Environmental justice consequences of the UK's Local Air Quality Management (LAQM) system

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Abstract

This paper will investigate the relationship between social deprivation and environmental quality, referred to as Environmental Justice. Specifically it examines the formulation, structure and implementation of the UK's Local Air Quality Management (LAQM) system in terms of its possible impacts on social equity. Under the LAQM system Local Authorities (LAs) are required to identify areas, known as Air Quality Management Areas (AQMAs), where air quality objectives cannot be met. LAs that have declared AQMAs are also required to produce Air Quality Action Plans (AQAPs); these are reports that inform the government of, amongst other things, the mitigations strategies to be adopted by the LA. This paper will present the initial findings on the level of social deprivation within the AQMAs. The methodological complexities of computing deprivation within AQMAs are also discussed. An assessment of the inclusion of social issues within the LAQM process is undertaken by appraising AQAPs. The paper will review the method adopted by LAs in developing AQAPs and examine the extent to which social considerations are included in the plans. The overall project aim is to provide a decision support process in which social issues are considered in the development, implementation and enforcement of environmental policies.
Keywords: Air Quality Management Areas (AQMAs), local air quality management, environmental justice, social equity.

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1 Introduction

The importance of protecting human health and the environment against the adverse effects of air pollution is well established. Legislation at an international, European and national level combined with technological advances have brought about great improvements in air quality. In the UK the Local Air Quality Management (LAQM) system, established since 1997, has placed responsibility on local government in tackling air pollution problems [1]; it deals specifically with areas where the national air quality objectives are not likely to be met. Under this system Local Authorities are required to identify areas, known as Air Quality Management Areas (AQMAs). LAs that that have designated AQMAs are also required to produce Air Quality Action Plans (AQAP); these are reports that inform the government and devolved administrations of the pollution sources causing the designation, quantifying and predicting concentrations and suggesting possible solutions [2]. The LAQM system has been reviewed at several occasions and subsequently adapted [3]. The process has proved successful at providing a detail account of areas in the UK with poor air quality, but at the same time indicated a lack of adequate provisions in coordinating implementation of the necessary measures to meet objectives within the desirable timescale [4].

Environmental management mechanisms, although effective in reducing overall pollution levels, have not taken into account social issues especially when drawing up environmental policies. The significance of considering social impacts is due to inequalities that may rise in the distribution of pollution across the different social strata from implementation of management regimes. This project is trying to address this issue by examining the relationship between social deprivation and environmental quality, referred to as Environmental Justice (EJ). It is investigating the LAQM system in reference to its possible implications on EJ, a term defined as the equitable treatment of all people regardless of their race, culture, income and social class in the development, implementation and enforcement of environmental regulations and policies [5].

The driving force of EJ has been primarily grass root activism in the USA that led to extensive research and the adoption by the US Environmental Protection Agency of EJ in environmental decision-making [6]. At European level community regulations, set up through the Aarhus Convention established the need for access to information, public participation in decision-making and access to justice in environmental matters [7]. EJ research in the US deals primarily with racial discrimination whereas the UK experience is concerned with general inequality. Furthermore, the UK research although more limited still suffers with the lack of a methodological consensus in measuring environmental equity. In the UK studies on EJ have used a variety of geographical scales to deal primarily with point sources issues but also to establish possible correlations of pollutant concentration and level of deprivation [8]. The published research has been undertaken not only by academic institutions but also by pressure groups [9].

This project examines the EJ consequences of the LAQM system by identifying social attributes of the population living in AQMAs and therefore assesses any possible inequalities in exposure to air pollution. AQMAs have been declared in the UK for exceedences of the air quality objectives for NO_2, PM_{10} and SO_2. These exceedences are primarily due to traffic emissions. A significant part of this project involves the appraisal of AQAPs that provide a list of strategies aimed at mitigating the air quality objective exceedences, as well as their feasibility, their timetable, and the quantification of their environmental, economic and social impact. Several departments within the LA take part in the process of producing these reports such as transport planning, land use and town management, environment protection, energy management, waste management, economic development, regeneration and tourism and corporate policy and resources [2]. This level of involvement by the different LA departments is indicative of the need of coordination in producing satisfactory reports.

2 Methodology

The methods used in this project combine qualitative and quantitative analysis of data taken from AQAPs, questionnaire surveys and case studies. Geographical Information Systems (GIS) are used for visualising and performing part of the analysis. GIS is used in the digitisation of AQMAs and the computation of deprivation scores. The process of declaring AQMA implies that they will be revoked and new ones will be declared when new information emerges [10]. This characteristic makes the prospect of analysing poverty within these areas problematic as the AQMAs are not static. As a result the analysis of poverty is limited to LAs that have produced a draft or final version of their AQAPs up to October 2005. Table 1 provides the number of AQMA used in this project for computing poverty; they are classified according to their geographical characteristics.

Table 1: Classification of AQMAs.

AQMA Type	Number of maps
Road network	87
Whole Borough	20
Individual residencies	6
Area of borough	56
Motorway network	27
Other	3
Total	**199**

The number of AQMAs does not reflect the LAs with AQMAs as a significant number of LAs have declared more than one AQMA. Specifically 113 LAs from England and Wales are used in this project. The decision to

declare an AQMA is based from modelling and monitoring work undertaken in the different stages of the LAQM process [11, 12] The AQAPs are appraised in order to assess the way that social issues are considered in the formulation of strategies aimed at alleviating the pollution problem leading to the declaration of AQMAs. Table 2 provides a list of AQAPs appraised according to region.

Table 2: Air Quality Action Plans (AQAPs).

Region	AQAPs	
	Final	Draft
England	59	20
London	27	4
Wales	3	
Total	89	24

In order to compute deprivation within AQMAs a Geographical Information System (GIS) is used to digitise the maps and subsequently calculate and visualise deprivation. The way GIS analysis performed in this study greatly depends on the use of AQMAs as the location of the investigation. The lack of availability of AQMAs in a GIS format meant that they had to be digitised manually in order to visualise and perform statistical analysis. The steps undertaken to digitise the AQMA maps involves obtaining different layers of information. The first layer needed is raster data. Raster data models represent spatial features in grid-cells or pixels; Raster digital map data are created by scanning paper maps (such as the Ordnance Survey Landranger® 1:50000 series) or aerial photography into a computer file [13]. The raster data are provided by the website http://www.edina.ac.uk/digimap/. The second layer is administrative boundaries of LAs. The boundaries used have been provided by the National Statistics website in the form of a new geography referred to as Super Output Areas (SOAs). Specifically for England and Wales three layers of SOAs have been created [14]. The deprivation data are provided in the form of the Index of Multiple Deprivation (IMD) 2004 and the Welsh IMD 2005, a measure of general deprivation that is preferred by the UK government and is available at a small scale for England and Wales [15]. There are several drawbacks with this type of analysis which will be discussed in detail in the results section.

The process of appraising AQAP reports involved an initial review of a small number of reports for which an appraisal checklist was compiled. The checklist was used to standardise the appraisal process and ensure uniformity. The format of the checklist developed, was based on checklist used by a number of the helpdesks set up by the UK government to appraise reports produced in the LAQM process.

The AQAP appraisal was complimented with a questionnaire survey on the process of compiling AQAPs aimed at LAs that have declared AQMA. Initially a pilot questionnaire was sent to three authorities for feedback on the content and structure of the questionnaire. The comments received were minor and the

questionnaire was adapted and was sent to 151 LAs. The questionnaire was sent in electronic form and on-line, and a link was provided. An information sheet was also sent with the questionnaire providing the background to the project as well as how the data were going to be used.

3 Results and discussion

The analysis of deprivation within AQMAs has been completed and different representation of deprivation is available, however summary statistics are not available. Figure 1-3 shows a map of England and Wales with the geographical location of AQMAs, AQAPs and level of overall deprivation respectively. Please note that LAs that have declared an AQMAs have not necessarily produced an AQAPs. The digitisation process and subsequent calculation of deprivation brought about several methodological issues that are not limited to the use of specific software, in our case Arcview 3.2.

A major contentious issue in the use of GIS in EJ analysis is the choice of scale. It has been argued that performing EJ analysis at only one scale cannot produce reliable results [16]. The ability to streamline EJ research depends on the database availability and the scale of the different parameters. The problems associated with scale choice are referred to as the Modifiable Area Unit Problem (MAUP) [17, 18]. In general terms aggregated data at county/city level will be less reliable as deprivation indicators at such level are unable to display the make up of the population which is bound to be diverse at such a large scale of analysis [18]. Consequently EJ analysis has been conducted using small geographical areas in order to develop a comprehensive hazard database and perform a more complete health and population survey [18]. However this is more likely to be achievable for point sources like industrial emissions.

The complexity of EJ analysis is evident in this project due to the variety of the physical boundaries of AQMAs. In some case AQMAs might be too small or large to allow any meaningful analysis as the population data are available at a much bigger scale. There is not a single method that can be applied to all AQMAS when computing the score. Consequently the maps are examined according to their boundary classification and a small number of them individually. Figure 3 illustrates the problem of representing the deprivation scores at LA level. An attempt to correlate the scores with the presence of AQMAs and AQAPs will be meaningless as the score is at too high resolution and therefore likely to hide the deprivation issues at a local level. At the same time using the smaller scale score and aggregating it according to the size of the AQMA makes the score less robust. In this project deprivation scores are available at a small scale for most AQMAs, but in the case of individual residencies the score is not usable due to confidentiality issues. However this can be resolved by using buffers around the AQMA. They are also uncertainties with population statistics and whether area units reflect the notion of community regardless of the small scale [16].

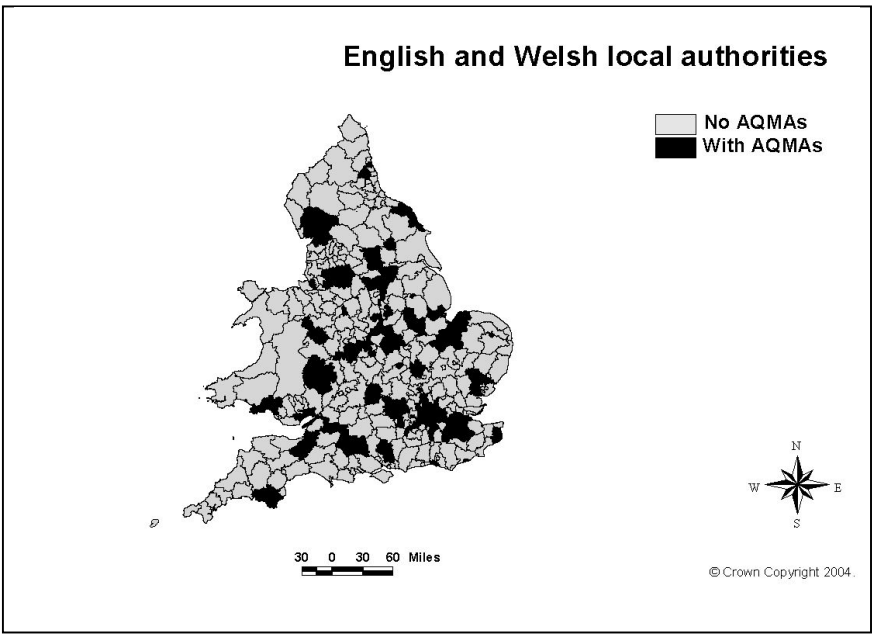

Figure 1: A map of England and Wales showing the geographical location of local authorities with Air Quality Management Areas (AQMAs).

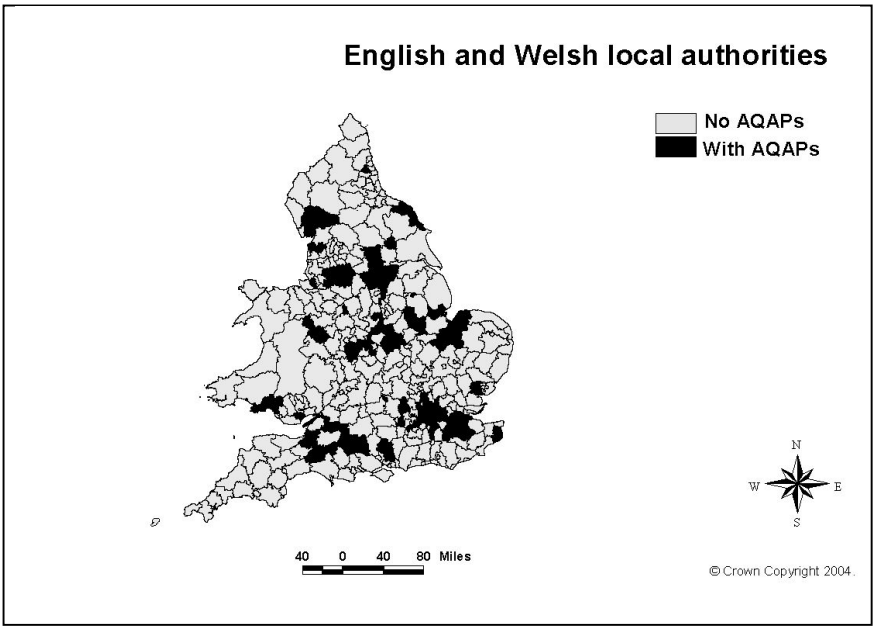

Figure 2: A map of England and Wales showing the geographical location of local authorities with Air Quality Action Plans (AQAPs).

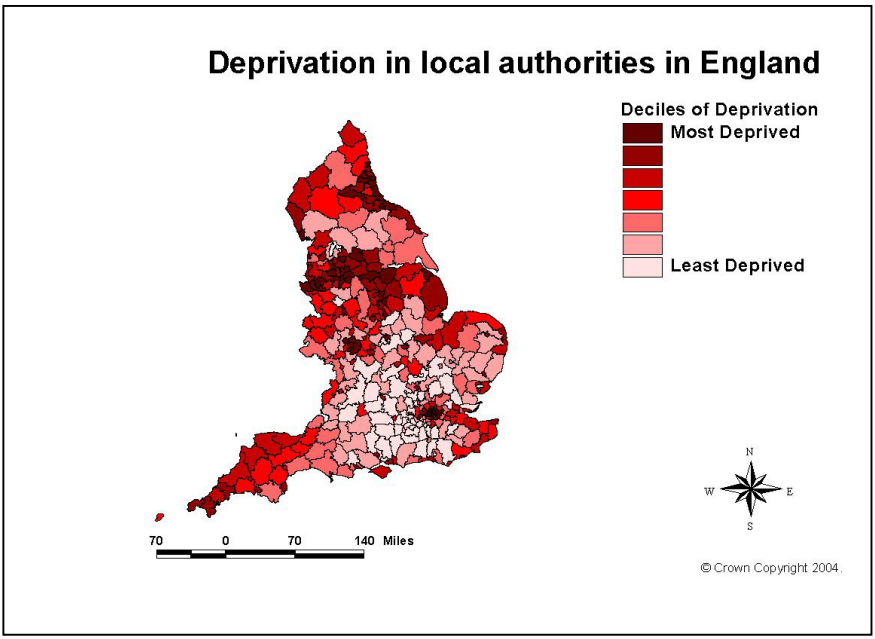

Figure 3: A map showing the level of deprivation in local authorities across England (*please note that the Welsh data were not directly compatible and were omitted*).

Another issue relating to computing deprivation scores is the nature of the AQMAs. The process of declaring AQMAs although helpful at identifies pollution hotspots does not necessarily imply that other areas within a LA do not suffer from elevated levels of pollution. It is therefore advisable to consider deprivation not just at the scale of AQMAs but by using buffers around the AQMAs. A further element that should also be taken into account is the strategies implemented, which according to the appraisal of AQAPs are usually transport and traffic related and are employed in a wider area that the AQMAs. This raises the issue on how to assess the impact of measures on the resident population when deprivation derived at a far smaller scale than the possible impacts of the measures. A possible solution is to classify measures according to the geographical area they are impacting on; future work will determine the feasibility of this approach.

Analysis of AQAPs to date indicate the diverse nature of the plans in terms of their structure and detail. This can be attributed to the nature of the LAQM process and possible lack of prescriptive guidance. The checklist compiled to appraise AQAP covers four main areas. The general information section notes details on the LAs, the number and shape of the AQMAs as well as a population estimate. The second section deals with the process of compiling an AQAP in terms of the strategies considered and bodies involved in the process, these being LA departments or other public, private and voluntary organisations. The section

detailing mitigation strategies examines the type of strategies considered and how they are prioritised. Finally the section on environmental considerations tries to unpick any specific information that relates to EJ, such as consideration of relevant strategies and LA departments as well as any reference to public participation. The appraisal of AQAP provides an insight into action planning and the necessary tools to identify the stages of the process where EJ considerations can be incorporated. Together these outputs will inform the development of a conceptual model.

4 Conclusion

At the current stage of the project several issues have emerged not only relating to methodological complexities but also on the possible implementation of the outcomes. In terms of the GIS analysis there are issues on how representative the scores are of the actual deprivation as well as how one can judge the impacts of the mitigation strategies in AQAPs when they cover a far greater area than the AQMAs. The complexity of this analysis might lead one to explore the prospect that EJ issues in the LAQM process could be addressed with better co-ordination and co-operation within LAs to ensure that exchange of information is achieved.

This is an ongoing project and there are several elements that are under completion such as the appraisal of the AQAPs and the analysis of the response to the questionnaires. The questionnaire survey will provide us direct information from LA officer's that are working or have worked in producing the plans; this will be compared with the data extracted from AQAPs. The AQAP questionnaire will be followed up with a second questionnaire targeted specifically at EJ and will assess LA officer's knowledge of the concept of EJ and the consideration of social issues in environmental policy making. At the final stages of the project case studies will be undertaken to test the derived conceptual model of EJ consideration in the LAQM practices of local government.

These different parts contribute to the overall aims of the project which is to produce guidelines and recommendation for the Environment Agency and other government bodies on the minimisation of EJ consequences of the LAQM process, and to contribute to the debate on the relationship between social deprivation and exposure to environmental pollution

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