Information Survey published in 2000. This equates to 4.9% of properties within Swansea. The number of properties burning fuel oil as their primary source of heating is given as 1,759 which equates to 2% of properties. The figures for the whole of Wales are 7.4% and 5.3% respectively.

8.4.3 Small boilers > 5MW$_{(thermal)}$

There are no boilers > 5MW$_{(thermal)}$ either on their own, or combined with other sources within 500m of receptor locations that would cause a breach of the 15-minute objective. These sources have been reviewed during the first round assessment process.

8.4.4 Shipping sources

Swansea is Associated British Ports (ABP's) most westerly South Wales port and has developed a substantial trade base with North and Western Europe, the Mediterranean and also with Northern Ireland and the Irish Republic. The port's major cargo-handling trade is receiving and shipping steel cargoes for Corus. It is equipped with a wide range of heavy-duty handling equipment offering

quayside cranes and a range of forklift trucks with capacities of up to 40 tonnes. Other traffics include containers, forest products, bulk cargoes, liquid bulks and general/project cargoes. Swansea Cork Ferries operates a service to Cork, Republic of Ireland from the port's Ferryport Terminal. The port can accommodate vessels up to 30,000 dwt.

Guidance within LAQM.TG(03) requires the determination on the number of ship movements per year and also to establish if there is relevant exposure within 1km of the quayside and manoeuvring areas. The guidance points to proceeding to a detailed assessment only if the total ship movements exceed 5000 per year. During 2003 there were a total of 1200 vessels visiting the port which equates to 2400 total ship movements. On the basis of this information, there is no requirement to proceed further.

8.4.5 Railway Locomotives

Landore Diesel Sheds is a major servicing centre primarily for Inter City 125 high-speed trains (HST) and is located within the Hafod Air Quality Management Area. The site operates on a 24 hour seven day a week basis. An aerial view of the site is shown below as aerial photograph 1 indicating the proximity of domestic dwellings to the site.

Site activities can be broadly classified into two categories: maintenance and servicing. Maintenance tends to occur within the sheds themselves. Here, engines are repaired, maintained and tested. It is not uncommon for several HST engine units to be under test at the same time. Exhaust emissions are vented through cowl housings to the roof of the sheds.

Servicing of the HST units occurs before the HST units are deployed for scheduled service at Swansea Central railway station. This activity tends to occur outside the sheds themselves in dedicated servicing bays. These servicing bays are similar to railway sidings. Following termination of the service at Swansea Central the whole HST train (consisting of two HST engine units) are moved to the servicing bays. The train is taken out onto Landore Viaduct under the power of the Cardiff facing power unit only. The train is manovered into the servicing bay still under the power of the Cardiff facing power unit only. Upon

Aerial photograph 1 – Landore diesel Sheds and Surrounding Area

the train being wholly located within the servicing bay the power is switched off to the Cardiff facing power unit. Power is then obtained from a shore supply. The HST train is then cleaned internally and prepared for the next scheduled service. However, prior to the HST train being permitted to move under its own power, it is mandatory that both power units undergo a "warm-up" period. This

period allows enough time for all hydraulic systems including braking to reach the minimum operational pressures. The warm-up period lasts for a minimum of 20 minutes. Again, it is not uncommon for several complete HST units to be undergoing warm-up periods at the same time. Following these warm-up periods the HST units are then permitted to move across the main line and back onto Landore viaduct. From here they make their way into Swansea Central railway station awaiting departure of the scheduled service - primarily to London Paddington. As part of the deployment process the HST may also take on fuel. The fuel pumps are located approximately 50 metres from the nearest property at Hamilton Street, Landore. Fuel takes the form of low sulphur content diesel.

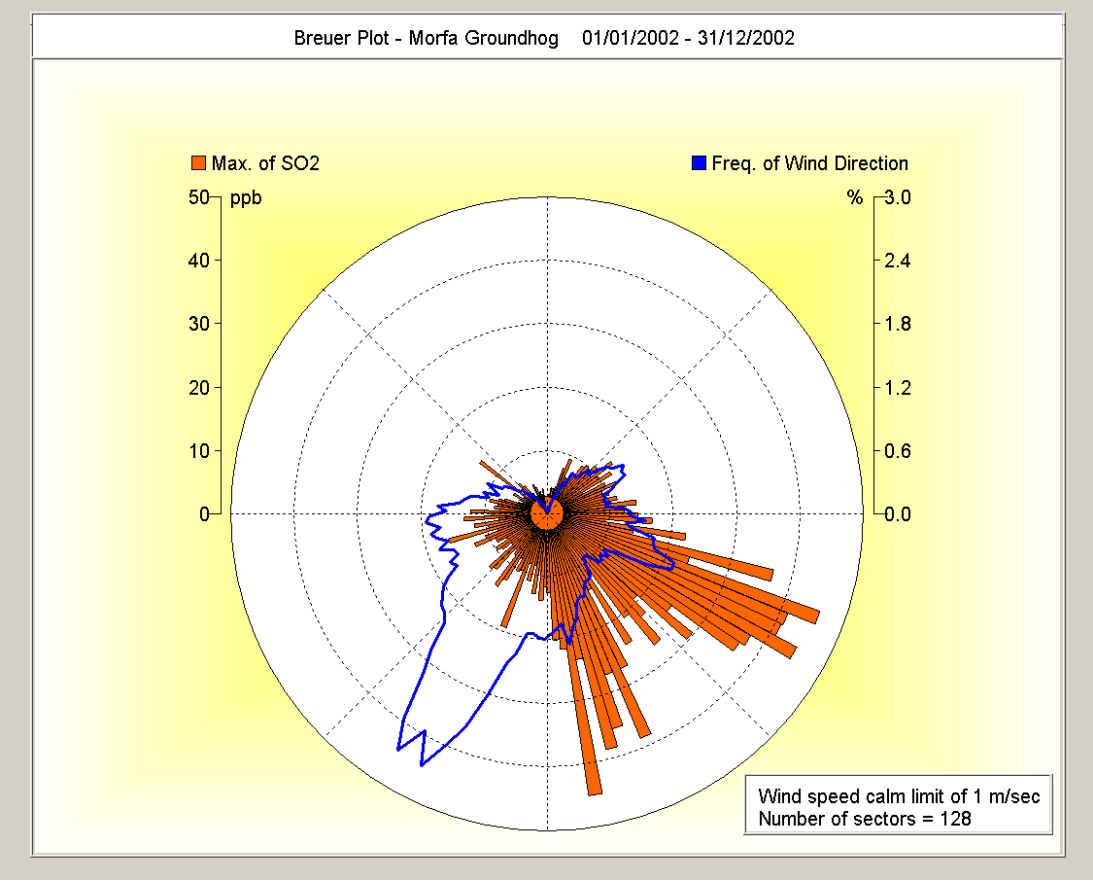
Guidance within LAQM.TG(03) requires the identification of locations where diesel locomotives are regularly stationary for periods of more than 15 minutes. This is clearly the case at Landore diesel Sheds but the guidance also indicates exposure potential for regular outdoor exposure of members of the public within 15 m of the stationary locomotives.

The nearest façade of any dwelling is approximately 35m from the servicing bay. There is also a public “open grassed area” within approximately 40 m of the servicing bays. Observations at this location have indicated very infrequent use by the general public. Bearing in mind that the majority of servicing occurs during the night-time hours it is concluded that there is no relevant exposure from this activity at this location. A similar view has been formed over the use of the main shed complex for the repair and servicing of the locomotive engines.

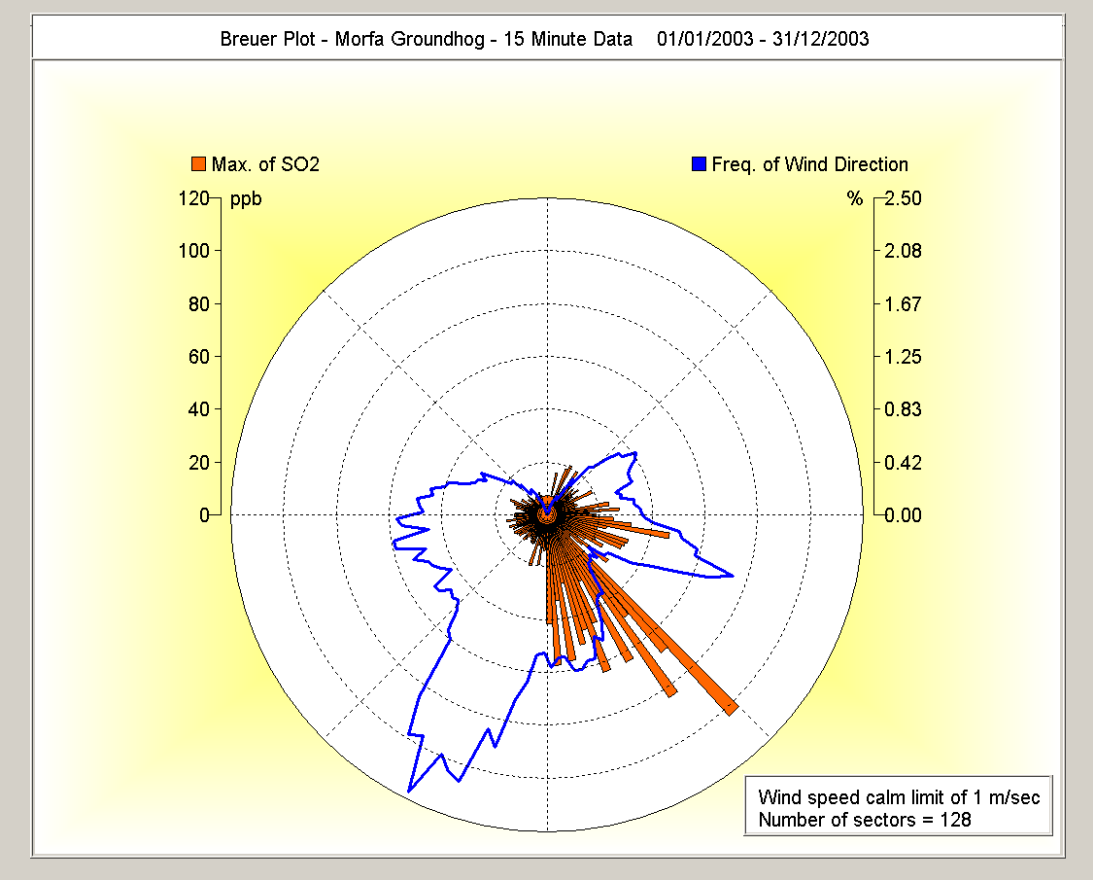
The activities of the diesel sheds (primarily during the night-time hours) has given rise to a review, on alleged noise nuisance grounds, of the activities

carried out with the management of the complex. This has seen improvements from an emissions perspective as it has been agreed that all servicing will now take place under the provision of a shore supply of electricity. The operators have pointed out that the requirements of the mandatory "warm-up" periods may become more prescriptive in the future. Indeed over the last several years this mandatory period has already been reviewed in light of the several rail crashes, and has already seen the introduction of more stringent measures.
As the servicing is carried out mainly during the nighttime hours, the $S0_2$ levels recorded at the nearby Morfa Groundhog air quality station were analysed. This area of the Lower Swansea Valley can be prone to temperature inversions.

An analysis was undertaken looking at the frequency of the prevailing wind direction and maximum 15-minute $S0_2$ levels recorded at the Morfa Groundhog station during 2002 and 2003. These can be seen below as plots 1 and plot 2.



Plot 1 – Morfa Groundhog SO_2 levels – 2002



Plot 2 – Morfa Groundhog SO_2 levels - 2003

The diesel sheds are located approximately 200m (from the centre of the site) in a westerly/south westerly direction from the Morfa Groundhog monitoring station (see aerial photograph 1). As can be seen from both the plots for 2002 and 2003, the frequency of the prevailing wind direction (15-minute data) is from this quarter but the maximum 15-minute SO_2 levels emanate from a south-easterly direction. Maximum 15-minute means from a westerly direction are between 20-30ppb (53 – 80 µg/m^3).

There are clearly more than two occasions a day when there are locomotives stationary with their engines running for periods of 15-minutes or more within the diesel shed complex. However, based on the evidence of plots 1 and 2, there is little evidence that there is an influence on ambient SO_2 levels from the activities carried on at the diesel sheds.

Inter City 125 and other diesel locomotives are stationary with their engines running at Swansea Central Railway Station for periods greater than 15 minutes. A canopy covers the railway platforms, which is open for part of its length on 3 sides. A separate enclosed waiting area is provided for passengers within the main terminal area. There are no receptor locations within 15m of the platforms.

8.5 Monitoring Data

Existing data collected by this authority has been analysed for the Swansea AURN, Morfa and Morriston Groundhogs.

8.5.1 Monitoring data within an AQMA

The City and County of Swansea operate the Morfa Groundhog station, which is located within the Hafod Air Quality Management Area. The station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. All equipment is housed within an air-conditioned unit and operates continuously. Sulphur dioxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time SO_2 analyser. Receptor locations are within 25m of the site.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

The 15-minute means, hourly and 24-hour means have been analysed for 2002 and 2003 and are reproduced below as table 11. The hourly means have been calculated by the OPSIS Reporter software package from 15-minute mean data. In order to form a valid 1-hour mean 75% data capture i.e. three out of every four 15 minute periods, was stipulated for the compilation of the hourly mean. The 24-hour means have been compiled from 1-hour data.

Morfa Groundhog	Max 15-Min Mean μg/m^3	Max 1-hour Mean μg/m^3	Max 24-Hour Mean μg/m^3
2002	122	90.1	24.4
Exceedences	0	0	0
Date of Max	24/10/2002	24/10/2002	11/9/2002
Wind Direction @ Max conc.	111°	112°	151°
2003	274	163.3	36.4
Exceedences	1	0	0
Date of Max	24/9/2003	11/4/2003	26/2/2003
Wind Direction @ Max conc.	136°	155°	111°

Table 11 Morfa Groundhog SO_2 levels 2002 and 2003

From plots 1 and 2 above (Para 8.4.5) the maximum SO_2 loading recorded at the Morfa Groundhog can be seen to originate from a south easterly direction. The Corus Steelworks at Port Talbot is located within this quadrant and is the more likely source as opposed to the Port of Swansea. The single 15-minute exceedence was from a south easterly direction and occurred at the same time as the maximum 15-minute recorded at the Swansea AURN site (see table 13)

8.5.2 Monitoring Data outside an AQMA

The City and County of Swansea operate the Swansea AURN and Morriston Groundhog air quality monitoring stations, which are both located outside the Hafod Air Quality Management Area.

The Swansea AURN network is affiliated onto the UK National Monitoring Network and has a classification of an urban background site. The station has been operational in its present location since June 1995. All equipment is housed within an air-conditioned unit and operates continuously. Sulphur dioxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time SO_2 analyser. The station is subject to full network QA/QC procedure's undertaken by NETCEN and AEA Technology on behalf of the Department of Environment, Food and Rural Affairs (DEFRA) and Welsh Assembly Government. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Hafod AQMA boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd

Sulphur dioxide is measured at both stations utilising Advanced Pollution Instruments (API) real-time SO_2 analysers.

The 15-minute means, hourly and 24-hour means from the Morriston have been analysed for 2002 and 2003 and are reproduced below as table 12. The hourly means have been calculated by the OPSIS Reporter software package from 15-minute mean data. In order to form a valid 1-hour mean 75% data capture i.e. three out of every four 15 minute periods, was stipulated for the compilation of the hourly mean. The 24-hour means have been compiled from 1-hour data.

Morriston Groundhog	Max 15-Min Mean µg/m^3	Max 1-hour Mean µg/m^3	Max 24-Hour Mean µg/m^3
2002	138	82	29.2
Exceedences	0	0	0
Date of Max	19/10/2002	1/10/2002	27/3/2002
Wind Direction @ Max conc.	50°	104°	161°
2003	196	117	29.2
Exceedences	0	0	0
Date of Max	15/5/2003	21/3/2003	08/01/2003
Wind Direction @ Max conc.	129°	148°	202°

Table 12 Morriston Groundhog SO_2 levels 2002 and 2003

Verified and ratified data for the Swansea AURN monitoring station has been downloaded from http://www.airquality.co.uk/archive/data_and_statistics.php and is shown below in table 13

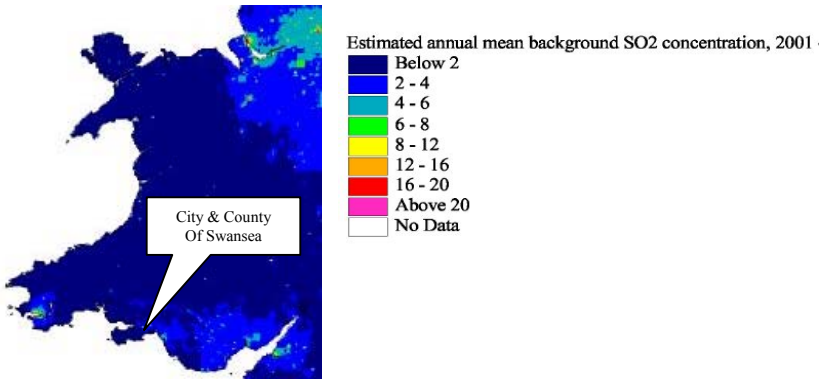
Swansea AURN	Max 15-Min Mean µg/m^3	Max 1-hour Mean µg/m^3	Max 24-Hour Mean µg/m^3
2002	164.9	103.2	98.4
Exceedences	0	0	0
Date of Max	01/08/2002	24/10/2002	29/03/2002
Wind Direction @ Max conc.	83°	84°	165°
2003	260.68	111.7	26.6
Exceedences	0	0	0
Date of Max	24/09/2003	24/09/2003	16/04/2003
Wind Direction @ Max conc.	109°	138°	65°

Table 13 Swansea AURN SO_2 levels 2002 and 2003

8.6 Background Mapping

Background maps have been downloaded from the Local Air Quality Management section of the National Atmospheric Emissions Inventory at http://www.airquality.co.uk/archive/laqm/laqm.php for the year 2001. These have shown background concentrations well below the objective levels.

Estimated background concentrations of sulphur dioxide in 2001 (in µg/m^3)



8.7 Conclusion of USA for sulphur dioxide

There are no indications at present to indicate that the 15-minute mean objective of 266µg/m^3 (not to be exceeded more than 35 times a year) will be exceeded at any location within the authority's area at the compliance date of the 31st December 2005. Also, there are no indications at present to indicate that the 1-hour mean objective of 350µg/m^3 (not to be exceeded more than 24 times a year) will be exceeded at any location within the authority's area by the compliance date of the 31st December 2004. Similarly, there are no indications at present to indicate that the 24-hour mean objective of 125µg/m^3 (not to be

exceeded more than 3 times a year) will be exceeded at any location within the authority's area at the compliance date of the 31st December 2004.

There is therefore, no requirement to proceed to a detailed assessment for sulphur dioxide.

9 Updating and Screening Assessment for Particulate Matter PM_{10}

9.1 Introduction

There are a wide range of emission sources that contribute to PM_{10} concentrations in the UK. These sources can be divided into 3 main categories. *Primary particle* emissions are derived directly from combustion sources including road traffic, power generation and industrial processes. *Secondary particles* are formed by chemical reactions in the atmosphere and comprise principally of sulphates and nitrates. *Coarse particles* comprise of emissions from a wide range of sources, including re-suspended dusts from road traffic, construction works, mineral extraction processes, wind-blown dusts and soils, sea salt and biological particles.

The principle focus of Local Air Quality Management should be towards controlling local sources and emissions. However, a significant proportion of the current annual mean PM_{10} is derived from regional (including long range transportation from Europe) background sources. Regional background concentrations at any one site are variable and are dependent upon geographical location. Typical regional annual mean background concentrations[7] are currently within the range of 14-21$\mu g/m^3$, gravimetric and are outside the control of local authorities.

Particulate PM_{10} levels are measured in Swansea using Rupprecht & Patashnick Co., Inc. Tapered Element Oscillating Microbalance (TEOM) which is not a

[7] Source LAQM.TG(03) Section 8.07

true gravimetric device. A concern with the TEOM analyser is that the filter is held at a temperature of 50 °C in order to minimise errors associated with the evaporation and condensation of water vapour. Data presented here has therefore been adjusted to units of μg/m^3 gravimetric by the application of the interim default adjustment factor of 1.3. This will enable comparison to the reference gravimetric method.

9.2 Health effects of Particulate PM_{10}

As mentioned in 8.1 above the introduction of the first Clean Air Act of 1956 introduced in response to the excess mortality caused by the London smog's provided the first impetus to reduce domestic coal burning and thus particulate concentrations.

Particulate pollution is associated with a range of health effects including effects on the respiratory and cardiovascular systems, asthma and mortality. As is seen with other pollutants, particulate pollution episodes are responsible for causing premature mortality and increased morbidity[8]. EPAQS also concluded that there is a relationship between concentrations of PM_{10} and health effects such that the higher the concentration of particulate, the greater the effects on health.

9.3 Standards and Objectives

There are currently two air quality objectives for particulate $PM_{10,}$ which are equivalent to the EU Stage 1 limit values in the First Air Quality daughter Directive. The objectives set in regulation are an annual mean of 40μg/m^3 and a

[8] Expert Panel on Air Quality Standards 2000 – Airborne particles

24-hour mean of 50μg/m^3 not to be exceeded more than 35 times per year. Both objectives have compliance dates of 31st December 2004.

The new particles objectives (PM_{10}) for 2010 announced by the Welsh Assembly Government on the 18th September 2002 are provisional objectives broadly in line with the Stage 2 limit values. These provisional objectives will not, for the time being, be included in Regulation for purposes of LAQM in Wales. These particle objectives may be set in regulation once the EU has decided its new limit value. Therefore, the City and County of Swansea are only required to review and assess PM_{10} particles as prescribed in the Air Quality (Wales) Regulations 2000. However, both the guidance and Welsh Assembly Government recommends that local authorities include a provisional assessment of whether or not the new particles objectives are likely to be met in their reviews and assessments. The new provisional particles PM_{10} objectives are set out in table 2 above.

Monitoring already undertaken has shown that the 24-hour objective is more stringent than the annual mean objective in 2004. The opposite will be true in 2010 with the annual mean objective being more stringent than the 24-hour objective.

9.4 Review of Existing Information

9.4.1 Authorised processes

There are no new processes either within the authority boundary or within neighbouring authorities that have the potential to emit significant quantities of particulate PM_{10} from that reviewed during the first round of review and

assessment process. There have been no significant changes to any of the existing processes.

In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

9.4.2 Monitoring data from within an AQMA

The City and County of Swansea operate the Morfa Groundhog station, which is located within the Hafod Air Quality Management Area. The station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. All equipment is housed within an air-conditioned unit and operates continuously. Particulate PM_{10} is measured at this station utilising a Rupprecht & Patashnick Co., Inc. TEOM. The data has therefore been adjusted to units of $\mu g/m^3$ gravimetric by the application of the interim default adjustment factor of 1.3. This will enable comparison to the reference gravimetric method. Receptor locations are within 25m of the site.

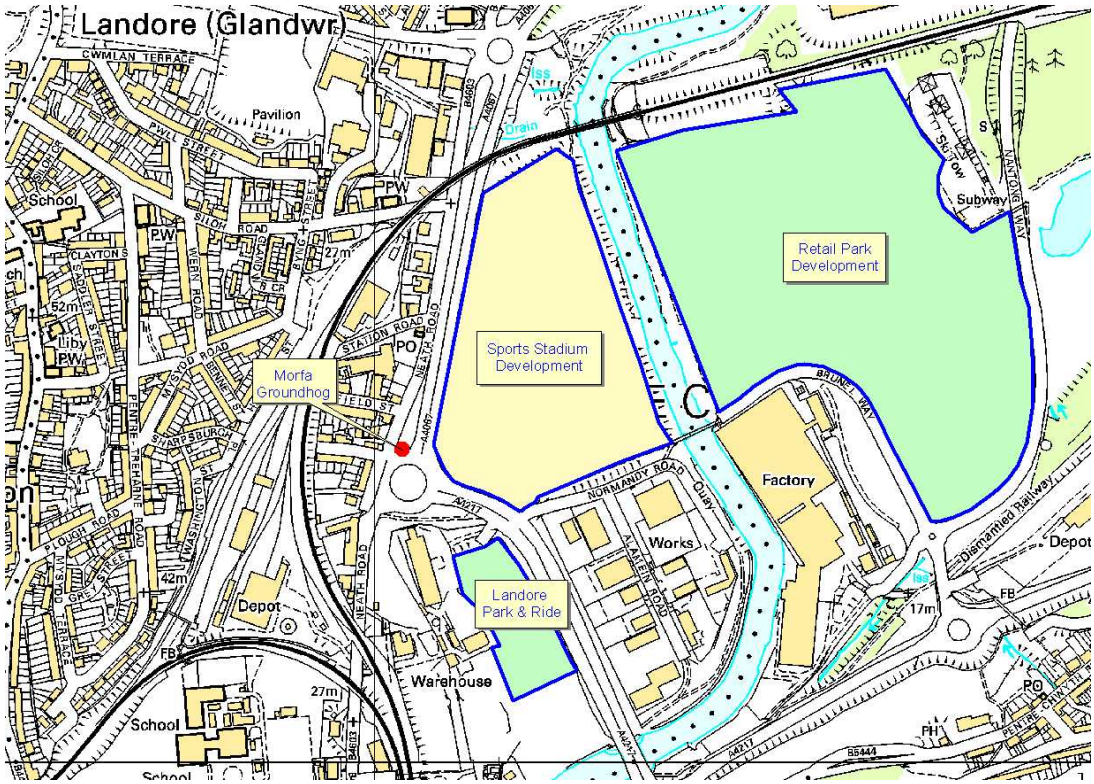
The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

Data obtained from the Morfa groundhog has been analysed for 2002 and 2003 and the results are presented in table 14.

Morfa Groundhog	Annual Mean (40µg/m^3)		24-hour Exceedences (50µg/m^3)	
	2002	2003	2002	2003
	26.8µg/m^3	30.7µg/m^3	5	40

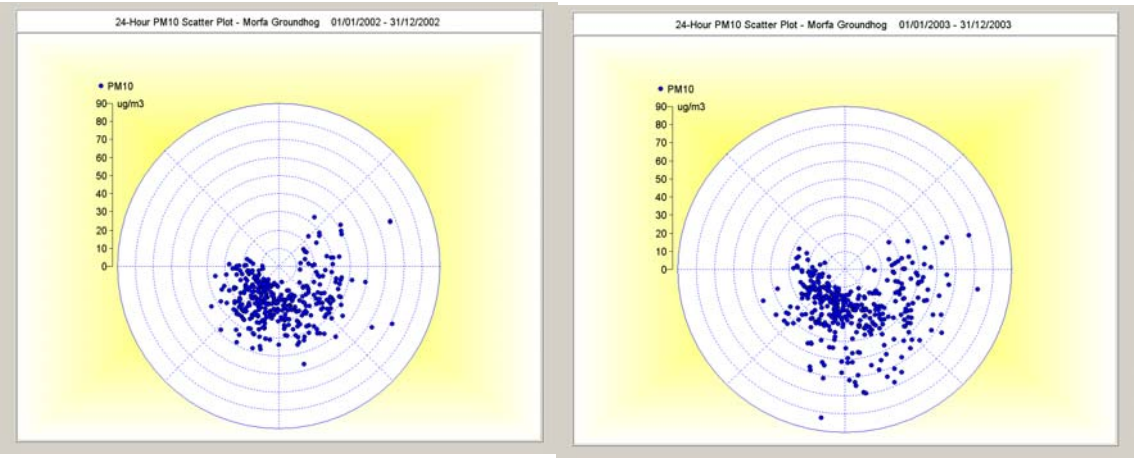
Table 14 – Morfa PM_{10} 2002 – 2003

Scatter plots have been generated in respect of the 24-hour mean data for both 2002 and 2003. From table 14, the number of 24-hour exceedences recorded at the Morfa Groundhog during 2003 was 40. This clearly is a breach of the 24-hour objective for PM_{10}. Plot 3 gives the scatter plot for 2002 data, and plot 4 that for the 2003 data. However, in order to understand the factors that have contributed to these exceedences, local developments must be taken into account. The construction and development works that are underway in the immediate area to the monitoring station are extensive and may well account for the majority of the exceedences. Map 1 given below outlines the development that commenced during 2003.



Map 1- Developments affecting Morfa Groundhog Station.

The developments underway are all taking place within the range of approximately 40° to 170° relative to the Morfa groundhog Station.



Plot 3 Morfa PM_{10} Scatter Plot 2002

Plot 4 Morfa PM_{10} Scatter Plot 2003

Plot 3 shows the PM_{10} 24-hour means for 2002 in direct relation to the 24-hour mean wind direction for this period. Exceedences of the PM_{10} 24-hour 50µg/m^3 objective can be seen as emanating from wind directions ranging from 68° to 165°.

Plot 4 representing the 24-hour PM_{10} means for 2003, shows a similar wind trajectory resulting in exceedences of the 24-hour mean objective, ranging from 72° to 199°.

The extent that these developments have impacted on the number of exceedences at the Morfa Groundhog can at this stage only be surmised. From scatter plots 1 and 2 (within 8.4.5 above) there is evidence to suggest that increased loading of SO_2 thought to emanate from the Corus plant also impact upon this area. It would seem logical therefore that a certain proportion of the PM_{10}, given the evidence within plots 3 and 4 must also originate from the same source. What is unclear, at present is the exact impact that the Corus steelworks is having upon PM_{10} at the Morfa Station as the situation is being confused by

the nearby development works. In addition, the increased traffic flows to the lower Swansea valley particularly around the Normandy roundabout have also to be factored in. If one was to take 2002 as being a representative year, the view would have to be that any impact from activities carried on at the steelworks site on local PM_{10} levels is minimal.

The development works are due to be complete between late 2004 and early 2005. A clearer picture will emerge once construction works have ceased. PM_{10} will continue to be monitored for the foreseeable future at this location. Vehicle by vehicle automatic classification and counting is now ongoing throughout the lower Swansea Valley and this will provide the data enabling a clearer picture to be obtained of the influence of the road transport network to the valley area. However, it is both anticipated and projected that traffic flows will significantly increase upon the opening of the Morfa Retail Park.

The results from 2003 for the Morfa Groundhog should also be read in conjunction with 9.3.3 below which looks at exceedences of the PM_{10} 24-hour mean objective at the Morriston Groundhog and Swansea AURN sites.

9.4.3 Monitoring Data outside an AQMA

The City and County of Swansea operate the Swansea AURN and Morriston Groundhog air quality monitoring stations, which are both located outside the Hafod Air Quality Management Area.

The Swansea AURN network is affiliated onto the UK National Monitoring Network and has a classification of an urban background site. The station has been operational in its present location since June 1995. All equipment is

housed within an air-conditioned unit and operates continuously. The station is subject to full network QA/QC procedure's undertaken by NETCEN and AEA Technology on behalf of the Department of Environment, Food and Rural Affairs (DEFRA) and Welsh Assembly Government. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

The Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Hafod AQMA boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

Particulate PM_{10} is measured at both stations utilising Rupprecht & Patashnick Co., Inc. TEOM's.

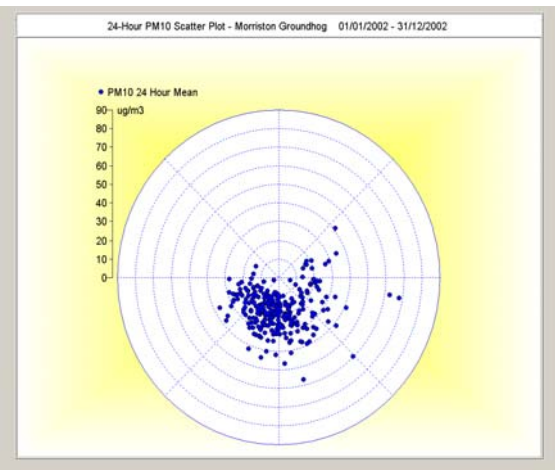
Particulate PM_{10} data from both stations has been analysed for 2002 and 2003. The results are shown below in table 15.

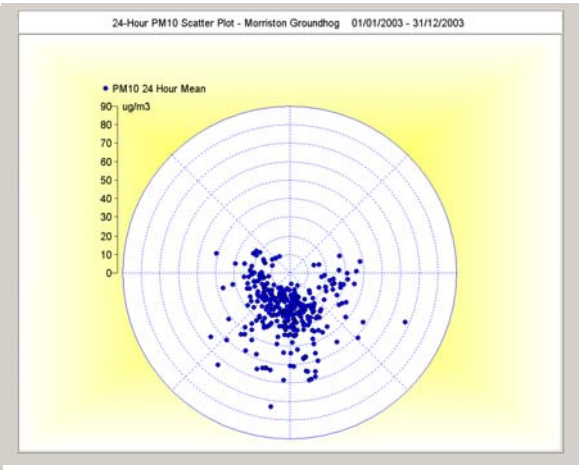
Swansea AURN	Annual Mean (40µg/m^3)		24-hour Exceedences (50µg/m^3)	
	2002	2003	2002	2003
	24.7µg/m^3	24.5µg/m^3	6	11
Morriston Groundhog	Annual Mean (40µg/m^3)		24-hour Exceedences (50µg/m^3)	
	2002	2003	2002	2003
	24µg/m^3	26µg/m^3	4	22

Table 15

The same analysis was carried out on the data from both stations for 2002 and 2003 and the resultant scatter plots are shown below as plot 5 and plot 6 (Morriston Groundhog) and plot 7 and plot 8 (Swansea AURN).

A similar conclusion was reached to that formed for the Morfa Groundhog station for 2003 – that the majority of exceedences emanate from an easterly direction.

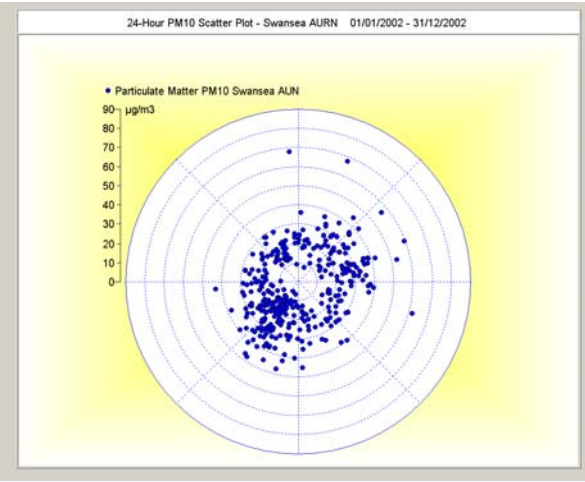




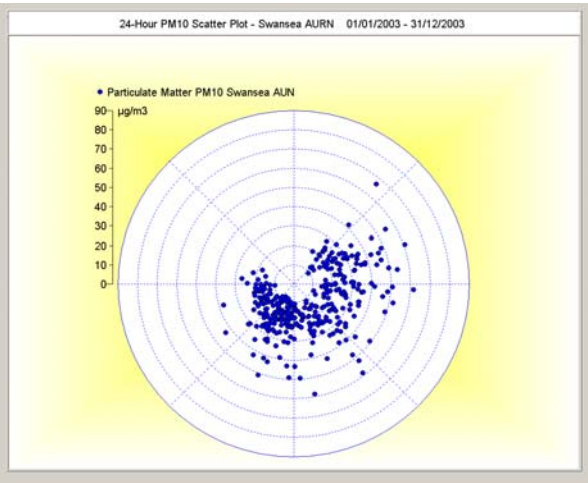
Plot 5 – Morriston Groundhog PM_{10} Scatter Plot 2002 *Plot 6 - Morriston PM_{10} Scatter Plot 2003*

Plot 5 representing the 24-hour PM_{10} means for 2002, shows a wind trajectory resulting in exceedences of the 24-hour mean objective, ranging from 99° to

166°. Plot 6 representing 2003, shows a wind trajectory resulting in exceedences of the 24-hour mean objective, ranging from 113° to 231°.



Plot 7 - Swansea AURN Scatter Plot 2002



Plot8 - Swansea AURN Scatter Plot 2003

Plot 7 representing the 24-hour PM_{10} means for 2002, shows a wind trajectory resulting in exceedences of the 24-hour mean objective, ranging mainly from 23° to 100°. Plot 7 representing 2003, shows a wind trajectory resulting in exceedences of the 24-hour mean objective, ranging from 39° to 169°.

From tables 14 and 15, significant exceedences were recorded at all 3 monitoring stations during 2003. The exceedences recorded at the Morriston and Swansea AURN sites however, did not exceed the 35 permitted instances. There were 11 days during 2003 when all 3 sites breached the 24-hour mean of 50µg/m^3 on the same day. This suggests several regional episodes and is therefore not site specific and wholly reflective of local prevailing conditions. The dates where all three sites failed the 24-hour objective are shown below as table 16, together with the 24-hour mean of the prevailing wind direction from each station. It is not possible to measure wind direction on-site at the Swansea AURN. The wind direction data for this site has therefore been taken to be that as recorded at the OPSIS Meteorological Station together with some non automatic data located on the roof of the Guildhall.

	Morriston 24-Hour Mean Wind Direction	Morfa 24-Hour Mean Wind Direction	Swansea AUN 24-Hour Mean Wind Direction
10/03/2003	171	198	200
22/03/2003	196	125	91
26/03/2003	199	156	82
27/03/2003	170	98	58
16/04/2003	166	174	101
17/04/2003	166	171	92
18/04/2003	134	98	70
20/04/2003	113	74	39
22/04/2003	183	174	169
08/08/2003	170	151	140
09/08/2003	188	170	142

Table 16 – 2003 PM_{10} Exceedences at Morriston, Morfa and Swansea AURN Sites

The Morfa Groundhog exceedences for 2003 can therefore be put down to a combination of substantial construction works coupled with at least 11 regional PM_{10} episodes. It is not proposed therefore, to read any great significance into the 40 exceedences of the 2004 objective at this stage. This view may be subject to modification once traffic impacts of the Retail Park and Sports Stadium have been assessed in the real world by a combination of data from the automatic GPRS traffic counters and automatic real-time monitoring undertaken at the Morfa Groundhog site.

9.4.4 Areas of Domestic Solid Fuel Burning

Domestic consumption of coal has dramatically declined within Swansea over the last two decades. This is not solely attributable to the declaration of the 5 Smoke Control Areas within the Port Tennant and St.Thomas districts but is seen as part of the national trend away from coal to natural gas consumption as the primary domestic fuel.

Guidance within LAQM.TG(03) requires the identification of significant areas where solid fuel burning still takes place. Significant areas of solid fuel burning is given as a density of premises burning solid fuel exceeding 50 per 500 by 500 meter area. Solid fuel burning has been assumed to be coal burning. Local knowledge points to the assumption that there are no longer any areas within Swansea that have this density of domestic coal burning.

The actual number of properties within the City and County of Swansea's area that burn solid fuel as the primary fuel for central heating is given as 4,398 within the 1997 Welsh Household Information Survey published in 2000. This equates to 4.9% of properties within Swansea. In contrast the number of properties burning gas (including LPG) is given as 73,883 or 83.1% of properties. Other forms of fuel burned are electric (4.5%), oil (2%) and communal heating systems (fuel not specified 0.5%). Properties without any form of central heating make up the remaining 5%.

The main form of other heating in winter i.e. not central heating (presumed to be room heaters etc.) is given as solid fuel fires/stoves 1,035 properties (1.2%), Electric fires/heaters 1,242 (1.4%), gas fires/heaters 2,949 (3.3%). Only 155 or 0.2% of properties within Swansea has no heating whatsoever.

If a 500m by 500m grid is placed over any area of traditional high density, terraced housing that are more likely to burn solid fuel i.e. either the Manselton or Hafod districts, and the number of domestic properties is extracted using the latest Post Office address point file, the average number of dwellings is found to be approximately 900. Using the guidance value of 50 dwellings burning solid fuel within such an area, this would equate to roughly 5.5% of the properties having to burn solid fuel to warrant further investigation. In light of the input from local knowledge and the fact that the total percentage of properties in

Swansea that burn solid fuel is only 4.9% it is not thought necessary to proceed further.

9.4.5 Airports

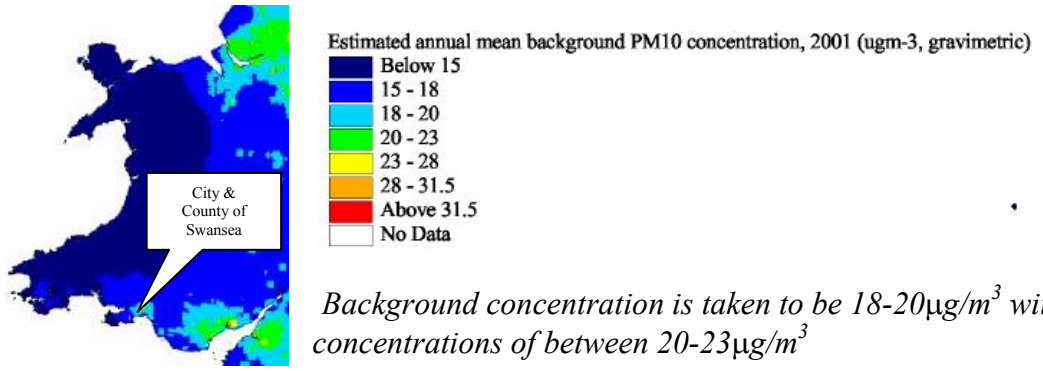
Swansea has an airport located in the rural area of Fairwood, on the Gower Peninsular. There are receptor locations within 500m of the airport boundary, but as the airport passenger numbers will not exceed the threshold mentioned in LAQM.TG(03) of 10 million passengers in 2004 and freight traffic is minimal, there is no requirement to proceed further.

9.4.6 Background Mapping

Background maps have been downloaded from the Local Air Quality Management section of the National Atmospheric Emissions Inventory at http://www.airquality.co.uk/archive/laqm/laqm.php for the years 2001, 2004 and 2010. These maps provide estimations of annual mean background levels in 2001, 2004 and 2010 together with an estimation of the annual mean secondary PM_{10} concentration in 2001.

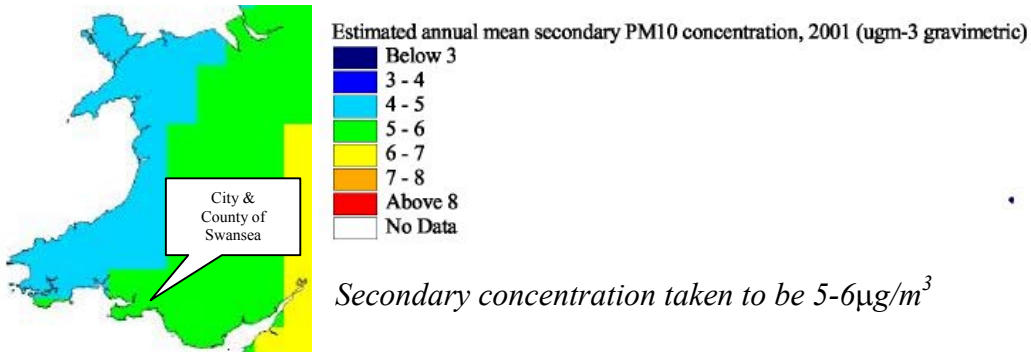
These estimations have been used within the approach to correct measured PM_{10} concentrations to 2004 and 2010 as set out in LAQM.TG(03) guidance Box 8.6 (page 8-10) and Box 8.7 (page 8-11) as well as within 9.6 below - Quarries, landfill sites, Opencast coal and handling of dusty cargoes at ports.

Estimated annual mean background concentrations of Particulate Matter PM_{10} in 2001 (in μg/m^3 gravimetric).



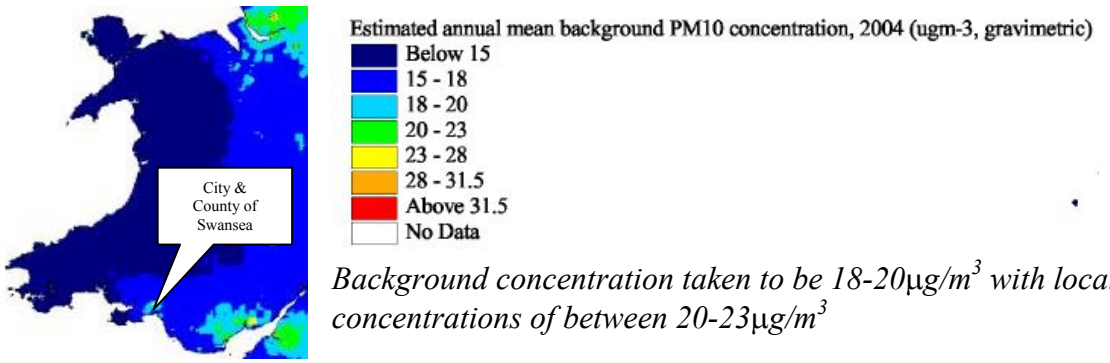
Background concentration is taken to be 18-20μg/m^3 with local concentrations of between 20-23μg/m^3

Estimated annual mean secondary concentrations of Particulate Matter PM_{10} in 2001 (in μg/m^3 gravimetric).



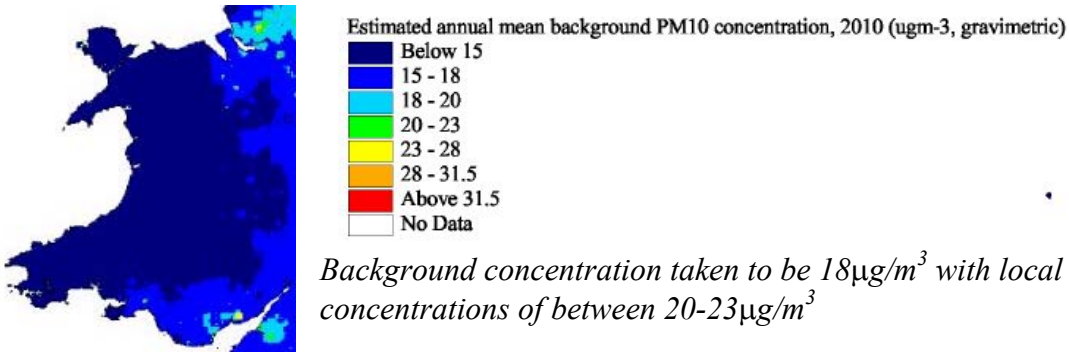
Secondary concentration taken to be 5-6μg/m^3

Estimated annual mean background concentrations of Particulate Matter PM_{10} in 2004 (in μg/m^3 gravimetric)



Background concentration taken to be 18-20μg/m^3 with local concentrations of between 20-23μg/m^3

Estimated annual mean background concentrations of Particulate Matter PM_{10} in 2010 (in μg/m^3 gravimetric)



Background concentration taken to be 18μg/m^3 with local concentrations of between 20-23μg/m^3

9.5 Projection of measured PM_{10} concentrations to 2004 and 2010

The PM_{10} annual means recorded at all 3 real-time monitoring stations for 2002 have been projected forward using the methodology prescribed within LAQM.TG(03) to 2004 and 2010, and are shown below as table 16. In this instance, 2002 was thought to be more representative of a typical year due to the numerous regional episodes recorded within Swansea during 2003.

	Measured 2002 Annual PM_{10} Mean μg/m^3	Projected 2004 PM_{10} Annual Mean μg/m^3	Projected 2010 PM_{10} Annual Mean μg/m^3
Swansea AURN	24.7	24.03	22.2
Morfa Groundhog	26.8	26.02	23.97
Morriston Groundhog	24	23.36	21.64

Table 16 – Projected PM_{10} Annual Mean Concentrations in 2004 and 2010

From table 16 it can be seen that the UK provisional annual mean objective not as yet set in regulation for 2010 of an annual mean PM_{10} concentration not exceeding 20μg/m^3 is predicted to be exceeded at all 3 real-time monitoring stations. There are no predicted breaches of the annual mean objective of 40μg/m^3 set in regulation with a compliance date of the 31st December 2004.

Once the projected annual means have been calculated LAQM.TG(03) indicates a method (paragraph 8.29) of estimating the number of 24-hour exceedences by comparing the projected annual mean to figure 8.1 (page 8-41) of LAQM.TG(03). Using this method the projected exceedences of the 24-hour objectives for 2004 and 2010 are shown below as table 17.

	Projected 2004 PM_{10} Annual Mean $\mu g/m^3$	Projected 2004 24-hour objective exceedences (35 permitted)	Projected 2010 PM_{10} Annual Mean $\mu g/m^3$	Projected 2010 24-hour objective exceedences (7 permitted)
Swansea AURN	24.03	10	22.2	7
Morfa Groundhog	26.02	17	23.97	8
Morriston Groundhog	23.36	9	21.64	6

Table 17 Projected 24-hour mean exceedences 2004 and 2010

9.6 Quarries, landfill sites, Opencast coal and handling of dusty cargoes at ports

Guidance within LAQM.TG(03) indicates an approach to adopt to deal with fugitive sources of PM_{10} from the above sources. Where dust is emitted, a proportion, (typically about 20%) will be present as PM_{10}. The guidance indicates that relevant exposure "near" to the sources of dust emission be established. Near is defined as within 1000m if the estimated 2004 PM_{10} annual mean background concentration is greater than or equal to $27\mu g/m^3$, within 400m if the estimated 2004 PM_{10} annual mean background concentration is greater than or equal to $26\mu g/m^3$, and within 200m if the estimated 2004 PM_{10} annual mean background concentration is less than $26\mu g/m^3$.

From 9.4.6 above, the estimated 2004 PM_{10} annual mean background mapping concentration within Swansea is18-20μg/m^3 with local concentrations of between 20-23μg/m^3. From table 17 all real-time monitoring stations are predicted to have an annual mean concentrations less than 26μg/m^3. Based on these estimations, "near" is taken to be the latter distance i.e. 200m.

There is relevant exposure within 200m of the main entrance/haul road at the Tir John Landfill Site off Fabian Way in Port Tennant, but these access roads have not been the subject of nuisance complaints regarding re-suspended particulates. The requirement for damping of these access roads is included within the operating licence of the facility.

There are operations carried out within the ABP Port of Swansea that have the potential for fugitive emissions i.e. 4 Quay bulk coal-handling facility and Morrisey's Cement Bulk off loading facility both located around the Kings Dock. The Port Health Authority regulates both of these operations. Morrisey's Cement Bulk off loading facility has been the subject of enforcement actions by the Port health Authority to effect abatement techniques. There is no relevant exposure within 200m of these operations.

There are no operational opencast coal mines or quarries within the Swansea area.

There is therefore, no requirement to proceed further with these fugitive sources.

9.7 New Roads Constructed / Planned /Significantly changed Traffic Flows

9.7.1 Gowerton Bypass

A bypass has been constructed around the village of Gowerton, which is located within the outer urbanised area to the west of Swansea. The bypass has been constructed to reduce the volume of traffic queuing at a set of traffic lights that leads indirectly to the Dunvant/Killay areas. An automatic traffic counter (ATC) has recently been located within the stage 2 section that was completed during early 2004. However, this ATC site does not provide a classification-split, mearly a volumetric count. At this stage it would appear that the estimated annual average daily traffic (AADT) flow for both the completed stage 1 and stage 2 sections is 6,000. As guidance within LAQM.TG(03) indicates that only new roads with an (AADT) flow greater than 10,000 vehicles would warrant further investigation, there is no requirement to proceed further.

9.7.2 Sports stadium/Morfa Retail Park

A new road linking the new sports stadium/retail park is due to be completed during the summer of 2004. This new road links the dual carriageway A4067 at Normandy roundabout with the A4217 running along the eastern flank of the Lower Swansea Valley via a new road bridge across the river Tawe, providing access both into the new retail park and sports stadium complex. Whilst there are no receptor locations within the immediate area of the new road, the effect that this development will have on traffic usage and routes through surrounding roads is not known at this stage. At present, there are ATC sites located on the existing road network surrounding the new development but as this new road

provides a short cut across the lower Swansea valley it may be possible that usage will not be confined solely for access and egress to the development. It is planned to locate an ATC within this road to assess usage in the near future, as it will be possible for vehicles to bypass the existing ATC's and escape detection. Any impacts that this new development and access road will have at nearby receptor locations will be assessed when suitable data is available.

9.7.3 Tawe Vale Access Road

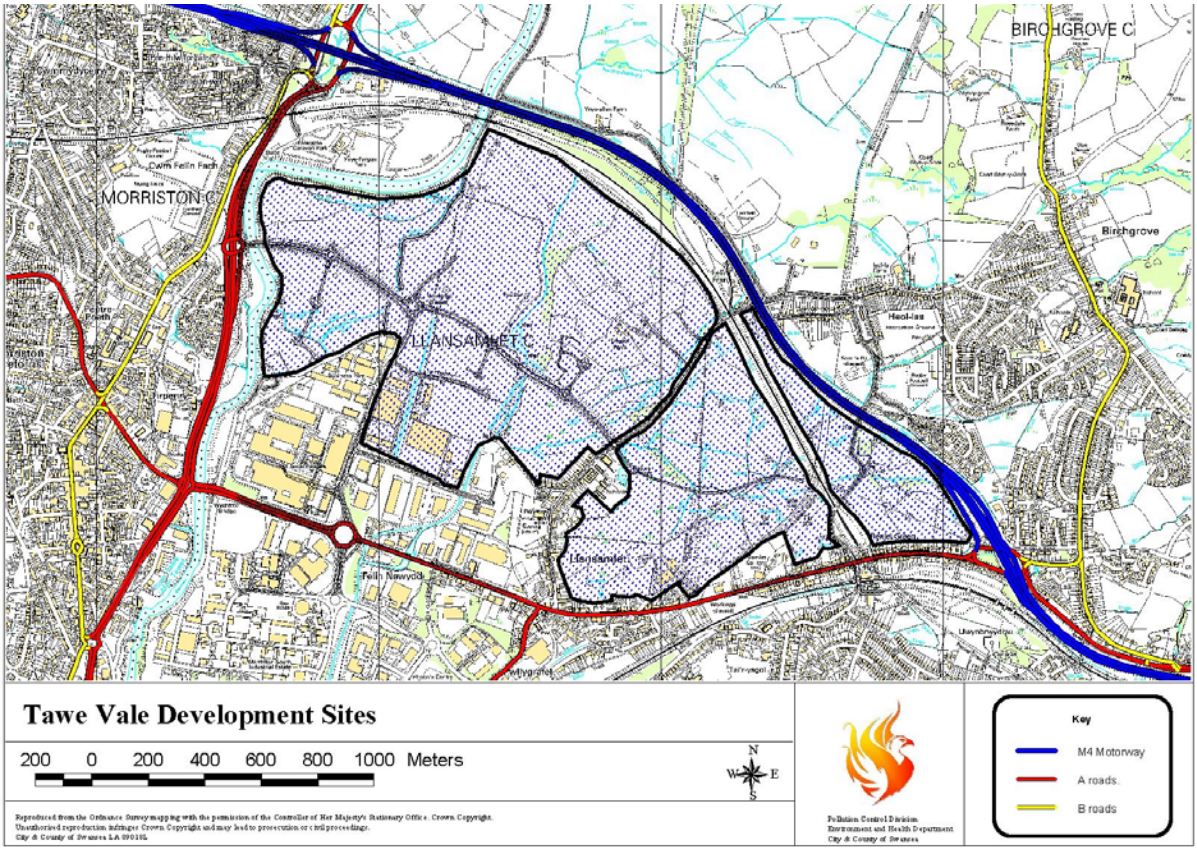
The Tawe Vale development lies to the north-east of Swansea, approximately 5 miles from the City Centre and approximately 2 miles from the northern most boundary of the Hafod AQMA. The site as a whole covers 190 hectares of what was originally urban fringe land, of mixed use ranging from improved agricultural land to derelict "brown field" sites. An Environmental Statement was submitted in May 1993.

The overall proposal is for a mixture of housing, business, industry and leisure uses. Proposals have been made to provide for up to 1800 new homes on approximately 132 acres of the site. The housing is intended to provide clusters of villages separated by landscaped areas. A range of housing types will be provided but as yet the precise mix and distribution of private and social housing has yet to be finalised. Residential land parcels are to be sold to interested developers and, given the large-scale provision of housing land at this site the development of the overall housing provision will take place in a phased manner over a long term. Construction of one "village" commenced in late 2001/2002 and numerous homes are now occupied.

Employment provision is made for at approximately 100 acres. As with the housing proposals, the employment sites have been divided into discrete

parcels, each of which is proposed to be situated in a landscaped setting. A mix of employment uses is envisaged, within a high quality business park.

The Environmental Statement identified problems with the overall road network that existed with heavy congestion on the A4067 and A48 at peak times. Works have been undertaken during the last several years to improve the A4067 with the construction of an underpass at the Wychtree roundabout intersection with improvements to the A48 also being made. The development has seen the provision of a new dual-carriageway access from the A4067 and a single lane access from Church Road, Llansamlet. The M4 motorway runs from east to west around the eastern and northern boundaries of the site. Access can be gained indirectly from junctions 44 and 45 of the M4.



The development site overall will see the continued development of all the provisions that make up the overall scheme for several years into the future.

As yet, no automatic traffic counting sites have been established within the development and so, no definitive answer on whether the AADT will exceed 10,000 can be made. The housing provision will mean receptor locations will exist throughout the development site as some housing abuts onto the access roadway. These receptor locations will be assessed when sufficient data becomes available.

9.8 Roads with high flows of buses and/or HGVs

Guidance within LAQM.TG(03) requires the identification of all roads with an unusually high proportion of heavy duty vehicles. Unusually high proportion is further defined as to be greater than 20% of AADT.

Data from 30 new GPRS ATC's that produce a classification split to the EUR6 standard is available and is undergoing data import testing into a traffic database. This network of GPRS ATC's will be expanded to cover the majority of the heavily trafficked areas within the authority in the coming years. As a result, a precise classification split is not as yet available. Data from the existing ATC's operated by the authority do not undertake a classification split only a volumetric count. However, local knowledge would seem to indicate that the AADT of HGVs is unlikely to exceed 20% of the traffic load at any location. This matter will be subject to quantification at a later date.

9.9 Junctions

Guidance within LAQM.TG(03) requires the identification of all "busy" junctions. A busy junction is defined within LAQM.TG(03) as one with more than 10,000 vehicles per day. An additional requirement is to determine if there is relevant exposure within 10m of the kerb (Swansea's population of approx. 240,000 does not take it into the major conurbation category where relevant exposure would be within 20m of the kerb). Whilst there are several junctions that it is thought will meet the traffic volumes required, there are none where the receptor locations are within 10m of the kerb. LAQM.TG(03) does not define at what point the 10m measurement is to be taken from i.e. anywhere from along the road link or from the kerb nearest the centre point of the junction. The DMRB printed manual Volume II Chapter 3 section 3.23 does not clarify this point. Indeed, it adds additional complications that deviate from the guidance issued in LAQM.TG(03) Sec 8-25.

ATC data is available from around these junctions but it mainly takes the form of either 10 or 24-hour duration surveys. Whilst it is possible to derive an AADT from this data it may not be the more appropriate way to approach the assessment required.

However, it is recognised that the identified junctions will require a full and proper assessment/investigation. It is therefore proposed to site PM_{10} monitors at the nearest receptor location to the identified junctions. It should be noted that the nearest receptor location may in the majority of cases be greater than 10m away from the main junction. Practical considerations i.e. power requirements may also dictate the exact siting. The proposed junctions from local knowledge

with combined traffic volumes likely to be >10,000 AADT flow to be monitored are: -

a) Fforestfach Cross
b) Sketty Cross
c) Oystermouth Road
d) Llansamlet Cross
e) Quay Parade Bridges
f) Dyfatty Junction
g) Uplands Cross

9.10 Conclusion of USA for Particulate Matter PM_{10}

There are no indications at present to indicate that the Particulate Matter PM_{10} annual mean objective set in regulation of 40μg/m^3 will be exceeded at any monitoring location within the authority's area at the compliance date of the 31st December 2004. However, there are indications from the projections made to 2010 that the UK provisional annual mean objective of 20μg/m^3 not as yet set in regulation and with a compliance date of the 31st December 2010 will be breached at all 3 real-time monitoring locations operated within the authority.

In addition the projections made for the provisional 24-hour mean 2010 objective of 7 permitted exceedences not as yet set in regulation indicate that the permitted number of exceedences will be reached at the Swansea AUN and exceeded at the Morfa Groundhog site.

Due to the uncertainties surrounding the PM_{10} concentrations at major road junctions, real-time monitoring work is required in these areas.

As the 2010 PM_{10} provisional objectives are not as yet set in regulation, there is no statutory requirement to proceed to a detailed assessment at this stage. However, in practice, the additional work necessary will be undertaken as if it were a detailed assessment to supplement the information already gathered. This additional information will be the subject of a separate report at a later date.

10 Updating and Screening assessment for Nitrogen Dioxide.

10.1 Introduction

Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen, and are collectively referred to as oxides of nitrogen (NO_x). All combustion processes produce NO_x emissions, largely in the form of nitric oxide, which is then converted to nitrogen dioxide, mainly as a result of reaction with ozone. Whilst ozone can have an adverse effect upon human health it is mainly nitrogen dioxide that is associated with health effects.

The principle source of nitrogen oxides emissions is road transport, which accounted for approximately 49% of total UK emissions in 2000. Major roads such as motorways are a predominant source but congested roads within the major urban centres are of more concern locally. Within most urban areas, the contribution of road transport to local emissions will be much greater than the national picture.

The contribution of road transport sources to NO_x emissions has declined in recent years due to a combination of policy measures and technological improvements (in part dictated by the policy measures). Further reductions are expected up to and beyond 2010. These reductions are forecast to be about 20% between 2000 and 2005 and 46% between 2000 and 2010.

Other significant sources of NO_x emissions include electricity generation and other industrial and commercial sectors. Emissions are also continuing to decline in part due to the move to natural gas plant.

10.2 Health effects of nitrogen dioxide

In very high concentrations, such as have occurred during industrial accidents, nitrogen dioxide can cause severe and sometimes fatal lung damage. At much lower ambient levels it has been suggested that the gas may both have acute, short-term and chronic longer-term, effects on health, particularly in people with asthma. In addition, short-term exposure can affect the immune cells of the airways in a manner that might predispose people to an increased risk of respiratory infections.

Human health is exposed on a routine basis to the effects from indoor exposure to nitrogen dioxide and is often an important contributor to the overall exposure of individuals. Some studies have shown that indoor concentrations of nitrogen dioxide from the use of gas cookers average 15ppb (28.65μg/$m^{3)}$ over a year. Peak concentrations may be as high as almost 600ppb (1146μg/m^3) over an hour. The outdoor concentration of nitrogen dioxide is the main determinant of indoor concentrations in homes without gas cookers. In homes with such cookers, indoor levels are usually at or above outdoor levels, being higher in the winter months when homes are less well ventilated and more use is made of gas appliances. Modern construction methods requiring increased ventilation may go some way to addressing these issues but the situation is likely to remain in the older traditional housing.

10.7 Standards and Objectives

Two air quality objectives have been adopted within the Air Quality (Wales) Regulations 2000 and by the Air Quality (Amendment) (Wales) Regulations 2002 (which came into force on 31st December 2002). The first is an annual mean concentration not to exceed 40μg/m^3 and the second is a 1-hour mean concentration of 200μg/m^3 not to be exceeded on more than 18 occasions. Both objectives have a compliance date of the 31st December 2005.

In addition, the First Air Quality Directive also sets limit values for nitrogen dioxide, which has been transposed into UK legislation. The Directive includes a 1-hour limit value of 200μg/m^3 not to be exceeded on more than 18 occasions and an annual mean concentration limit not to exceed 40μg/m^3. Both limit values are to be achieved by the 1st January 2010.

10.8 Review of Existing Information

The first round of review and assessment concluded that there would be widespread projected breaches of the NO_2 annual mean objective of 40μg/m^3 within the Hafod district and surrounding areas. As a result, the area was declared an Air Quality Management Area. The first round of review and assessment process concluded that these projected breaches were due to emissions from road transport sources.

10.4.1 Authorised Processes

There are no new processes either within the authority boundary or within neighbouring authorities that have the potential to emit significant quantities of NO_2 from that reviewed during the first round of review and assessment process. There have been no significant changes to any of the existing processes

10.4.2 Monitoring data from within an AQMA

10.4.2.1 Real-Time Continuous Data

The City and County of Swansea operate the Morfa Groundhog station, which is located within the Hafod Air Quality Management Area. The station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. All equipment is housed within an air-conditioned unit and operates continuously. Nitrogen dioxide is measured at this station utilising an Advanced Pollution Instruments (API) real-time NO_x analyser. Receptor locations are within 25m of the site.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

Data obtained from the Morfa groundhog has been analysed for 2002 and 2003 and the results are presented below in table 18

Morfa Groundhog	Annual Mean (40µg/m^3)		Max 1-hour (200µg/m^3)		Exceedences of 1-hour std	
	2002	2003	2002	2003	2002	2003
	30.7µg/m^3	32.0µg/m^3	115µg/m^3	148µg/m^3	0	0

Table 18 – Morfa Groundhog $N0_2$ 2002 - 2003

10.4.2.2 Diffusion Tube Data

This authority have operated a roadside measurement site at the Hafod Post Office at Neath Road, Hafod since the mid 1970's. The site is located on the façade of the Post Office building within the narrow and congested section of Neath Road that is the centre of the authorities Action Plan. The Post Office site is situated within a section of terraced domestic dwellings. The façade of the Post Office building is within 2m of the roadway. Early measurements at this site concentrated on smoke and SO_2 by way of the smoke and SO_2 bubbler method. This method of sampling ceased some 10 years ago.

NO_2 passive diffusion tube data is available from 1993. This site participates in the UK Non-Automatic (NO_2) Network and supplies data on a monthly and weekly basis to the network. The monthly data was examined via the UK National Air Quality Information Archive (http://www.airquality.co.uk/archive/no2diff.php) for 2003 but none was found to exist. Data held by this authority that has been submitted to AEA Technology/NETCEN has therefore been used. Data from the annual validated data published on CD-ROM by AEA Technology for the UK Non-Automatic Networks for 2002 (Report AEAT/ENV/R/1578 - UK Nitrogen Dioxide Network 2002) has also been used. Use of and justification for the use of previous data from this network in presenting the annual means from 1993 was outlined in the authorities Stage 4 report (section 2.4.2)

Annual Means for the Hafod Post Office site between 1993 and 2003 have been calculated and are shown below in table 19. Table 19 also shows the corrected annual mean after correction for Bias. The Bias factor that has been used is 0.78, as advised by Harwell Scientifics Ltd. It is recognised that this Bias correction factor may not be the more appropriate factor to use for data relating to the start of the period under discussion, but for consistency, this Bias correction has been applied to all data back to 1993.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Corrected Annual Mean $\mu g/m^{-3}$
1993	65	50.3
1994	61	47.3
1995	73	57.1
1996	65	51
1997	59	45.7
1998	55	42.6
1999	69	53.7
2000	61	47.5
2001	61	47.3
2002	66	52.2
2003 *	69 *	53.7 *

** 2003 data based on provisional data held by this authority*

Table 19. Hafod Post Office Site NO_2 Tubes Annual Means 1993-2003.

As can be seen from table 3, and if 2003 is accepted as valid for now, the NO_2 annual mean has remained consistent over the past decade. This assumption does not take account for any changes in analytical methods or variance from laboratory operating procedures over the years.

10.4.2.3 Hafod DOAS Nitrogen Dioxide Data

It was recognised during the original review and assessment process of the need to provide real-time measurements of nitrogen dioxide along the congested Neath Road corridor. The section of Neath Road through the Hafod district exceeds the traffic volumes identified within the current LAQM.TG(03) guidance for narrow congested streets of 10,000 AADT. The carriageway is less than 10m wide and average speeds are less than 50kph.

This section of Neath Road has an annual average daily traffic flow (AADT) of approximately 18,000 vehicles. What distinguishes the section of Neath Road from other roads is the narrow and congested route that traffic is forced to take. The section of Neath Road from its junction at Normandy Roundabout to Dyfatty lights has seen the introduction of numerous traffic calming measures. Siting a "traditional" monitoring station enclosure along this section of carriageway was impossible.

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road. These measurements take place at first floor level - a height of approximately 3 - 4 metres and less than 0.5m away from the front facade of the terraced dwellings. The DOAS transmitter is fixed externally to the front wall of a terraced dwelling that fronts onto Neath Road at one end of the open path measurement.

DOAS Receiver

DOAS Transmitter

The receiver module is located on the front wall of another dwelling that also fronts onto Neath Road at the other end of the open path measurement length. The receiver focuses the light received and transmits the light via fibre optic cable into a spectra analyser.

The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet too visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser which measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored.

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants, as the carriageway is approximately 2 metres away from the front facade of these dwellings.

Valid data capture commenced on the 8th January 2004 at 16:00hrs

The current mean (9th January 2004 00:00 to 9th July 2004 24:00) is 43.27μg/m^3. This reflects measurements over a period of 6 months and does not include the majority of the winter months when meteorological conditions have been known to influence the conditions within the congested section of highway and the Lower Swansea Valley as a whole.

Annexe 4 contains the QA/QC manual for the OPSIS DOAS system. The system is operated and calibrated in accordance with the procedures laid down within this manual. The installation is serviced and maintained by Enviro Technology Services Plc on a 6-monthly basis.

10.4.3 Monitoring data from outside an AQMA

The City and County of Swansea operate the Swansea AURN and Morriston Groundhog air quality monitoring stations, which are both located outside the Hafod Air Quality Management Area.

The Swansea AURN network is affiliated onto the UK National Monitoring Network and has a classification of an urban background site. The station has been operational in its present location since June 1995. All equipment is housed within an air-conditioned unit and operates continuously. The station is subject to full network QA/QC procedure's undertaken by NETCEN and AEA Technology on behalf of the Department of Environment, Food and Rural Affairs (DEFRA) and Welsh Assembly Government. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

The Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Hafod AQMA boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut a red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the

calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd.

Nitrogen dioxide is measured at both stations utilising Advanced Pollution Instruments (API) real-time NO_x analysers.

Nitrogen dioxide data from both stations has been analysed for 2002 and 2003. The results are shown below as table 20.

Swansea AURN *	Annual Mean (40µg/m^3)		Max 1-hour		Exceedences of 1-hour std (200µg/m^3)	
	2002	2003	2002	2003	2002	2003
	31.2µg/m^3	33.8µg/m^3	105µg/m^3	164µg/m^3	0	0
Morriston Groundhog	Annual Mean (40µg/m^3)		Max 1-hour		Exceedences of 1-hour std	
	2002	2003	2002	2003	2002	2003
	23.5µg/m^3	26.4µg/m^3	129µg/m^3	144µg/m^3	0	0

Table 20 NO_2 Data 2002 – 2003 Swansea and Morriston Monitoring Stations

* *Fully Verified and ratified datasets provided by NETCEN*

10.4.4 Nitrogen Dioxide Diffusion Tube Monitoring outside an existing AQMA.

The authority contributes data monthly to the UK Non-Automatic Network at two background sites and one roadside site that are outside of the Hafod Air Quality Management Area. Data is presented for 2002 and 2003 as table 21 below. Annual Mean Data for 2002 has been derived from the annual validated data published on CD-ROM by AEA Technology for the UK Non-Automatic Networks for 2002 (Report AEAT/ENV/R/1578 - UK Nitrogen Dioxide Network 2002). Data for 2003 has been derived from the data held by this

authority that remains to be fully validated and reported on by the national network and is therefore to be regarded at this stage as provisional. The same bias correction factor of 0.78 as used within 10.4.2.2 has been applied as it is not stated if any bias correction has been applied to the ratified dataset. As numerous laboratories analyse the diffusion tubes it has been assumed that the data presented within the ratified dataset is "raw" and uncorrected for any bias.

Site	Site Classification	Raw 2002 $\mu g/m^3$	Raw 2003 $\mu g/m^3$	Bias Corrected 2002 $\mu g/m^3$	Bias Corrected 2003 $\mu g/m^3$
3N Manselton	Urban Background	29	32.3	22.6	25.1
4N West Cross	Urban Background	15	18.5	11.7	14.4
5N Uplands	Roadside	54	53.5	42.12	41.7

Table 21 – UK Non Automatic NO_2 Diffusion Tube Sites outside Hafod AQMA

10.5 Projected Annual Means in 2005 from Measured Data

The annual means from both the real-time measurements and diffusion tube studies have been projected forward to 2005 by the methodology contained within LAQM.TG(03) – Box 6.6 in regards to roadside sites and Box 6.7 at background sites. The results are summarised below as tables 22 (within AQMA) and 23 (outside AQMA).

The data from the Hafod DOAS has not been projected forward to 2005. The reason for this is that the methodology contained within LAQM.TG(03) Box 6.5 applies to short-term monitoring data derived from either diffusion tube or a chemiluminesence analyser. It does not mention if this approach is valid for use with the 6-month dataset that is available from the differential optical

absorption spectroscopy technique that is utilised within the 250 metre open path monitoring at this station.

Site	Site Classification	2002 Annual Mean $\mu g/m^3$	2003 Annual Mean $\mu g/m^3$	Projected 2005 mean (from 2002 data) $\mu g/m^3$	Projected 2005 mean (from 2003 data) $\mu g/m^3$
Morfa Groundhog	Roadside	30.7	32	28.26	30.33
Hafod 1N	Roadside	52.2	53.7	48.05	50.9

Table 22 – 2005 Annual mean NO_2 projections from monitoring within an AQMA

Site	Site Classification	2002 Annual Mean $\mu g/m^3$	2003 Annual Mean $\mu g/m^3$	Projected 2005 mean (from 2002 data) $\mu g/m^3$	Projected 2005 mean (from 2003 data) $\mu g/m^3$
Morriston Groundhog	Roadside	23.5	26.4	21.6	25.02
Swansea AURN	Urban Background	31.2	33.8	29.11	32.3
3N Manselton	Urban Background	22.6	25.1	21	24.04
4N West Cross	Urban Background	11.7	14.4	10.9	13.8
5N Uplands	Roadside	42.12	41.7	38.77	39.52

Table 23 – 2005 Annual mean NO_2 projections from monitoring outside an AQMA

From tables 22 and 23 and data being obtained from the Hafod OPSIS DOAS it is evident that breaches of the annual mean objective are predicted in 2005. These predictions continue within the Hafod Air Quality Management Area and now also at one location outside of this area where sufficient data exists to base the prediction on.

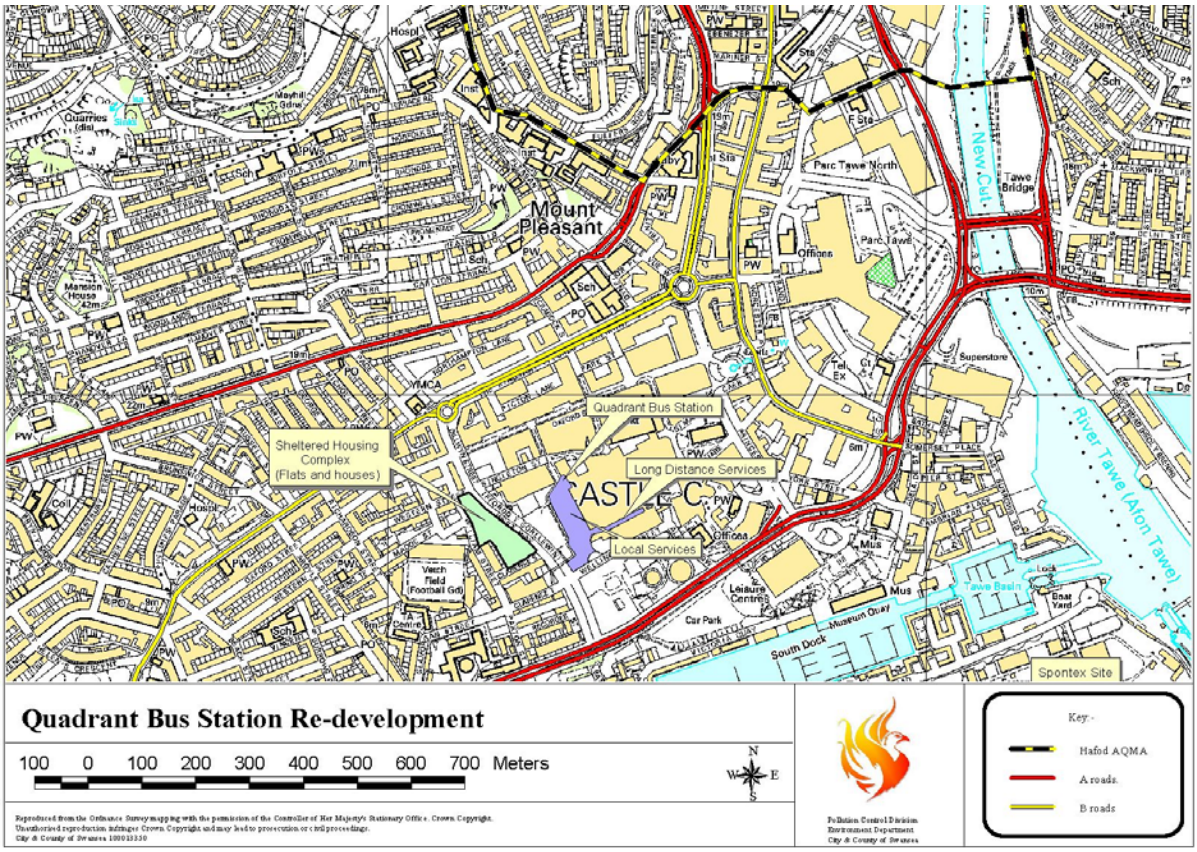
10.6 Bus Stations

The Quadrant Bus Station is the main pick-up and drop-off point for all local and long distance journeys that start and/or terminate within the city centre. It was constructed as part of the major Quadrant shopping complex during the late 1970's and early 1980's. The majority of the bus station complex is taken up with the space required for bus movements themselves. The passenger terminal is located immediately adjacent to the shopping complex and has been heavily criticised both for its general condition and distance from Swansea Central railway station.

Total bus movements are not thought to exceed the threshold mentioned in LAQM.TG(03) of 1000 movements per day. In addition, there is no relevant exposure within 10m of the bus station (Swansea's population does not exceed 2 million that would then make relevant exposure within 20m).

However, there are major discussions with interested parties regarding the future of the station complex at its present location. Discussions have partly explored relocation to provide an integrated service with the rail network. However, the feasibility and practicality of this option has now meant this option has now been discounted. Current plans for the terminal have moved away from the above option, to more of a redevelopment and upgrading of the existing terminal. A compulsory purchase order has been made to permit the above. As this is now likely to prove the case, the effects on air quality will require assessment as a new access and egress road is envisaged from Westway dual carriageway, controlled by traffic lights. A large sheltered hosing complex borders and overlooks the already congested Westway which acts as a route to, and link from The Kingsway (via Dillwyn Street) to the north and west of the

city centre down to Oystermouth Road to the south. Any impacts on the pattern and frequency of bus provision are not known at this stage.



The change to the flow and composition of the traffic making use of Westway will require clarification in a practical way. It is anticipated that these developments outlined above will have an impact on the nearest receptor location – possibly directly and indirectly. When the development is complete it is anticipated that these receptor locations will be between 30-40 meters of the revamped station.

This location will in all likelihood be the subject of further work and possibly a detailed assessment for NO_2 and PM_{10}.

10.7 Authorised processes

There are no new processes either within the authority boundary or within neighbouring authorities that have the potential to emit significant quantities of nitrogen oxides from that reviewed during the first round of review and assessment process. There have been no significant changes to any of the existing processes.

10.8 Airports

Swansea has an airport located in the rural area of Fairwood, on the Gower Peninsular. There are receptor locations within 1000m of the airport boundary, but as the airport passenger numbers will not exceed the threshold mentioned in LAQM.TG(03) of 5 million passengers in 2005 and freight traffic is minimal, there is no requirement to proceed further.

10.9 Roads with high flows of buses and/or HGVs

Guidance within LAQM.TG(03) requires the identification of all roads with an unusually high proportion of heavy duty vehicles. Unusually high proportion is further defined as to be greater than 25% of AADT.

Data from 30 new GPRS ATC's that produce a classification split to the EUR6 standard is available and is undergoing data import testing into a traffic database. This network of GPRS ATC's will be expanded to cover the majority of the heavily trafficked areas within the authority in the coming years. As a result, a precise classification split is not as yet available. Data from the existing

ATC's operated by the authority do not undertake a classification split only a volumetric count. However, local knowledge would seem to indicate that the AADT of HGVs is unlikely at present to exceed 25% of the traffic load at any location. The redevelopment of the Quadrant Bus Station (Sec 10.6) may prove to be the exception. These matters will be subject to quantification and additional reporting at a later date.

10.10 Narrow congested streets with residential properties close to the kerb

Guidance within LAQM.TG(03) requires the identification of all general areas where there may be narrow congested streets with residential properties within 5m of the kerb. Additional guidance is that the daily traffic flow should be greater than 10,000 vehicles per day.

This basic approach coupled with local knowledge on traffic volumes has led to several such congested streets being identified. These streets were not identified in the previous review and assessment works undertaken.

It has been decided to undertake diffusion tube monitoring within these identified streets, as detailed traffic information is unavailable for use with the DMRB screening tool. The situation in regard to the availability of detailed traffic information has been mentioned elsewhere and is currently being addressed. Monitoring however, was unable to commence until June 2004. It is planned to undertake an assessment for at least 6 months with the likelihood of this being extended to a full year. As and when data for the initial 6 months of monitoring becomes available the results will become the subject of a separate interim report.

The identified streets and areas are given below in table 23.

Street	Area
Dillwyn Road	Sketty
Gower Road	Sketty
Vivian Road	Sketty
Peniel Green Road	Llansamlet
Nantyffin Road	Llansamlet
Alexandra Road	Gorseinon
Pontardulais Road	Gorseinon
High Street	Gorseinon
Ravenhill Road	Fforestfach
Station Road	Fforestfach

Table 23 – Diffusion Tube Monitoring – Narrow congested streets

Additional monitoring is also being undertaken along the congested sections of Neath Road, Hafod, which lie within the existing Hafod Air Quality Management Area.

10.10.1 Gowerton Bypass Study.

As mentioned in 9.7.1 above, a bypass of the narrow, congested, traffic light controlled crossroads at Gorseinon has been completed in two stages. The effectiveness of the usage of this bypass in terms of reducing the congestion at the traffic lights and also nitrogen dioxide levels within the village of Gorseinon as a whole has been underway since November 2002 and remains ongoing. Typically, around this junction, receptor locations are within 2 meters of the kerb. Traffic flows at the crossroads are not thought to exceed an AADT of 10,000 as current indications show the AADT of the bypass sections themselves to be around 6,000.

Typical Receptor Locations

For the sake of completeness, the currently available data from this study is presented below as table 24. Sites 5 and 6 are located either side of the traffic lights crossroads. The projected 2005 annual mean has been derived from the calculated 2003 mean using the guidance contained within LAQM.TG(03)) – Box 6.6 in regards to roadside sites and Box 6.7 at background sites. The 18-month exposure data commended in November 2002 and extends to June 2004.

Site	X Coord	Y Coord	Site Classification	18 Months Raw mean $\mu g/m^3$	2003 Raw Mean $\mu g/m^3$	2003 Bias corrected $\mu g/m^3$	Projected 2005 $\mu g/m^3$
1	259094	196477	Background	21.5	24.2	18.88	18.08
2	259025	196548	Background	27	26.2	20.44	19.57
3	258934	196598	Background	30.6	31.3	24.41	23.38
4	258885	196531	Roadside	38.5	41.4	32.29	30.61
5	258782	196382	Roadside	44.3	45.4	35.41	33.57
6	258758	196336	Roadside	48.7	50.7	39.55	37.49
7	258977	196369	Background	23.9	25.5	19.89	19.05
8	259175	196274	Roadside	37.1	37.6	29.33	27.80
9	259255	196217	Roadside	35.6	37.2	29.02	27.51
10	258923	196278	Roadside	35.5	38.9	30.34	28.76

Table 24 – Gowerton Bypass NO_2 monitoring data

From the calculated annual mean projections within table 23 for 2005, it is not predicted that there will be any exceedences of the annual mean objective of $40\mu g/m^3$ at any site.

10.11 Junctions

Guidance within LAQM.TG(03) advises that busy road junctions were often not considered adequately during the original review and assessment process. A busy junction is defined as one with an AADT of 10,000 or more. Additional guidance is to determine if there is relevant exposure within 10m of the kerb (Swansea's population of approx. 240,000 does not take it into the major

conurbation category where relevant exposure would be within 20m of the kerb). Whilst there are several junctions that it is thought will meet the traffic volumes required, there are none where the receptor locations are within 10m of the kerb. LAQM.TG(03) does not define at what point the 10m measurement is to be taken from i.e. anywhere from along the road link or from the kerb nearest the centre point of the junction. The DMRB printed manual Volume II Chapter 3 section 3.23 does not clarify this point. Indeed, it adds additional complications that deviate from the guidance issued in LAQM.TG(03) Sec 8-25.

ATC data is available from around these junctions but it mainly takes the form of either 10 or 24-hour duration surveys. Whilst it is possible to derive an AADT from this data it may not be the more appropriate way to approach the assessment required.

However, it is recognised that the identified junctions will require a full and proper assessment/investigation. It is therefore proposed to site nitrogen dioxide passive diffusion tubes at receptor locations to the identified junctions. It should be noted that the nearest receptor location may, in the majority of cases, be greater than 10m away from the main junction. The proposed junctions from local knowledge with combined traffic volumes likely to be >10,000 AADT flow to be monitored are: -

a) Fforestfach Cross
b) Sketty Cross
c) Oystermouth Road
d) Llansamlet Cross
e) Quay Parade Bridges (St.Thomas side)
f) Dyfatty Junction

g) Uplands Cross
h) Gorseinon Cross

The situation with regard to the availability of detailed traffic information has been mentioned elsewhere and is currently being addressed. Monitoring of these locations was however, unable to commence until June 2004.

It is planned to undertake an assessment for at least 6 months with the likelihood of this being extended to a full year. As and when data for the initial 6 months of monitoring becomes available the results will become the subject of a separate interim report.

10.12 Diesel and Coal-Fired Locomotives

Both types of locomotive emit nitrogen oxides, but there is no evidence to suggest that there is any risk of the 1-hour or annual mean objectives for NO_2 being exceeded at the compliance date of the 31st December 2005.

Guidance within LAQM.TG(03) concludes therefore, that there is no requirement to undertake any additional assessment.

10.13 Shipping

There are emissions of nitrogen oxides from the burning of oil in ship's engines, but there is no evidence to suggest that there is any risk of the 1-hour or annual mean objectives for NO_2 being exceeded at the compliance date of the 31st December 2005.

Guidance within LAQM.TG(03) concludes therefore, that there is no requirement to undertake any additional assessment.

10.14 Conclusion of USA for Nitrogen dioxide

There are no indications at present to indicate that the 1-hour objective of 200μg/m^3 will be exceeded at any monitoring location within the authority's area at the compliance date of the 31st December 2005.

However, there are indications from the projections made to 2005 that the annual mean objective of 40μg/m^3 will continue to be exceeded at locations within the Hafod Air Quality Management Area, and in all probability at the Uplands 5N site outside of the AQMA.

It is not thought appropriate to amend or revoke the declared Hafod Air Quality Management Area (NO_2), cited as the City & County of Swansea (Hafod Air Quality Management Area (NO_2)) Order 2001 in light of the continued predictions for breaches of the annual mean objective in 2005.

The situation with regard to the additional narrow, congested streets and busy junctions identified has yet to be clarified due to the lack of availability of monitoring data. However, based on the likelihood of breaches of the annual mean objected at these locations and the probable failure of the Uplands 5N site it is thought appropriate to proceed to a detailed assessment for nitrogen dioxide at all of the identified locations.