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

City & County of Swansea

Progress Report 2004

July 2005

Title	**Air Quality Progress Report 2004**

Address	Mrs Reena Owen, Director of Environment, City & County of Swansea, Countyhall, Swansea.

Date	July 2005

	Name	Designation	Signature	Date
Data Analysis and Reporting	Mr P.J.Govier	Environmental Management Systems Development Officer		
Reviewed and Authorised	Mr H.Morgan	Divisional Pollution Control Officer		

Contents

1 Introduction

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 In Wales the Air Quality Regulations 1997 have been superseded by the Air Quality (Wales) Regulations 2000 which themselves have been amended with the Air Quality (Amendment) (Wales) Regulations 2002 and came into effect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.

1.1 Review of Previous 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.

In 2004, the authority commenced works on the second round of review and assessment. In accordance with current policy and technical guidance documents, the second round of review and assessment was, and is still being 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. The detailed assessment works remain ongoing and will form the subject of a separate report.

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.

1.2 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.

Report	Date Completed
1st Stage Review	1999
Brynlliw Colliery Remediation	1999-2000
2nd & 3rd Stage Review	2001
Declaration of Hafod AQMA	September 2001
Stage 4 Review	October 2003
2nd Round Review USA	July 2004
Hafod AQMA Action Plan	December 2004

1.3 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).

The new guidance sets out the legislative framework for local air quality management (LAQM). It is seen as an integral part of delivering the Air Quality Objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000, The Air Quality (Wales) Regulations 2000 and the Air Quality (Wales) (Amendment) Regulations 2002.

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

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

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

The 2000 and 2002 Regulations provide the statutory basis for the system of Local Air Quality Management (LAQM) and prescribe the standards and objectives to be achieved for those pollutants set in regulation. The Regulations also provide dates by which these standards and objectives are to be achieved. The 2002 Amendment Regulations introduce a second air quality objective for benzene of 5μg/m^3 or less, when expressed as an annual mean, to be achieved by 31st December 2010. The 2002 Amendment Regulations also alter the air quality objective for carbon monoxide (CO), which is to be achieved by 31st December 2003 to a maximum daily running 8 hour mean of 10mg/m^3 or less. The pollutants set in regulation together with the target dates for compliance are set out in table 1 below. Table 1 also includes the permitted exceedences allowed under the regulations.

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

Sulphur Dioxide	350µg/m^3	1 hour Mean	24	31/12/2004
	125µg/m^3	24 Hour Mean	3	31/12/2004
	266µg/m^3	15 Minute mean	35	31/12/2005

Table 1 – Objectives included in the Air Quality (Wales) Regulations 2000 and Air Quality (Wales) (Amendment) Regulations 2002
[1] As amended by the Air Quality (Wales) (Amendment) Regulations 2002
[2] The objectives for nitrogen dioxide are provisional

1.5 UK Objectives not as yet set in Regulation

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

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

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

1.6 The Purpose of the Progress Report

Progress Reports have been introduced into the LAQM system following a detailed evaluation of the first round of local authority review and assessment (see 1.3 above). A need was identified to develop a longer-term vision for both LAQM and the review and assessment process. The process was seen as being too start-stop, with some local authorities completing their first round of review and assessment and then doing little or nothing for several years until the next round of reviews commenced. Updating and Screening Assessments are now required at intervals of three years whilst Progress Reports maintain the continuity and are to be produced in the intervening years.

Progress reports should ensure a continuity in the LAQM process and should help local authorities:-

- by helping retain a profile for LAQM within the authority, including the retention of staff with a knowledge of air quality issues
- by providing a means for communicating air quality information to members and the public
- by maximising the usefulness and interpretation of the monitoring effort being carried out by the local authority
- by maximising the value of investment in monitoring equipment
- by making the next round of review and assessment that much easier, as there will be a readily available up-to date source of information
- by helping local authorities respond to requests for up-to-date information on air quality
- by providing information to assist in other policy areas, such as transport and land use planning

- by providing a ready source of information on air quality for developers carrying out environmental assessments for new schemes
- by demonstrating progress with implementation of air quality Action Plans and/or air quality strategies
- by providing a timely indication of the need for further measures to improve air quality, rather than delaying until the next full round of review and assessment

There is a separate requirement for those authorities who are implementing air quality Action Plans to prepare annual Progress Reports on the actions completed or those that are still being implemented in the pursuit of compliance with the air quality objectives within the AQMA. As has been mentioned above, this authorities Action Plan for the Hafod AQMA was submitted to the Welsh Assembly Government in December 2004. As recommended within the Progress Report Guidance LAQM.PRG (03) details of the progress made to date with the identified actions points listed within the authorities Action Plan are included within this report and can be seen within chapter 4.

This Progress report has been prepared having had regard to the guidance issued under Progress Report Guidance LAQM.PRG (03).

2 New Monitoring Data

2.1 Automatic Real-Time Data within Hafod AQMA

2.1.1 Morfa Groundhog

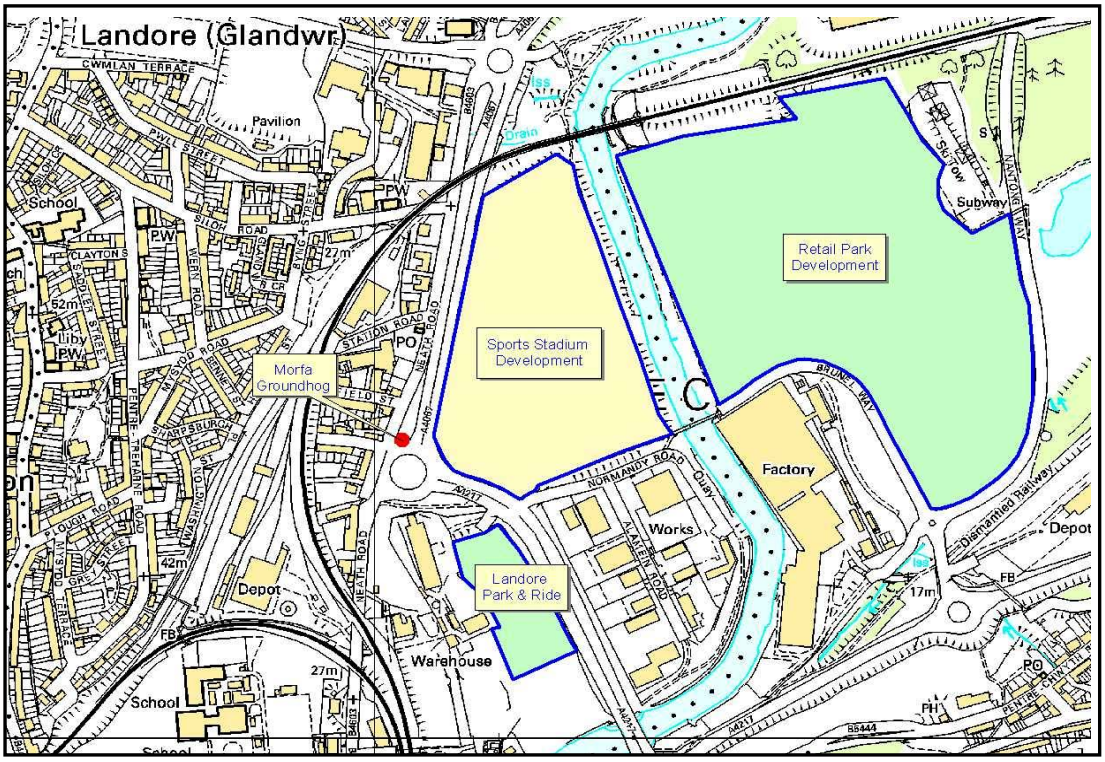
The Morfa station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Morfa / Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. The station is within the boundary of the Hafod AQMA and has been given a site classification Kerbside (U1)[1].

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring 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.

[1] *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.

A map showing the location of the Morfa Groundhog station is given below as map 1



Map 1- Location of Morfa Groundhog Station

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. All data presented from the Morfa Groundhog site within this report has been ratified by the authority following completion of QA/QC procedures.

2.1.2 Results of automatic monitoring for 2004

2.1.2.1 Nitrogen dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO_x analyser. 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 annual mean.

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 1.91[2] to produce results expressed in $\mu g/m^3$. For ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 3 below.

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

A graph of the hourly means is also given below as chart 1

Morfa Groundhog	Annual Mean (40µg/m^3)		Max 1-hour (200µg/m^3)		Exceedences of 1-hour std (18 permitted)	
	2003	2004	2003	2004	2003	2004
	36.6 *	33.5	155.1 *	201.6	0	1

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

Table 3 - Nitrogen Dioxide Monitoring data - Morfa Groundhog 2003 - 2004

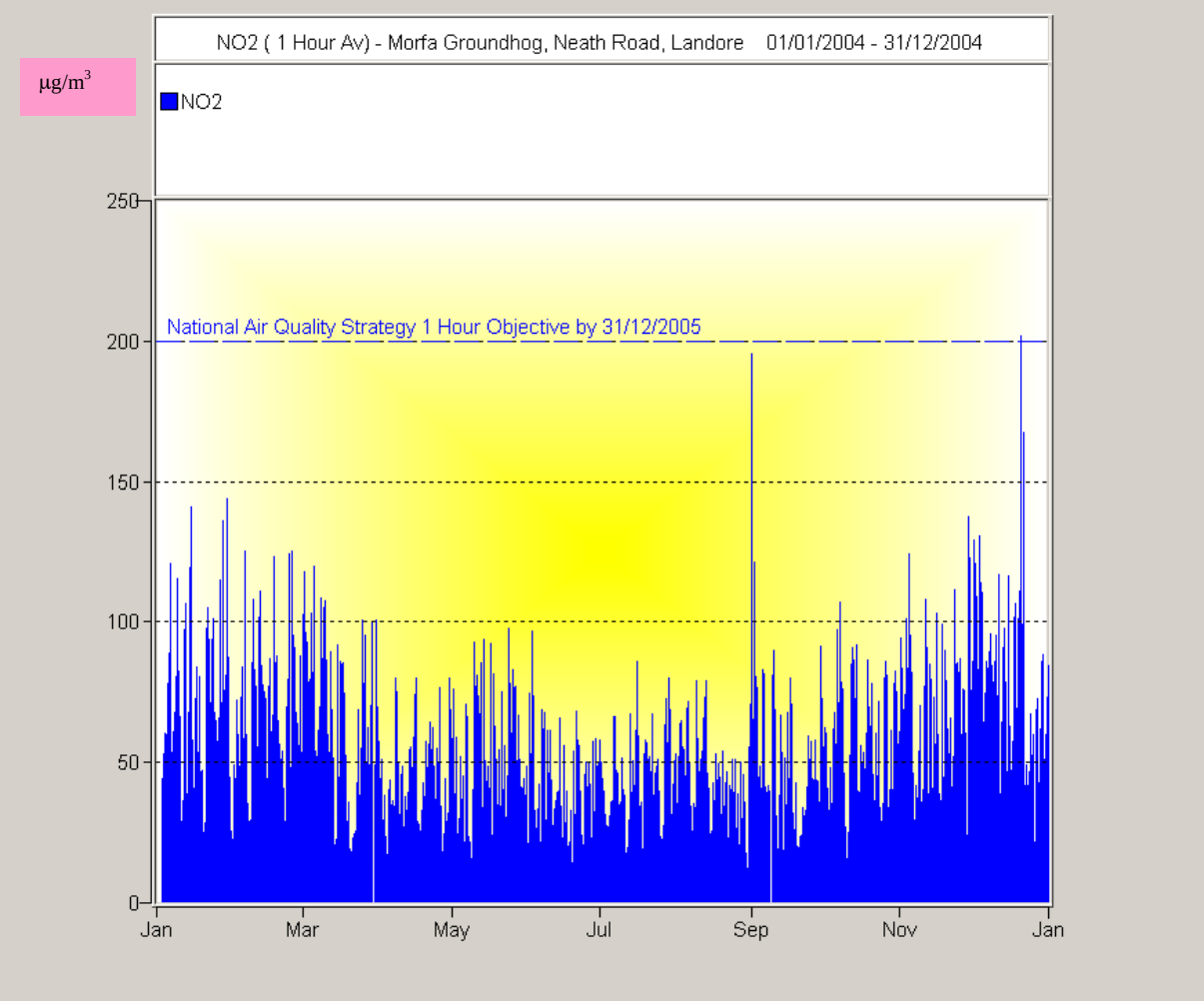


Chart 1 - NO_2 1-hour means 2004 - Morfa Groundhog

The annual NO_2 mean for 2004 is below the 40µg/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%. This data capture rate permits the direct

compilation of hourly exceedences rather than the use of the 99.8th percentile of hourly means.

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[3] for roadside sites. Using this method a projected annual mean of 32.66μg/m^3 is obtained for 2005.

For the sake of completeness, the same methodology contained within LAQM.TG(03) enables a projection to be made up to the provisional objective in 2010. Using the factors provided, an annual mean concentration of 26.87μg/m^3 is obtained for 2010 against a target standard again of 40μg/m^3

Ideally, monitoring data should be available for at least 5 years before trends in NO_2 concentrations can be meaningfully discussed. Monitoring commenced at this site during August 2000 so at best, four and a half years worth of data are available. Accepting the limitations of the historical data set, the annual means from 2001 to 2004 are presented below for sake of completeness within table 4 and for a preliminary brief discussion on trends to be made.

Morfa Groundhog	Annual Mean (40μg/m^3)				
	2001	2002	2003	2004	Projected 2005
	38.63	34.13	36.6	33.5	32.66

Table 4 - Morfa Groundhog NO_2 monitoring results 2001 - 2004

The data presented within table 4 suggests a gradual decline in NO_2 concentrations over the 4 years that monitoring data is available. The exception to this is the annual mean result from 2003. However, it has been observed not

[3] LAQM.TG(03) box 6.6 page 6-9

only here in Swansea [4] but also nationally [5] that meteorological conditions experienced during 2003 were atypical of previous years. The slight elevation of the NO_2 annual mean during 2003 can in all probability be attributed to "abnormal" meteorological conditions within the lower Swansea valley. The annual mean projection (made from the 2004 annual mean) for 2005 would suggest a continuation of the decline in NO_2 levels.

2.1.2.2 Particulate Matter PM_{10}

A Rupprecht & Patashnick Co., Inc. TEOM measures particulate Matter PM10 at the Morfa 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[6]. 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[7].

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 ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 5 below. A chart representing the 24-hour daily means from 2004 is given below as chart 2 and a Breuer Plot representing the scatter of the 24-hour means as Breuer Plot 1.

---

[4] *City & County of Swansea Updating and Screening Assessment - July 2004 page* 64

[5] *Met Office - Air Quality Wales - Welsh Air Quality Forum Bulletin Issue 5 September 2003*

[6] *LAQM.TG(03) Monitoring A1-37*

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

Morfa Groundhog	Annual Mean (40µg/m^3)		Max 24-hour mean		Exceedences of 24-hour objective 50µg/m^3 (35 permitted)	
	2003	2004	2003	2004	2003	2004
	30.60	29.17	82.89	110.87	39	28

Table 5 - Morfa Groundhog PM_{10} Monitoring results 2003 - 2004

The annual mean returned for 2004 is below the objective value of 40µg/m^3. The number of exceedences of the 24-hour objective is also below the permitted number of exceedences of 35.

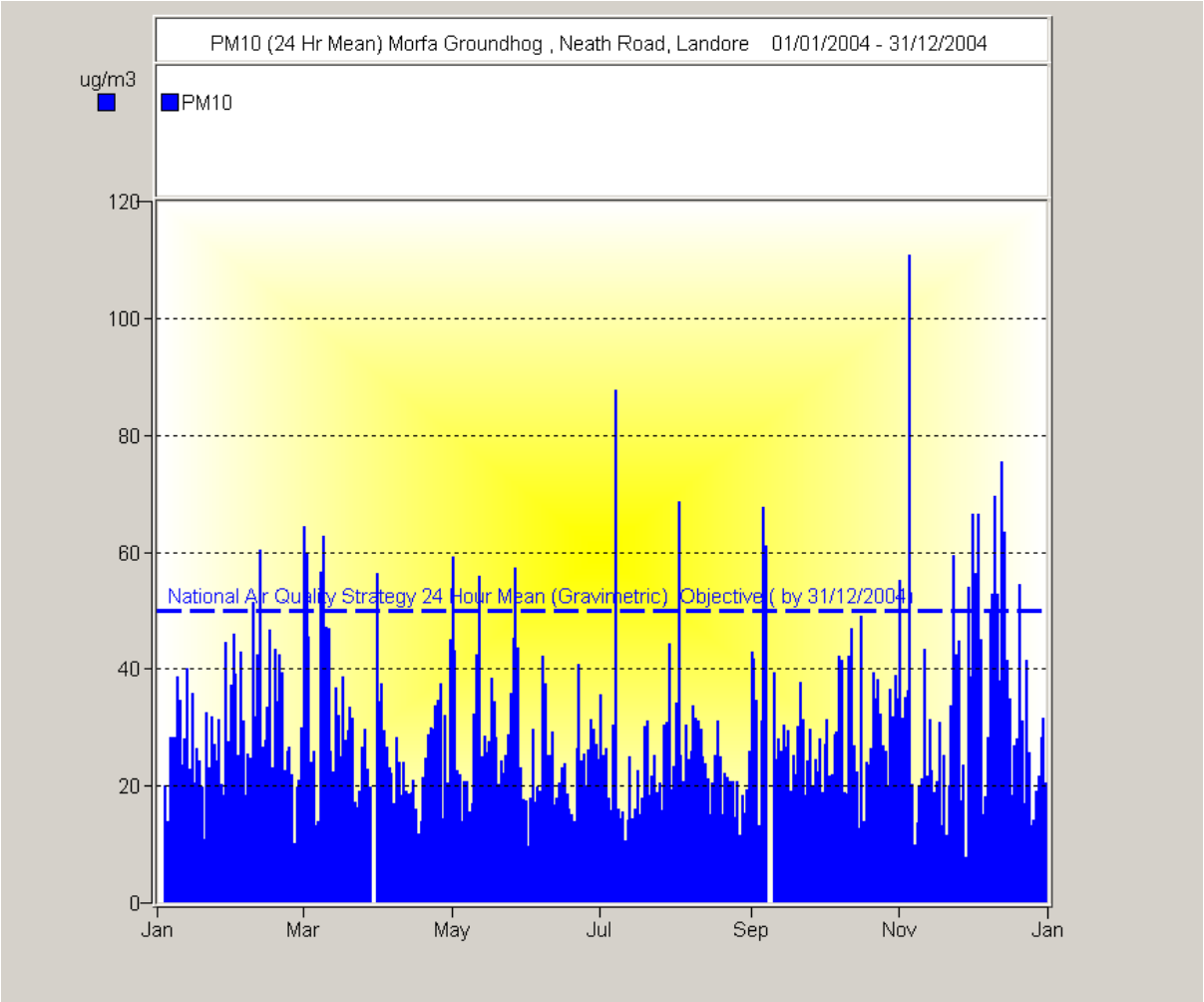
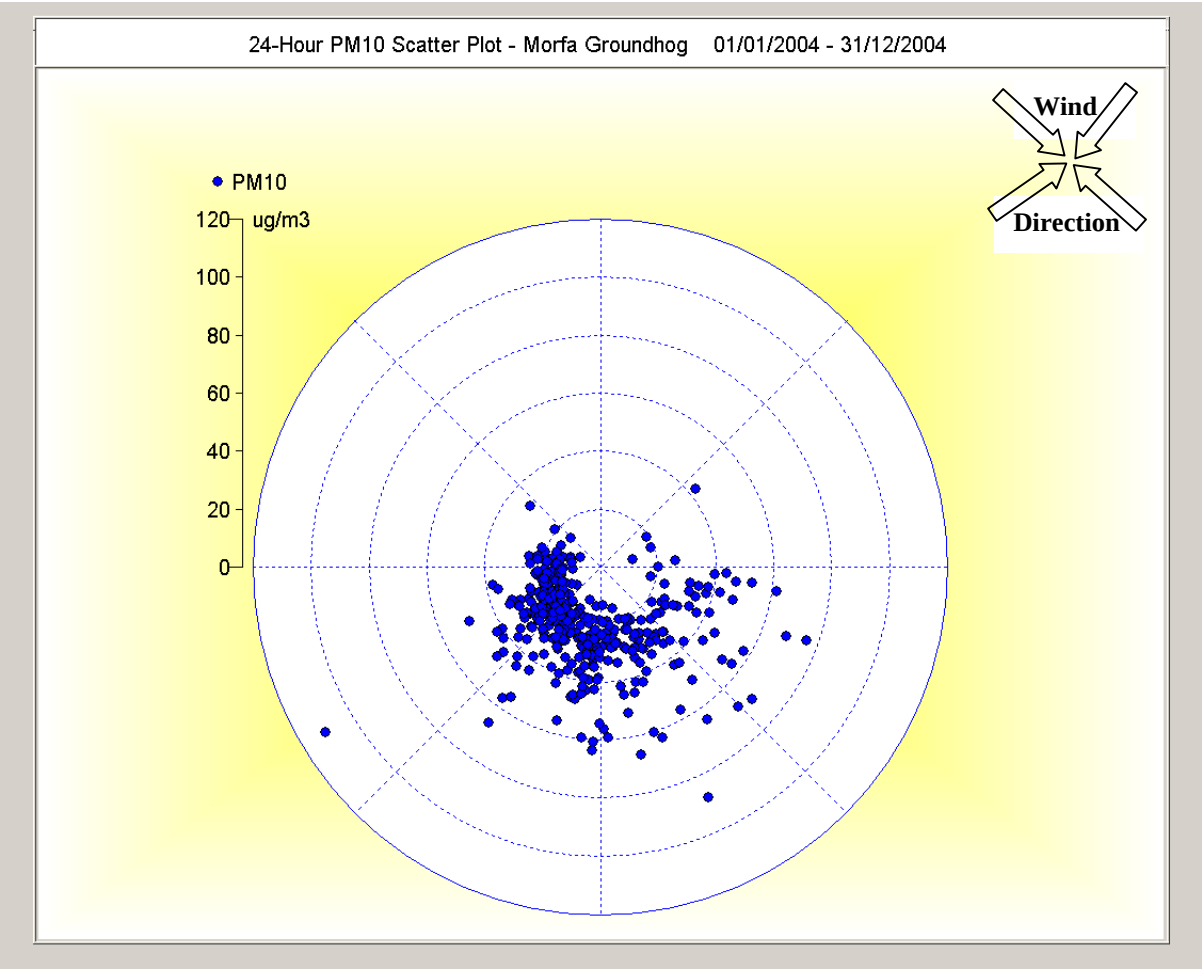


Chart 2 - 24-Hour PM_{10} means - Morfa Groundhog 2004



Breuer Plot 1 - Morfa Groundhog PM_{10} 24-Hour Means 2004

The maximum daily mean was, unsurprisingly, recorded on the 5th November 2004. Data capture for 2004 was 98.09% allowing direct compilation of 24-hour exceedences rather than the use of the 90th percentile of 24-hour means.

As can be seen from Breuer plot 1 above, with the exception of the 24-hour mean from 5th November 2004, the majority of the 24-hour objective failures emanated when the prevailing wind direction was from the east/south-east.

It is possible to project the annual mean concentration forward to 2010 using the 2004 annual mean. Guidance on the method to correct PM_{10} measured concentrations to 2010 is given within LAQM.TG (03) box 8.6 page 8-10 and box 8.7 page 8-11. Using this method a projected annual mean of 26.64µg/m^3 is obtained for 2010.

Accepting the limitations of the historical data set for this site as (mentioned in 2.1.2.1 above), the annual means from 2001 to 2004 are presented below as table 6, enabling a brief discussion on PM_{10} trends to be made**.**

Morfa Groundhog	Annual Mean (40µg/m^3)				Annual Mean (20µg/m^3)
	2001	2002	2003	2004	Projected 2010
	28.76	26.77	30.60	29.17	26.64

Table 6 Morfa Groundhog PM_{10} concentrations 2001 - 2004

From table 6, there is no clear trend with PM_{10} concentrations over the limited dataset. However, before a view is taken on the overall situation with PM_{10} concentrations at this site, the construction and development works that were underway in the immediate area to the monitoring station must be taken into account. Map 1 (above within 2.1.1) outlines the extensive developments that commenced during 2003 within the vicinity of the monitoring station and may well account for the apparent increase in concentration during 2003 and 2004 compared with reductions seen within the previous two years. The exceedences of the 24-hour objective for 2003 and 2004 are given within table 5.

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

The situation with regard to the PM_{10} monitoring results from 2003 and the 39 exceedences of 24-hour objective is discussed in greater detail within the Updating and Screening Assessment completed in July 2004 (pages 59-66) and takes into account numerous regional episodes of elevated PM_{10} concentrations. As can be seen within table 6, if the projection to 2010 is correct then this site will fail to meet the provisional PM_{10} annual mean objective of 20μg/m^3 even before the increase in traffic movements within the lower Swansea valley area can be fully factored in. It should be noted that it will in all probability, prove harder to comply with the annual mean objective in 2010 than the daily 24-hour exceedence objective. This situation is reversed at present.

Once the projected annual means have been calculated LAQM.TG(03) indicates a method (paragraph 8.29 page 8-10) of estimating the number of 24-hour exceedences by comparing the projected annual mean to figure 8.1 (page 8-41) of LAQM.TG(03). Using this method the projected number of exceedences of the 24-hour objectives for 2010 is 15.

It is therefore predicted that failures of both the provisional annual mean and 24-hour objectives for PM_{10} in 2010 will be seen at the Morfa Groundhog site.

2.1.2.3 Carbon Monoxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. 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 running eight hour means. 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. [8] A chart representing the 8-hour running means during 2004 is given below as chart 3.

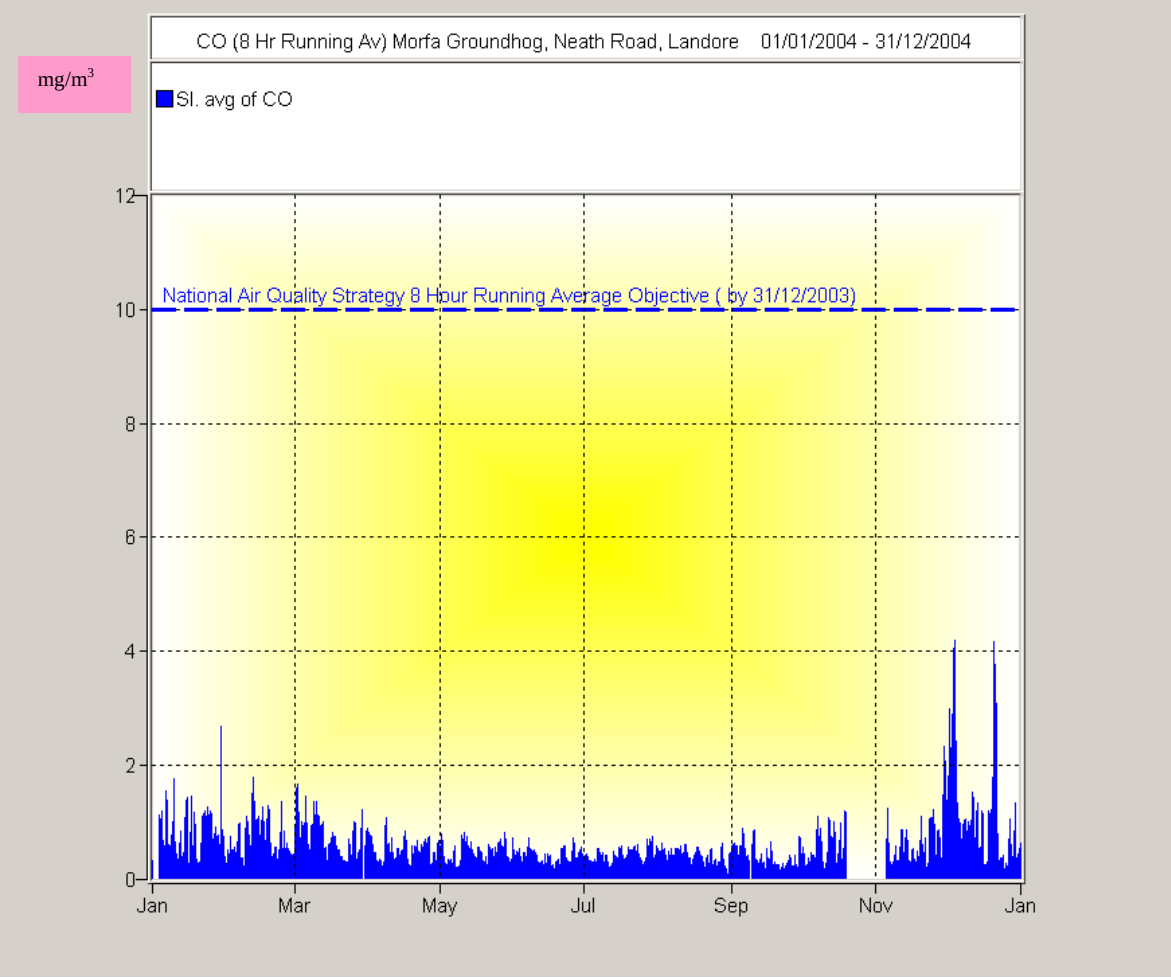


Chart 3 - 8-Hour Running CO means 2004- Morfa Groundhog

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

All results are presented in mg/m^3 by multiplying the logged result in ppm by the conversion factor of 1.16 [9] to produce results expressed in mg/m^3. For ease of comparison with results from the previous year, the results obtained from 2001to 2003 are shown alongside those for 2004 (highlighted) within table 7 below. There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site. 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 also looks likely to be achieved.

Data capture for the 8-hour running means during 2004 was 94.13% allowing direct comparison with the objective standard.

Morfa Groundhog Carbon Monoxide	Max 8-hour Running mean mg/m^3 (10mg/ m^3)			
	2001	2002	2003	2004
	6.17*	3.14*	3.17*	4.18

Table 7 - Morfa Groundhog Carbon Monoxide Max daily running 8-hour means 2001-2004

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

Again, the limitations of the available dataset have to be accepted but there appears no discernible trend with the data at present except to say that concentrations have remained below the objective levels during every year of measurements.

2.1.2.4 Sulphur Dioxide

An Advanced Pollution Instrumentation (API) real-time SO_2 analyser measures $S0_2$ at the Morfa Groundhog site. The logged 15-minute means have been

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

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 has been analysed for each of the objectives averaging periods and the results are presented below within table 8. No exceedences of any of the objectives were observed during 2004.

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°

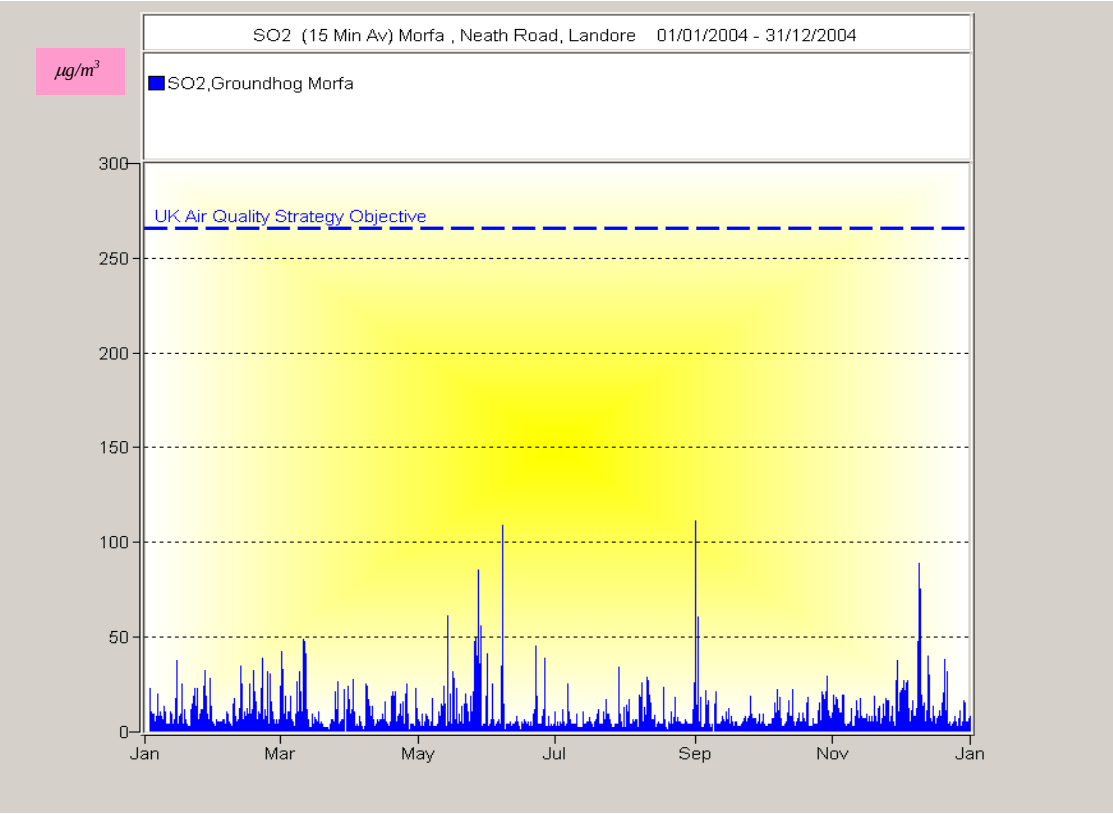
Table 8 - SO_2 Results Morfa Groundhog 2004

Data capture at the base 15-minute logged means for 2004 is 97.48%, allowing direct comparison with the objective standards and not the percentile values.
It is worthwhile noting that whilst traffic sources may contribute slightly to SO_2 concentrations at this site, local knowledge would point to industrial sources

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

being the prime contributors. This is borne out by the Breuer Scatter analysis carried out and presented as Breuer Plots 2 - 4 below.

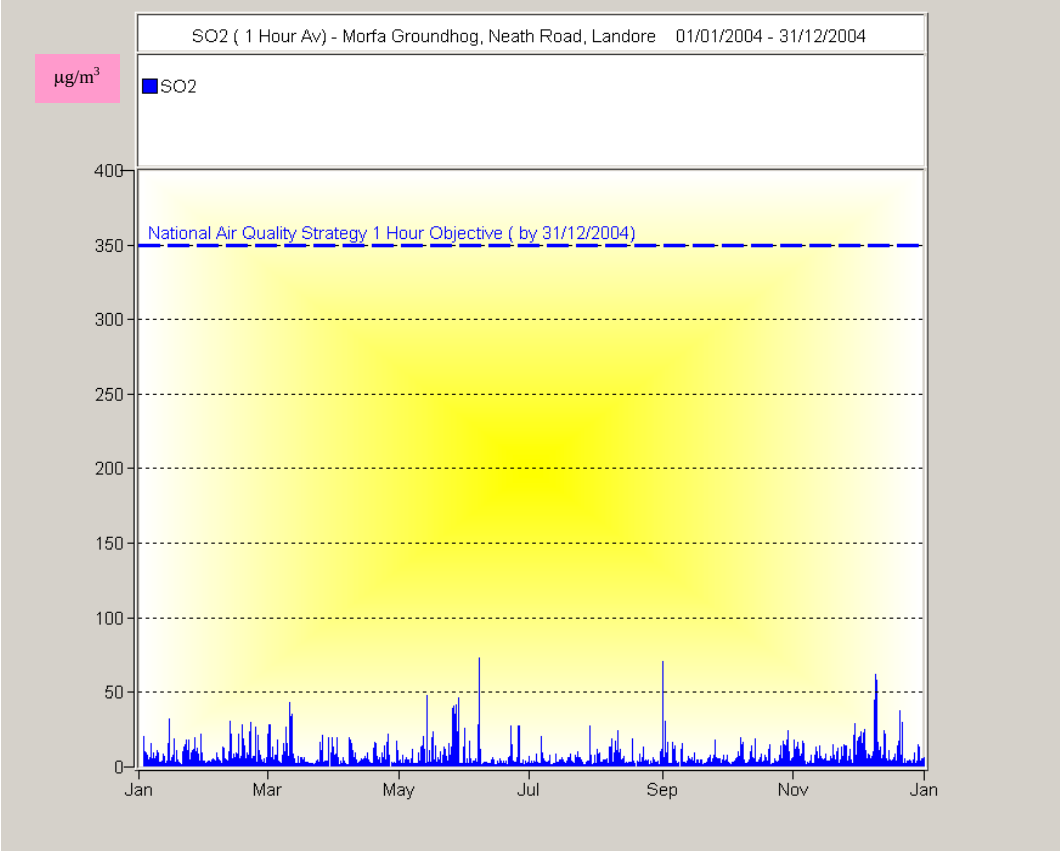
The Landore Railway Diesel Sheds carry out a 24-hour operation, servicing the Inter-City 125 High Speed Trains (HST). This operation involves long safety checks whilst each HST power unit is stationary of at least 20 minutes and is located within 250m of the Morfa Groundhog site to the south-west. The fuel used is of a low sulphur content. The only other major industrial source is the Corus Steelworks plant at Port Talbot. The plant is located to the east / south-east of the Swansea conurbation (see map 1a below). The wind trajectories recorded during the periods identified within table 8 would point to the operations undertaken within the steel making process to be the more likely source of SO_2. Graphs representing the various averaging periods for 2004 and



detailed within table 8 above are shown below as chart 4

Chart 4 - Morfa Groundhog 15-minute means SO_2 2004

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



(15-minute means), chart 5 (1-hour means) and chart 6 (24-hour means).

Chart 5 - Morfa Groundhog 1-hour means SO_2 2004

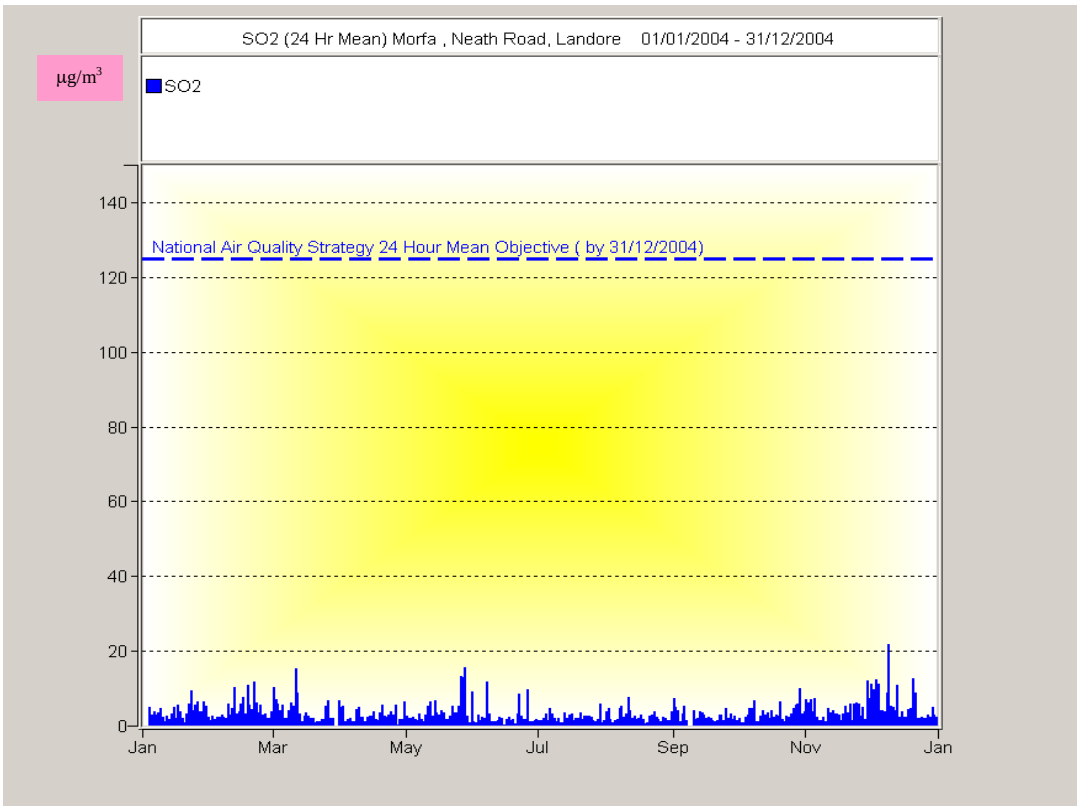
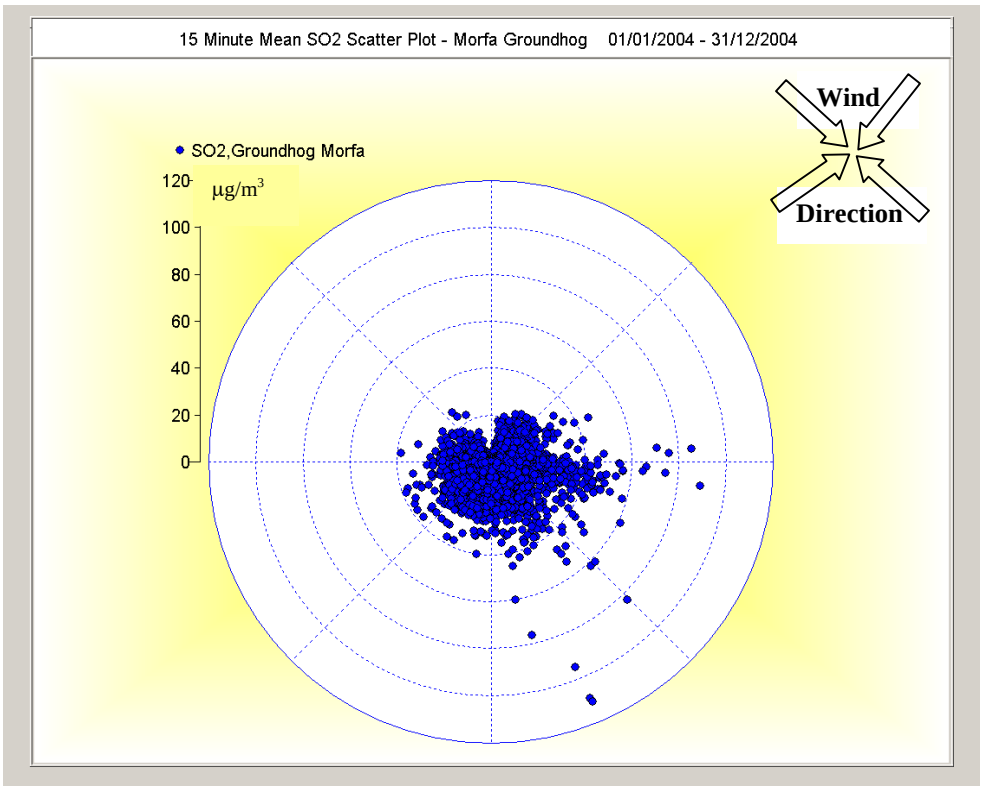
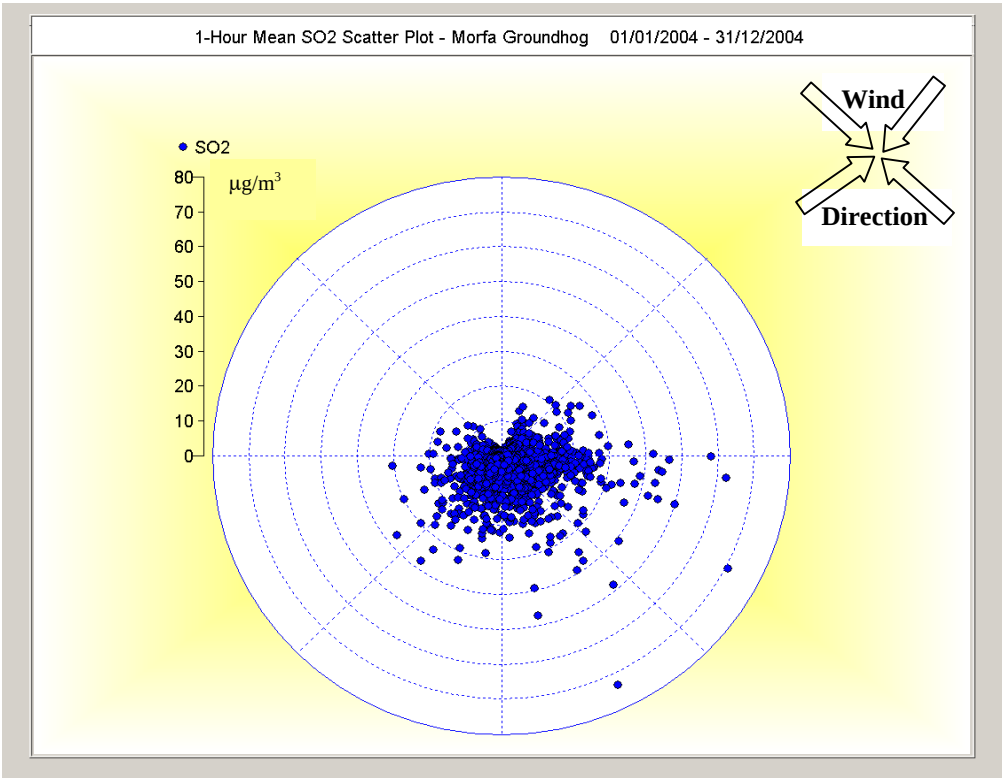


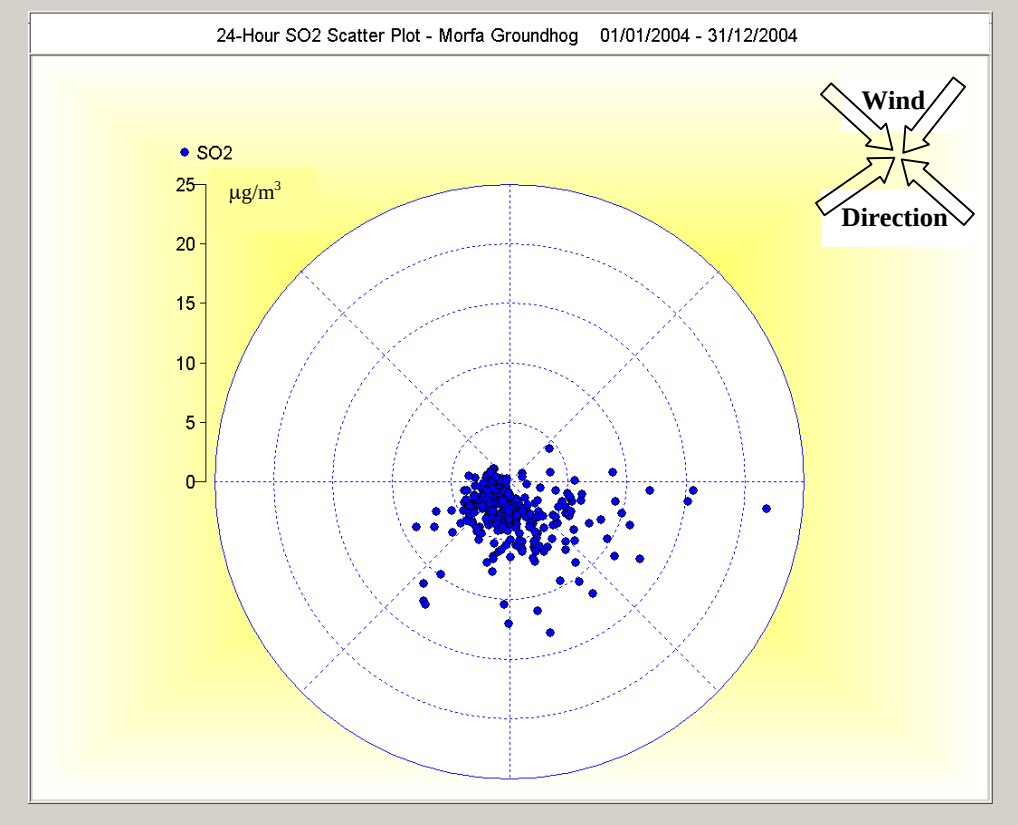
Chart 6 - Morfa Groundhog 24-hour means 2004



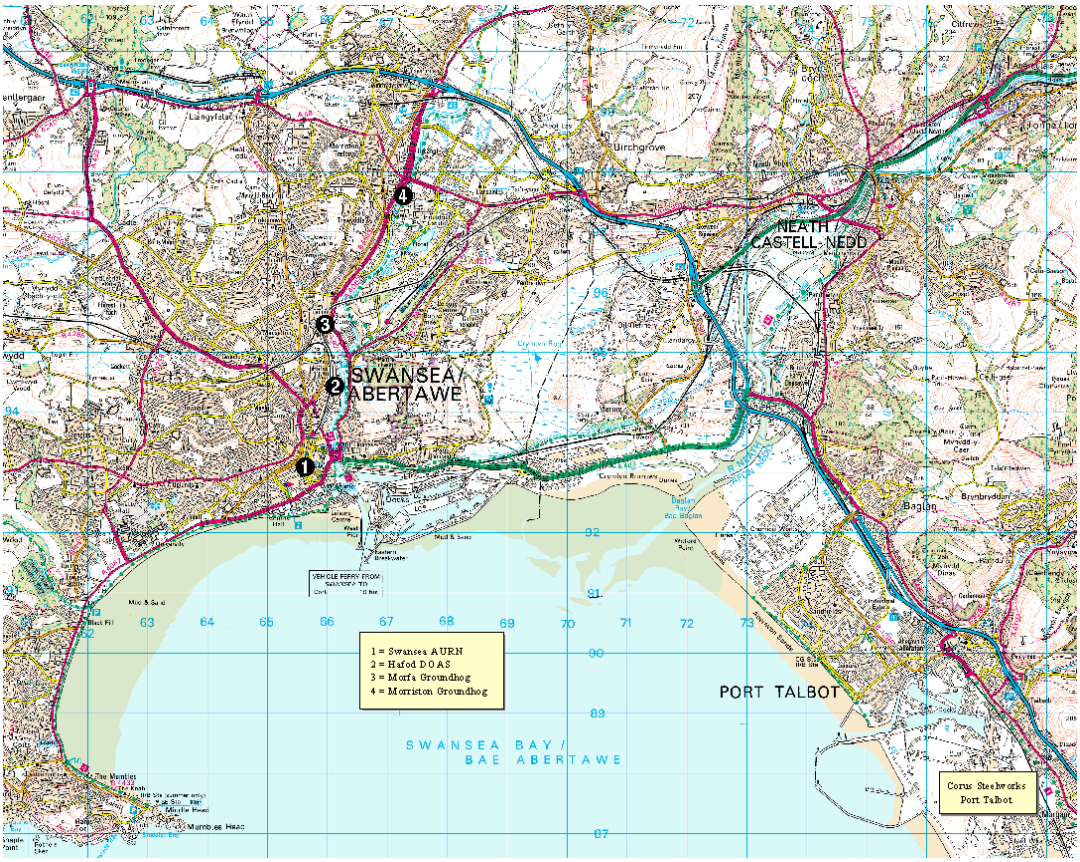
Breuer Plot 2 - Morfa Groundhog SO_2 15-Minute means



Breuer Plot 3 - Morfa Groundhog SO_2 - 1-hour means



Breuer Plot 4 - Morfa Groundhog SO_2 - 24-hour means



Map 1a - Location of Corus Steelworks Plant, Port Talbot

There is at present, no straightforward way to project forward to future years the number of likely exceedences etc. Accepting the limitations of the historical data set for this site as mentioned in 2.1.2.1 above, compliance with each of the objective standards has been calculated from 2001 to 2004 and is presented below as table 9, enabling a brief discussion on SO_2 trends to be made.

Morfa 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)	Annual Mean
2001	130.44 *	98.42 *	30.85 *	6.01 *
Exceedences	0	0	0	-
2002	120.71 *	90.44 *	25.00 *	4.78 *
Exceedences	0	0	0	-
2003	274.48 *	153.21 *	26.37 *	5.05 *
Exceedences	1	0	0	-
2004	111.18	73.15	21.8	3.67
Exceedences	0	0	0	-

Table 9 - Morfa Groundhog SO_2 - 2001 - 2004
**Results have been recalculated following review of QA/QC procedures*

As the maximum averaging periods given above will vary from year to year probably the easiest way to initially assess trends with the SO_2 concentrations is to look at the annual means returned from each of the years under consideration. Again, accepting that the meteorological conditions prevailing during 2003 were atypical, a clear trend emerges from the annual mean data with almost a halving of the concentrations being observed between 2001 and 2004. Whilst it has been stated above that the maximum concentrations over the various averaging periods will fluctuate from year to year, this decrease in the SO_2 concentrations is also evident from the maximum concentrations recorded for all of the averaging periods. There continues therefore, to be a very clear downward trend with regards to ambient SO_2 levels recorded within Swansea. Factors that may account for the continued reductions may include increased and improved abatement techniques employed within the Corus plant at Port

Talbot, the continuing decline in the burning of coal as a domestic heating source and the reduction in the sulphur content of fuels i.e. diesel.

2.1.3 The OPSIS Hafod Differential Optical Absorption Spetroscopy (DOAS) Monitoring Station

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road, within the Hafod district of the lower valley area. These measurements take place at first floor level - a height of approximately 3 - 4 metres and less than 0.5m away from the front facade of the terraced dwellings. The DOAS transmitter ❶ 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 ❷ 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. Map 2 below shows an aerial photograph of the location of the transmitter and receiver heads.

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. The highway at this location can loosely be referred to as a "street canyon". Valid data capture commenced on the 8th January 2004 at 16:00hrs. The station has been given a site classification Roadside (U2)[12].

Map 2 - Aerial View Hafod OPSIS DOAS - Location of Transmitter and Receiver Heads

The DOAS system returns data in the form of 5-minute means. In order to compile a valid hourly mean, a minimum of 100% of the 5-minute means was required to be present. Data capture of less than 100% for the hour therefore excludes that hour from any subsequent analysis. In addition to the above, conditions were imposed on the minimum acceptable light levels and maximum

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

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 250-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations.

2.1.3.1 Nitrogen Dioxide

In order to form a full valid annual mean for 2004, the date range selected extended from 8th January 2004 16:00hrs to 8th January 2005 15:00hrs as data capture commenced at 16:00hrs 8th January 2004. It is envisage that this "additional" 8 days will not adversely skew the validity of the results present.

The results presented below within table 10 have been compared to the objectives within the Air Quality (Wales) Regulations 2000 as amended by the Air Quality (Amendment)(Wales) Regulations 2002.

Hafod DOAS	Max 1-hour Mean μg/m^3 (200μg/m^3)	Annual Mean μg/m^3 (40μg/m^3)
2004	174	41.94
Exceedences	0	-
Data Capture	96.88%	-

Table 10 - Hafod DOAS NO_2 2004

The annual mean objective for NO_2 has therefore continued to be exceeded along the 250-meter path length during 2004. (1st Jan 2004 - 31st December 2004 produces an annual mean of 42.20μg/m^3 with a data capture of 94.85%)

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[13] for roadside sites. Using this method a projected annual mean of 40.88μg/m^3 is obtained for 2005. It is therefore projected that the objective standard of 40μg/m^3 will not be achieved by the compliance date of 31st December 2005 within this section of Neath Road. Non automatic passive NO_2 monitoring data from other sections of Neath Road (see 2.3.2.3) reinforce this view that large sections of the B4603 Neath Road through the lower valley area will not meet the objective standard in 2005.

For the sake of completeness, the same methodology contained within LAQM.TG(03) enables a projection to be made up to the provisional objective date in 2010. Using the factors provided, an annual mean concentration of 33.64μg/m^3 is obtained for 2010 against a target standard again of 40μg/m^3. Whilst compliance is indicated in 2010, the increase in traffic thought likely throughout the lower Swansea valley may cause a re-think of this view.

A chart representing the monitoring undertaken during 2004 is presented below as chart 7

The limited dataset compiled from this location does not permit any discussion on trends as yet.

[13] LAQM.TG(03) box 6.6 page 6-9

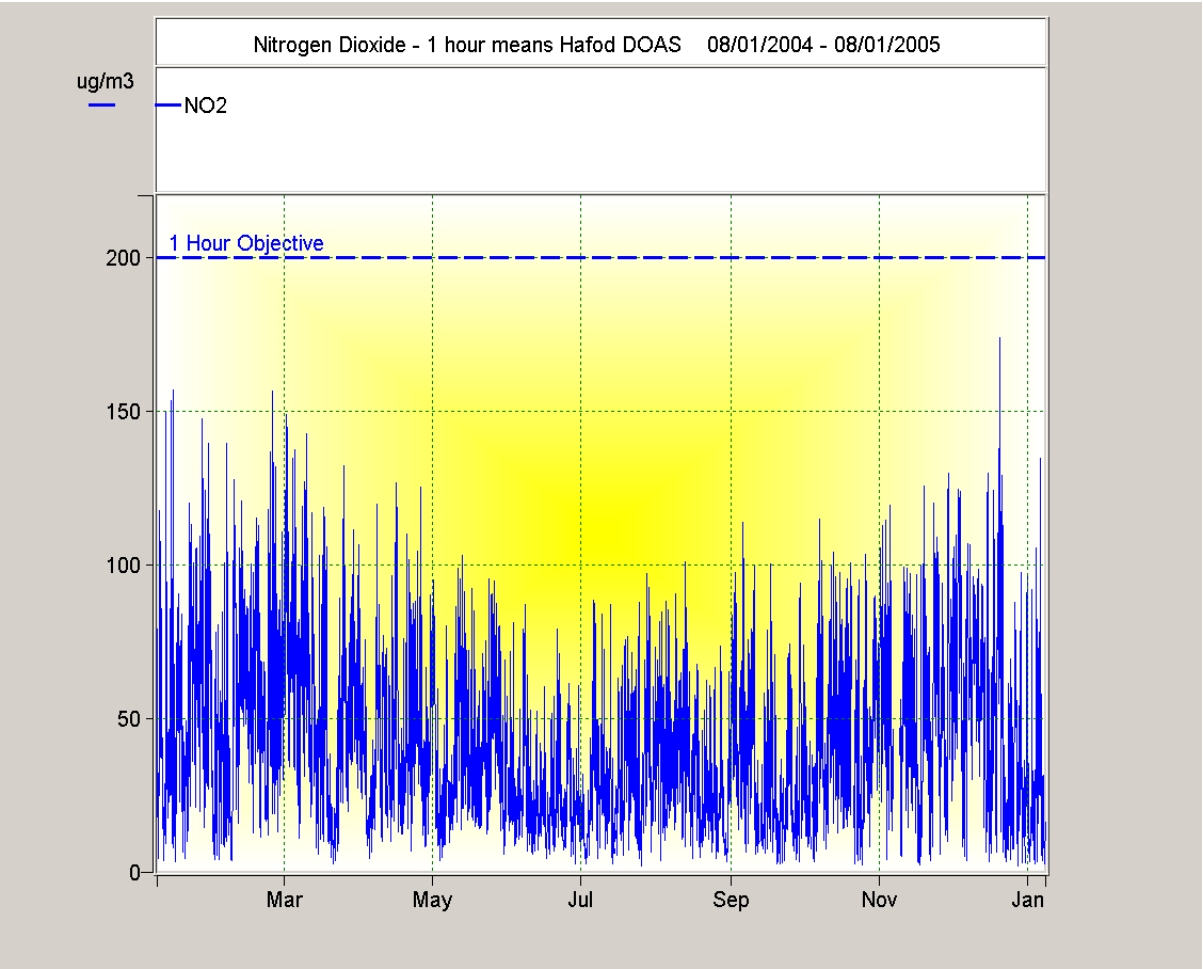


Chart 7 - NO_2 1-hour means Hafod OPSIS DOAS

2.1.3.2 Benzene

Identical dates were used to form the annual mean as described above in 2.2.1. i.e. 8th January 2004 16:00hrs to 8th January 2005 15:00. The results of this analysis are shown below along with the data capture within table 11.

Hafod DOAS Benzene	Annual Mean µg/m^3 (5µg/m^3)
2004	4.39
Exceedences	-
Data Capture	84.64%

Table 11 - Hafod OPSIS DOAS Benzene 2004

The annual mean obtained for 2004 indicates that levels of benzene are below the objective standard of 5μg/m^3 to be achieved by the 31st December 2010.

Again, methodology contained within LAQM.TG(03)[14] enables a projection to be made for the objective year of 2010. Using the factors provided, an annual mean concentration of 2.89μg/m^3 is obtained for 2010 against a target standard of 5μg/m^3.

The limited dataset compiled from this location does not permit any discussion on trends at this stage.

2.1.3.3 Ozone

Ozone is measured along the open path of 250 along with the pollutants NO, NO_2 and benzene. Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2004. The objective for ozone is an 8-hour mean not to exceed 100μg/m^3 on more than 10 occasions.

Ozone measurements along the 250-meter open path reflect the complex photochemistry that is occurring within the tight congested highway within the street canyon at this location. The ozone measurements therefore, may not be typical or similar to those measured at either the Morriston Groundhog or Swansea AURN monitoring stations.

The results from the monitoring during 2004 are presented below as table 12 and show compliance during 2004 with the objective standard.

Hafod DOAS Ozone 2004	Max 8-hour mean	Data capture	Exceedences of 8-hour objective 100µg/m^3 (10 permitted)
	107.61	94.5%	6

Table 12 - Ozone 8-hour means - Hafod OPSIS DOAS

A chart representing the ozone monitoring undertaken during 2004 is presented below as chart 8

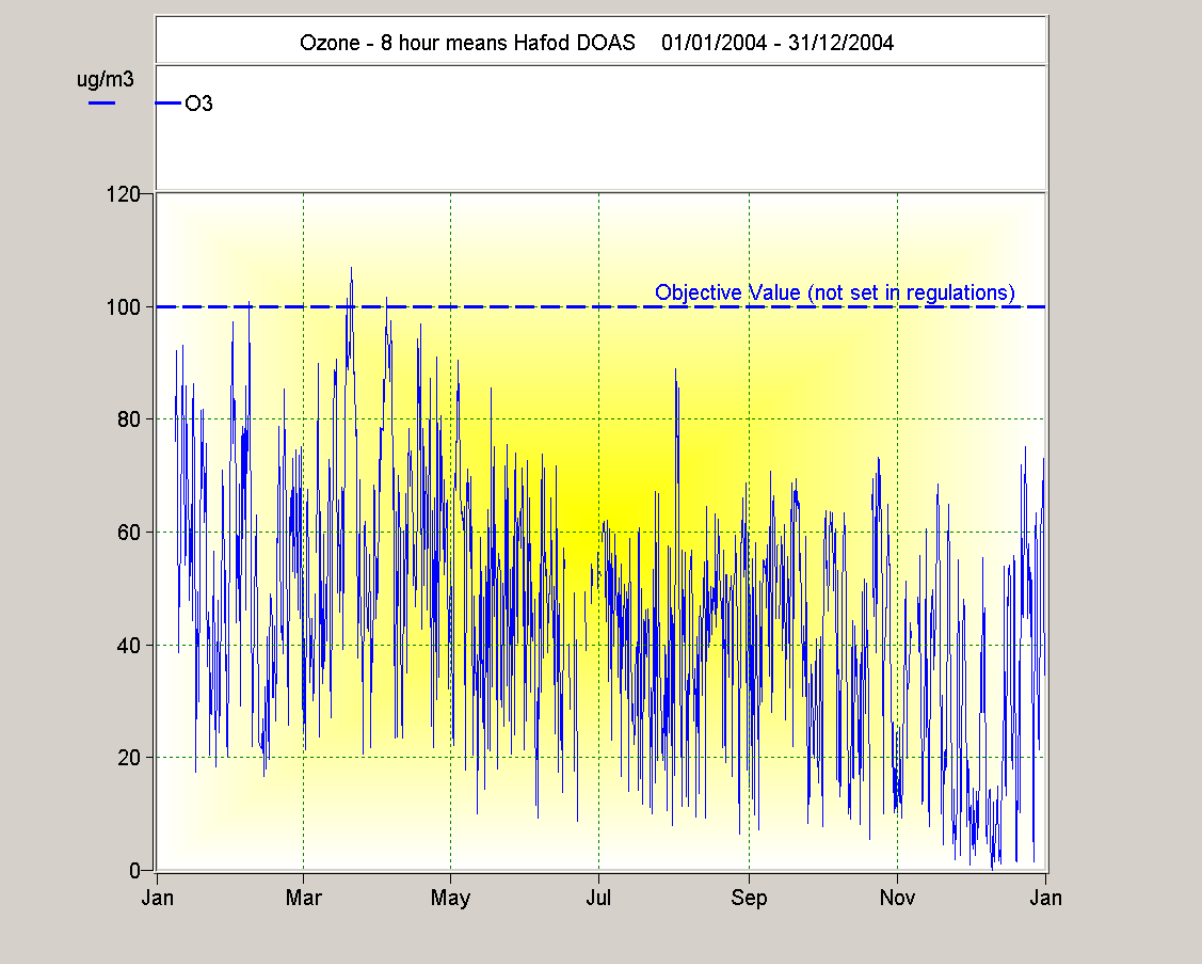


Chart 8 - Ozone 8-hour means 2004 Hafod OPSIS DOAS.

Again, due to limited period of operation, a discussion on trends is not possible at this stage.

[14] LAQM.TG(03) box 3.3 page 3-5

2.2 Automatic Monitoring Data from outside of an Air Quality Management Area.

2.2.1 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)[15]. Map 3 below is an aerial view of the site and the surrounding locations.

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

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

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 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.

Map 3 - Aerial view - Morriston Groundhog

2.2.1.1 Nitrogen Dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO_x analyser. 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 annual mean.

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 1.91[16] to produce results expressed in $\mu g/m^3$. For ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 13 below.

A graph of the hourly means is also given below as chart 9

Morriston 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	2003	2004	2003	2004
	32.2*	31.2	158.8*	136.9	0	0

Table 13 - Morriston Groundhog NO_2 Monitoring Data 2004
**Results have been recalculated following review of QA/QC procedures*

The annual NO_2 mean for 2004 is below the $40\mu g/m^3$ objective for both 2005 and the provisional objective in 2010. No exceedences of the 1-hour objective were recorded. Hourly NO_2 data capture for 2004 is 98%. This data capture rate permits the direct compilation of hourly exceedences rather than the use of the 99.8^{th} percentile of hourly means.

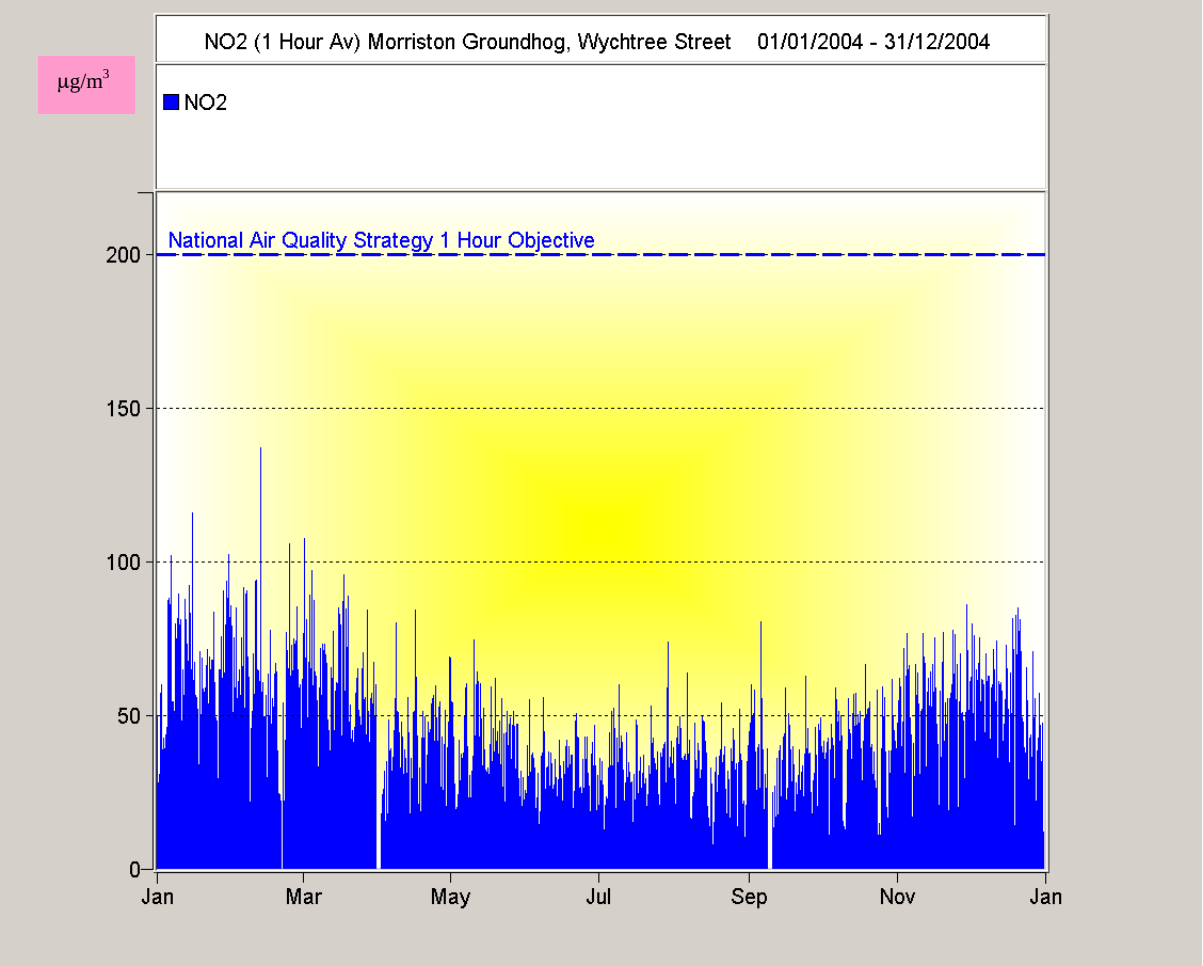


Chart 9 - Morriston Groundhog NO_2 Monitoring Data 2004

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[17] for roadside sites. Using this method a projected annual mean of 30.41µg/m^3 is obtained for 2005.

For the sake of completeness, the same methodology contained within LAQM.TG(03) enables a projection to be made up to the provisional objective in 2010. Using the factors provided, an annual mean concentration of 25.02µg/m^3 is obtained for 2010 against a target standard again of 40µg/m^3.

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

[17] LAQM.TG(03) box 6.6 page 6-9

Ideally, monitoring data should be available for at least 5 years before trends in NO_2 concentrations can be meaningfully discussed. Monitoring commenced at this site during September 2000 so at best, just over four years worth of data are available. Accepting the limitations of the historical data set, the annual means from 2001 to 2004 are presented below within table 14. From table 14, it can be seen (accepting the limitations of the dataset and the poor data capture rates of 2002 and 2003) that NO_2 levels have remained fairly consistent over these years. No discernible reduction trend is therefore evident from this dataset.

Morriston Groundhog	Annual Mean (40µg/m^3)				
	2001	2002	2003	2004	Projected 2005
	* 31.0	27.2 **	32.2 **	31.2	30.41

Table 14 - Morriston groundhog NO2 Annual Mean Concentrations 2001 - 2004

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

*** Data capture for 2002 85% and for 2003 81.5%*

2.2.1.2 Particulate Matter PM10

A Rupprecht & Patashnick Co., Inc. TEOM measures particulate Matter PM10 at the Morfa 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[18]. 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.[19]

[18] *LAQM.TG(03) MonitoringA1-37*

19 LAQM.TG(03) MonitoringA1-38

All results are presented in µg/m^3 and have been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration. For ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 15 below. A chart representing the 24-hour daily means from 2004 is given below as chart 10 and a Breuer Scatter Plot representing the scatter of the daily means as Breuer Plot 5.

Morriston Groundhog	Annual Mean (40µg/m^3)		Max 24-hour Mean		Exceedences of 24-hour objective 50µg/m^3 (35 permitted)	
	2003	2004	2003	2004	2003	2004
	25.72	22.68	73.31	69.61	21	6

Table 15 - Morriston Groundhog PM_{10} Monitoring 2004

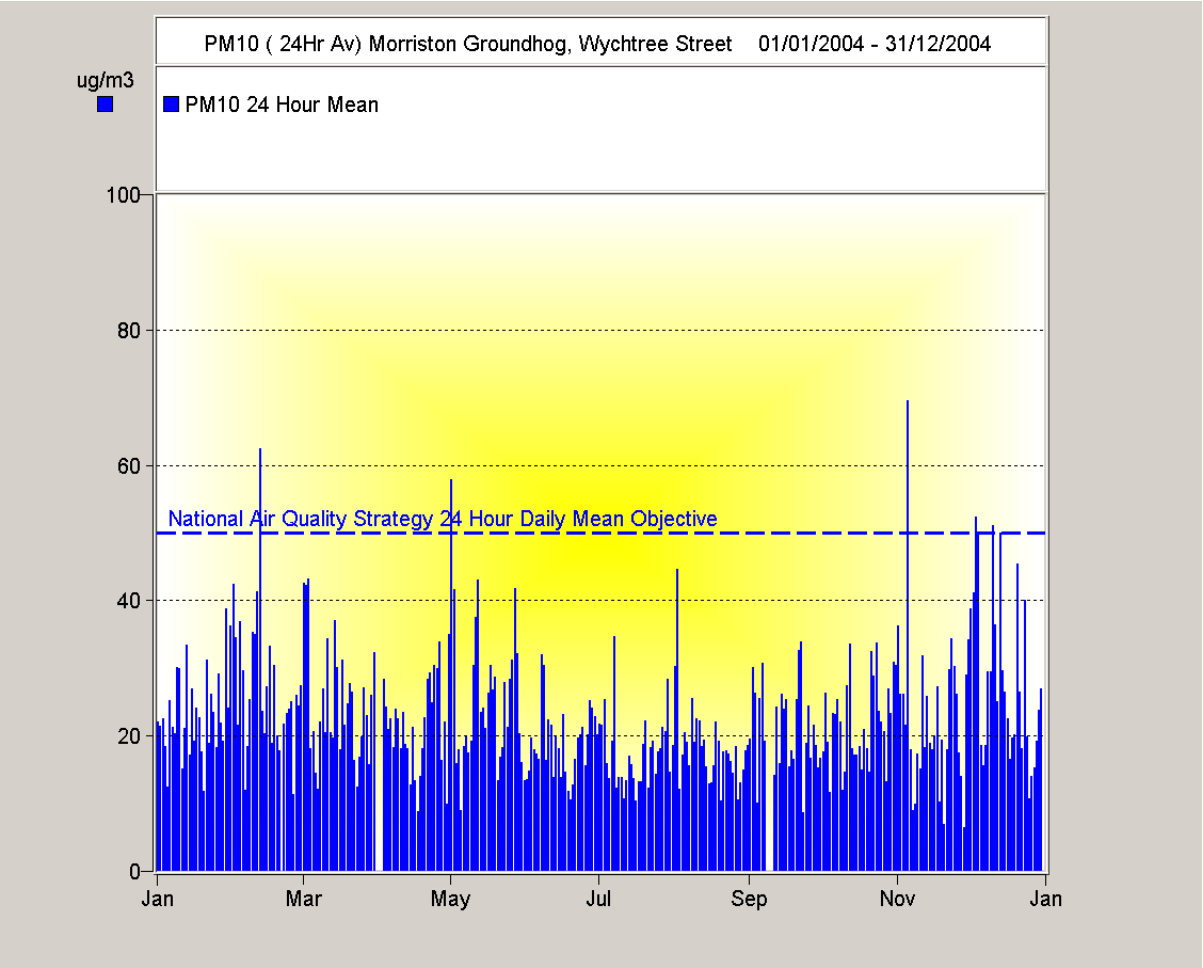
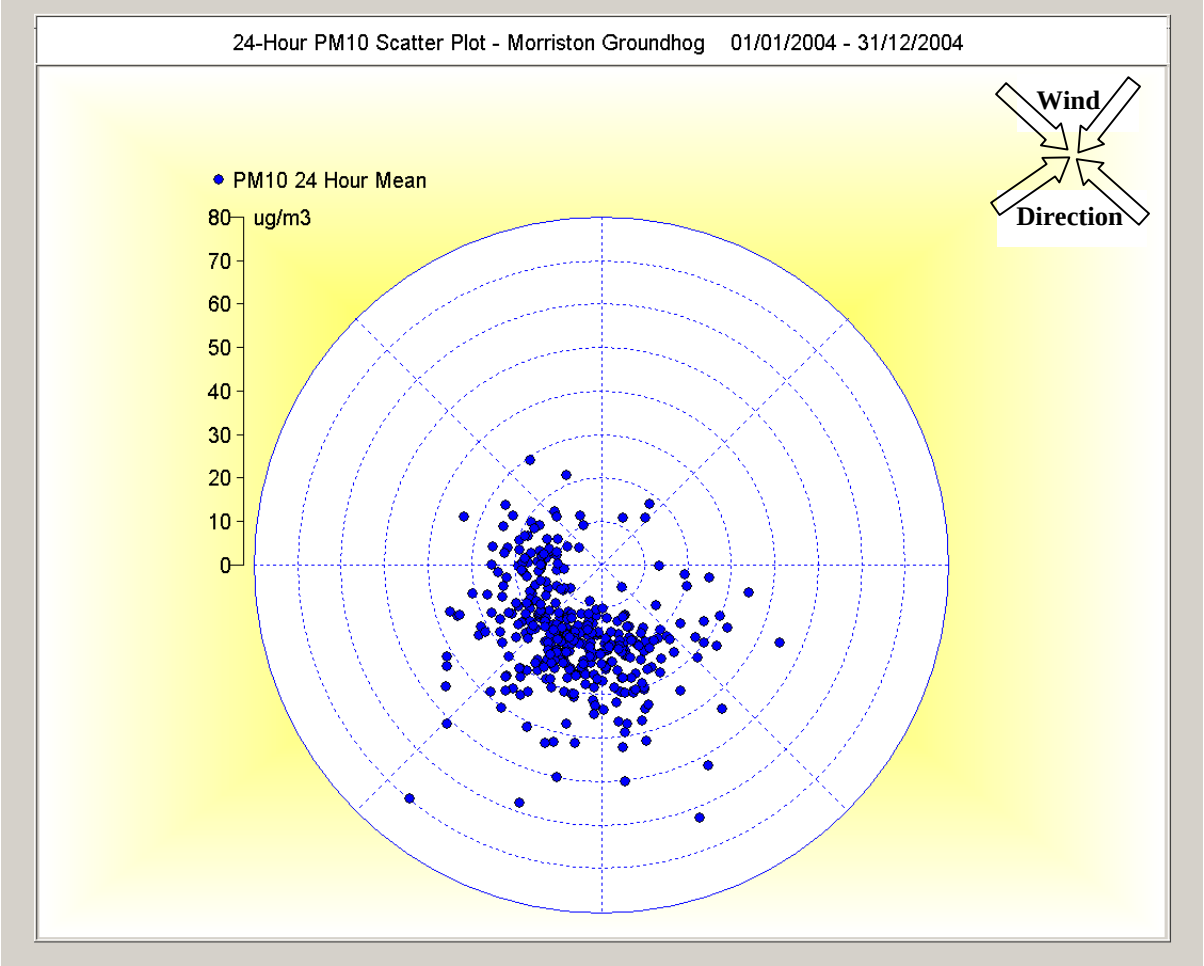


Chart 10 Morriston Groundhog PM_{10} Monitoring 2004 - 24hour means



Breuer Plot 5 - Morriston Groundhog 24-Hour Means

The maximum daily mean was, unsurprisingly, recorded on the 5th November 2004. Data capture for 2004 was 97.81% allowing direct compilation of 24-hour exceedences rather than the use of the 90th percentile of 24-hour means.

It is possible to project the annual mean concentration forward to 2010 using the 2004 annual mean. Guidance on the method to correct PM_{10} measured concentrations to 2010 is given within LAQM.TG (03) box 8.6 page 8-10 and box 8.7 page 8-11. Using this methodology a projected annual mean of 20.49µg/m^3 is obtained for 2010.

Accepting the limitations of the historical data set for this site (above), the annual means from 2001 to 2004 are presented below as table 16.

Morriston Groundhog	Annual Mean (40μg/m^3)				Annual Mean (20μg/m^3)
	2001	2002	2003	2004	Projected 2010
	*23.34#	*23.56#	*25.72	22.68	20.49

Table 16 - Morriston Groundhog PM_{10} - Annual Means 2001-2004
**Results have been recalculated following review of QA/QC procedures*
 # Data capture for 2001 82.74% and for 2002 85.75%

Once the projected annual means have been calculated LAQM.TG(03) indicates a method (paragraph 8.29 page 8-10) of estimating the number of 24-hour exceedences by comparing the projected annual mean to figure 8.1 (page 8-41) of LAQM.TG(03). Using this method the projected number of exceedences of the 24-hour objectives for 2010 is 5. It should be noted that it will in all probability, prove harder to comply with the annual mean objective in 2010 than the daily 24-hour exceedence objective. This situation is reversed at present.

It is therefore predicted that a failure of the provisional annual mean will be seen at the Morriston Groundhog site in 2010. The prediction for the number of 24-hour objective exceedences for PM_{10} in 2010 is thought to be below the permitted number of 7 at this stage.

Due to the poor data capture rates during 2001 and 2002 and the limitations of the dataset no discussion is possible with regard to trends.

2.2.1.3 Carbon Monoxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. 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 running eight hour means. 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. [20] A chart representing the 8-hour running means during 2004 is given below as chart 11.

All results are presented in mg/m^3 by multiplying the logged result in ppm by the conversion factor of 1.16 [21] to produce results expressed in mg/m^3. For ease of comparison with results from the previous year, the results obtained from 2001to 2003 are shown alongside those for 2004 (highlighted) within table 17 below. There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site. The date for compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31st

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

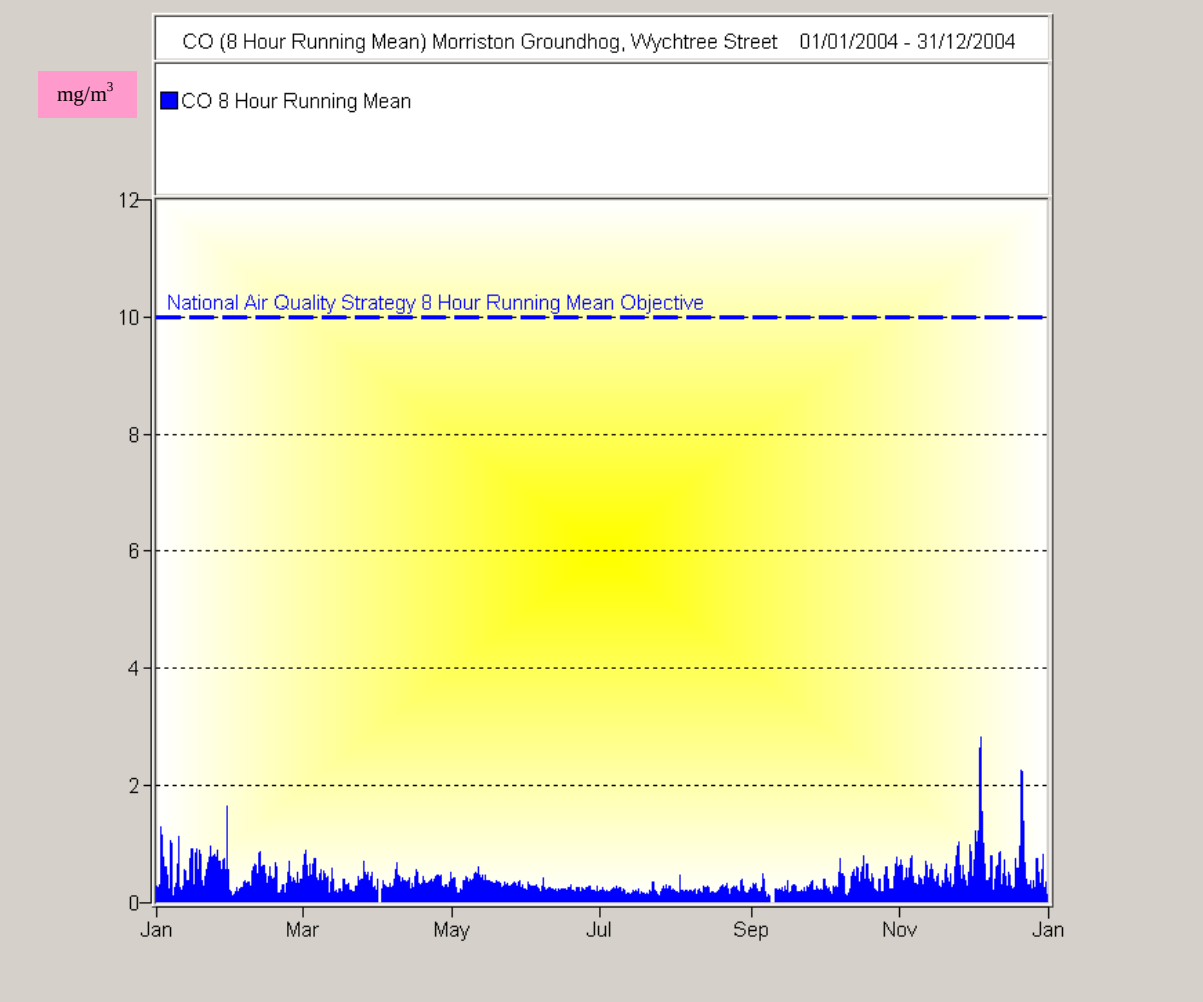


Chart 11 - Morriston Groundhog CO 8-hour rolling means 2004

December 2003. The EU objective of a maximum daily 8-hour running mean of 10mg/ m^3 with a compliance date of 2005 also looks likely to be achieved.

Data capture for the 8-hour running means during 2004 was 98% allowing direct comparison with the objective standard.

Morriston Groundhog Carbon Monoxide	Max 8-hour Running mean mg/m^3 (10mg/ m^3)			
	2001	2002	2003	2004
	*4.61	*2.31#	*2.07	2.83

Table 17 - Morriston Groundhog Carbon Monoxide Max daily running 8-hour means 2001-2004
**Results have been recalculated following review of QA/QC procedures*
 # Data capture for 2002 88.73%

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

Again, the limitations of the available dataset have to be accepted but there appears no discernible trend with the data at present except to say that concentrations have remained below the objective levels during every year of measurements.

2.2.1.4 Sulphur Dioxide

An Advanced Pollution Instrumentation (API) real-time SO_2 analyser measures $S0_2$ 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. 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[22].

All results are presented in $\mu g/m^3$ by multiplying the logged result in ppb by the conversion factor of 2.66 [23] to produce results expressed in $\mu g/m^3$.

Data from 2004 has been analysed for each of the objectives averaging periods and the results are presented below within table 18. No exceedences of any of the objectives were observed during 2004. Graphs representing the various averaging periods for 2004 and detailed within table 18 above are shown below as chart 12 (15-minute means), chart 13 (1-hour means) and chart 14 (24-nour means).

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

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

Data capture at the base 15-minute logged means for 2004 is 97%, allowing direct comparison with the objective standards and not the percentile values.

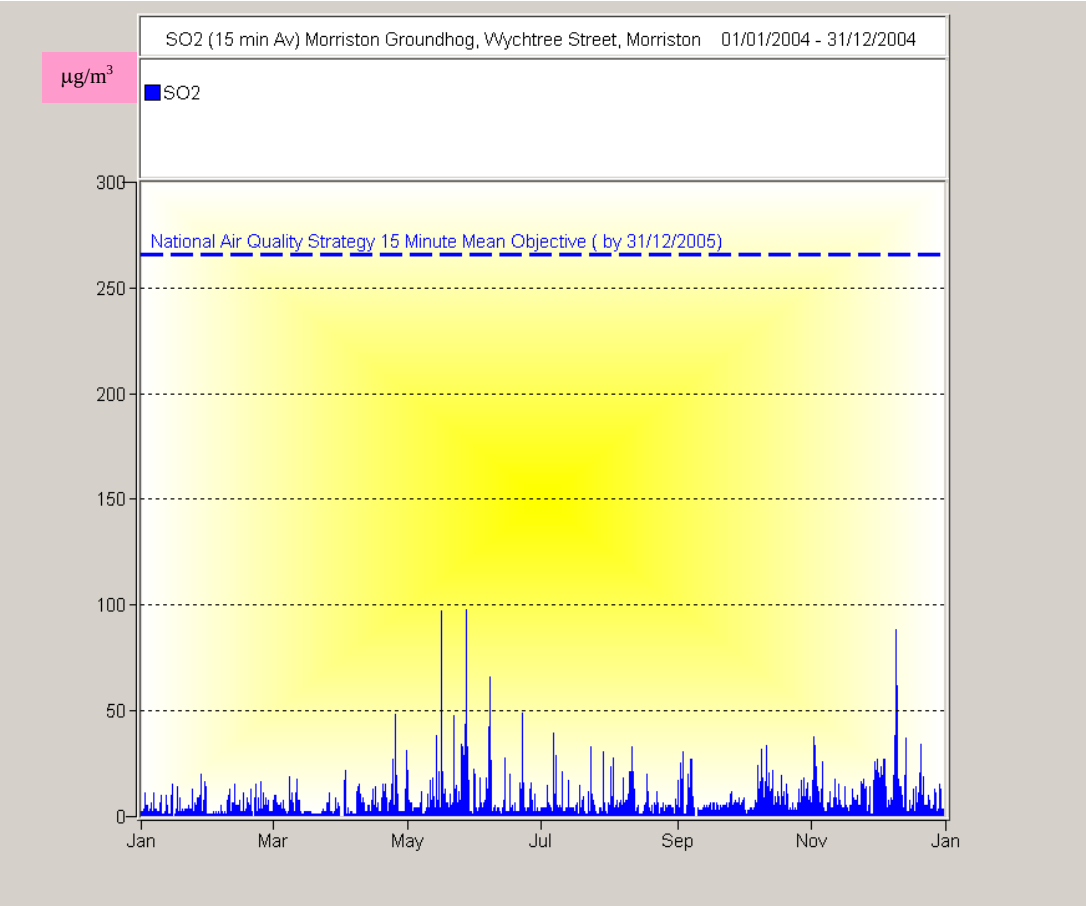


Chart 12 - Morriston Groundhog SO_2 15-minute means 2004

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

Morfa 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°

Table 18 - SO_2 Monitoring - Morriston Groundhog 2004

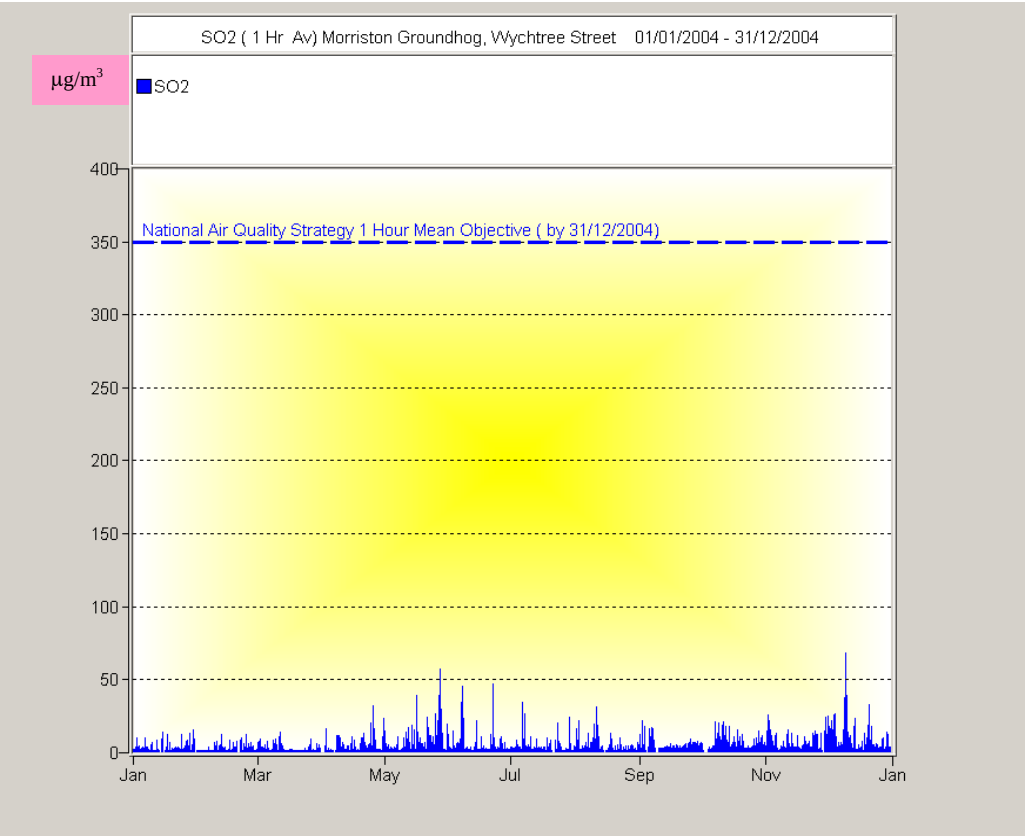


Chart 13 - Morriston Groundhog SO_2 1-hour means 2004

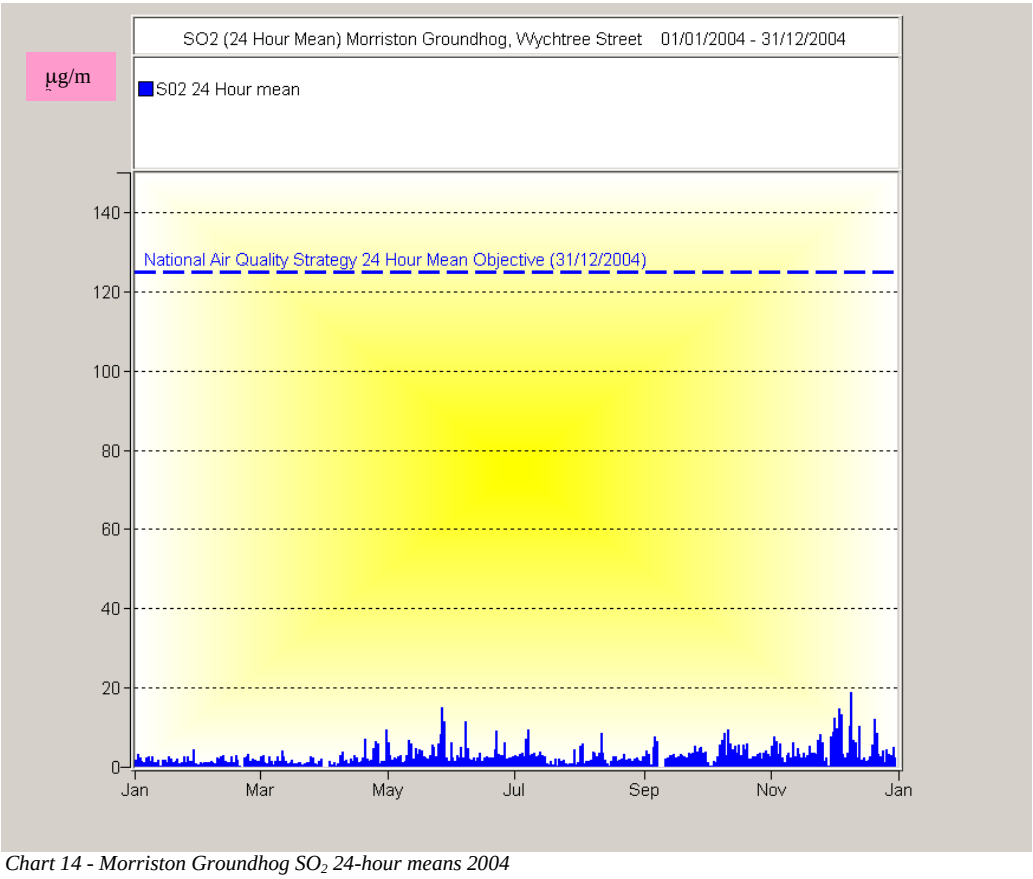


Chart 14 - Morriston Groundhog SO_2 24-hour means 2004

There is at present, no straightforward way to project forward to future years the number of likely exceedences etc. Accepting the limitations of the historical data set for this site, compliance with each of the objective standards has been calculated from 2001 to 2004 and is presented below as table 19, enabling a brief discussion on SO_2 trends to be made.

Morfa 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)	Annual Mean
2001	*158.95	*94.15	*29.37	*4.98
Exceedences	0	0	0	-
2002	*122.30 #	*72.06 #	*24.25#	*3.48#
Exceedences	0	0	0	-
2003	*189.30	*114.27	*21.4	*3.32
Exceedences	0	0	0	-
2004	98.12	68.02	18.73	3.08
Exceedences	0	0	0	-

Table 19 - Morriston Groundhog SO_2 - 2001 - 2004
**Results have been recalculated following review of QA/QC procedures*
 # Data capture for 2002 87.31%

As the maximum concentrations recorded within the various averaging periods given above will vary from year to year again, the easiest way to initially assess trends with the SO_2 concentrations is to look at the annual means returned from each of the years under consideration. Again, a similar pattern to that seen at the Morfa Groundhog site is apparent from the data. A clear trend emerges from the annual mean data with almost a halving of the concentrations being observed between 2001 and 2004. Whilst it has been stated above that the maximum concentrations over the various averaging periods will fluctuate from year to year, this decrease in the SO_2 concentrations is also evident from the maximum concentrations recorded for all of the averaging periods (excepting the 15-minute and 1-hour concentrations during 2003). There continues therefore, to be a very clear downward trend with regards to ambient SO_2 levels recorded within

Swansea. Factors that may account for the continued reductions are discussed within 2.1.2.4 above (Morfa Groundhog Sulphur Dioxide).

2.2.1.5 Ozone

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2004. The objective for ozone is an 8-hour mean not to exceed 100μg/m^3 on more than 10 occasions with a compliance date of 31st December 2005

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO_x analyser. 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 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

The results from the monitoring during 2004 are presented below as table 20 and show non-compliance during 2004 with the objective standard.

Morriston Groundhog 2004	Max 8-hour Mean (μg/m^3)	Data capture	Exceedences of 8-hour objective 100μg/m^3 (10 permitted)
	142.33	98%	26

Table 20 - Ozone 8-hour means - Morriston Groundhog 2004

A chart representing the ozone monitoring undertaken during 2004 is presented below as chart 15.

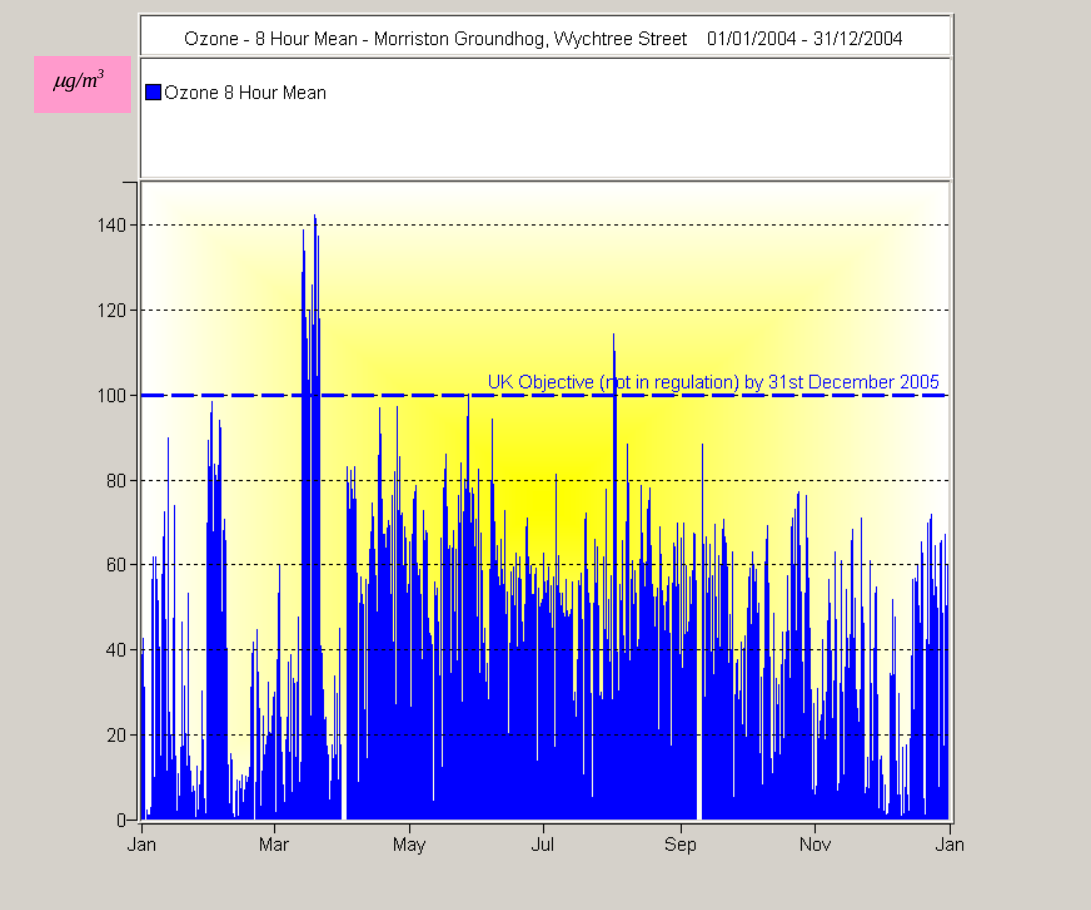


Chart 15 - Ozone 8-hour means - Morriston Groundhog 2004

An interesting observation can be made from chart 15. Out of the 26 exceedences recorded during 2004, 20 occurred between the 13th March 2004 and 21st March 2004. This is somewhat surprising as ozone is traditionally seen as a summer-time pollutant when intense sunlight acts upon the precursors (NO_x) in the presence of a catalyst (normally VOC's i.e. benzene) to commence the photochemical reaction that produce ozone. Observations of the ambient air temperature recorded as part of the Morriston Groundhog dataset show temperatures in the range of 5.32 Deg C to 12.5 Deg C for this time frame - hardly thought sufficient to kick off the photo-chemical reaction. Chart 16 below shows ozone, NO_2 and air temperature plotted against each other as 8-

hour means (note air temperature scale is on a separate axis) for the period 13th - 21st March 2004.

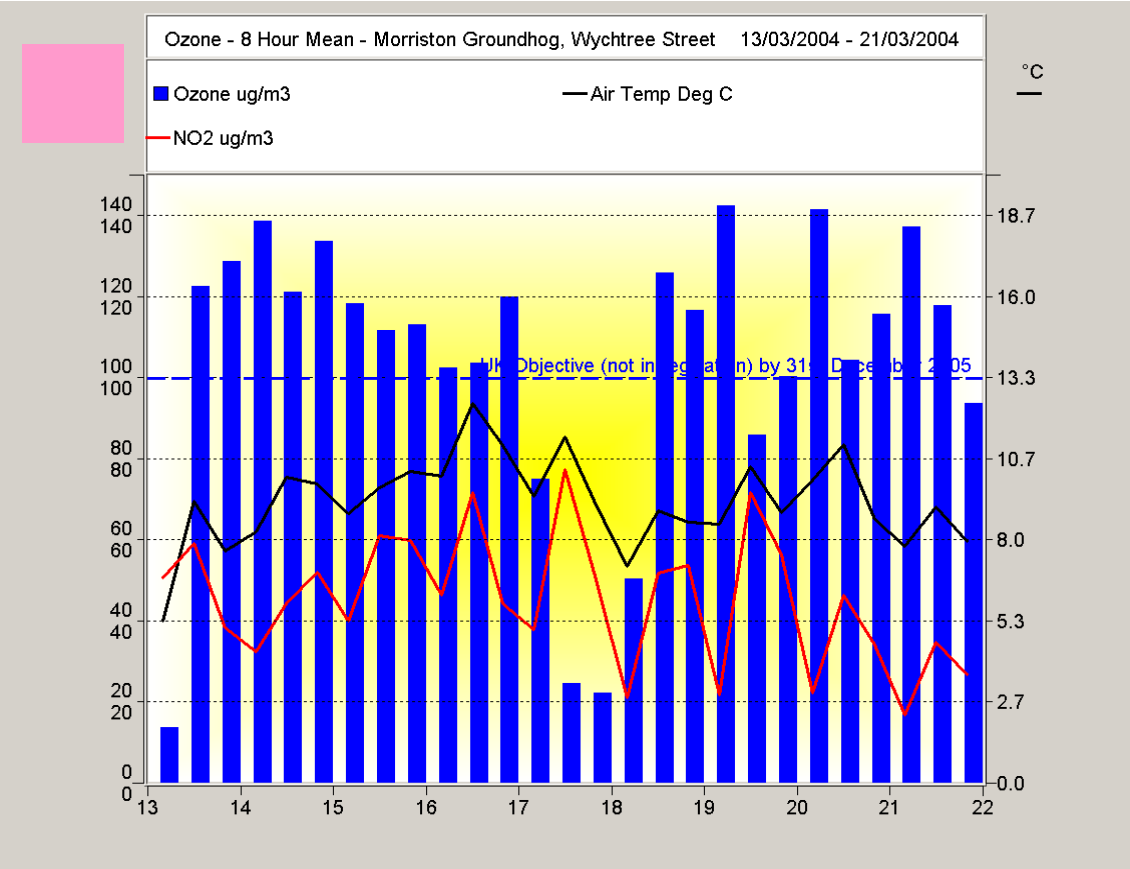
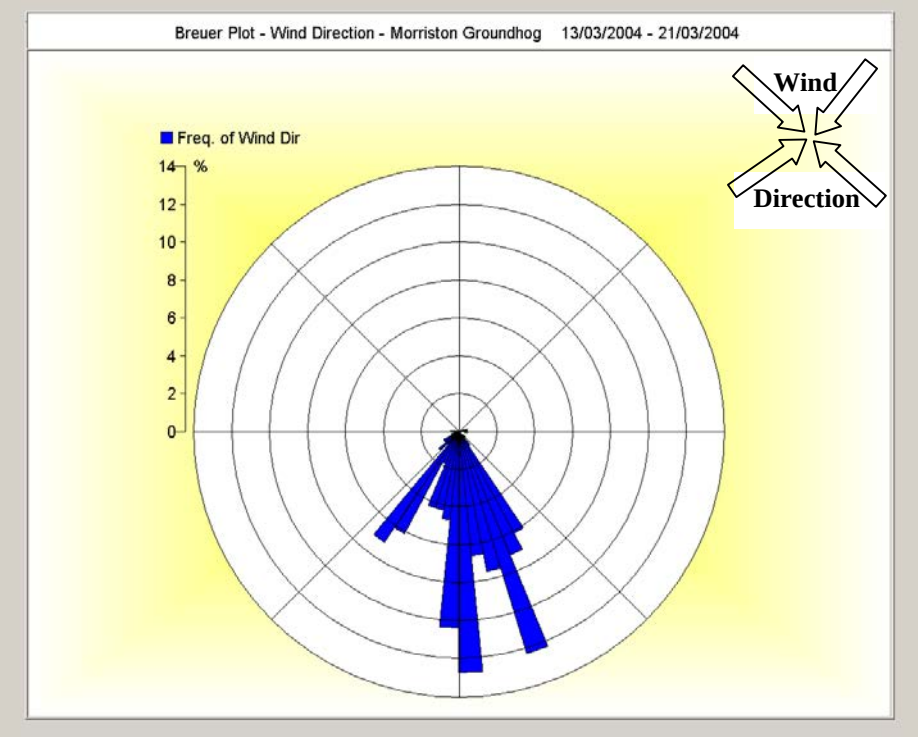


Chart 16 - Ozone, NO_2 and Air temperature 13th - 21st March 2004 - Morriston Groundhog

This analysis does not in itself explain the formation of "local" ozone during this time frame. What is significant is that the Hafod OPSIS DOAS, the Swansea AURN and the Neath-Port-Talbot AURN all recorded elevated levels of ozone for this time frame. Whilst these monitoring locations all recorded elevated levels, none matched those recorded at Morriston.

It is possible that this was part of a much wider trans-boundary episode, possibly emanating from Eastern Europe. However, during March, the air temperatures / global radiation (sunlight) across eastern Europe are thought to be much lower than those found in the UK and would, in all probability not sustain or be sufficient to start the photo-chemical reaction. Further analysis and

correlation with additional sites and air mass trajectories to the east of the Swansea conurbation is needed to attempt to explain these results. A basic wind trajectory analysis (shown below as Breuer Plot 6) has been carried out on the meteorological data from the Morriston Groundhog and shows a predominance of southerly / south-easterly winds for the period.



Breuer Plot 6 - Wind Direction Frequency Morriston Groundhog 13th - 21st March 2003

This pattern of elevated ozone concentrations during the winter months has been seen before - the most recent during the late winter months of 2003 and is the subject of a report by NETCEN at

http://www.airquality.co.uk/archive/reports/cat12/marchapril03_episode.pdf

This report deals with the ozone episode during March - April 2003 which also saw elevated levels of PM_{10} episodes - in this instance, air mass back trajectories indicated the ozone precursors originated from within eastern Europe.

2.2.1.6 Hydrogen Sulphide (H_2S)

There are some local industrial emissions sources of H_2S within the Enterprise Zone. These discharges are to both air and water. Odour complaints from local businesses have been received by the authority resulting from the discharges into the main foul sewerage system. However, the more predominant local source is from vehicles fitted with catalytic converters.

The Expert Panel on Air Quality has not published any regulatory standards and the World Health Organisation does not propose a health-based guideline value, although there are very clear health risks to exposure above odour threshold. European Directive 80/778/EEC requires that hydrogen sulphide should be undetectable organoleptically. Results from the 2004 monitoring are presented below as chart 16a.

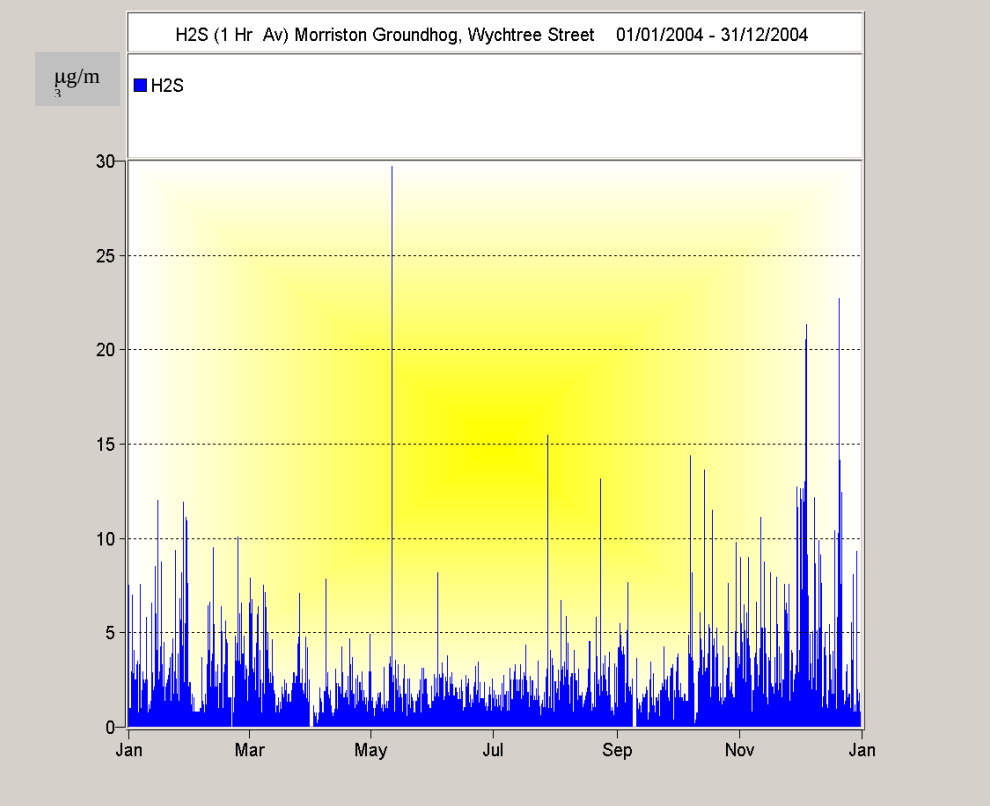


Chart 16a - Hydrogen Sulphide Monitoring 2004 - Morriston Groundhog

2.2.2 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)[24]. Map 4 below is an aerial view of the site and the surrounding locations.

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

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.

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 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 2004 data for the pollutants Carbon Monoxide, Ozone, Nitrogen Dioxide and Particulate Matter PM10 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.

2.2.2.1 Nitrogen Dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO_x analyser. The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data expressed in $\mu g/m^3$ being provided. The ratified hourly means have been used to calculate the objectives for the hourly and annual means.

For ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 21 below. A graph of the hourly means is given below as Chart 17

Swansea AURN	Annual Mean ($40\mu g/m^3$)		Max 1-hour ($200\mu g/m^3$)		Exceedences of 1-hour std (18 permitted)	
	2003	2004	2003	2004	2003	2004
	33.96	36.95	164	143	0	0

Table 21 - Swansea AURN- NO_2 Monitoring Data 2004

The annual NO_2 mean for 2004 is below the $40\mu g/m^3$ objective for both 2005 and the provisional objective in 2010. No exceedences of the 1-hour objective were recorded. Hourly NO_2 data capture for 2004 is 91.19%. This data capture rate permits the direct compilation of hourly exceedences rather than the use of the 99.8^{th} percentile of hourly means.

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical Guidance LAQM.TG(03)[25] for Urban Centre

[25] LAQM.TG(03) box 6.7 page 6-29

sites. This methodology (box 6.7 page 6-29) has been chosen in preference to the methodology outlined within box 6.6 page 6-9 as this methodology assumes

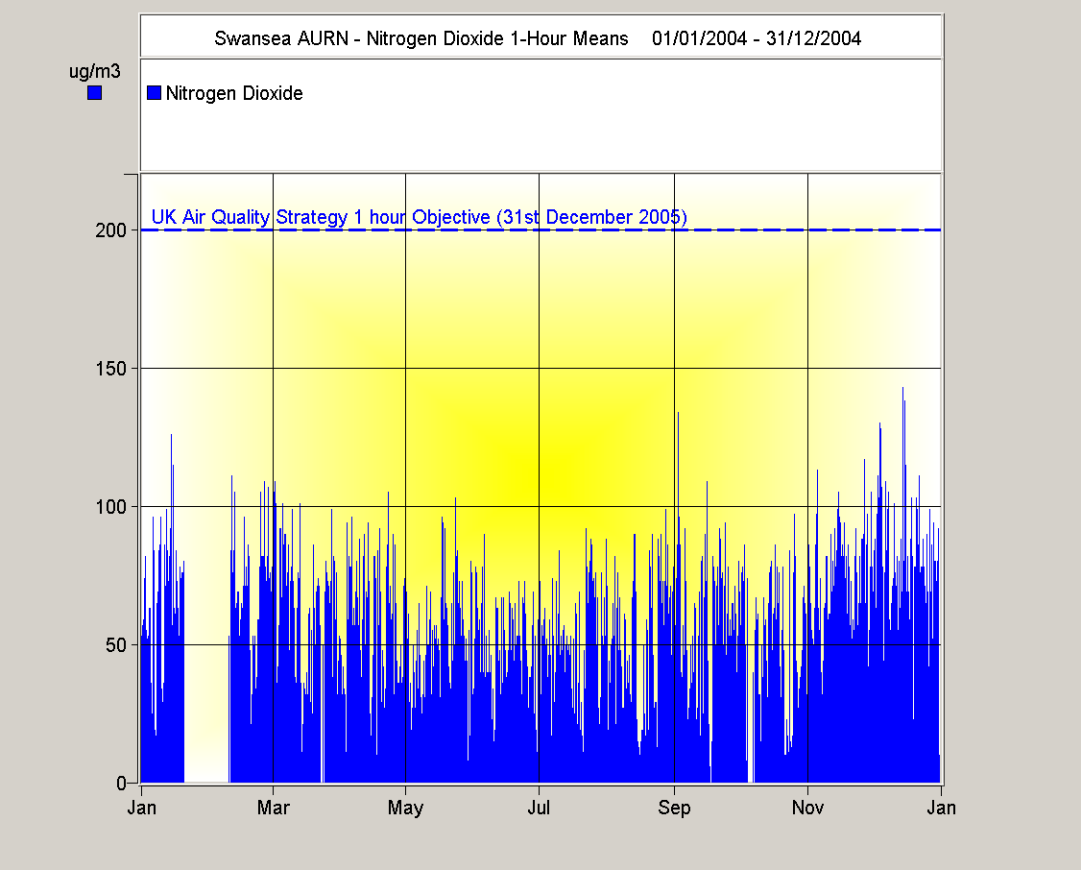


Chart 17- Swansea AURN - Hourly NO_2 Data 2004

a roadside location. Using the methodology within LAQM.TG(03) box 6.7 page 6-29 a projected annual mean of 36.19µg/m^3 is obtained for 2005.

For the sake of completeness, the same methodology contained within LAQM.TG(03) (box 6.7 page 6-29) enables a projection to be made up to the provisional objective in 2010. Using the factors provided, an annual mean concentration of 31.01µg/m^3 is obtained for 2010 against a target standard again of 40µg/m^3.

Monitoring commenced at this site during June 1994 but ratified data is only available from 1st December 1994. Analysis has therefore been performed from 1995 to 2004, providing 10 years of measurements to assess trends. Table 22

details annual means between 1995 and 2004 and chart 18 plots the trend over this time period.

Swansea AURN	Annual Mean (40µg/m^3)											
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Projected 2005**	**Projected 2010**
	41.25	**43.19**	**38.03**	**36.15**	**34.08**	**33.37**	**35.42**	**31.25**	**33.96**	**36.95**	**36.19**	**31.01**

Table 22- Swansea AURN NO_2 Annual Means 1995 - 2004

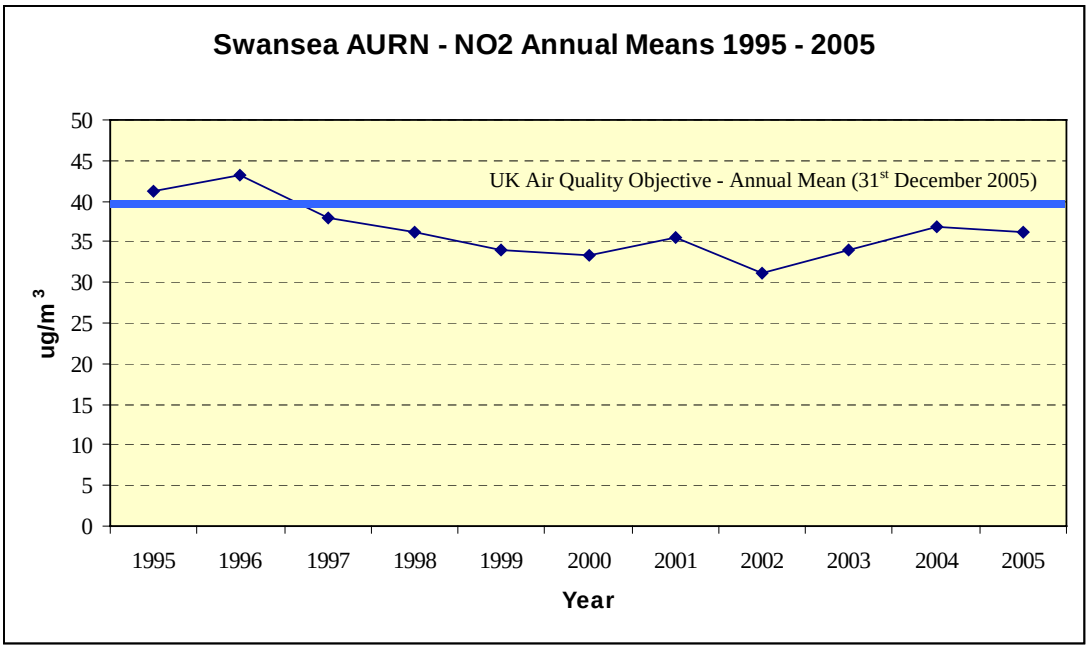
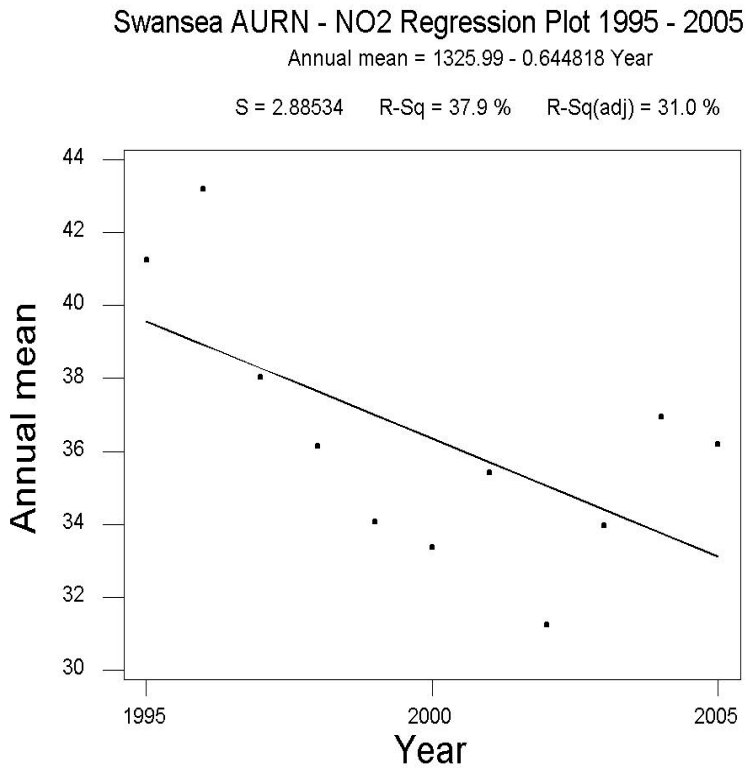


Chart 18 Swansea AURN NO_2 Annual Means 1995 - 2004

Regression analysis has been undertaken using the software package MiniTab 13[26]. The resultant regression plot is shown below as regression plot 1. The analysis has returned a p-value of 0.044, which being less than 0.05, shows that the overall regression is significant.

26 *MiniTab Inc, Quality Plaza, 1829 Pine Hall Road, State College, PA 16801-3008, U.S.A.*



Regression Plot 1 - Swansea AURN NO_2 Regression 1995 - 2005

2.2.2.2 Particulate Matter PM10

A Rupprecht & Patashnick Co., Inc. TEOM measures Particulate Matter PM10 at this site. 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. The ratified 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.

All results are presented in $\mu g/m^3$ and have been corrected by NETCEN with the interim default correction factor of 1.3 to estimate gravimetric concentration. For ease of comparison with results from the previous year, the results obtained for 2003 are shown alongside those for 2004 (highlighted) within table 23 below. A chart representing the 24-hour daily means from 2004 is given below as chart 18.

Swansea AURN	Annual Mean ($40\mu g/m^3$)		Max 24-hour Mean		Exceedences of 24-hour objective $50\mu g/m^3$ (35 permitted)	
	2003	2004	2003	2004	2003	2004
	24.88	25.88*	67.25	56.67*	11	3*

** Ratified data capture for 2004 23.22%*

Table 23 - Particulate Matter PM10 - Monitoring Data 2004

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%

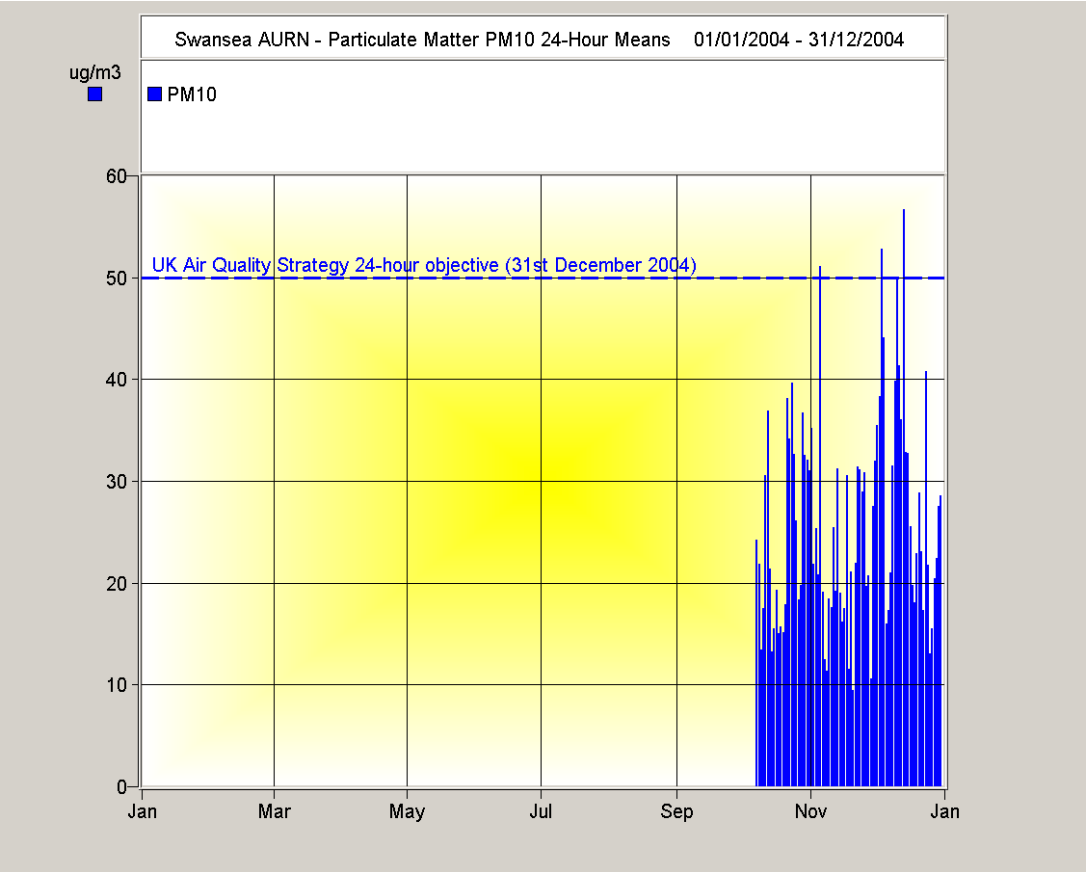


Chart 18 - Particulate PM_{10} Monitoring Data 2004 - 24-hour means

It is possible to project the annual mean concentration forward to 2010 using the previous years annual mean. However, in this instance due to the low ratified

data capture rate of 23% it was not thought valid to project forward to 2010 from the 2004 annual mean. It has been decided to use the 2003 annual mean, which is substantiated by a data capture rate of 97.53%. There are also uncertainties in projecting forward to 2010 from this annual mean as 2003 is known to have suffered from numerous regional/trans boundary PM_{10} episodes, (mentioned in 2.2.1.5 above) in part caused by atypical meteorological conditions.

Guidance on the method to correct PM_{10} measured concentrations to 2005 and 2010 is given within LAQM.TG (03) box 8.6 page 8-10 and box 8.7 page 8-11. Using this methodology a projected annual mean of 22.65μg/m^3 is obtained for 2010.

Once the projected annual means have been calculated LAQM.TG(03) indicates a method (paragraph 8.29 page 8-10) of estimating the number of 24-hour exceedences by comparing the projected annual mean to figure 8.1 (page 8-41) of LAQM.TG(03). Using this method the projected number of exceedences of the 24-hour objectives for 2010 is approximately 5. It should be noted that it will in all probability, prove harder to comply with the annual mean objective in 2010 than the daily 24-hour exceedence objective. This situation is reversed at present. **It is therefore predicted that a failure of the provisional annual mean will be seen at the Swansea AURN site in 2010**. The prediction for the number of 24-hour objective exceedences for PM_{10} in 2010 is thought to be below the permitted number of 7 at this stage.

Monitoring commenced at this site during June 1994 but ratified data is only available from 1st December 1994. Analysis has therefore been performed from 1995 to 2004, providing 10 years of measurements to assess trends. Table 24

details annual means between 1995 and 2004 and chart 19 plots the trends over this time period.

Swansea AURN	Annual Mean (40µg/m^3)										Annual Mean (20µg/m^3)
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Projected 2010**
Annual Mean	**34.54**	**30.49**	**31.05**	**27.15**	**21.86**	**25.52**	**25.46**	**25.03**	**24.91**	**25.88 ***	**22.65**
Max 24-Hour	**90.08**	**107.4**	**73.08**	**102.5**	**54.88**	**81.38**	**70.13**	**68.29**	**67.25**	**56.67 ***	**-**
24-Hour Exceedences (35 Permitted)	**51**	**34**	**25**	**18**	**1**	**13**	**7**	**5**	**11**	**3***	**5**
Data capture %	**94.52**	**96.72**	**96.99**	**95.62**	**95.62**	**96.45**	**93.15**	**98.08**	**97.53**	**23.2***	**-**

**Statistics Unreliable due to poor data capture rate*

Table 24 Swansea AURN PM_{10} 1995 - 2004

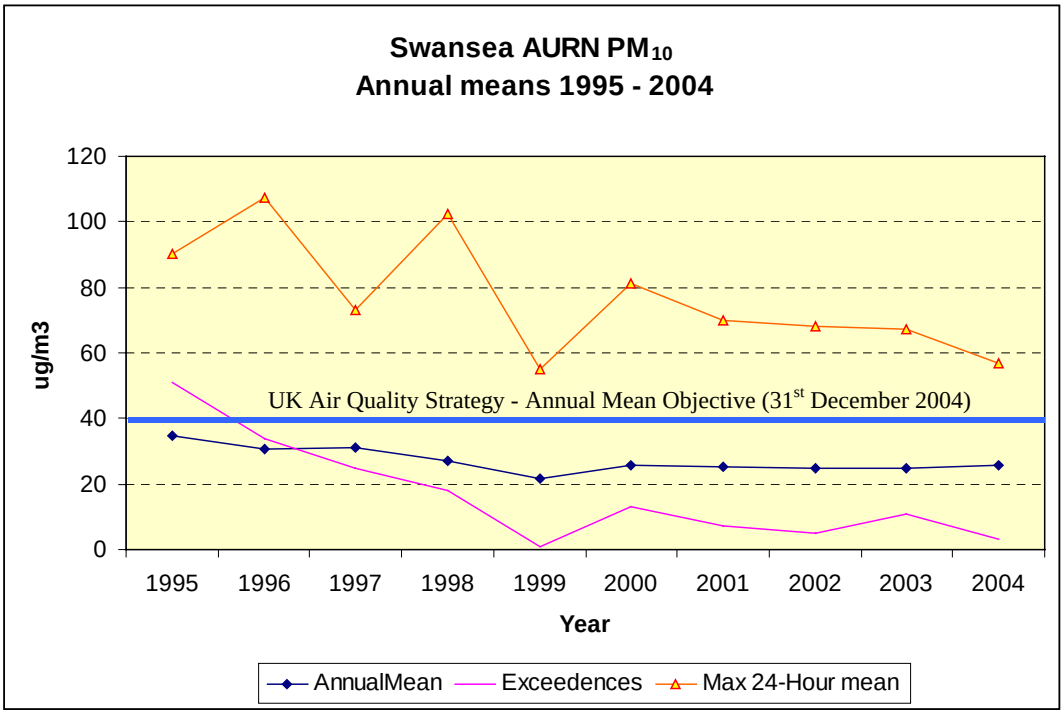
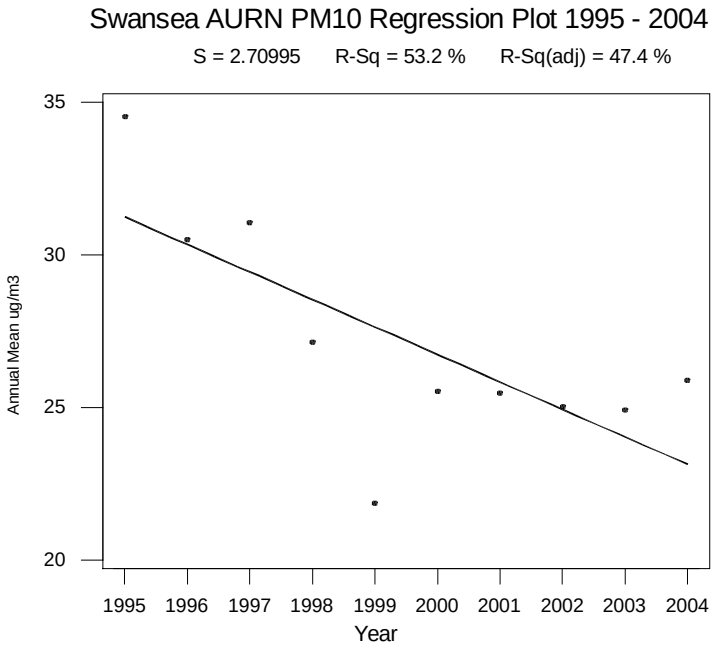


Chart 19 Swansea AURN PM_{10} Annual Means 1995 - 2004

There are obvious visual trends with the PM_{10} data from chart 19 in that there have been reductions in the annual mean from 1995 to 1999. Following a slight rise during 2000, a levelling off of the returned annual mean in subsequent years is being seen. The more pronounced reduction has been with the maximum daily concentration and its associated exceedences.

The annual mean trend is also evident from the regression analysis undertaken with the software package Minitab. The resultant regression plot is shown below as regression plot 2.



Regression Plot 2 - Swansea AURN PM10 Annual Means 1995 - 2004

The regression analysis has returned a p-value of 0.017, which, being less than 0.05, shows that the overall regression is significant.

2.2.2.3 Carbon Monoxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. . The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data expressed in mg/m^3 being provided. The ratified hourly means have then been used to calculate the running 8-hour means. 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 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). The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day. [27] A chart representing the 8-hour running means during 2004 is given below as chart 20.

There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site during 2004. The date for compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31st December 2004. Data capture for the 8-hour running means during 2004 was 98% allowing direct comparison with the objective standard.

The EU objective of a maximum daily 8-hour running mean of 10mg/ m^3 with a compliance date of 2005 also looks likely to be achieved.

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

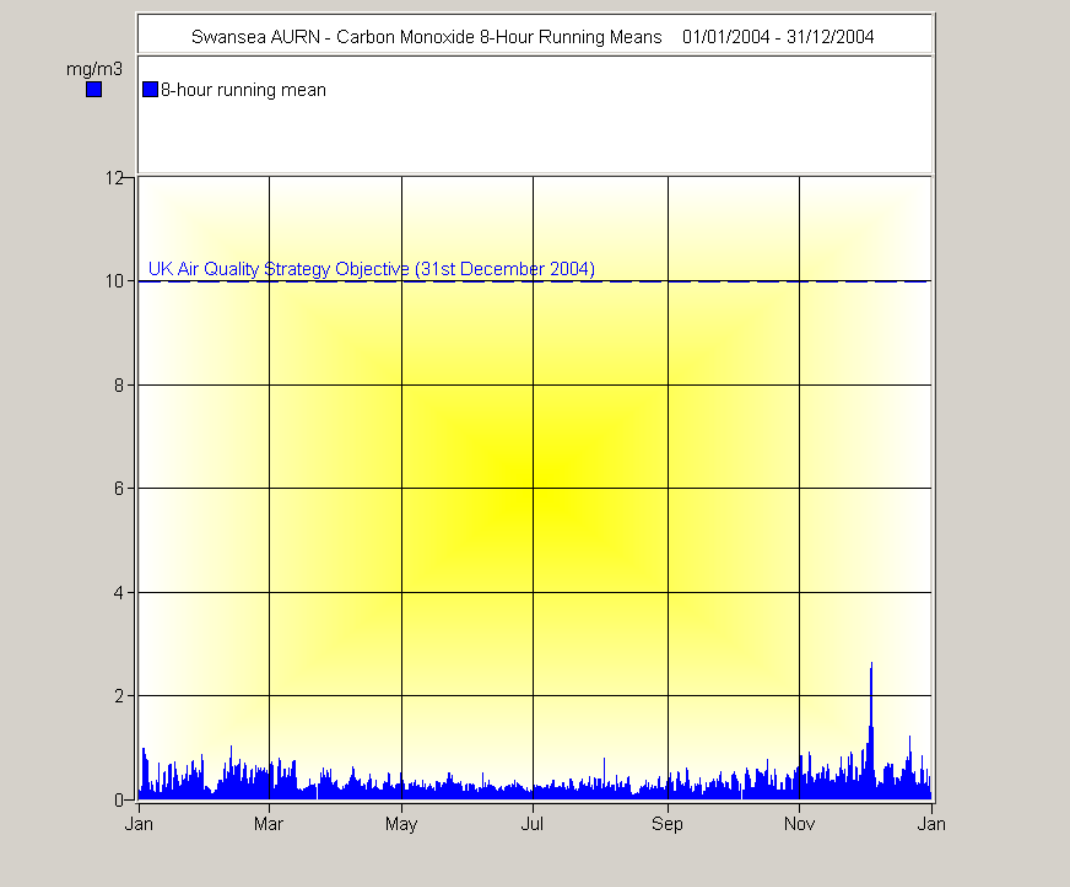


Chart 20 - Swansea AURN - Carbon Monoxide 8-Hour Running Means 2004

Monitoring commenced at this site during June 1994 but ratified data is only available from 1st December 1994. Analysis has therefore been performed from 1995 to 2004, providing 10 years of measurements to assess trends. Table 25 details the maximum running 8-hour means between 1995 and 2004 and chart 21 plots the trends over this time period.

There have been no exceedences of the maximum daily 8-hour running mean of 10mg/ m^3 recorded at this site during the whole period that the dataset extends i.e. 1995 - 2004.

Swansea AURN	Objective - Max Running 8-Hour Mean 10mµg/m^3									
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Max 8 - Hour Running Mean	**4.35**	**4.6**	**4.69**	**4.74**	**2.6**	**2.8**	**3.2**	**1.96**	**2.16**	**2.65**
Runing 8-Hour Exceedences	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Data capture %	**98**	**97**	**97**	**97**	**98**	**97**	**96**	**96**	**97**	**98**

Table 25 - Swansea AURN - Maximum daily CO 8-hour Running Means

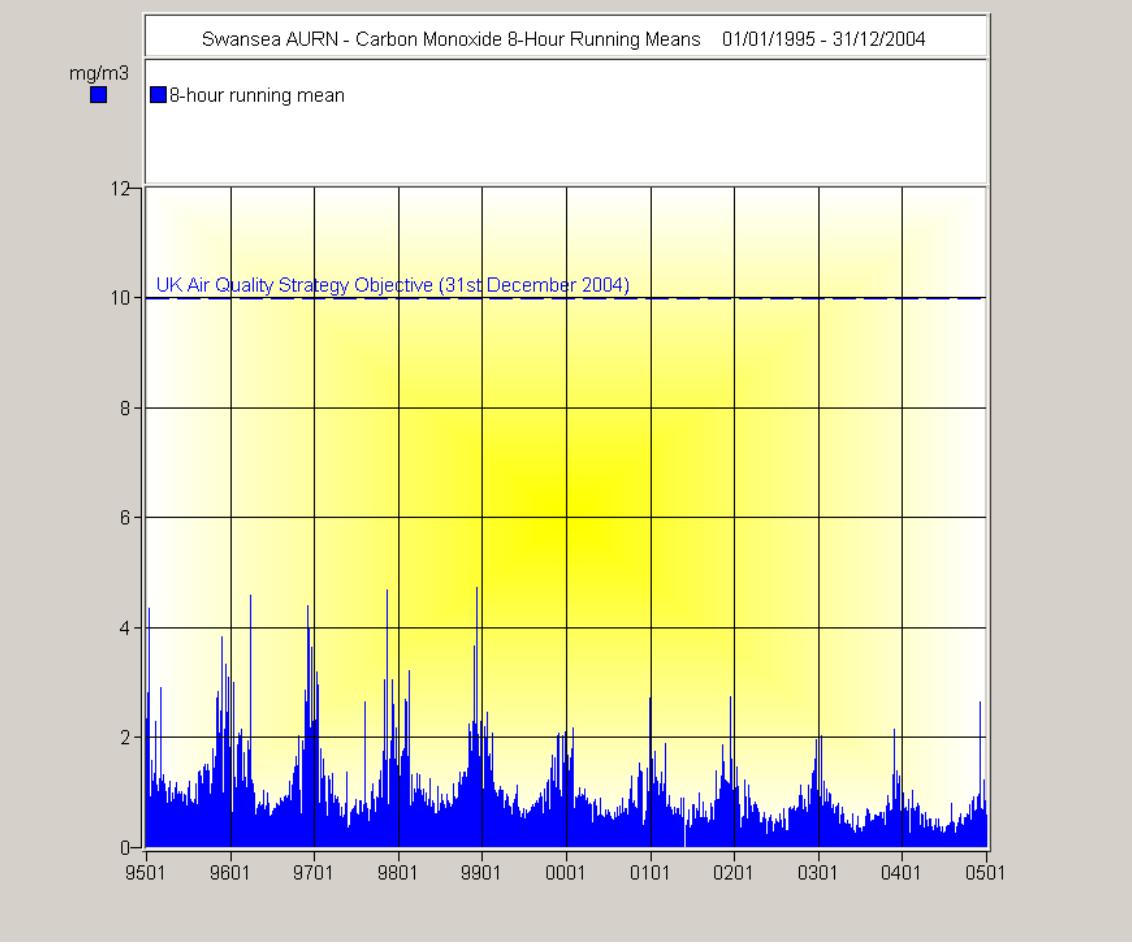


Chart 21- Swansea AURN - CO 8-hour Running Means 1995 - 2004

2.2.2.4 Sulphur Dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time SO_2 analyser. The QA/QC procedures undertaken by NETCEN have resulted in ratified 15-minute data expressed in $\mu g/m^3$ being provided. The ratified 15-minute means have been used to calculate the objectives for the hourly and 24-hour objectives.

Data from 2004 has been analysed for each of the objectives averaging periods and the results are presented below within table 26. No exceedences of any of the objectives were observed during 2004. Graphs representing the various averaging periods for 2004 and detailed within table 26, are shown below as chart 22 (15-minute means), chart 23 (1-hour means) and chart 24 (24-hour means).

Data capture at the base 15-minute logged means for 2004 is 95.42%, allowing direct comparison with the objective standards and not the percentile values.

Swansea AURN	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	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°

Table 26 - Swansea AURN - Sulphur Dioxide Monitoring 2004

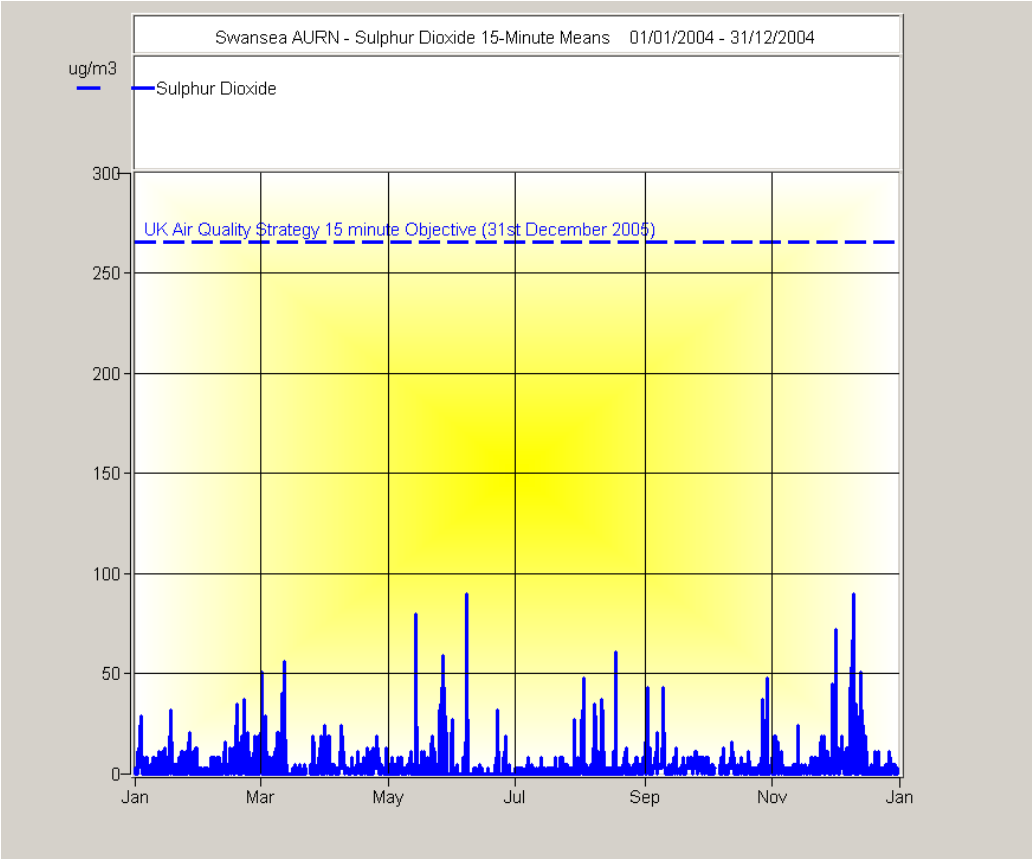


Chart 22 - Swansea AURN - 15-Minute SO_2 Means 2004

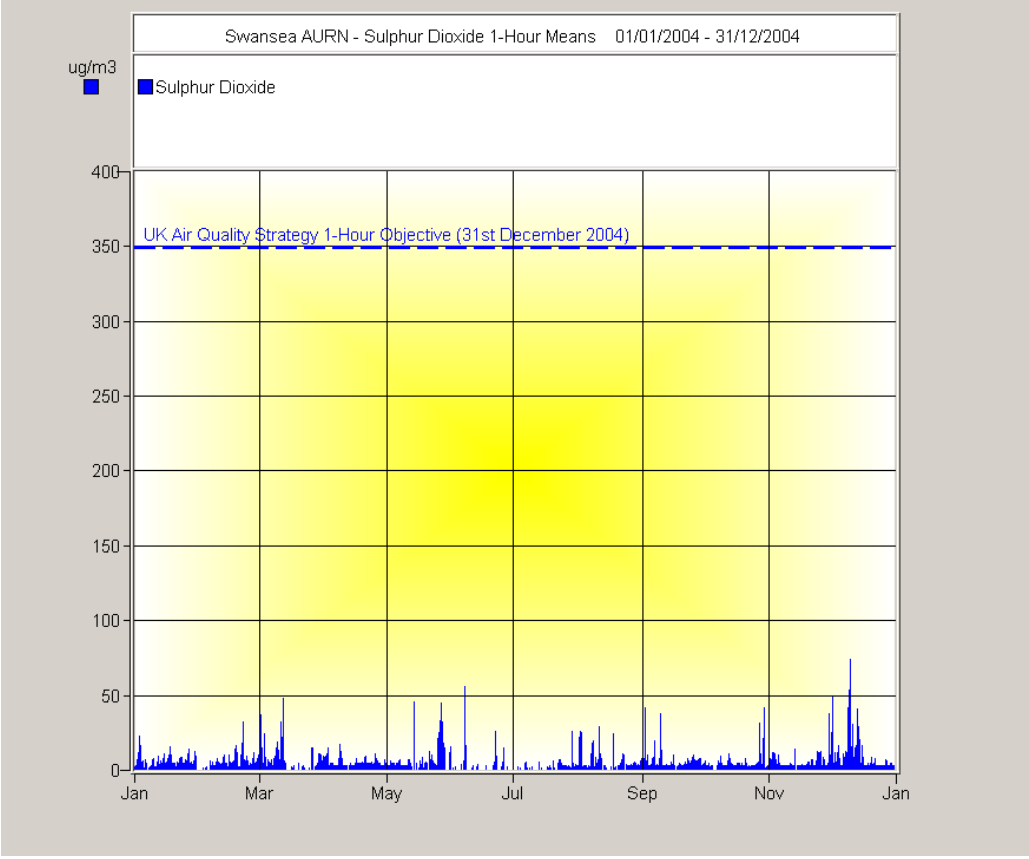


Chart 23 - Swansea AURN - 1-Hour SO_2 Means 2004

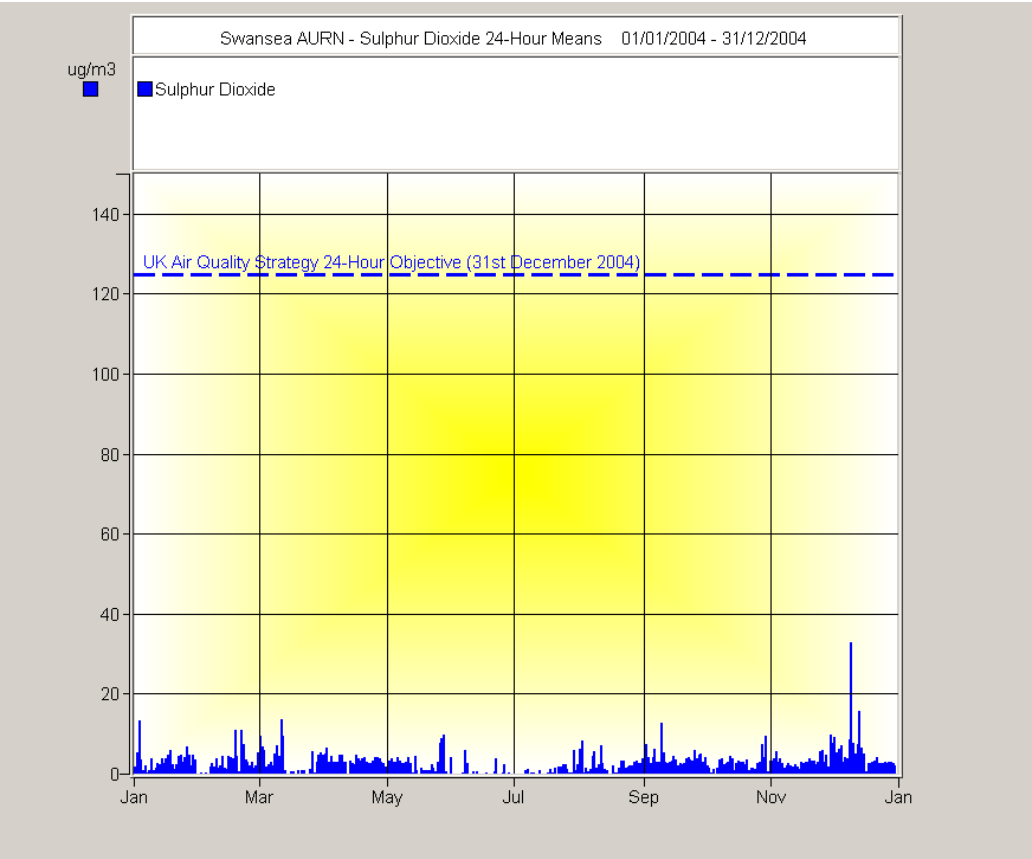


Chart 24 - Swansea AURN - 24-Hour SO_2 Means 2004

Table 27 below details the maximum concentrations recorded within the various averaging periods for the period 1995 - 2004 at the Swansea AURN. The only exceedences recorded were during 1995 and 1996 and were for what was to become the 15-minute objective. The number of exceedences recorded during these two years would not have meant a failure of the objective standard had it been in force.

Again, a similar pattern to that seen at the Morfa Groundhog and Morriston Groundhog sites is apparent from the data. A clear trend emerges from the annual mean data with a seven-fold reduction being seen since 1995. This decrease in the SO_2 concentrations within Swansea is also evident from the maximum concentrations recorded for all of the averaging periods (excepting the 15-minute and 1-hour concentrations during 2003).

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)	Annual Mean
1995	319	223	97.46	17.18
Exceedences	2	0	0	-
1996	274	176	76.38	18.10
Exceedences	1	0	0	-
1997	239	181	51.04	13.79
Exceedences	0	0	0	-
1998	184	130	46.50	11.62
Exceedences	0	0	0	-
1999	170	128	29.77	8.04
Exceedences	0	0	0	-
2000	141	96	29.92	6.28
Exceedences	0	0	0	-
2001	112	85	34.83	5.96
Exceedences	0	0	0	-
2002	165	98	26.50	4.47
Exceedences	0	0	0	-
2003	261	112	27.29	4.41
Exceedences	0	0	0	-
2004	90	72	33.52	2.50
Exceedences	0	0	0	-

Table 27 - Swansea AURN SO_2 Monitoring Data 1995 - 2004

There continues therefore, to be a very clear downward trend with regards to ambient SO_2 levels recorded at the Swansea AURN and indeed within the wider Swansea conurbation. Possible reasons for this reduction trend have been discussed in 2.1.2.4 above (Morfa Groundhog Sulphur Dioxide).

2.2.2.5 Ozone

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2004. The objective for ozone is an 8-hour mean not to exceed 100μg/m^3 on more than 10 occasions with a compliance date of 31st December 2005

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time ozone (O_3) analyser. The ratified 1-hour means provided by NETCEN have been imported into the software package OPSIS Enviman Reporter. The hourly means have been used to calculate the 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

The results from the monitoring conducted during 2004 are presented below as table 28 and chart 25 and show compliance during 2004 with the objective standard.

Swansea AURN 2004	Max 8-hour Mean (μg/m^3)	Data capture	Exceedences of 8-hour objective 100μg/m^3 (10 permitted)
	126.25	97%	5

Table 28 - Swansea AURN Ozone Monitoring 2004

Whilst the majority of the ozone 8-hour exceedences at the Morriston Groundhog occurred during March and April 2004, 3 out of the 5 ozone 8-hour mean exceedences recorded at the Swansea AURN occurred between the 1st and the 2nd August - a time where high ozone levels are more traditionally observed.

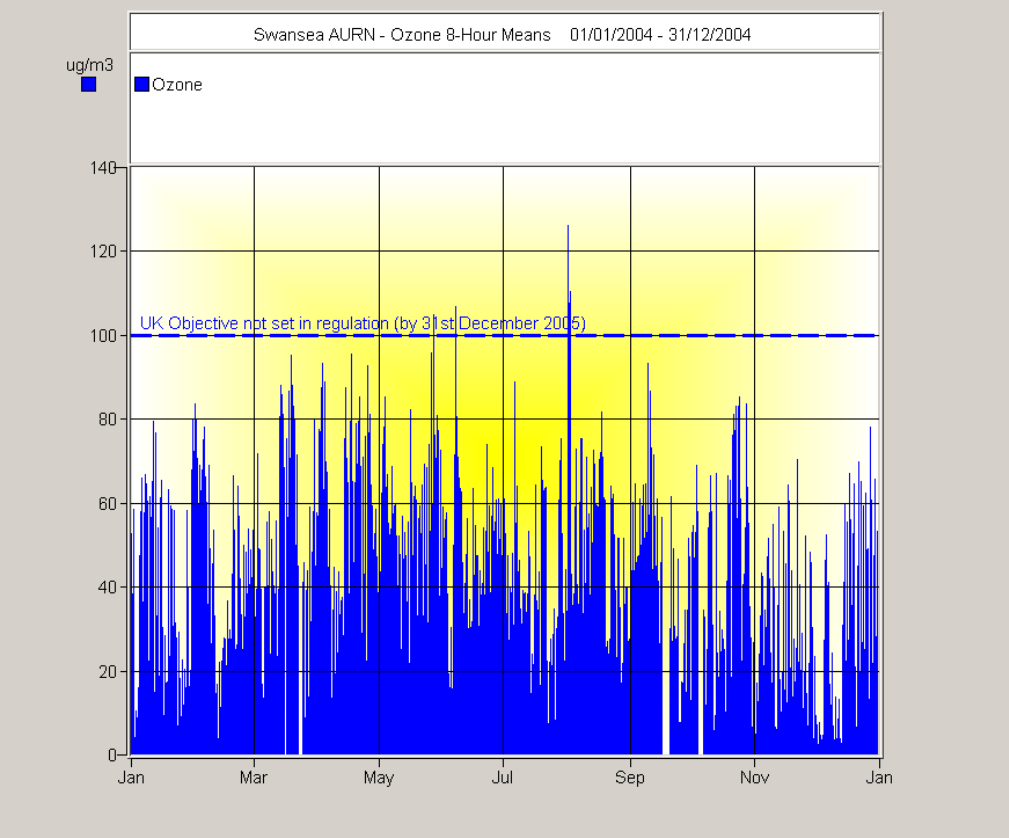


Chart 25 - Swansea AURN - Ozone 8-Hour Means 2004

Table 29 below details the maximum concentrations recorded and exceedences of the 8-hour mean objective for the period 1995 - 2004 at the Swansea AURN. The only exceedences of the objective were during 1995 and 2003. Prevailing meteorological conditions during 2003 are known to have been atypical. The ozone episodes of 2003 have been investigated by NETCEN and as mentioned within section 2.2.1.5 (Ozone Morriston Groundhog) is the subject of a report at **http://www.airquality.co.uk/archive/reports/cat12/marchapril03_episode.pdf** This report deals with the ozone episode during March - April 2003 which also saw elevated levels of PM_{10} episodes - in this instance, air mass back trajectories indicated the ozone precursors originated from within eastern Europe.

Year	Max 8-hour Mean ($\mu g/m^3$)	Data capture %	Exceedences of 8-hour objective $100\mu g/m^3$ (10 permitted)
1995	181.00	96.53	21
1996	114.75	97.18	7
1997	113.75	96.89	3
1998	112.25	96.35	3
1999	127.50	98.17	7
2000	123.75	97.81	7
2001	138.75	94.34	5
2002	100.75	98.36	1
2003	144.50	97.99	30
2004	126.25	97%	5

Table 29 - Ozone 1995 - 2004 Swansea AURN

2.3 Non Automatic Monitoring Data

The authority operates a network of passive nitrogen dioxide diffusion tubes. Some sites provide data to the UK Non-Automatic (NO_2) Network on a weekly and monthly basis. The remainder of the sites form part of specific studies within areas of concern. The datasets from these studies may therefore be for a limited time frame whilst conditions are assessed.

The contract for the supply and analysis of all passive diffusion tubes has been awarded to Harwell Scientifics of 551 South Becquerel Avenue, Harwell International Business Centre, Didcott, Oxon.

This contract laboratory has been operating for over 15 years and has extensive UKAS accreditation. In addition all work is accredited to BS EN ISO 9001. Its predecessor the EMS Division, Harwell, carried out Swansea's original NO_2 mapping in 1985/86.

Data is presented below in both its "raw" format and bias corrected format. The bias correction factor used for 2004 is 0.75 as advised by Harwell Scientifics.

2.3.1 UK Non-Automatic (NO_2) Network Sites

During 2004, the authority supplied data from four sites to the UK Non-Automatic Network. Only monthly time series data is presented here.

2.3.1.1 Hafod Post Office - 1N

This authority have operated a roadside measurement site at the Hafod Post Office at Neath Road, Hafod since the mid 1970's. The site is located on the façade of the Post Office building within the narrow and congested section of Neath Road that is the centre of the authorities Hafod Air Quality Action Plan. Map 5 below shows the site in relation to the OPSIS DOAS transmitter ❶ along Neath Road.

Map 5 - 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. Data from 2004 is presented below as table 30, expressed in $\mu g/m^3$.

Month	Measured Data $\mu g/m^3$
January	-
February	65
March	68
April	58
May	61.1
June	54
July	41.4
August	38.4
September	54.8
October	63
November	76.8
December	66.7
Annual mean	58.8
Bias Corrected Annual Mean	44.1

Table 30 - Hafod Post Office NO_2 Tube Monitoring 2004

As can be seen from table 30, the annual mean returned for 2004 is above the UK air quality objective of $40\mu g/m^3$ and is further evidence that the Hafod Air Quality Management Area remains justified.

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[28] for roadside sites. Using this method a projected annual mean of $42.99\mu g/m^3$ is obtained for 2005. It is therefore projected that the objective standard of $40\mu g/m^3$ will not be achieved by the compliance date of 31st December 2005

Annual Means for the Hafod Post Office site between 1993 and 2004 have been calculated and are shown below in table 31. Table 31 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, 0.75 for 2004, 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	44.1

Table 31 - Hafod Post Office Passive NO_2 Tubes 1993-2004

Table 31 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. No noticeable trend can be seen apart from the consistency of the levels being recorded.

2.3.1.2 Uplands - 2N and 5N

A measurement site (2N) ❶ at Uplands Crescent, Uplands has been operational since 1993. The location of the site however changed from January 2001. Between January 1993 and December 2000 the sampling site was located to the

[28] LAQM.TG(03) box 6.6 page 6-9

pine end/façade of a commercial premises. 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) ❷ has been relocated roadside and now provides a worse case scenario measurement.

Map 6 - Location of Uplands 2N and 5N NO_2 Tube Sampling

Data from Uplands site 5N for 2004 is presented below as table 32, expressed in $\mu g/m^3$.

Month	Measured Data $\mu g/m^3$
January	-
February	45
March	57
April	51.1
May	38.3
June	43.9
July	37.1
August	37.4
September	46.8
October	44.5
November	51.7
December	61.4
Annual mean	46.75
Bias Corrected Annual Mean	35.06

Table 32 - Uplands (5N) Passive NO_2 Monitoring Data 2004

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[29] for roadside sites. Using this method a projected annual mean of 34.17$\mu g/m^3$ is obtained for 2005. Using the LAQM.TG(03) guidance method it is projected that the annual mean objective standard not to exceed 40$\mu g/m^3$ will be achieved at the compliance date of 31st December 2005

For reference purposes, annual mean data from the previous site Uplands 2N between 1993 and 2000 is shown below as table 33. Annual mean data is shown below for site Uplands 5N from 2001 to 2004 as table 34

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

[29] LAQM.TG(03) box 6.6 page 6-9

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, 0.75 for 2004, 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 33 - 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	35.06

Table 34 - Uplands Site 5N NO_2 Tube Data 2001 - 2004

2.3.1.3 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)[30] and can be seen within map 7 below. The site is located in a residential area to the west of the city centre.

Map 7 - Location of West Cross 4N NO_2 Tube Sampling

Data from monitoring undertaken during 2004 is presented below as table 35 and is expressed in $\mu g/m^{-3}$. The bias factor that has been used is 0.78 from 1993

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

to 2003 and as mentioned above, 0.75 for 2004, as advised by Harwell Scientifics Ltd.

Month	Measured Data $\mu g/m^3$
January	-
February	20
March	2
April	10.9
May	11
June	8.7
July	5.5
August	4.8
September	-
October	16
November	19.6
December	20.7
Annual mean	11.92
Bias Corrected Annual Mean	8.94

Table 35 - West Cross site 4N - NO_2 Tube Monitoring Data 2004

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[31] for background sites. Using this method a projected annual mean of $8.75\mu g/m^3$ is obtained for 2005 and it is therfore projected that the annual mean objective standard not to exceed $40\mu g/m^3$ will be achieved at the compliance date of 31st December 2005.

Annual mean data is shown below for West Cross site 4N between 1993 and 2004 as table 36. 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.

[31] LAQM.TG(03) box 6.7 page 6-29

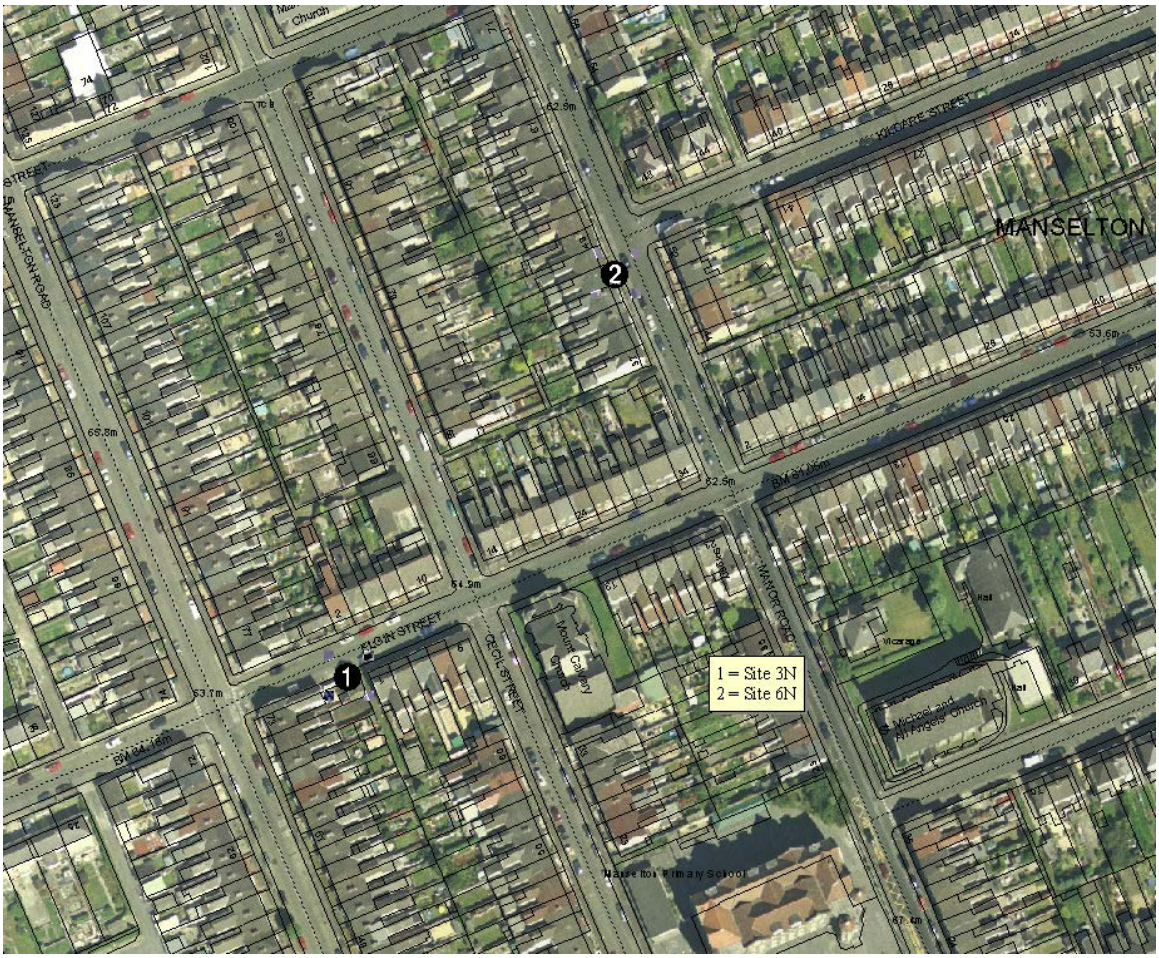
Year	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1993	21.33	16.64
1994	15.47	12.07
1995	19.04	14.85
1996	19.58	15.27
1997	17.80	13.88
1998	12.55	9.79
1999	13.93	10.87
2000	13.19	10.29
2001	15.00	11.70
2002	18.92	14.76
2003	18.57	14.48
2004	11.92	8.94

Consideration is being given to decommissioning this site during 2005 as the property has been offered for sale. This coupled with the consistent low readings may see it ceasing measurement. Its use a representative Suburban site, removed from major traffic sources may however see monitoring continue within the area if not from exactly the same location.

2.3.1.4 Manselton - Sites 3N and 6N

A measurement site (3N) ❶ at Elgin Street, Manselton had been operational since 1993. 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) ❷ during October 2004. The site classification has remained as Urban Background (U4)[32] allowing direct comparison between the two locations. Map 8 shows the location of both sampling sites.



Map 8 - Manselton Sites 3N and 6N - NO_2 sampling Locations

Data from monitoring undertaken during 2004 is presented below as table 37 and is expressed in $\mu g/m^{-3}$. The bias factor that has been used is 0.78 from 1993 to 2003 and as mentioned above, 0.75 for 2004, as advised by Harwell Scientifics Ltd.

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

Month	Measured Data $\mu g/m^3$
January	-
February	32
March	29
April	24
May	23.8
June	20.3
July	41.5
August	-
September	-
October	26.8
November	31.6
December	33.5
Annual mean	29.17
Bias Corrected Annual Mean	21.88

Table 37 Manselton Sites 3N and 6N NO_2 Monitoring 2004

Data capture for 2004 is 75% permitting the calculation of the annual mean.

It is possible to project forward the annual mean from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[33] for background sites. Using this method a projected annual mean of 21.43$\mu g/m^3$ is obtained for 2005. It is therefore projected that the annual mean objective standard not to exceed 40$\mu g/m^3$ will be achieved at the compliance date of 31st December 2005.

Annual mean data is shown below for Manselton sites 3N and 4N between 1993 and 2004 as table 38. 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

[33] LAQM.TG(03) box 6.7 page 6-29

evident within the annual mean for that year. This effect is 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	21.88

Table 38 Manselton Sites 3N and 6N NO_2 Monitoring 1993 - 2004

2.3.2 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 as this work has not been reported on fully, the whole period of monitoring is reported here, regardless of whether the period of monitoring falls wholly within 2004 or not.

2.3.2.1 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) [34] or Urban Background (U4)[35] classifications. The location of the sample sites is shown in Map 9 with additional site location details contained within table 39.

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

Map 9 - Gowerton Bypass Phase 2 NO_2 Sampling Locations

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 39 - 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 40. A bias factor of 0.78 has been used for 2003 with a bias factor of 0.75 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	12.64
2	26.19	20.43	23.39	17.54
3	31.34	24.45	24.39	18.29
4	41.40	32.29	32.97	24.73
5	45.41	35.42	36.95	27.71
6	50.71	39.55	36.65	27.49
7	25.49	19.88	16.45	12.33
8	37.48	29.23	29.71	22.28
9	37.27	29.07	28.12	21.09
10	38.97	30.39	24.08	18.06

Table 40 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 40μg/m^{-3} is site 6. The bias corrected result shows the annual mean to be just 0.45μg/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.

2.3.2.2 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) [36] or Urban Background (U4)[37] classifications. The location of the sample sites is shown in Map 10 with additional site location details contained within table 41. 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.

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

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 10 - 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 41 - 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[38] 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[39]. 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.

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 42 - Loughor NO_2 Monitoring Annual means

38 *LAQM.TG(03) Box 6.2 (A3)page 6-15*

39 *LAQM.TG(03) Box 6.5 page 6-8*

It is clear from table 42 that no location looks likely to approach the annual mean objective in 2005 of 40μg/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.

2.3.2.3 Updating and Screening Assessment - Detailed Assessment Work.

The authority completed its Updating and Screening Assessment (USA) report during July 2004. The findings of this review resulted in a recommendation that a Detailed Assessment be undertaken around identified busy junctions. Fifty-five passive NO_2 diffusion tube monitoring locations were identified around several junction and monitoring works commenced during June 2004. Again, the monitoring locations chosen were to present a worst case scenario. The majority of the monitoring locations chosen are where receptor locations' i.e. domestic dwellings front directly onto the pavement around these junctions. Numerous monitoring locations are located either on the façade of dwellings or are within 2m of the front façade.

This work remains on going and will be the subject of a separate report. Details of the sites chosen are given within table 43. A full year's worth of data is now

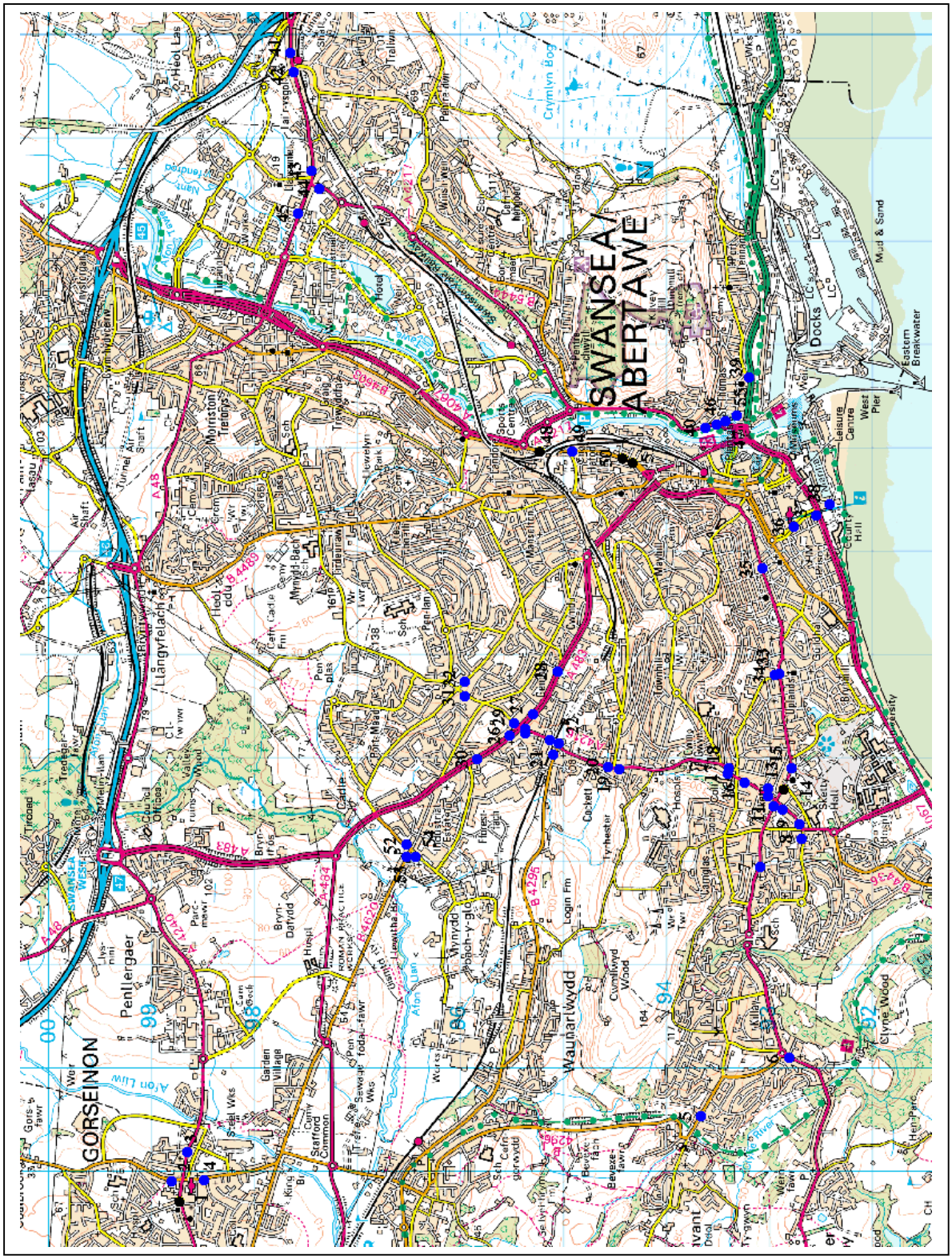
available (from June 2004 - June 2005) and for sake of completeness, the measured annual means and bias corrected annual means are presented below as table 44. Map 11 indicates the areas where monitoring is taking place.

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

Site	Easting	Northing	Roadside (U2)	Location
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

Table 43 - Updating and Screening Assessment NO_2 Monitoring Locations

The calculations of the "annual mean" that are presented here are for the period June 2003 - June 2004 representing a full year of measurement. Additional details will be presented as part of the detailed assessment report that will be prepared. The bias factor used to correct the measured tube data is 0.75 for 2004 /2005.



Reproduced from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationary Office. Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
City & County of Swansea 100013350

Map 11 - Updating and Screening NO_2 Detailed Assessment Monitoring Locations

Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$	Site	Measured NO_2 Annual Mean $\mu g/m^{-3}$	Bias Corrected Annual Mean $\mu g/m^{-3}$
1	33.8	25.35	29	44.91	33.68
2	26.35	19.76	30	47.26	35.45
3	38	28.50	31	29.5	22.13
4	35.42	26.57	32	32.33	24.25
5	31.24	23.43	33	45.85	34.39
6	23.81	17.86	34	45.04	33.78
7	36.2	27.15	35	51.24	38.43
8	30.24	22.68	36	42.4	31.80
9	35.12	26.34	37	45.26	33.95
10	39.29	29.47	38	30.36	22.77
11	41.46	31.10	39	37.77	28.33
12	37.47	28.10	40	44.42	33.32
13	26.15	19.61	41	39.66	29.75
14	53.86	**40.40**	42	40.66	30.50
15	36.77	27.58	43	43.19	32.39
16	32.68	24.51	44	39.85	29.89
17	45.86	34.40	45	31.5	23.63
18	32.16	24.12	46	33.82	25.37
19	31.77	23.83	47	49.16	36.87
20	31.8	23.85	48	61.83	**46.37**
21	30.84	23.13	49	47.01	35.26
22	31.77	23.83	50	65.43	**49.07**
23	36.82	27.62	51	56.86	**42.65**
24	25.2 *	18.90 *	52	24.82	18.62
25	40.73	30.55	53	33.2	24.90
26	43.55	32.66	54	25.27	18.95
27	38.95	29.21	55	52.7	39.53
28	36.78	27.59			

Table 44 - Updating and Screening Assessment - NO_2 Annual Means June 2003 - June 2004

** Data capture less than 75%*

The monitoring undertaken has highlighted 4 sites where the corrected NO_2 annual mean is above the objective standard of 40$\mu g/m^{-3}$ (marked as black within Map 11 above). However, 3 of these failing sites (sites 48, 50 and 51) represent additional monitoring within the existing Hafod Air Quality

Management Area. The other newly identified site (site 14) is outside of the Hafod Air Quality Management Area.

A further 5 sites (sites 30, 35, 47, 49 and 55) are within the annual mean range 35 - 40μg/m^{-3}. Sites 47 and 49 again represent additional monitoring within the existing Hafod Air Quality Management Area. These 5 sites can be considered as having the potential to breach the objective standard.

It is possible to project forward the annual means from 2004 to 2005 using the method set out within Technical guidance LAQM.TG(03)[40] for roadside sites. Using this method the following projections within table 44(a) have been obtained for 2005.

Site	Bias Corrected Annual Mean μg/m^{-3}	Projected 2005	Site	Bias Corrected Annual Mean μg/m^{-3}	Projected 2005
1	25.35	24.71	29	33.68	32.84
2	19.76	19.27	30	35.45	34.55
3	28.50	27.78	31	22.13	21.57
4	26.57	25.90	32	24.25	23.64
5	23.43	22.84	33	34.39	33.52
6	17.86	17.41	34	33.78	32.93
7	27.15	26.47	35	38.43	37.46
8	22.68	22.11	36	31.80	31.00
9	26.34	25.68	37	33.95	33.09
10	29.47	28.73	38	22.77	22.20
11	31.10	30.31	39	28.33	27.62
12	28.10	27.40	40	33.32	32.48
13	19.61	19.12	41	29.75	29.00
14	40.40	39.38	42	30.50	29.73
15	27.58	26.88	43	32.39	31.58
16	24.51	23.89	44	29.89	29.14
17	34.40	33.53	45	23.63	23.03

[40] LAQM.TG(03) box 6.6 page 6-9

18	24.12	23.51	46	25.37	24.73
19	23.83	23.23	47	36.87	35.94
20	23.85	23.25	48	46.37	**45.21**
21	23.13	22.55	49	35.26	34.37
22	23.83	23.23	50	49.07	**47.84**
23	27.62	26.92	51	42.65	**41.57**
24	18.90	18.42	52	18.62	18.15
25	30.55	29.78	53	24.90	24.27
26	32.66	31.84	54	18.95	18.48
27	29.21	28.48	55	39.53	38.53
28	27.59	26.89			

Table 44(a) - USA Projected Annual Means 2005

Only 3 sites, all 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 14, which lies outside of the HAFOD AQMA, is projected to show marginal compliance with the objective standard at the compliance date of 31st December 2005.

It is proposed to continue NO_2 monitoring at site 14 for the foreseeable future to verify the predictions of LAQM.TG(03). This will occur at this and several other sites to build up a long term dataset of those locations thought to be at risk of breaching the UK annual mean objective standard during 2005 and the EU objective during 2010.

2.4 Other Monitoring Works

2.4.1 Radon Monitoring

Radon is a naturally occurring gas produced from the decay of uranium. Uranium is present in all rocks and soils thus radon is present to a greater or lesser extent in all buildings and even outdoor air.

Starting in the early 1980's the National Radiological Protection Board (NRPB) has undertaken surveys of radon levels in homes to determine the average levels and also to identify areas where high levels were likely to be found. In 1990, formal advice was given to Government to limit exposure. An Action Level for homes was proposed and accepted, its value, expressed as the annual average of the radon gas concentration, was set at 200 Bq m^{-3}. The NRPB also recommended that when the annual average level of radon in an existing dwelling exceeds the Action level remedial action is advisable and when the remedial action is taken, the annual average radon concentration should become as low as reasonably practicable. The Government accepted this advice.

Areas where 1% or more of homes are predicted to exceed the Action Level are defined as radon Affected Areas so as to focus attention on the right parts of the country. Existing homes in Affected Areas should have a radon measurement. The latest advice on radon Affected Areas in Wales was given to Government in 1998[41]. Central to this advice was a map which defined radon Affected Areas by 5km squares of the Ordnance Survey grid - see map 12. More recently, a new map has been published[42]. From map 12 it can be seen that the whole of the

41 *NRPB. Radon Affected Areas:Wales - 1998 Review, Doc.NRPB, 9, No.3 (1998)*

42 *Green B M R, Miles J C H, Bradley E J, Rees D M. Radon atlas of England and Wales. NRPB, Chilton, NRPB-W26 (2002)*

unitary area of the City & County of Swansea is within an area identified where <1% of homes are predicted to exceed the Action Level.

The recommended measurement procedure for dwellings uses two passive detectors over a 3-month period. This evens out the temporal variations in indoor radon levels and can be used to estimate the annual average concentration for the property.

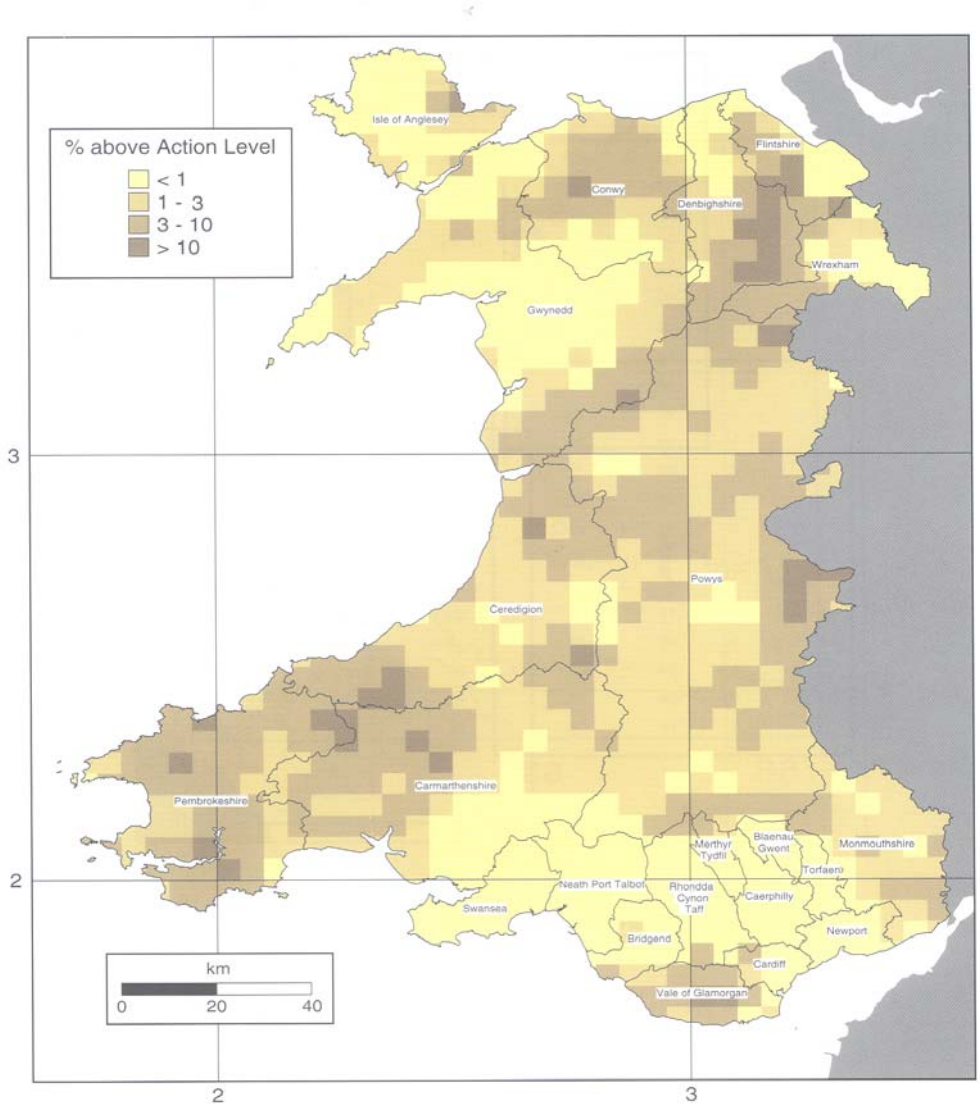


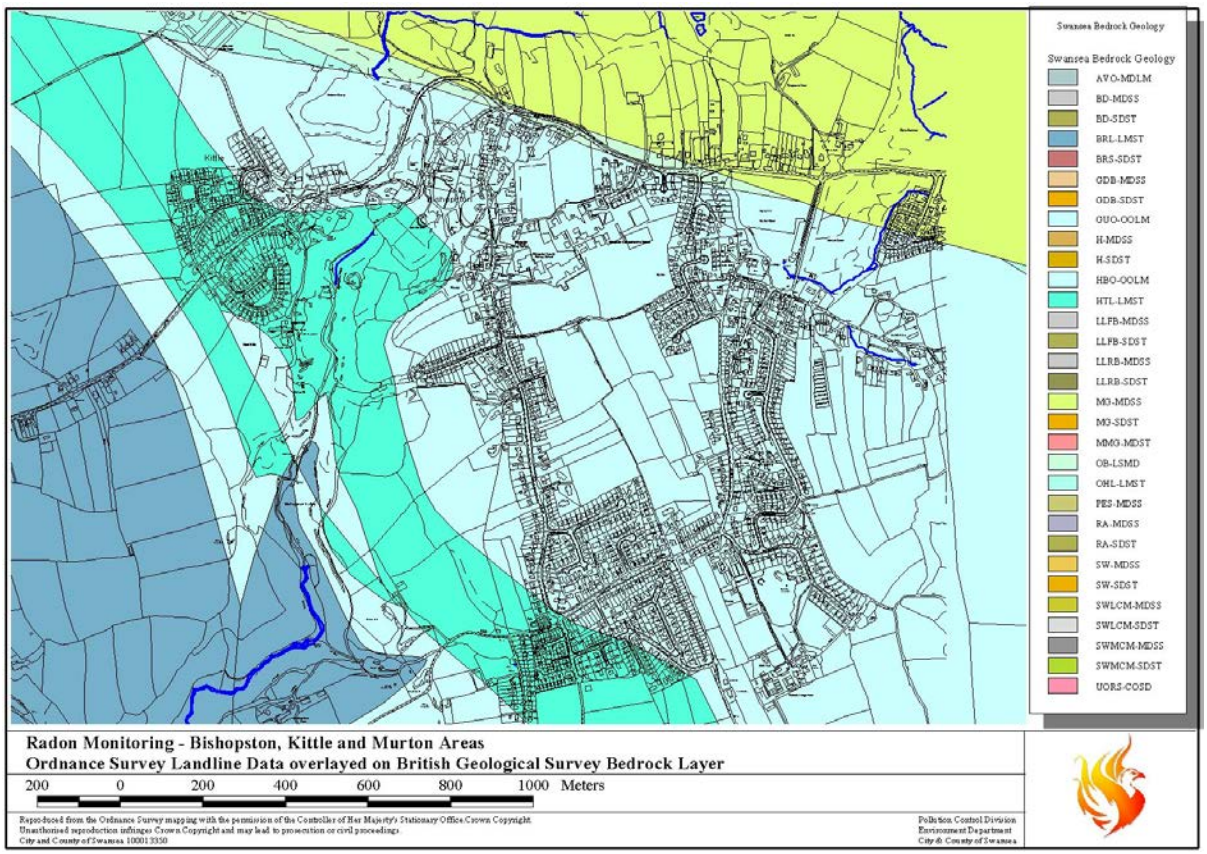
FIGURE 3 Estimated proportion of homes exceeding the Action Level in each 5 km grid square in Wales

Map 12 -Courtesy of NRPB - Radon in Dwellings Wales:Atlas and 1998 Review

In November of 2001, this authority commissioned a survey of 25 properties within the Bishopston, Kittle and Murton areas of Gower. Each monitoring pack consisted of two detectors and full placement instructions. One detector was to be placed in the living area and the other in a regularly used bedroom. The detectors remained in-situ for 3 months. A questionnaire was also included to obtain information about placement period, the positions of the detectors and the property construction; this information is required when calculating the results. The annual average for the property was calculated on the assumption that the detectors were placed in accordance with the instructions and that people spend 45% of their time at home in the living area and 55% of the time in the bedroom. A correction factor is also applied to account for seasonal variations. Measurement uncertainty is estimated to be ± 15% (1 standard deviation of the mean). The annual average radon concentration can then be compared with the action Level of 200 Bq m^{-3}.

For anonymity, the property addresses where measurements were undertaken are not given below within table 45. Results have been grouped into area i.e. Bishopston, Kittle and Murton.

Geological map layers have been purchased through the British Geological Survey and have been used as an overlay with the Landline mapping data from Ordnance Survey. An example map can be seen below as map 13 for the area of interest. It has traditionally been the view that radon migration would normally only be expected in areas where granite was present in the underlying strata. However, it has recently been discovered that underlying areas of limestone where they are fissured and storing pools of water can also be affected by radon migration. This situation typifies a large portion of the Gower peninsula.



Map 13 - Radon Monitoring Areas

Bishopston	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 1	290	260	240
Property 2	1100	590	630
Property 3	39	49	34
Property 4	20	16	14
Property 5	24	<10	12
Property 6	140	100	89
Property 7	<10	87	39
Property 8	<10	<10	<10
Property 9	37	27	24
Property 10	-	-	-
Property 11	81	100	69
Property 12	63	43	40
Property 13	130	93	84
Property 14	57	70	49
Property 15	310	190	180
Property 16	780	440	450
Property 17	13	29	17

Property 18	480	360	310
Property 19	150	150	120
Property 20	57	34	34
Kittle	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 21	73	99	67
Property 22	410	-	260*
Property 23	160	73	86
Property 24	-	-	-
Murton	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 25	-	-	-

* *Greater uncertainty as annual average based on single detector result*

Table 45 - Radon Monitoring results

The initial survey identified 5 properties found to be above the Action Level. In November 2002, a further follow-up survey was commissioned of 22 properties to repeat 17 of the original tests undertaken in the initial survey along with 5 new properties. The results of the repeat study are given below as table 46.

Bishopston	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 1	360	320	260
Property 2	1100	490	580
Property 3	57	39	36
Property 4	31	20	19
Property 5	23	15	14
Property 8	<10	11	<10
Property 14	72	42	42
Property 15	330	190	190
Property 16	720	410	420
Property 17	24	31	21
Property 18	290	220	190
Property 19	200	270	180
Property 20	100	81	65

Kittle	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 21	550	490	390
Property 22	230	110	130
Property 23	110	74	68
Murton	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 25	31	-	19

Table 46 - Repeat Radon Measurements November 2002

The repeat monitoring have highlighted 4 properties above the Action Level with a further 3 approaching the Action Level. The results of the new monitoring undertaken between November 2002 and February 2003 are given below as table 47.

Bishopston	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 26	-	-	-
Property 27	37	32	26
Property 28	67	49	43
Gowerton	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 29	27	19	17
Murton	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 30	120	55	63

Table 47 - Additional Radon Monitoring November 2002

Of the new monitoring undertaken between November 2002 and February 2003, all properties are well below the Action Level limit.

A further study of nine properties was commissioned in November 2003. The results of this additional monitoring were reported by the NRPB during April of 2004 and are shown below as table 48.

Bishopston	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 31	35	32	25
Property 32	100	110	82
Brynmill	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 33	38	25	23
Dunvant	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 34	42	20	22
Gowerton	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 35	17	16	13
Property 36	24	12	13
Mumbles	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 37	55	34	33
Southgate	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 38	21	<10	10
West End	Radon Concentration Bq m^{-3}.		
	Living Area	Bedroom	Annual Average
Property 39	28	27	21

Table 48 - Radon Monitoring November 2003 - April 2004

This latest study has shown all 9 properties to be well below the Action Level. Owners of those properties shown to be approaching or exceeding the

recommended Action Levels have been supplied with detailed remediation measures to reduce the presence of radon within their properties.

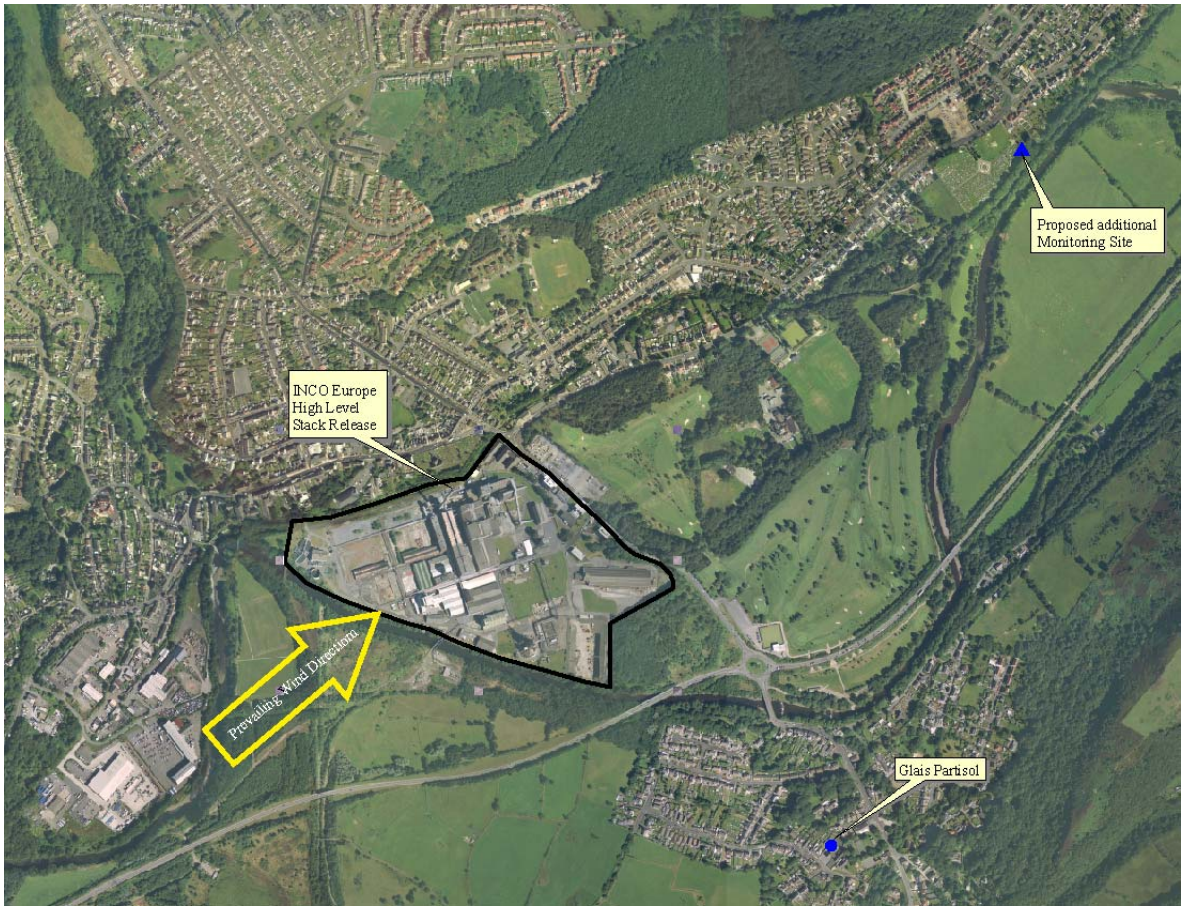
2.4.2 Heavy Metals Monitoring

The Department of the Environment, Transport and the Regions (DETR) is funding a 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 within map 14.

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. Results are available for 2004 as monthly means for all metals monitored and are given below as table 49. All measurements are expressed as ng/m^{-3} (nano grammes.) There are some data missing for some elements between January and August 2004 - 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.



Map 14 - Heavy Metals Monitoring -Glais Partisol

Month	As	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Pt	V	Zn	Hg
January							**22.73**					
February							**25.47**					
March							**26.65**					
April							**36.88**					
May							**52.67**					
June							**54.91**					
July							**45.38**					
August							**35.74**					
September	0.41	0.12	0.12	5.41	84	3.26	**26.52**	5.03	0.003	1.33	4.0	0.05
October	0.61	0.15	2.77	2.87	103	6.86	**20.19**	8.94	0.000	1.08	18.6	0.00
November	0.70	0.14	0.88	5.21	102	1.99	**33.98**	10.33	0.000	1.08	11.8	0.37
December	1.36	0.71	1.40	6.88	169	5.18	**25.05**	42.70	0.180	1.62	28.2	0.00
Annual	**0.77**	**0.28**	**1.29**	**5.09**	**114**	**4.3**	**33.83**	**16.75**	**0.046**	**1.28**	**15.6**	**0.11**

Mean ng/m^{-3}												

Table 49 - Heavy Metals Monitoring 2004 - Glais Partisol - Glais Primary School

On the 16th July 2003 the European Commission adopted a proposal for a Directive relating to arsenic, cadmium, nickel, mercury and ploycyclic hydrocarbons (PAH) in ambient air[43]. The target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of Best Available Technique (BAT). There are therefore, as yet, no binding obligations to reduce these pollutants. Ambient air concentrations of these substances only have to be monitored once emissions have passed a critical threshold.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and bezo(a)pyrene and these are reproduced below as table 50.

Pollutant	Target value ng/m^{-3}
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Table 50 - Target Values 4th Daughter Directive - Heavy Metals Monitoring

Annual means for nickel are available from 2002 - 2004 from the UK Heavy Metal Monitoring Survey being conducted at Glais Primary School and are given below as table 51.

Year	Annual Mean ng/m^{-3}
2002	28.91
2003	18.14
2004	33.83

43 *COM 2003 (423)*

Table 51 - Glais Partisol Heavy Metals Monitoring - Nickel Annual Means 2002 - 2004

The annual mean for nickel from 2003 seen within table 51 is probably attributable to the atypical meteorological conditions that were known to prevail throughout 2003. Whilst ambient levels of other pollutants mentioned elsewhere within this Progress Report were elevated due to these atypical meteorological conditions it is apparent that the prevailing wind directions during 2003 had the opposite effect at this site. The depressed levels of nickel recorded are more likely because the winds were blowing away from the monitoring location. This situation is probably to be expected when only one monitoring location is used. If 2003 is discounted for the time being, it is clear that ambient levels of nickel within the vicinity of the refinery are above the 4th Daughter Directive target annual mean levels.

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. The monitoring undertaken by this authority will be undertaken with high volume samplers, capable of sampling 70m^3 of air per hour and fitted with a PM_{10} size selective inlet head. This authority is considering two additional monitoring locations. To date one additional monitoring location is being considered directly upwind of the prevailing wind direction within Coed-Gwilym Cemetery. This provisional location is identified within map 14 above.

Information to hand would indicate that low-level fugitive emissions are minimal and that the vast majority of release is via the high-level discharge stack. It is anticipated that the proposed monitoring location at Coed-Gwilym Cemetery will be within the footprint of the stack plume. Additional monitoring locations are also 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.

3. New Local Developments

3.1 New A1, A2 and Part B Processes

There have been no new processes established within the boundary of the authority during 2004.

3.2 New Retail Development

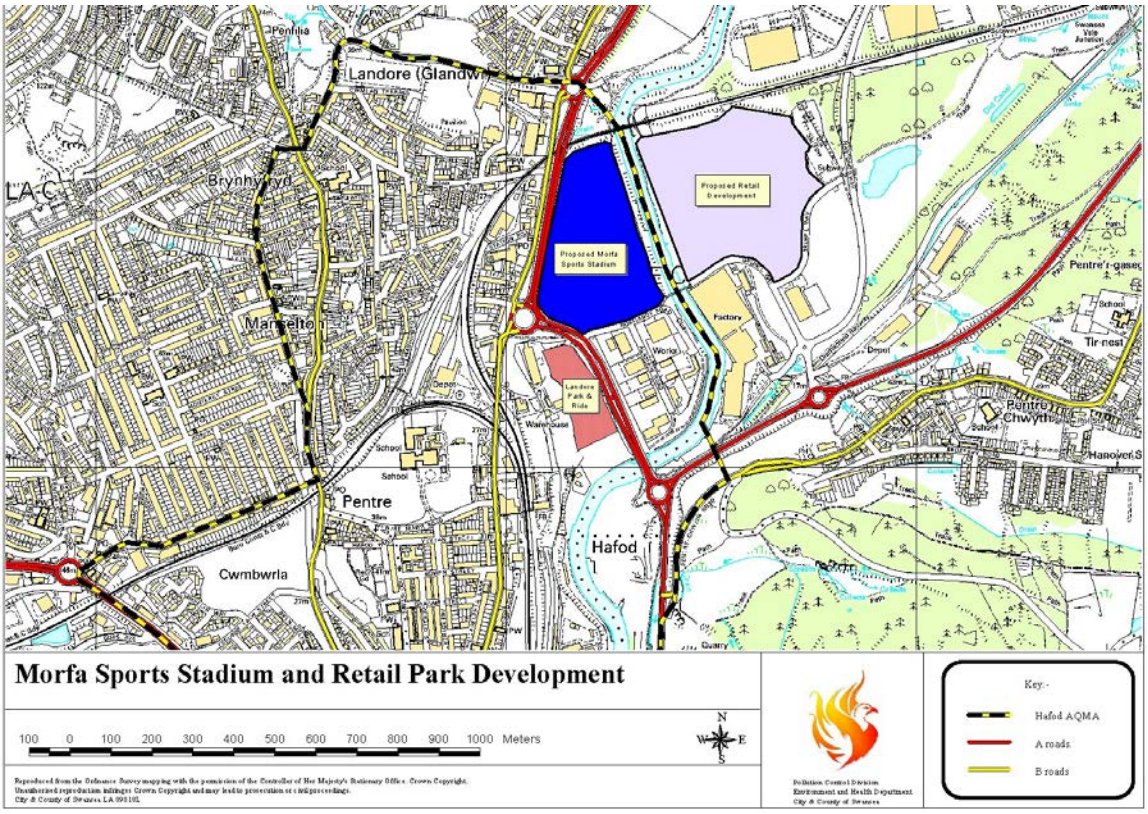
3.2.1 Morfa Retail Park

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 is located within the boundary of the Hafod Air Quality Management Area (AQMA). The retail park development lies just outside of the Hafod AQMA. Map 15 indicates the extent and location of the development's within the lower Swansea Valley.

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 remainder of the retail units are likely to be occupied during 2005.

The sports stadium will be completed during June 2005 and will host its first football game during July 2005 prior to the commencement of the football and rugby seasons. It is highly likely therefore, that 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 15 - 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. However, it is both anticipated and projected that traffic flows will significantly increase upon the full opening of the Morfa Retail Park and Sports Stadium.
The Morfa Groundhog (see 2.1.1 above) air quality monitoring station is located at Normandy roundabout, adjacent to the development site and its location can be seen within map 1. 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.

3.2.2 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). The location and monitoring results from 2004 for these sites can be seen within tables 43, 44 and 44a 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 $60\mu g/m^{-3}$ [44]. The location of the developments can be seen below as map 16.

ght.

[44] *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 16 - 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 equipment that has been ordered is delivered to the authority sometime during the summer of 2005. 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 3.4.1. Additionally the proposed mixed-use development off Ffordd Cynore (see 3.3.3.4 below) is adjacent to these developments.

3.3 Mixed Use Developments

3.3.1 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.

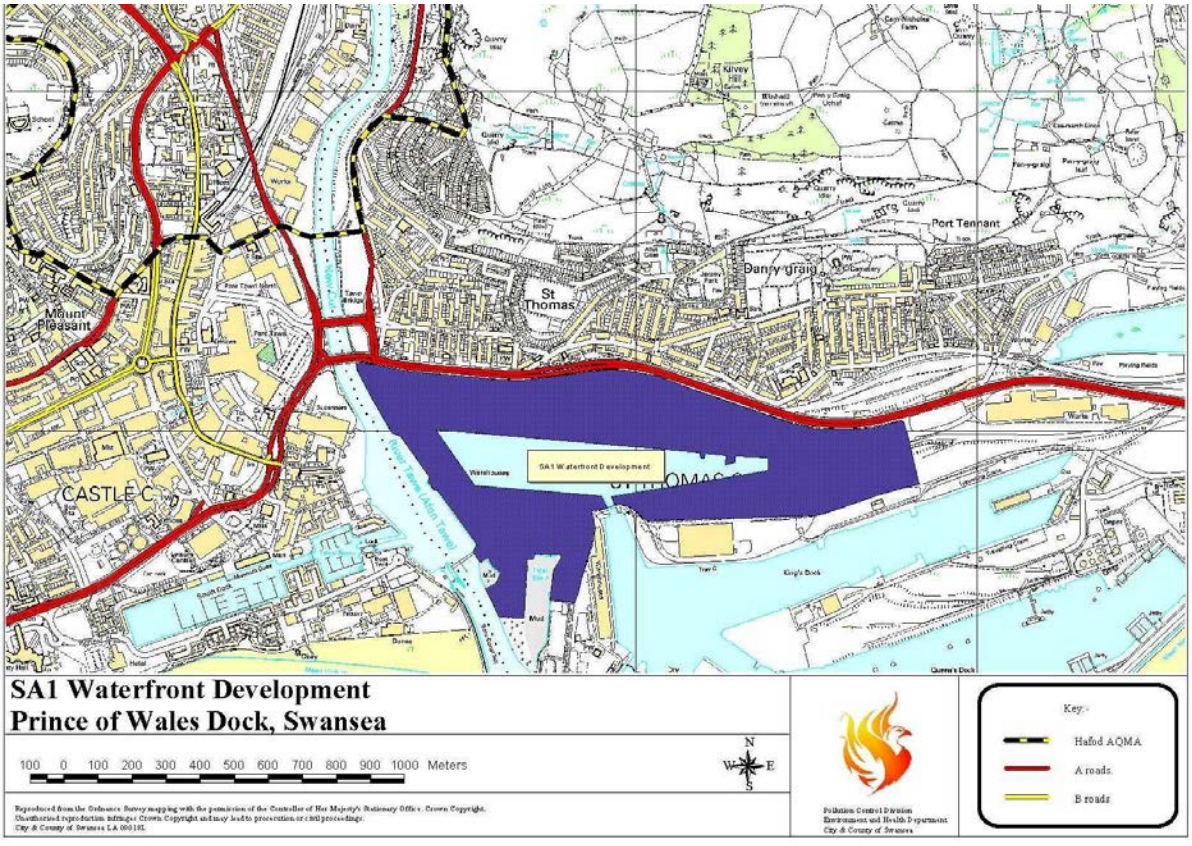
The SA1 Development is proposed as a mixed-use development combining residential and commercial development. The development will extend the waterfront along both banks of the River Tawe. Development works have been divided into zones A-F and will be undertaken in four phases running from 2002 to 2017. Phase 1 began during late 2002 with extensive redevelopment works taking place during 2004. It is envisaged that some elements of the scheme will 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 is planned 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 17 below.



Map 17 - SA1 Development Site

3.3.2 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.

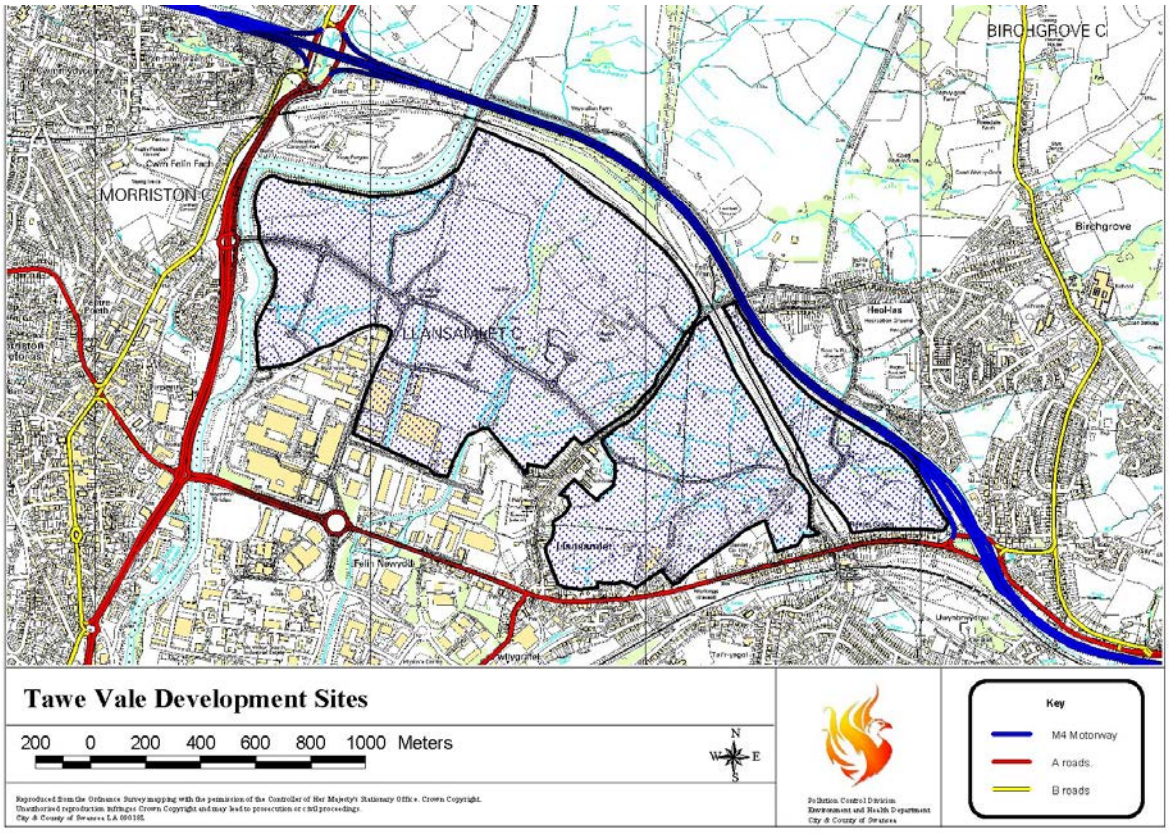
The overall proposal is for a mixture of housing, business, industry and leisure uses. Proposals have been made to provide for up to 1800 new homes on approximately 132 acres of the site. The housing is intended to provide clusters of villages separated by landscaped areas. A range of housing types will 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 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 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 18.



Map 18 - Tawe Vale Development

3.3.3 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.

Map 19 below indicates the extent and location of the development.

Map 19 - Seagate and Ferrara Quay Development, Trawler Road, Maritime Quarter

3.3.4 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 20 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 3.2.2 (Parc Fforestfach) and section 3.4.1 (Ffordd Cynore Development) which are located adjacent to the proposed site.

Map 20 - Ffordd Cynore Mixed Use Development, Fforestfach

3.3.5 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 21 - Swansea Point Development

3.4 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.

3.4.1 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. The extent of the development can be seen within map 22 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 22 -Ffordd Cynore Development, Fforestfach

3.4.2 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 has been received and is being considered with works likely to commence during the autumn 2005.

Map 23 - St Thomas Riverside Development (Former Station Yard Site)

3.4.3 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 "brownfield" 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 24 - Former Bryngwyn Steelworks Development site

3.4.4 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 "brownfield" 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

southeastern 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 hardstandings, 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 25 - Former Marccroft Engineering Development Site

3.5 New Landfill Developments

There have been no new landfill development sites within the authority. Indeed, as the Environment Agency have refused to issue a Permit for the operations carried out at Tir John Landfill Site, Port Tennant by the authority, the operations undertaken have ceased, subject to appeal. The amount of HGV traffic using the access and haul roads is therefore minimal from April 2004. It is thought that the Civic Amenity Site at Tir John landfill site will also close.

3.6 New Mineral Extraction Developments

There have been no new operations or applications for mineral extraction within the authorities area during 2004 or early months of 2005.

3.7 New Road Schemes

3.7.1 Gowerton Bypass Scheme

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. This scheme (Phase 2) followed on from the completion of the Phase 1 bypass during 2001. Construction work commenced on the 20th January 2003 and the opening ceremony took place on the 8th October 2003.

The scheme has been discussed as part of the NO_2 monitoring data within section 2.3.2.1 above. The extent and location of the works can be seen within map 9.

3.7.2 Fabian Way

Fabian Way will see the construction of a junction to serve the new SA1 development access road around the Port Tennant Road junction with the A483 Fabian Way. This junction will be controlled via traffic signals and will be approximately 450 meters from the existing traffic signal controlled junction to the old dock entrance and Quay Parade Bridges. To the east of the proposed new SA1 junction and approximately 1100 meters away, is the traffic signal controlled junction that regulates access at the new main docks entrance and the Fabian way Park and Ride site.

There are also proposals to construct a new dedicated express bus route into the city centre from the Fabian Way Park and Ride site. Phase 1 of the express bus route will cross over the A483 Fabian Way at the site of an old railway bridge, which has now been removed. This crossing is to be replaced with a "sail-bridge" during 2005. The express bus route will then run parallel at ground level, adjacent to and parallel with the inbound carriageway of the A483 to Quay Parade Bridges. Further phases of the Fabian Way Express Bus Route will see it extended into the city centre.

3.7.3 Landore Park & Ride Express Bus Route

Phase 1 of the Landore Park & Ride Express Bus Route was completed along a section of Neath Road, Hafod late 2004 / early 2005. The existing provision has seen a link provided from the Park & Ride site at Landore through a parcel of derelict land up to a traffic control point ❶on the B4603 Neath Road at the commencement of the bus lane itself - see Map 26. This traffic control point is traffic signal controlled and activated when a Park & Ride bus approaches. Initially, a cycle time of 140 seconds in the am peak and 115 seconds in the pm peak was proposed that would allow three phases of green for southbound Neath Road traffic, but just one phase of green for the Park & Ride site. This cycle time would result in an amber/red phase lasting about 20-30 seconds followed by a green phase lasting 20-25 seconds. Northbound traffic would be halted once every cycle for about 16 seconds, to allow traffic from the Park & Ride site to exit (provision has to be made for access into and from the Landore Social Club off this link road). The consultants employed, modelled the effects of these cycles it was found that significant queues would be formed equivalent to around 85-110 seconds per vehicle in the am and pm peaks respectively.

If the above were accepted, this would require modifications to the junction of Pentre Mawr Road and Neath Road to prevent long queues forming due to traffic turning right at this junction. It was decided therefore to remove the existing mini-roundabout and make Neath Road the priority route with a dedicated right turn lane.

Discussions remain ongoing over the exact method of operation of this traffic control point from an air quality perspective. Local knowledge indicates that queues will quickly form towards Normandy roundabout and Morfa Terrace.

What is in doubt is the actual extent of these queues and the knock-on effect in the real world. One avenue being explored is allowing the lights to remain on green phase except when activated by the express bus route, thus minimising delays and stationary traffic. Southbound traffic may well be discouraged from using Neath Road as a southbound route anyway by the proposed road-narrowing ❸ of lower sections of Neath Road as recommended by the Hafod Integrated Transport Study and included as part of the Action Plan.

Map 26 - Landore Park & Ride Express Bus Route Phase 1

As a long term goal, it may be desirable to actively use this point as a delaying tactic during periods where pollution is forecast to be high along Neath Road, to intentionally make Neath Road less attractive as a through route. The outcome achieved would however be a fine balancing act between improving conditions within the Neath Road corridor and possibly worsening conditions along Morfa Terrace and Normandy roundabout.

From this control point, the express bus route has been constructed parallel to the existing B4603 neath Road. Neath Road from this point effectively becomes 3 lanes with the main carriageway being reduced to 6meters width. Phase 1 of the express bus route has stopped outside junction of Neath Road with Bowen Street. At present, buses merge onto the existing Neath Road again via a traffic signal controlled junction. Phase 2 (expected to commence September 2005) of the express bus route ❷ will see the route extended behind terraced housing along Neath Road to High Street Railway station. Buses using the route southwards into the city centre will not travel inbound along the more congested section of Neath Road. Buses making the return journey to Landore Park & Ride site will access Neath Road at the priority junction at Bowen Street. Buses will use the existing carriageway up to the access junction to the Park & Ride site mentioned above where they will activate the traffic signals to receive a priority right turn.

4 Action Plan Progress

The authority only submitted its Action plan in relation to the Hafod Air Quality Management Area in December 2004. Delays were incurred in the formulation of the plan due to the extensive planning and consultation works that were thought vital to delivering a workable plan.

The Action Plan detailed 10 action points to be taken forward by the authority. Progress against each of these action points are briefly discussed below:

- **Action Point 1 - Traffic Management measures on Neath Road**

  The majority of measures identified for this action point depend upon funding being made available to undertake the recommendations of the Integrated Hafod Transport Study. Some identified action points have been completed and have been undertaken as part of phase 1 works in relation to the Landore Park & Ride Express Bus Route scheme. Items completed as part of this scheme include:

  - Provision of some bus stops and shelters
  - Gateway treatment to entrance to Neath Road from the Normandy Road roundabout
  - Creation of traffic control point

  All other identified action points within the Action Plan remain outstanding at present. The recommendations of the Hafod Integrated Transport Study are to be phased in after the renewals program being undertaken along Neath Road as part of the Hafod Renewals Program. This program is undertaking

complete renovation of both domestic and commercial properties within the Hafod. At present, major works by the renewals program are scheduled for two sections of Neath Road. As these works entail extensive building works taking over part of the footway/highway with scaffolding, skips etc. it has been decided to undertake the Hafod Integrated Transport Study works after the renovation works are complete, as to do so earlier would result in the damage of any finished surfaces.

Renewal works are to undertaken in two phases on two separate blocks of properties along neath Road. The first phase will undertake works between 1364 - 1391 Neath Road and then between 15 - 52 Neath Road. Consequently, it may 2-3 years before the Transport Study recommendations are complete. The Action Plan initially indicated a target of December 2005.

- **Action Point 2 - Park and Ride provision**

Provision of Park & Ride is seen as a fundamental element of Swansea's Transportation Strategy. Significant progress has been made in respect to this action point:

- Landore and Port Tennant Park and Ride sites now fully operational.
- Establishment of an additional site at Fforestfach remains ongoing with the site now identified. Further preparatory planning work is underway.
- Phase 1 of the dedicated express route serving the Landore Park and Ride site has been completed. Phase 2 is due to commence during September 2005.
- A Planning Application has been has been submitted in respect of the dedicated express bus route from the Port Tennant Park & Ride site.

Some preparatory works on the ground have already been undertake and include the removal of an old railway bridge crossing which it is proposed to replace with a new bus/cycle bridge to carry the express bus route across the A483 (see 3.7.2 above).

All other identified action points within the Action Plan remain outstanding and are unlikely to be complete by the indicated target of December 2005.

- **Action Point 3 - Improved Bus Provision**

The action points contained within the Action Plan were to the main being achieved upon submission of the Action Plan. However, in order to continue to achieve these aims, the authority continues to:

- Use its revenue budget to ensure that most areas have at least a minimum level of service.
- Make use of the National Assembly's Bus Subsidy Grant to ensure breaks in service are kept to a minimum
- Promote bus priority routes
- Fund a local concessionary bus fares scheme for certain categories of people
- Provide free unlimited bus travel within the authorities area for elderly people

The identified action points within the Action Plan are being achieved now but ongoing provision remains desirable.

- **Action Point 4 - Bus Corridor Enhancements**

  Progress made to date include:

  - Transport Grant funded improvements to A48 Bus priority Demonstration Corridor completed during early 2005
  - Bus priority proposals for Neath Road being reviewed. Feasibility study commissioned for a new concept TramBus service linking Morriston Hospital with the city centre, Singleton Hospital and the Mumbles. The aim is to provide advantages of modern tram at modest costs. Envisaged that the service will use the Landore express bus route, thereby avoiding much of Neath Road and that bus priority will be introduced at key junctions along the route.
  - Variable Message displays installed along a number of routes to improve dissemination of travel information to passengers.
  - Accessibility to bus services for residents who are disabled or who suffer from limited mobility increased, following Transport Grant funding to raise kerb levels along with the provision of road markings and bus clearway orders at bus stops.
  - Bus shelters upgraded on a number of routes

  The identified action points within the Action Plan are being achieved now but ongoing provision and enhancements remain desirable.

- **Action Point 5 - Enhancements of Bus and Rail Stations**

  Progress made to date include:

  - Swansea High Street Transport Interchange was completed during March 2004. Funded through a combination of Transport Grant and Objective 1 funding, this scheme has provided improved access to the railway station by bus, taxi, and on foot, together with a new public realm, improved security and improved parking facilities.
  - Discussion ongoing with network rail and Arriva Trains Wales on how to improve passenger facilities at the station itself.

  - Transport Grant funding has been secured to redevelop the Quadrant Bus Station to provide a modern secure passenger friendly bus interchange. Outline planning consent has been granted and a compulsory purchase order has been served on the owner of the land currently used as the bus pad and turning area. The owner has appealed against the CPO and it is envisaged that a public enquiry will be held during late 2005.

- **Action Point 6 - Safe Routes to School**

The safe Routes to School has been delivered in Swansea for the last 6 years with numerous schemes undertaken.

- Currently, Safe Routes to school schemes are being developed at:
  - Clydach,
  - Brynhyfryd,
  - Pennard,

- Birchgrove.

  The aim again, is to encourage more pupils to walk and cycle to school through improved facilities, the introduction of traffic calming measures together with complementary educational work and road safety training.

- The focus of this work with schools is now based on the development of school travel plans. These have recently been prepared for YGG Bryniago (Pontardulais), Penllergaer Primary, Penyrheol Primary (Gorseinon) and Whitestone Primary (West Cross). These travel plans will provide the basis for both infrastructure and educational work over the next two years.

- **Action Point 7 - Vehicle Emissions Testing**

No additional progress has been made with respect to this action point. The primary reasons for the lack of progress are:

- Lack of staff resources due to the labour intensive nature of the work.
- Difficulties in identifying suitable check points within the desired area.
- Lack of suitably trained and certified staff

- **Action Point 8 Quay Parade Bridges Improvements**

- Feasibility studies remain ongoing as to how total capacity at the bridges can be increased. The initial intention of providing a signal controlled gyratory scheme has now been discounted due to the assessment that it would have a significant and unacceptable negative impact on local traffic and some bus

services. The feasibility works are currently looking at the recalibration of the traffic signals at the bridges together with those along Quay parade/Victoria Road/Oystermouth Road. The aim however remains the same - to make more effective use of the existing highway network. Parallel options for extending bus priority across Quay Parade to Oystermouth Road are still being investigated.

- An air quality monitoring station along Pentreguinea Road has been established with measurements commencing during May. The system measures the pollutants nitrogen dioxide, sulphur dioxide, ozone, benzene, toluene and xylene along a 280-meter open path. The system comprises of a transmitter and a receiver. The transmitter shines a xenon lamp along the path length to the receiver module where the light is focused and transmitted down a fibre optic cable and into a spectra analyser where the measurements take place. The system is now providing spatial data over the 280-meter path length.

Photo 1 - St Thomas DOAS Transmitter

Photo 2 - St Thomas DOAS Receiver Station

- **Action Point 9 - City & County of Swansea Vehicle Fleet**

Improvements are ongoing within the fleet of vehicles operated by the authority. With 40% of the potential green fleet vehicles converted to L.P.G., other bespoke solutions have been implemented to assist in managing down the

environmental impact of a 750 vehicle fleet operation within the Council's area. These include,

- A robust time based maintenance and inspection regime that specifies oil and filter changes twice a year
- A rolling 5 year programme of vehicle renewals to consolidate technological advancements within the fleet
- Detailed consultation with users on specifications to ensure maximised utility for the supplied vehicle
- A replacement component strategy that " builds in " disposal and recycling requirements for tyres, oils, batteries, cleaning products, asbestos free linings etc
- Active pursual of Energy Savings Trust grants for dualfuel vehicle provision that totals in excess of £120,000 to date
- Establishing a refuelling site within our primary operational depot for L.P.G. vehicles, in partnership with Flogas, and extending the use of this facility to other dualfuel users such as the D.V.L.A., taxi associations, local businesses and private individuals.
- Specifying Eminox Continuous Regenerating Particle traps (CRTs) and Euro 3 compliant engines on new heavy commercial vehicles
- Retrospectively fitting CRTs to existing ordered vehicles and applying for the Wales Assembly Government grants in support of this
- Introduction of Low Sulphur diesel to the Council's fuel stocks

The authority actively enforces a " good neighbour " approach in terms of the Council's driver conduct, vehicle operations and parking arrangements.

- **Action Point 10: Traffic Management Systems with Air Quality Monitoring feedback.**

Considerable efforts are being made to ensure that all data feeds into the system operate reliably. The major data feeds are:

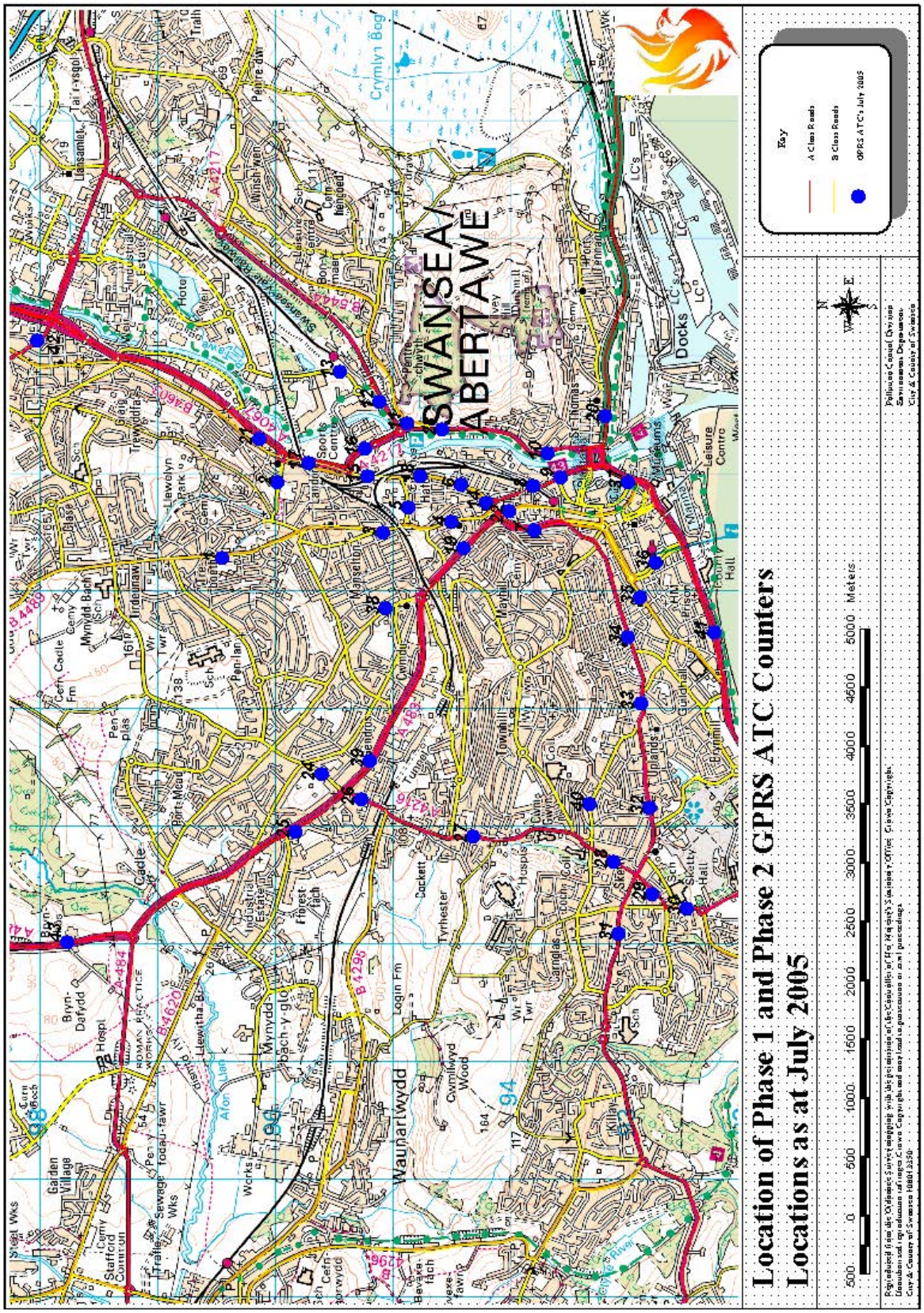
- Vehicle by Vehicle Traffic flow
- Ambient Air Quality Monitoring data
- Meteorological forecast

- At the moment there are issues with the transmittion of vehicle traffic flow information from the GPRS Automatic Traffic Counters through the GPRS Vodafone network. Certain sites are being prevented from transmitting data every 5 minutes back to an FTP server. These issues are being resolved with Vodafone as reliable uninterrupted flow of this data is vital to the operation of the Nowcaster model.

- An additional 19 automatic traffic counters have been installed and commissioned and data quality is being assessed - see map 27 below for location of existing 43 GPRS traffic counters.

- Additional air quality monitoring stations have been installed within St.Thomas and an additional 10 laser light scattering PM_{10} analysers are to be installed during August 2005.

- The Nowcaster model interface with the system under development is still undergoing customisation to allow unattended import of all required datasets and automatic operation and output of predictions. This is taking longer than anticipated.

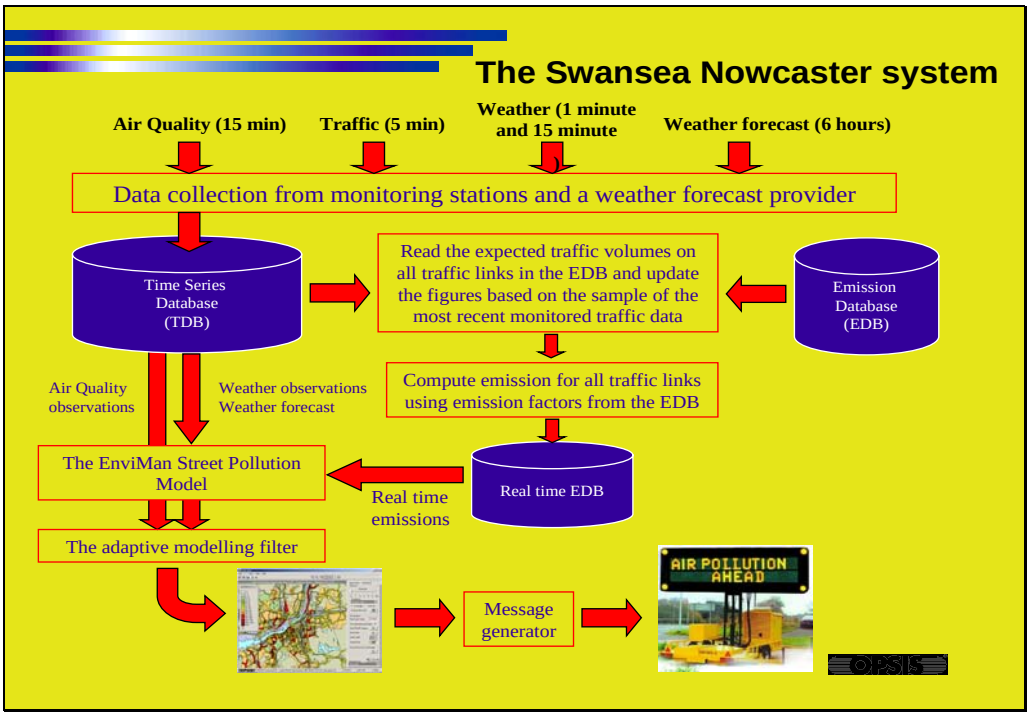


Map 27 - Location of GPRS Automatic Traffic Counters

- Discussions have commenced with Variable Message Systems on the integration and adaptation of their traffic management program TRAMs within the system. This system will receive output predictions from Nowcaster and will take logical decisions upon what messages are disseminated to variable message signs located initially within the lower Swansea valley. Discussions are ongoing with regard to the specification of the variable message signs.

- Emissions data is being collated and inputted into an emissions database which will be central to the system.

A schematic of the system under development is shown below



Schematic 1 - Swansea Nowcaster Traffic Management System

As a result of the considerable testing and development works ongoing it is no longer envisaged that the system will be proven by December 2005.

5 Planning Policies

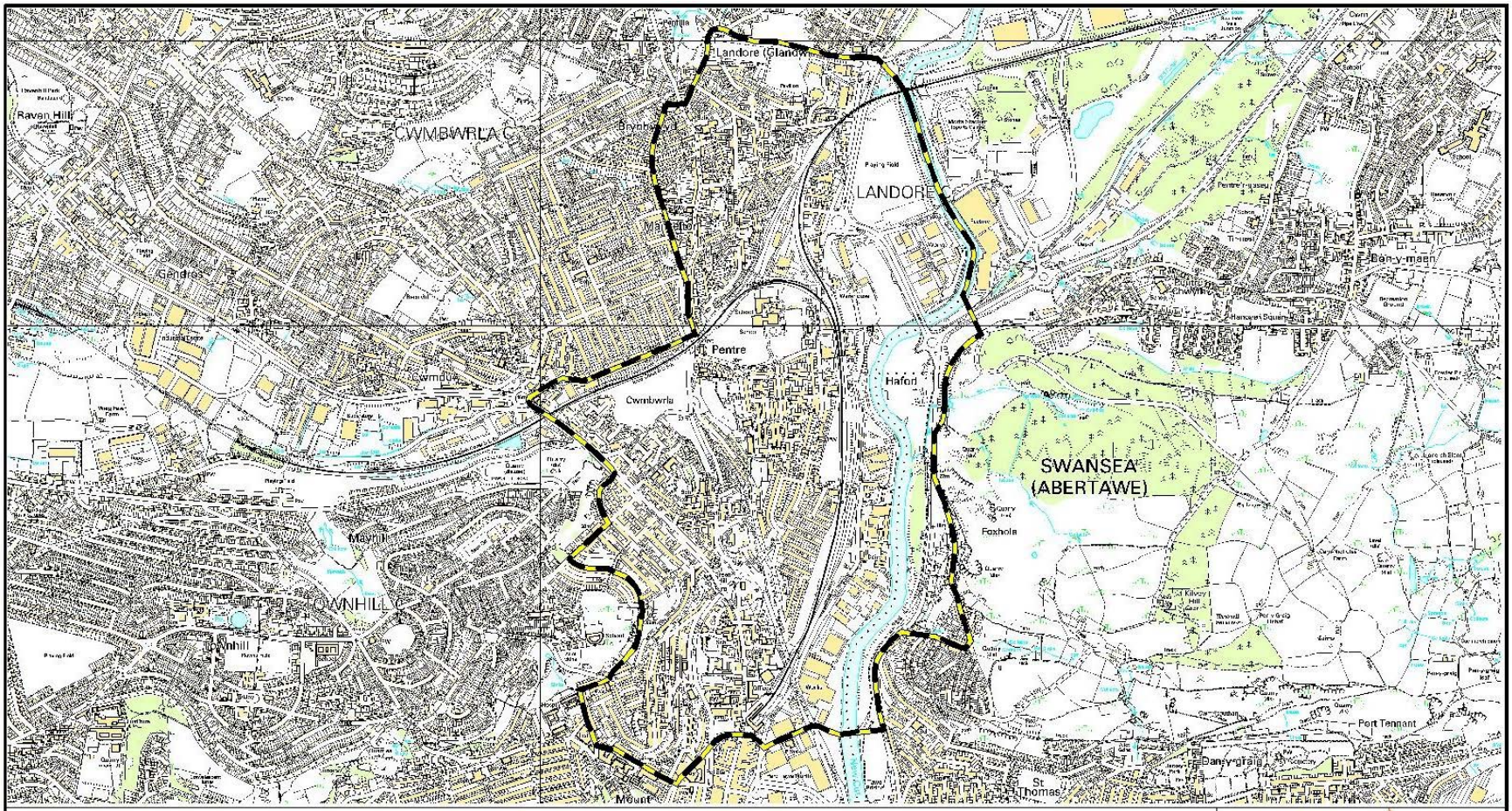
Policy EV40 has been inserted within the authorities draft Unitary Development Plan. In particular, sub policies within policy EV40 seek to clarify the authorities position with regard to air quality considerations.

1.8.8 Pollution may cause significant damage to human health, quality of life, residential amenity, and the natural and historic environment. This policy seeks to ensure that developments that would result in unacceptable high levels of noise, light or air pollution are appropriately located away from residential areas, other sensitive developments and areas of landscape, natural environment and heritage importance. The policy also seeks to ensure that incompatible development and land uses are not located close to existing sources of potential pollution.

1.8.9 The adverse effects of pollution are an important consideration when determining planning applications. When assessing new development proposals the Council will seek to minimise the impact of pollution of all kinds, and where possible planning conditions will be used to minimise environmental harm. The Council will look to the statutory environmental agencies to use there anti pollution legislative powers to monitor and enforce against discharges, noise, etc.

1.8.10 *Planning permission will not be granted for development that would be harmful to air quality by virtue of emissions from the development itself or the additional new traffic movements it would generate. Neither will permission be granted where a development is proposed that would increase the number of exposed individuals in an area likely to fail UK air quality objectives (proposed or in Regulations). This may be a declared Air Quality Management Area (AQMA), or an area that might become an AQMA if the application were to be granted.*

Appendix 1



The Hafod Air Quality Management Area (N02)
City & County of Swansea (Hafod Air Quality Management Area (NO2)) Order 2001

300 0 300 600 900 1200 1500 Meters

N
W E
S

Scale 1:12000

Pollution Control Division
Environment Department
City & County of Swansea