

# **UNDERSTANDING THE FACTORS AFFECTING HEALTH IN HALTON**

**SHORT VERSION OF FINAL REPORT  
31<sup>st</sup> AUGUST 2003**

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## SHORT VERSION OF FINAL REPORT

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### 1. Introduction

- In March 2002 Halton Health Partnership contracted a team of researchers from the Department of Geography and the Institute for Health Research at Lancaster University to undertake a study of the factors affecting health in Halton (N. Cheshire). This arose from concern about the high rates of mortality and morbidity in the borough, and was to build on previous enquiries into health and environment that have been undertaken in Halton. The research was scheduled to be completed by August 31<sup>st</sup> 2003.
- The project included three main phases: a review of scientific literature relating to health and the environment; comparison of Halton with selected comparator boroughs with respect to selected variables measuring health, environmental pollution and social deprivation; detailed investigation of the impact of environmental, social and lifestyle factors on the health of people in Halton.

### 2. Data and method

- Data were acquired from a variety of sources. The literature review was based on a wide range of scientific literature ranging from articles published in international journals to local reports arising from previous research on the mid-Mersey area. Background statistics on health and deprivation in Halton and the comparator boroughs were derived from national databases, and acquired directly from the relevant authorities. Data on environmental pollution and potential land contamination were acquired from databases compiled by Halton Borough Council, together with information provided by the national Environment Agency. Data on individual health status and on access to health care were derived from the North Cheshire Health, Lifestyle and Community Survey (2001), and a specially-designed questionnaire survey. In-depth interviews with residents in Halton provided detailed information on the experience of living in the borough and enabled the in-depth exploration of issues relating to health and social capital.
- The questionnaire survey was undertaken in representative areas located in six wards of Halton (Beechwood, Appleton, Halton Brook, Halton, Castlefields, Mersey). Wards were chosen following detailed analysis of the 2001 Health, Lifestyle and Community Survey. The main purpose of the questionnaire survey was to provide a sampling frame for in-depth interviews, and to provide background data on health and health care in the sample populations. 1200 questionnaires were distributed with an overall response rate of 23.6 per cent. Although low, this was not unexpected, and there were sufficient

responses to allow a sample of respondents to be selected for in-depth interviews. A total of 36 in-depth interviews have been completed in the six wards.

- Halton was compared to four broadly similar boroughs (Knowsley, St Helens, Hartlepool, Middlesbrough) with respect to a range of health, deprivation and pollution indices. These comparator boroughs were selected because they have socio-economic and environmental characteristics that are broadly similar to those in Halton, and because they have been used for comparative purposes in other studies of Halton.
- Whenever possible the research team has taken the opportunity to consult directly with the people of Halton, for instance through contact with voluntary organisations, residents' groups and area panels.
- A research project of only 18 months' duration cannot provide definitive answers to the complex issues that underlie health inequalities. In particular, there are a number of key limitations to the research. First, data on air pollution are modelled from the available information on emissions in and around Halton. There are currently no comprehensive data on actual pollution levels throughout the borough, and there are some pollutants that may be important locally for which there are no reliable emissions data. Second, data on land contamination simply identify 'potentially contaminated' land, from data on the historic use of land within the borough. Again, there are currently no comprehensive data on actual levels of land contamination. Third, the factors influencing health in the borough are only explored at the aggregate level. It is not possible to identify precise causal relationships between individual ill health and particular possible causes. However, despite these limitations, the report does draw together previously disparate data to provide a clear overview of health and environment in Halton, and is able to indicate the key areas where future policy initiatives should be directed.

### **3. Review of scientific literature on health and environment**

- There are well-documented links between health inequalities and socio-economic status, with poor health linked to a range of indices of multiple deprivation. Recent research highlights 'multiple chains of risk' that encompass the broader social structure, living and working conditions, and health-related behaviours including cigarette smoking and exercise. There is also evidence of a 'life course' effect, with disadvantage (either material or environmental) accumulating over the life course and linked to social class. Some research has also focused on 'area effects', suggesting that in addition to individual material disadvantage (compositional factors), the health of poor people may be further damaged by the characteristics of the places in which they live (contextual factors including environmental influences). Attention has also been focused on the impact of 'social capital' on health status in particular communities, and on the role of government policy.

- There is a large literature on environmental influences on human health, which focuses increasingly on the impact of the long-term exposure of large populations to low levels of (for instance) air pollution, endocrine disrupting chemicals and pesticide residues. However, proving causal relationships between particular pollutants or environmental influences and individual health is difficult. Confounding factors include the extent of multiple exposures, synergistic effects (the interaction between different substances), and the varying susceptibility of individuals. Epidemiological studies have demonstrated an association between particulate air pollution and adverse health in susceptible parts of the population (particularly the elderly with respiratory or cardiovascular disease). Various health and developmental effects have also been linked to the level of polychlorinated biphenyls (PCBs) and dioxins that infants receive from their mothers while in the womb. Childhood leukaemia and some cancers have also been linked to environmental hazards. There is increasing interest in issues to do with land contamination, though it has proved difficult to assess the precise levels of exposure to a range of toxins that any individual might receive.
- In Halton, the most recent study of the Weston Quarries incident studied a cohort of subjects exposed to Hexachlorobutadiene (HCBD) in their homes. Overall, this study suggested that there was an effect on kidney function which improved when subjects moved house. The other main area of research with regard to the Weston Quarries incident has been to assess its social and psychological impacts. These included stress; damaged relationships; stigma; division; loss of trust; and uncertainty.
- Evidence from the range of scientific studies outlined above was used to focus the research undertaken in Halton. It was decided to focus on three key areas: the links between social deprivation, individual health and access to health care; the potential impact of air pollution, contaminated land and water pollution on the health of people in Halton; and the influence of life style, community and social capital factors on individual health in particular locations within Halton.

#### **4. Health and health care**

- Using a variety of health indicators, Knowsley has the worst overall health record of the five boroughs that were compared, but SMRs (standardised mortality ratios) in Halton are especially high for cancers, coronary heart disease, circulatory disease, stroke, suicide and infant mortality. The SMR for all causes for Halton (1998-2000) was 20% higher than for England and Wales as a whole, and higher than all comparator areas apart from Knowsley. Mortality from asthma in Halton was lower than all the comparator areas.
- For many illnesses, incidence is a more important measure than mortality. However, it is much more difficult to compile reliable statistics. Hospital admission statistics show that hospital admissions in Halton for bronchitis and emphysema, all cancers, and coronary heart disease were lower than in all the

comparator boroughs, and hospital admissions in Halton for asthma were lower than in all comparator boroughs except St Helens. Prescribing rates for Inhaled Corticosteroids (used to control asthma and other respiratory illness) were highest in St Helens South and Knowsley, but rates in Halton were higher than those in Middlesbrough and Hartlepool. Within Halton, prescribing rates were higher in Runcorn than in Widnes.

- These data are not entirely consistent as, in the context of the five comparator boroughs, Halton has (for instance) a high cancer mortality but low hospital admissions rates; and low asthma mortality, relatively low hospital admission rates but middle-ranking prescribing rates for asthma medication. The apparent discrepancies could be explained by variations in access to health care for certain groups of the population, or variations in the effectiveness with which illnesses such as asthma are managed at the primary care level. These are issues that warrant further investigation within Halton.
- Detailed comparison of Halton with St Helens South using the Health, Lifestyle and Community Survey (HLCS, 2001) suggests that individual lifestyle factors may also be important determinants of health in Halton, as both smoking and the lack of someone to confide in appear to be more significant in Halton than in St Helens.
- Health care provision in Halton is similar to, or more favourable than, in the comparator boroughs. With regard to primary care, Runcorn in particular has the smallest mean GP list size, the greatest proportion of female GPs, and the lowest proportion of older patients and of GPs over 60 of all the comparator areas. The provision of Practice Nurses, Health Visitors and District Nurses in Halton also compares favourably with the comparator boroughs.
- There are significant spatial variations in health within Halton. Using 1991 wards, the highest SMRs from all causes are in Brookfields, Riverside, Norton, Castlefields and Hough Green, and 14 of the 19 wards analysed have a SMR (all causes) greater than expected for England and Wales. The lowest SMRs are found in Mersey, Daresbury, Farnworth, Heath and Hale.
- The links between health and deprivation were explored using both data from the Health, Lifestyle and Community Survey, and ward-level SMRs. These analyses show that indices of deprivation, including low incomes and receipt of income support, are strongly correlated with a range of health outcomes. Lifestyle factors are also influential, with smoking especially associated with poor self-reported health, angina and bronchitis. Social capital/community issues, especially the lack of someone to confide in, had a significant impact on all health outcomes with the exception of asthma. These findings are entirely consistent with other research on health inequalities, and underline the influence of socio-economic factors, lifestyle and community on individual health.
- A number of additional themes emerged from the in-depth interviews with residents in Halton, but in general qualitative evidence revealed a high degree of satisfaction with health care provision within the borough. Problems

recorded were mostly related to individual circumstances or to specific local issues. Residents also talked about their perceptions of health risks in Halton. Some respondents expressed concern about the impact of environmental pollution on health, though their concerns were not always borne out by statistical evidence.

## 5. Environmental factors

- The history of Halton contains examples of a particularly wide range of manufacturing processes, especially in the chemical sector, each with its distinctive residues and emissions to the environment. Pollution levels in Halton and the four comparator boroughs have decreased substantially over the past decade, but when compared to the other areas studied Halton still experiences a heavier total pollution load and, especially, a heavier load of air pollution. None of the other four boroughs has so wide a range of air-borne chemicals that pose potential carcinogenic or developmental hazards to their population.
- Atmospheric dispersion models have been used to simulate the present-day distribution of air pollution across the borough. Major sources of pollution include road traffic, Part A and Part B industrial processes in Halton, and Part A and Part B industrial processes within 10km of the borough (Table 1). Modelled at a nominal resolution of 50metres, this analysis is 20 times more detailed than any previously available data, and demonstrates complex pollution surfaces with substantial variations from one part of the borough to another (Figures 1-7). Where possible modelled estimates have been compared to actual monitoring data. There is a good level of agreement between the modelled data and actual levels recorded at specific points.
- Pollution levels for benzene, 1,3-butadiene, carbon monoxide, lead and sulphur dioxide fall comfortably below annual average standards set by health experts. It is difficult to determine whether particulates fall below current standards due to the lack of appropriate background data for Halton. This has probably led to the over-estimation of this element in the study. However, it is clear that there are a number of 'hot spots' worthy of more detailed monitoring. These are identified in the full report.
- Modelled average annual nitrogen dioxide concentrations exceed the annual mean air quality standard for 2005. The modelled concentrations generally show a good level of agreement with monitoring data derived from diffusion tube sampling but are significantly higher than those obtained from the mobile monitoring station. NO<sub>2</sub> is produced almost entirely from vehicle exhausts, and at a conservative estimate 8.5% of residential properties in the borough are located in areas that exceed the annual mean air quality standard of 40µg/m<sup>3</sup>. The wards most severely affected are Mersey (55% of properties) and Beechwood (54.5%). The exceeded area also includes Runcorn town centre, which has implications for people who use the town centre on a daily basis.

- Detailed monitoring needs to be undertaken to determine whether the levels predicted by the models used in this study actually occur in reality. An intensive diffusion tube campaign may provide the most useful information in this respect.
- Data available enables the identification of land in Halton that has been ‘potentially contaminated’ by industrial processes operating in the borough from 1874 to the present. This is not a measure of actual land contamination (this can only be established from detailed soil surveys and, in common with most other areas of Britain, these data do not currently exist for most of Halton), but is a well-established technique that can be used to identify land that may be contaminated based on knowledge of the previous land use. The technique also allows the identification of ‘potentially high-risk contaminated land’ based on knowledge of the types of substances that were processed at each site (Figures 8 and 9).
- In total 15% of land in Halton is ‘potentially contaminated’ (PCL) and 5% is ‘potentially high risk contaminated land’ (PHRCL). For comparison, 22% of land in St Helens is classed as PCL and 10% is classed as PHRCL. Although less than 3% of residential buildings in Halton are located within 50m of PHRCL and less than 0.5% of residential buildings are located directly on PHRCL, a substantial proportion of residential buildings (more than 40%) are located within 50m of PCL. The close proximity of housing to potentially contaminated land may be significant. Wind-blown dust, recreational activity and general day-to-day movement in the immediate vicinity could result in health risks to the local population.
- Riverside, Mersey and Halton wards have the highest concentration of ‘potentially contaminated land’, each with in excess of 20% PCL and 10% PHRCL. In Riverside no less than 60% of land is ‘potentially contaminated’, 50% of residences lie within 50m of PCL and 12% lie within 50m of PHRCL. Although Halton Brook has considerably less PCL, it is comparable to Halton and Mersey with respect to PHRCL.
- At present, only a very limited amount of information is available from intrusive surveys of contaminated land in Halton. These can be used to identify the actual amount of contamination found on sites identified as ‘potentially contaminated’ from historical cartographic evidence. Evidence from recent surveys on different sites reveals that the levels of contamination in many of the soil samples were far greater than the recommended concentrations for residential land use. In several cases the recommended values for commercial and industrial use were also exceeded. This evidence confirms that many of the sites identified as ‘potentially contaminated’ may have significant levels of actual contamination.
- Two key recommendations arise from the research on contaminated land in Halton. First, the research shows that, on the basis of previous land use, certain areas within Halton are much more likely to be affected and residents in those areas are more likely to be at risk from adverse health effects. Whilst Halton Borough Council is proceeding with the contaminated land strategy

across the borough in accordance with DEFRA guidelines, the study has identified a much higher incidence of potentially contaminated land in Riverside, Mersey and Halton wards than in other wards in the borough. As such, it is recommended that Halton Borough Council should accelerate the process of risk assessment in these three wards and, where shown to be necessary, intrusive soil surveys should be completed within two years. Such work is crucial if the precise risks to human health in Halton borough are to be ascertained. Second, future research should focus more sharply on the characteristics of a much larger sample of residents in these three wards in order to better understand the role of environmental quality on health.

- Lead in drinking water has been a concern for Runcorn in recent years because random samples from individual households have far exceeded the regulatory standard. Nevertheless, there is little apparent distinction between the average level of lead in Halton's water supply and the supplies to other boroughs. United Utilities has introduced phosphate dosing in Halton, which is designed to form an insoluble crust on the inside of lead pipes, thus reducing the risk of contamination. Still, the limited availability of data means that the possibility of high concentrations of lead in drinking water within Halton before 1999 cannot be ruled out.
- On balance, it appears that water quality in Halton is far less of a health concern than either land contamination or air quality. It is suggested that future research should focus on these two aspects rather than drinking water quality.

## **6. Deprivation, community and social capital**

- It has already been demonstrated that ill health is strongly related to material deprivation. Four different deprivation indices were used to compare levels of material deprivation in Halton with the four comparator boroughs (Knowsley, St Helens, Middlesbrough, Hartlepool). Although there are some small variations between indicators, material deprivation is on average more severe in Knowsley, Middlesbrough and Hartlepool than in Halton. St Helens experiences the least deprivation, but there are marked variations within the borough with the south part of St Helens having similar levels of deprivation to those found in Widnes and Runcorn.
- There are substantial variations in deprivation within Halton, with ten of the wards in Halton amongst the most deprived 10% of wards in England and Wales. Highest levels of material deprivation are experienced in Castlefields, Riverside and Kingsway, with the lowest levels in Heath, Daresbury and Birchfield.
- High levels of deprivation, as measured by standard indices, do not necessarily indicate that people dislike living in an area or that there is no sense of community. Interviews conducted with residents in six wards, ranging from the most deprived (Castlefields) to one of the least deprived (Beechwood) were used to explore the relationship of people to their community. Many of



the themes that emerge from the data can be related to aspects of 'social capital'. This is a theoretical construct that aims to characterise those aspects of life in a cohesive community that have been found to be beneficial to the health of community members. Particularly important aspects of social capital include trust and mistrust; membership of local organisations; and levels of reciprocal help and support among members of the community.

- Residents who were interviewed expressed a strong attachment to the area in which they lived. They were keen to emphasise the positive aspects of their neighbourhood, and to stress that they had made a conscious choice to live where they did. Many respondents were part of strong local support networks. They had frequent contact with family members and with neighbours, even though this latter contact was often superficial. Residents also participated in a wide range of local activities and perceived themselves as having a strong sense of community, reinforced by the relative stability of residential areas in Halton. Some respondents did comment that community networks were closer in the past, but others recognised that such close-knit communities could have negative effects, and they welcomed the more open but mutually supportive communities that they felt they belonged to. In general, respondents in Halton indicated that they had developed a high degree of social capital within their respective communities, and that they gained benefits from this.
- Fear and mistrust are factors that can undermine social capital. Most respondents said that they felt safe in their local communities, but there was a more generalised view that fear of crime had increased. This was related in part to specific local incidents, but more commonly to general media reporting of crime and violence. Some respondents commented on the unruly behaviour of gangs of youths (though others saw this as normal behaviour), some commented on the lack of police visibility and a few felt that their activities were restricted by fear of crime. Some respondents also felt that their community had deteriorated due to an increasing number of incomers and lack of stability. There are thus some indications that recent changes may be beginning to undermine social capital in communities in Halton.
- Some respondents expressed frustration at the behaviour of other people's children, and at the degeneration of their communities and other aspects of daily life. However, respondents' accounts also made it clear that they were not merely passive recipients of the positive and negative aspects of life in their areas. Rather, they portrayed themselves as actively engaging with their environments to try to take control, particularly in order to counteract some of the negative influences on social capital outlined above. Most saw their own neighbourhood as 'good', with problems concentrated elsewhere in Halton, and residents of Castlefields were particularly keen to emphasise that the area was not as bad as its reputation. Many respondents related how they had engaged actively with potential sources of trouble (such as noisy neighbours or unruly kids) to solve the problems in a constructive way. These comments suggest that many people have developed strategies to deal with potentially detrimental aspects of their residential areas and that, rather than being passive victims, residents of Halton are actively engaged in taking control of their own circumstances and in shaping their own communities.

- In summary, it seems that the residents of Halton who were interviewed had complex relationships with the areas in which they lived. In general, respondents felt an allegiance to the area and were keen to point out the positive aspects of living where they did. Community life seemed to be important to the majority of respondents, and most people reported activities that contributed to the building and maintenance of social capital in their communities. Overall, respondents seemed to be actively engaging with the negative aspects of living in their areas, and maintaining a sense of control or ability to influence their surroundings was an important element of their accounts. These characteristics indicate a strong sense of social capital that may already have positive influences on individual health, and that could be harnessed to further improve health through community-based policies.

## **7. Integrating social and environmental influences on health**

- The statistical technique of logistical regression was used to assess the joint contribution to health in Halton made by social and environmental influences. It has already been demonstrated that material deprivation and lifestyle factors are important determinants of health in Halton. Data from the Health, Lifestyle and Community survey were combined with a range of environmental variables to assess the extent to which environmental variables derived from data on modelled air pollution and proximity to potentially contaminated land can provide further explanation of health variations in Halton.
- Overall, there is little evidence that environmental factors make a significant additional contribution to ill health in Halton. After controlling for age and limiting long-term illness, high rates of self-reported ill health are most likely to be reported by those on low incomes, those who are overweight and who have no-one to confide in. People who live in Widnes are significantly less likely to report ill health than those in Runcorn. Of the eight pollution variables considered, only modelled lead pollution has any significant effect, with people living in areas with high levels of modelled atmospheric lead pollution reporting more ill health. Proximity to potentially contaminated land has no influence on self-reported ill health.
- Other health variables show similar associations. Poor mental health is associated with having no-one to confide in, low income and long-term limiting illness. No air pollution or environmental variables have any statistically significant effect. Angina is significantly associated with smoking, poverty and lack of someone to confide in. Again none of the environmental variables has any significant effect. Asthma is associated with increasing age, poverty and poor diet but, in addition, high modelled levels of butadiene (associated with vehicle exhausts) and lead are also significantly associated with the incidence of asthma. Bronchitis is particularly associated with age, smoking and being overweight, but environmental variables have no significant impact. There are higher levels of both asthma and bronchitis in women than in men.

- There is thus no evidence from this analysis that either potentially contaminated land or most of the modelled contemporary air pollutants has any statistically significant effect on the health of the population. As shown in numerous studies elsewhere, ill health is associated primarily with a range of socio-economic and lifestyle variables: most notably poverty, obesity, smoking and isolation. The association of asthma with butadiene pollution supports a well-established link between vehicle exhaust emissions and asthma, though this is by no means the only cause. Butadiene levels within Halton are also well within national air quality standards. The contribution of airborne lead pollution to high self-reported ill health and to asthma should be interpreted with caution. As shown earlier, airborne lead levels within Halton are well below national air quality standards and are not a cause for concern. However, the concentration field for lead is very restricted as it is generated by only three sources, all of which are in Riverside ward. There is no significant contribution from roads or external sources. It is most likely that the area in which lead is concentrated coincides with areas of poor housing and relative deprivation in Widnes, thus producing the observed association with some indicators of ill health.
- It should be stressed that this analysis is based necessarily on a restricted range of variables (those pollutants for which appropriate emissions data were available) and on the statistical modelling of aggregate level data. Whilst we can confidently state that current levels of pollution for which data are available in Halton have no significant adverse impact on the general health of the population, there are a number of important caveats. First, pollution levels in the past were much higher, and much of the ill health currently experienced in Halton may be due to past exposure. This historical dimension of the impact of environmental factors was beyond the scope of this study, but is worthy of further investigation. Second, whilst there is no evidence of any general effect on the health of the population, we have no information on the extent to which particular individuals or groups of people have experienced exposure to specific pollutants in their workplace, home or neighbourhood. The well-documented events at Weston Quarry demonstrate the ways in which specific toxins may have a marked impact in particular locations. The health impacts of individual-level exposure to pollutants can only be examined through long-term cohort studies of specific populations in high-risk areas. Third, whilst the modelled (and monitored) levels of most pollutants in Halton meet national standards, scientific knowledge of the impact of long-term exposure to low levels of pollution from either airborne sources or land contamination is limited. Based on the ‘precautionary principle’ it is sensible to both monitor pollution levels carefully and to seek cost-effective ways to continue to reduce them to the lowest practicable levels.

## **8. Conclusions and summary recommendations**

- The primary purpose of this research was to improve understanding of the factors influencing health in Halton. Our principal finding is that health in Halton is affected by the same factors that have been shown to be significant in numerous studies elsewhere: namely material deprivation and unhealthy

lifestyles. Our first recommendation is thus that policy initiatives within Halton should continue to concentrate on these factors, with programmes focused on those locations shown to have the highest levels of deprivation. Policies to reduce unemployment, raise income levels, improve housing, increase educational attainment, reduce smoking, improve diet and increase exercise could all have significant positive impacts on the health of people in Halton.

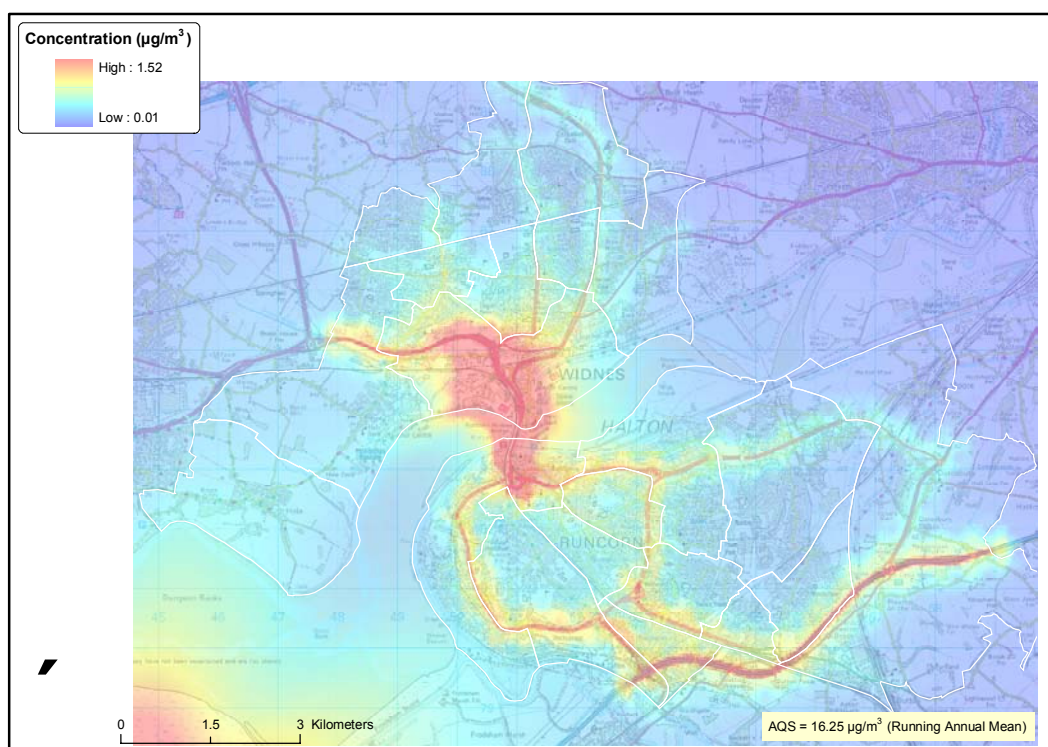
- Qualitative evidence has demonstrated that the residents of Halton have developed a high degree of social capital and have a strong commitment to their local communities. It is argued that policies to reduce deprivation and increase healthy living should capitalise on this strong sense of community within Halton. Rather than imposing ‘top down’ solutions, that are often perceived as coming from outside the area, it is suggested that policymakers should work with local community groups and voluntary organisations to develop policies and strategies that involve local people directly in improving their own health and reducing deprivation in their local community.
- Although, overall, there is no significant link between present day environmental pollution and health in Halton, and the level of most pollutants falls well within national standards, the borough of Halton does have a heavier air pollution load than any of the comparator boroughs. The research has also highlighted significant variations in both air pollution and contaminated land within Halton, and has identified specific areas where further investigation would be worthwhile. We recommend that the Borough Council should continue and extend its programme of air quality monitoring, and of risk assessment and where necessary intrusive soil surveys of potentially contaminated land, focusing first on those sites identified in this study as high priority. This will allow a fuller assessment of environmental factors than has been possible in this study, which has been based only on modelled air quality data and on the identification of potentially contaminated land from historical records. Finally, it is recommended that the ‘precautionary principle’ should be adopted with respect to potential pollution. All reasonable efforts should be made to work with industry and other organisations, and to develop a sustainable transport policy, to further reduce levels of pollution, as the long-term effects on health of exposure to even low levels of pollution are not well understood.
- The full report lists 21 more detailed recommendations arising from the research. However, it should be noted that there are currently a large number of initiatives within Halton that begin to address many of the issues identified. The results of this research should enable both existing and new policies to be targeted more effectively on the areas of greatest need.

## Tables and Figures

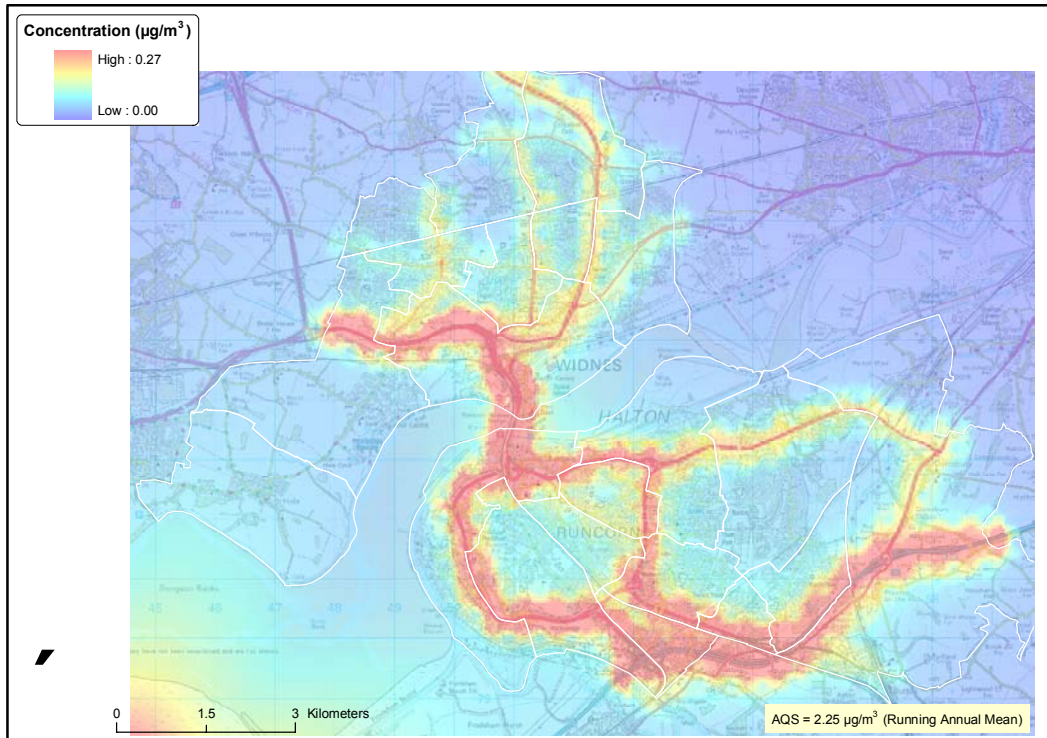
**Table 1: Percentage contribution to air pollution in Halton from different source sectors.**

<i>Pollutant</i>	External Industry	Internal Industry	Internal Roads
Benzene	39.4	24.6	36.0
1,3-Butadiene	31.6	0.0	68.4
CO	9.0	1.9	89.1
NO <sub>2</sub>	32.3	35.6	32.0
Total PM (particulates)	3.1	4.6	* 92.3
Lead	0.0	100.0	0.0
Sulphur Dioxide	97.1	2.5	0.4

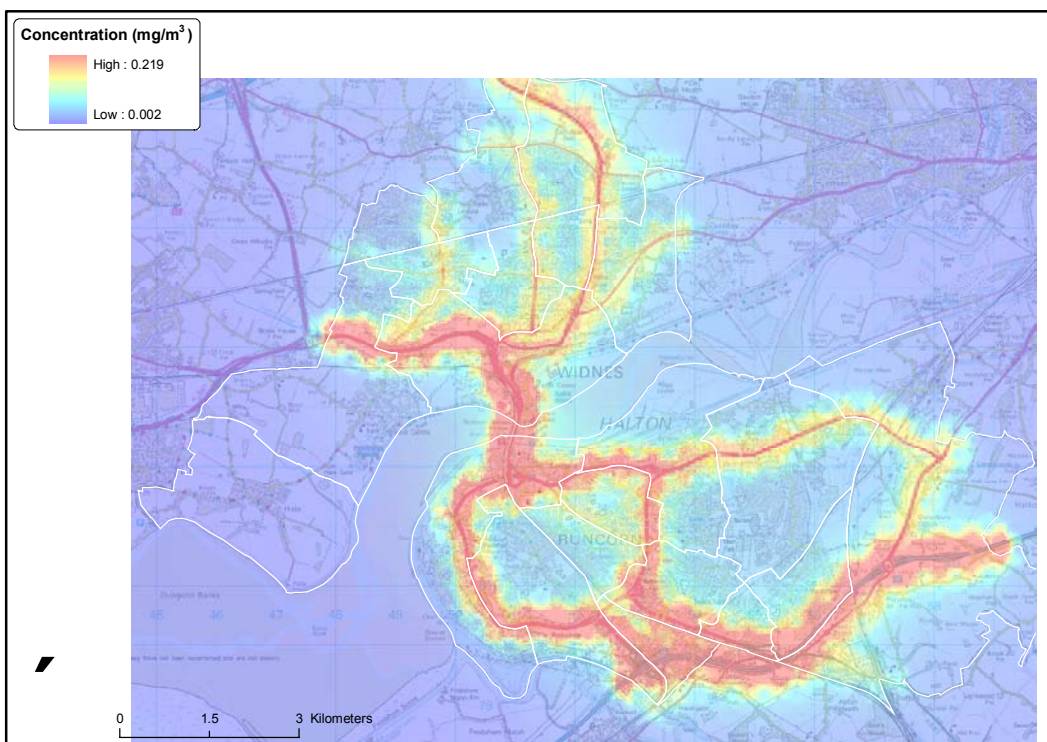
\* Dominated by contribution from background sources



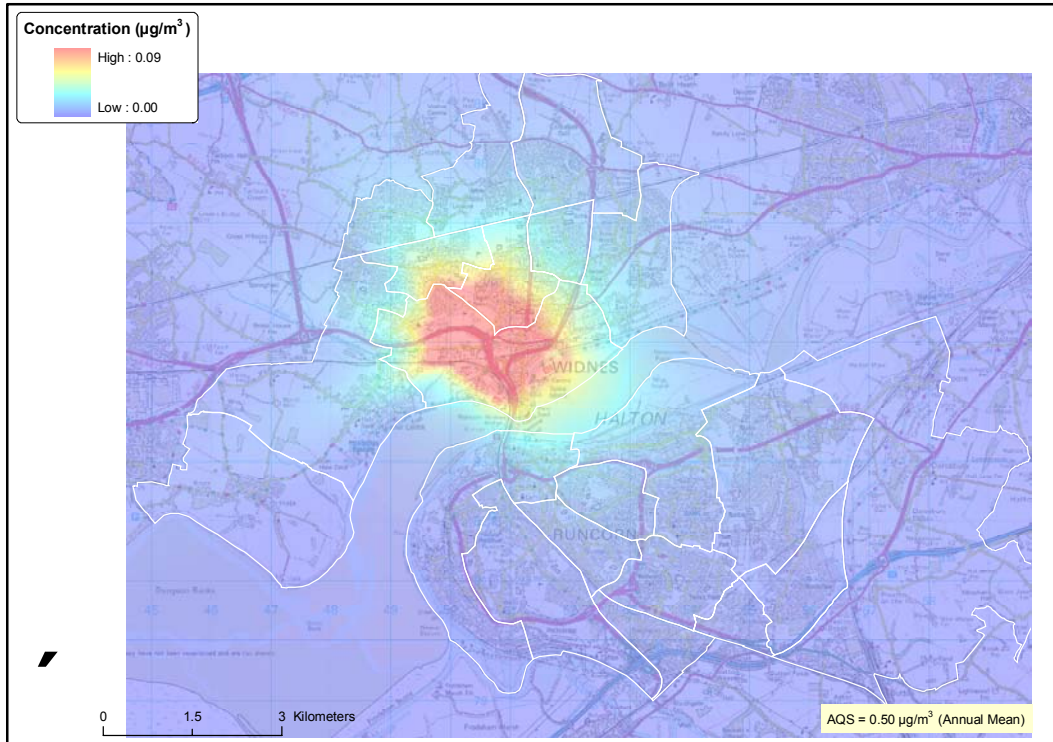
**Figure 1: Modelled average annual Benzene concentration (2000) – All sources.**



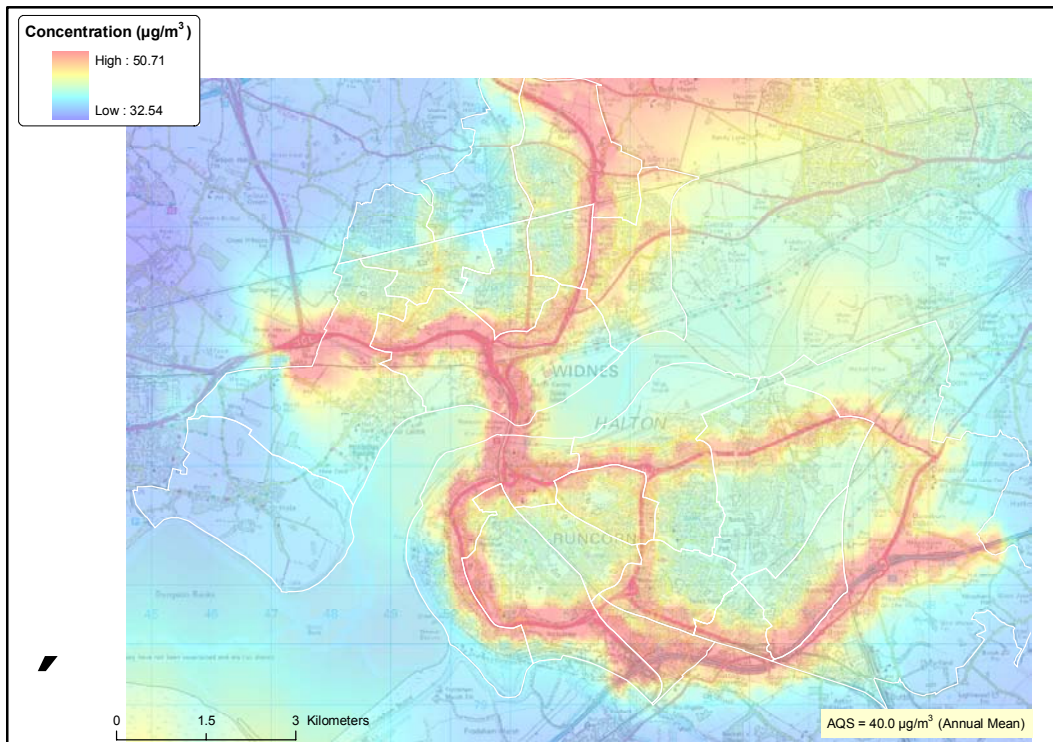
**Figure 2: Modelled average annual 1,3-Butadiene concentration (2000) – All sources.**



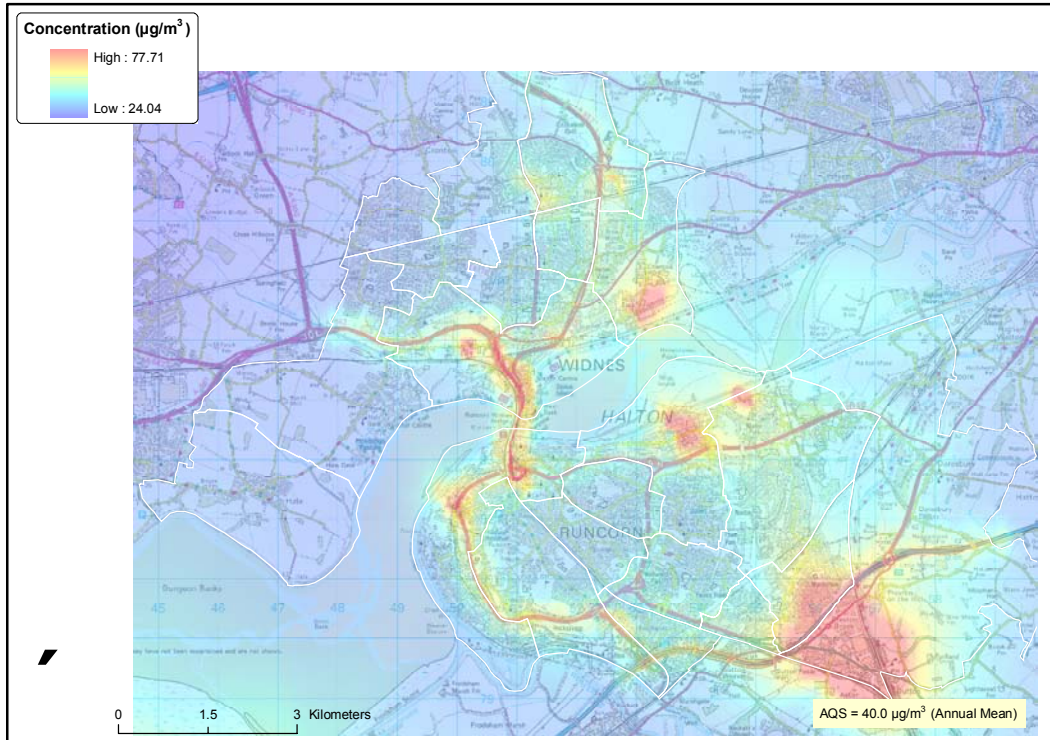
**Figure 3: Modelled average annual Carbon Monoxide concentration (2000) – all sources.**



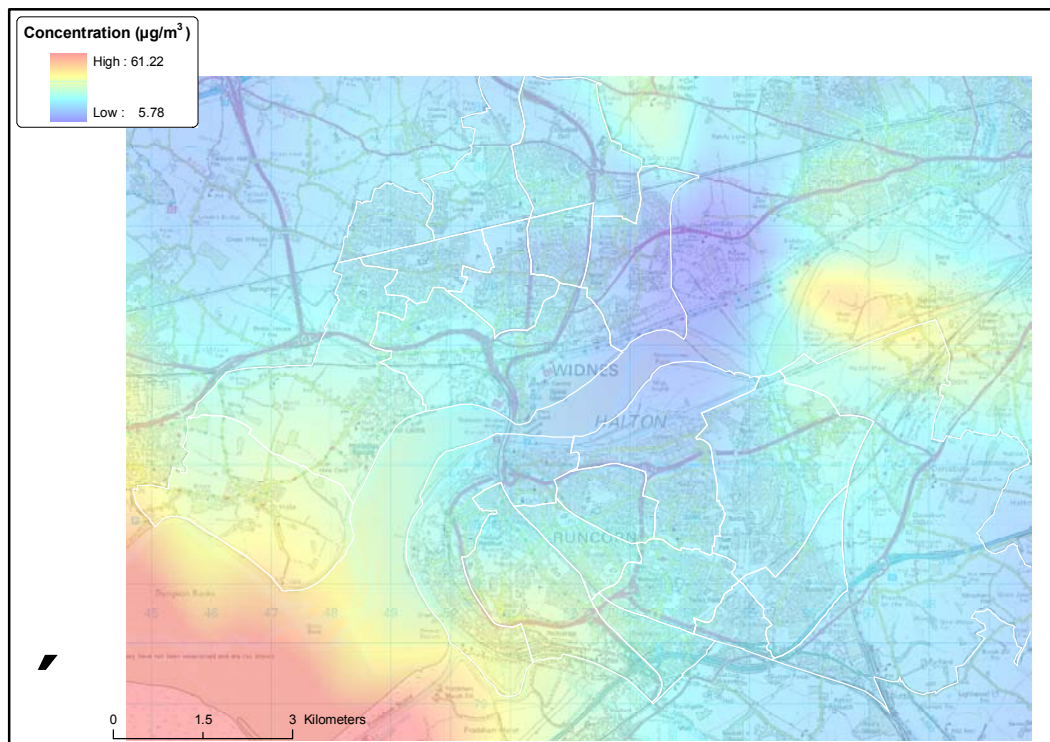
**Figure 4: Modelled average annual Lead concentration (2000) – All sources.**



**Figure 5: Modelled average annual Nitrogen Dioxide concentration (2000) – All sources.**

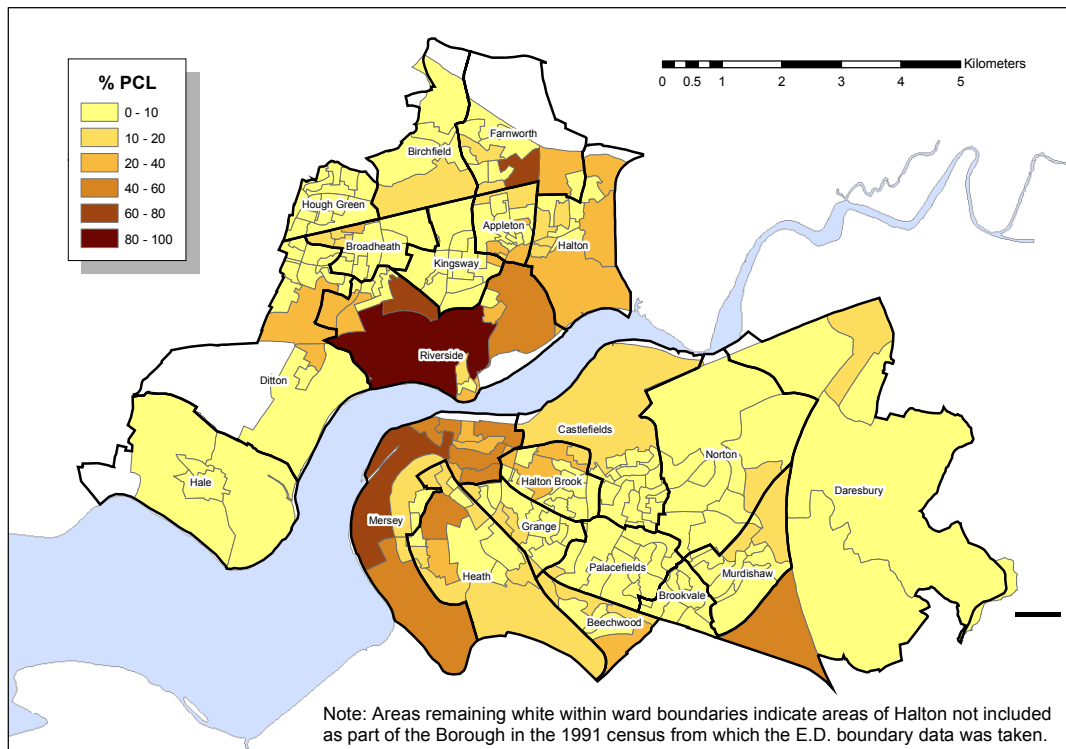


**Figure 6: Modelled average annual Particulates concentration (2000) – All sources.**

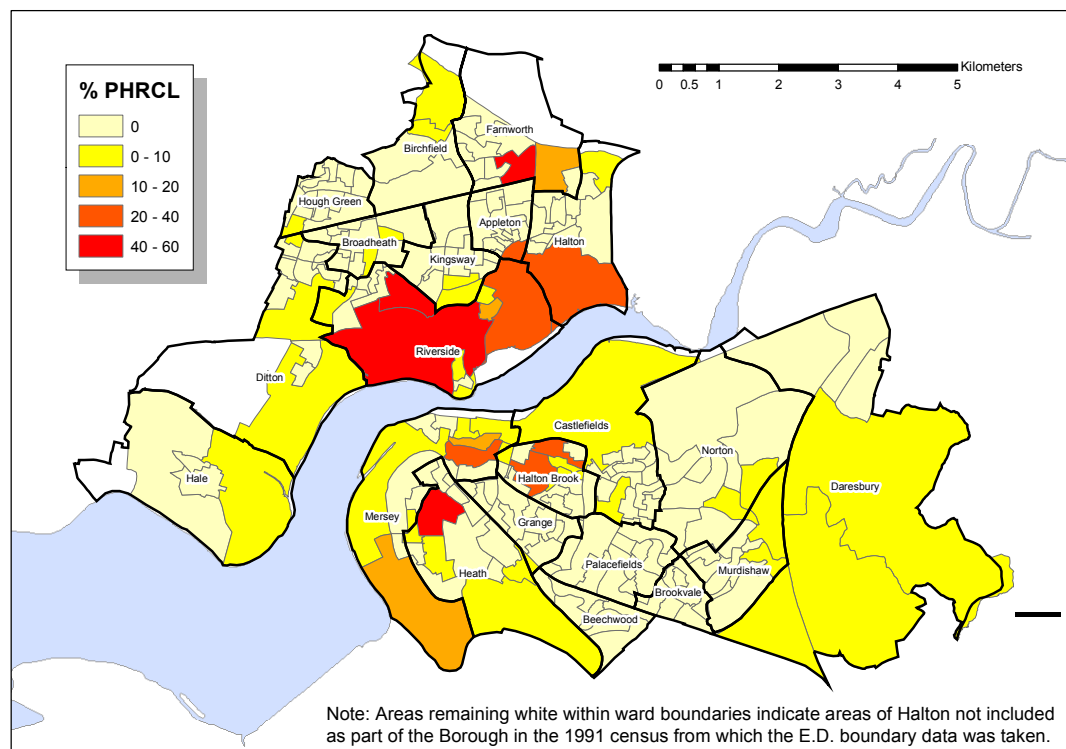


**Figure 7: Modelled average annual Sulphur Dioxide concentration (2000) – All sources.**





**Figure 8: Percentage ‘potentially contaminated land’ in Halton.**



**Figure 9: Percentage ‘potentially high risk contaminated land’ in Halton.**