REPORT

UK Air Quality Forecasting: Operational Report for January to March 2005

A report produced for the Department for Environment, Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment in Northern Ireland

AEAT/ENV/R/1973 Issue 1
April 2005

UK Air Quality Forecasting: Operational Report for January to March 2005

A report produced for the Department for Environment, Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment in Northern Ireland

AEAT/ENV/R/1973 Issue 1
April 2005

Title	UK Air Quality Forecasting: Operational Report for January to March 2005.
Customer	Department for Environment Food and Rural Affairs, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment in Northern Ireland
Customer reference	EPG 1/3/179
Confidentiality, copyright and reproduction	Copyright AEA Technology plc. All rights reserved. Enquiries about copyright and reproduction should be addressed to the Commercial Manager, AEA Technology plc.
File reference	ED45099
Report number	AEAT/ENV/R/1973 Issue 1
Report status	Issue 1

AEA Technology plc
Netcen
Building 551
Harwell
Didcot
Oxfordshire
OX11 0QJ
UK
+44 (0) 870 190 6441 tel.
+44 (0) 870 190 6608 fax.

Andy.cook@aeat.co.uk

Netcen is an operating division of AEA Technology plc
AEA Technology is certificated to BS EN ISO9001:(1994)

	Name	Signature	Date
Author	Andy Cook		
Reviewed by	Paul Willis		
Approved by	Jon Bower		

Executive Summary

This report covers the operational activities carried out by Netcen and the Met Office on the UK Air Quality Forecasting Contract from January to March 2005. The work is funded by the Department for Environment Food and Rural Affairs (Defra), the Scottish Executive, Welsh Assembly Government and the Department of the Environment in Northern Ireland.

During the first quarter of 2005, there were no days on which HIGH air pollution was recorded, therefore no associated forecast accuracy rates are presented. Many MODERATE days were measured, as could normally be expected. These MODERATE periods are recorded within the forecasting success and accuracy calculations. The forecasting success and accuracy for this quarter for HIGH and MODERATE episodes is summarised in Table 1 below.

Success figures for MODERATE forecasts issued show that a large proportion of measured polluted days were successfully forecast (percentage above 100%)[1]. An average accuracy figure of 78 % indicates that only 22 % of the forecast MODERATE levels were not measured and remained LOW. The accuracy figures tend to be lower due to the precautionary approach that Netcen takes when issuing the daily forecasts- we issue a forecast for MODERATE pollution when there is only a small chance that it will be recorded.

Table 1 – Forecast success/accuracy for incidents[1] above 'HIGH' and above 'MODERATE', January 1st to March 31st 2005.

Region/Area	HIGH		MODERATE	
	% success	% accuracy	% success	% accuracy
Zones	100	N/a	143	86
Agglomerations	100	N/a	160	69

We continue to research ways of improving the air pollution forecasting system by:

1. Investigating ways of using automatic software systems to streamline the activities within the forecasting process, thus allowing forecasters to spend their time more productively considering the most accurate forecasts.
2. Researching the chemistry used in our models, in particular the NO_x->NO_2 conversion used in NAME, and the chemical schemes for secondary PM_{10} and ozone.
3. Improving the NAME model used for ad-hoc analyses. In particular, recent improvements have assisted with investigations of the possible long-range transport of PM_{10} pollution from forest fires in Russia and the long-range transport of particles from Saharan Dust Storms.
4. Improving and updating the emissions inventories used in our models.

There were no reported breakdowns in the forecasting service between January and March; all bulletins were delivered to the Air Quality Communications contractor on time.

[1] Note that the calculations of accuracy and success rates are based on a successful prediction being ±1 of the measured index; it is therefore possible to record rates in excess of 100% rather than 'true' percentages.

Contents

1 Introduction

A forecast of the following day's air pollution is prepared every day by Netcen in collaboration with the Met Office. The forecast consists of a prediction of the air pollution descriptor for the worst-case situation in 16 zones and 16 agglomerations over the following 24-hours. Forecasts can be updated and disseminated through Teletext, the World Wide Web and a Freephone telephone number at any time of day, but the most important forecast of the day is the "daily media forecast". This is prepared at 3.00 p.m. for uploading to the internet and Air Quality Communications contractor before 4.00 p.m. each day, and is then included in subsequent air quality bulletins for the BBC, newspapers and many other interested organisations.

This report covers the media forecasts issued between 1st January and 31st March 2005. Results from forecasting models are available each day and are used in constructing the forecast. The forecasters issue predictions for rural, urban background and roadside environments but, for the purposes of this report, these have been combined into a single "worst-case" category.

Twice every week, on Tuesdays and Fridays, we also provide a long-range pollution outlook. This takes the form of a short text message which is emailed to approximately sixty recipients in Defra and other Government Departments, together with the BBC weather forecasters. The outlook is compiled by careful assessment and review of the outputs from our pollution models, which currently run out to 3 days ahead, and by also considering the long-term weather situation.

We continue to provide a quality control system to ensure that the 5-day forecasts provided by the Met. Office to the BBC are consistent with the "daily media forecasts" and long-range pollution outlook provided by Netcen for Defra and the DAs. The BBC requires 5-day air pollution index forecasts for 230 UK towns and cities on their BBC Online service. The quality control work is carried out at around 3.00 p.m. daily, with the forecast updating onto the BBC Online Web site at 4.00 a.m. the following morning.

2 New developments during this period

2.1 QUARTERLY REPORT FORMAT

An enhanced format for quarterly reports has been agreed with Defra and the Devolved Administrations, including important new features such as:

- Clearer explanation of the analysis results.

2.2 OZONE WEB DEVELOPMENT

During this quarter the UK Air Quality Forecasting contract was varied to include development of software needed for the UK to join the Ozone Web near-real time European data exchange system. Work is underway to develop the scripts required to extract the data from the Air Quality Archive every hour and submit via the XML data format to the European Environment Agency. In the next quarter we will report on the testing and implementation of this service.

3 Analysis of Forecasting Success Rate

Analysis of the forecasting performance is carried out for each of the 16 zones and 16 agglomerations used in the daily forecasting service. Further details of these zones and agglomerations are presented in Appendix 2. Forecasting performance is analysed for a single, general pollutant category rather than for each individual pollutant and has been aligned to the forecasting day (a forecasting day runs from the issue time, generally 3 pm). This analysis of forecasting performance is based on provisional data, as used in the daily forecasting process. Any obviously faulty data have been removed.

The analysis treats situations where the forecast index was within ±1 of the measured index as a successful prediction, as this is the target accuracy we aim to obtain in the forecast. Because the calculations of accuracy and success rates are based on a success being ±1 of the measured index, it is possible to record rates in excess of 100% rather than 'true' percentages. Appendix 3 shows a worked example of how accuracy and success rates are calculated. Further details of the text descriptions and index code used for the forecasting are given in Appendix 1.

The forecasting success rates for each zone and agglomeration for January - March 2005 are presented in Tables 3.1 (forecasting performance in zones) and 3.2 (forecasting performance in agglomerations) for 'HIGH' days. Table 3.5 provides a summary for each pollutant of the number of days on which HIGH and above pollution was measured, the maximum exceedence concentration and the day and site at which it was recorded. The forecasting performance Tables 3.1 and 3.2 give:

- The number of 'HIGH' days measured in the PROVISIONAL data
- The number of 'HIGH' days forecast
- The number of days with a correct forecast of 'HIGH' air pollution, within an agreement of ±1 index value. A HIGH forecast is recorded as correct if air pollution is measured HIGH and the forecast is within ±1 index value, or it is forecast HIGH and the measurement is within ±1 index value. For example measured index 7 with forecast index 6 counts as correct, as does measured index 6 with forecast index 7.
- The number of days when 'HIGH' air pollution was forecast ('f' in the tables) but not measured ('m') on the following day to within an agreement of 1 index value.
- The number of days when 'HIGH' air pollution was measured ('m') but had not been forecast ('f') to within an agreement of 1 index value.

The two measures of forecasting performance used in this report are the 'success rate' and the 'forecasting accuracy'.

The forecast success rate (%) is calculated as:

- (Number of episodes successfully forecast/total number of episodes measured) x 100

The forecast accuracy (%) is calculated as:

- (Number of episodes successfully forecast/[Number of successful forecasts + number of wrong forecasts]) x 100

The forecasting success rates for 'MODERATE' days or above for each zone and agglomeration are presented in Tables 3.3 (zones) and 3.4 (agglomerations). Table 3.3 and 3.4 give the same information as in Tables 3.1 and 3.2, but summarised for 'MODERATE' days and above.

3.1 FORECAST ANALYSIS FOR JANUARY 1ST TO MARCH 31ST 2005.

Table 3.1 - Forecast Analysis for UK Zones 'HIGH' band and above *

ZONES	Central Scotland	East Mids	Eastern	Greater London	Highland	North East	North East Scotland	North Wales	North West & Merseyside	Northern Ireland	Scottish Borders	South East	South Wales	South West	West Midlands	Yorkshire & Humberside	Overall
measured days	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
forecasted days	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ok (f and m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wrong (f not m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
wrong (m not f)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
success %	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
accuracy %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.2 - Forecast Analysis for UK Agglomerations 'HIGH' band and above *

AGGLOMERATIONS	Belfast UA	Brighton/Worthing/ Littlehampton	Bristol UA	Cardiff UA	Edinburgh UA	Glasgow UA	Greater Manchester UA	Leicester UA	Liverpool UA
measured days	0	0	0	0	0	0	0	0	0
forecasted days	0	0	0	0	0	0	0	0	0
ok (f and m)	0	0	0	0	0	0	0	0	0
wrong (f not m)	0	0	0	0	0	0	0	0	0
wrong (m not f)	0	0	0	0	0	0	0	0	0
success %	100	100	100	100	100	100	100	100	100
accuracy %	0	0	0	0	0	0	0	0	0

AGGLOMERATIONS	Nottingham UA	Portsmouth UA	Sheffield UA	Swansea UA	Tyneside	West Midlands UA	West Yorkshire UA	Overall
measured days	0	0	0	0	0	0	0	0
forecasted days	0	0	0	0	0	0	0	0
ok (f and m)	0	0	0	0	0	0	0	0
wrong (f not m)	0	0	0	0	0	0	0	0
wrong (m not f)	0	0	0	0	0	0	0	0
success %	100	100	100	100	100	100	100	100
accuracy %	0	0	0	0	0	0	0	0

*** All performance statistics are based on provisional data. Obviously incorrect data due to instrumentation faults have been removed from the analyses.**

Please refer to the start of section 3 for an explanation of the derivation of the various statistics, figures >100 % may occur.

Table 3.3 - Forecast Analysis for UK Zones 'MODERATE' band and above *

ZONES	Central Scotland	East Mids	Eastern	Greater London	Highland	North East	North East Scotland	North Wales	North West & Merseyside	Northern Ireland	Scottish Borders	South East	South Wales	South West	West Midlands	Yorkshire & Humberside	Overall
measured days	2	0	25	22	26	7	3	5	4	10	1	5	0	16	0	10	136
forecasted days	0	8	14	23	19	6	1	13	3	12	0	11	6	12	4	5	137
ok (f and m)	1	6	27	32	30	8	3	12	6	20	1	13	3	17	2	13	194
wrong (f not m)	0	2	2	2	2	1	0	2	0	1	0	0	3	0	2	1	18
wrong (m not f)	1	0	2	4	0	1	0	0	0	0	0	0	0	5	0	1	14
success %	50	100	108	145	115	114	100	240	150	200	100	260	100	106	100	130	143
accuracy %	50	75	87	84	94	80	100	86	100	95	100	100	50	77	50	87	86

Table 3.4 - Forecast Analysis for UK Agglomerations 'MODERATE' band and above *

AGGLOMERATIONS	Belfast UA	Brighton/Worthing/ Littlehampton	Bristol UA	Cardiff UA	Edinburgh UA	Glasgow UA	Greater Manchester UA	Leicester UA	Liverpool UA
measured days	0	2	1	0	5	9	3	0	0
forecasted days	0	4	3	3	1	6	2	2	3
ok (f and m)	0	4	2	2	6	6	5	0	2
wrong (f not m)	0	0	1	1	0	1	0	2	1
wrong (m not f)	0	1	1	0	0	5	0	0	0
success %	100	200	200	100	120	67	167	100	100
accuracy %	0	80	50	67	100	50	100	0	67

AGGLOMERATIONS	Nottingham UA	Portsmouth UA	Sheffield UA	Swansea UA	Tyneside	West Midlands UA	West Yorkshire UA	Overall
measured days	0	1	1	6	0	4	3	35
forecasted days	2	4	3	7	2	3	9	54
ok (f and m)	1	4	3	9	0	6	6	56
wrong (f not m)	1	1	1	0	2	0	4	15
wrong (m not f)	0	0	0	1	0	1	1	10
success %	100	400	300	150	100	150	200	160
accuracy %	50	80	75	90	0	86	55	69

*** All performance statistics are based on provisional data. Obviously incorrect data due to instrumentation faults have been removed from the analyses.**

Please refer to the start of section 3 for an explanation of the derivation of the various statistics, figures >100 % may occur.

Table 3.5 – Summary of episodes January to March 2005 (Based on latest provisional data)

Pollutant	High days	Moderate days	Max. conc. (µg /m^3) *	Site with max. conc.	Zones or Agglomeration	Date of max conc.	Forecast success HIGH days (%) [no. incidents]
Ozone	0	35	134	Brighton	Brighton UA	16/03/05	N/A [0]
PM_{10} gravimetric	0	40	92	Port Talbot and Scunthorpe	Swansea UA and Yorkshire and Humberside zone	12/01/05 and 22/03/05	N/A [0]
NO_2	0	3	432	Middlesborough	North East Zone	11/02/05	N/A [0]
SO_2	0	3	503	Grangemouth	Central Scotland	28/01/05	N/A [0]
CO	0	0	3.3 mg/m^3	London Hackney	Greater London UA	14/01/05	N/A [0]

* Maximum concentration relate to 8 hourly running mean or hourly mean for ozone, 24 hour running mean for PM_{10}, hourly mean for NO_2, 15 minute mean for SO_2 and 8 hour running mean for CO.

General Observations

There were no instances of HIGH band pollution measured during this quarter.

MODERATE band PM_{10} measurements were seen frequently during the quarter and on 31st March twelve sites measured MODERATE levels during settled weather conditions. MODERATE band ozone was seen more frequently in March, with eight sites or more measuring index 4 or above on two separate occasions. Background levels of ozone are generically highest in March and April for the northern hemisphere, accounting for many of the MODERATE levels measured at rural sites. Figure 3.5 illustrates this for the "remote" Mace Head site in Ireland in 2004.

Three MODERATE days were measured for sulphur dioxide and three for nitrogen dioxide, all at various locations.

The London Marylebone Road site measured 18 days of MODERATE band particulate PM10 and one day for NO2.

Figures 3.1 – 3.3 show the trends of pollutants in graphical form. A site-by-site breakdown is given in Figures 3.4a and 3.4b.

O_3

The most significant days for ozone formation over this quarter were 6th March (nine MODERATE sites), 16th March (10 sites) and 19th March (6 sites).

The largest proportion by far of sites experiencing MODERATE levels were in rural locations. During March and April background ozone is at its highest, accounting for the majority of these exceedences. The forecasting success rate is inherently good for ozone as these MODERATE levels tend to persist for long periods.

PM_{10}

The largest number of MODERATE exceedences were experienced at roadside locations (Marylebone Road on 18 days, Camden Kebside on 8 days and Glasgow Kerbside on 12 days) and were likely to be due to a contribution from traffic emissions. 12 sites measured MODERATE levels of PM_{10} on 31st March due to settled weather conditions, which led to poor atmospheric dispersion. PM_{10} exceedences are often difficult to predict because of their localised nature.

The highest measurement made was 92 ug/m^3 (gravimetric) at jointly Scunthorpe and Port Talbot, both stations situated in industrial areas.

Figure 3.2 shows the trends in PM_{10} levels over this period.

NO_2

Nitrogen dioxide levels rose into the MODERATE band on one occasion at London Marylebone Road (traffic related measurements), Salford Eccles (a localised build up of pollution) and Middlesborough (a localised source).

SO_2

Sulphur dioxide levels did not reach the HIGH band during this period. MODERATE levels were measured at: Grangemouth (network maximum 503 ug/m^3 on 28th January and a further measurement of 306 ug/m^3 on the 25th January) and Salford Eccles (415 ug/m3 on 24th March), likely to be the result of local industrial emissions for all examples.

Figure 3.3 shows the trends in SO_2 levels over this period with NO_2 also included.

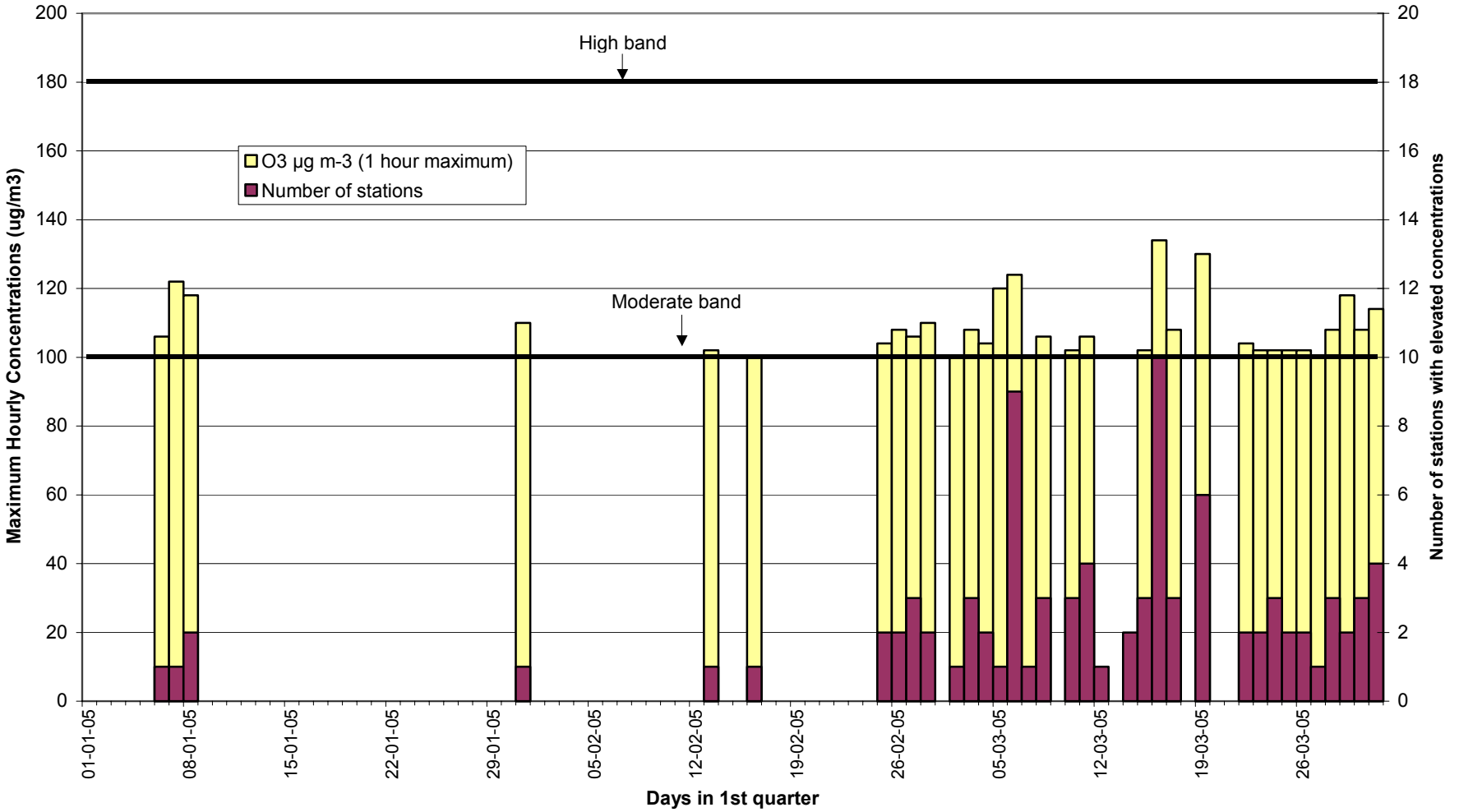


Figure 3.1 Daily maximum hourly ozone concentration across AURN Network with total number of stations measuring moderate or above levels of ozone over 1st quarter 2005.

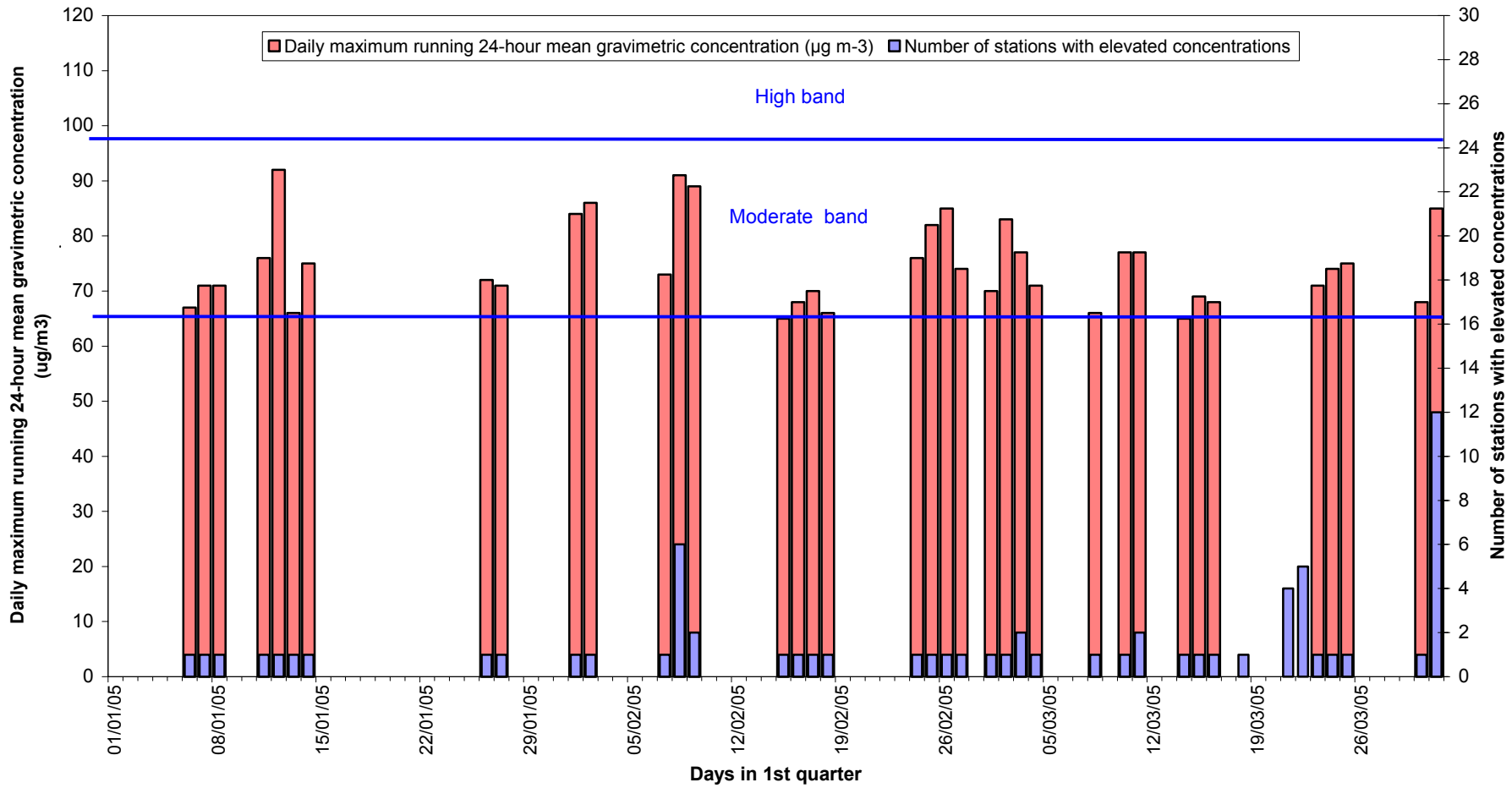


Figure 3.2 Daily maximum running 24-hour mean PM_{10} concentration across AURN Network with total number of stations measuring moderate or above levels over the 1st quarter 2005

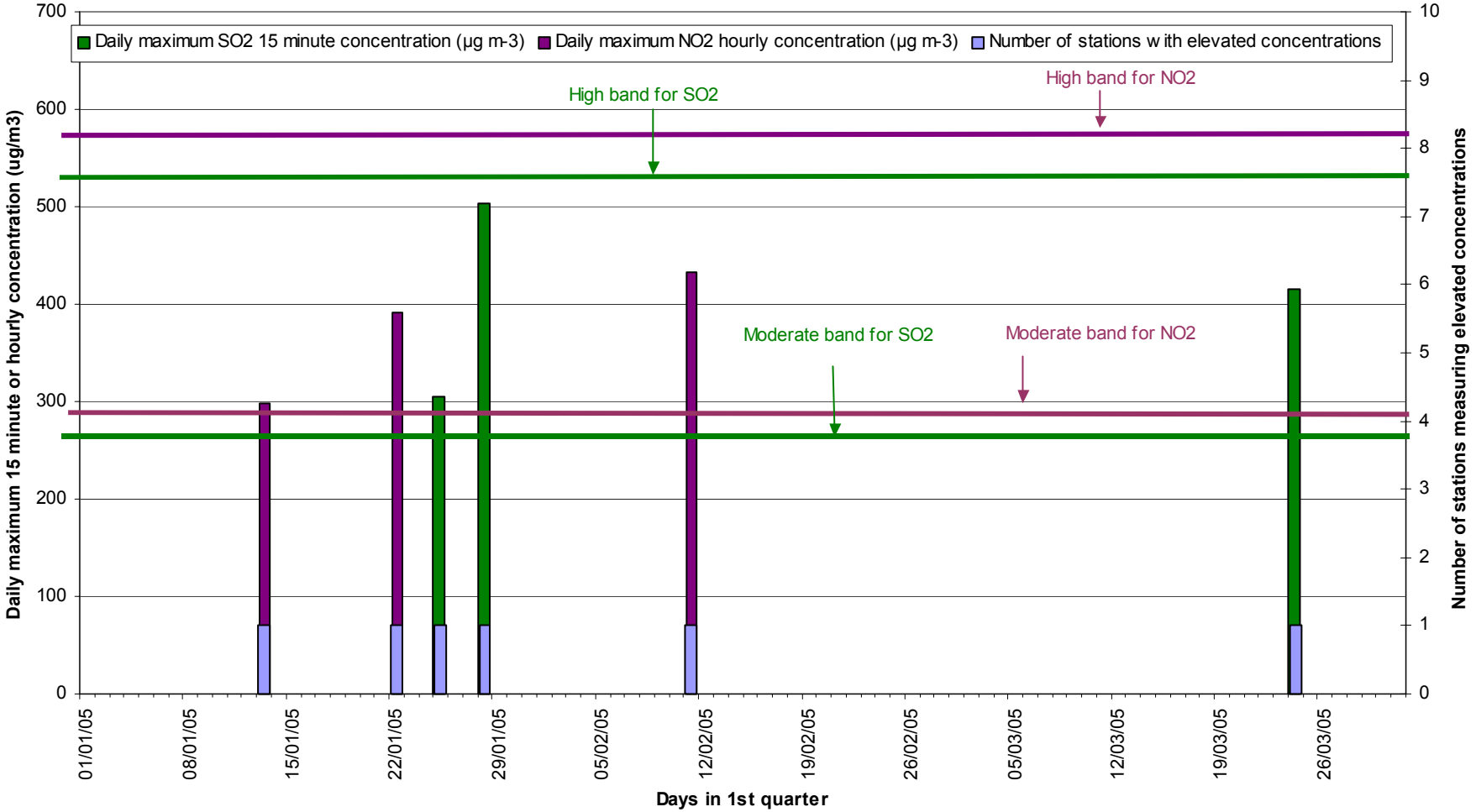


Figure 3.3 Maximum 15 minute average concentrations of SO_2 and hourly average of NO2 across AURN Network with total number of stations measuring moderate or above levels over the 1st quarter 2005

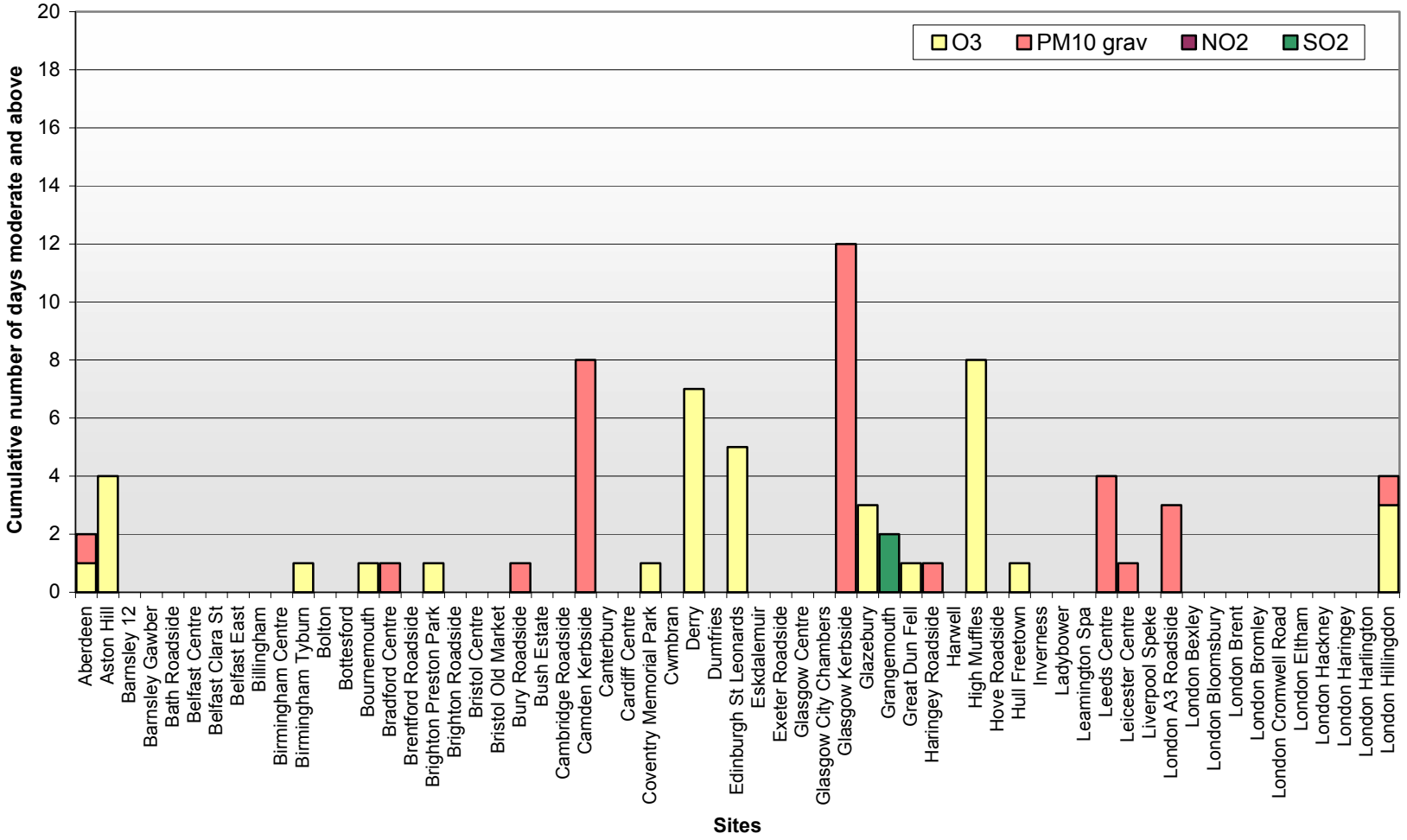


Figure 3.4a Number of days moderate and above for each AURN Network station over 1st quarter 2005 – provisional data

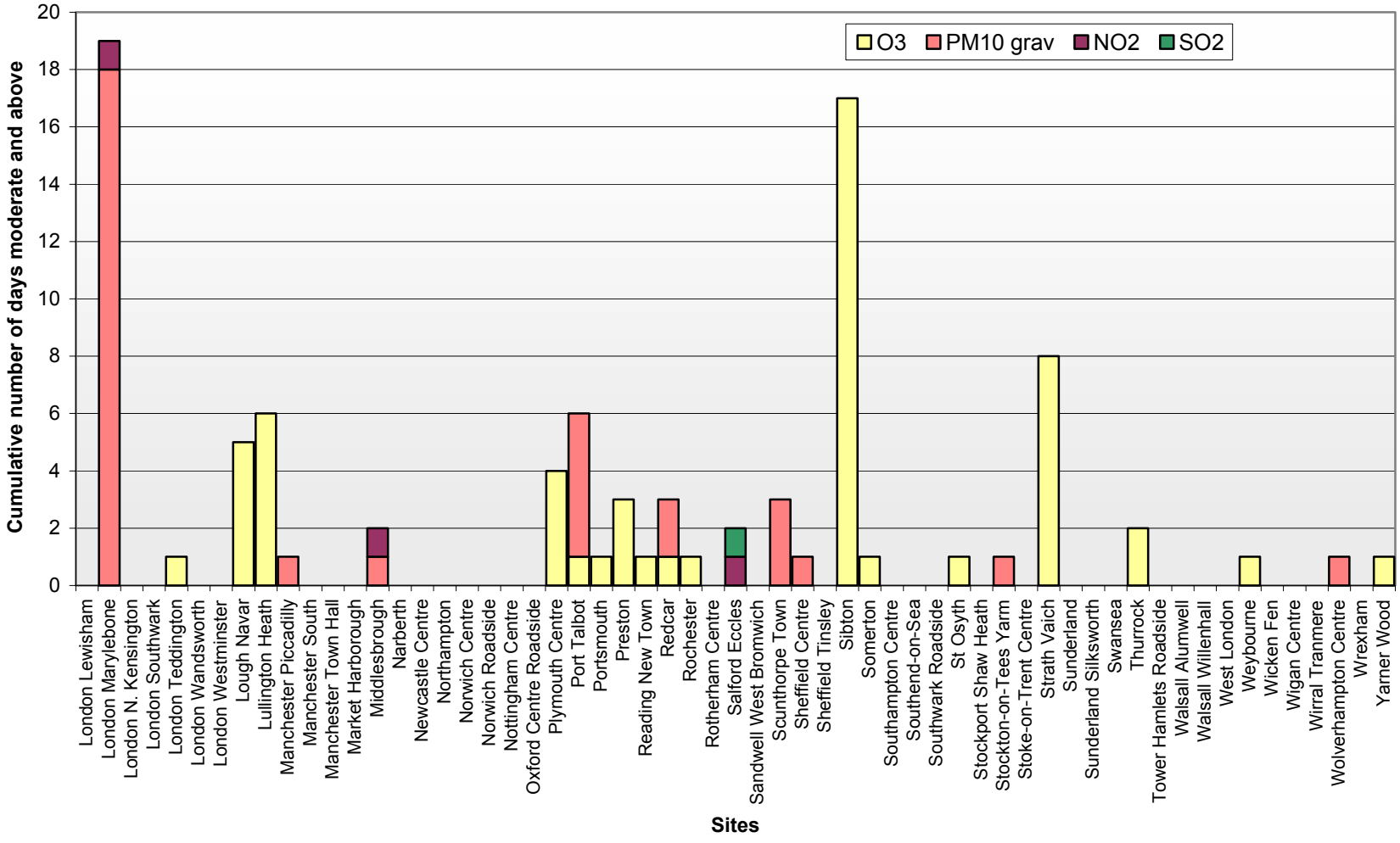


Figure 3.4b Number of days moderate and above for each AURN Network station over 1st quarter 2005 – provisional data

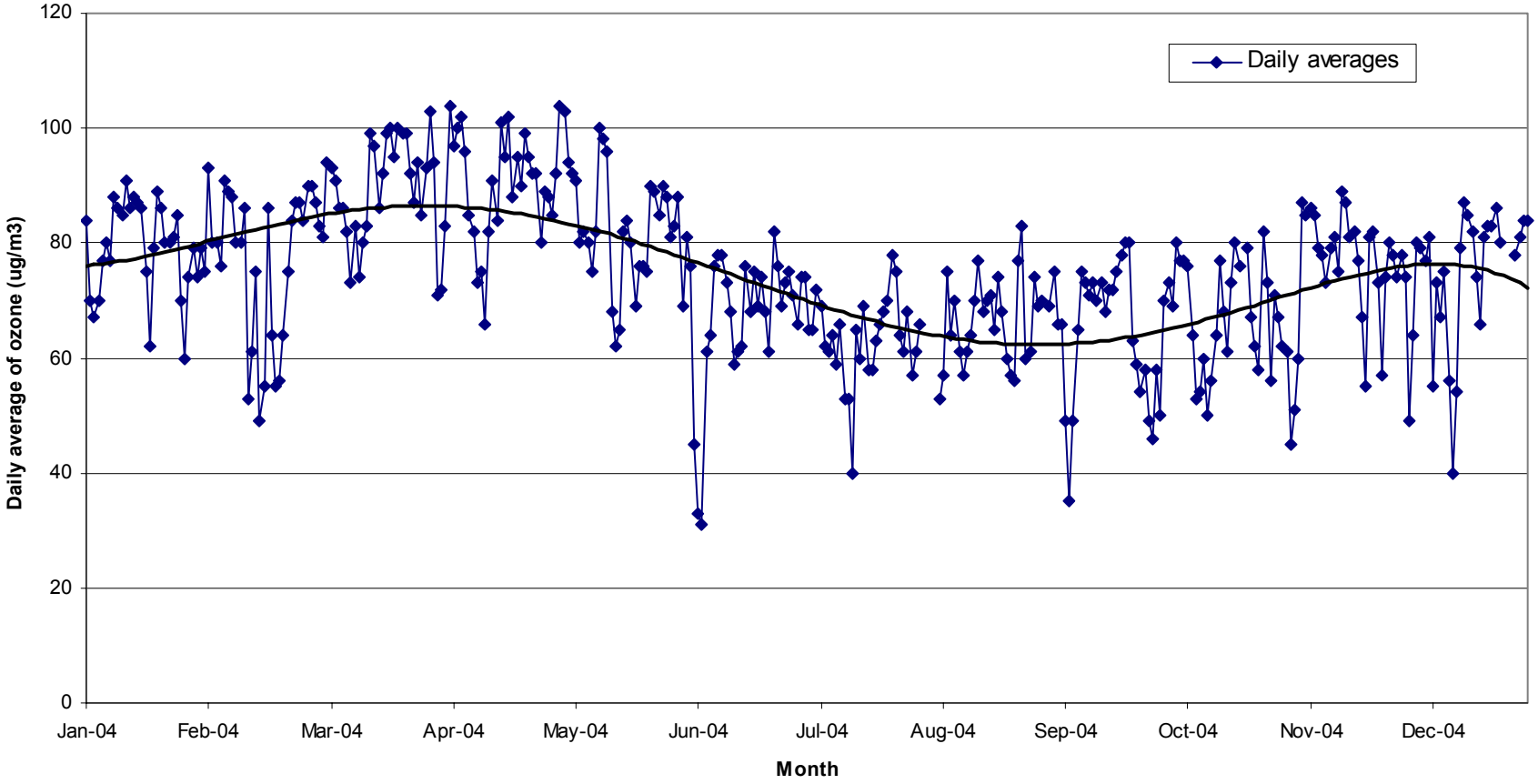


Figure 3.5 Mace Head – trend of ozone in 2004

4 Breakdowns in the service

All bulletins were successfully delivered to the Air Quality Communications contractor on time. There were no reported breakdowns in the service over this three-month period.

5 Additional or enhanced forecasts

No formal enhanced forecasts can be issued until the format of the enhanced service has been agreed with Defra and the Devolved Administrations.

The air pollution forecast is always re-issued to Teletext, Web and Freephone services at 10.00 local time each day, but will only be updated when the pollution situation is changing.

The bi-weekly air pollution outlooks have continued to be delivered successfully to Defra and other government departments by email on Tuesdays and Fridays.

6 Ad-hoc services

No new ad-hoc reports were issued this period.

The paper on the explosion at the Port Talbot Steel Works in November 2001 was re-circulated for comments prior to being published on the National Air Quality Archive and referenced in the AQEG PM_{10} report.

7 Ongoing research

Netcen and the Met office will also continue to:

1. Investigate ways of using automatic software systems to streamline the activities within the forecasting process, thus allowing forecasters to spend their time more efficiently considering the most accurate forecasts.
2. Research the chemistry used in our models, in particular the NO_x->NO_2 conversion used in NAME, and the chemical schemes for secondary PM_{10} and ozone.
3. Improve the NAME model runs that can be used for ad-hoc analyses, in particular with regard to investigating the possible long-range transport of PM_{10} pollution from forest fires in Russia and the long-range transport of particles from Saharan Dust Storms.
4. Improve and update the emissions inventories used in our models.

8 Forward work plan for April to June 2005

Major tasks include:

- Ongoing daily air pollution forecasting activities.
- Ongoing improvements to NAME model, including:
    - Improved modelling over steep topographical gradients
    - Higher resolution model runs with reduced statistical noise
    - Update of emissions inventory used in the model.
- Publication of quarters 1 to 4 2004 reports on the Air Quality Archive Web Site and an annual report for 2004.

9 Hardware and software inventory

Defra and the Devolved Administrations own the code for the ozone and secondary PM_{10} models, but not the graphical interface for these. Defra and the Devolved Administrations own the software for delivering the air pollution forecast to the Air Quality Communications system. Defra and the Devolved Administrations also own the web pages used to display the forecasts.

No computer hardware being used on this project is currently owned by Defra and the Devolved Administrations.

Appendix 1 - Air Pollution Index

CONTENTS

The UK Air Pollution Indices

Old Banding	Index	Ozone 8-hourly/ Hourly mean		Nitrogen Dioxide Hourly Mean		Sulphur Dioxide 15-Minute Mean		Carbon Monoxide 8-Hour Mean		PM_{10} Particles 24-Hour Mean
		μgm^{-3}	ppb	μgm^{-3}	ppb	μgm^{-3}	ppb	mgm^{-3}	ppm	gravimetric μgm^{-3}
LOW										
	1	0-32	0-16	0-95	0-49	0-88	0-32	0-3.8	0.0-3.2	0-21
	2	33-66	17-32	96-190	50-99	89-176	33-66	3.9-7.6	3.3-6.6	22-42
	3	67-99	33-49	191-286	100-149	177-265	67-99	7.7-11.5	6.7-9.9	43-64
MODERATE										
	4	100-126	50-62	287-381	150-199	266-354	100-132	11.6-13.4	10.0-11.5	65-74
	5	127-152	63-76	382–477	200-249	355-442	133-166	13.5-15.4	11.6-13.2	75-86
	6	153-179	77-89	478-572	250-299	443-531	167-199	15.5-17.3	13.3-14.9	87-96
HIGH										
	7	180-239	90-119	573-635	300-332	532-708	200-266	17.4-19.2	15.0-16.5	97-107
	8	240-299	120-149	636-700	333-366	709-886	267-332	19.3-21.2	16.6-18.2	108-118
	9	300-359	150-179	701-763	367-399	887-1063	333-399	21.3-23.1	18.3-19.9	119-129
VERY HIGH										
	10	≥ 360 μgm^{-3}	≥ 180 ppb	≥ 764 μgm^{-3}	≥ 400 ppb	≥1064 μgm^{-3}	≥ 400 ppb	≥ 23.2 mgm^{-3}	≥ 20 ppm	≥ 130 μgm^{-3}

Old Banding	New Index	Health Descriptor
LOW		
	1	Effects are unlikely to be noticed even by individuals who know they are sensitive to air pollutants
	2	
	3	
MODERATE		
	4	Mild effects unlikely to require action may be noticed amongst sensitive individuals
	5	
	6	
HIGH		
	7	Significant effects may be noticed by sensitive individuals and action to avoid or reduce these effects may be needed (e.g. reducing exposure by spending less time in polluted areas outdoors). Asthmatics will find that their "reliever inhaler is likely to reverse the effects on the lung.
	8	
	9	
VERY HIGH		
	10	The effects on sensitive individuals described for "HIGH" levels of pollution may worsen.

Appendix 2 - Forecasting Zones and Agglomerations

CONTENTS

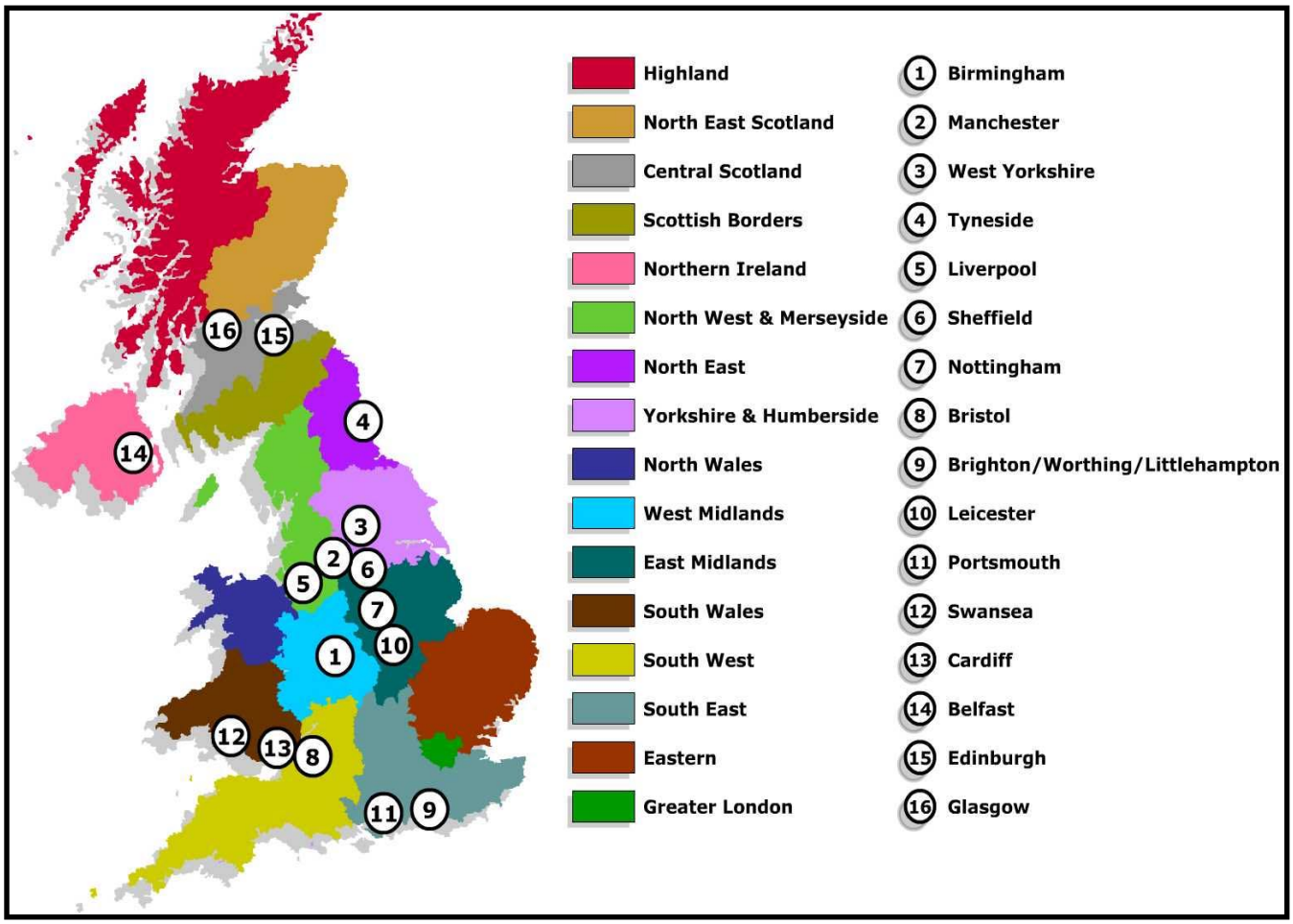
Forecasting Zones

Zone	Population
East Midlands	2923045
Eastern	4788766
Greater London	7650944
North East	1287979
North West and Merseyside	2823559
South East	3702634
South West	3728319
West Midlands	2154783
Yorkshire and Humberside	2446545
South Wales	1544120
North Wales	582488
Central Scotland	1628460
Highland	364639
North East Scotland	933485
Scottish Borders	246659
Northern Ireland	1101868

Forecasting Agglomerations

Agglomeration	Population
Brighton/Worthing/Littlehampton	437592
Bristol Urban Area	522784
Greater Manchester Urban Area	2277330
Leicester	416601
Liverpool Urban Area	837998
Nottingham Urban Area	613726
Portsmouth	409341
Sheffield Urban Area	633362
Tyneside	885981
West Midlands Urban Area	2296180
West Yorkshire Urban Area	1445981
Cardiff	306904
Swansea/Neath/Port Talbot	272456
Edinburgh Urban Area	416232
Glasgow Urban Area	1315544
Belfast	475987

Map of UK forecasting zones and agglomerations



Appendix 3 – Worked Example of How UK Forecasting Success and Accuracy Rates are Calculated.

CONTENTS

A worked example showing how forecasting accuracy and success rate are defined and calculated in this report

This analysis is based on an imaginary period of high pollution concentrations in South East England which occurred during warm weather and resulted in the formation of photochemical ozone. There were 4 days on which HIGH concentrations were measured; 29th July, 30th July, 1st August and 2nd August. Over the slightly longer period from 29th July – 3rd August, there were 6 days on which HIGH levels were either measured or forecast. During the whole reporting period, there were no other observations of HIGH band measurements, either forecast or actual. 31st July was a cooler day and measurements did not reach the HIGH band, despite being forecasted. Measured air pollution and previous day forecast are shown below for each day during this period, in terms of index and descriptive bands:

Date	***28/7***	***29/7***	***30/7***	***31/7***	***1/8***	***2/8***	***3/8***	***4/8***
Measured Index value (M)	**5** (MOD)	7 (HIGH)	7 (HIGH)	6 (MOD)	7 (HIGH)	7 (HIGH)	5 (MOD)	5 (MOD)
Forecast Index value (F)	5 (MOD)	6 (MOD)	7 (HIGH)	7 (HIGH)	8 (HIGH)	5 (MOD)	7 (HIGH)	6 (MOD)

Based on the figures above, the success and accuracy of predicting HIGH episodes (>= Air Pollution index 7) for the South East Zone may be analysed as shown below:

Date	***28/7***	***29/7***	***30/7***	***31/7***	***1/8***	***2/8***	***3/8***	***4/8***
Measured Index value (M)	**5** (MOD)	7 (HIGH)	7 (HIGH)	6 (MOD)	7 (HIGH)	7 (HIGH)	5 (MOD)	5 (MOD)
Forecast Index value (F)	5 (MOD)	6 (MOD)	7 (HIGH)	7 (HIGH)	8 (HIGH)	6 (MOD)	7 (HIGH)	6 (MOD)
HIGH forecast or measured	No, so not used in calculations	Yes	Yes	Yes	Yes	Yes	Yes	No, not used in calcs
OK- Agreement of F and M to +/- 1 index band	N/A	Yes	Yes	Yes	Yes	Yes	No	N/A

HIGH days measured	4
HIGH days forecast	4
OK (M and F) [i.e. Agreement of F and M to +/- 1 index band	5
Wrong (F not M)	1
Wrong (M not F)	0

The forecasting **success** during this period is calculated as:

[OK (M and F) / HIGH days measured]*100 = [5/4]*100 **= 125 %**

The corresponding **accuracy** is calculated as:

[OK (M and F) / {OK (M and F) + Wrong (M not F) + Wrong (F not M)}]*100

= [5 / {5+0+1}]*100 = [5/6]*100 = **83**

The analysis is then repeated for each of the 16 UK zones and 16 UK agglomerations.