AIR QUALITY MANAGEMENT AREAS: A REVIEW OF PROCEDURES & PRACTICE FOR LOCAL AUTHORITIES

This report provides a toolkit for local authorities to assist them in the definition and declaration of Air Quality Management Areas under the Environment Act 1995 and the Local Air Quality Management regime. This guidance was first produced by NSCA in spring 2001, under the title Air Quality Management Areas: Turning Reviews into Action. It has been revised and updated in the light of experiences from the first round of local authority air quality review and assessment, to produce this note.

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Chapter 1: Introduction

The process of Local Air Quality Management (LAQM) is defined through the Environment Act 1995, regulations, Secretary of State's guidance notes[1], and informal guidance documents such as this. In its simplest form, LAQM is an obligation placed on all first tier local authorities in the UK (borough, district and unitary authorities, but not county councils) to review the air quality in their areas, and assess whether there are likely exceedances of the UK Air Quality Objectives at the relevant date[2]. Where exceedance is thought likely, the authority is required to declare an air quality management area (AQMA), covering at least the area of exceedance. The precise size and shape of an AQMA is open to interpretation (see Chapter 2). AQMA declaration triggers the production of an Action Plan[3], for which NSCA has also produced guidance, to supplement that produced by Defra and the Devolved Administrations.

NSCA first produced guidance on the definition of air quality management areas during the first round of "review and assessment", in spring 2001. This essentially addressed two areas – the administrative process for declaring an AQMA, and a method for defining its boundary, based on a simple assessment of model uncertainty[4]. This relied on sample information from a relatively small data pool.

The first round of review and assessment was completed in 2003, and this guidance is an update on the 2001 version, incorporating experiences from the first round and using the expanded pool of data to reanalyse the "NSCA method" for boundary definition.

In all, AQMAs have been designated by 130 local authorities across England (including London), Scotland and Wales, following the first round of review and assessment. The great majority of them were declared on the basis of predicted exceedance of the nitrogen dioxide (NO_2) annual mean objective, largely as a result of road traffic emissions. Other AQMAs have been declared for the short-term objectives for particulates (PM_{10}) and sulphur dioxide (SO_2). There were no AQMAs declared for lead, carbon monoxide, benzene or 1,3-butadiene, nor are there likely to be any on current trends for most of these pollutants. In over 95% of AQMAs, road traffic emissions were the main cause of exceedance, and problem areas have included narrow, congested streets in smaller towns, motorway corridors in rural locations, as well as large urban conurbations.

Designating AQMAs still raises challenges for local authorities and revocations and amendments of existing AQMAs have occurred. This guidance seeks to provide information on:

- The administration of AQMAs;
- Defining the size and shape of AQMAs;
- The process involved in revoking and amending AQMAs;
- Consultation on AQMAs, and importance of regional working (although not to the depth of the last version of the guidance);
- The impact of AQMAs on planning; and
- The future of AQMAs as a tool for local air quality management.

Clear messages have emerged from the first round declaration process. Difficulties have arisen with scientific justifications for AQMAs, the political decision-making processes involved, delays in actually declaring AQMAs and local perceptions as to what AQMAs mean for local communities.

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1 LAQM Policy Guidance LAQM.PG(03) (Defra & Welsh Assembly Government, 2003; Scottish Executive, 2003; DoE Northern Ireland, 2003); LAQM Technical Guidance LAQM.TG(03) (Defra & Devolved Administrations, 2003).
2 Each objective has its own target date at which compliance is assessed. For example, the two objectives for particles (PM_{10}) are to be met by 31st December, 2004.
3 At the time of writing, the Government has produced proposals to change this obligation for local authorities in England. If these are taken up, English local authorities graded as "excellent" in their Comprehensive Performance Assessment will no longer be required to produce formal action plans, although they will still be under an obligation to use the powers and measures at their disposal to pursue the Air Quality Objectives, where an AQMA has been declared. Review and assessment obligations will not change.
4 Most local authorities have used complex air quality dispersion models to define their "area of exceedance", based on contour plots.

Chapter 2: Defining Size and Boundaries

Introduction

For the purpose of review and assessment, local authorities are required to undertake a Detailed Assessment if there is a likelihood of future exceedances of the objectives, as identified from an Updating and Screening Assessment. Box 1 indicates the four outcomes possible from a Detailed Assessment.

Box 1. The four possible outcomes from a Detailed Assessment

- Whether an AQMA is necessary where one does not currently exist;
- Whether or not an existing AQMA should be revoked or amended;
- Whether more AQMAs (i.e. in addition to those already declared) are necessary; or
- There is no requirement for an AQMA.

Local authorities should report upon and describe all areas where it is considered likely that the air quality objectives will not be met by the relevant period[1]. Where possible, the report should also propose the location of the AQMA, although the final decision as to where an AQMA is to be declared is usually a political one. Local authorities need to demonstrate confidence in their monitoring and modelling results, which includes an understanding of the inherent uncertainties in monitoring and modelling methods used.

Previously, the identification of exceedance areas has not appeared to cause local authorities a significant problem. However, difficulties have arisen in the decision-making process as to where to declare AQMAs subsequently, and how to address modelling uncertainties in the declaration process.

The Environment Act states that *"the local authority shall by order designate as an air quality management area any part of its area in which it appears that [the air quality objectives] are not likely to be achieved…"*. Taken literally, this means that the AQMA and the area of exceedance are exactly the same. Some authorities have designated AQMAs using the contours produced by dispersion modelling software as their boundaries. However, the majority have used such plots only as a guide, making use of physical features, e.g. roads, property boundaries, to mark out the AQMA. Others have used administrative boundaries, such as electoral wards, and a significant number, mainly in large conurbations, have declared their entire area as an AQMA.

While this latter case may not strictly be in the spirit of the Act, it does have some advantages, especially where the urban area (and area of exceedance) is contiguous with neighbouring authorities. This is especially the case in London, where authorities generally cover a small area and where there are few, if any, physical indications of the borders between different areas. In this case, "whole borough" declaration makes good sense. It also circumvents some administrative problems, and is perceived to avoid planning blight. However, as Chapter 4 shows, the presence of an AQMA can be a useful tool in influencing the kind of development allowed in an area, promoting low pollution developments. Blanket declaration of a whole borough, where there are only small areas of exceedance, is likely to dilute this effect.

A number of different types of AQMA have been identified, all of which are valid for their own circumstance, and these are summarised in Box 2, below. However, whatever type of AQMA is used, the Action Plan subsequently developed will, by necessity, impact on a much wider area. The argument that a greater area will benefit from the Action Plan associated with a blanket declaration of a whole borough is, in reality, largely used for presentational purposes.

Box 2. Types of AQMAs that emerged from Round 1

- Linear or "ribbon" AQMAs along individual roads and motorways
- Whole borough designations or "blanket" designations
- Road network or "matrix" AQMAs encompassing many roads (trunk, major or minor)
- Industrial "footprint" AQMAs around a particular industrial process, stack or building
- Individual or "spot" AQMA encompassing a single building or property
- Regional AQMA encompassing numerous local authorities
- Combination of roads (matrix) and land in between roads to produce a "mitten" or "blob" approach.

Predicting future concentrations is not an exact science, and as such local authorities have applied professional judgement in drawing boundaries for designated AQMAs. It is important for local authorities to ascertain the approximate extent of the exceedances and to then declare AQMAs where relevant exposure exists. However, not every local authority has AQMAs where there is relevant exposure – some have chosen to declare all areas of predicted exceedances, so as to inform local planning processes. This is discussed further in Chapter 4. More importantly, local authorities are required to consider source apportionment as part of further reviewing air quality within AQMAs, to underpin the air quality action planning process. Methods of source apportionment are not discussed in this guidance, and information can be found in other NSCA guidance[2] and other relevant government guidance[3].

The "NSCA Method" for Defining AQMA Boundaries

The previous version of this guidance, produced by NSCA in 2000, recommended a method for defining the boundary of

1 In England, Wales and Northern Ireland, provisional objectives for PM_{10} have been set for 2010, and 2015 in London. Local authorities have been asked by the Government and Devolved Administrations to assess air quality against them although, as they are not contained in regulations, local authorities are not under a legal obligation to assess against them. Therefore, an exceedance of these provisional objectives should not trigger the declaration of an AQMA. In Scotland, PM_{10} objectives for 2010 are contained in regulation, and so should be treated in the same way as other objectives, i.e. exceedance of these should trigger the declaration of an AQMA.

2 Air Quality Action Plans: Interim Guidance for Local Authorities. NSCA, Brighton, 2000. Air Quality: Planning for Action. NSCA, Brighton, 2001.

3 LAQM Policy Guidance LAQM.PG(03) (Defra & Welsh Assembly Government, 2003); LAQM Technical Guidance LAQM.TG(03) (Defra & Devolved Administrations, 2003).

an air quality management area. This method relied on an assessment of the uncertainty of the model used to predict the exceedance. It produces “uncertainty bands” within which the boundaries can be drawn, using physical features to aid clarity. In this version of the guidance, data from previous review and assessment reports has been used to update some of the assumptions made in the methodology, and to refine some of the stock values given.

However, it should be noted that this method is not intended to give a full assessment of model uncertainty, nor should it be used to do so. While the concepts within it are sound, the method is a simplified version of statistically more robust procedures which take account of log-normal distribution of data[1]. It is NSCA’s belief that the process of defining the AQMA boundary should not detract from the overall process of local air quality management, and in particular should not delay progression to the next stage, i.e. action planning. The method is therefore designed to allow local authorities to apply it quickly and easily, to inform the AQMA decision-making process.

A review of the data used to generate “stock U values” has been undertaken for the purpose of updating and reviewing this guidance. Appendix A provides an account of the “NSCA Method”, which remains an appropriate method for assisting with defining AQMA boundaries. Details of the data review are also provided in Appendix A, the outcome of which has confirmed that the stock U values for the NO_2 annual mean objective remain relevant and are therefore unchanged.

1 For an example of this, see Colvile R N, N K Woodfield, D J Carruthers, B E A Fisher, A Rickard, S Neville, A Hughes. Uncertainty in dispersion modelling and urban air quality mapping. Environmental Science & Policy, 5, 207-220, 2002.

Chapter 3: Declaration, Revocation and Amendment

Following the designation of AQMAs, local authorities have a duty to review air quality once more within the AQMA, to justify its existence and to initiate policies for subsequent action to improve poor air quality. This chapter considers the procedures necessary for declaring AQMAs initially, and for revoking and amending AQMAs in light of further assessment work.

Timing of AQMA Declarations

AQMAs are declared following a consultation period after the conclusion of Detailed Assessment work. It has often been the case that a local authority has proposed an AQMA, or various AQMA scenarios, within their Stage 3 reports. Other local authorities identified the areas of predicted air quality objective exceedances, with an intention of defining AQMAs following a period of consultation. Government guidance suggested a period of four months for declaring AQMAs, however in practice many local authorities took far longer to declare their AQMA(s) officially.

Delays in declaring AQMAs were due to a variety of reasons. Local authority committee cycles do not always lend themselves to keeping to strict deadlines. Changes in local government structure, political party or other such changes have caused difficulties for some authorities. Likewise, delays in consultation feedback, refining modelling outputs and other such issues have led to delays.

Whilst the time scale for declaring AQMAs remains the same (i.e. following the conclusion of the Detailed Assessment, as appropriate), local authorities do not have to await certain processes and outcomes before declaring AQMAs. With the new LAQM timetable imposed on local authorities following the 2003 revision of the policy and technical guidance, there are various time periods when local authorities may need to declare AQMAs. These are summarised in Box 3 below.

Box 3. Time interval for declaring AQMAs

- Following the conclusion of a Detailed Assessment;
- As a result of new information identified as part of the Progress Reports (to be undertaken by all local authorities every year, other than years when an Updating and Screening Assessment is to be undertaken (April 2006, April 2009) and a Detailed Assessment is to be undertaken (if necessary, i.e. April 2004, April 2007, April 2010), or
- At any time when monitoring or modelling indicates the need for an AQMA(s) to be declared.

A local authority has a duty to declare an AQMA, whether it can resolve the air quality exceedence through the action planning process or not. This caused confusion amongst some local authorities during the first round. The local authority is required to consult on proposals to declare AQMAs, and should publish the intention to declare in local papers. The publication of an official AQMA Order is also a requirement.

Consultation

Consultation and communication are inherent elements of the LAQM process, as they now are for many areas of local authority policy development. However, these terms take in a very wide variety of activities, and care needs to be taken in order to ensure that the methods used at different stages of the process are appropriate and likely to give the desired outcomes. The statutory consultation requirements for LAQM as a whole are specified in Schedule 11 of the Environment Act 1995. This prescribes a list of consultees, and allows discretion to consult other bodies and persons as considered appropriate, including both business interests and others (discretionary consultees referenced in 2(h) and 2(j) of Schedule 11).

Consultation methods are often characterised by the level of involvement they require, or, the degree to which decision-making is devolved to the consultees. This is often represented by a "ladder of involvement", and one version of this is shown below:

- **Information:** one way provision of information, e.g. simple leaflets
- **Education:** usually one way
- **Consultation:** asking opinions, e.g. questionnaires, voting, focus groups etc. Two-way with decision made by those who are doing the consulting
- **Involvement:** more than one opinion sought, and participants may be part of the solution through taking action. Two way, with responsibilities and roles variable
- **Partnership:** direct involvement in decision making and action, with all parties having clear roles, usually with a common aim
- **Devolved power:** giving away decision making, resources and control

Most well designed consultation campaigns will utilise several of these stages at different points in the process. Key to deciding which method to use at which point is having a clear understanding of the desired outcome – why is consultation being carried out? Consultation for its own sake will usually be a wasted effort.

Beyond this, a number of key questions need to be asked:

- How can consultation change the decision?
- How wide does it need to be (consultation can simply mean working with other professionals. It does not mean asking everyone, everything, all of the time)?
- How much time is there before the decision *has* to be made?
- What information is needed from other sources before the decision can be made?
- How relevant is the decision to any particular group?

In terms of air quality management areas, consultation clearly cannot change the decision of whether or not to declare. However, parts of the decision could be open to consultation, such as the extent of the area. There will be a question of relevance, and time is also likely to be restricted, being kept short in order to move swiftly on to the action planning stage. Finally, the information needed to make the decision has already been assembled, and so consultation is not likely to be of help here.

Therefore, taken in isolation, the decision of whether or not to declare an AQMA, and even the shape and size this should be, may not be an issue which will require extensive consultation. However, this decision does not exist in isolation, particularly if it is affirmative, but rather is part of a continuous process. Moreover, it is the first point at which a "public" decision is made. It is therefore an opportunity to raise the profile of the authority's activities with regard to air quality, and to prepare the ground for the development of an action plan or local strategy (i.e. information giving – see above). A number of authorities have used the decision to declare an AQMA to undertake information campaigns which have been successful in generating interest both of the general public and key stakeholder groups.

Examples of local authority good practice consultation are available for viewing at:
www.uwe.ac.uk/aqm/review/initiatives.html

Official Orders

A report should be submitted to the Council, Cabinet Member or Committee (or Officer) to whom the responsibility for making the Order is delegated. Where this is unclear, it is recommended that the report is taken to the Full Council or Executive, as this will:

- Fully mandate the making of the Order and, therefore, the AQMA, and
- Publicise its existence more widely among Elected Members, and not just those responsible for environmental issues.

The report should show that the correct procedures have been followed, identify the locations to be designated, and a resolution must be passed, authorising the making of an Order. The nominated Council Officer will then make the Order by affixing the local authority seal to the Order, designating the area. Usually, the relevant Officer is a Senior Legal Officer or Chief Executive.

The making of the Order is not prescribed by Statutory Instrument, nor is it the subject of Secretary of State's Guidance. Section 83(1) says that the Order must designate the area of the land and it is recommended that a map be provided. The Order must be officially sealed and must have the date of sealing.

It is not stated whether the date of operation should be the date of making. It may be advisable that the date of operation is later, up to two or three months, to allow for full local advertising of the Order. Section 84(1) hints at this when it says "where an Order under Section 83 above comes into operation" rather than saying "where an Order ... is made". Once again, decisions made by the local authority must be reasonable and the decision-making process demonstrable.

The only requirement is under Schedule 11, 4, 2 (c) which stipulates that copies of the document should be freely available to the public. Good practice should be to notify the Secretary of State, the Environment Agency or Highways Agency, where appropriate, relevant local businesses and local environmental pressure groups. It should be advertised locally and ideally placed on the Internet. While the local authority is obligated to make the Order, i.e. to declare the AQMA, it does mark a crucial stage in the local air quality management process and so should be included in the authority's consultation programme.

As with any decision made by a local authority, the general public has the right to question the efficacy, legality, or appropriateness of an AQMA Order. In reality this challenge is likely to be made through a pressure group, either nationally or locally based. The ultimate form of this challenge is through judicial review and it can realistically be expected that somewhere such a challenge will be mounted. It is important, therefore, that the decision-making process of the local authority can be demonstrated and this must be supported by relevant scientific information and robust evidence. It is advisable that the necessary information is assembled and made accessible both to the public and to Council Officers.

Revocation

A number of local authorities have undergone the process of revoking an AQMA within their authority. Box 4 illustrates the possible reasons and circumstances for revoking AQMAs.

Under the Environment Act 1995, local authorities are not necessarily under a duty to revoke an AQMA once the air quality objectives are predicted to be met. The provision in the Act gives local authorities the discretion to revoke if as a result of a review it appears to them that air quality objectives are likely to be met. However, a great deal of caution should be exercised before revoking an AQMA. Air quality improvements are likely to be gradual in nature, and so concentrations in the "former" AQMA are likely to remain just below the objective levels for some time. Keeping the Order in force will potentially offer a greater check on developments within the area, which could significantly degrade air quality, thereby triggering re-declaration. In particular, revocations should not be based on short-term monitoring campaigns, or on conditions prevalent for only one or two years.

Box 4. Some circumstances for revoking AQMAs within a local authority

- Exceedances of relevant AQO no longer predicted in AQMA (i.e. whole AQMA revoked)
- Exceedances of relevant AQO within one of a number AQMAs will require the revocation of that single AQMA
- Removal of relevant exposure from the designated AQMA may cause revocation
- Exceedances of a particular AQO no longer predicted, causing a revocation for the particular pollutant or objective within the AQMA

It is recommended that local authorities consult widely before deciding whether or not to revoke an AQMA. A local authority should then submit its justification to Defra or the appropriate Devolved Administration (including the GLA). The necessary information may be encompassed within a Further Review or an Action Planning Progress Report, or the annual Progress Reporting process, although a local authority can at any time revoke an AQMA, and provide the justification for doing so. As with the designation of an AQMA, the local authority must publish its intention to revoke an AQMA, and must publish its Revocation Order.

Amending AQMAs and Official Orders

There have been instances where local authorities have amended their previous AQMA Orders, as a result of further assessments within their AQMAs. For some local authorities, the area of predicted exceedances may increase (or decrease conversely), as a result of refining data as part of an assessment, or as a result of new data indicating a greater (or lesser) area of exceedance. A further reason for amending the boundaries of an AQMA may be an increase in exposure, for example through the construction of residential buildings on or near to the current boundary.

Significant changes may be identified in some local authorities, for example in those that have only parts of the authority where exceedances are predicted but have declared the whole borough. Conversely, only minor amendments, by way of an AQMA needing to extend further up a specific street or encompass a new street, may be required. In both cases, a local authority should amend the AQMA Order by the publication of a subsequent, new Order (section 83(2)(b) of the Environment Act 1995). The local authority is required to announce the intention to amend the Order, and publish the Amended Order. A local authority should inform central government of the intention to amend an Order.

Again, caution should be exercised before amending the boundaries of an AQMA. It is relatively easy to envisage a situation where a local authority becomes locked into a process of continually refining the AQMA boundaries, while delaying the process of action planning. It is suggested that boundaries are only changed where doing so makes a significant difference in terms of the actions and measures available, or the level of protection afforded against the adverse impacts of development

Post-Declaration Statutory Requirements

Section 84(1) of the Environment Act 1995 states the duties of local authorities in relation to designated areas being:

- An assessment of the quality for the time being, and the likely future air quality within the relevant period, of air within the designated area to which the Order relates; and
- The respects (if any) in which it appears that air quality standards or objectives are not being achieved, or are not likely within the relevant period to be achieved, within the designated area.

Where sophisticated modelling has been used to identify the AQMA initially, it is unlikely that an authority will require much additional work as a Further Assessment (formerly known as a Stage 4). However, a significant part of the requirement for a further review is to consider source apportionment, in order to assist with the development of an Action Plan. A local authority has 12 months from declaring an AQMA to submit a Further Assessment to the appropriate authority for approval, following which an Action Plan should be developed and implemented. Formal and informal guidance is available to local authorities on the development and implementation of Air Quality Action Plans[1].

Cross Boundary Cooperation

Cooperation and coordination between neighbouring local authorities should be given particular attention throughout the administrative process of declaration, amendment or revocation of AQMAs. This is particularly true where the boundary runs through an urban or residential area. In such cases, authorities using divergent methods and operating on radically different timescales can undermine the confidence of stakeholders. All efforts should be made to coordinate activities and ensure similar approaches, through consultation and joint working. The use of regional groups to exchange information and ideas, and to discuss administrative and technical issues is extremely helpful in this.

1 Formal action planning guidance in Policy Guidance for Local Authorities (LAQM.PG(03)), Defra & the Welsh Assembly Government, 2003 and the equivalent LAQM.PG(03) from the Scottish Executive and DoE Northern Ireland. Informal guidance in Air Quality: Planning for Action, NSCA, 2001.

Chapter 4: Local Authority Planning Processes

Introduction

From the outset of the LAQM process, and more specifically the process of designating AQMAs, concerns have been raised over the potential for AQMAs to affect local planning processes and cause planning blight. As a tool for improving air quality locally, AQMAs have not intended to cause a complete and definitive block on development. The impact of AQMA designations on planning processes are slowly emerging, as applications are refused and appealed on grounds that may include air quality, either entirely or partly.

This chapter serves as a reminder or indicator as to the practical implication AQMAs have on local planning processes, be they at a strategic or development control level. Conversely, the potential implication of planning processes on designated AQMAs is also explored.

Impact of AQMAs on Local & Strategic Planning

The designation of AQMAs serves to indicate the locations where people are exposed to elevated concentrations of pollutants. Although the designation of AQMAs is a statutory requirement, at locations of public exposure, AQMAs are also being used to inform local planning processes. They provide an indication as to those locations where air quality is impoverished, and where development should be sensitive to the need to ensure air quality is not compromised.

Strategic Planning

There is a need for AQMAs to be identified in local plans, unitary plans, transport plans, and any local authority plan where policies and actions may impact on efforts to reduce the air quality concentrations locally. Air quality officers, environmental health professionals and all those involved in facilitating the LAQM process should ensure that the necessary local authority departments are made aware of any designated AQMAs. Such departments should also be made aware of any subsequent AQMA revocations, amendments or new AQMAs as a result of subsequent rounds of air quality assessment.

Development Control Planning

Individual developments have the potential to affect local air quality concentrations. For example, bus stations or car parks with large movements of vehicles are not best located close to narrow, residential streets. Kerbside residential housing is best avoided along heavily trafficked roads or those experiencing regular and heavy congestion.

Planning Officers are not required to refuse planning proposals as a result of designated AQMAs alone. Air quality considerations, though material in planning terms, are considered together with a long list of environmental and other criteria. Experience so far has not shown air quality considerations to be responsible for determining applications on their own merit.

Local Transport Planning

For many local authorities with designated AQMAs, the Local Transport Plan (and the equivalent in Scotland, Northern Ireland and London) will serve as the main mechanism for improving local air quality through transport and traffic related measures. A Local Transport Plan has the potential to reduce significantly local emissions from traffic, but also to move traffic emissions into locations where air quality may be compromised. It is therefore imperative that AQMAs are considered as specific locations where a focus on improving local air quality must apply. Local authorities may need to put in place measures above and beyond those identified in Local Transport Plans in order to move towards the achievement of air quality objectives. The objective and purpose of air quality action planning is to identify the specific improvements to be made and the necessary schemes required to implement these. The NSCA has provided guidance documents on Air Quality Action Planning[1,2].

Guidance available on Planning and AQMAs

Planning Policy Guidance Note 23 (PPG23) provides guidance for planners on the consideration of air quality and environmental pollution in local planning processes. A revision of the Guidance Note is underway, and in future the profession anticipates a Planning Policy Statement, Environmental Pollution and Planning, to take the place of the previous PPG23. Other available guidance on Planning and AQMAs, for local planners and environmental health professionals is available from the government sponsored web site at www.uwe.ac.uk/aqm/review/planning.html.

Examples of planning protocols developed by local authorities to address air quality, AQMAs and planning can be found at this site, with other information. Links to formal guidance, as it emerges, will be linked from this site. Also to be linked from this site will be future guidance to emerge on Planning and Local Air Quality Management, and the preparation of Air Quality Assessments for local planning requirements, which will consider the impact of AQMAs on the process.

Emerging Examples of the Impact of AQMAs on Local Planning

Case law exists for planning applications that have been affected by air quality as a consideration. Little case law exists on the impact of AQMAs, or air quality generally, and planning applications specifically. Some examples are provided in Box 5 (see page 10) for information and to illustrate the nature of such AQMA and air quality impacts on planning, although this is by no means an exhaustive list.

1 Air Quality Action Plans: Interim Guidance for Local Authorities. NSCA, Brighton, 2000.
2 Air Quality: Planning for Action. NSCA, Brighton, 2001.

Box 5. Case Law examples

1 In 1998, planning permission for a supermarket development was refused on grounds that increased air pollution from exhaust emissions may cause damage to historic buildings. The decision was subsequently overturned by the Secretary of State, given the absence of an argument that negative impacts outweighed any benefit of the development.

2 In 1998 a drive-through McDonalds was refused on air quality grounds, though the case was successful on appeal through evidence to suggest that the development was not likely to cause air quality objectives to be exceeded.

3 In 1999 a housing development next to the M3 motorway was refused. The case saw a requirement for planning permission not to be granted until pollutant concentrations are below specific air quality objective levels.

4 In 2001, planning permission was refused for a single house development within an AQMA adjacent to the M20. The Inspector relied upon the Local Development Plan in his judgement, which specified air quality considerations in detail.

5 In 2002, a development for a block of flats along the A2 within a London Borough, which has declared the whole borough an AQMA, was refused. Air quality was a key objection, and a subsequent appeal was also rejected.

Chapter 5: Conclusions

Air quality management areas provide an important tool for bringing about improvements in local air quality, from a number of different perspectives. From an air quality management perspective, their designation pinpoints specifically the locations where air quality must improve to meet national objectives and where monitoring should be focused. For planners, AQMAs indicate where development must take account of the need to reduce the number of people exposed to elevated air quality concentrations. For transport planners, AQMAs provide further ammunition in seeking reduced congestion, improved traffic flow and transport facilities, albeit through the local transport planning process. Perhaps more importantly, and from a health perspective, AQMAs are a recognition of the risks posed to the public through polluting activities, and are evidence enough for the need to change our travel and socio-economic behaviour collectively.

In practice, AQMAs are a clear example of environmental decision-making at the local, ward and community level. They provide a useful and effective mechanism for informing the public and other stakeholders about the links between local air quality and health, and may become an important mechanism for implementing health action plans and providing useful evidence for the newly formed Health Development Agency[1]. The need to maintain communication with all parties involved in the AQMA decision-making process will become increasingly important, particularly as the process of action planning unfolds.

Whilst advances in the science underpinning AQMAs may occur over time, the diversity of shapes, sizes and types of AQMAs designated is likely to increase, as local decision-making processes continue to operate. Local circumstances, pressures and priorities will always dominate in the designation, amendment and revocation of AQMAs. A truly holistic approach to environmental protection should consider AQMAs as a tool for encouraging wider environmental improvement beyond the defined boundaries used.

1 For details on the Health Development Agency see www.hda.nhs.uk/evidence

Appendix A: The "NSCA Method" for Defining the Boundary of an AQMA

In carrying out statutory air quality reviews and assessments, local authorities are likely to use some highly sophisticated modelling tools during Detailed Assessments. The output of such tools is usually a contour plot, showing the location of expected exceedances, with the area bounded by a "line of exceedance". The Environment Act 1995 states that local authorities must designate *"any part of its area in which it appears that...[the air quality objectives]...will not be achieved"* as an AQMA. However, it would usually be inappropriate to translate the line of exceedance directly into the boundary of the AQMA because:

- dispersion model outputs are inherently uncertain, and it is therefore unlikely that the predicted line of exceedance will match the actual line of exceedance;
- for administrative and communication purposes, it would be better to define the AQMA boundary by reference to physical features (e.g. roads, rivers, field or property boundaries).

The NSCA method uses a simplified assessment of model uncertainty to produce a number of zones either side of the line of exceedance. It provides a methodology for assessing uncertainty by estimating the standard deviation of the model (SDM) to assist with defining boundaries where air quality is "almost certain" to comply with the objective (-2 SDM) or "almost certain" to exceed the objective (+2 SDM). By using the zone immediately outside the line of exceedance (+1 SDM) in which to set the boundary, there is sufficient flexibility to be able to use physical features, while giving confidence that the boundary is within a reasonable distance of the line of exceedance itself. The method therefore allows some scientific rigour to be applied to the process of boundary setting, and an audit trail for the final decision.

Review of Stock U Values

The guidance provides two methods of estimating SDM. The first requires data from at least four monitoring stations within the model study area. The second approach makes reference to "stock U values". Further details of the approach are provided later in this section. For the critical air quality objectives, the "stock U values" are as follows:

- 0.1 - 0.2 : annual mean nitrogen dioxide (air quality objective = 40µg/m^3)
- 0.3 - 0.5 : 90th percentile of 24 hour mean PM_{10} (air quality objective = 50µg/m^3)
- 0.1 - 0.2 : annual mean PM_{10} (air quality objective = 40µg/m^3).

The stock U values were derived previously from limited data available from London at the time. Since the publication of the original guidance, the first round of Review and Assessment has been completed, significantly extending the dataset for deriving stock U values.

Paired modelled and monitored data for 121 urban background sites and 40 roadside sites have been compiled for annual mean nitrogen dioxide. These datasets exclude a very small number of outliers, defined as data pairs with the modelled value being greater than ±50% of the monitored value. A linear regression has been constructed for each dataset with a good degree of correlation (r^2 >50%). For both datasets the results, with only a few exceptions, are within the bounds of ± 25%. This suggests that there has been an overall improvement and refining of input data used in modelling work, as technical guidance currently suggests a model error of ±50%.

Using the method described in the original NSCA guidance, the U value has been calculated from these datasets as 0.19 for urban background sites and 0.17 for roadside sites. These results are within the range of stock U values (0.1 - 0.2).

Similarly, paired modelled and monitored data for 13 urban background sites and three roadside sites have been compiled for daily mean particles (PM_{10}) although, using the same method for excluding outliers, only seven urban background and one roadside sites provide suitable data for annual mean particles. Unfortunately, there are insufficient data to draw any firm conclusions. A U value of 0.13 has been calculated from the daily mean urban background dataset. This is within the range of stock U values (0.1 - 0.2). A U value of 0.51 has been calculated from the annual mean urban background dataset. This is outside the range of stock U values (0.1 - 0.2).

Revisiting the stock U values with reference to a more extensive dataset reinforces the approach developed by NSCA, particularly for NO_2. A more extensive dataset is required to draw firm conclusions for PM_{10}.

The "NSCA Method": Approaches A and B

An approach towards defining uncertainty is described in an "ideal" situation where the authority has a number of high quality monitoring stations (Approach A). This sets out the important basis of defining uncertainty, which should be used wherever possible. However, it is recognised that such data requirements are unlikely to be achieved by the majority of local authorities, and so a less sophisticated approach is also described which offers a more pragmatic solution (Approach B).

If there is little or no confidence either in the modelled or the observed data, regardless of statistical analysis, it should not be used as the basis for declaring an air quality management area. In this case, the authority must be explicit as to why declaration has not been carried out and should inform the appropriate authority of its reasoning. It should also be clear as to the actions it intends to carry out in order to improve the data quality, such as reviewing its emissions inventory or obtaining more monitoring data.

Approach A: Data From 3 or More Stations

The method detailed below provides one way of assessing the uncertainty within model outputs. Whether or not a local authority adopts this method, the key issue is that it carries out its assessment reasonably and that it is both explicit and transparent as to the method used. This method should properly reflect local circumstances and the data available at the time of the assessment.

What data do I need?

The first stage of this procedure is to validate the dispersion model to find the error level. In order to do this, the model should be run to predict the concentration at a location and time period where concentrations are known (i.e. a monitoring station). The output from the model and the actual data, i.e. the monitored or observed data, should be assembled in a table (in a format comparable with the relevant objective, e.g. annual mean, 99.9th percentile of 15-minute mean, etc.) as in the following example:

Example:

Annual Mean NO_2	Observed Data µg/m^{-3})	Model Predictions µg/m^{-3})
Station 1, year 1	38	40
Station 1, year 2	41	37
Station 1, year 3	44	43
Station 2, year 1	29	33
Station 2, year 2	30	34
Station 2, year 3	32	36
Station 3, year 1	50	48
Station 3, year 2	56	40
Station 3, year 3	48	38
Station 4, year 1	23	20
Station 4, year 2	27	25
Station 4, year 3	26	27

How much data do I need?

This method, when carried out in full, uses a regression analysis to obtain a value for uncertainty. The minimum number of data points needed for this is three, although simply having three data points may not properly assess the performance of the model. It is recommended that the assessment includes data from at least four monitoring stations and that these are representative of the various types of environment being monitored (for example, urban centre, roadside, sub-urban, etc.). Caution may need to be applied if different site types are included in a single regression analysis – the model may perform differently for background and kerbside sites. It is recognised that many local authorities will not have this level of data and so the following options could be explored:

- Expand the area under consideration to include monitoring points in neighbouring areas – this will obviously be easier where a joint arrangement has been entered into.
- Develop an assessment method which more fully represents local circumstances, for example using sensitivity analysis for the model, or by comparison with studies in similar areas where uncertainty has been successfully assessed.
- Adopt Approach B described below, using tabulated values.

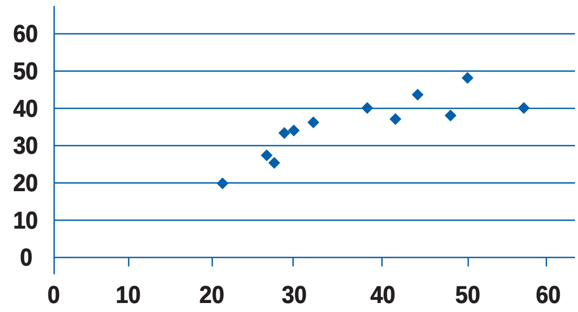
Assessing uncertainty

This method can be carried out using a spreadsheet package, such as Microsoft Excel or Lotus 123, which may also help with the presentation of the calculations at a later date.

A1: The first step, once it is assured that data of suitable quality are available from at least 4 stations, is to tabulate the measured and monitored concentrations.

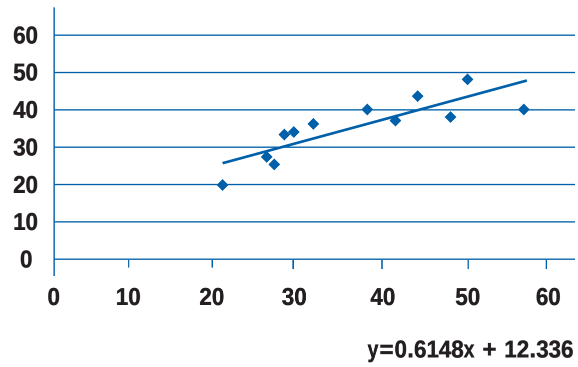
A2: Plot the data points on a scatter graph, with observed data (monitoring data) on the x (horizontal) axis and modelled data on the y (vertical) axis. Using the data in the example above gives the following plot:

Example 1: Data Points



A3: Plot the line of best fit (by regression of y (modelled) on x (observed) through the scattered points. The origin may, or may not, intersect 0, depending on whether an offset for background concentrations, etc. is included. Having a free-floating line will obviously give a statistically better fit, as in the example below. The formula for the line is also shown, in the form $Y=MX + C$:

Example 2: Data Points, with best fit line



A4: Calculate the horizontal difference of the points from the line, i.e. the deviation of the modelled data. This can be done using the formula for the line of best fit:

Modelling deviation = ((M.observed) + C) – modelled

therefore, for the first data point:

Modelling deviation = ((0.6148 x 38) + 12.336) – 40
= (23.3624 + 12.336) – 40
= 35.6984 – 40
= -4.3016

Repeat this calculation for each data point and tabulate:

Data Point	Observed Data	Model Predictions	Modelling Deviation
1	38	40	-4.3016
2	41	37	0.5428
3	44	43	-3.6128
4	29	33	-2.8348
5	30	34	-3.22
6	32	36	-3.9904
7	50	48	-4.924
8	56	40	6.7648
9	48	38	3.8464
10	23	20	6.4764
11	27	25	3.9356
12	26	27	1.3208

A5: Use the deviation values to calculate the standard deviation. From the example, standard deviation (SD) is 4.37.

A6: Calculate the U value for the data using the following formula

$$U = \frac{SD}{\text{mean of observed data}}$$

From the example, U = 4.37/37
= 0.1181
= 0.12

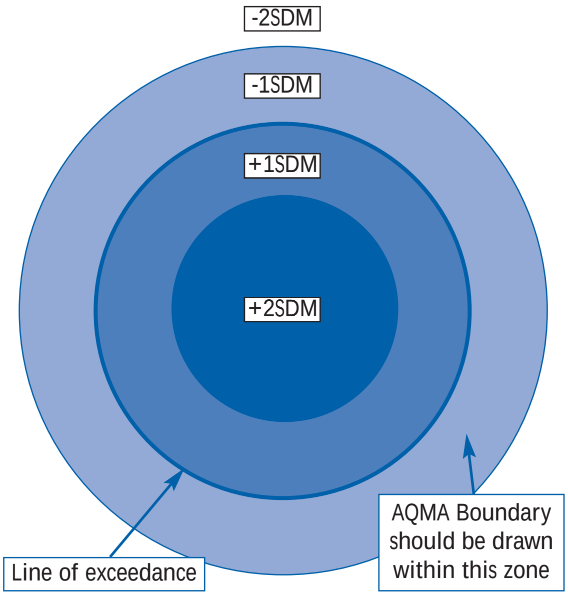
A7: Calculate the standard deviation for the model (SDM) using the following formula, SDM = U x Co, where Co is the concentration of the air quality objective under consideration. Assuming the annual mean objective concentration from the example is 40 µg/m^3 NO_2:

SDM = 0.12 x 40 = 4.8

A8: Plot contours at locations where the model predicts Co+2.SDM, Co+SDM, Co, Co-SDM, Co-2.SDM. In the example, this would be approximately 49.6, 44.8, 40, 35.2, 30.4 µg/m^3 NO_2. If this is not possible or produces a confusing picture, the number of uncertainty "zones" should be minimised in the first instance e.g. plots at Co±1.SDM.

The output from this process is, therefore, a contour plot of the modelled area showing a number of regions, with the line of exceedance roughly in the middle (i.e. the line at Co). At the centre is a region where the air quality is "almost certain" (+2.SDM) to exceed the air quality objective and around the outside, the region where air quality is "almost certain" (-2.SDM) to comply with the objective. The regions either side of the line of exceedance contain the greatest degree of uncertainty. Using this method, the AQMA boundary should be drawn using physical features within the zone +1.SDM, as shown in figure 1.

Figure 1: Schematic of the output from the NSCA method



Approach B: Data from 1 or 2 Monitoring Stations

It is recognised that in many situations, authorities will only have monitoring data from one, or possibly two monitoring stations. In such situations it is not possible to determine the modelling uncertainty using the approach described above, as there are simply not enough points to plot on the graph (e.g. the calculation of an annual mean concentration from hourly data at a station will reduce the number of data points from 8760 to 1!). However, even limited monitoring data can be used to improve the validation process, and the following approach is suggested:

B1: Assess the systematic error – Where the annual mean concentration is considered with few sites, it will not be possible to plot the data. In this case, it is recommended that a comparison of modelled vs. observed annual mean concentrations (or other relevant average/percentile) is undertaken, and a factor derived which can be used to correct the model values. For example, assuming a modelled annual mean for PM_{10} of 71 µg/m^3 and a observed annual mean of 56 µg/m^3, it could be assumed that the model is over predicting by a factor of (71/56) i.e. by about 27%. All modelled concentrations could then be "corrected" accordingly. Where short-term concentrations are considered it will be possible to plot the modelled vs. observed data and a "correction factor" derived from the best fit line.

B2: The "corrected data" will still be subject to uncertainty in the modelling process. In the absence of sufficient data, stock values of "U" are provided in the table below, based upon previous experience. In some cases a range of values is given – in the absence of other information the authority may select the mean value of the range.

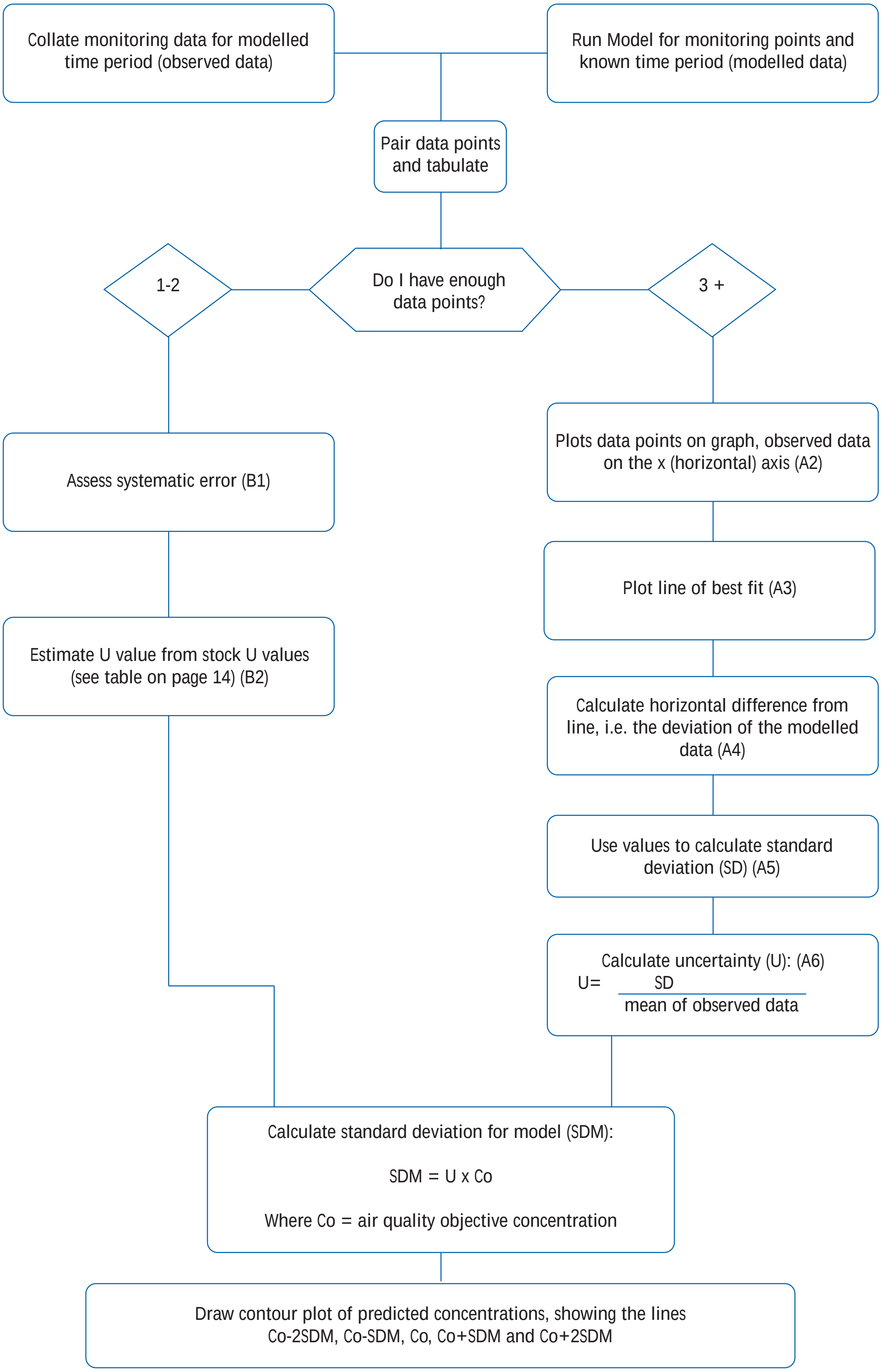
Air Quality Objective	Stock U Value
Benzene, running annual mean	0.1 – 0.3
1,3-butadiene, running annual mean	0.1 – 0.3
Carbon monoxide, running 8 hour mean	0.3 – 0.5
Lead, annual mean	0.1 – 0.3
Nitrogen dioxide, 1 hour mean (99.8th percentile)	0.3 – 0.5
Nitrogen dioxide, annual mean	0.1 – 0.2
Particles, 24 hour mean (90th percentile)	0.3 – 0.5
Particles, annual mean	0.3
Sulphur dioxide, 1 hour mean (99.7th percentile)	0.5
Sulphur dioxide, 24 hour mean (99th percentile)	0.3 – 0.5
Sulphur dioxide, 15 minute mean (99.9th percentile)	0.5

Note: the above table suggests values of "U" based on studies of model runs in London

Ideally, the assessment would be based on a logarithmic distribution – the above method is suggested for simplicity. Values of "U" have been capped at 0.5 to prevent the calculation of negative concentrations.

B3: Calculate the standard deviation (SDM) for the model and plot contours as described above in Steps (A7) and (A8).

NSCA Method Summary Flowchart



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NSCA is a Registered Charity (number 221026)

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