The Environment Act 1995: Part IV
Local Air Quality Management
Review and Assessment of Air Quality

City & County of Swansea

Updating and Screening Assessment

April 2006

Title	**Updating and Screening Assessment**

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Date	April 2006

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Contents

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 third 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 following the first round of review and assessment, concluded that there was a requirement to declare the Hafod area as an Air Quality Management Area. This area was declared in September 2001 and a map outlining the area can be seen within Annexe 1.

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

1. Updating and Screening (submitted July 2004)
2. Detailed Assessment.(submitted December 2005)

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) and the update to LAQM.TG(03) during January 2006. 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. Indications at present point towards compliance with the NO_2 annual mean objective at all monitored locations that lie outside of the existing Hafod Air Quality Management Area.

It has also been concluded that whilst the objectives for particulate matter PM_{10} were 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. However, there is great debate over the future direction with UK policy in regard to particulate matter. This authorities concern with regard to this uncertainty are outlined within 9.3.1

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. This trend is changing however and within the last 3 years Swansea has seen the SA1 development within the old docks area provide a springboard for new housing development both within the SA1 development site and more lately within the marina area. These developments are outlined within section 11 and are provided for information within this report.

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).

In between these stages, the authority had to deal with and resolve a old, disused coal spoil tip at the former Brynlliw Colliery site. This absorbed most resources available between 1999 and 2000.

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 40$\mu g/m^3$ 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 feasibility and infrastructure work in formulating its Action Plan resulting in delays in production of the report. The completed Action Plan was submitted for consideration to the Welsh Assembly Government in December 2004.

In 2004, the authority commenced works on the second round of review and assessment. In accordance with the policy and technical guidance documents, the second round of review and assessment was carried out in two stages;

- An Updating and Screening Assessment (USA) - intended to identify aspects that have changed since the first round of review and assessment (from 1999 in Swansea's case) and identify those that require further assessment; namely
- A Detailed Assessment of those pollutants that have been identified as requiring further work and investigation

The Updating and Screening Assessment was submitted to the Welsh Assembly Government in July 2004 with a recommendation to proceed to a detailed assessment for nitrogen dioxide at identified narrow congested streets and busy junctions. The USA also concluded that particulate matter PM_{10} should also be investigated using real-time techniques at the identified narrow, congested

streets and busy junctions, despite the 2010 provisional objectives not being set in regulation.

A brief summary of the results and conclusions of the Detailed Assessment into NO_2 levels can also be found within the Progress Report 2004 – section 2.3.2.3 page 95. The Detailed Assessment itself was submitted to the Welsh Assembly Government during December 2005.

The Progress Report for 2004 was submitted for consideration during July 2005

The infrastructure required for a real-time assessment of PM_{10} is still being developed. The authority have purchased ten Met One E-Type light scattering PM_{10} dust samplers and are in the process of deploying these at the identified narrow, congested roads and busy junctions mentioned within the last USA submitted in July 2004 and the Detailed Assessment. Identification of suitable sites is underway but what is proving time consuming are the practical considerations of the site location itself together with the provision of suitable services i.e. un-metered electricity feeds and suitable mounting points. It is recognised that these analysers do not have formal UK type approval but due to both the expense and considerable practical considerations of deploying Rupprecht & Patashnick Co., Inc. TEOM's, these E Type samplers will, it is thought, provide a more accurate assessment than use of the DMRB screening tool would be able to provide. It is both hoped and envisaged that by the time these sites are established that the other infrastructure works to develop the capability to model air quality across the authority will be complete. The modelling will supplement the data collected by the E Type samplers.

Additional works underway include the collection of real-time classified counts of traffic data via the Vodafone GPRS network together with the construction of

an emissions database. It is these latter items, particularly communications problems with the GPRS system that have delayed the modelling capabilities to date.

3.2 Summary of LAQM Actions to date

Details on the various stages completed by the authority in the Local Air Quality Management process are given below. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. The Internet addresses (URL's) that these reports can be downloaded from are given where appropriate.

Report	Date Completed	Internet URL
1st Stage Review	1999	http://www.swansea.gov.uk/index.cfm?articleid=5563
Brynlliw Colliery Remediation	1999-2000	
2nd & 3rd Stage Review	2001	http://www.swansea.gov.uk/index.cfm?articleid=5565
Declaration of Hafod AQMA	September 2001	http://www.swansea.gov.uk/index.cfm?articleid=5557
Stage 4 Review	October 2003	http://www.swansea.gov.uk/index.cfm?articleid=5568
2nd Round Review USA	July 2004	http://www.swansea.gov.uk/index.cfm?articleid=5561
Hafod AQMA Action Plan	December 2004	http://www.swansea.gov.uk/index.cfm?articleid=9930
Progress Report 2004	July 2005	http://www.swansea.gov.uk/index.cfm?articleid=9929
Detailed Assessment	December 2005	

3.3 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). LAQM.TG(03) has undergone further review for this the third round of review and assessment. An update has been produced in January 2006 resulting in LAQM.TG(03) not being re-published in its entirety. The revisions and updates are provided as a series of FAQ's, supported where necessary by new LAQM tools. The revisions and updates focus upon experiences from the previous rounds of review and assessments and concern the following issues:

- Background pollution maps and future year calculation tools
- Emissions of sulphur dioxide from steam locomotives
- Emissions of sulphur dioxide from shipping

- Emissions of PM_{10} from poultry farms
- Data ratification procedures
- NO_x:NO_2 relationships

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 previous reviews and assessments.

LAQM.TG(03) and its subsequent update in January 2006 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.

3.4 The Role of Local Authorities

In accordance with the current policy and technical guidance documents, the third 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 the second review and assessment (July 2004 in Sweansea's case) 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.

3.5 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

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

[1] Source Technical Guidance LAQM.TG(03) Chapter 2 page 2-1
[2] Source Expert Panel on Air Quality Standards – Carbon Monoxide

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 with an EU objective again of 10mg/m^3 as a maximum CO daily running eight hour mean to be achieved by 31st December 2005.

4.4 Review of Existing Information

4.4.1 Authorised Processes

Previous reviews and assessments have not identified 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.

Previous reviews have however, identified 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.

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 by previous assessment works 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)(as amended January 2006) 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 and Quay Parade) 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. This situation has not changed since previous assessments were undertaken.

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 -2005 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.

All results are presented in mg/m^3 by multiplying the logged result in ppm by the conversion factor of 1.16 [5] to produce results expressed in mg/m^3. For ease of comparison with results from the previous year, the results obtained from 2001to 2005 are shown within table 4 below. There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site.

[4] Source LAQM.TG(03) – Monitoring - Calculation of exceedence statistics, paragraph A1.104 page A1-37.
[5] *Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44*

The date for compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31st December 2003. The EU objective of a maximum daily 8-hour running mean of 10mg/ m^3 with a compliance date of 2005 has also been achieved.

Year	Max 8-hour running mean
2001 *	6.17 mg/m^3
2002 *	3.14 mg/m^3
2003 *	3.17 mg/m^3
2004	4.19 mg/m^3
2005 **	2.65 mg/m^3

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

** Results have been recalculated following review of QA/QC procedures*

*** January – September 2005 ratified data. October – December 2005 provisional data*

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.

The CO 8-hour running mean data from both stations have been examined for 2001 - 2005 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.[6] For the Swansea AUN site verified and ratified hourly data has been downloaded/ provided by NETCEN at

http://www.airquality.co.uk/archive/flat_files.php?site_id=SWAN&zone_id=9

The hourly means for the Morriston Groundhog site 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.

All results are presented in mg/m^3 by multiplying the logged result in ppm by the conversion factor of 1.16 [7] to produce results expressed in mg/m^3. For ease of comparison with results from the previous year, the results obtained from 2001to 2005 are shown within table 5 below. There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site.

Year	Max 8-hour running mean	
	Swansea AURN *	Morriston Groundhog
2001	3.18 mg/m^3	** 4.61 mg/m^3
2002	2.28 mg/m^3	** 2.31 mg/m^3
2003	2.51 mg/m^3	** # 2.07 mg/m^3
2004	3.07 mg/m^3	2.83 mg/m^3
2005	*** 2.13 mg/m^3	*** 1.96

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

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

*** Results have been recalculated following review of QA/QC procedures. # Data capture for 2002 88.73%*

**** January – September 2005 ratified data. October – December 2005 provisional data*

[6] Source LAQM.TG(03) – Monitoring – Calculation of exceedence statistics, paragraph A1.104 page A1-37.
[7] *Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44*

4.5 Conclusion of USA for Carbon Monoxide

Having reviewed the information contained within the authorities Progress Report for 2004 and the check list approach detailed in LAQM.TG(03)(revised January 2005) 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 was achieved at all locations within the boundaries of the authority at the objective date of 31st December 2003. In addition the EU objective of a maximum daily 8-hour running mean of 10mg/m^3 was achieved at all locations within the boundaries of the authority at the objective date of 31st December 2005.

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.[8]

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

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

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 Member States 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 and the USA completed in July 2004 identified no Part A 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.

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 remains that these processes are unlikely to contribute to a failure of the benzene objective.

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).

During previous assessment works (USA July 2004) 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 late night noise nuisance complaints.

Consequently, there remain 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. Major conurbation is defined within the January 2006 update of LAQM.TG(03) as a city with a population in excess of 2 million – this does not apply therefore to this authority. Very busy roads are defined within LAQM.TG(03) and its subsequent update 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 and at Quay Parade) 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. This situation remains unchanged since the previous assessment works during July 2004.

5.4.5 Benzene Monitoring Data

The authority has completed a 12 month BTEX Passive Diffusion Tube study within the Hafod Air Quality Management Area during 2003. The survey focused on benzene levels along Neath Road and within the residential streets leading off Neath Road. The results of this monitoring have been reported within the USA dated July 2004. The conclusion of this survey was that the benzene levels would not breach the annual mean objective of 5μg/m^3 at any monitoring location at the compliance date of 31st December 2010.

Additionally, an OPSIS Differential Optical Absorption Spectroscopy (DOAS) has been installed along a 250m path length of Neath Road within the Hafod area to measure benzene (with additional measurements also made for nitrogen dioxide, nitric oxide and ozone). Data capture commenced on the 8th January 2004. 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.

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.

Despite the guidance contained within LAQM.TG(03) and its January 2006 update, the AADT along Neath Road does not remotely approach the definition of "very busy" for a single carriageway road. However, the annual mean for 2004, whilst remaining below the 2010 objective, is 4 $\mu g/m^3$. The annual mean for 2004 has been projected forwards to 2010 using the correction factors

contained within LAQM.TG(03)[9]. The resultant prediction for 2010 is an annual mean of 3.17μg/m^3 which, whilst indicating compliance with the objective, is somewhat surprising given the AADT. From the background mapping (see 5.5 below) and, if the section of Neath Road is taken to be within the 0.3 – 0.5μg/m^3 area, then, a rough indication of the traffic component (being the only dominant source in the area) of the projected annual mean is in the region of 2.6μg/m^3.

Annexe 2 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.

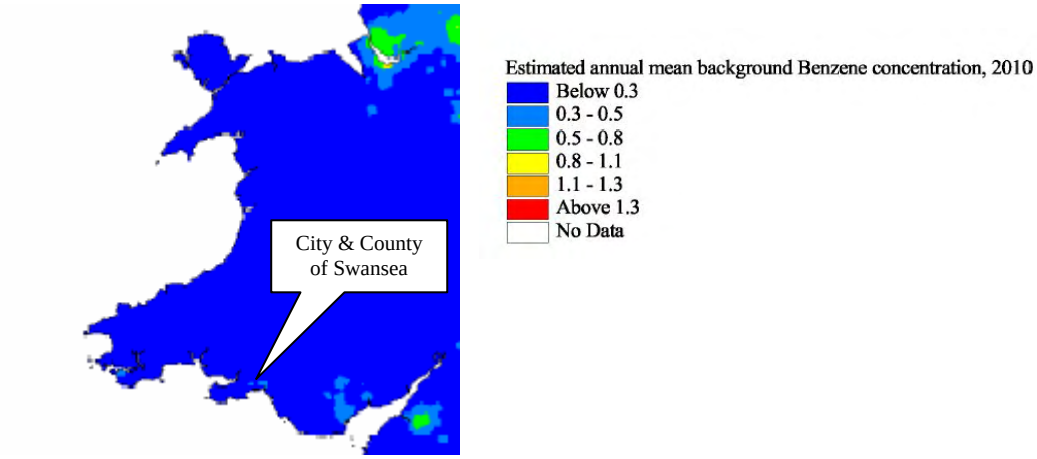
No data is available for 2005 as the property that the DOAS transmitter is fixed to, commenced a complete renovation during the early months of 2005. The transmitter head has been removed to prevent damage whilst these works are completed. It is envisaged that data capture will recommence during May 2006.

5.5 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/tools/aq_maps_2001.pdf for the years upto 2010. These indicate background concentrations as expected, well below the objective in 2010.

[9] LAQM.TG(03) *Box 3.4 (page 3-6)*

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



5.6 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 warrant further monitoring.

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 further when data collection has recommenced following the extensive renovation works underway at the monitoring location.

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 two rounds 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 two rounds of assessment also 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 still 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 for the monitoring station formally operated by Neath Port Talbot County Borough Council at the Baglan Primary School hydrocarbon site which would have been the closest local. This site was decommissioned some years ago.

Data is available from the Cardiff Centre monitoring site for 1,3-butadeine at http://www.airquality.co.uk/archive/flat_files.php?site_id=CARD&zone_id=9 This site is now the nearest and most relevant to the Swansea conurbation. It is thought valid to quote annual means from this site to provide an indicative level of what would be most probable for this authorities conurbation. These hourly data have been examined by the OPSIS Reporter package to compile annual means for 2003 – 2005 and are shown below as table 7. Data capture during some periods is poor falling close to 50% when the site was re-commissioned during 2005.

Year	Annual mean $\mu g/m^3$	Ratified data capture %
2003	0.1	75.8
2004	0.1	91.4
2005	0.5	51.2

Table 7 – Cardiff Centre 1,3-butadeine annual means 2003-2005

If the above were to be indicative of the levels expected within other urban areas then it is clear that the objective of a running annual mean not exceeding $2.25\mu g/m^3$ has been met within Swansea at the objective date at 31st December 2003 and in all subsequent years.

6.5 Background Mapping

Background maps are no longer provided as part of the update during January 2006 of LAQM.TG(03) in respect of 1,3-butadeine for future years as the objective date has now passed. Maps indicating the modelled background concentrations within Swansea for 2001 and 2003 were detailed within the USA dated July 2004 - Section 6.5 page 35 and 36.

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.

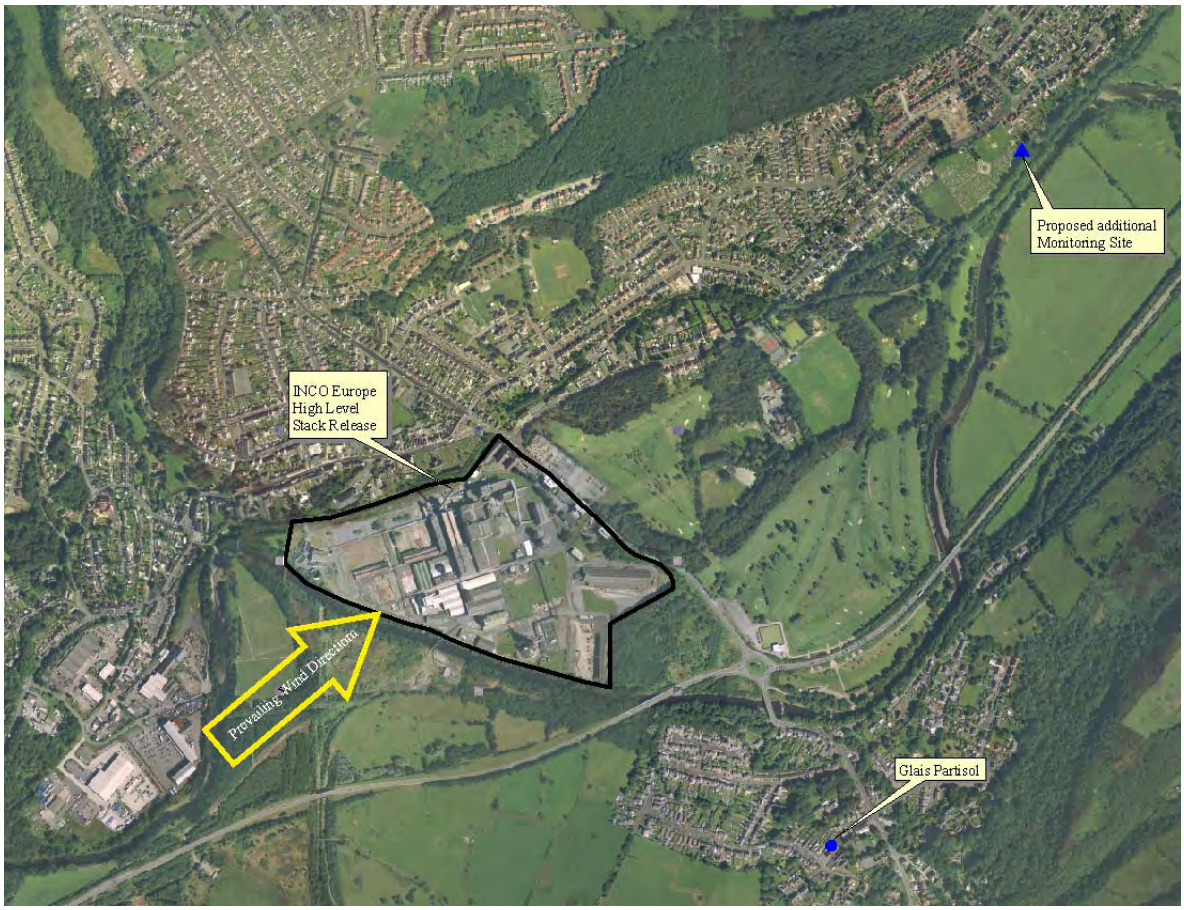
In addition, the detailed reviews of all IPPC applications have not revealed any off-site problems with ground-level concentrations of this pollutant.

7.4.2 Monitoring Data

Ambient lead levels are no longer routinely monitored and measured within the City & County of Swansea. However, this authority is participating in the Department of the Environment, Transport and the Regions (DETR) monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes.

The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at INCO Europe being located within the authorities area at Clydach.

Glais Primary School, School Road, was chosen as the monitoring location due to its proximity to the refinery and for additional security issues with the equipment at the time. The location of INCO Europe and the sampling location can be seen below within map 1.



Map 1 - Heavy Metals Monitoring -Glais Partisol

A Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling unit, fitted with a PM_{10} sampling inlet with a flow rate of 16.7 l/min, has been installed on a flat roof at the school. Filters are exposed on a weekly basis and sent to the contracted laboratory for analysis. Data from this study upto August 2004 is not available to this authority - it is thought that this is due to the re-allocation of the contract by DETR. Efforts are being made to obtain access to these data but to date these have not proved successful. Since August 2004 the contract for the management and analysis of data collected has been awarded to the National Physics Laboratory (NPL).

The data that is available from 2004 for the Glais heavy metals monitoring site (downloaded from http://www.airquality.co.uk/archive/data/metals/metals_data.xls) indicates an annual lead mean of 0.017μg/m^3.

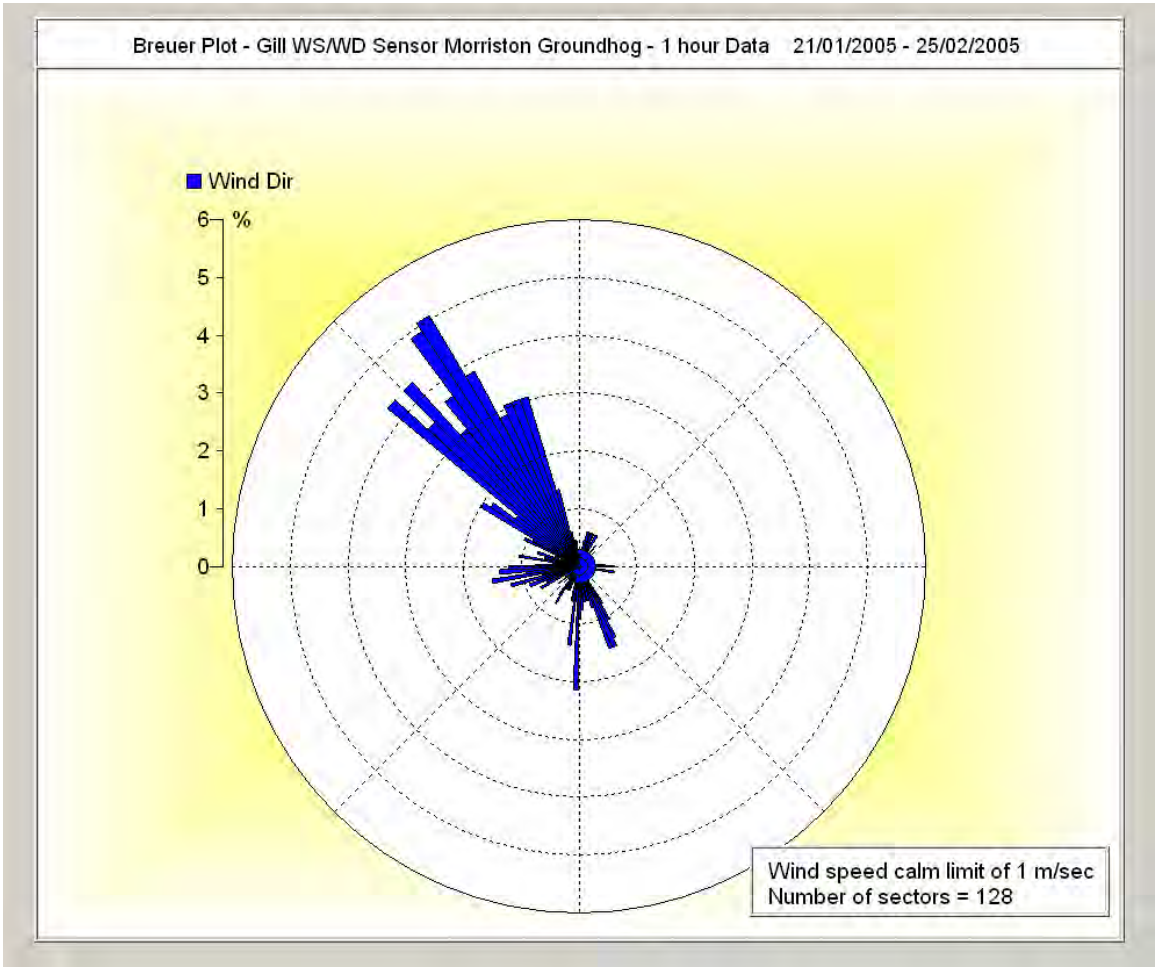
NPL have been contacted and they have provided the weekly data for all elements monitored at this site from 2nd September 2004 to 30th September 2005. Data has been supplied expressed as nanograms/m^3 and has been converted into μg/m^3. The resultant "annual" mean of 20.626 nanograms = 0.0206μg/m^3 seems representative of the previous annual mean for the whole of 2004 and remains below the objective level set for compliance in 2008.

Interestingly, there were high weekly lead results between the 21st January 2005 and 25th February 2005 in comparison to previous weekly results. These results are detailed below as table 8 and include the weekly result prior to, and post the period mentioned above for comparison.

Week Commencing	Pb nanograms/m^3
14th January 2005	6.2044
21st January 2005	34.6132
27th January 2005	100.9729
4th February 2005	130.9069
11th February 2005	103.3108
18th February 2005	93.57953
25th February 2005	3.261216

Table 8 – Weekly Lead results – Glais School Partisol

A wind rose analysis has been carried out for the period 21st January 2005 to 25th February 2005 using meteorological data from the Morriston Groundhog monitoring station. This station is located approximately 2 miles south-west of Glais, and is the closest available capable of providing representative meteorological conditions to be found further up the valley area. The resultant wind rose is shown below as plot 1.



Plot 1 – Breuer Plot Morriston Groundhog data

The predominant wind direction for this period is from the north-west: the same general direction that the INCO Nickel Refinery is from the monitoring station at Glais School. Whilst these data have been presented for illustration purposes it should be noted that the process undertaken at INCO are not known to emit significant quantities of lead. The indications to date would seem to point to that whilst it is probable that the manufacturing process undertaken within the INCO Mond complex are the more dominant local source of ambient levels of lead, these emissions do not breach the objective standard set for compliance within 2008. The area to the north-west of the ICO Refinery is primarily a rural upland area with no known sources of lead.

The heavy metals monitoring currently undertaken from Glais School is set to be extended with at least a further 3 monitoring locations during 2006. This is not due solely in relation to the lead levels mentioned here but primarily as there are indications that the EU directive in relation to nickel may be at risk of being breached. Additional monitoring is planned by this authority in the vicinity of the refinery in collaboration with the Environment Agency and Neath Port Talbot Borough Council. One additional monitoring station being considered by this authority is at Coed-Gwilym Cemetery shown within map 1 above, being almost directly upwind of the INCO complex. An additional heavy metals monitoring site will also be established downwind to the south-west of the site at the Morriston Groundhog site during 2006.

Additional monitoring locations are being investigated as it is not clear whether the stack emissions could generate these data, or, what the contribution from re-suspended historical deposition might be. An added complication with lead is the known historical contamination of the majority of the lower Swansea Valley area extending close to Glais from past multiple heavy metal workings throughout the entire lower valley area.

7.5 Conclusion of Updating Screening Assessment for Lead

There are no indications at present to indicate that the annual mean objective of 0.5μg/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 0.25μg/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 the 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 undertaken at the Corus Plant at Port Talbot. 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. This view remained the same during the Updating and Screening Assessment undertaken as part of the 2nd round of assessment

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.

8.4.2Areas 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. This trend continues to this day.

Guidance within LAQM.TG(03) and its January 2006 update 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. This situation has not altered from the previous Updating and Screening assessment submitted during July 2004.

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 and second round assessment processes.

Proposals to site 1 Biomass boiler (850kW), 2 gas boilers at 782kW each and 4 Mini Combined Heat and Power units at 5.5kW and12.5kW have been received for a site on Hazel Court, Sketty, Swansea. Additionally a proposal to site a Biomass burner (<400kW) at Ethnic Cuisine, Winch Wen, Swansea has been

received. However, in view of past experience and in light of the existing and revised guidance, these new sources are unlikely to be significant.

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 reviewed LAQM.TG(03) guidance issued in January 2006 further advises that in light of evidence derived from Detailed Assessments carried out by other local authorities that an authority should only need to proceed to a Detailed Assessment where this is relevant exposure within 250meters of the emission sources, and there are between 5,000 to 15,000 movements per year, or where there is relevant exposure within 1km and over 15,000 movements per year. During 2003 there were a total of 1200 vessels visiting the port which equates to 2400 total ship movements. During 2004 and 2005 the figures remain broadly

similar. 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 map 2 indicating the proximity of domestic dwellings to the site

Map 2 – *Landore Diesel Sheds and Surrounding Area*

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.

Maintenance operations involve the routine cleaning and refuelling of the HST units in dedicated sidings. Extensive warm up periods are mandated prior to movement of the HST train back out and onto the main line.
Guidance within LAQM.TG(03) and the January 2006 update 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 15m 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.

An identical view has also been formed for the activities undertaken at Swansea Central railway Station. Inter City 125 units and other diesel locomotives are left running during periods leading upto the scheduled service. However, there is no regular outdoor exposure of members of the public within 15m of the stationary locomotives.

“Sprinter services” are offered to/from several local stations both on the mainline Swansea – London line and also the West Wales line. However, these

sprinter services are not stationary at these very local stations for periods of 15 minutes or more. Consequently, their impact is minimal.
The current situation with railway locomotives has not changed from the detailed work and reporting that is included within the Updating and Screening Assessment submitted during July 2004. This work can be found on pages 45 – 50 of this report at http://www.swansea.gov.uk/index.cfm?articleid=5561

8.5 Monitoring Data

Existing data collected by this authority has been analysed for the Swansea AURN, Morfa and Morriston Groundhogs and for part of 2005 from the St Thomas DOAS.

8.5.1 Monitoring data within an AQMA

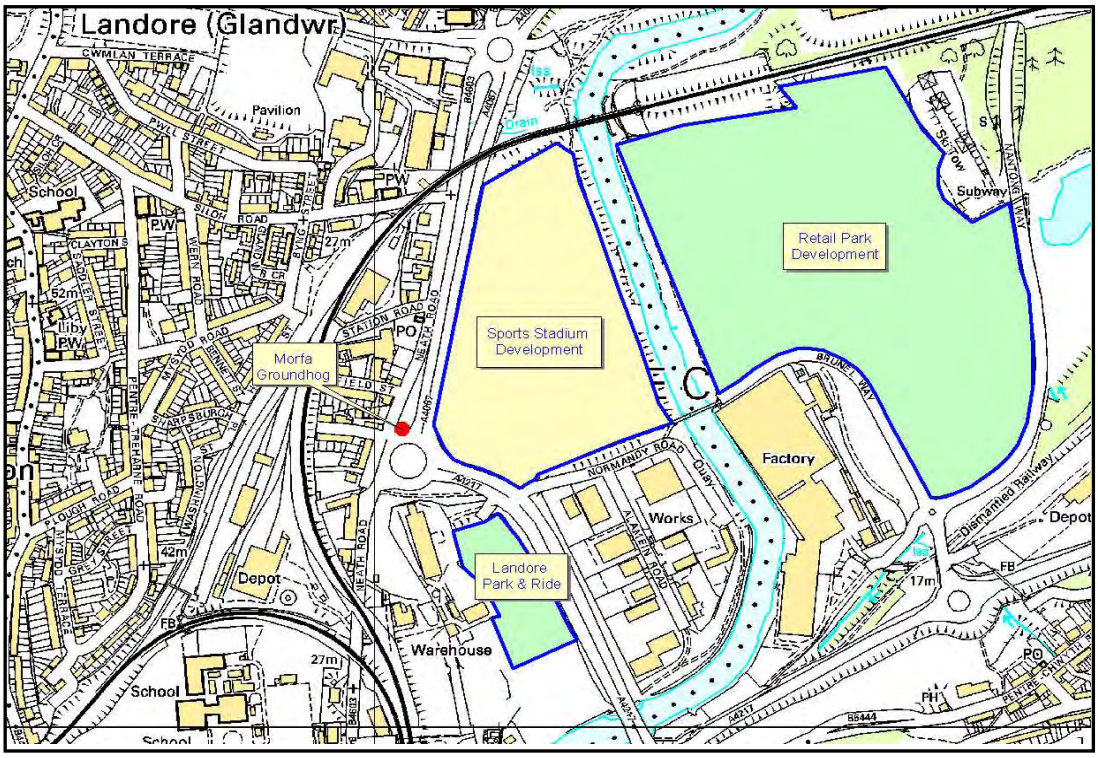
8.5.1.1 Morfa Groundhog, Neath Road, Landore

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

As with the majority of monitoring stations, the location finally chosen for monitoring has to be a compromise between the ideal desired location and the practicalities of siting a station of this size. It is recognised that this station having being sited on a roundabout is not ideally placed. However, in saying this, the station satisfies the majority of the monitoring criteria required by this authority with receptor locations (dwellings) being located within 25m. A map showing the location of the Morfa Groundhog station is given below as map 3



Map 3- Location of Morfa Groundhog Station

The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the daily 24-hour means.

In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present[10].

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 2.66 [11] to produce results expressed in $\mu g/m^3$.
Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 9. No exceedence of any objective was observed.

Morfa Groundhog	Max 15-Min Mean $\mu g/m^3$ ($266\mu g/m^3$)	Max 1-hour Mean $\mu g/m^3$ ($350\mu g/m^3$)	Max 24-Hour Mean $\mu g/m^3$ ($125\mu g/m^3$)
2004	111.18	73.15	21.8
Exceedences	0	0	0
Date of Max	01/09/2004	07/06/2004	09/12/2004
Time of Max	08:15am	11:00am	-
Wind Direction @ Max conc.	157°	154°	96°
2005	73.59	50.37	15.35
Exceedences	0	0	0
Date of Max	22/04/2005	21/04/2005	9/12/2005
Time of Max	01:30am	15:00	-
Wind Direction @ Max conc.	76°	131°	125°

Table 9 - SO_2 Results Morfa Groundhog 2004

Data capture at the base 15-minute logged means for 2004 is 97.48% and for 2005 is 97.65%, allowing direct comparison with the objective standards and not the percentile values.

[10] *LAQM.TG(03) Monitoring A1-38*
[11] *LAQM.TG(03) Appendix B - Conversion factors page A1-44*

It is worthwhile noting that whilst traffic sources may contribute slightly to SO_2 concentrations at this site, local knowledge and past analysis would point to industrial sources being the prime contributors.

Chart 1 below shows the 15-minute means, chart 2 the 1-hour means and chart 3 the 24 hour sulphur dioxide means for 2004-2005. Scatter Plot 1 shows 15 minute data for 2004 and scatter plot 2 15 minute data for 2005.

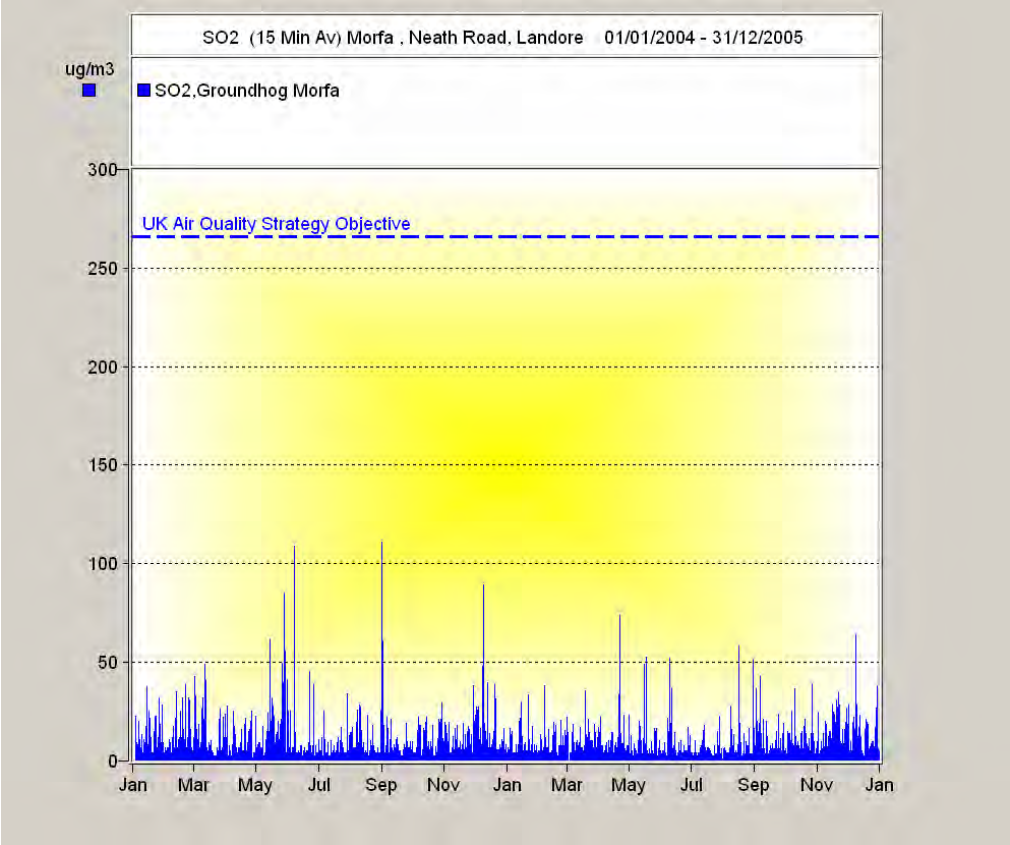


Chart 1 – Sulphur Dioxide 15-minute Means Morfa Groundhog 1st January 2004 – 31st December 2005

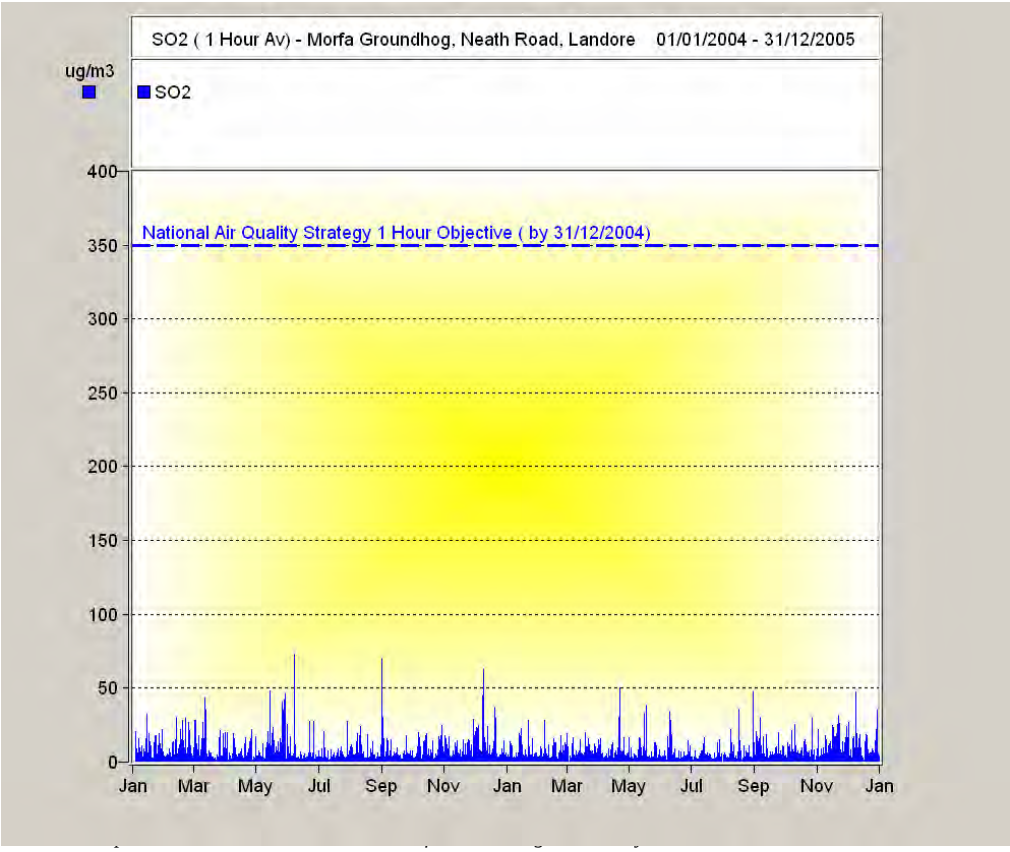


Chart 2 – Sulphur Dioxide 1-hour means Morfa Groundhog 1st January 2004 – 31st December 2005

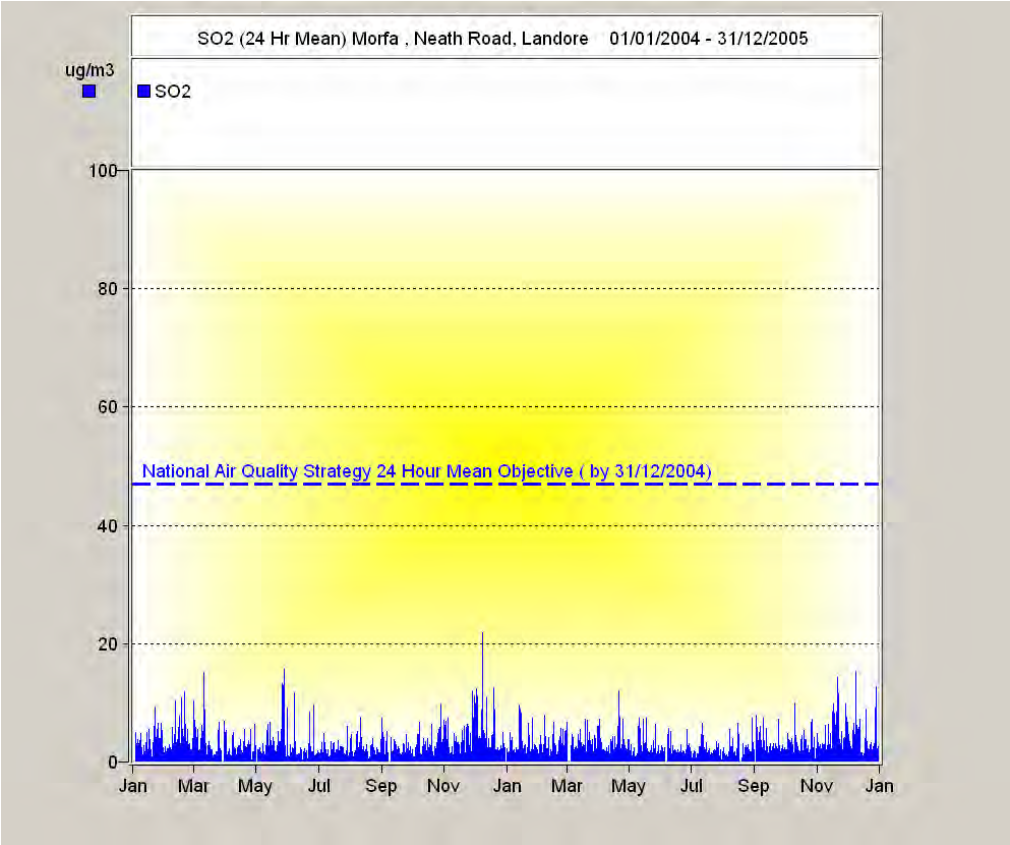
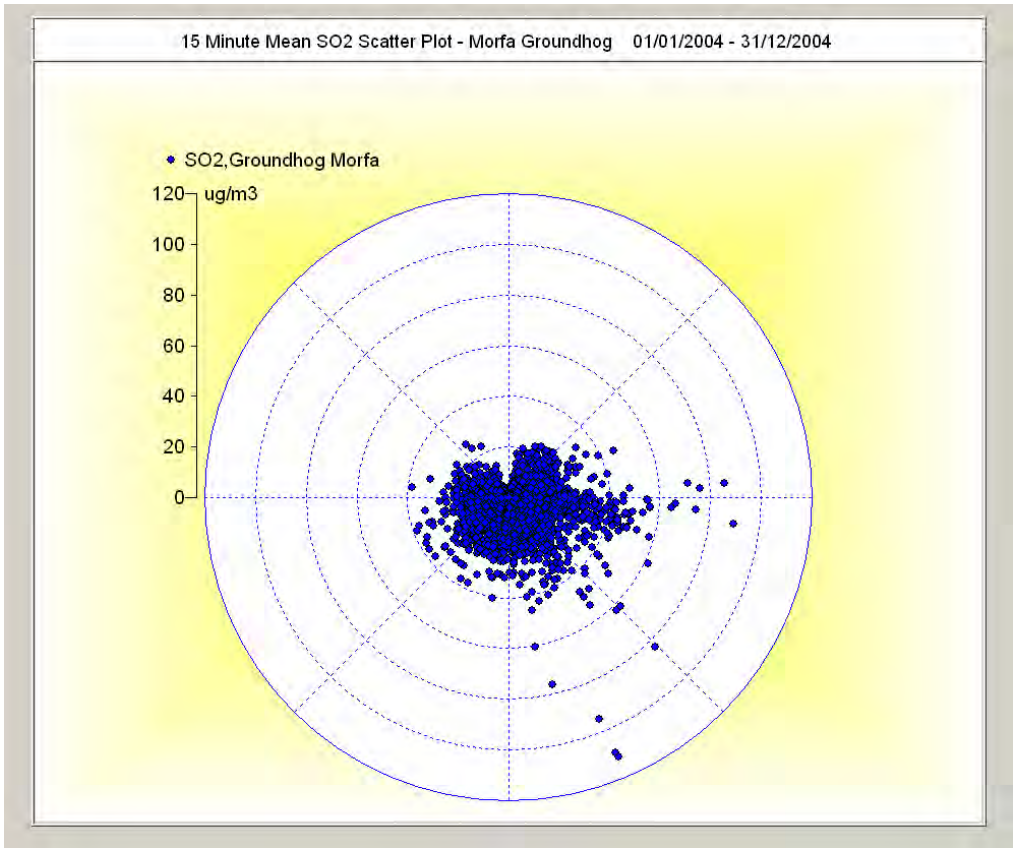
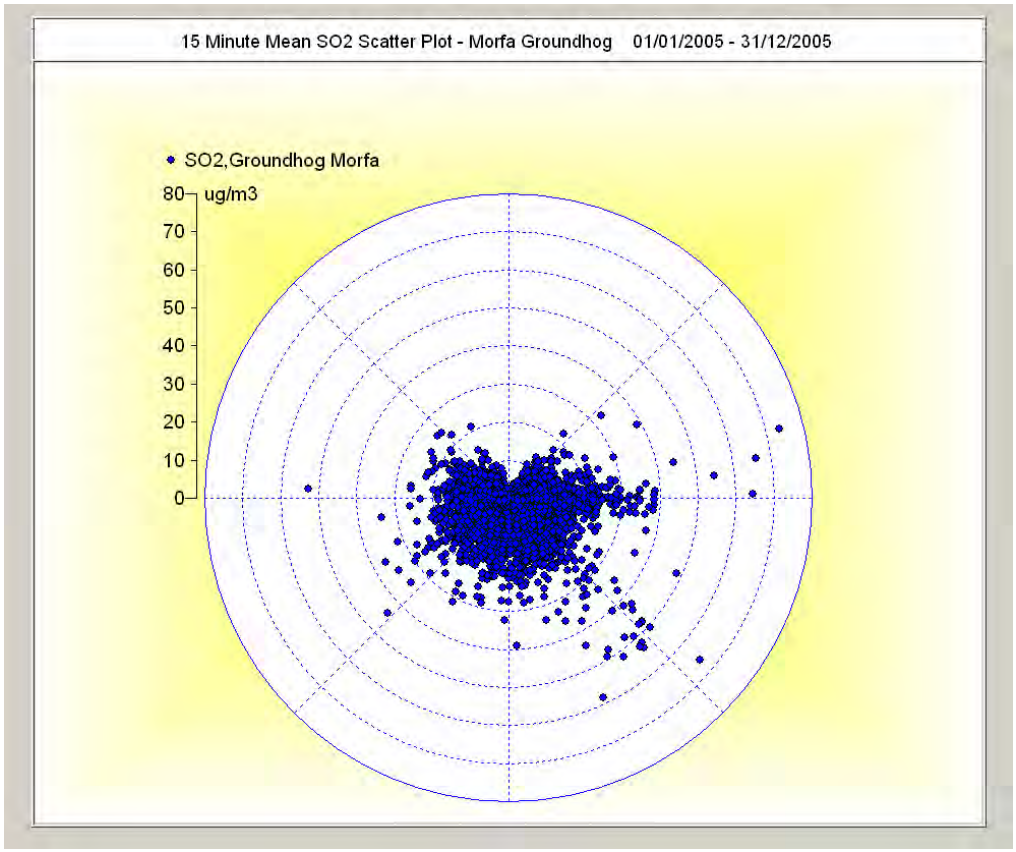


Chart 3 – Sulphur Dioxide 24-hour means Morfa Groundhog 1st January 2004 – 31st December 2005



Scatter Plot 1 – 15-minute SO_2 data 2004



Scatter Plot 2 – 15-minute SO_2 data 2005

Scatter plot 1 for 2004 indicates that the vast majority of 15-minute SO_2 means lie within the 0-40µg/m^3 range. This suggests that these data originate from within the local area as they are spread throughout the compass range. Those data greater than 40µg/m^3 tend to originate from an easterly or south-easterly source.

Similarly, from scatter plot 2 for 2005, the vast majority of data within the 0-30µg/m^3 range suggests a local origin. Those data that lie outside of this range again tend to originate from an easterly or south-easterly direction.

The Corus Steelworks at Port Talbot lie in a general south-easterly direction from all monitoring stations within Swansea. However, what is also suggested from scatter plot 2 is a slight impact from the Landore Diesel Sheds with some data outside of the "background" 0-30µg/m^3 level originating from a general south-westerly direction. It should be further stated that there were no breaches of the 15-minute directive observed despite all of these activities.

Past SO_2 statistical data from the Morfa Groundhog site has been reported within the Progress Report for 2004 submitted during July 2005 (page 27) and is available at http://www.swansea.gov.uk/index.cfm?articleid=9929. There is no straightforward way at present to project forwards to future years the number of likely exceedences etc and indeed there are no new objective dates post 2005. As maximum data for the differing averaging periods will inevitably vary year on year, probably the easiest way to asses any trend with the data is to examine the annual means returned. Table 10 below summarises the annual means between 2001 and 2005.

Year	Mean $\mu g/m^3$
2001	6.01
2002	4.78
2003	5.05
2004	3.67
2005	3.47

Table 10 – Sulphur Dioxide annual means – Morfa Groundhog 2001 - 2005

Meteorological conditions during 2003 are known to have been atypical but despite this, a clear trend is evident from the data with almost a halving of the concentrations between 2001- 2005. This trend is also evident from the maximum concentrations recorded for all of the averaging periods during this period.

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. In addition, the St.Thomas DOAS was established during late 2005.

8.5.2.1 Swansea AURN, Princess Way, Swansea.

The Swansea AURN is located in the heart of the city centre on the now pedestrian area of Princess Way.. Map 4 below is an aerial view of the site and the surrounding locations

Map 4 - Aerial View - Swansea AURN, Princess Way, Swansea

The station has been affiliated onto the UK National Network during late 1994 and has been operational ever since. The site was relocated during 1995 from its original location at Castle Gardens to its present location. The station has been given a site classification Urban Centre (U3)[12]The site is influenced by traffic using the nearby Princess Way/Kingsway roundabout but remains representative of typical population exposure in town or city centres. The main city centre shopping areas are to the south and south west of the site location.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring O_3, CO, SO_2 and NO_x, with an R&P TEOM

[12] *Source LAQM.TG(03) Appendix A page A1-42*

measuring PM_{10}. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is then forwarded to Cassella Stanger and NETCEN to perform data management procedures. The data is then further subjected 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).

Hourly ratified data for 2004 and 2005 has been downloaded from the Air Quality Archive at http://www.airquality.co.uk/archive/flat_files.php?site_id=SWAN&zone_id=9 along with ratified 15-minute Sulphur Dioxide data from the same location. These data have then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation.

Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 11. No exceedences of any of the objectives were observed. Graphs representing the various averaging periods for 2004 and 2005 that are detailed within table 11, are shown below as chart 4 (15-minute means), chart 5 (1-hour means) and chart 6 (24-hour means).

Data capture at the base 15-minute logged means for 2004 is 95.42% with data capture at 1-hour integration 97.34 % allowing direct comparison with the objective standards and not the percentile values. However, 15-minute data capture for 2005 is 89.75% which is marginally below the 90% data capture

required permitting calculation of the number of exceedences. Where data capture is less than 90%, calculation of the 99.9th percentile is required for the 15-minute data. Data capture at 1-hour integration for 2005 is 97.34 % allowing direct comparison with the objective standards and not the percentile values.

The ratified hourly means have then been used to calculate the daily 24-hour means for both 2004 and 2005. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly ratified means were specified to be present [13]. Data capture/coverage at the 24-hour integration is 97.27% for 2004 and 90.96% for 2005.

Swansea AURN	Max 15-Min Mean μg/m^3 (266μg/m^3)	Max 1-hour Mean μg/m^3 (350μg/m^3)	Max 24-Hour Mean μg/m^3 (125μg/m^3)
2004	90	74	32.70
Exceedences	0	0	0
Date of Max	07/06/2004	09/12/2004	9/12/2004
Time of Max	11:15	15:00	-
Wind Direction @ Max conc.	184°	70°	73°
2005	-	69	22.5
Exceedences	N/a	0	0
99.9th Percentile	43	-	-
Date of Max	22/04/2005	22/04/2005	22/04/2005
Time of Max	02:15	03:00	-
Wind Direction @ Max conc.	73°	64°	73°

Table 11 – Sulphur Dioxide Swansea AURN 2004 – 2005

[13] *LAQM.TG(03) Monitoring A1-38*

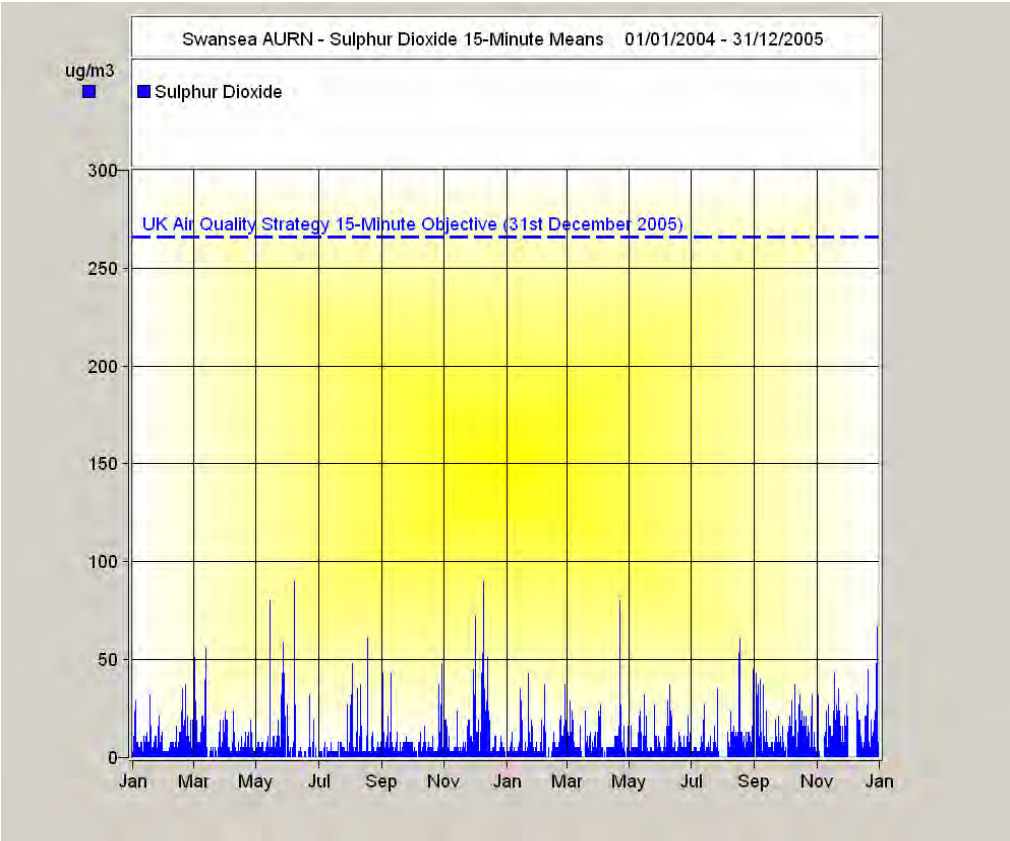


Chart 4 – Swansea AURN Sulphur Dioxide 15 Minute Means 2004 – 2005

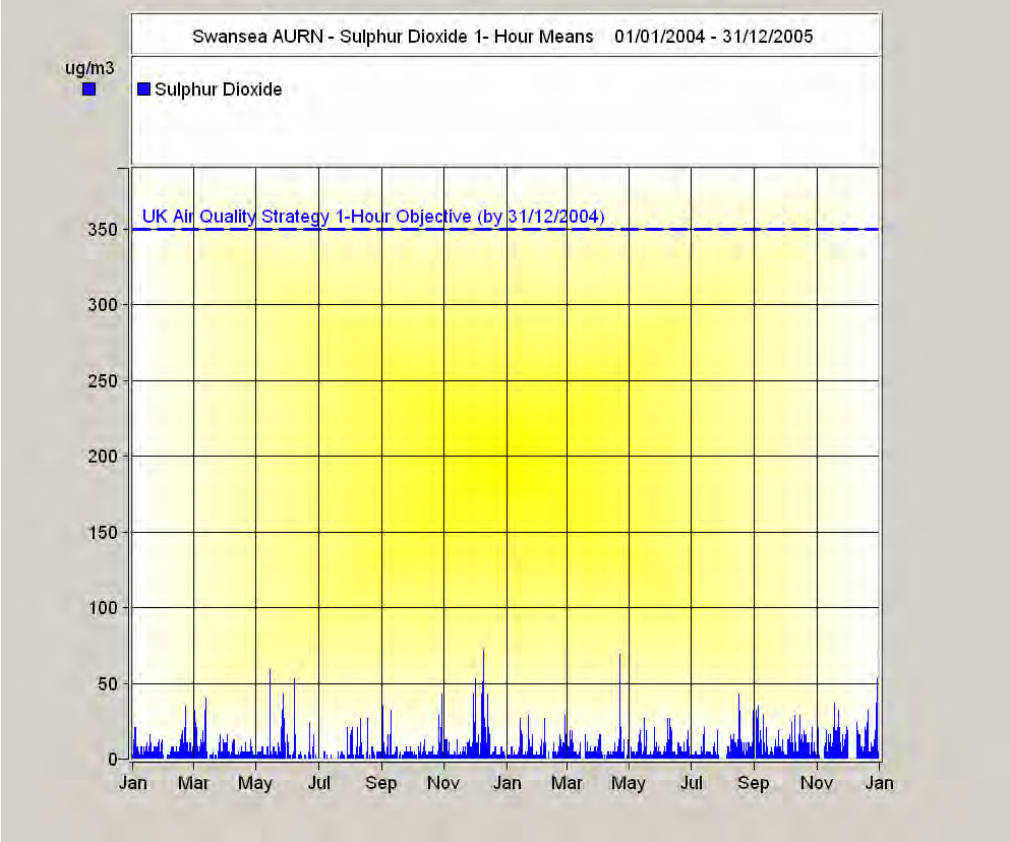


Chart 5 - *Swansea AURN Sulphur Dioxide 1-Hour Means 2004 – 2005*

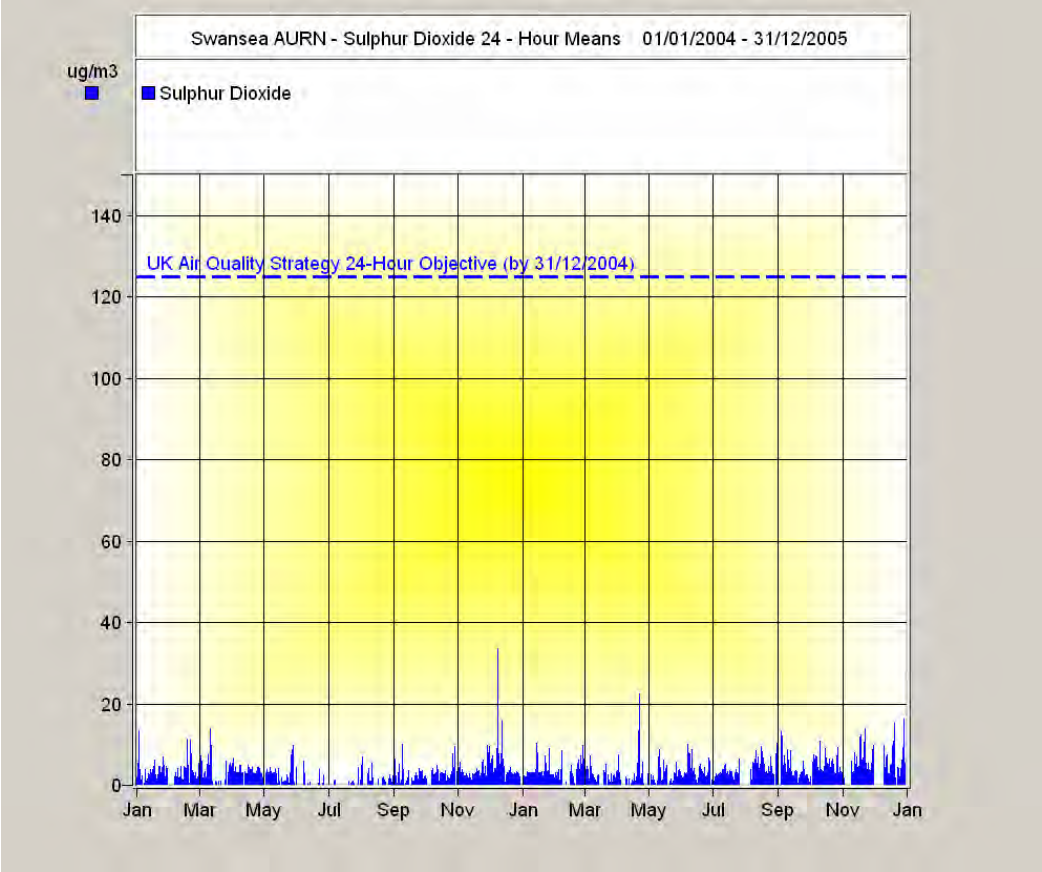


Chart 6 - *Swansea AURN Sulphur Dioxide 24-Hour Means 2004 – 2005*

Past SO_2 statistical data from the Swansea AURN site has been reported within the Progress Report for 2004 submitted during July 2005 (page 72) and is available at http://www.swansea.gov.uk/index.cfm?articleid=9929. There is no straightforward way at present to project forwards to future years the number of likely exceedences etc and indeed there are no new objective dates post 2005. As maximum data for the differing averaging periods will inevitably vary year on year, probably the easiest way to asses any trend with the data is to examine the annual means returned. Table 12 below summarises the annual means between 2001 and 2005.

Year	Mean $\mu g/m^3$
2001	5.96
2002	4.47
2003	4.41
2004	2.50
2005	3.89

Table 12 – Sulphur Dioxide annual means – Swansea AURN 2001 - 2005

Meteorological conditions during 2003 are known to have been atypical but despite this, these conditions have not has such a notable effect at this site as seen at the Morfa Groundhog during 2003. A clear overall downward trend is still evident from the data. This trend is also evident from the maximum concentrations recorded for all of the averaging periods during this period.

8.5.2.2 Morriston Groundhog, Wychtree Street

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 has been given a site classification Kerbside (U2)[14]. Map 5 below is an aerial view of the site and the surrounding locations.

[14] *Source LAQM.TG(03) Appendix A page A1-42*

Map 5 - Aerial view - Morriston Groundhog

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring O_3, H_2S, CO, SO_2 and NO_x, with an R&P TEOM measuring PM_{10}. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

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. Since the awarding of the contract to NETCEN by the Welsh Assembly Government to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a certified and traceable standard.

The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the daily 24-hour means. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present[15].

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 2.66 [16] to produce results expressed in $\mu g/m^3$.

Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 13. No exceedences of any of the objectives were observed. Graphs representing the various averaging periods for 2004 and 2005 that are detailed within table 13, are shown below as chart 7 (15-minute means), chart 8 (1-hour means) and chart 9 (24-hour means).

[15] *LAQM.TG(03) Monitoring A1-38*
[16] *Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44*

Morriston Groundhog	Max 15-Min Mean µg/m^3 (266µg/m^3)	Max 1-hour Mean µg/m^3 (350µg/m^3)	Max 24-Hour Mean µg/m^3 (125µg/m^3)
2004	98.12	68.02	18.73
Exceedences	0	0	0
Date of Max	27/05/2004	09/12/2004	9/12/2004
Time of Max	22:45	10:00	-
Wind Direction @ Max conc.	104°	96°	113°
2005	84.52	55.34	15.06
Exceedences	0	0	0
Date of Max	18/05/2005	30/08/2005	9/12/2005
Time of Max	06:15	12:00	-
Wind Direction @ Max conc.	69°	142°	170°

Table 13 – Sulphur Dioxide Morriston Groundhog 2004 – 2005

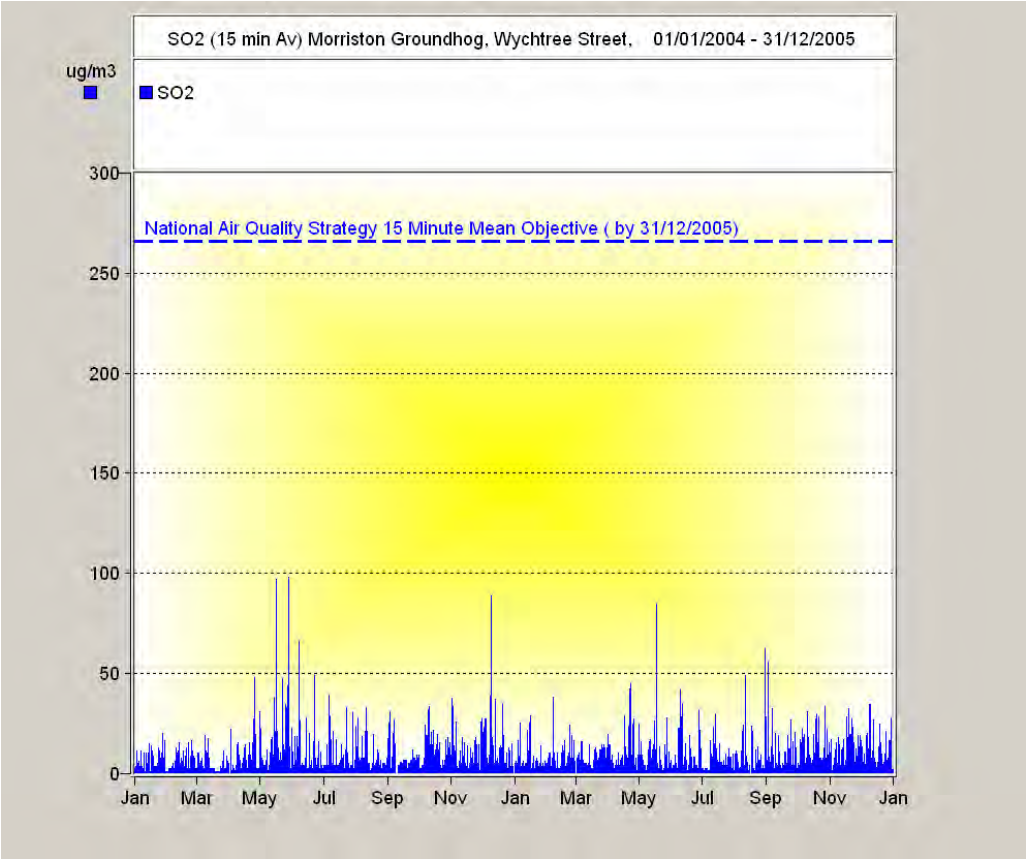


Chart 7 – Morriston Groundhog Sulphur Dioxide 15 Minute Means 2004 – 2005

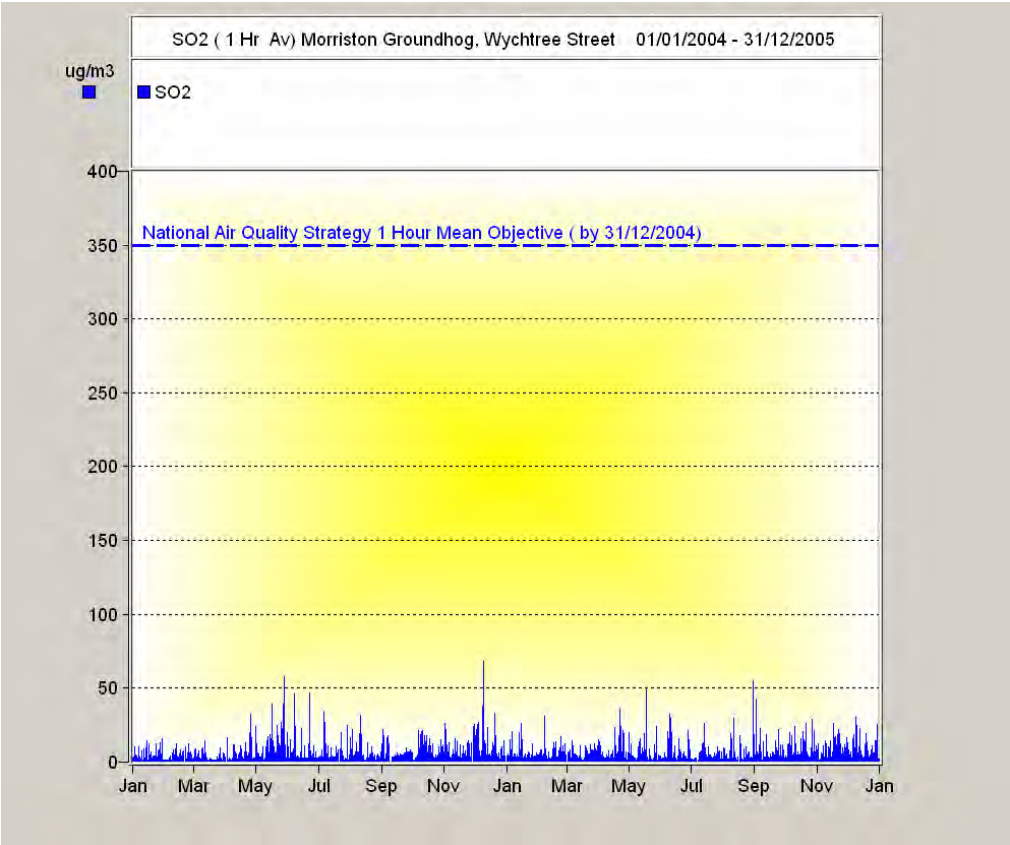


Chart 8 – Morriston Groundhog Sulphur Dioxide 1 -hour Means 2004 – 2005

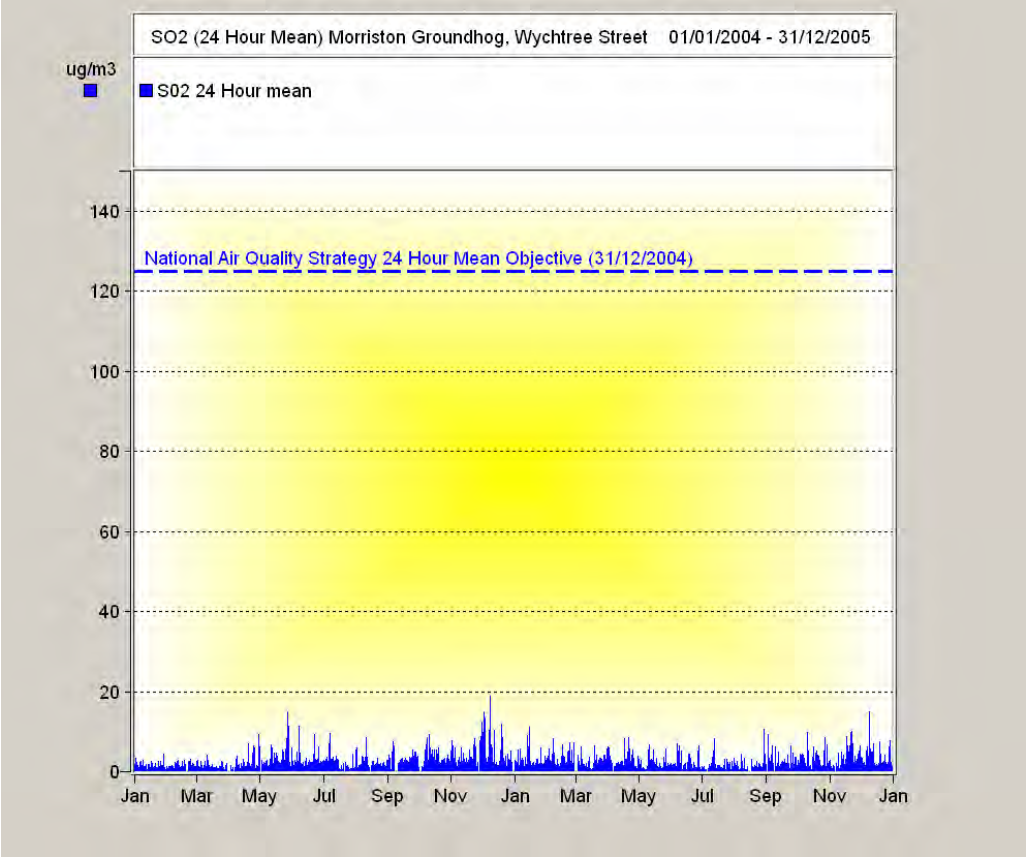


Chart 9 – Morriston Groundhog Sulphur Dioxide 24-hour Means 2004 – 2005

Data capture at the base 15-minute logged means for 2004 is 97.13% with data capture at 1-hour integration 98% allowing direct comparison with the objective standards and not the percentile values. Data capture for the 15-minute means for 2005 is 97% and at 1-hour integration 98.4%. Where data capture is less than 90%, calculation of the 99.9th percentile is required for the 15-minute data and at 1-hour integration the 99.7th percentile. These data capture rates allow direct comparison with the objective standards and not the percentile values.

The ratified hourly means have then been used to calculate the daily 24-hour means for both 2004 and 2005. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly ratified means were specified to be present[17].

Data capture/coverage at the 24-hour integration is 97.8% for 2004 and 98.3% for 2005. Where data capture is less than 90%, calculation of the 99th percentile is required rather than the number of 24-hour exceedences. Data capture rates from both 2004 and 2005 allow direct comparison with the objective standards and not the percentile values.

Past SO_2 statistical data from the Morriston Groundhog site has been reported within the Progress Report for 2004 submitted during July 2005 (page 48) and is available at http://www.swansea.gov.uk/index.cfm?articleid=9929. There is no straightforward way at present to project forwards to future years the number of likely exceedences etc and indeed there are no new objective dates post 2005. As maximum data for the differing averaging periods will inevitably vary year on year, probably the easiest way to asses any trend with the data is to examine

[17] *LAQM.TG(03) Monitoring A1-38*

the annual means returned. Table 14 below summarises the annual means between 2001 and 2005.

Year	Mean $\mu g/m^3$
2001	4.98
2002	3.48
2003	3.32
2004	3.08
2005	3.05

Table 14 – Sulphur Dioxide annual means –Morriston Groundhog 2001 - 2005

As has been observed at other monitoring stations, there continues to be a clear if less pronounced than at the other stations, downward trend with regard to SO_2.

8.5.2.3 St.Thomas DOAS, Pentreguinea Road

The St.Thomas OPSIS Differential Optical Absorption Spectroscopy (DOAS) has been installed during 2005 along a 280m path length of Pentreguinea Road within the St.Thomas area to measure the pollutants benzene, toluene, p-xylene, sulphur dioxide, nitrogen dioxide, and ozone. Valid data capture commenced on the 12th September 2005 at 09:30am. This section of Pentreguinea Road has an annual average daily traffic flow (AADT) of approximately 22,500 vehicles.

Measurements take place at a height of approximately 3 - 4 metres and less than 2m away from the front facade of the majority of terraced dwellings. The DOAS transmitter is fixed on top of a concrete column located north of the junction of Kilvey Terrace and Pentreguinea Road as shown in photo 1 below.

The receiver module is located on top of a concrete column and site housing at the other end of the open path measurement length as shown in photo 2 below.

Photo 1 - St Thomas DOAS Transmitter

Photo 2 - St Thomas DOAS Receiver Station

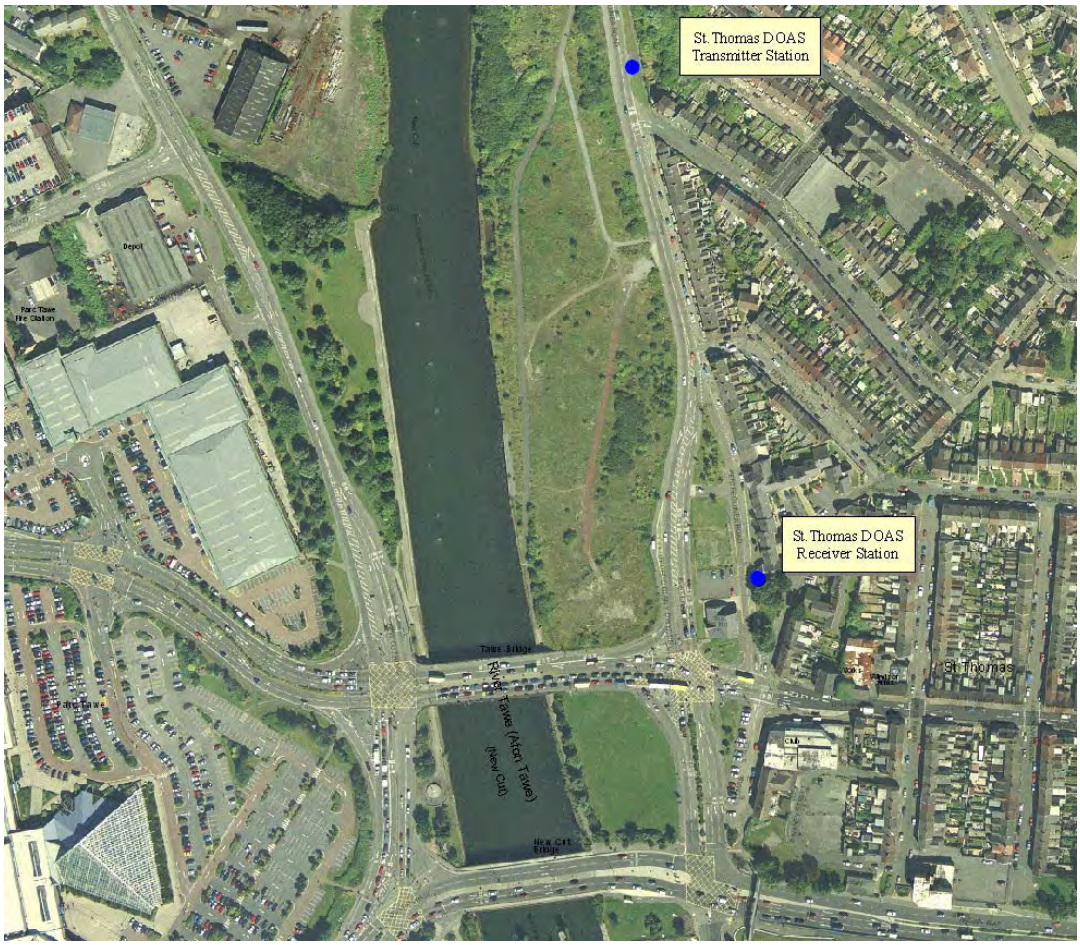
The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity 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. The location of the open path monitoring can be seen within map 6 below.

Quay Parade Bridges are to the south of this location. Congestion extends from Quay Parade bridges up Pentreguinea Road with congestion being seen as far north as the new Morfa Shopping Parc in Landore. There are numerous dwellings located along this section of Pentreguinea Road with an application already received to develop housing on the former St.Thomas Station Yard Site located between Pentreguinea Road and the River Tawe (SEE SEC). This

application for planning has been refused but it is envisaged that a modified scheme will be resubmitted. Congestion extends outwards from Quay Parade bridges at peak times over all links.

The station has been given a site classification Roadside (U2)[18].



Map 6 – Aerial View of St.Thomas OPSIS DOAS and surrounding area

The DOAS system returns data in the form of 5-minute means. In order to compile valid 15-minute and hourly means, a minimum of 100% of the 5-minute means were required to be present. Data capture of less than 100% for either the 15-minute or the hourly mean therefore excludes that 15-minute/hourly data

[18] *Source LAQM.TG(03) Appendix A page A1-42*

point from any subsequent analysis. In addition to the above, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted before the 5-minute mean was accepted as valid.

It should be noted that the data presented here represents the spatial average over the whole of the 280-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations.

Data available from 2005 and the first two months of 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 15. Unfortunately, only the briefest snapshots are available at present and these can be see within chart 10 (15-minute), chart 11 (1-hour) and chart 12 (24-hour).

LAQM.TG(03) suggests that ideally, monitoring should be carried out over a period of one year. However, it also indicates that a shorter period of monitoring i.e. 9 months[19] may be sufficient. Clearly, neither of these are the case at present. Data capture as a 15-minute mean for the period 12th September 2005 to 28th February 2006 is however high at 99.2%. The analysis shown here therefore is for indicative purposes only at this stage and extends to the 28th February 2006.

[19] LAQM.TG(03) page 7-3 paragraph 7.15

St.Thomas DOAS	Max 15-Min Mean µg/m^3 (266µg/m^3)	Max 1-hour Mean µg/m^3 (350µg/m^3)	Max 24-Hour Mean µg/m^3 (125µg/m^3)
2005/2006	261.9	138.5	35.8
Exceedences	0	0	-
Date of Max	07/01/2006	09/01/2006	09/12/2005
Time of Max	14:30	11:00	-
Wind Direction @ Max conc.	110°	121°	85°

Table 15 – Sulphur Dioxide St.Thomas DOAS 12th September 2005 – 28th February 2006

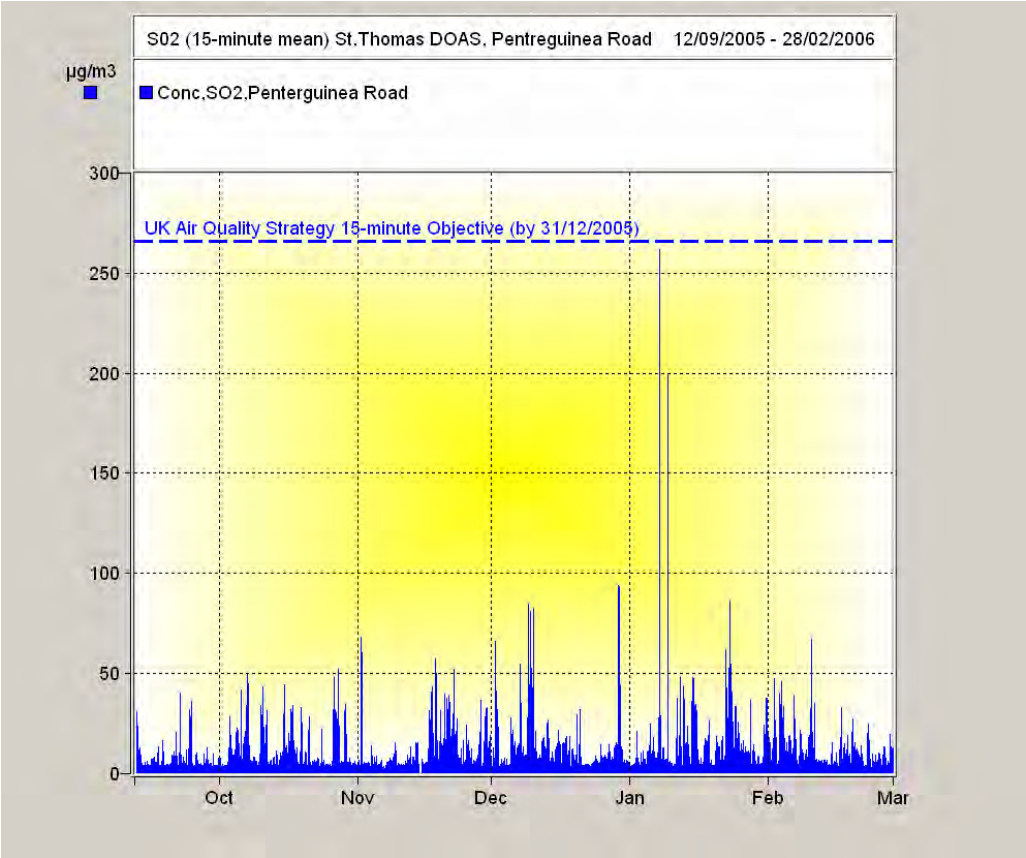


Chart 10 – 15-minute $S0_2$ Means 12th September 2005 – 31st December 2005 – St.Thomas DOAS

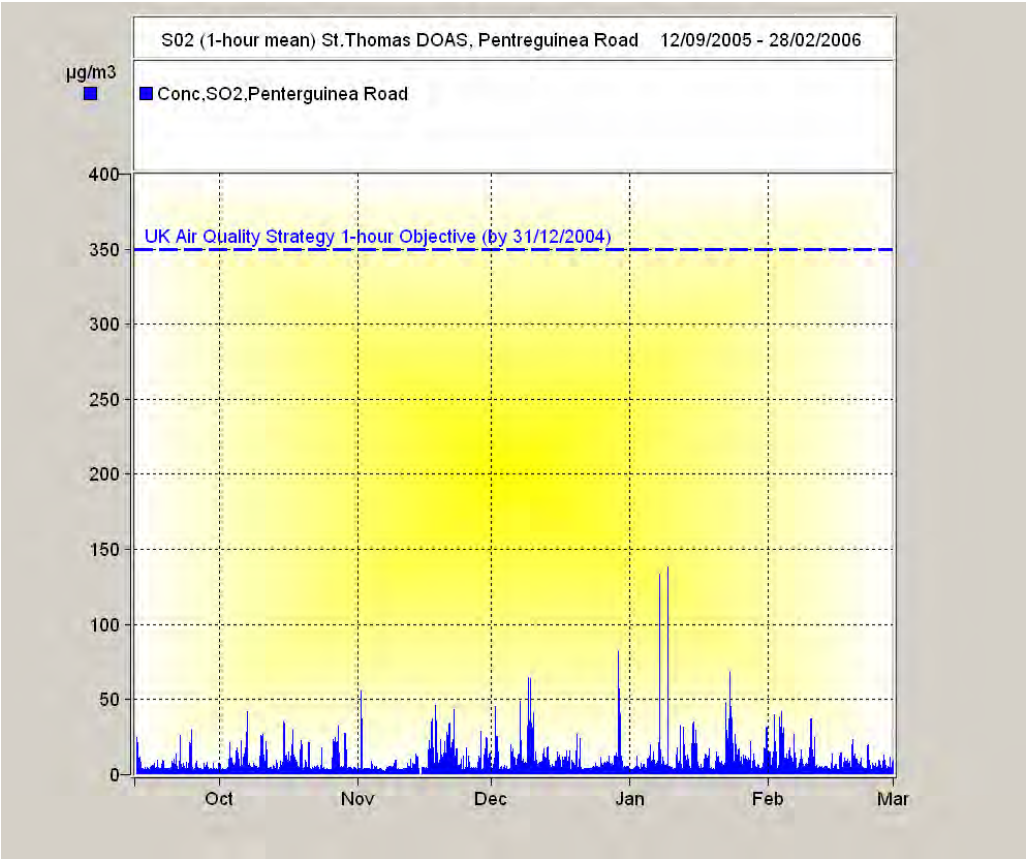


Chart 11 – 1hour $S0_2$ Means 12th September 2005 – 31st December 2005 – St.Thomas DOAS

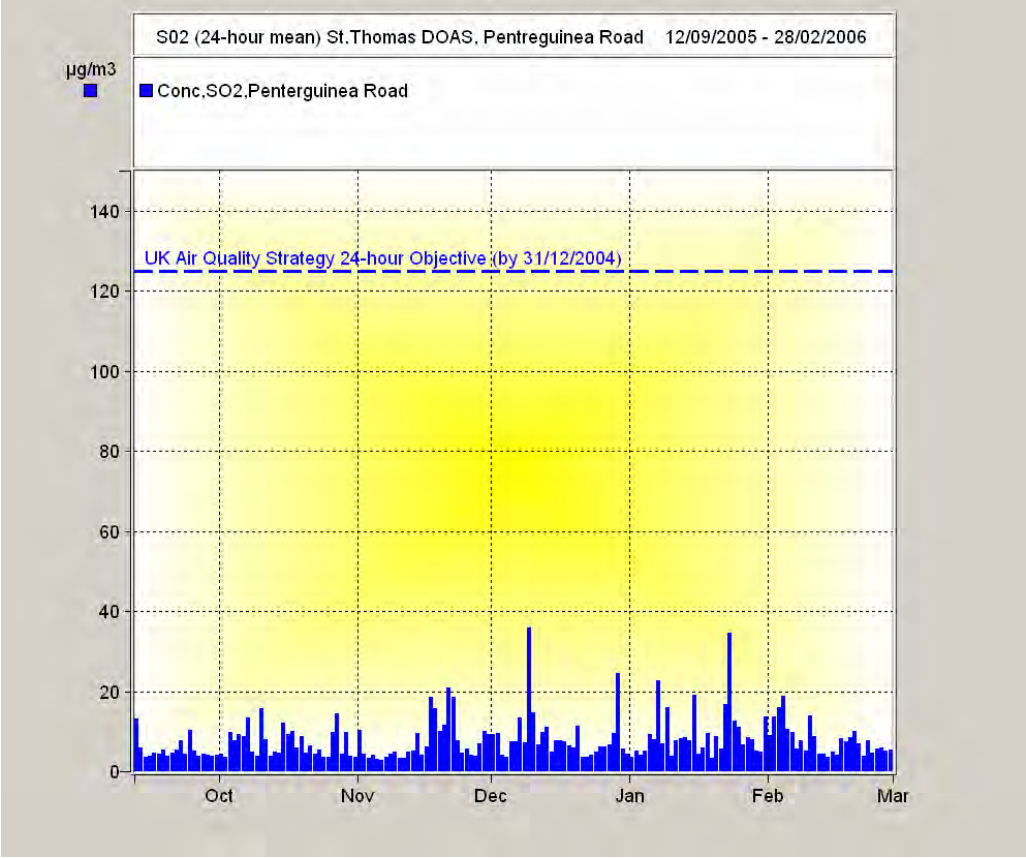
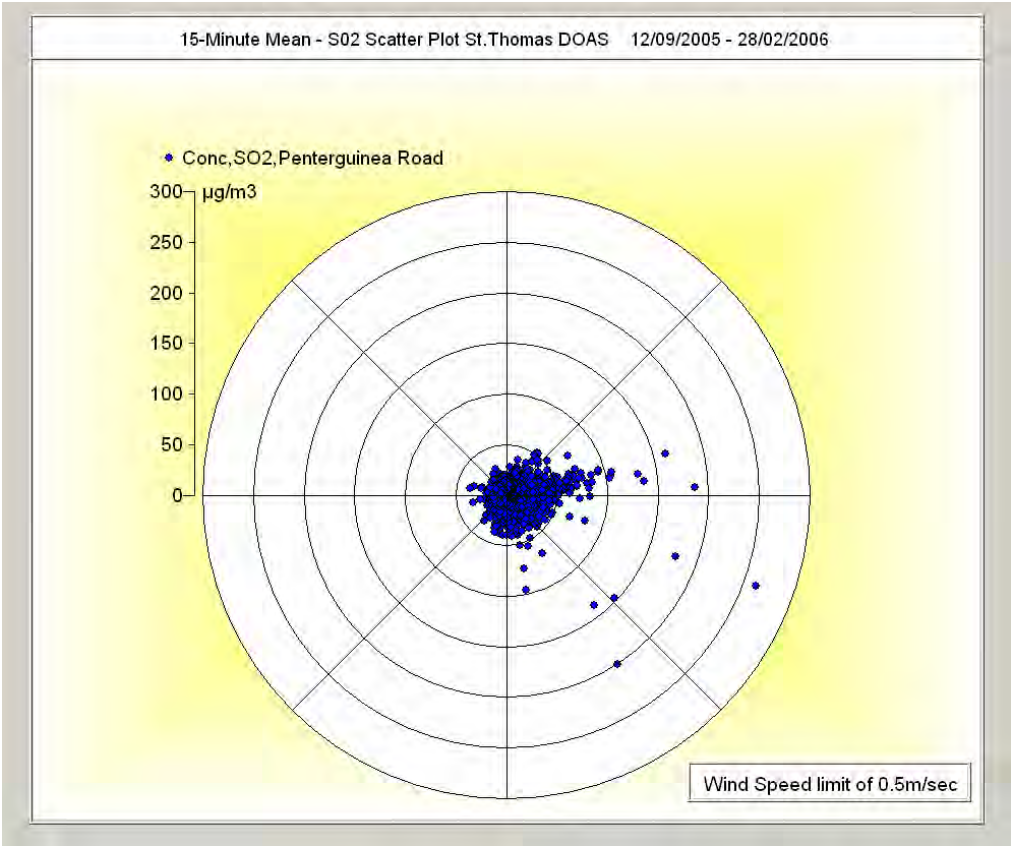


Chart 12 – 24-hour $S0_2$ Means 12th September 2005 – 31st December 2005 – St.Thomas DOAS

Using the 15-minute data, a scatter plot has been generated for the period outlined above. As meteorological parameters are not logged at this station the meteorological information has been incorporated using data from a Gill Windsonic ultrasonic combined wind speed/wind direction sensor located at the Guildhall, Swansea. The Gill sensor[20] has a wind speed resolution of 0.01m/sec and a wind direction resolution of 1°. A calm wind speed of 0.5 m/sec has been set within the analysis undertaken. The analysis is shown below as scatter plot 3 and shows maximum 15-minute means originating from generally an easterly direction. This would concur with similar analysis carried out using data from the Morfa (see 8.5.1.1 above) and Morriston Groundhogs.



Scatter Plot 3 – 15-minute $S0_2$ data – St Thomas DOAS

[20] Source http://www.gill.co.uk/data/datasheets/WindSonicWebDatasheet.pdf

Scatter plot 3 indicates that the vast majority of 15-minute SO_2 means lie within the 0-50μg/m^3 range. This suggests that these data originate from within the local area as they are spread throughout the compass range and show little directionality. Those data greater than 50μg/m^3 tend to originate from an easterly or south-easterly source.

The Corus Steelworks at Port Talbot lie in a general south-easterly direction from all monitoring stations within Swansea and is the more probable source of the maximum SO_2 concentrations. Whilst local traffic may contribute slightly to the SO_2 loadings seen at this station, the only other sources that could possibly account for the loadings from the north-east sector between 45° and 90° are a combination of sources within Swansea Docks and the Baglan Energy Park as domestic coal burning within the immediate area is now minimal.

8.6 Conclusion of USA for sulphur dioxide

There are no indications at present to indicate that any of the objectives were breached at any location within the City & County of Swansea at the relevant compliance dates. This view is unlikely to change and is supported by the continuing reduction in ambient levels of SO_2 seen with the monitoring data.

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[21] 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 true

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

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[22]. 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 set in Regulation

There were 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 were an annual mean of 40μg/m^3 and a 24-hour

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

mean of 50μg/m^3 not to be exceeded more than 35 times per year. Both objectives had compliance dates of 31st December 2004. The EU objective uses the same compliance data as the UK objective set in regulation but extends the compliance date to the 31st December 2005

9.3.1 Future uncertainty with regards to UK and European Union policy in respect of Fine Particulate Matter

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 was 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.

However, there is currently great debate on future UK policy in regards to particulate matter. It is clear that the delayed publication of the Air Quality Strategy (AQS) review puts a significant question mark against the adoption of the provisional PM_{10} objectives outlined above. The planned consultation for the AQS review was scheduled to commence during the autumn of 2005 but has been significantly delayed (eventually being produced during April 2006.)

Added to the above, the City & County of Swansea are having regard to the Clean Air for Europe (CAFÉ) proposals and are actively considering our position on $PM_{2.5}$ reduction schemes. CAFÉ propose protection of public health by effecting overall reduction in population exposure to particulate matter and not just concentrating efforts at identified local "hot-spots". Latest evidence from the World Health Organisation (WHO) and the Commissions own Scientific Committee on Health and Environmental Risk has strongly suggested that the smallest of the fine particles ($PM_{2.5}$) need to be regulated. This is why the Commission of the European Communities Strategy and accompanying CAFÉ proposal to revise the Ambient Air Quality Directive would, for the first time introduce controls on human exposure to $PM_{2.5}$. As there is a lack of evidence at present to identify a threshold below which $PM_{2.5}$ would not pose a risk, this pollutant should not be regulated in the same way as pollutants are presently. The proposed approach would establish an absolute concentration cap for $PM_{2.5}$ in ambient air in the most polluted areas at a level that would prevent unduly high risks to the population. This would be coupled with an obligation on Member States to reduce average human exposure in the urban background over the period 2010-2020. As far as possible, Member States would have to aim for a 20% reduction.

CAFÉ with DEFRA support appear to be effecting a change with the EU policy position on particulate matter. Until these uncertainties are clarified and a clear

direction forwards identified, there seems to be little to be gained in undertaking works to project current PM_{10} levels forwards to the provisional objectives date in 2010. As such therefore, this Updating and Screening Assessment will only evaluate particulate matter within the objectives currently set within existing regulation.

However, the City & County of Swansea are commencing a $PM_{2.5}$ survey to establish some basic background and kerbside data for the County.

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, (see map 3 within 8.5.1.1) 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 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. Since the awarding of the contract by the Welsh Assembly Government to NETCEN to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a certified and traceable standard.

The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[23]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the daily 24-hour means and the annual mean. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present[24].

All results are presented in $\mu g/m^3$ and have been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration. Receptor locations are within 25m of the site.

Data obtained from the Morfa groundhog has been analysed for 2004 and 2005 and the results are presented in table 16. For the sake of completeness and to

[23] *LAQM.TG(03) Monitoring A1-37*
[24] *LAQM.TG(03) Monitoring A1-38*

show the effect of atypical meteorological conditions during 2003, data is shown from 2002 – 2005.

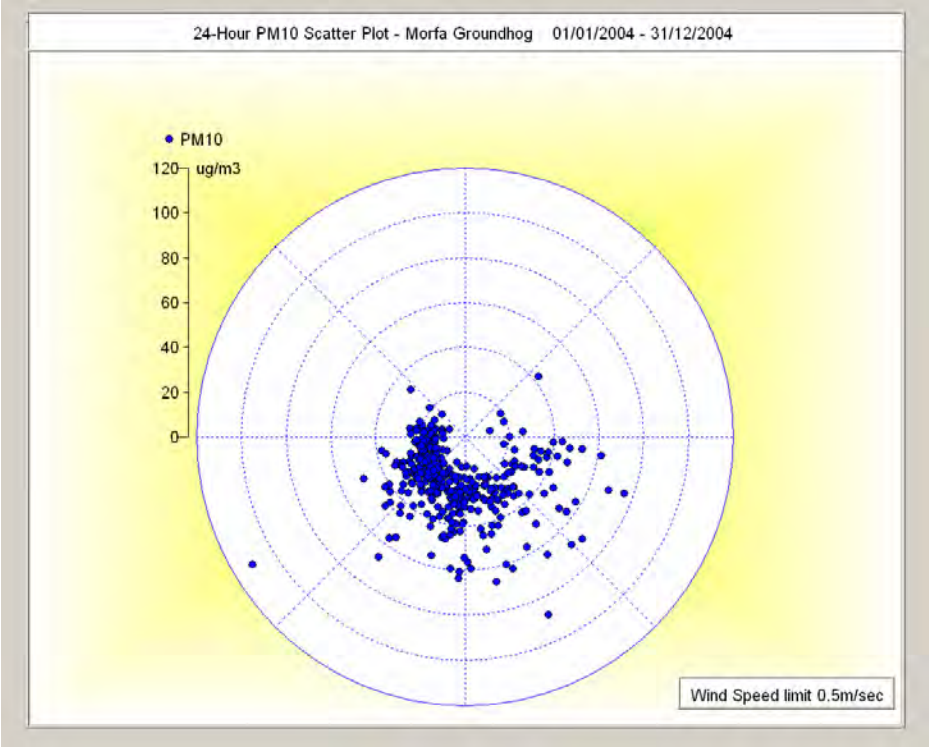
Morfa Groundhog PM_{10}	Annual Mean ($40\mu g/m^3$)				24-hour Exceedences ($50\mu g/m^3$)			
	2002	2003	2004	2005	2002	2003	2004	2005
	26.8	30.7	29.17	27.13	5	40	28	8

Table 16 – Morfa Groundhog PM_{10} 2002-2005

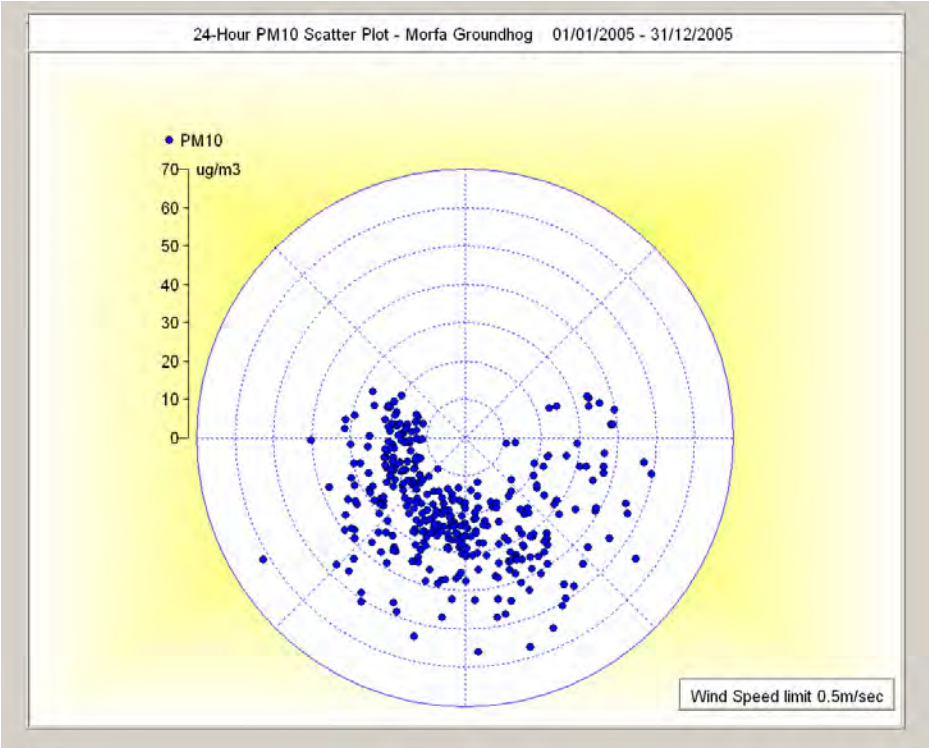
The atypical meteorological conditions experienced during 2003 have been discussed in greater detail within the Updating and Screening Assessment dated July 2004 and can be viewed at http://www.swansea.gov.uk/index.cfm?articleid=5561 along with further discussion within the Progress Report for 2004 dated July 2005 at http://www.swansea.gov.uk/index.cfm?articleid=9929

From table 16, the number of 24-hour exceedences recorded at the Morfa Groundhog during 2004-2005 do not breach either the UK or the EU 24-hour objectives for PM_{10}. In addition, the annual means do not breach either the UK or EU annual mean objectives.

Scatter plots have been generated in respect of the 24-hour mean data for both 2004 and 2005 and these can be seen below as scatter plot 4 and scatter plot 5.



Scatter Plot 4 - Morfa Groundhog PM_{10} 24-hour means 2004



Scatter Plot 5 -- Morfa Groundhog PM_{10} 24-hour means 2005

The extensive construction works under way within the area during 2003-2004 are evident from within the data. Accepting that 2003 exhibited atypical

meteorological conditions the reduction in daily exceedences is clearly evident during 2005. This reduction is despite increased traffic loadings within the area. The scatter plots generally show little directionality, indicative of local sources.

The maximum daily mean for 2004 was, unsurprisingly, recorded on the 5th November 2004 with the maximum for 2005 being recorded on the 21st November 2005.

Data capture for 2004 was 98.09% and for 2005 99.4%, allowing direct compilation of 24-hour exceedences rather than the use of the 90th percentile of 24-hour means.[25]

What is clear from the scatter plots is the shielding from a northerly direction exhibited at the site. This effect is thought to have been caused by a small copse of trees that have now been significantly thinned with the larger trees removed. In addition, to ensure high quality data capture, a new 9 metre mast is to be installed at the site to remain out of the influence of any shielding as far as possible.

Chart 13 below represents the 24-hour means monitored during 2004-2005.

Data has not been projected forwards to 2010 within this USA – see 9.3.1 above for details. Previous data reported within the Progress Report 2004 dated July 2005 have been projected forwards to 2010 from the 2004 annual mean. This work can be found on pages 17-18 at http://www.swansea.gov.uk/index.cfm?articleid=9929

[25] LAQM.TG(03) Box 8.4 page 8-22

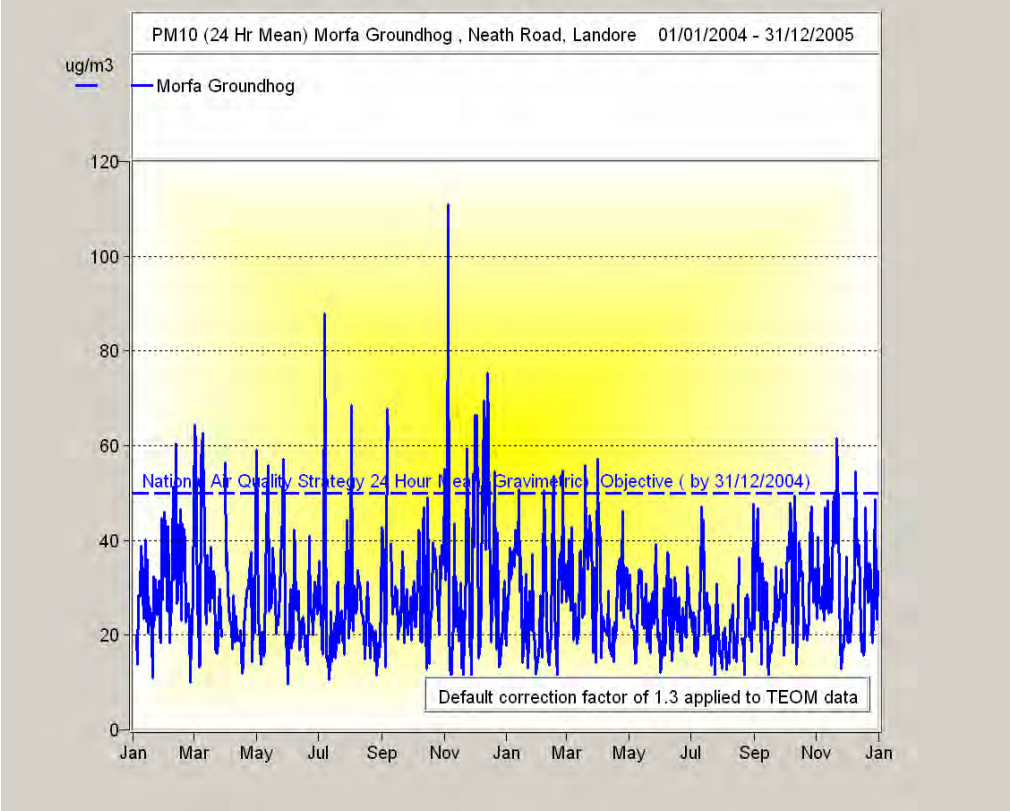


Chart 13 – Morfa Groundhog 24-hour means 2004-2005

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.

9.4.3.1 Morriston Groundhog

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 has been given a site classification Kerbside (U2)[26]. Map 5 shown within 8.5.2.2 above gives an aerial view of the site and the surrounding locations.

A Rupprecht & Patashnick Co., Inc. TEOM measures particulate Matter PM_{10} at the Morriston Groundhog site. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[27]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the daily 24-hour means and the annual mean. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the daily hourly averages were specified to be present.[28] All results are presented in $\mu g/m^3$ and have been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration.

For the sake of completeness and to show the effect of atypical meteorological conditions during 2003, data is shown from 2002 – 2005 within table 17 below.

[26] *Source LAQM.TG(03) Appendix A page A1-42*
[27] *LAQM.TG(03) MonitoringA1-37*
28 LAQM.TG(03) MonitoringA1-38

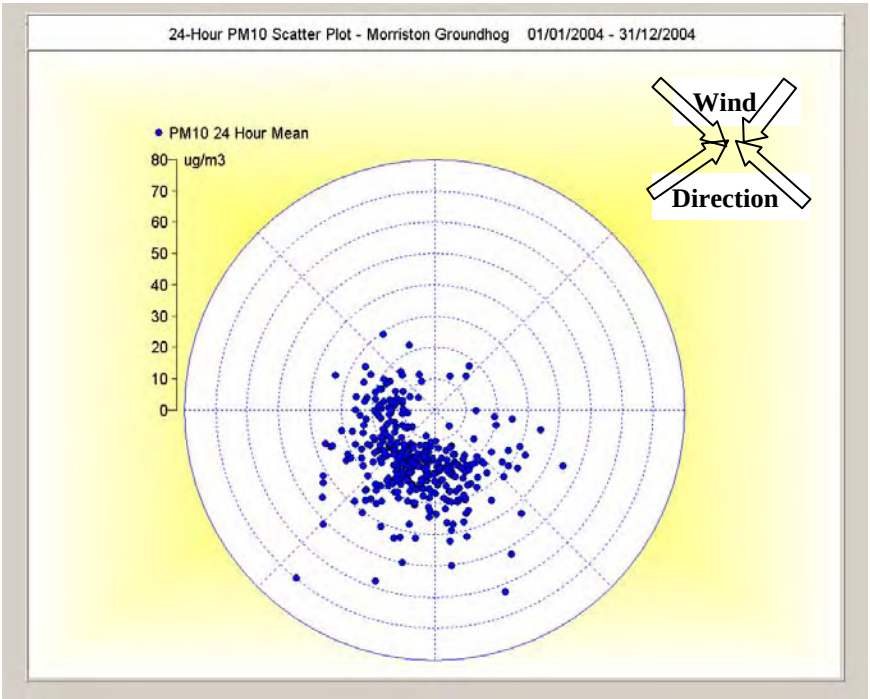
Morriston Groundhog PM_{10}	Annual Mean ($40\mu g/m^3$)				24-hour Exceedences ($50\mu g/m^3$)			
	2002	2003	2004	2005	2002	2003	2004	2005
	23.56	25.72	22.68	22.47	4	21	6	0

Table 17 – Morriston Groundhog PM_{10} 2002-2005

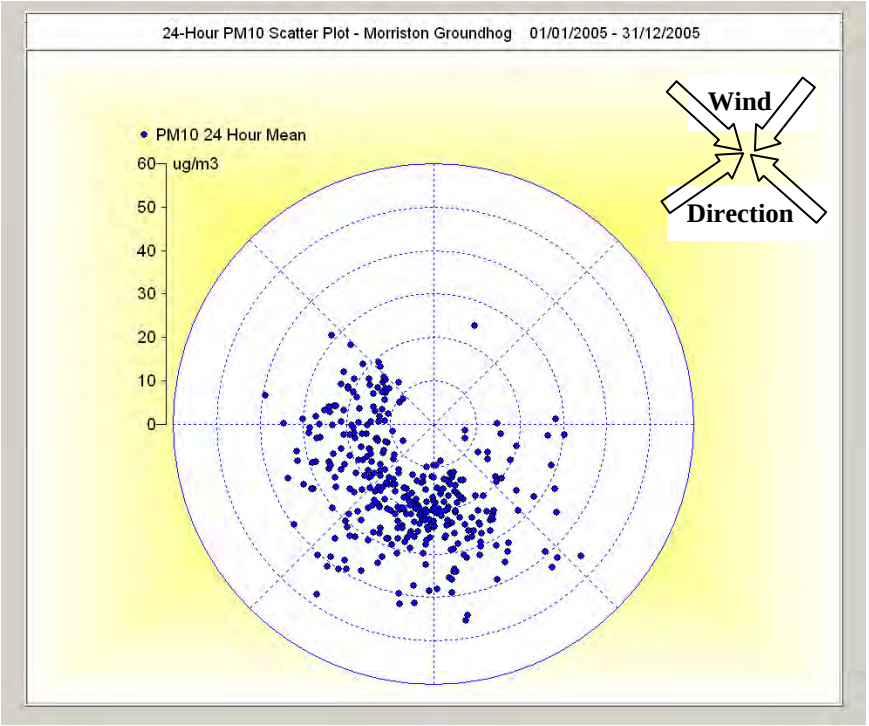
The atypical meteorological conditions experienced during 2003 have been discussed in greater detail within the Updating and Screening Assessment dated July 2004 and can be viewed at http://www.swansea.gov.uk/index.cfm?articleid=5561 along with further discussion within the Progress Report for 2004 dated July 2005 at http://www.swansea.gov.uk/index.cfm?articleid=9929

From table 17, the number of 24-hour exceedences recorded at the Morriston Groundhog during 2004-2005 do not breach either the UK or the EU 24-hour objectives for PM_{10}. In addition, the annual means do not breach either the UK or EU annual mean objectives.

Scatter plots have been generated in respect of the 24-hour mean data for both 2004 and 2005 and these can be seen below as scatter plot 6 and scatter plot 7.



Scatter Plot 6 – Morriston Groundhog 24-Hour PM_{10} Means 2004



Scatter Plot 7 – Morriston Groundhog 24-Hour PM_{10} Means 2005

The maximum daily mean for 2004 was, unsurprisingly, recorded on the 5th November 2004 with the maximum for 2005 being recorded on the 21st November 2005 – identical dates to that recorded at the Morfa Groundhog site. Both the scatter plots for 2004 and 2005 show little directionality indicating localised sources and there is little evidence to indicate any major regional episodes from the data.

Data capture for 2004 was 97% and for 2005 98%, allowing direct compilation of 24-hour exceedences rather than the use of the 90th percentile of 24-hour means.[29]

Chart 14 below represents the 24-hour means monitored during 2004-2005.

Data has not been projected forwards to 2010 within this USA – see 9.3.1 above for details. Previous data reported within the Progress Report 2004 dated July

[29] LAQM.TG(03) Box 8.4 page 8-22

2005 have been projected forwards to 2010 from the 2004 annual mean. This work can be found on pages 41-42 at http://www.swansea.gov.uk/index.cfm?articleid=9929

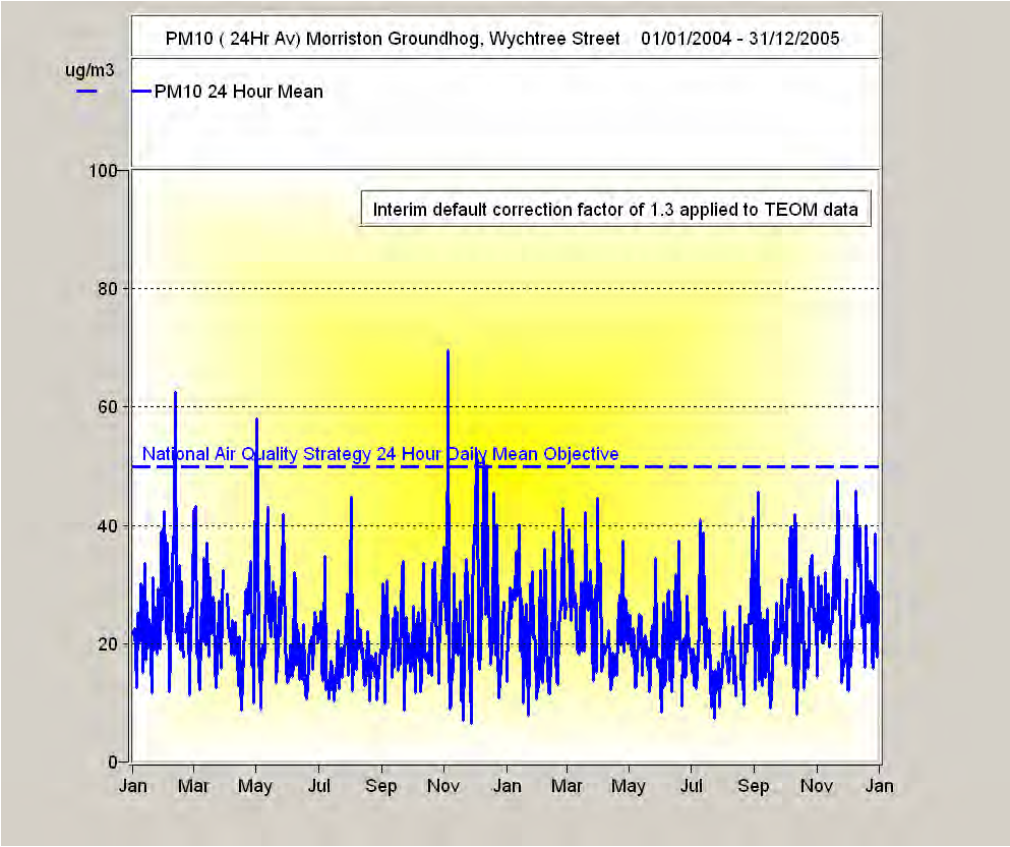


Chart 14 – Morriston Groundhog PM_{10} 24-hour means 2004-2005

9.4.3.2 Swansea AURN

The Swansea AURN is located in the heart of the city centre on the now pedestrian area of Princess Way. The station has been affiliated onto the UK National Network during late 1994 and has been operational ever since. The site was relocated during 1995 from its original location at Castle Gardens to its present location. The station has been given a site classification Urban Centre (U3)[30]. The site is influenced by traffic using the nearby Princess Way/Kingsway roundabout but remains representative of typical population

[30] *Source LAQM.TG(03) Appendix A page A1-42*

exposure in town or city centres. The main city centre shopping areas are to the south and south west of the site location. Map 4 shown within 8.5.2.1 above gives an aerial view of the site and the surrounding area.

A Rupprecht & Patashnick Co., Inc. TEOM measures Particulate Matter PM10 at this site. Hourly ratified Particulate Matter PM_{10} data has been downloaded from the Air Quality Archive for 2004 and 2005 at http://www.airquality.co.uk/archive/flat_files.php?site_id=SWAN&zone_id=9 .The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data (corrected with default interim factor of 1.3) expressed in $\mu g/m^3$ being provided. These hourly ratified data have then been imported into the OPSIS Enviman Reporter software package allowing analysis. Ratified hourly means have been used to calculate both the daily 24-hour means and the annual mean. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the daily hourly averages were specified to be present.[31]

All results are presented in $\mu g/m^3$. Data supplied by NETCEN had already been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration.

For the sake of completeness and to show the effect of atypical meteorological conditions during 2003, data is shown from 2002-2005 below within table 18.

Swansea AURN PM_{10}	Annual Mean ($40\mu g/m^3$)				24-hour Exceedences ($50\mu g/m^3$)			
	2002	2003	2004	2005	2002	2003	2004	2005
	25.03	24.91	25.8*	24.8	5	11	3*	1

Table 18 – Swansea AURN PM_{10} 2002-2005

** Ratified data capture for 2004 23%*

[31] *LAQM.TG(03) MonitoringA1-38*

As part of the data ratification and verification procedures undertaken by NETCEN, data between 1st January 2004 and 6th October 2004 have been rejected due to leaks in the TEOM analyser. Leaks to the sampling system were identified at two successive QA/QC audits on the 16th March 2004 (main flow 60% low) and on the 20th September 2004 (main flow 45% low). The first leak was due to a cracked plastic fitting at the mass flow controller. Despite the first leak being repaired, a second leak was found at the audit in September due to a cracked disposable filter unit (DFU). Due to the magnitude of the leaks and resulting effect on sampling efficiency, all poor quality data from January 2004 until the repair of the second leak at the service on 6th October 2004 (9 months) has been deleted. The resultant verified data capture rate for 2004 is 23.22%

Chart 15 below represents the 24-hour means monitored during 2004-2005.

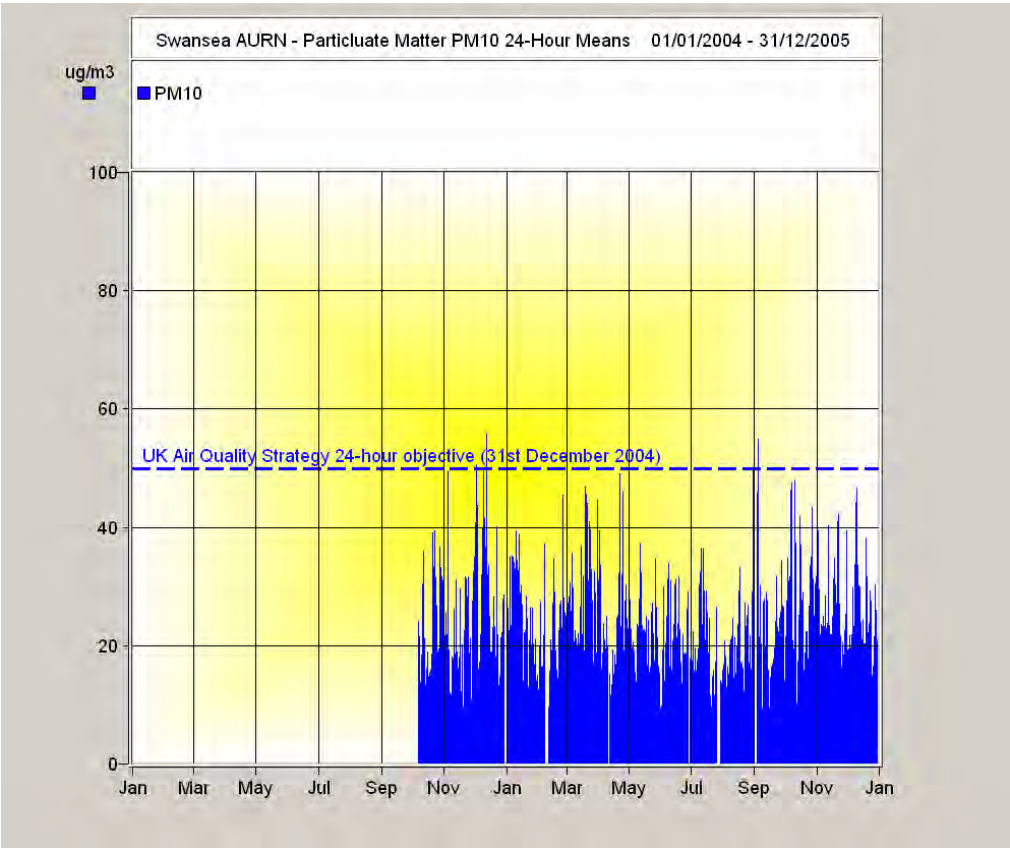


Chart 15 – Swansea AURN PM_{10} 24-hour means 2004-2005

Data has not been projected forwards to 2010 within this USA – see 9.3.1 above for details.

Previous data reported within the Progress Report 2004 dated July 2005 have been projected forwards to 2010 from the 2004 annual mean. This work can be found on pages 61-62 at http://www.swansea.gov.uk/index.cfm?articleid=9929 In addition, the 2nd round of Review and Assessment projected data forwards from all three automatic sites to 2010. This work can be found on pages 90-91 at http://www.swansea.gov.uk/index.cfm?articleid=5561

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.

This issue was examined during the second round of review and assessment dated July 2004 and the position has not altered.

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

Guidance within LAQM.TG(03) and its January 2006 revision 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 27μg/m^3, within 400m if the estimated 2004 PM_{10} annual mean background concentration is greater than or equal to 26μg/m^3, and within 200m if the estimated 2004 PM_{10} annual mean background concentration is less than 26μg/m^3.

Based on previous work undertaken as part of the 2nd round of review and assessment, "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. The Environment Agency have refused to issue a permit for the ongoing use of Tir John to the LAWDC – Swansea Waste Disposal Company as a landfill site. The site has therefore ceased operation, pending an appeal by the LAWDC

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.

9.4.7 Poultry Farms

The revision of LAQM.TG(03) during its January 2006 update indicates a new potential significant source of PM_{10} to be assessed from poultry farms. The revised guidance indicates that the larger poultry farms[32] housing more than 40,000 birds are due to come under PPC regulation in 2007 by the Environment Agency as A1 processes. Monitoring studies have been undertaken within some local authorities – Anglesey within Wales for example but the results of these studies are at present inconclusive.

There is one poultry farm located within the authority's area at Kittle, Gower. Maps 7 and 8 below indicate its location

Map 7 – Location of Kittle Hill Poultry Farm, Kittle, Gower, Swansea

[32] LAQM.TG(03) revision 2006 defined as chicken laying hens and boilers, turkeys, ducks and Guinea foul

Map 8 – Aerial view – Kittle Poultry Farm, Kittle, Gower, Swansea

A total of 300,000 chicken laying hens are housed, split over 3 sheds containing 100,000 birds each. In addition, a separate establishment at Parkmill breads chickens for supply to the above mentioned establishment.

As indicated within map 8 above, the direction of the ventilation of the sheds is in a south easterly direction between the sheds and then finally out, over a field adjacent to the premises. The nearest domestic receptor/dwelling is approximately 290m from the sheds. There have been previous complaints regarding dust from local residents but these have not as yet been substantiated. It is not known what the prevailing meteorological conditions were leading up to these complaints. Numerous complaints have also been received regarding noise from the ventilation system.

Due to the lack of real-time monitoring data within the area, there is at present no evidence to suggest that any exceedences of the existing objectives are likely to occur.

9.5 New Roads Constructed / Planned /Significantly changed Traffic Flows

The above was outlined in detail during the 2nd round review and assessment and can be found on pages 73-76 at http://www.swansea.gov.uk/index.cfm?articleid=5561 which focused on the Gowerton Bypass, the new Sports Stadium/Morfa Retail Park and the Tawe Vale Access Road.

Present indications are that the AADT at the Gowerton Bypass remains below 10,000. However, there remains no reliable information on the flows at the new Morfa Stadium/Retail Park access road and the Tawe Vale Access Road.

9.6 Roads with high flows of buses and/or HGVs

Guidance within LAQM.TG(03) and its January 2006 update 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 42 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 HGV's is unlikely to exceed 20% of the traffic load at any location. This matter will be subject to quantification at a later date but in essence remains the same as described within the 2nd round review and assessment.

9.7 Junctions

Guidance within LAQM.TG(03) and its January 2006 update 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 as stated within the 2nd round of review and assessment there were several junctions that it was thought would meet the traffic volumes required, there were none where the receptor locations were within 10m of the kerb. However, this situation has now changed with the construction of the new SA1 junction along Fabian Way and the construction of the new Tesco access road /junction following the reconstruction and expansion of its outlet at Nantyffin Road, Llansamlet.

ATC data is now available from around some of these junctions as part of the introduction of the 43 GPRS ATC's outlined above. Development works as explained above remain ongoing in regard to the analysis of this traffic count data.

However, it is still recognised that the identified junctions will require a full and proper assessment/investigation. This statement was also made within the 2nd round of review and assessment and remains valid. It has not been possible to progress this matter since the original comments within the 2nd round USA due to financial restrictions. However, it has now become possible to undertake a basic "screening assessment" using real-time monitoring techniques. It is thought that to measure PM_{10} at these locations would provide more meaningful data in preference to DMRB calculations. The monitoring proposed is due to commence during May 2006. Delays have been experience not only due to financial considerations but also the practicalities of siting real-time equipment at these junctions. It has proved to be not economically viable or practical to deploy Rupprecht & Patashnick Co., Inc. TEOM's at these locations. Therefore, alternative real-time instruments have been sourced to undertake the monitoring works that are desirable. The instruments chosen are Met One Instruments Inc. E-Type sampler (http://www.metone.com/documents/esamplerParticulate.pdf) It is recognised that these are not true gravimetric or type approved instruments for use on the UK network but current guidance indicates that use of the near forwards light scattering technique are suitable for screening assessments. This coupled with their ease of deployment make them an ideal alternative in these situations.

It is therefore proposed to site the Met One E Type PM_{10} monitors close to 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
h) SA1 junction, Fabian Way

9.8 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.

9.9 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 were exceeded at any monitoring location within the authority's area at the compliance date of the 31st December 2004. From previous work undertaken within the 2nd round review and assessment and the Progress Report 2005 there, 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.

It is important to state that this work to project forwards to 2010 has not been revisited as explained within section 9.3.1 above.

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

At present and having regard to 9.3.1 above, there is no requirement to proceed to a Detailed Assessment for PM_{10}. The authority will, however, complete a basic screening assessment at the identified busy roads / junctions as indicated within previous reviews.

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.

10.3 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.

10.4 Review of Existing Information

Previous work undertaken as part of the LAQM process 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. Further work notably the stage 4 review confirmed this opinion.

10.4.1 Authorised Processes

There are no new processes either within the authority boundary that have the potential to emit significant quantities of NO_2 from that reviewed during the first and second round of review and assessment process. There have been no significant changes to any of the existing processes. The only possible exception to this is the ongoing development at the Baglan Energy Park within the boundary of Neath Port Talbot. A new gas fired power station is now on-line. Neath Port Talbot undertake real-time monitoring at a nearby primary school. The following, is an extract provided by Neath Port Talbot from their latest 3rd round of review and assessment:

"The annual mean concentration of nitrogen dioxide in 2004 at the Baglan Primary School continuous monitoring station was 11 µg/m^3. The corresponding figure for 2005 was 10 µg/m^3. There were no breaches of the 1-hour mean Air Quality Objective in either year."

The impact of this development site within the boundary of the City & County of Swansea is therefore assumed to be minimal.

Proposals to site 1 Biomass boiler (850kW), 2 gas boilers at 782kW each and 4 Mini Combined Heat and Power units at 5.5kW and12.5kW have been received for a site on Hazel Court, Sketty, Swansea. Additionally a proposal to site a Biomass burner (<400kW) at Ethnic Cuisine, Winch Wen, Swansea has been received. However, in view of past experience and in light of the existing and revised guidance, these new sources are unlikely to be significant.

10.4.2 Real-Time Monitoring data from within an AQMA

10.4.2.1 Morfa Groundhog, Neath Road, Landore

The Morfa station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Morfa / Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. The station is within the boundary of the Hafod AQMA and has been given a site classification Kerbside (U1)[33].

As with the majority of monitoring stations, the location finally chosen for monitoring has to be a compromise between the ideal desired location and the practicalities of siting a station of this size. It is recognised that this station having being sited adjacent to a roundabout is not ideally placed. However, in saying this, the station satisfies the majority of the monitoring criteria required by this authority with receptor locations (dwellings) being located within 25m. Due to its location in a fairly open aspect of the lower valley area, this station does not truly reflect the conditions experienced within the narrow congested streets within the Hafod Air Quality Management Area.

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. The API gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform

[33] *Source LAQM.TG(03) Appendix A page A1-42*

routine fortnightly manual calibrations. The analyser is subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analyser is also subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

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. Since the awarding of the contract by the Welsh Assembly Government to NETCEN to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a certified and traceable standard. Following rescaling works using the factors derived from the routine calibration of the analyser, NO_2 is determined by NO_x - NO = NO_2. All existing stored NO_2 data is overwritten with the rescaled derived NO_2 data.

A map showing the location of the Morfa Groundhog station is given above within section 8.5.1.1 as map 3.

The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[34]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis.

[34] LAQM TG(03) Appendix A - Monitoring page A1-37

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 1.91[35] to produce results expressed in $\mu g/m^3$.

Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 19. For the sake of completeness and to show the effect of atypical meteorological conditions during 2003, data is also shown from 2003.

Morfa Groundhog	Annual Mean ($40\mu g/m^3$)			Max 1-hour ($200\mu g/m^3$)			Exceedences of 1-hour std (18 permitted)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
	36.6 *	33.5	33.9	155.1 *	201.6	169.7	0	1	0

**Results for 2003 have been recalculated following review of QA/QC procedures.*

Table 19 - Nitrogen Dioxide monitoring data - Morfa Groundhog 2003 - 2005

A graph of the hourly means between 2004 and 2005 is also given below as chart 16

The annual NO_2 means for 2004 and 2005 are below the $40\mu g/m^3$ objective for both 2005 and the provisional objective in 2010. Whilst an exceedence of the 1-hour objective was recorded (20th December 2004 @ 17:00) this is well below the permitted maximum exceedences of 18 both for 2005 and 2010. Hourly NO_2 data capture for 2004 is 98%, and for 2005 is 98.6%. These data capture rates permit the direct compilation of hourly exceedences rather than the use of the 99.8th percentile of hourly means[36].

[35] *LAQM.TG(03) Appendix B - Conversion factors page A1-44*

[36] LAQM TG(03) box 6.2 page 6-16 (applies to data outside AQMA – assumption made that this approach is valid within AQMA as well)

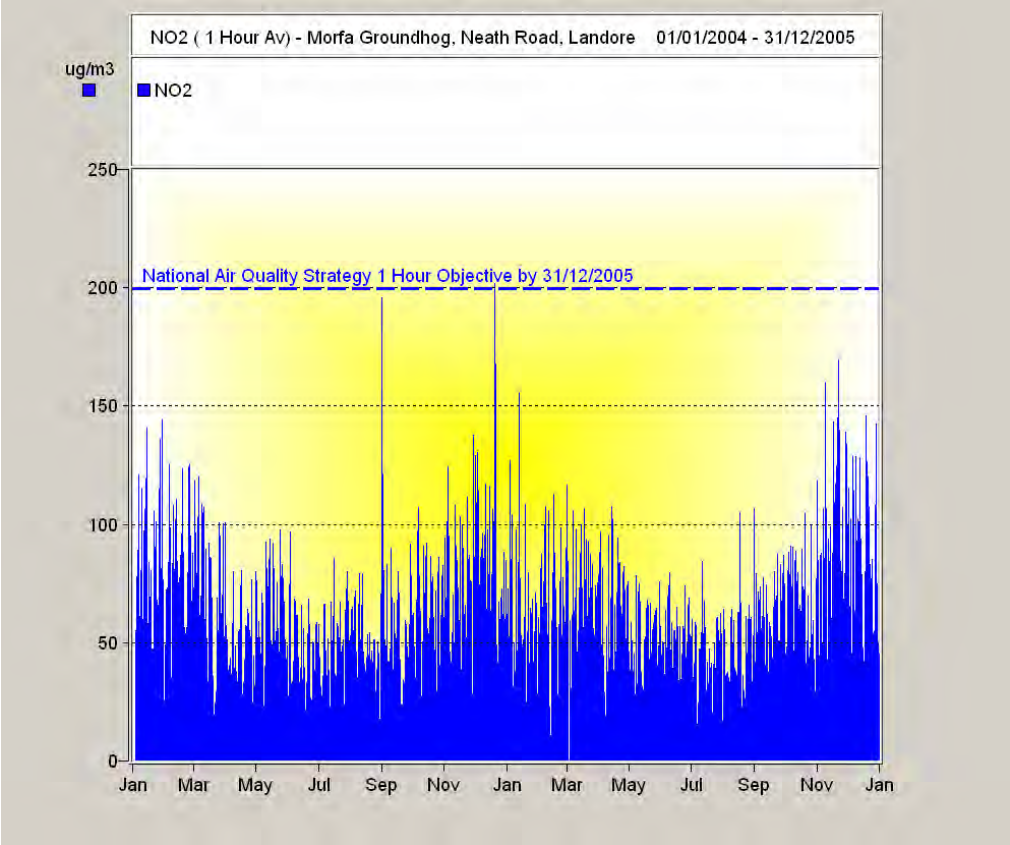


Chart 16 – Morfa Groundhog 1-Hour NO_2 means 2004 – 2005

Whilst 2003 is known to have exhibited atypical meteorological conditions both within Swansea and to some extent the whole of the UK, and, whilst the annual mean for 2003 is higher than 2004 and 2005, the maximum 1-hour means are higher both in 2004 and 2005, but still well within the maximum number of permitted exceedences.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 28.52µg/m^3 is obtained for 2010 which remains below the EU objective of 40µg/m^3

It is interesting to compare previous predictions made for 2005 which can be used as a guide to the accuracy of this method. During the Stage 4 assessment predictions were made to 2005 using both 2001 and 2002 measured data (http://www.swansea.gov.uk/index.cfm?articleid=5568 – Table 5 page 49). From the 2001 data the predicted 2005 mean was 38.7μg/m^3 and from the 2002 data the predicted 2005 mean was 31.9μg/m^3.

The second round USA also contained predictions forwards from 2003 data (http://www.swansea.gov.uk/index.cfm?articleid=5561 – table 22 page 91) with a prediction in 2005 of an annual mean of 30.33μg/m^3.

Within the Progress Report 2004 (http://www.swansea.gov.uk/index.cfm?articleid=9929 - table 4 page 14) predictions to 2005 were made (from 2004 data) resulting in a projected annual mean at the Morfa Groundhog site of 32.66μg/m^3.

These initial projections using measured data as the base year generally compares favourably with the actual 2005 measured mean of 33.9μg/m^3. There are variations in the actual predictions but these are probably to be expected due to revisions both within the factors used in the calculation and the technique itself.

10.4.3 Real-Time Monitoring data from outside an AQMA

10.4.3.1 Morriston Groundhog

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 has been given a site classification Kerbside (U2)[37].

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. The API gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analyser is subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analyser is also subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

[37] *Source LAQM.TG(03) Appendix A page A1-42*

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. Since the awarding of the contract by the Welsh Assembly Government to NETCEN to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a certified and traceable standard. Following rescaling works using the factors derived from the routine calibration of the analyser, NO_2 is determined by NO_x - NO = NO_2. All existing stored NO_2 data is overwritten with the rescaled derived NO_2 data.

A map showing the location of the Morriston Groundhog station is given above within section 8.5.2.2 as map 5.

The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified[38]. Data capture of less than 75% for the hour therefore excludes that hour from any analysis.

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 1.91[39] to produce results expressed in $\mu g/m^3$.

Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 20. For the sake of completeness and to show the effect of atypical meteorological conditions during 2003, data is also shown from 2003.

[38] LAQM TG(03) Appendix A - Monitoring page A1-37
[39] *LAQM.TG(03) Appendix B - Conversion factors page A1-44*

Morriston Groundhog	Annual Mean (40µg/m^3)			Max 1-hour (200µg/m^3)			Exceedences of 1-hour std (18 permitted)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
	32.2 *	31.2	29.9	158.8 *	136.9	144.1	0	0	0

**Results for 2003 have been recalculated following review of QA/QC procedures.*

Table 20 - Nitrogen Dioxide monitoring data - Morriston Groundhog 2003 - 2005

Hourly NO_2 data capture for 2004 is 98%, and for 2005 is 98.5%. These data capture rates permit the direct compilation of hourly exceedences rather than the use of the 99.8th percentile of hourly means[40]. A graph of the hourly means between 2004 and 2005 is also given below as chart 17

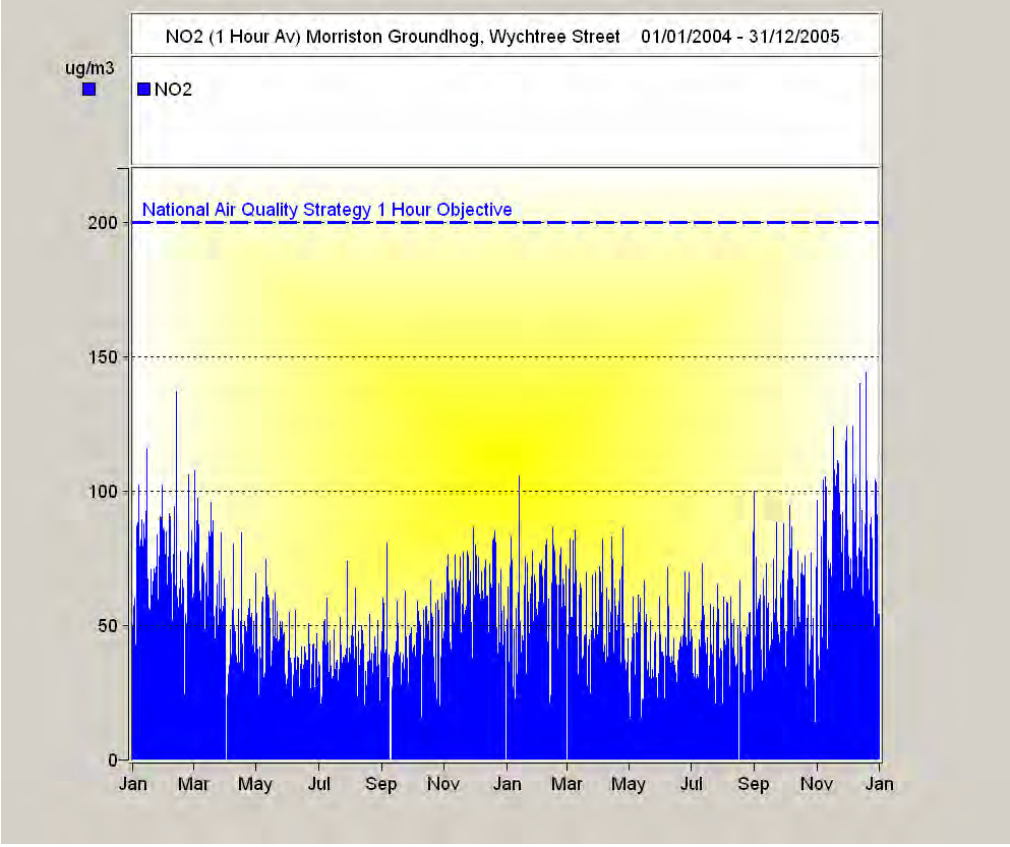
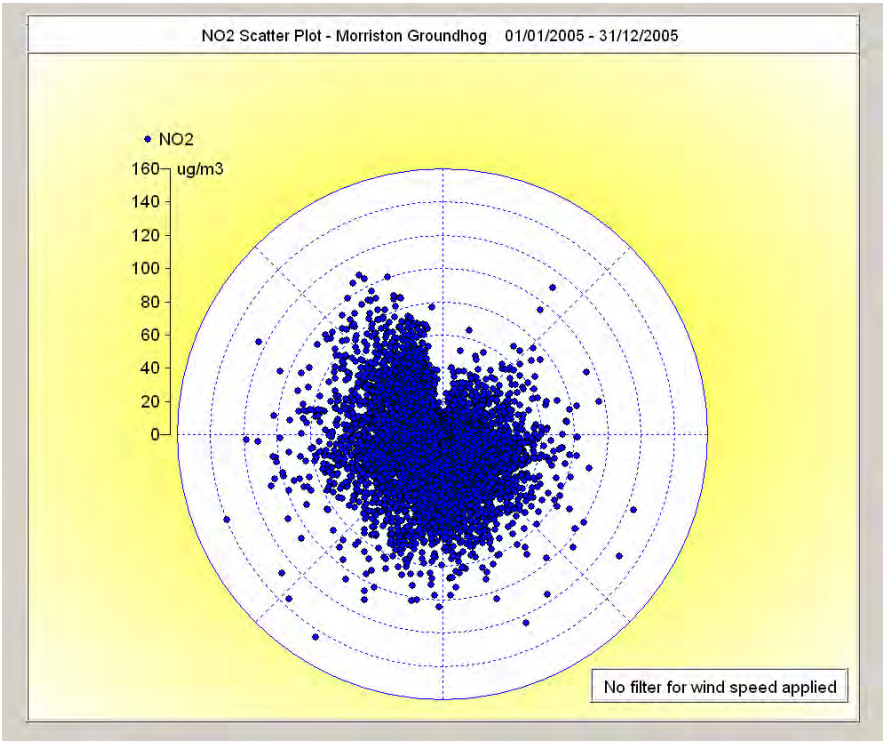


Chart 17 – Morriston Groundhog *1-Hour NO_2 means 2004 – 2005*

[40] LAQM TG(03) box 6.2 page 6-16

From table 20 above, it can be seen that in respect of both the annual means and 1-hour objectives, these were met at the Morriston Groundhog station for both 2004 and 2005.

The maximum 1-hour mean for 2005 was at 09:00 hrs on the 19th December. The wind speed during this period was 0.4m/sec. Wind speeds for the preceding couple of hours were also low. Wind speed and wind direction is measured using a Gill Windsonic ultrasonic combined wind speed/wind direction sensor located on top of a 6 metre mast. The Gill sensor[41] has a wind speed resolution of 0.01m/sec and a wind direction resolution of 1°. If all data is included within a scatter plot analysis, the results can be seen below within scatter plot 8



Scatter Plot 8 – Morriston Groundhog NO2 2005

[41] Source http://www.gill.co.uk/data/datasheets/WindSonicWebDatasheet.pdf

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 25.15μg/m^3 is obtained for 2010 which remains below the EU objective of 40μg/m^3

As mentioned above for the Morfa Groundhog, it is interesting to compare previous annual mean predictions made for 2005 at the Morriston Groundhog which can be used as a guide to the accuracy of this method. During the Stage 4 assessment predictions were made to 2005 using both 2001 and 2002 measured data (http://www.swansea.gov.uk/index.cfm?articleid=5568 – Table 7 page 51). From the 2001 data the predicted 2005 mean was 24.37μg/m^3 and from the 2002 data the predicted 2005 mean was 26.01μg/m^3.

The second round USA also contained predictions forwards from 2003 data (http://www.swansea.gov.uk/index.cfm?articleid=5561 – table 23 page 91) with a prediction in 2005 of an annual mean of 25.02μg/m^3.

Within the Progress Report 2004 (http://www.swansea.gov.uk/index.cfm?articleid=9929 - table 14 page 39) predictions to 2005 were made (from 2004 data) resulting in a projected annual mean at the Morriston Groundhog site of 30.41μg/m^3.
These initial projections using measured data as the base year generally compares favourably with the actual 2005 measured mean of 29.9μg/m^3. There are variations in the actual predictions but these are probably to be expected due to revisions both within the factors used in the calculation and the technique itself. It would appear, (as would probably again be expected), that the closer to

the forecast date the base year data is taken the greater accuracy and more reliable the forecast.

10.4.3.2 Swansea AURN, Princess Way, Swansea.

The Swansea AURN is located in the heart of the city centre on the now pedestrian area of Princess Way. The station has been affiliated onto the UK National Network during late 1994 and has been operational ever since. The site was relocated during 1995 from its original location at Castle Gardens to its present location (the station is due to be relocated again during May 2006 due to the redevelopment of the David Evans site which lies adjacent to the site).The station has been given a site classification Urban Centre (U3)[42]. The site is influenced by traffic using the nearby Princess Way/Kingsway roundabout but remains representative of typical population exposure in town or city centres. The main city centre shopping areas are to the south and south west of the site location. Map 4 shown within 8.5.2.1 above gives an aerial view of the site and the surrounding area.

An Advanced Pollution Instrumentation (API) NO_x analyser measures NO_x, NO and NO_2 at this site. Hourly ratified data has been downloaded from the Air Quality Archive for 2004 and 2005 at http://www.airquality.co.uk/archive/flat_files.php?site_id=SWAN&zone_id=9 .The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data expressed in $\mu g/m^3$ being provided. These hourly ratified data have then been imported into the OPSIS Enviman Reporter software package allowing analysis. Ratified hourly means have been used to calculate the objectives for the hourly and annual mean.

[42] *Source LAQM.TG(03) Appendix A page A1-42*

Data from 2004 and 2005 has been analysed for each of the objectives averaging periods and the results are presented below within table 21. For the sake of completeness and to show the effect of atypical meteorological conditions during 2003, data is also shown from 2003

Swansea AURN	Annual Mean (40µg/m^3)			Max 1-hour (200µg/m^3)			Exceedences of 1-hour std (18 permitted)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
	33.96	36.95	33.8	164	143	138	0	0	0

Table 21 - Nitrogen Dioxide monitoring data - Morriston Groundhog 2003 – 2005

Hourly NO_2 data capture for 2004 is 91.19%, and for 2005 is 94.39%. These data capture rates are above the 90% required within LAQM.TG(03)[43] and permit the direct compilation of hourly exceedences. A graph of the hourly means between 2004 and 2005 is given below as chart 17.

Table 21 indicates compliance during the last 3 years with both the 1-hour and annual mean objectives. During 2003, the effect of the atypical meteorological conditions is not noticeable within the annual mean.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 29.56µg/m^3 is obtained for 2010 which remains below the EU objective of 40µg/m^3.

[43] LAQM.TG(03) box 6.2 page 6-16

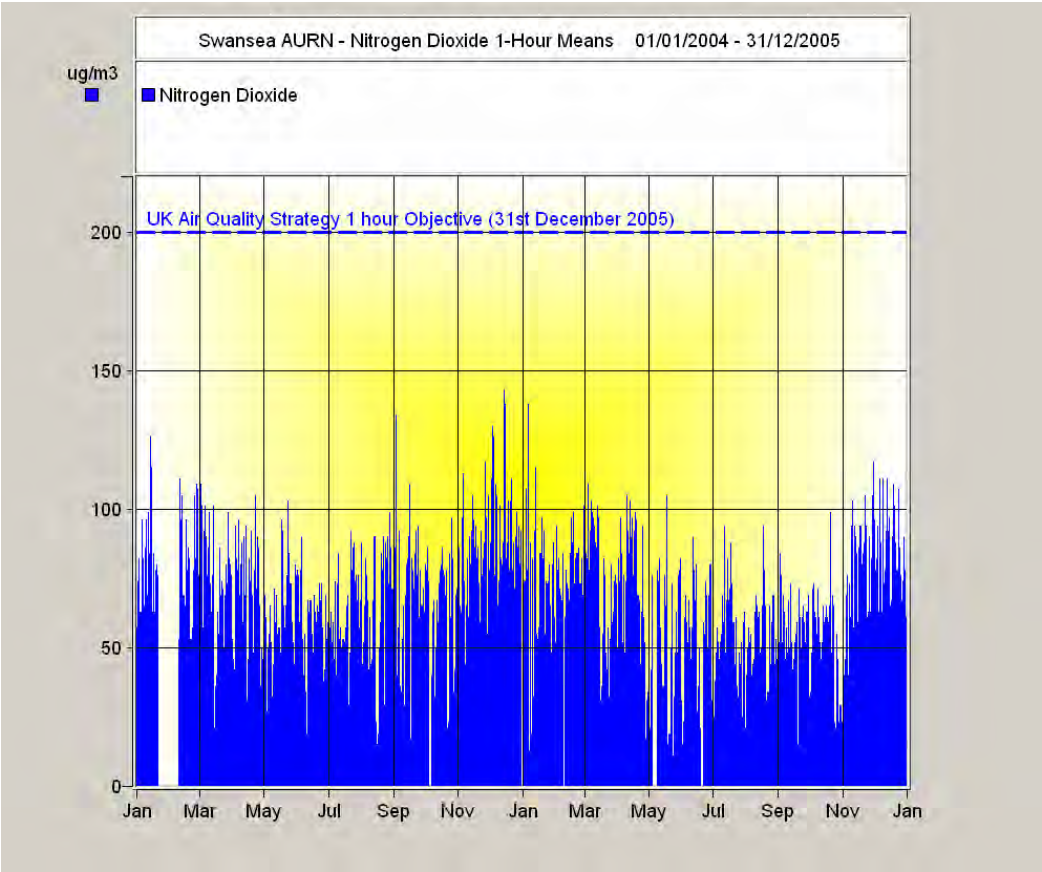


Chart 17 – Swansea AURN *1-Hour NO_2 means 2004 – 2005*

For sake of completeness, previous annual mean predictions made for 2005 at the Swansea AURN site are detailed below in the same format as presented above for both the Morfa and Morriston Groundhogs.

During the Stage 4 assessment predictions were made to 2005 using both 2001 and 2002 measured data (http://www.swansea.gov.uk/index.cfm?articleid=5568 – Table 9 page 54). From the 2001 data the predicted 2005 mean was 32.08µg/m^3 and from the 2002 data the predicted 2005 mean was 29.13µg/m^3.

The second round USA also contained predictions forwards from 2003 data (http://www.swansea.gov.uk/index.cfm?articleid=5561 – table 23 page 91) with a prediction in 2005 of an annual mean of 32.3µg/m^3.

Within the Progress Report 2004 (http://www.swansea.gov.uk/index.cfm?articleid=9929 - table 22 page 58) predictions to 2005 were made (from 2004 data) resulting in a projected annual mean of 36.19μg/m^3.

These initial projections using measured data as the base year generally compares favourably with the actual 2005 measured mean of 33.8μg/m^3. There are variations in the actual predictions but these are probably to be expected due to revisions both within the factors used in the calculation and the technique itself.

10.4.4 Non Automatic Data

Nitrogen dioxide monitoring was conducted using passive diffusion tubes exposed on a monthly basis. The contract for the supply and analysis of the monthly diffusion tubes was awarded to Harwell Scientifics of 551 South Becquerel Avenue, Harwell International Business Centre, Didcott, Oxon.

Whilst Harwell Scientifics supply and analyse the passive diffusion tubes used, the final monthly bias factor is generated by the Health and Safety Laboratory (HSL). Harwell Scientifics undertake co-location of 3 of their passive NO_2 diffusion tubes with an automatic chemiluminescent analyser operated and run by HSL. The tubes are exposed as per the UK nitrogen network tube timetable and approximates to monthly exposure. Full QA/QC of the data from the chemiluminescent analyser is undertaken by HSL and used in the final determination of the bias factor quoted within the Harwell Scientifics monthly reporting of results to their customers. The bias factor quoted since January 2004 is based on a 12-month rolling average of the bias factor data that Harwell Scientifics receive from HSL.

Harwell Scientifics have supplied a spreadsheet of all monthly data from the UK Nitrogen Dioxide Laboratory Intercomparisom Exposure Bias Tube Results with HSL. This spreadsheet is enclosed in its entirety as Annexe 3. Examination of the results contained within this spreadsheet indicates consistent performance over the two years detailed. What is accepted is the monthly variation that can be seen, but as all NO_2 passive diffusion tube data is corrected using the annual bias factor, this removes the monthly variation - adoption of the reporting of the 12-month rolling average also smoothes out this fluctuation.

Harwell Scientifics also take part in the Workplace Analysis Scheme for Proficiency (WASP) operated by HSL. The WASP scheme is an independent proficiency testing scheme operated by the Health and Safety Laboratory (HSL). Each month a diffusion tube doped with nitrite is distributed to each participating laboratory; participants then analyse the tube and report the results to HSL. The nominal mass of nitrite on the doped tubes is different each month, and is intended to reflect the range encountered in actual monitoring. For the purpose of diffusion tube QA/QC in the context of Local Air Quality Management, NETCEN carry out an assessment of laboratory performance for each full calendar year.

This was based on the following criteria, which were agreed with DEFRA and HSL:

1. Participating laboratories must complete at least 10 of the 12 monthly WASP rounds.
2. The year's single worst result is ignored: this makes some limited allowance for one-off problems with analytical equipment etc.

3. Each laboratory's monthly standardised results are then combined to give a standard uncertainty for the full year, expressed as a relative standard deviation (%RSD)
4. The RSD must be within 15%.

Harwell Scientifics also take part in the NETCEN run DEFRA interlab QC solution testing scheme. Although both of these schemes are more to do with competency of the analysis and not directly associated with the derivation of bias they are further evidence as to both the compency of the laboratory and consistency of results. Details of the above are enclosed as Annexe 5.

It is this authorities opinion that the bias factors as quoted by Harwell Scientifics and HSL are far more reliable and traceable than those quoted as “national figures” within the spreadsheet guidance at http://www.uwe.ac.uk/aqm/review/mfaqroad.htm#ROAD6 . If the national bias correction factors with inherent uncertainties are taken into consideration, it is evident that far greater uncertainties lie behind the use of the national factors of 0.87 and 0.89 as opposed to the bias factors quoted by Harwell Scientifics for 2004 and 2005 of 0.73 and 0.71 respectively. This authority therefore contends that use of the bias correction factor as detailed above is valid. The authority are due to commence a co-location study to derive a “Swansea” bias factor using the three real-time monitoring stations mentioned within this report shortly.

The original Detailed Assessment Report submitted in December 2005 quoted exposure data from June 2004 to June 2005. The bias factor used to correct the passive data was quoted as 0.75 within the Detailed Assessment. Examination of the monthly bias factors between June 2004 and June 2005 from the data contained within annexe 3 would now suggest that a slight revision of this factor is required. The “annual” bias factor between June 2004 and June 2005 has now

been calculated as 0.71. The data presented here and detailed within the Detailed Assessment (as revised April 2006) has now been reviewed in light of the above.

10.4.4.1 Hafod Post Office - 1N

This authority has operated a monthly roadside measurement site at the Hafod Post Office at Neath Road, Hafod since the mid 1970's and provided data to the UK Non Automatic Network. 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 Hafod Air Quality Action Plan. Map 9 below shows the site in relation to the OPSIS DOAS transmitter (1) along Neath Road.

Map 9 - Location of Hafod Post Office Passive NO_2 Tube Sampling

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.

Annual Means for the Hafod Post Office site between 1993 and 2005 are shown below in table 22 for completeness and to view the entire dataset for this site. Table 22 also shows the corrected annual mean after correction for tube bias. The bias factor that has been used is 0.78 from 1993 to 2003 and as mentioned above, 0.73 for 2004, and 0.71 for 2005 as advised by Harwell Scientifics Ltd.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias 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
2004	58.8	42.9
2005	65.6	46.57

Table 22 - Hafod Post Office Passive NO_2 Tubes 1993-2005

Table 22 shows that the NO_2 levels measured at the façade of the Post Office building within the block of terraced housing have remained fairly consistent over the last decade or so. The corrected annual means indicate continuing exceedences of the annual mean objective level and is further evidence justifying the declaration of the Hafod Air Quality Management Area.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 39.17μg/m^3 is obtained for 2010 which , whilst below the EU objective of 40μg/m^3 clearly remains marginal and is at risk of being breached.

10.4.4.2 Uplands - 2N and 5N

A measurement site (2N) at Uplands Crescent, Uplands has been operational since 1993 and provided data to the UK Non Automatic Network. The location of the site however changed from January 2001. Between January 1993 and December 2000 the sampling site was located to the pine end/façade of a commercial premise. The siting over the years became unsuitable, as the side of the commercial premises was becoming increasingly prone to large overhanging trees.

The site was relocated during January 2001 when improvement works at the commercial premise forced its relocation. The Uplands site (5N) has been relocated roadside and now provides a worse case scenario measurement.

Map 10 - Location of Uplands 2N and 5N NO_2 Tube Sampling

For reference purposes, annual mean data from the previous site Uplands 2N between 1993 and 2000 is shown below as table 23. Annual mean data is shown below for site Uplands 5N from 2001 to 2005 as table 24

It would not be valid to compare the two datasets and form a view on the overall NO_2 trends in the area due to the relocation of the passive sampling tube even though the site classification has remained broadly the same. It is thought probable that because of the amount of foliage overhanging the Uplands 2N site that this in itself would not truly be indicative or reflect NO_2 levels at the façade due to the shielding etc. of the trees.

The bias factor that has been used is 0.78 from 1993 to 2003 and as mentioned above, 0.73 for 2004, and 0.71 for 2005 as advised by Harwell Scientifics Ltd.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1993	31.03	24.20
1994	35.45	27.65
1995	32.17	25.09
1996	33.07	25.80
1997	30.75	23.99
1998	27.29	21.29
1999	30.56	23.84
2000	28.16	21.96

Table 23 - Upland Site 2N NO2 Tube Data 1993 – 2000

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
2001	49.30	38.45
2002	51.09	39.85
2003	53.53	41.75
2004	46.75	34.12
2005	42.01	29.8

Table 24 - Uplands Site 5N NO_2 Tube Data 2001 - 2005

It is possible to use a conservative method to estimate the concentrations from the data presented within table 24 to the façade of the nearest property (as if it were a continuation of site 2N). Using guidance from http://www.uwe.ac.uk/aqm/review/mfaqroad.html paragraph 7, the following conservative façade measurements presented within table 25 are obtained by assuming a kerb to façade distance between 5-10m.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$	Corrected to façade $\mu g/m^{-3}$
2001	49.30	38.45	34.60
2002	51.09	39.85	35.87
2003	53.53	41.75	37.58
2004	46.75	34.12	30.71
2005	42.01	29.8	26.82

Table 25 – Corrected Façade Measurements Uplands Site 5N NO_2 Tube Data 2001 - 2005

With the exception of 2003 which is known to be an atypical year, the levels being recorded have moved from showing marginal compliance with the annual mean objective during 2001 and 2002 to full compliance during the last two years - this is even more definitive if the corrected façade measurement is taken into consideration.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 25.07$\mu g/m^3$ is obtained for 2010 which is below the EU objective of 40$\mu g/m^{3.}$

Despite the closure of the UK Non Automatic Network, it has been decided to continue monthly measurements at this site for the foreseeable future.

10.4.4.3 Moorside Road, West Cross - Site 4N

A measurement site located to the façade of a private dwelling has been operational at West Cross since 1993. The site has a classification of Suburban (SU)[44] and can be seen within map 11 below. The site is located in a residential area to the west of the city centre.

Map 11 - Location of West Cross 4N NO_2 Tube Sampling

[44] *Source LAQM.TG(03) Appendix A page A1-43*

Annual mean data is shown below for West Cross site 4N between 1993 and 2005 as table 25. This site has consistently recorded levels below the annual mean objective standard as would be expected with its site classification.
The bias factor that has been used is 0.78 from 1993 to 2003 and as mentioned above, 0.73 for 2004, and 0.71 for 2005 as advised by Harwell Scientifics Ltd.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1993	21.33	16.64
1994	15.47	12.07
1995	19.04	14.85
1996	19.58	15.27
1997	17.80	13.88
1998	12.55	9.79
1999	13.93	10.87
2000	13.19	10.29
2001	15.00	11.70
2002	18.92	14.76
2003	18.57	14.48
2004	11.92	8.7
2005	15.7	11.1

Table 25 – West Cross Site 4N Annual Mean data 1993 - 2005

Consideration was given to decommissioning this site during 2005 as the property has been offered for sale. This coupled with the consistent low readings and the demise of the Non UK Automatic Network has seen it ceasing as a measurement site following completion of the December 2005 measurement period. The full dataset is presented here for sake of completeness.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator

v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 9.71µg/m^3 is obtained for 2010 which is below the EU objective of 40µg/m$^{3.}$

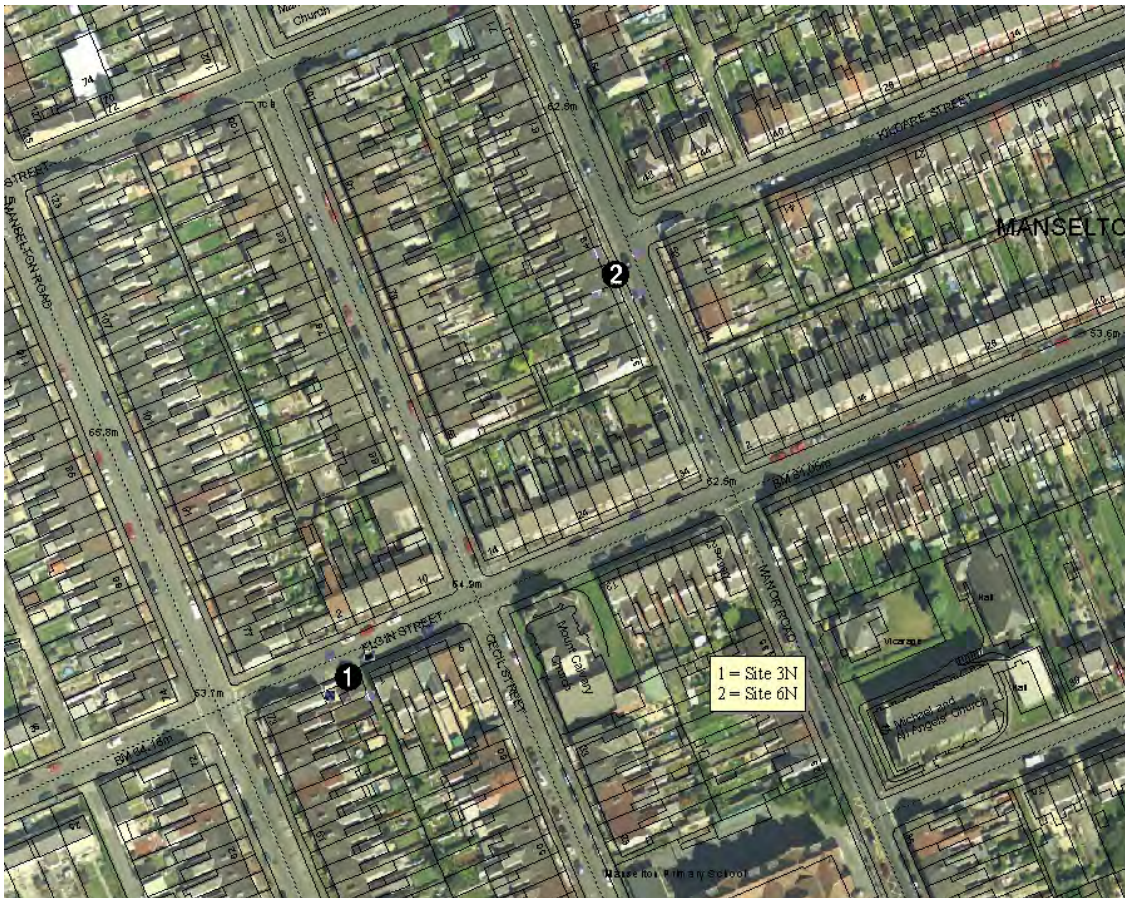
10.4.4.3 Manselton

A measurement site (3N) at Elgin Street, Manselton had been operational since 1993 and has provided data to the UK Non Automatic Network. The location of the site however changed from October 2004. Between January 1993 and August 2004 the sampling site was located to the façade of a garage fronting onto Elgin Street, Manselton. However, the property was sold during the August/September period and sampling tubes were lost due to redevelopment of the property and associated garage. The site was therefore relocated to the façade of a terraced dwelling in an adjacent street.

Measurements commenced at the relocated site along Manor Road, Manselton (site 6N) during October 2004. The site classification has remained as Urban Background (U4)[45] allowing direct comparison between the two locations. Map 12 shows the location of both sampling sites.

The demise of the UK Non Automatic Network has resulted in this site ceasing as a measurement site following completion of the December 2005 measurement period. The full dataset is presented here for sake of completeness.

[45] *Source LAQM.TG(03) Appendix A page A1-42*



Map 12 - Manselton Sites 3N and 6N - NO_2 sampling Locations

The bias factor that has been used is 0.78 from 1993 to 2003 and as mentioned above, 0.73 for 2004, and 0.71 for 2005 as advised by Harwell Scientifics Ltd.

Data capture for 2004 is 75% permitting the calculation of the annual mean. Annual mean data is shown below for Manselton sites 3N and 6N between 1993 and 2005 as table 26. This site has consistently recorded levels below the annual mean objective standard as would be expected with its site classification. No major trend is evident within the data, as levels have remained remarkably consistent over the period of measurement. One interesting observation is that the atypical meteorological conditions experienced during 2003 are clearly

evident within the annual mean for that year. This effect was not so pronounced at the other UK Non automatic network sites operated by the authority.

Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1993	30.39	23.70
1994	32.53	25.37
1995	32.90	25.66
1996	33.42	26.07
1997	30.55	23.83
1998	26.19	20.43
1999	31.2	24.34
2000	29.36	22.90
2001	31.25	24.38
2002	28.77	22.44
2003	35.29	27.53
2004	29.17	21.30
2005	22.2	15.76

Table 26 Manselton Sites 3N and 6N NO_2 Monitoring 1993 - 2005

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2005 as the base year a projection of 13.78$\mu g/m^3$ is obtained for 2010 which is below the EU objective of 40$\mu g/m^3$.

10.4.5 Survey Specific Passive NO_2 Tube Monitoring

Several area specific surveys have been carried out in recent years. The majority of these surveys do not conveniently start exposure and cease exposure during one calendar year but span multiple years. Wherever possible, the data is presented as calendar years but some overlap is unavoidable. In the majority of cases, this work has been reported on fully: within the Progress Report 2004 for example, but for the sake of completeness, the results are reproduced within this 3rd round USA. This also allows an opportunity to review the data based on the revised bias factors supplied by Harwell Scientifics Ltd.

10.4.5.1 Gowerton bypass Study

A bypass has been constructed within the village of Gowerton, which is located within the outer urbanised area to the west of Swansea. The bypass has been constructed to assist in the reduction of the volume of traffic queuing at the traffic signal controlled junction at Sterry Road/Mill Street that allows access indirectly to the Dunvant/Killay areas. An automatic traffic counter (ATC) has recently been located within the stage 2 section 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.

The survey ran from the 5th November 2002 to 8th December 2004. Phase 2 construction work commenced on the 20th January 2003 and the opening ceremony took place on the 8th October 2003. The survey therefore allowed measurements pre works, during works and then for a period of a year post

construction works to assess the effectiveness of the bypass in reducing NO_2 levels around the traffic light controlled intersection.

Ten sites were selected falling into either the Roadside (U2) [46] or Urban Background (U4)[47] classifications. The location of the sample sites is shown in Map 13 with additional site location details contained within table 27.

Map 13 - Gowerton Bypass Phase 2 NO_2 Sampling Locations

[46] *Source LAQM.TG(03) Appendix A page A1-42*
[47] *Source LAQM.TG(03) Appendix A page A1-42*

Site	Easting	Northing	Site Class	Location
1	259094	196477	UB(U4)	Outside 42 Elba Street, Gowerton
2	259025	196548	UB(U4)	Outside 27 Elba Street, Gowerton
3	258934	196598	Roadside (U2)	Outside 3 Elba Street, Gowerton
4	258866	196525	Roadside (U2)	Outside 25 Mill Street, Gowerton
5	258782	196382	Roadside (U2)	Outside 5 Mill Street, Gowerton
6	258778	196300	Roadside (U2)	Outside 14 Sterry Road, Gowerton
7	258977	196369	UB(U4)	Outside 11 Church Street, Gowerton
8	259175	196278	Roadside (U2)	Jnc Sterry Road / Phase 2 Bypass
9	259326	196117	Roadside (U2)	Outside 40 Gorwydd Road, Gowerton
10	258923	196278	Roadside (U2)	Outside 40 Sterry Road, Gowerton

Table 27 - Gowerton Bypass Site Locations

When the annual means are calculated for 2003 and 2004 from the monthly monitoring results, it would appear at first glance, that there has been a very pronounced reduction during 2004, being the period post construction works. However, it is known that monitoring from 2003 reflected the atypical meteorological conditions at every monitoring station within Swansea. It is highly likely therefore, that the results from 2003 do not present an indicative picture of conditions either pre construction works or during construction works. To compare 2003 and 2004 as pre and post construction works could easily lead to the view being formed that the bypass had seen a pronounced reduction in NO_2 levels - especially around the traffic signal controlled junction between sites 5 and 6. This is not to say that the bypass has not had the desired effect of reducing congestion and therefore pollution levels within the village, but that the perceived reduction should be treated with caution at this stage.

Annual means from all monitoring stations are given below as table 28. A bias correction factor of 0.78 has been used for 2003 with a new bias factor of 0.73 for 2004, as advised by Harwell Scientifics Ltd.

Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$ 2003	Bias Corrected Annual Mean $\mu g/m^{-3}$ 2003	Measured NO_2 Annual Mean $\mu g/m^{-3}$ 2004	Bias Corrected Annual Mean $\mu g/m^{-3}$ 2004
1	24.21	18.88	16.85	12.3
2	26.19	20.43	23.39	17.05
3	31.34	24.45	24.39	17.8
4	41.40	32.29	32.97	24.06
5	45.41	35.42	36.95	26.97
6	50.71	39.55	36.65	26.75
7	25.49	19.88	16.45	12.00
8	37.48	29.23	29.71	21.68
9	37.27	29.07	28.12	20.52
10	38.97	30.39	24.08	17.57

Table 28 Gowerton bypass NO_2 Study - Annual Means 2003 and 2004

Following bias correction of the annual means for 2003, the only site that could reasonably be considered as failing the UK Air Quality annual mean objective of 40$\mu g/m^{-3}$ is site 6. The bias corrected result shows the annual mean to be just 0.45$\mu g/m^{-3}$ below the objective standard. During 2004 all monitoring locations showed compliance with the annual mean objective standard. No further monitoring is envisaged at present.

Using the bias corrected annual means from 2004; projections can be made to both 2005 and 2010. The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls). Using 2004 as the base year, projections for 2005 and 2010 are shown below as table 29.

Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$ 2004	Bias Corrected Annual Mean $\mu g/m^{-3}$ 2004	Projection 2005 $\mu g/m^{-3}$	Projection 2010 $\mu g/m^{-3}$
1	16.85	12.3	12.07	10.56
2	23.39	17.05	16.73	14.63
3	24.39	17.8	17.29	14.55
4	32.97	24.06	23.37	19.66
5	36.95	26.97	26.20	22.04
6	36.65	26.75	25.93	21.86
7	16.45	12.00	11.78	10.30
8	29.71	21.68	21.06	17.72
9	28.12	20.52	19.93	16.77
10	24.08	17.57	17.07	14.36

Table 29 – Future Projections to 2005 and 2010 Gowerton Study

It is clear from the projections outlined above that there are no forecast exceedences of the annual mean objective at any site either during 2005 or 2010.

10.4.5.2 Loughor NO_2 Study

A request was received to undertake NO_2 monitoring along Castle Street in Loughor due to proposed traffic calming measures outside Casllwchwr Primary School, extending to the majority of Castle Street itself. The scheme was to both upgrade existing traffic calming measures and to introduce additional calming measures - mainly a 20mph zone outside the school entrance. Calming measures included a raised crossing outside the school, to chicanes' and speed bumps.

Passive NO_2 tube monitoring commenced on the 12th August 2003 and exposure ran until 6th July 2004. Ten sites were selected falling into either the Roadside (U2) [48] or Urban Background (U4)[49] classifications. The location of the sample sites is shown in Map 14 with additional site location details contained within

[48] *Source LAQM.TG(03) Appendix A page A1-42*
[49] *Source LAQM.TG(03) Appendix A page A1-42*

table 30. A worse case scenario was undertaken with the siting of the sampling tubes along Castle Street. Two background sites were used - sites 9 and 10 - being far removed from any sources at Castle Street. It is accepted that site 10 would be influenced by the Loughor bypass to its south.

Again, part of the exposure period occurred during 2003 where elevated levels of pollution were recorded throughout Swansea due to atypical meteorological conditions. The picture is somewhat further muddied as to any detrimental effects following completion of the works as Statutory Undertakers were undertaking a mains replacement program along parts of Castle Street, affecting sites 1, 2, 3 and 4 with queuing traffic from traffic signals post completion of the works.

Map 14 - Loughor NO_2 Monitoring 2003-2004

Loughor is located to the north west of the authorities' area within the semi-rural area of North Gower. The Loughor estuary allows an uninterrupted fetch out to the Irish Sea and is heavily influenced by prevailing south-westerly winds. Air pollution levels are normally very low due to the influence of a "clean" airflow off the Irish Sea; the only major conurbation being passed over is Llanelli.

Site	Easting	Northing	Site Class	Location
1	257060	198182	UB(U4)	181 Glebe Road
2	256933	198163	UB(U4)	Glebe Road/Glanymor Drive
3	256783	198111	Roadside (U2)	Corner of Glebe Road/The Croft
4	256705	198102	Roadside (U2)	Outside 46 Castle Street
5	256624	198080	Roadside (U2)	Outside 37 Castle Street
6	256751	198067	Roadside (U2)	Outside 45/47 Castle Street
7	256441	198020	UB(U4)	Opp Ship and Castle Inn
8	256332	198032	Roadside (U2)	Castle Street (Rear of 4 Ferry Road)
9	256731	198370	Roadside (U2)	T'graph Pole Gwydr Place
10	256764	197889	Roadside (U2)	L'post outside 1 Castle Court

Table 30 - NO_2 sampling Locations - Loughor 2003 - 2004

As Technical Guidance LAQM.TG(03) recommends calculation of the annual mean from a minimum of 75% data capture[50] for the year, this would clearly not be available in this case for 2003. LAQM.TG(03) also identifies a method to estimate the annual mean should say 6 months of monitoring data be available[51]. Again, this is not available for 2003. What is presented here therefore, is an "annual mean" covering the period of measurement i.e. 12th August 2003 to 6th July 2004. A bias factor of 0.75 has been used to correct the measured data.

[50] *LAQM.TG(03) Box 6.2 (A3)page 6-15*
[51] *LAQM.TG(03) Box 6.5 page 6-8*

Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1	33.7	25.3
2	31.3	23.5
3	30.1	22.6
4	29.9	22.4
5	27.9	20.9
6	29.1	21.8
7	28.4	21.3
8	27.7	20.8
9	18.1	13.6
10	23.0	17.3

Table 31 - Loughor NO_2 Monitoring Annual means

It is clear from table 31 that no location looks likely to approach the annual mean objective in 2005 of $40\mu g/m^{-3}$. Statutory Undertakers were still working along Castle Street when exposure ceased. The effect of this work can be seen mainly to sites 1-4. No traffic count data is available at present but local knowledge would not point an AADT greater than 6,000 vehicles. Due to the Statutory Undertakers work, it has not been possible to assess any degradation of air quality following completion of the traffic calming works. It is thought likely that due to the exposed location of Loughor to prevailing south-westerly winds from the Irish Sea, that any effect would have been difficult to detect using this method of sampling.

No projections to 2005 and 2010 have been undertaken due to the split in the monitoring year, but even without this it is clear that no location would breach either the 2005 or 2010 annual mean objective standard.

10.4.5.3 Detailed NO_2 Monitoring at identified locations

The details now presented below are reproduced in the main from the original Detailed Assessment report dated December 2005 and its subsequent amendment during April 2006 and are shown again here for sake of completeness. Analysis has been confined to the data originally reported as some sites within the dataset that made up the Detailed Assessment report were decommissioned during July 2005. To only report on those sites with a complete dataset for 2005 as requested by the Welsh Assembly Government in their letter dated 29th March 2006 may cause additional confusion in interpretation of the results. The original bias factor used to correct the "raw" NO_2 passive diffusion tube data was 0.75. In light of additional evidence received from Harwell Scientifics (as detailed above) this bias correction factor has now be revised to 0.71 and the data recalculated.

Fifty six sites were located around the identified junctions together with additional monitoring within the Hafod Air Quality Management Area. Table 32 details the site classification assigned to each site, together with the sites Ordnance Survey 6 digit grid co-ordinates and location. Map 15 indicates the areas where monitoring was undertaken. Site classification is limited to Roadside (U2)[52].

[52] Source LAQM.TG(03) Appendix A page A1-42

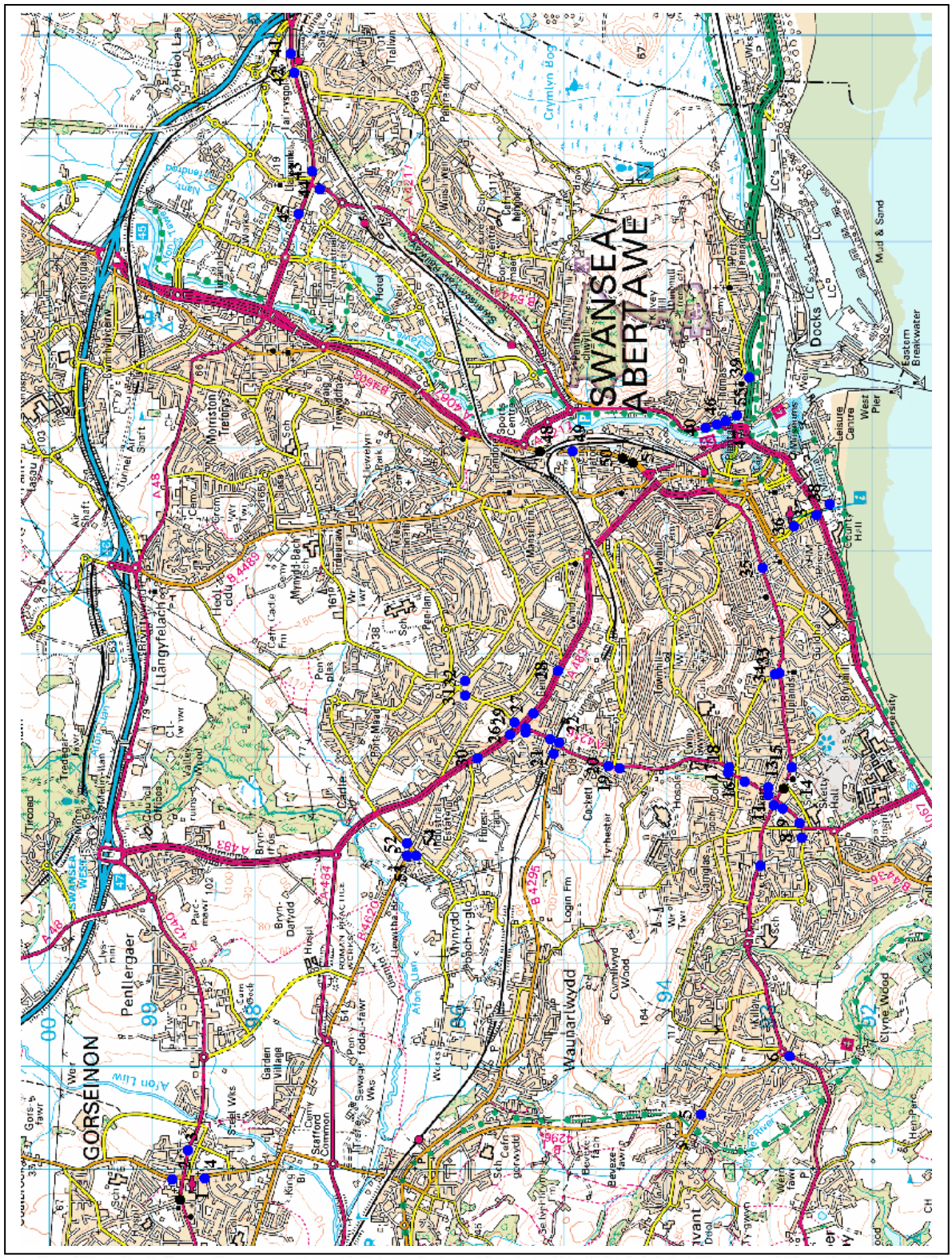
Site	Easting	Northing	Site Class	Location
1	258714	198713	Roadside (U2)	40 Alexandra Road, Gorseinon
2	258910	198789	Roadside (U2)	21 Pontardulais Road, Gorseinon
3	259192	198641	Roadside (U2)	o/side 41 High Street Gorseinon
4	258921	198470	Roadside (U2)	38 West Street, Gorseinon
5	259543	193648	Roadside (U2)	310 Dunvant Road, Dunvant
6	260102	192798	Roadside (U2)	470 Gower Road, Killay
7	261949	193075	Roadside (U2)	173 Gower Road, Sketty
8	262225	192674	Roadside (U2)	O/s 12 Sketty Park Drive, Sketty
9	262367	192699	Roadside (U2)	O/s Dylan's 73 Dillwyn Road
10	262504	192862	Roadside (U2)	22 Dillwyn Road, Sketty
11	262537	192945	Roadside (U2)	112 Gower Road, Sketty
12	262633	193004	Roadside (U2)	22 Vivian Road, Sketty
13	262707	192996	Roadside (U2)	6 Frogmore Avenue, Sketty
14	262694	192852	Roadside (U2)	15 Gower Road, Sketty,
15	262903	192772	Roadside (U2)	34 Gower Road, Sketty
16	262762	193230	Roadside (U2)	95 Vivian Road, Sketty
17	262855	193393	Roadside (U2)	133 Vivian Road, Sketty
18	262903	193376	Roadside (U2)	5 Broadway, Broadway
19	262899	194446	Roadside (U2)	165 Cockett Road, Cockett
20	262920	194555	Roadside (U2)	188 Cockett Road, Cockett
21	263033	195089	Roadside (U2)	Cwmbach Road, Cockett
22	263141	195028	Roadside (U2)	9 St Peters Terrace, Cockett
23	263175	195121	Roadside (U2)	8 Station Road, Cockett
24	263243	195362	Roadside (U2)	89 Station Road, Cockett
25	263280	195358	Roadside (U2)	90 Station Road, Cockett
26	263217	195505	Roadside (U2)	932 Carmarthen Road
27	263428	195286	Roadside (U2)	838 Carmarthen Road, Fforestfach
28	263838	195047	Roadside (U2)	694 Carmarthen Road, Fforestfach
29	263334	195465	Roadside (U2)	12 Ravenhill Road, Fforestfach
30	262988	195820	Roadside (U2)	1034 Carmarthen Road
31	263595	195948	Roadside (U2)	129 Ravenhill Road, Fforestfach
32	263737	195941	Roadside (U2)	547 Pentregethin Road, Gendros
33	263819	192896	Roadside (U2)	11 Sketty Road, Sketty
34	263803	192935	Roadside (U2)	rear of 2 Sketty Road, Sketty
35	264833	193059	Roadside (U2)	Brunel Court, Uplands
36	265238	192745	Roadside (U2)	37-44 West Way, Swansea
37	265354	192533	Roadside (U2)	132 Oystermouth Road, Swansea
38	265457	192403	Roadside (U2)	Trawler Road, Marina, Swansea
39	266682	193189	Roadside (U2)	Port Tennant Road, Port Tennant
40	266201	193608	Roadside (U2)	Pentreguinea Road, St Thomas

41	269822	197634	Roadside (U2)	260 Peniel Green Road, Llansamlet
42	269641	197610	Roadside (U2)	233 Peniel Green Road, Llansamlet
43	268687	197434	Roadside (U2)	outside 9 Peniel Green Road, Llansamlet
44	268509	197356	Roadside (U2)	26 Nantyffin Road, Llansamlet
45	268270	197563	Roadside (U2)	66 Samlet Road, Llansamlet
46	266258	193408	Roadside (U2)	Sheltered housing Pentreguinea Road, St Thomas
47	266229	193502	Roadside (U2)	Jnc Pentreguinea Road and Benthal Place, St Thomas
48	265973	195220	Roadside (U2)	5 Morfa Terrace, Hafod
49	265965	194900	Roadside (U2)	120 Neath Road, Hafod
50	265904	194416	Roadside (U2)	38 Neath Road, Hafod
51	265858	194315	Roadside (U2)	16 Neath Road (Hafod Laundrette)
52	262161	196513	Roadside (U2)	2 Ffordd Cynore, Fforestfach
53	262047	196420	Roadside (U2)	12 Ystrad Road, Fforestfach
54	262048	196508	Roadside (U2)	1344 Carmarthen Road, Fforestfach
55	266316	193300	Roadside (U2)	50 Delhi Street, St Thomas
5N	264061	192886	Roadside (U2)	Uplands Crescent, Uplands

Table 32 – Detailed Assessment NO_2 monitoring locations

Monthly exposure periods ran from June 2004 to June 2005. All passive diffusion tubes were exposed in accordance with the UK NO_2 survey Instruction Manual and were either fixed to the front façade of a receptor i.e. to a down pipe or where one was not available to the nearest lamppost. All lampposts used were within 5m of the façade of the dwellings – in majority of cases within 2.5m as the properties fronted directly onto the pavement.

All passive diffusion tubes were analysed using Harwell Scientifics Ltd standard operating procedure's AEAT/GW1/1015 issue 10. The bias factor applied to correct the measured tube data between June 2004 and June 2005 is 0.71 as now advised by Harwell Scientifics.



Map 15 - *Detailed Assessment Monitoring Locations*

10.4.5.3.1Monitoring Results

Monitoring has been conducted between the 2nd June 2004 and the 1st June 2005. The calculations of the "annual mean" that are presented below within table 33 are for the period June 2004 - June 2005 representing a full year of measurement. The bias factor used to correct the measured tube data for 2004 /2005 is 0.71.

Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$	Data loss	Range	Standard Deviation	Coefficient of Variation (CV%)
1	33.8	24.00	0	30.4	10.4	30.8
2	26.35	18.71	1	22	7.9	30.2
3	38	26.98	0	25.2	7.4	19.6
4	35.42	25.15	0	23.8	8.3	23.5
5	31.24	22.18	1	21.9	5.8	18.8
6	23.81	16.91	1	20.7	7.2	30.6
7	36.2	25.70	0	32.1	9.9	27.38
8	30.24	21.47	0	29.4	10.1	33.6
9	35.12	24.94	0	27.6	9.9	28.4
10	39.29	27.90	0	36.2	11.35	28.8
11	41.46	29.44	0	31.5	11.25	27.1
12	37.47	26.60	0	21	6.9	18.4
13	26.15	18.57	1	22.4	8.3	31.8
14	53.86	38.24	1	32.7	9.9	18.4
15	36.77	26.11	1	29.7	10.7	29.2
16	32.68	23.20	2	25.6	8.5	26.1
17	45.86	32.56	0	31.2	10.5	22.9
18	32.16	22.83	0	15.9	5.6	17.4
19	31.77	22.56	0	26	8.1	25.7
20	31.8	22.58	2	34.7	9.9	31.7
21	30.84	21.90	2	25.2	7.8	25
22	31.77	22.56	1	28	9.0	28.5
23	36.82	26.14	4	26.4	7.9	24.2
24	25.2	17.89 *	6	36.5	15.3	44.9
25	40.73	28.92	0	30.3	9.1	22.4

Site	Measured NO_2 Annual Mean µg/m^{-3}	Bias Corrected Annual Mean µg/m^{-3}	Data loss	Range	Standard Deviation	Coefficient of Variation (CV%)
26	43.55	30.92	0	36.5	11.1	25.6
27	38.95	27.65	0	28.8	10.7	27.5
28	36.78	26.11	1	29.5	10.7	29
29	44.91	31.89	1	37.7	11.7	26.2
30	47.26	33.55	0	37.5	11.7	24.9
31	29.5	20.95	0	26.9	9.8	33.2
32	32.33	22.95	1	26.3	9.9	31.5
33	45.85	32.55	1	21.8	7.2	15.7
34	45.04	31.98	1	32.4	10	22.2
35	51.24	36.38	2	34.1	12.4	24.3
36	42.4	30.10	3	22.6	7.3	17.3
37	45.26	32.13	1	33.9	11.7	25.8
38	30.36	21.56	1	36.1	11.8	39
39	37.77	26.82	2	32.3	9.9	26.3
40	44.42	31.54	0	35.8	10.9	24.7
41	39.66	28.16	0	23	7.2	18.2
42	40.66	28.87	1	26	9.1	22.5
43	43.19	30.66	0	28.9	9	20.9
44	39.85	28.29	0	22.1	6.9	17.3
45	31.5	22.37	0	31.9	9.5	30.3
46	33.82	24.01	2	25	8.2	25.2
47	49.16	34.90	2	35.3	11.9	25.3
48	61.83	**43.90**	0	15.8	5.7	9.4
49	47.01	33.38	1	28.8	10.3	22.5
50	65.43	**46.46**	1	34.9	12.1	18.7
51	56.86	**40.37**	0	30.8	11.8	21.5
52	24.82	17.62	0	15.6	5.9	25.1
53	33.2	23.57	0	24.4	8.4	26.9
54	25.27	17.94	0	18	6.5	26.8
55	52.7	37.42	1	37.8	11.6	24.5
5N	43.11	30.61	2	40	10.5	24.4

Table 33 – NO_2 monitoring results June 2004 – June 2005

* Data capture less than 75%

The monitoring undertaken has highlighted 3 sites where the corrected NO_2 annual mean is above the objective standard of 40µg/m^{-3}. However, all 3 of

these failing sites (sites 48, 50 and 51) represent additional monitoring within the existing Hafod Air Quality Management Area.

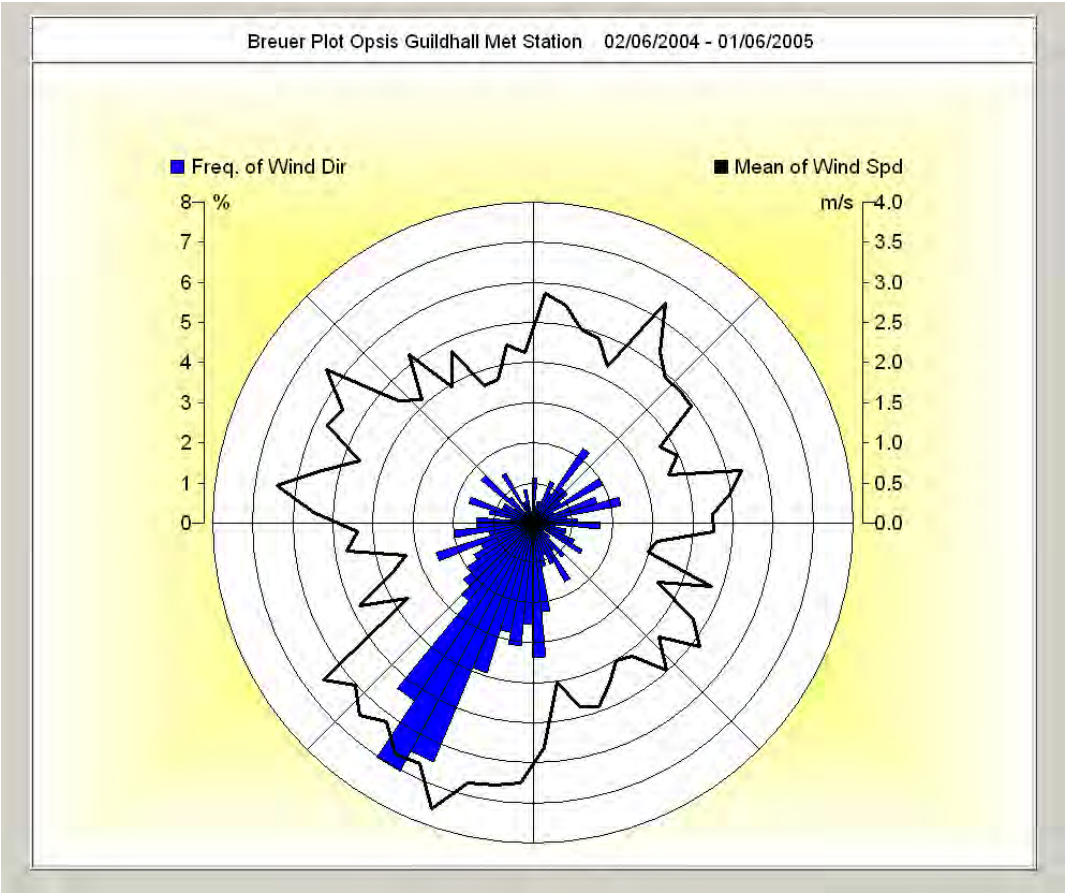
A further 3 sites (sites 14, 35, and 55) are within the annual mean range 35 - 40μg/m^{-3}.. These 5 sites can aa be considered as having the potential to breach the objective standard.

Coefficients of variation (CV%) of the monthly measurements at the monitoring locations are included in table 1. These coefficients, which are defined as the standard deviation as a percentage of the mean, are an additional indication of the spread of the results; the higher the values the greater the spread or variability.

Coefficients of variation varied between 9.4% (site 48) and 44.9% (site 24). Site 24 suffered from considerable data loss and this result is probably to be expected.

Meteorological data has been examined for the period June 2004 – June 2005. A Breuer Plot representing the period of measurement is given below as Breuer plot 1 and shows a prevalence of south westerly winds. This probably typifies the expected meteorological conditions.

Previous passive diffusion tube surveys notably during 2003 have been found to have been heavily influenced under the prevalence of a south easterly wind.



Breuer Plot 1 – Meteorological conditions June 2004 – June 2005

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls).

Within the original Detailed Assessment which was written prior to the issue of the revised LAQM.TG(03) guidance during January 2006, the guidance and projection factors used were that as stated within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29). Clearly, this now requires correction and is the reason for this datasets including within this USA as well as the amended Detailed Assessment.

Using 2004 as the base year, projections for 2005 and 2010 are shown below as table 34 and table 35 respectively.

Site	Bias Corrected Annual Mean $\mu g/m^{-3}$	Projected 2005	Site	Bias Corrected Annual Mean $\mu g/m^{-3}$	Projected 2005
1	24.00	23.32	29	31.89	30.98
2	18.71	18.18	30	33.55	32.59
3	26.98	26.21	31	20.95	20.35
4	25.15	24.43	32	22.95	22.30
5	22.18	21.55	33	32.55	31.62
6	16.91	16.43	34	31.98	31.07
7	25.70	24.97	35	36.38	35.34
8	21.47	20.86	36	30.10	29.24
9	24.94	24.23	37	32.13	31.21
10	27.90	27.10	38	21.56	20.95
11	29.44	28.60	39	26.82	26.06
12	26.60	25.84	40	31.54	30.64
13	18.57	18.04	41	28.16	27.36
14	38.24	37.15	42	28.87	28.05
15	26.11	25.37	43	30.66	29.79
16	23.20	22.54	44	28.29	27.48
17	32.56	31.63	45	22.37	21.73
18	22.83	22.18	46	24.01	23.33
19	22.56	21.92	47	34.90	33.90
20	22.58	21.94	48	**43.90**	**42.65**
21	21.90	21.28	49	33.38	32.43
22	22.56	21.92	50	**46.46**	**45.14**
23	26.14	25.39	51	**40.37**	39.22
24	17.89 *	17.38	52	17.62	17.12
25	28.92	28.10	53	23.57	22.90
26	30.92	30.04	54	17.94	17.43
27	27.65	26.86	55	37.42	36.35
28	26.11	25.37	5N	30.61	29.74

Table 34 –NO_2 Survey June 2004 – June 2005 Projected Annual Means in 2005

Only 2 sites (sites 48 and 50), both of which are contained within the existing Hafod Air Quality Management Area, and which represent additional

monitoring within the AQMA are projected to exceed the objective standard in 2005.

Site	Bias Corrected Annual Mean µg/m^{-3}	Projected 2010	Site	Bias Corrected Annual Mean µg/m^{-3}	Projected 2010
1	24.00	19.61	29	31.89	26.06
2	18.71	15.29	30	33.55	27.42
3	26.98	22.05	31	20.95	17.12
4	25.15	20.55	32	22.95	18.75
5	22.18	18.12	33	32.55	26.60
6	16.91	13.82	34	31.98	26.13
7	25.70	21.00	35	36.38	29.73
8	21.47	17.54	36	30.10	24.60
9	24.94	20.38	37	32.13	26.26
10	27.90	22.80	38	21.56	17.62
11	29.44	24.06	39	26.82	21.92
12	26.60	21.74	40	31.54	25.77
13	18.57	15.17	41	28.16	23.01
14	38.24	31.25	42	28.87	23.59
15	26.11	21.34	43	30.66	25.05
16	23.20	18.96	44	28.29	23.12
17	32.56	26.61	45	22.37	18.28
18	22.83	18.66	46	24.01	19.62
19	22.56	18.44	47	34.90	28.52
20	22.58	18.45	48	**43.90**	35.87
21	21.90	17.90	49	33.38	27.28
22	22.56	18.44	50	**46.46**	37.97
23	26.14	21.36	51	**40.37**	32.99
24	17.89 *	14.62	52	17.62	14.40
25	28.92	23.63	53	23.57	19.26
26	30.92	25.27	54	17.94	14.66
27	27.65	22.59	55	37.42	30.58
28	26.11	21.34	5N	30.61	25.01

Table35 –NO2 Survey June 2004 – June 2005 Projected Annual Means in 2010

From table 35 above all sites are predicted to show compliance with the EU Objective during 2010. Site 50 (located within the existing Hafod AQMA) is

predicted to show the more marginal compliance in 2010. Site 14 is projected to show full compliance with the EU Objective during 2010.

It is proposed to continue NO_2 monitoring at these and several other sites to build up a long term dataset to establish continued compliance with the EU objective during 2010.

Whilst the primary consideration has been to establish compliance with the annual mean objective, there is of course the 1 hour mean objective to consider as well. However, in view of the annual means returned from all sites and the report Analysis of the Relationship between 1-hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen et al, July 2003 paragraphs 5.3 and 5.4, it is concluded that there will be no exceedences of the 1 hour objective not to exceed 200$\mu g/m^{-3}$ at any monitoring location at the objective date of 31st December 2005. This view is unlikely to change with view to the EU objective date in 2010 but it will be reviewed accordingly when additional monitoring data is available.

LAQM.TG(03) indicates that where there are monitoring data for the identified junctions, then these results should be used in preference to the DMRB screening model to reach a decision, assuming the data has been quality assured [53]. Therefore, whilst the authority are in the process of establishing a network of automatic traffic counters classifying data to the EUR6 standard, this work is not at a sufficiently advanced stage to provide enough meaningful data to input into any modelling system. This situation will change during late 2006 when the systems being developed by the authority to permit modelling of air quality are complete.

[53] *LAQM.TG(03) box 6.2 page 6-18 and section 6.58 page 6-29*

10.5 Conclusion into USA for Nitrogen Dioxide

From the monitoring undertaken no location breached the UK annual mean objective for NO_2 at the compliance date of 31st December 2005. Indications from the additional monitoring undertaken within the existing Hafod Air Quality Management Area indicate continued exceedences within the declared area at the objective date of 31st December 2005.

From both the automatic and passive diffusion tube monitoring undertaken, the results have been projected forward to the EU NO_2 annual mean objective date in 2010. Forward projections indicate that all sites will show compliance during 2010 with the EU NO_2 objective.

From the real-time and surrogate monitoring undertaken, there are no indications that the 1-hour mean NO_2 objective was be breached at any monitoring location at the objective date in 2005.

In light of the above there is no requirement to proceed to a Detailed Assessment for Nitrogen Dioxide. It is further concluded that the existing Hafod Air Quality Management Area remains valid.

11 New Local Developments

During the last two to three years, Swansea has seen a substantial amount of interest in development of both green field sites and brown field sites. The catalyst for this upsurge in development has undoubtedly been the Welsh Development Agency led redevelopment of the old docklands within Swansea Port that has become known as the SA1 development. This major investment site has seen developers submitting Planning Applications both within the SA1 area and more lately outside of that area but to the main within the influence zone of the SA1 development.

Details of all major projects know of are summarised below as some developments have the potential to impact upon air quality. To the main, these impacts have largely been resolved through the planning process. Some development sites have been completed while others remain either in the early stages of construction or planning processes. These details have been reported within the Progress Report submitted during July 2005 but are repeated and updated here where appropriate for the sake of completeness.

11.1 New Retail Developments

11.1.1 Morfa Retail Park

Construction of the Morfa Retail Park commenced during 2003 alongside the construction of a new sports stadium to be used by both Swansea City Football Club and for the new regional rugby team the Ospreys. Swansea City Football Club will play all of its home games at the stadium whilst the Ospreys will play

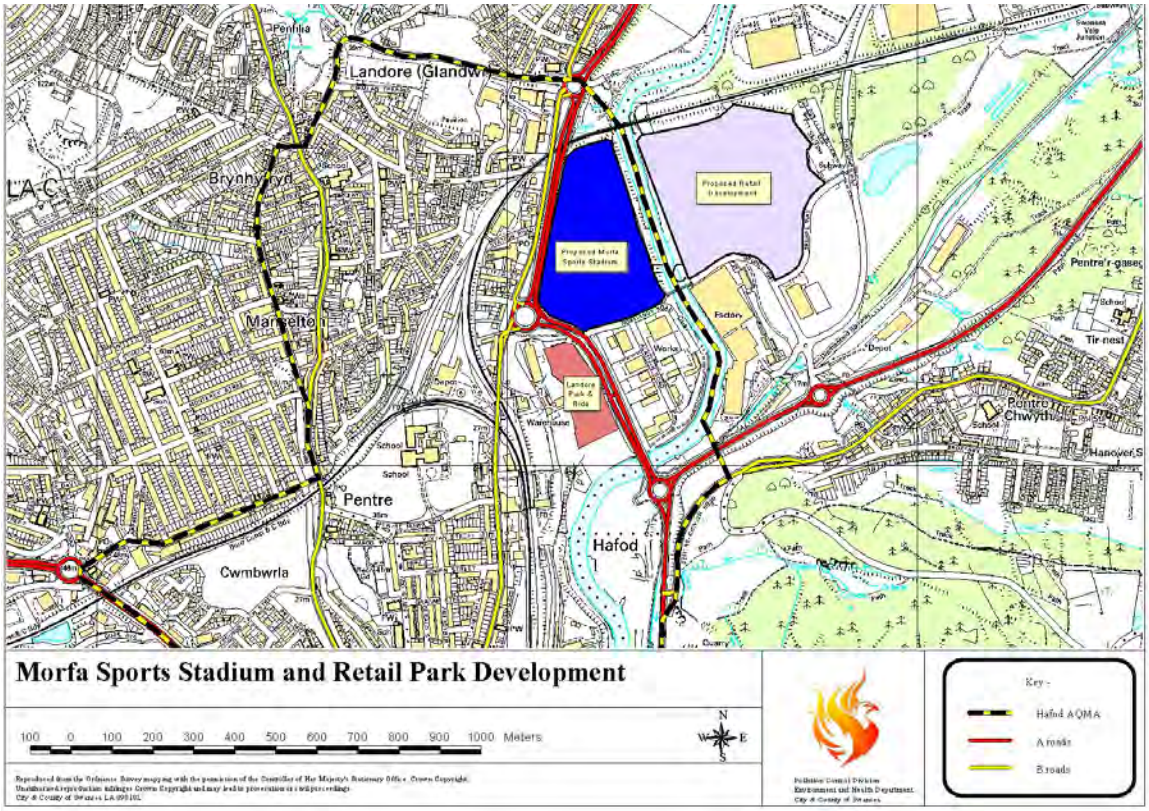
some of their home fixtures at the venue - the remainder being hosted at The Gnoll, Neath. The sports stadium development has been named during 2006 as The Liberty Stadium and is located within the boundary of the Hafod Air Quality Management Area (AQMA). The Morfa Retail Park development lies just outside of the Hafod AQMA. Map 16 below indicates the extent and location of the development within the lower Swansea Valley.

The Morfa Groundhog (see 8.5.1.1 above) air quality monitoring station is located at Normandy roundabout, adjacent to the development site. This site will provide the data to enable an assessment of any impact upon the lower valley area from the development and the road transport infrastructure of the lower valley area.

Part of the Retail Park opened during late 2004/early 2005 and has seen major UK operators establish premises within the retail park. These operators include a major DIY chain, numerous cloths and sports goods outlets and a major UK food retailer. The vast majority of the remainder of the retail units were occupied during 2005 but one or two remain vacant.

The sports stadium was completed during June 2005 and hosted its first football game during July 2005 prior to the commencement of the football and rugby season for 2005/2006. The stadium will be in use for the majority of weekends as well as certain weekday evening fixtures for both sport uses.

There are plans to stage major pop concerts and other “outdoor events” at this venue. The detail and frequency of these events are not known at present. In addition, the Retail Park will be open for business until late evening for the majority of the time.



Map 16 - Sports Stadium and Morfa Retail Park Developments

Vehicle by vehicle automatic classification and counting is now ongoing throughout the lower Swansea Valley via a network of GPRS Automatic Traffic Counters. This will provide the data to enable a clearer picture to be obtained of the influence of the road transport network to the lower valley area.

11.1.2 Parc Fforestfach & Pontardulais Road Retail Park

Parc Fforestfach has been constructed over the last couple of years following the reconstruction of a major UK food retailer store and the aquisision of adjoining derelict retail units. The complex now can be considered to straddle two sites - one either side of the busy A483 Pontardulais Road. The complex as a whole comprises of major UK food retailers, clothing retailers and electrical retailers

together with a fast food outlet and other mixed retail units consisting of, amongst other things, a bookstore and chemists.

It has become established as a major "out-of-town" retail attraction for both Swansea residents and further afield. Access to the complex is off the A483 and also via the traffic signal controlled junction at the intersection of the A483 with Ffordd Cynore and Pentregethin Road. Junction 47 of the M4 is approximately one mile to the north of the site. Swansea City centre is located approximately 3 miles to the south of the complex.

Traffic congestion at peak times - particularly over the weekends is becoming a concern for local residents. Passive nitrogen dioxide monitoring tubes have been established to the facade of terraced dwellings along Ffordd Cynore (site 52), Ystrad Road (site 53) and the A483 Carmarthen Road (site 54) – as mentioned within 10.4.5.3 above. The location and monitoring results from 2004 for these sites can be seen within tables 33 - 35 above. Monitoring undertaken during 2004 has resulted in no predicted breach of the NO_2 annual mean objective in 2005 being seen at any of these locations. Indeed, in view of the noticeable congestion within the area at certain periods, the results are surprisingly low. This is not to say that there have been or will be breaches of the NO_2 1-hour objective standard but this is unlikely given the annual mean values from 2004 being considerably lower than 60μg/m^{-3} [54]. The location of the developments can be seen below as map 17.

[54] *Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites - Laxen et al July 2003*

Map 17 - Parc Fforestfach and Pontardulais Road Retail Parks

PM_{10} will be monitored along Ffordd Cynore in the vicinity of the Retail Park as soon as the monitoring station that has been ordered is established. Difficulties have been experienced with its location and electricity supply etc but the site should finally be established during the summer of 2006. It is intended to use the laser light-scattering device initially as a screening tool to assess any likely breach of the as yet provisional PM_{10} standards for 2010. These measurements will continue for the foreseeable future along with the passive NO_2 diffusion tube work. These measurements have taken on greater significance due to the housing development commencing opposite the Retail Park during 2004 and early 2005. This housing development accessed off Ffordd Cynore is outlined

below within 11.3.1. Additionally the proposed mixed-use development off Ffordd Cynore (see 10.2.4 below) is adjacent to these developments.

11.2 Mixed Use Developments

11.2.1 SA1 Development

The SA1 Development is located alongside the River Tawe and the Prince of Wales Dock and covers an area of approximately 40 acres. The proposed development lies approximately 450 metres south of, and outside of, the Hafod AQMA. The site extends from the eastern bank of the River Tawe 1.2 Km eastwards. The A483-Fabian way forms its northern boundary. The A483 is one of the principal routes into and out of Swansea and connects to junction 42 of the M4. The eastern boundary of the site extends to the Port Tennant district of Swansea.

To the south and east the site is surrounded by the existing dock's complex. The Swansea-Cork Ferry opperates from a berth to the south of this development. The River Tawe Barrage is also located close to this development and the Maritime Quarter is located to the west of the development.

Existing businesses that are traditionally associated with docks i.e. sand dredging and building supplies will be relocated to existing derelict plots elsewhere within the docks complex.

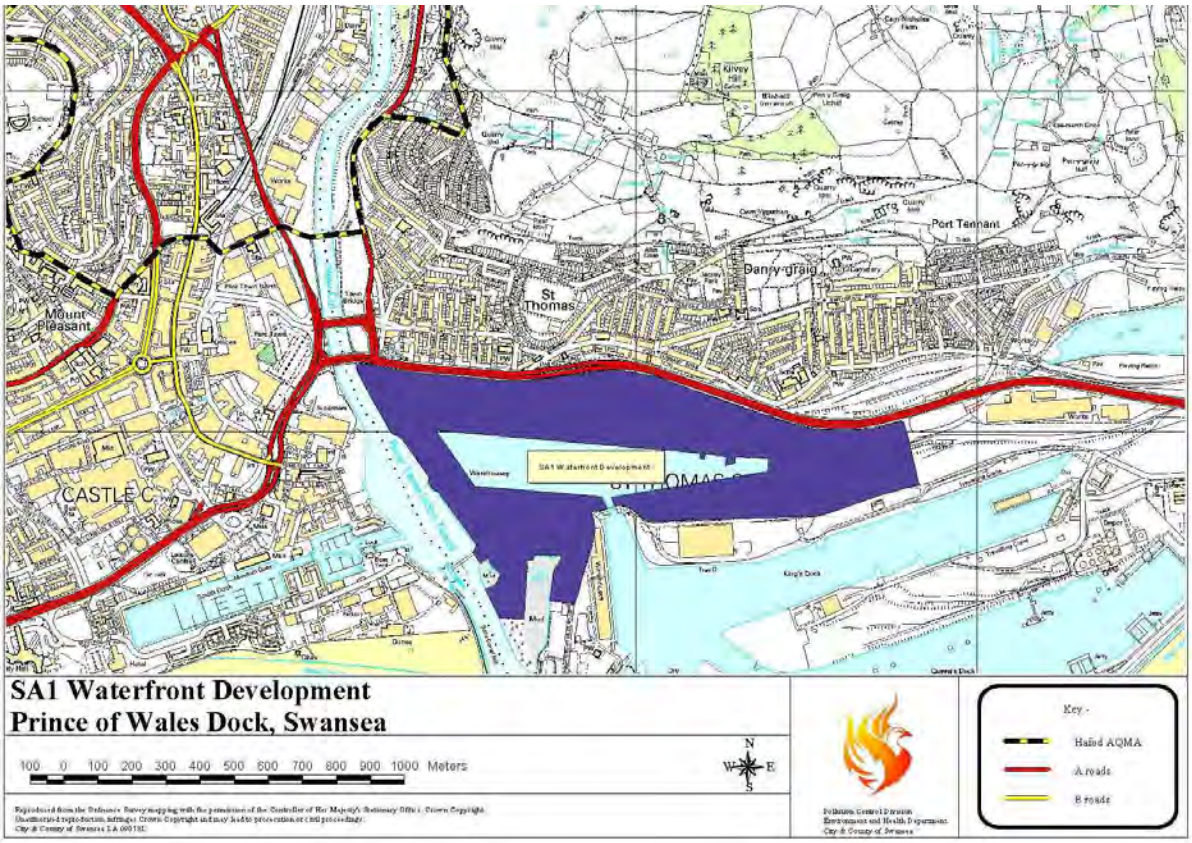
The SA1 Development is proposed as a mixed-use development combining residential and commercial development. The development will extend the waterfront along both banks of the River Tawe. Development works have been

divided into zones A-F and will be undertaken in four phases running from 2002 to 2017. Phase 1 began during late 2002 with extensive redevelopment works taking place during 2004. Some elements of the scheme were be available for occupation during the late summer of 2005.

The Environmental Statement submitted concludes that the results of the Design Manual for roads and Bridges (DMRB) screening assessment indicate that no exceedences of air quality standards at sensitive sites closest to the A483 and the Quay Parade bridges are predicted. Assessments undertaken for future traffic flows (2005-2017) and traffic directly associated with the development indicate that both nearby and existing residents along with new residents are unlikely to experience a significant deterioration in air quality with all objectives being met in both 2005 and 2017. The Environmental Statement states that whilst traffic flows are not disputed to show an increase as a result of the development, any effect from this increase in traffic flows and resultant emissions will be mitigated by technological improvements in emissions management. However, recent EIA submissions based on detailed modelling for the most recently released phases within the development are starting to contradict this view. Modelling projected to 2010 is indicating that the whole of the SA1 development and surrounding existing residential areas will fail the as yet provisional PM_{10} annual mean standard.

A new traffic signal controlled access road into the development site was completed during March/April of 2006 at the junction of the main A483 Fabian Way and Port Tennant Road. The development site will also be capable of being access by the existing "docks entrance" at Quay Parade Bridges.

The location and extent of the development is indicated within map 18 below.



Map 18 - SA1 Development Site

11.2.2 Tawe Vale Development Site

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

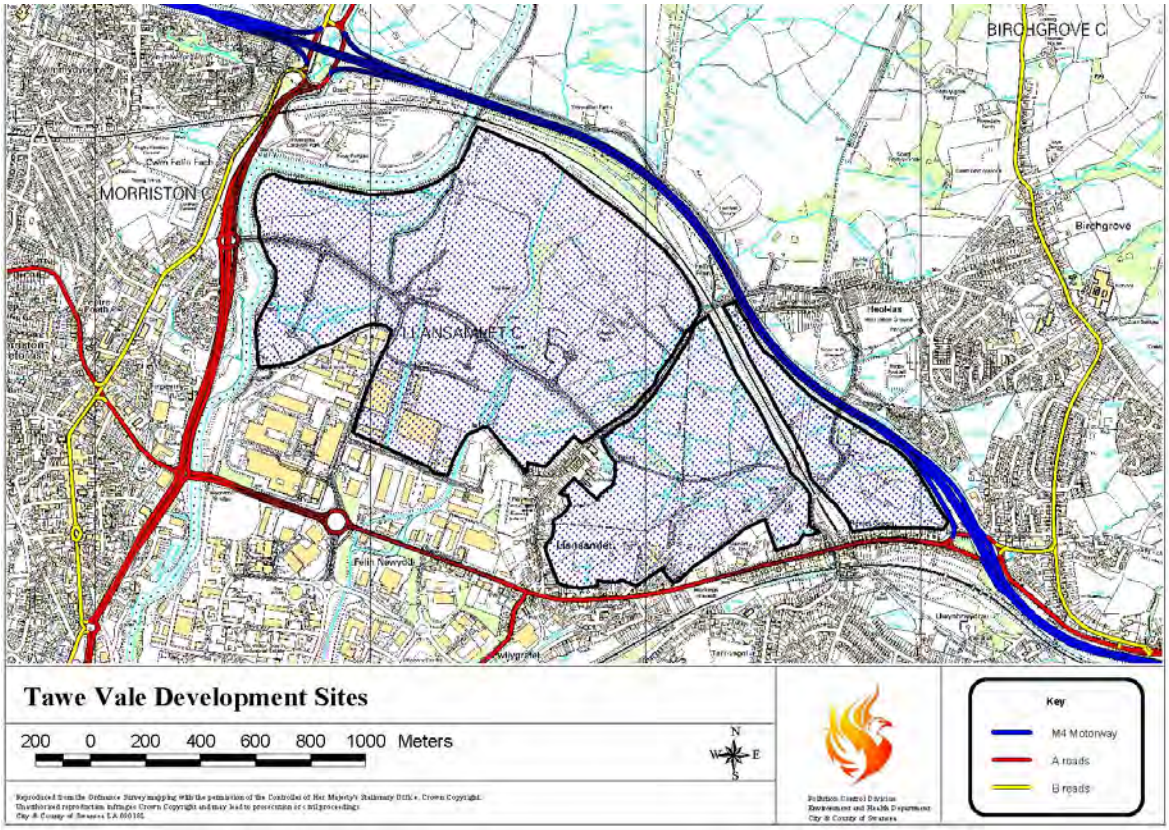
provided but as yet the precise mix and distribution of private and social housing has yet to be finalised. Residential land parcels are to be sold to interested developers and, given the large-scale provision of housing land at this site the development of the overall housing provision will take place in a phased manner over a long term. Construction of one “village” commenced in late 2001/2002 with the homes being occupied during early 2003. Further extensive housing developments were undertaken during 2003 and 2004 with the majority of these dwellings, also now fully 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 within a landscaped setting. A mix of employment uses is envisaged, within a high quality business park.

The main leisure provision is via a golf course and recreational use of the designed open spaces will be encouraged through the extension of the footpath and cycle networks along the River Tawe. The golf course development has yet to commence.

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 over the next several years. The extent of the development site as a whole can be seen in map 19.



Map 19 - Tawe Vale Development

11.2.3 Seagate and Ferrara Quay, Trawler Road, Maritime Quarter.

This mixed use application was granted full planning on the 10th March 2005 and comprises:

Ferrara Quay

- A twenty nine storey tower with retail/leisure use (Class A1/D2) at ground floor, restaurant (Class A3) on the top floor and 124 residential uses throughout the interim levels (Ferrara Tower);
- One six storey block with ground floor commercial uses (retail Class A1/A3, leisure use Class D2 and Office Class B1) and 20 residential units above (Ferrara Block A);
- One part six storey/part ten storey block with ground floor commercial (retail Class A1/A3, leisure Class D2 and office Class B1) and 41 residential units above (Ferrara Block B);

Seagate

- One six storey block with 47 residential units with ground floor commercial unit (office Class B1) (Seagate Block A);
- One part seven/part nine storey block with 41 residential units (Seagate Block B);
- Two nine storey towers providing 18 residential units (Seagate Tower 1 and 2);

Plus

- Two hundred and thirty four undercroft car parking spaces (78 spaces at Ferrara Quay and 156 spaces at Seagate);
- Refurbishment of existing Camona Drive multi-storey car park to provide 67 allocated;

- Associated areas of open space, landscaping, pedestrian routes and infrastructure.

The application site in the main comprises two distinct areas separated by Trawler Road in the Swansea Maritime Quarter. The seafront area (Seagate) measures approximately 0.35 hectares and has a southern frontage boundary onto the established seafront promenade and a northern boundary to Trawler Road. The site is currently vacant and predominantly level and grassed. The land is approximately 2m above Trawler Road level and slightly elevated above the promenade. The dockside area (Ferrara Quay) measures approximately 0.27 hectares and has an extensive northern frontage to the dockside walkway. The ground is level and the southern boundary adjoins Trawler Road. Ferrara Quay is currently in use as a pay and display surface car park.

A further element of the site is the Camona Drive multi-storey car park, which is an existing 120 space facility of four mezzanine floors located on the southern side of Trawler Road, to the east of the Seagate site. The upper two floors comprise 38 public car parking spaces and 15 spaces allocated to local residents. The remaining 67 lower car parking spaces are currently cordoned off and are unused. It is proposed as part of the scheme to introduce lighting, CCTV and generally upgrade the lower floors. The number of car parking spaces will not change; however, 59 of the unused spaces would be used by occupants of Seagate and Ferrara Quay, with the remaining 8 spaces used by the commercial units.

The main element of the proposal involves the introduction of high density mixed use development on the Seagate and Ferrara Quay sites. This is predominately residential, adding a further 291 apartments to the existing complement of living accommodation at the Maritime Quarter. This is made up

from 138 two-bedroom apartments, 11 three-bedroom apartments, 12 three-bedroom penthouse apartments, 124 one-bedroom apartments and 6 one-bedroom penthouse apartments. Added to this are commercial uses totalling 2,500 square metres, positioned at key locations on the ground floor as well as in the top two levels of the tower. The majority of the car parking (234 spaces) would be accommodated within the basement and semi-basement levels beneath both halves of the site.

The strategy for the development is based upon the use of three distinct architectural forms: -

- The most significant of these is the high-rise tower of 29 storeys at the western end of the Ferrara Quay site, which would measure 90m in height by 40.5m in width. Its elliptical plan derived from the sweep of Trawler Road is carried through its full height resulting in a blade-like form. The tower is positioned so that its curved form 'hugs' the side of the road. It is oriented with its narrow ends facing due east and west and its broadsides facing due south and north. Particular attention has been paid to the design of the uppermost storeys that would accommodate a restaurant. The roof of the tower is raised above two storeys of glass and inclined towards the east. Otherwise, the materials employed on the elevations are intended to reinforce the tower's smooth curved planes. The composition is based on a series of bold verticals such as the multiple stacked balconies and slender rendered panels designed to disguise the tower's apparent width.

- In addition to the main tower, four smaller towers are proposed; three nine storey towers measuring 28m in height and 11m in width aligned alongside the promenade on the Seagate site and one ten storey tower, measuring 31m in height and 11m in width, at the north east corner of the Ferrara Quay site

at the end of the six storey Ferrara Block B. The Seagate towers would enclose semi private gardens at regular spacing thereby permitting views into and out of the development through the gaps. These towers are slender in proportion and intended to provide a distinctive, albeit less imposing frontage to the promenade.

- The remainder of proposed development comprises predominantly 6 storey blocks known as Ferrara Blocks A and B and Seagate Blocks A and B. These are intended to be the 'background' architecture that unify the development and create an urban structure that provides enclosure and continuity to the Trawler Road and dockside frontages. The blocks would also frame two new public spaces: Ferrara Square next to Trawler Road and Ferrara Quayside, next to the dock. Additionally the design of these blocks are intended to establish an aesthetic rapport with the warehouse inspired render and brick architecture of the existing Maritime Quarter which are of similar scale and materials.

Turning to the treatment of the public realm around the buildings, it is proposed that the promenade would be integrated with the site where it would border the development by the introduction of a broad raised plinth designed to bring pedestrians closer to the level of the semi-private 'Seagate Gardens'. A series of interweaving ramps and steps are proposed to link the western end of the promenade to Trawler Road, whilst a link between the promenade and Trawler Road and the dock edge is proposed along the western side of Camona Drive. On the opposite side of Trawler Road, Ferrara Square is intended to act as the hub at the centre of the development with further routes linking to the dock edge. Because of the semi-basement car park, the level of the two linked squares at this location is raised above Trawler Road and the dock edge, consequently a

number of ramps and steps are proposed. The dock edge walk would be linked to the development at four separate locations.

In view of the scale of the proposed development, it has been necessary to analyse the potential changes it may cause to wind speeds, especially at pavement level. The results have identified the need for the positioning of additional artificial and natural screening at strategic locations throughout the development to mitigate the effects of worse case scenario wind speeds. Although the precise design of the wind mitigation measures are not yet finalised, it is likely they would include trees and sail-like screens within both squares on the Ferrara Quay site, transparent screens positioned at both ends of the north-south link between Ferrara Blocks A and B and Camona Drive with canopies around the base of Ferrara Tower and Ferrara Block A.

It is proposed that the development be constructed on a phased basis as follows:

- Phase 1: Seagate Block B
- Phase 2: Seagate Block A
- Phase 3: Seagate Tower 1
- Phase 4: Seagate Tower 2
- Phase 5: Ferrara Block A
- Phase 6: Ferrara Block B
- Phase 7: Ferrara Tower
- Phase 8: External Works

Phases 1 - 7 would commence construction at the same time although it is envisaged that occupation of these phases will occur in the order listed above.

Phase 8, external works, would be developed as an integral part of each development phase.

The Seagae element of the development site is due to commence construction works during June 2006

Map 20 below indicates the extent and location of the development.

Map 20 - Seagate and Ferrara Quay Development, Trawler Road, Maritime Quarter

11.2.4 Ffordd Cynore Development, Fforestfach

A formal Planning Application has not been received as yet for the proposed mixed use development on the site outlined within map 21 below. However, it is anticipated that any application will seek to include residential dwellings, along with a hotel/pub/restaurant. This section should be read in conjunction with sections 11.1.2 (Parc Fforestfach) and section 11.3.1 (Ffordd Cynore Development) which are located adjacent to the proposed site.

Map 21 - Ffordd Cynore Mixed Use Development, Fforestfach

11.2.5 Swansea Point (Spontex Site), Marina

This development is taking place on a brown field site formally occupied by sponge manufacturers Spontex. Planning approval has been given in 2004 for a mixed-use housing and commercial development and works are in progress.

The proposal is for a dense urban development that would reflect the character of the adjacent area and the aspirations of the City and County of Swansea's Development Brief. The buildings would define the edge of the streets, which would in turn create a series of spaces that connects the residents and visitors into the pedestrian network of Swansea Marina and across the River Tawe into the new Swansea Waterfront development. To meet the demands of providing an active public frontage on the street and private residential areas, the design concept illustrates how the buildings set along the street frontages, would create private courtyard areas for amenity and vehicular access. In this way all the residential car parking would be provided within the courtyards with public car parking provided along the promenade and next to the mixed use area.

The focal point of the development would be The Point, a 10 storey landmark building on Harbour View Square next to the River Tawe and harbour entrance. The proposed location of The Point is at the termination of the seafront promenade and Trawler Road; it would be the natural destination for the main pedestrian routes and a significant landmark on the Swansea skyline.

The proposed Atlantic Square would provide a new public place, focused on the attractive barrage area and the new pedestrian link across the river. Within the Square would be provided a wide range of A3/leisure and support activities to enliven the public realm for all those living and working in the area.

The continuation of the seafront promenade is an integral part of Swansea Point. The promenade will extend along the whole southern frontage of the site, next to the dunes and around the eastern side next to River Tawe before joining the public area next to the barrage. It would also provide access to the two main pedestrian routes across the site, which connects into Swansea Marina.

The proposed land uses illustrates in indicative form the proposed layout of the development. The majority of the site has been identified as being appropriate for residential development in the form of townhouses and apartments. It is proposed that the site has the capacity to accommodate some 600 units in total. These would be laid out along the street frontages with private spaces located within the residential courtyards. Dual access is promoted for all properties onto the street and courtyard.

The mixed-use component of the scheme would be predominantly sited on the northeast of the site next to the River Tawe and Maritime Quarter. Atlantic Square forms the focal point of the mixed use development with 440m^2 of A3/leisure use on the north side of Atlantic Square, 480m^2 of A3/leisure use on the south side of Atlantic Square and a further 480m^2 of A3/leisure use on the ground floor of the hotel building next to Atlantic Square. In addition, 300 m^2 of commercial use is located on the ground floor of the block overlooking the Maritime Quarter. This will be used to provide accommodation for the Sea Scouts, who would need new accommodation when their existing building on Pilot Wharf Quay is demolished to make way for Atlantic Square to connect onto the barrage area.

A 3 star 60-bed hotel is proposed, that would cover 2,400m^2 on 6 floors above the ground floor A3/leisure use. 1,440m^2 of work units are also provided above the ground floor leisure facility on the south of Atlantic Square.

The car park to serve the leisure development in Atlantic Square and the public parking required for these uses would be provided in the multi-level car park adjacent to the new development. A waterfront A3/leisure use would also be located next to the public car park on Harbour View Square. This would provide 700m^2 of space on 2 storeys and 25 car-parking spaces dedicated to the leisure use. A 500m^2 play area is proposed next to the leisure use.

In addition three new public places are proposed, comprising:

- Crescent Park – a 0.3 ha green amenity area in the centre of the development and the crossroads for many of the pedestrian routes;

- Atlantic Square –the heart of the mixed use development with the building frontages providing a dynamic shape to the square opening out onto the river and barrage; and

- Harbour View Square –the termination of the seafront and riverfront promenades. The square would accommodate a number of different functions including a turning area for buses, public car parking, leisure use with car park and 500m^2 play area, together with car parking to serve the adjacent Point 10-storey residential development.

The proposed spaces would accommodate the pedestrian, cycle and vehicle movements into and through the site. Trawler Road would continue on a new alignment through the scheme to terminate at a new roundabout next to the promenade and new public car park at Harbour View Square. Trawler Road would also provide access to the multi-level public car park next to Atlantic Square. Further public car parking is proposed to be located on the west of the site at the end of Slipway Road.

The network of pedestrian routes in Swansea Marina, are continued through the development to connect to each other and onto the promenade. The seafront promenade would be designed to accommodate the train/people carrier that the City & County of Swansea will be providing at a later date. A new bus turning area would be provided in Harbour View Square at the termination of Trawler Road and a series of bus stops provided along the highway. It is also proposed that the main pedestrian/cycle routes within Swansea Point would form strategic connections to other parts of the city centre. There is also scope for the development to include offsite improvements next to the Boat yard, to open up the pedestrian link across Trawler Road and the provision of a pedestrian bridge across the lock of Swansea Marina.

Access and egress from this development will be via Trawler Road which itself is accessed from the A4067 Oystermouth Road located to the west of the development. The southern boundary of the Hafod AQMA is approximately 1000 metres north of the development. Immediately to the east of the development and across the River Tawe is the SA1 development site.

Map 22 - Swansea Point Development

11.3 Housing Developments

There are a number of developments that are either underway, have just gained Planning approval or are within the initial stages of the Planning Approval process. The major developments are listed below.

11.3.1 Ffordd Cynore Development, Fforestfach

The application for the construction of 230 dwellings on the former Brynau-Duon Farm on behalf of 3 developers was originally refused planning permission on the 16th January 2003. The reason for refusal was: "The development by virtue of traffic generation would exacerbate existing traffic congestion in the vicinity of Parc Fforestfach to the detriment of the safe and free flow of traffic in the area". However, the applicants appealed against the authorities decision and approval for the development was given upon appeal.

Construction works commenced during the early summer months of 2004 and a limited number of dwellings were occupied during the early months of 2005. Construction of the dwellings remains in progress. The extent of the development can be seen within map 23 below.

Access and egress to the development site is via a junction on Ffordd Cynore. This junction is within approximately 170 meters of the main traffic signal controlled junction leading into Parc Fforestfach and within 330 meters of the signal controlled junction of Ffordd Cynore with the A483 Pontardulais Road. To the west of the site access and within approximately 130 meters is the signal-controlled junction with Ystrad Road and Carmarthen Road.

Map 23 -Ffordd Cynore Development, Fforestfach

11.3.2 St.Thomas Riverside Development

Outline planning consent was approved on the 14th July 2003 for a hotel and residential development. The residential development comprises of 50 combination three/four storey townhouses, 169 apartments in 6 5.5 storey pavilions, 1 4.5 storey pavilion and 1 block rising from 4 storeys to 7.5 along with associated car parking. Landscaping and infrastructure requirements will also be undertaken.

The majority of the site is located on a former railway station yard that has been contaminated through its former use.

The site itself lies part within the Hafod AQMA, with the majority of the site lying just outside the boundary of the Hafod AQMA. Pentreguinea Road is subject to heavy congestion during peak times and will be affected by any re routing of traffic through the lower valley routes and more importantly by the existing Quay Parade bridges. Attention will be given to the access and egress from this site and whether this will compound the existing congestion.

An application for formal planning consent was received during 2005 but was rejected due to the intensity of the development. It is envisaged that a modified scheme will be resubmitted shortly.

Map 24 - St Thomas Riverside Development (Former Station Yard Site)

11.3.3 Bryngwyn Steelworks Site

The 13 hectare (about 32 acres) Corus Plant at Bryngwyn closed in June, 2001 and an outline application for the comprehensive redevelopment of this "brown field" site has been received. The former industrial site is bordered to the west by the residential properties of West Street and Libanus Road together with the Gorseinon Business Park, with more housing to the north along Lime Street. The eastern boundary is bordered by the Afon Lliw with the Mardy Industrial Estate on the eastern banks of the river. The centre of Gorseinon lies approx. 500 metres to the north west of the site.

Outline planning permission was approved on the 9th December 2003.

The outline application was for a mixed use redevelopment comprising residential development, a community enterprise centre and economic development. The application was accompanied by an illustrative land use plan, which provides a draft allocation of 21 acres of residential land, 6.4 acres of economic development and 4.5 acres for the community development facilities. The applicants (Corus) are seeking a valid planning permission to dispose of the site to a developer, who will carry out the demolition of the buildings and the site remediation and preparation, in advance of the site's redevelopment.

A reserved matter approval for the construction of residential development of 376 units (reserved matters approval pursuant to outline planning permission 2003/1241 granted 9th December 2003) was approved during August .A further reserved matters application for the construction of residential development of 359 units was approved during November 2004.

Map 25 - Former Bryngwyn Steelworks Development site

11.3.4 Former Marcroft Engineering Site, Port Tennant

The 4.6 hectare site at the former Marcroft Engineering Works, Port Tennant has been derelict for some time and an outline application has been made for the comprehensive redevelopment of this "brown field" site. The former industrial site is bordered to the west by the residential properties of Wern Terrace, and to the east, by the Crymlyn Bog Site of Special Scientific Interest (SSSI). The south-eastern boundary of the site is bounded by the main access road to the Tir

John landfill site located approx. 250 metres to the east. The former Marcroft Engineering Works buildings consist of two large disused workshops, a series of temporary 'portacabins' and associated peripheral facilities such as outbuildings, areas of hard standings, cranes, as well as fuel and chemical storage tanks. Whilst the application is submitted for outline consent it is indicated that access would be obtained to the north of the site from Danygraig Road/Tir John North Road. However, it is indicated that site access for construction traffic, particularly HGV's, could be obtained from the Tir John landfill site access to the south, which would reduce the impacts to local residents located along Danygraig Road.

The applicants have submitted a detailed application for the residential development of the site, which is currently being assessed. However, in the meantime, the applicants are seeking a valid outline planning permission to establish the principal of the redevelopment of the site for residential purposes. This would then justify the demolition of the buildings and ancillary structures on the site and to commence the site remediation and preparation, in advance of the site's redevelopment.

This outline approval was given, subject to a Section 106 on the 18th July 2005.

Map 26 - Former Marcroft Engineering Development Site