



ENVIRONMENTAL HEALTH SECTION

Draft Air Quality Action Plan

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Contents

Executive Summary

1.0 Introduction

1.1 Action Plans

1.2 Action Plan Aims & Objectives

1.3 Timescales

2.0 Further Assessment Within Air Quality Management Area

2.1 Determination Of Sources Of Air Pollution Within The AQMA

2.2 Air Quality Improvement Required

2.2.1 Magnitude Of Exceedence Of Air Quality Objective

3.0 Implications Of This Further Assessment For Antrim Borough Council

3.1 Effects Of New National Policy Developments

3.2 Effects Of Local Policy Development

3.2.1 The NIHE Fuel Appliance Conversion Programme

3.2.2 Take Up Of Natural Gas

3.3 Changes To The Air Quality Management Area As A Result Of The Further Assessment

- 4.0 Consideration Of Action Plan Options
- 5.0 Recommended Options to be Included For Implementation
- 6.0 Appropriateness & Proportionality Of Measures
 - 6.1 NIHE Heating Conversion Scheme
 - 6.2 Implementation Of Warm Homes Scheme & Other Energy Efficiency Schemes
 - 6.3 Demolition Of Flats At Craig Walk, Ballycraigy
 - 6.4 Introducing Guidance Relating To Bonfires
 - 6.5 Including Air Quality Considerations In Responses To The Planning Service
- 7.0 Timescales For Implementation
- 8.0 Impacts Of Introducing Action Plan Measures
- 9.0 Conclusions

Appendix 1 Verification Study For Sulphur Dioxide In AQMA

Executive Summary

The Air Quality Strategy for England, Scotland, Wales & Northern Ireland provides a framework for air quality control through air quality management and air quality standards. These and other air quality standards and their objectives have been enacted through the Air Quality Regulations (Northern Ireland) 2003 in Northern Ireland. The Environment (Northern Ireland) Order 2002 requires District Councils to undertake air quality reviews and assessments. In areas where the air quality objectives are not anticipated to be met by the specified dates, District Councils are required to establish Air Quality Management Areas as a means to improve air quality.

Antrim Borough Council has now completed the first round of the review and assessment process and as a result have declared an air quality management area affecting Ballycraigy and Greystone housing estates in relation to exceedences of the 15-minute mean air quality objective for sulphur dioxide which is due to be complied with by 31 December 2005. The source of the emissions is deemed to be domestic emissions from solid fuel combustion.

This report considers a range of options to reduce domestic and other emissions of sulphur dioxide and other pollutants and considers the costs involved, feasibility, other perceived benefits and a proposed timescale for introduction. The report also indicates the organisation/body responsible for implementing each of the measures proposed.

1.0 Introduction

Antrim Borough Council published the Stage 2/3 Review And Assessment Report in May 2004. The conclusions of the report highlighted the requirement upon Antrim Borough Council to declare an air quality management area in Antrim town in relation to exceedences of the air quality objectives for sulphur dioxide. The air quality management areas was brought into effect by means of an order made by Antrim Borough Council and came into effect on 31st October 2004.

1.1 Action Plans

Antrim Borough Council are now required by Article 13(2) of the Environment (Northern Ireland) Order 2002 to prepare and submit a written action plan to the Department of the Environment for Northern Ireland. The action plan outlines the measures to be taken in pursuit of achieving the air quality objectives and air quality standards for sulphur dioxide within the air quality management area and proposes the timescale for implementing such measures.

The prime responsibility for preparing and submitting the action plan rests with district councils. However there is a requirement on other relevant authorities to identify proposals in pursuit of the air quality objectives within their respective responsibilities and functions. Antrim Borough Council will consult with all relevant authorities prior to the completed action plan being submitted to Department of the Environment.

1.2 Action Plan Aims & Objectives

The principal aim of the air quality action plan is to minimise the effects of air pollution on human health within the Antrim Borough Council area using all reasonable measures, within reasonable timeframes and by working towards achieving the air quality objectives and standards for sulphur dioxide. In order to comply with the air quality objectives it may be necessary to include measures beyond the boundaries of the air quality management areas. Some of the measures may also benefit areas not included within AQMA's thereby improving the health of the population in those areas.

1.3 Timescales

The Department of the Environment expects action plans to be completed within 12 months of the AQMA's being designated. Antrim Borough Council has been unable to meet this expectation for the reasons outlined in section 2.0 below. The Air Quality Regulations (NI) 2003 require all relevant authorities to submit their proposals to district councils within a maximum period of 3 months from receiving the draft action plan.

2.0 Further Assessment Of Air Quality Within AQMA

Antrim Borough Council is required under Article 13 of the Environment (Northern Ireland) Order 2002 to assess existing and likely future air quality within AQMA's and to assess why air quality standards and objectives are not being achieved within the AQMA's by the relevant dates. In order to comply with this requirement, Antrim Borough Council commissioned NETCEN to carry out detailed air quality dispersion modelling of emissions within the AQMA. It was intended to re-model the existing situation with the benefit of updated fuel use information and to model a number of scenarios with regard to different fuel usage within the AQMA. This was intended to address the "business as usual", or no change case and estimate the impact of a range of fuel use changes.

In the event, only the "business as usual" scenario was modelled, because, when this was modelled it did not predict any exceedence of the regulated objectives.

The difference in results between the stage 3 and this stage 4 modelling was put down to a number of factors:

1. The stage 3 modelling used a conservative screening methodology to identify those areas most at risk of exceeding the objectives.
2. The stage 4 modelling employed a technique that enabled a level of detailed modelling not available at stage 3.

3. The emissions factors used for the various fuel types had been updated since the stage 3 modelling and were different to the extent that a significant change to the updated modelling was anticipated.
4. The fuel use survey information in Antrim had been much extended since the earlier assessment.
5. The stage 3 modelling had used differing meteorological and monitoring years and therefore had to make corrections in order to match these to each other and the period of the objective. The latter study had been able to use identical meteorological, monitoring and modelling periods.

All in all, it was considered that the stage 4 study represented a more accurate modelling exercise using more up to date information than the previous stage 3 modelling.

In the report, NETCEN concluded that Antrim Borough Council may or may not wish to consider revocation of the AQMA, but stressed that the model remained subject to verification with local monitoring data.

In the event the Council decided to keep the AQMA in place until such time as a verification exercise could be carried out using a full data set from the Council's own real time sulphur dioxide analyser which had been installed at a site within the AQMA in November 2004. However, given the likelihood that the verification exercise would lead to revocation, it was decided that, in the interim, no work would be carried out on action planning.

Sufficient local monitoring data to permit modelling verification became available in May 2006 and having adjusted the modelling NETCEN has reported that the conclusions of the stage 4 report cannot be substantiated and are once again predicting exceedences of the 15-minute mean objective for sulphur dioxide (Appendix 1).

2.1 Determination Of Sources Of Air Pollution Within The AQMA

Source apportionment is the process whereby the contributions from the sources of a pollutant are determined. The principal sources of pollution are local background, domestic emissions, industrial emissions and transport related emissions. This process enables the most important source or sources to be identified.

There are no significant industrial sources of sulphur dioxide in the vicinity of the AQMA. Industrial sources elsewhere in the district were considered at stage 2 and found to be insignificant. Background concentrations for 2005 and 2010 in the AQMA are a maximum of $1.9\mu\text{g}/\text{m}^3$ and whilst road traffic emits small quantities of sulphur dioxide, domestic fuel combustion is the only significant source in the localised area and therefore for source apportionment it is reasonable to conclude that domestic fuel combustion is the cause of the exceedence.

Measures included in this action plan will therefore primarily relate to reducing domestic emissions of sulphur dioxide within the AQMA.

2.2 Air Quality Improvements Required

Antrim Borough Council is required to identify the improvements needed in air quality, when there are exceedences of the UK air quality objectives. District councils do not need to attempt to improve air quality beyond the air quality objective that is being exceeded although improved air quality will have a beneficial effect on health. It may be prudent for administrative reasons to place the boundary of the AQMA where it may include houses where the concentrations of sulphur dioxide are not predicted to exceed the 15 minute mean objective of $266\mu\text{g}/\text{m}^3$ (with 35 exceedences). This may mean that some houses in the AQMA will experience concentrations of sulphur dioxide lower than the objective.

2.2.1 Magnitude of exceedence of the air quality objectives

The highest 99.9 percentile 15 mean sulphur dioxide concentration predicted in the verification of the modelling study was just over 320 $\mu\text{g}/\text{m}^3$. The reduction in concentration required to achieve the objective is a reduction of approximately 54 $\mu\text{g}/\text{m}^3$.

3.0 Implications Of This Further Assessment For Antrim Borough Council

This section highlights the implications of this further assessment for Antrim Borough Council and in particular comments on the effects that new national policy developments have had and may have in the future on the predicted air quality in the Antrim Borough Council area.

3.1 Effects Of New National Policy Developments

The Department Of Environment in Northern Ireland have specified that this further assessment must comment on any changes that new national policy developments may have on the outcome of the air quality review and assessment process. In this case the exceedences leading to the declaration of the AQMA relate to localised burning practices and national policy developments will not affect the extent to which local actions are necessary to achieve the prescribed air quality objectives.

3.2 Effects of Local Policy Development

There is only one main key policy issue that may affect domestic fuel burning in Antrim in the future and that is the Northern Ireland Housing Executive (NIHE) heating appliance conversion programme.

3.2.1 The NIHE Heating Appliance Conversion Programme

During the 1970s and 1980s solid fuel systems were installed in public sector properties. Oil was not used due to the crisis in the worldwide market. The NIHE have been implementing a conversion programme since 1996, to replace central heating systems in properties with oil or gas. Since 2000, only oil (where gas is not available) and gas have been offered as the replacement

fuel. Out of 110,000 NIHE properties, 40,000 currently use oil or gas, 50,000 properties use solid fuels, while 20,000 use electricity for heating.

The rate of conversion is 9,000 properties a year (a third of which are gas) – and the solid fuel properties are being prioritised for conversion first. This could mean that all solid fuel has been phased out in the public sector housing stock by 2010.

3.2.2 Take Up Of Natural Gas

In 2001 the Northern Ireland Executive announced its support for the development of a multi million pound natural gas project. The project involves the construction of a gas pipeline from Greater Belfast to Dublin (known as the South North pipeline), which will link with a pipeline from near Carrickfergus to Londonderry (the North West pipeline). The North West pipeline was completed in 2004. Construction began on the South North pipeline in February 2006 and is on track for completion by October 2006.

The town of Antrim lies along the route of the South North pipeline and plans are in place for the roll out of gas to domestic and non-domestic customers as the supply becomes available.

3.3 Changes To The Air Quality Management Area As A Result Of The Further Assessment

Antrim Borough Council is required to comment on any changes that might be necessary to the extent of the AQMA currently in place as a result of this further assessment.

The assessment predicted exceedences in both estates that make up the AQMA. The assessment does not provide any compelling argument for amending the AQMA so it will remain as originally designated.

4.0 Consideration Of Action Plan Options

The source apportionment has shown that domestic fuel burning is the only significant source of emissions of sulphur dioxide in the AQMA. Information

taken from the National Atmospheric Emissions Inventory (NAEI) shows that the emission rate of sulphur dioxide from burning smokeless solid fuel (both estates are in smokeless zones) is 16.00 kt / mt fuel burnt whereas the emission rate for oil is 0.58 kt / mt. Natural gas is even more environmentally friendly, producing virtually no sulphur dioxide. It is therefore appropriate that measures to reduce the prevailing sulphur dioxide concentrations are concentrated on reducing domestic emissions of this pollutant and primarily targeted at solid fuel burning. The measures available for local control of emissions include:-

- Bringing forward the NIHE heating conversion scheme for the relevant areas of the Antrim Borough Council area;
- Increasing awareness and uptake of the Warm Homes Scheme and other energy efficiency schemes within relevant properties;
- Demolition of flats at Chain Walk, Ballycraigy;
- Introducing guidance on the use of bonfires and/or prohibiting bonfires;
- Include air quality considerations in consultation responses to Planning Service.

5.0 Recommended Options To Be Included For Implementation

It is felt that in order to provide the greatest improvement in air quality and therefore provide the greatest improvement in health of the population of the Antrim Borough Council area, all of the above measures should be brought forward and implemented in the shortest reasonable time.

6.0 Appropriateness & Proportionality Of Measures

6.1 *NIHE Heating Conversion Scheme*

It is considered that the NIHE and the Department for Social Development as relevant authorities under the Air Quality Regulations (NI) 2003 have a major role to play in implementing the heating conversion scheme within the shortest reasonable time. The NIHE own a large number of domestic properties within the Antrim Borough Council area, including a significant number of the dwellings contained within the housing estates that make up the AQMA. A considerable proportion of these have solid fuel heating systems

therefore conversion of these to gas or oil will provide a significant reduction in emissions of sulphur dioxide. Whilst the conversion scheme is due to approach completion by 2010 throughout the Antrim area, it is felt necessary to prioritise the AQMA in a more proactive manner in order to reflect the need to reduce sulphur dioxide concentrations therein. Agreement has now been achieved in order to ensure that the NIHE conversion programme reflects the geographical location of the AQMA's and the prevailing pollutant concentrations in these areas. Given that the NIHE is a major landlord within the Antrim Borough Council area it is considered that the heating conversion scheme is an appropriate and proportionate measure to implement in the air quality action plan.

6.2 Promotion Of The Warm Homes Scheme And Other Energy Efficiency Schemes

Several schemes, such as the Warm Homes Scheme, Warmer Ways to Better Health Project and Help the Aged Energy Efficiency Project, are available to assist owner-occupiers and tenants of private landlords in installing new central heating systems and insulation measures in their homes in order to improve energy efficiency. Householders who are in receipt of certain benefits or meet other income related criteria may qualify for free conversion to oil or natural gas and/or insulation measures through one of the schemes. The range of insulation measures available include cavity wall insulation, loft insulation, hot water tank jacket, oil burner jacket, reflective radiator panels and draught proofing to windows and doors, as well as energy saving advice.

In addition to the above schemes, the Energy Savings Trust run an Insulation Cash-Back Scheme available to all owner-occupiers and private landlords, regardless of income levels or whether or not the householder is in receipt of benefits. The scheme offers £150 cash back for cavity wall insulation and £75 cash back for loft insulation.

Promotion of the above-mentioned schemes would contribute towards providing improved air quality and increased energy efficiency in homes

through conversion to oil fired central heating from solid fuel fires and improvements to home insulation. The schemes are of particular benefit to those householders who would otherwise lack the financial means to undertake the conversion or insulation measures.

In order to promote these schemes Council staff will carry out door-to-door visits to all owner-occupied and privately rented properties within the AQMA. A questionnaire will be completed with the householders of these properties during the visits in order to assess their eligibility for inclusion in any of the schemes available. Where a householder is eligible, their details will be referred to the appropriate body for inclusion in the applicable scheme.

6.3 *Demolition Of Flats At Chain Walk, Ballycraigy*

Chain Court consists of two blocks of flats and is located within the Ballycraigy housing estate and therefore within the AQMA. All 33 of the flats that make up Chain Court have solid fuel heating.

The Housing Executive, which owns the properties has decided that both blocks are to be demolished. Although the reasons for demolition do not relate to air quality the proposed action will have the effect of removing 33 potential solid fuel burners from the AQMA and as such is deemed to be appropriate for inclusion in the air quality action plan.

6.4 *Introducing Guidance Relating To Bonfires*

Each year Antrim Borough Council receives a number of complaints in relation to the burning of waste materials. The Council routinely uses the relevant powers available under the Clean Air (Northern Ireland) Order 1981 and other legislation in order to control and prohibit further instances of burning. The Council also subscribes to the guidance contained in the Interagency Working Group on Bonfires (2004). This guidance is the latest available for use within district councils and other relevant authorities.

The Council has also established a Bonfires Committee made up of representatives of the Council, Police Service of Northern Ireland, Housing Executive and Fire Brigade as well as representatives of the community groups associated with the traditional bonfire sites within the borough. The committee aims to achieve greater control over the traditional bonfires with a subsequent reduction of the environmental damage, including emissions of sulphur dioxide, caused by them and is seen as a valid means of information dissemination.

The adoption of this guidance is deemed to be a relevant factor to be included in the air quality action plan. However due to the diverse location of such fires across the district on an annual basis, (there is one very large traditional site within the AQMA), the contribution to annual sulphur dioxide emissions is impossible to calculate.

6.5 *Include Air Quality Considerations In Responses To The Planning Service*

Local planning decisions have the potential to affect local air quality significantly and development control is an important tool in the improvement of air quality. District Council Environmental Health Departments are consultees for relevant developments and procedures currently exist whereby comments are forwarded to Planning Service in relation to material matters that are relevant to applications for planning permission.

The Environmental Health Section will ensure that air quality considerations are included in consultation responses to ensure that developments in or close to the AQMA do not lead to a deterioration of air quality and that all potential mitigation measures are considered. In considering planning applications the Section will be guided by the recommendations contained within the National Society for Clean Air 2004 document – Development Control: Planning for Air Quality.

7.0 Timescale For Implementation

It is acknowledged that the practical and financial implications of implementing some of the measures outlined above will be more onerous on some organisations than others and in particular will impact upon the business plans of the NIHE.

The principal aspect of the action plan is NIHE heating conversion scheme. This is scheduled to be complete by 2010. Timetables for this scheme will be dependent on a number of factors including the timing of the arrival of the pipeline in Antrim as well as the budgetary considerations mentioned above. Discussion with local and regional NIHE officials has taken place and it is felt that it may be possible to give priority to the AQMA estates within the plan for Antrim. It is also likely that other areas with pre-programmed conversion schemes will be converted alongside the targeted areas experiencing the worst air quality thereby providing a gradual reduction of pollution across the district as implementation of the action plan occurs.

Demolition of the flats at Chain Walk is programmed for early 2007 and the majority of the flats are currently unoccupied. Promotion of the Warm Homes and other schemes within the AQMA is underway.

A proposed timetable for the implementation of the Action Plan is shown in the following table

Action	Implementation Date
NIHE Conversion Scheme	2007/2008
Warm Home Scheme Promotion	2006
Demolition Of Chain Walk Flats	2007/2008
Bonfire Guidance & Controls	2006/2007
Planning Controls	2006

8.0 Impacts Of Introducing Action Plan Measures

<i>Proposed Measure</i>	<i>Cost Of Implementing Measure</i>	<i>Impact Of Implementing Measure</i>	<i>Time Needed To Implement Measure</i>
<i>NIHE Heating Conversion Scheme</i>	Medium	Medium	Medium
<i>Warm Home & Energy Efficiency Scheme Promotion</i>	Low	Low/Medium	Low/Medium
<i>Demolition Of Chain Walk</i>	Medium	Low/Medium	Medium
<i>Guidance On Bonfires/Controlling Bonfires</i>	Low	Low	Low
<i>Introducing Planning Controls</i>	Low	Low	Low

9.0 Conclusion

Antrim Borough Council has identified an exceedence of the air quality objectives for sulphur dioxide and has declared an AQMA. This draft action plan outlines the measures currently available and which are most appropriate and proportionate in reducing the emissions of this pollutant. The implementation of this action plan at the earliest possible time is recommended as a means to attempting to comply with the air quality objectives for sulphur dioxide.

APPENDIX 1

REVERIFICATION STUDY FOR SO₂ IN ANTRIM

In July 2005, netcen undertook the “*Air Quality Review and Assessment – Stage 4*” for Antrim Borough Council. This modelling study assessed Particulate Matter (PM₁₀) and Sulphur Dioxide (SO₂) concentrations in Antrim and concluded that the daily PM₁₀ objective and the 15 minute SO₂ objective were unlikely to be exceeded across the study area. This modelling was validated with automatic monitoring data from the closest site, which at that time was in Carrickfergus. At the time of the modelling, there was not enough automatic monitoring data in Antrim BC to validate the results.

Following Stage 3, an automatic monitoring station has monitored SO₂ in Antrim from January 2005. Figure 1 shows the location of Antrim’s monitoring station. The data has been ratified to the QA/QC standards used in the Defra network by Netcen. These data have been used to verify the modelled results from Stage 4 domestic combustion assessment for Antrim for SO₂.

The model adjustment factor used is based on *Monitoring/(Modelled + Background)*. This approach takes into account the uncertainty of the two modelling approaches (1x1km UK Background maps using empirical model and 25m resolution using DISP). By adding up modelled and background, we are adjusting both uncertainties rather than only adjusting the domestic modelling and leaving background unadjusted. This way, we are also taking into account other sources that may arise in the local area that might not be included in the background data like traffic. Experience with point source ADMS and DISP modelling has placed great confidence in this approach. Netcen is very confident that this approach is the most reliable. This approach is consistent with the uncertainties reported by Stedman et al. in UK air quality modelling for annual reporting 2003 on ambient air quality assessment under Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC.

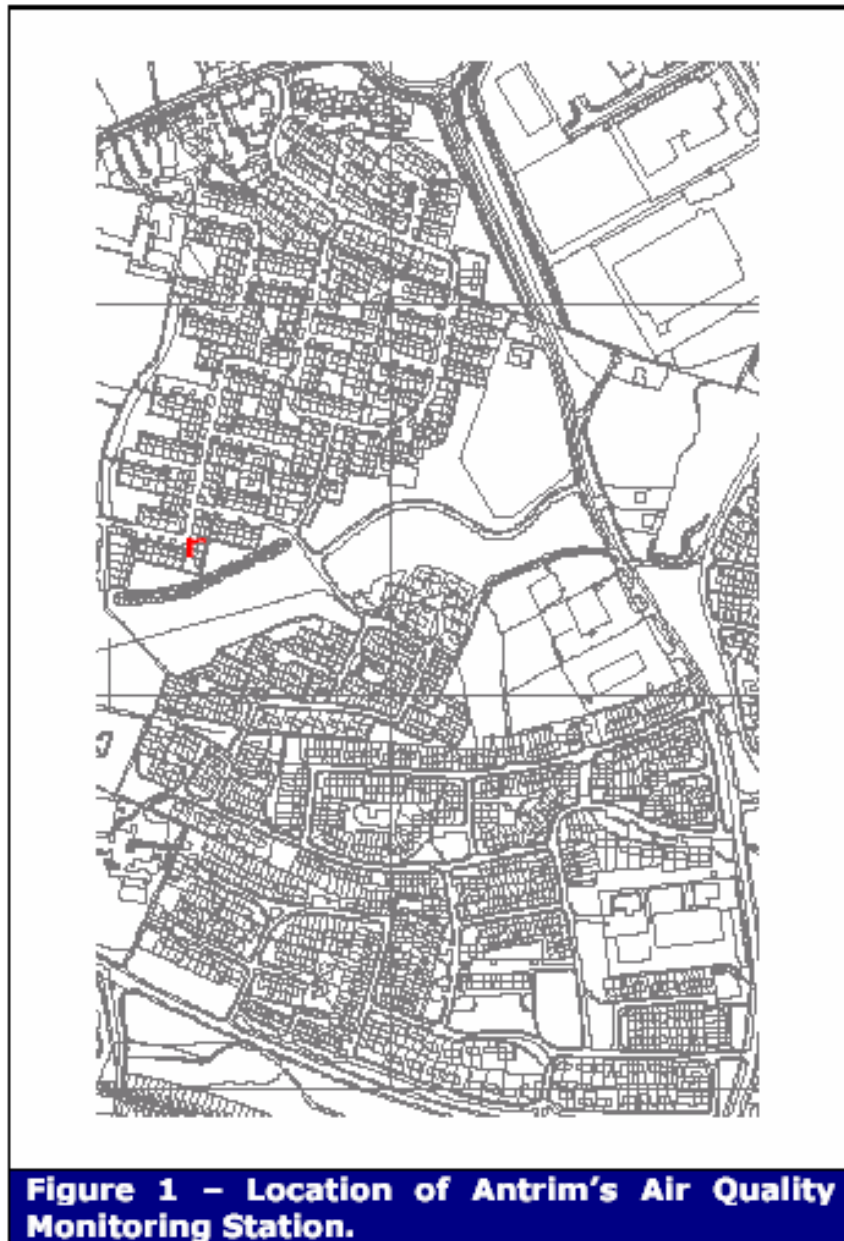


Table 1 and 2 show the way the model results were adjusted using monitoring data from Antrim’s monitoring station.

Table 1 Model adjustment for annual average

$\text{SO}_2 \text{ monitoring data} = (\text{SO}_2 \text{ background (monitoring period)} + \text{SO}_2 \text{ modelled}) \times f$ [annual mean]			
Monitoring data ¹	Background ²	Modelled Adjustment factor f	
13	2.09	6.50	1.51
¹ Annual average at Antrim (99.0% data capture)			
² Background SO ₂ data (Excluding sources modelled explicitly – 0.94 ug _m ⁻³)			

Table 2 Model adjustment for 15 minute average

$SO_2 \text{ monitoring data} = (15.568 * (SO_2 \text{ background (monitoring period)} + SO_2 \text{ modelled}) - 23.673) \times f$ [99.9 th %ile of 15 min mean]			
Monitoring data ¹	Background ²	Modelled Adjustment factor f	
178	2.09	6.50	1.62
¹ 99.9 th %ile 15 minute mean at Antrim (99.0% data capture)			
² Background SO2 data (Excluding sources modelled explicitly – 0.94 $\mu\text{g m}^{-3}$)			

SO₂ annual mean verified plots is shown in figure 2. The maximum SO₂ annual mean has been predicted to vary between 6 and 22 $\mu\text{g m}^{-3}$ across the grid.

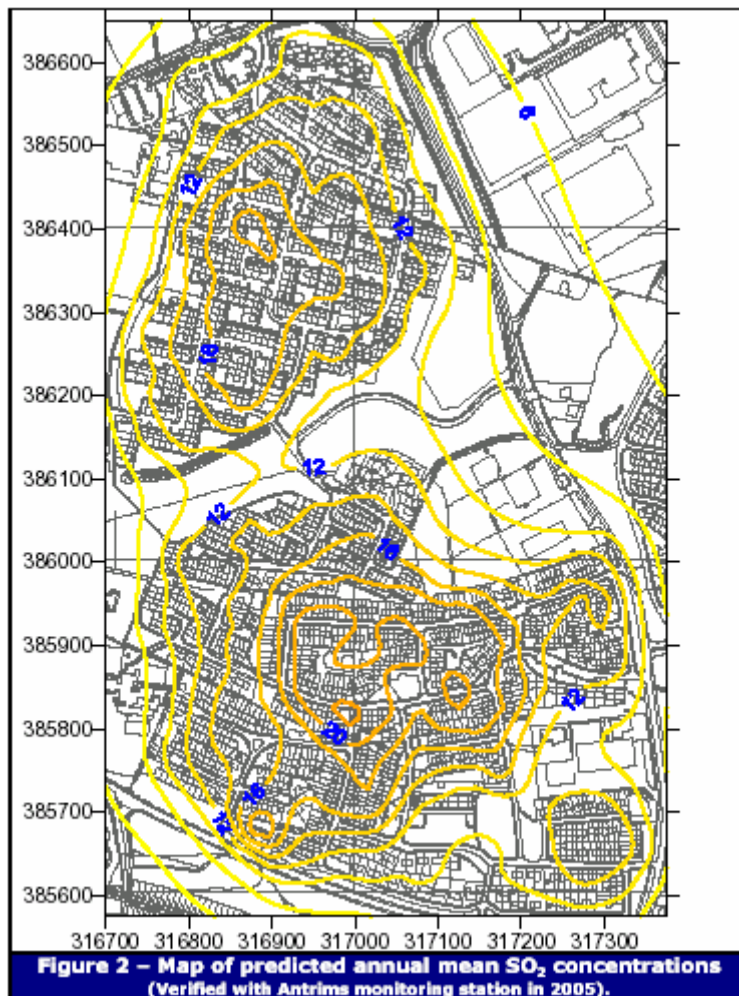
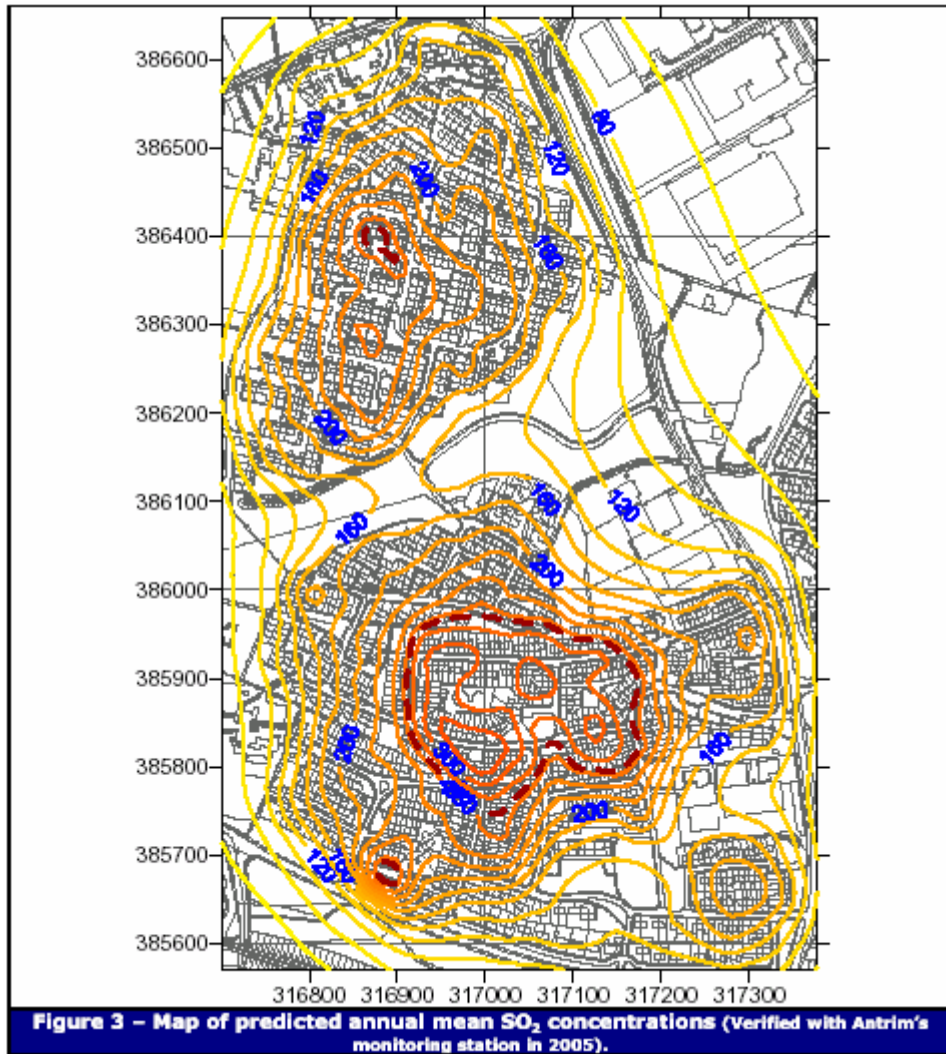


Figure 3 shows the predicted 99.9 percentile 15 minute mean SO₂ concentration for Antrim’s study area. The reverification of the modelling study predicts that the maximum 99.9 percentile 15 minute mean SO₂ within Antrim’s grid is above the 266 $\mu\text{g m}^{-3}$ objective level. Figure 3 shows an area with two smaller areas where the 15 minute mean SO₂ objective is likely to be exceeded.



* Should read “ Figure 3 – Map of predicted 15 minute mean SO₂ concentrations”

The reverification study predicts that the 99.9%ile 15 minute mean SO₂ objective is likely to be exceeded in Antrim.