Report of an Investigation into Claims of Ill-health in Telford & Wrekin Related to a Power Station in Ironbridge Gorge

Dr Catherine Woodward
Director of Public Health
Telford & Wrekin Primary Care Trust

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Table of Contents

	Page
1 Purpose of Report	2
2 Introduction	2
2.1 Background	2
2.2 The Nature of the Claims	2
3 Context	4
3.1 Telford & Wrekin	4
3.2 The Power Station	4
3.3 South Telford	6
4 The Investigation	7
4.1 Objectives	7
4.2 Approach and Methods	7
4.3 Findings	8
4.4 Conclusions and Discussion	15
4.5 Final Comment and Recommendations	17
Appendices	18

1 Hospital Admissions for Acute Pulmonary Disease: Children
2 Hospital Admissions for Acute Pulmonary Disease: Adults
3 All Cause Mortality : Telford & Wrekin and England & Wales
4 Mortality from Myocardial Infarction : Telford & Wrekin and England & Wales
5 Cancer Mortality : Telford & Wrekin and England & Wales
6 Mortality from Suicide and Undetermined Injury : Telford & Wrekin and England & Wales
7 Mortality from Chronic Obstructive Pulmonary Disease : Telford & Wrekin and England & Wales
8 All Cause Mortality : Ward-level and Telford & Wrekin
9 Mortality from Myocardial Infarction : Ward-level and Telford & Wrekin
10 Cancer Mortality : Ward-level and Telford & Wrekin
11 Mortality from Chronic Obstructive Pulmonary Disease : Ward-level and Telford & Wrekin
12 Infant Mortality : Telford & Wrekin and England & Wales
13 Infant Mortality : Ward-level and Telford & Wrekin
Appendices 1-13 are available from Telford & Wrekin Primary Care Trust on request
(Mary Anne Baxter on 01952 265172 or Maryanne.Baxter@telfordpct.nhs.uk)
14 Additional Information Requested by Professor Harrison

1 Purpose of Report

This report presents a study into claims of a causative link between emissions from a power station and levels of ill-health in Telford & Wrekin, for the purposes of expert review.

2 Introduction

2.1 Background

Two individuals have expressed concern that emissions from a local power station are responsible for substantial ill health and mortality within the population of Telford & Wrekin.

Work was undertaken by officers from Telford & Wrekin Primary Care Trust, Telford & Wrekin Borough Council and the Health Protection Agency and by other partners in response to these concerns. Approaches included liaison with the Environment Agency in relation to the compliance of the power station with National Air Quality Strategy standards and a review of the impact of air pollution on health, focusing on sulphur dioxide, nitrogen oxides and particulates.

The Director of Public Health also conducted a review of routinely available local health data and it is the findings of that investigation which form the body of this report. The Director of Public Health has sought an external assurance of this work because of the aggressive and personal approach being adopted by the two individuals in some of their correspondence, including with the local media. The Chief Executive of Telford & Wrekin PCT has had extensive personal involvement in the situation as it has evolved and the Chair of the organisation has also been briefed.

2.2 The Nature of the Claims

Although the claims are very wide ranging and no clear hypothesis has been put forward, the general position being adopted is as follows:

- That there are certain current geographical patterns of ill-health and mortality within Telford & Wrekin
- That these patterns are evidence that emissions from a local power station are currently having a significant adverse effect on the health of people living near to the power station and in Telford & Wrekin

In this context, claims have been made for increased rates of the following conditions:

- All cause mortality
- Premature mortality
- Respiratory disease
- Mortality from myocardial infarction
- Cancer mortality
- Suicide
- Infant mortality

Although the claims are condition specific, it is almost always unclear whether the concerns relate to incidence or prevalence and no age specific effect has featured in the correspondence. Electoral wards are rarely, if ever, mentioned by name. Moreover, no temporal effect has featured in the claims, either acute versus chronic effects at population level or epidemiological trends over time. PM 2.5s have sometimes been mentioned as the agent responsible for the adverse health effects.

There have, however, been two specific allegations as follows:

- That, comparing the periods 1991 to 1996 and 1998 to 2003, there was a large increase in the number of deaths in Telford & Wrekin compared to Shrewsbury & Atcham
- That there has been an increase in the number of deaths in the area surrounding the power station since 1999

Telford & Wrekin PCT has supplied data in response to all the requests which have been made by the individuals concerned under the provisions of the Freedom of Information Act. In addition to this, the individuals have also cited evidence from local undertakers and a local obituary column as the basis for some of their claims.

3 Context

3.1 Telford & Wrekin

Telford & Wrekin has a population of approximately 163,000 people and encompasses the main conurbation of Telford and its surrounding towns and villages in east Shropshire. Telford & Wrekin falls within the "Manufacturing Towns" subgroup of the Office for National Statistics Area Classification System for local authorities. The most notable feature of this subgroup is that a relatively high proportion of residents are employed in a manufacturing occupation. Telford & Wrekin has one of the most rapidly growing local populations in the West Midlands and between 1991 and 2001 saw its resident population increase by 11.9%. Telford itself is situated on the M54 corridor and is an area of relatively low unemployment and low wages. The local economy encompasses the service and public sectors, along with some industry, including manufacturing, engineering and new technology. The area is served by a relatively uncongested road network, with a mainline railway connection to Wolverhampton and Birmingham to the south east and Shrewsbury to the west.

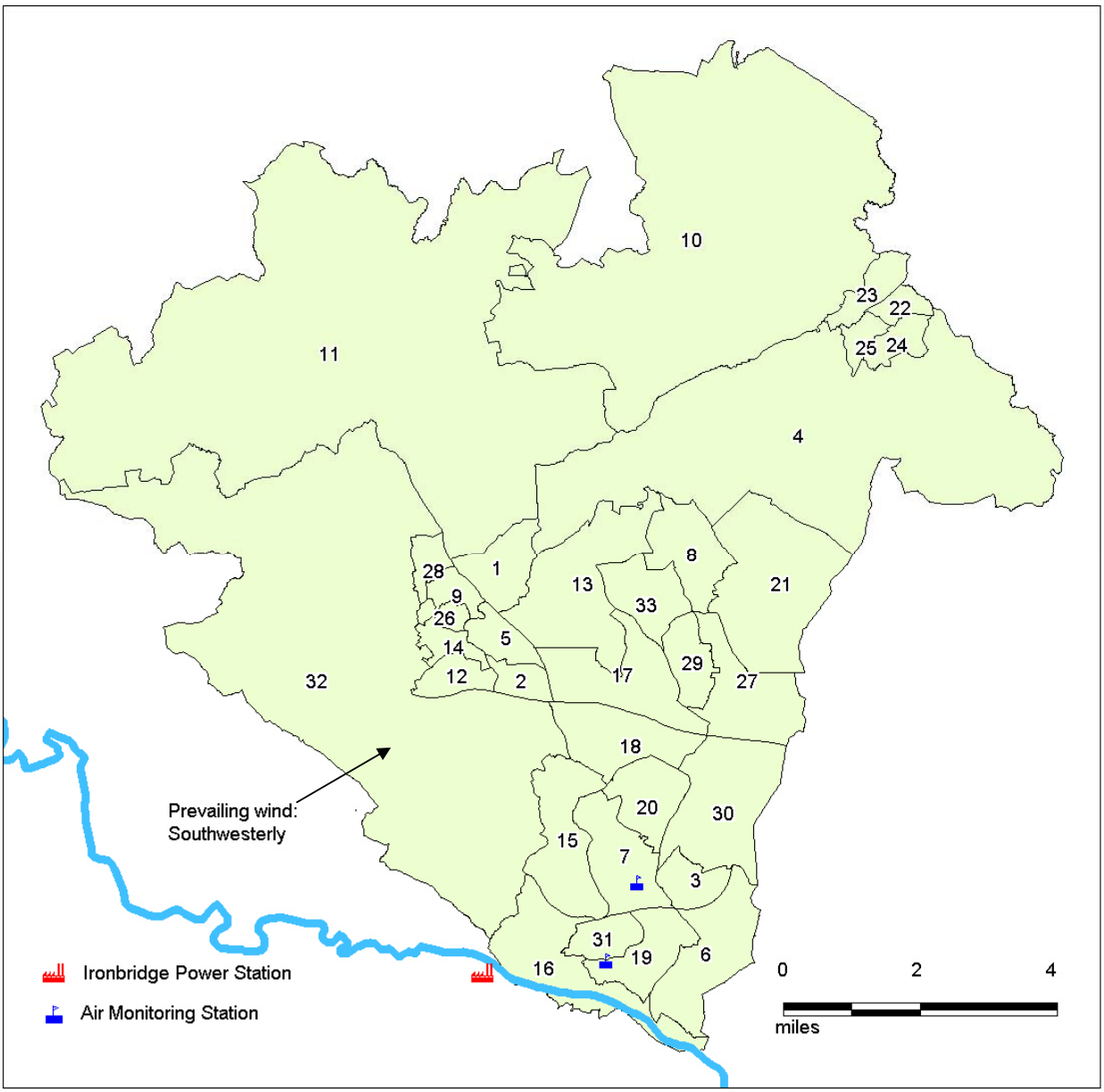
Telford & Wrekin has areas of significant socioeconomic deprivation, with around 24% of children living in households receiving a means tested benefit. Housing stock is generally mixed, including some large new estates but with poorer quality housing concentrated in 1960s developments in the south Telford area. There are also significant health inequalities within Telford & Wrekin. For example, male and female life expectancy is greater in the more affluent areas and there are similar inequalities in premature mortality from circulatory disease and cancer. Deprivation levels are correlated with a wide range of health indicators in Telford & Wrekin, including the incidence of low birth weight, breastfeeding, the consumption of fruit and vegetables, the incidence of sexually transmitted infection, smoking prevalence and outcomes from the local smoking cessation service.

3.2 The Power Station

Ironbridge power station is situated in Broseley, Shropshire in the Ironbridge Gorge on the south bank of the River Severn (latitude 52°37'27" N, longitude 2°30'35" W). It produces electricity for the national grid from the combustion of coal (including low sulphur) and biomass material. Commissioned in 1970, the power station occupies an 85 hectare site and is capable of generating 1,000 megawatts of electricity. The plant includes four cooling towers (each 114 metres high) and one chimney stack (204 metres high). An earlier, smaller station, commissioned in the early 1930s, was demolished in the 1980s.

Figure 1 maps the boundary and constituent wards of the Borough of Telford & Wrekin and the position of the power station. The figure also shows the position of the two air quality monitoring stations, which are specifically sited at the points of maximum ground level pollution from the power station, as determined by the Environment Agency using an air dispersion model.

The main atmospheric pollutants released from the power station are controlled under its “Authorisation”, granted by the Environment Agency under the Integrated Pollution Control arrangements. The Authorisation sets limits on the emissions permitted from the power station and specifies the controlling techniques to be used. Emissions are monitored against standards set in the National Air Quality Strategy and the power station has had an Air Quality Management Plan in place since 2001 to minimise the risk of any breaches in these standards. Ironbridge Gorge power station complies with all the National Air Quality standards. Air dispersion modeling of particulates emitted from the power station has predicted the ground level PM10 concentrations to be less that 2% of the National Air Quality Strategy objectives.



Ward Key

1	Apley Castle	8	Donnington	15	Horsehay & Lightmoor	22	Newport East	29	St. Georges
2	Arleston	9	Dothill	16	Ironbridge Gorge	23	Newport North	30	The Nedge
3	Brookside	10	Edgmond	17	Ketley & Oakengates	24	Newport South	31	Woodside
4	Church Aston & Lilleshall	11	Ercall Magna	18	Lawley & Overdale	25	Newport West	32	Wrockwardine
5	College	12	Ercall	19	Madeley	26	Park	33	Wrockwardine Wood & Trench
6	Cuckoo Oak	13	Hadley & Leegomery	20	Malinslee	27	Priorslee		
7	Dawley Magna	14	Haygate	21	Muxton	28	Shawbirch		

3.3 South Telford

For the purposes of this report and with reference to Figure 1, South Telford is defined as the wards of Ironbridge Gorge (16), Madeley (19), Woodside (31) and Dawley Magna (7) (for explanation, see Section 4.2). Although the total resident population of South Telford increased by 6.2% between 1991 and 2001 (from 22,933 to 24,355), this growth was significantly less than the Borough-wide rate described above.

The population growth in South Telford was predominantly driven by an increase in housing stock due to the building of new dwellings. This was primarily focused in the Dawley Magna ward, whose population increased by 14.6% between 1991 and 2001. During the same period, despite the increase in total population, the average household size in South Telford fell by 7.7% (from 2.6 to 2.4), due to a 16.2% increase in the number of households. The age profile of South Telford remained relatively stable during this period.

Table 1 shows the Area Classification subgroup for each of the four wards, including the notable characteristics for each ward.

Table 1 : Characteristics of the South Telford Wards

Ward	**ONS Sub-group**	**Notable Characteristics (i.e. higher than national average position)**
Madeley	Out of town manufacturing	• Employment in manufacturing occupations
Dawley Magna	Out of town manufacturing	• Employment in manufacturing occupations
Ironbridge Gorge	Suburbs A	• Detached housing • Households with two or more cars
Woodside	Built-up manufacturing	• Single parents • Unemployment • Terraced housing • Rented accommodation

4 The Investigation

4.1 Objectives

The objectives of the investigation were as follows:

- To determine the factual accuracy of the claims being made about patterns of ill health in Telford & Wrekin, using routinely available health data
- To determine whether any such patterns amount to evidence that emissions from Ironbridge power station are having an adverse impact on health

4.2 Approach and Methods

For the purposes of the study, four "at risk" wards were defined by their relative physical proximity to the power station and prevailing wind direction (Ironbridge Gorge and Woodside) or because they have an air quality monitoring station within their boundary (Madeley and Dawley Magna). Ward-level measures were compared to the Telford & Wrekin average position. The approach also included comparison of the Telford & Wrekin average position with England & Wales.

The study was based on a series of routine health and health service data. Data sources were as follows:

- Population: Office for National Statistics Revised Mid Year Population Estimates and 2001 Census Standard Tables for Wards
- Hospital Episode Statistics: Telford & Wrekin PCT Contract Minimum Datasets
- Mortality: Office for National Statistics Annual Death Extracts and Vital Statistics Tables
- Deprivation ranking: Office of the Deputy Prime Minister Indices of Multiple Deprivation 2004

Despite the absence of clear references to any trend effects in the claims being made, data was examined for the most recent ten year period for which data was available at the time of the analysis. Where indicated, analyses were based on five year rolling average positions, age-standardised rates and calculation of the 95% confidence interval. In summarising data for the purposes of the report, rates are described as "similar" when the difference between them is not statistically significant or "higher" or "lower" when a difference achieves statistical significance at the 95% confidence level.

The classification of mortality information in England and Wales has been governed by the Tenth Revision of the International Classification of Disease (ICD 10) since January 2001. To allow the development and interpretation of mortality trends spanning this transition, Telford & Wrekin mortality data based on ICD 9 is adjusted to take into account the comparability ratios similarly used by the National Centre for Health Outcomes Development. However, as adjusted national mortality data for chronic obstructive pulmonary disease is not available, local comparisons with the England & Wales position prior to 2001 have not been provided in the report.

Respiratory morbidity was examined through an analysis of hospital admission rates for acute pulmonary disease, based on the following codes from the tenth edition of the International Classification of Disease (ICD 10):

- J20: acute bronchitis
- J45: asthma (excluding J45.0: allergic asthma)
- J46: status asthmaticus
- J68: respiratory conditions due to the inhalation of chemicals, gases, fumes and vapours

Other ICD 9 and 10 codes are provided in the Appendices to the report. Ward level data on suicide has not been provided in the report due to the current advice on disclosure from the Office for National Statistics.

4.3 Findings

4.3.1 In response to the claim that, comparing the periods 1991 to 1996 and 1998 to 2003, there was a large increase in the number of deaths in Telford & Wrekin compared to Shrewsbury & Atcham

Table 2 shows all cause mortality information for the two Boroughs in question.

Table 2 : All Cause Mortality, Telford & Wrekin and Shrewsbury & Atcham

Period	Telford & Wrekin					Shrewsbury & Atcham				
	Total Number of Deaths	Population	Age Standardised Mortality Rate (/100,000)	95% Confidence Interval		Total Number of Deaths	Population	Age Standardised Mortality Rate (/100,000)	95% Confidence Interval	
				Lower Limit	Upper Limit				Lower Limit	Upper Llimit
1991-96	7,547	864,100	799	781	818	6,019	560,100	717	698	736
1998-03	7,944	941,500	718	702	735	6,053	573,800	635	618	652
Difference (number)	+397	+77,400				+34	13,700			
Difference (%)	+5%	+9%	-10%			+1%	+2%	-11%		

Source: Office for National Statistics Vital Statistics 3 Tables and Mid Year Population Estimates © Crown Copyright

The total number of deaths in Telford & Wrekin increased by 5% over the period in question, while there was a 9% increase in the size of the local population. Similar but smaller effects were observed in Shrewsbury & Atcham. The greater increase in the number of deaths in Telford & Wrekin was to be expected, given the relative increase in the local population. However, the age standardised mortality rates fell significantly in the two Boroughs, with a 10% decrease in absolute terms being observed in Telford & Wrekin and an 11% decrease in Shrewsbury & Atcham.

4.3.2 In response to the claim that there has been an increase in the number of deaths in the area surrounding the power station since 1999

"Area" was not defined in the claim. However, Table 3 shows all cause mortality information for the Telford & Wrekin study wards for 1999 and 2003.

Table 3 : All Cause Mortality, South Telford Wards

Ward	1999				2003			
	Total Number of Deaths	Age Standardised Mortality Rate (/100,000)	95% Confidence Interval		Total Number of Deaths	Age Standardised Mortality Rate (/100,000)	95% Confidence Interval	
			Lower limit	Upper limit			Lower limit	Upper limit
Madeley	77	934	714	1,155	80	866	662	1,071
Dawley Magna	58	576	426	726	64	604	454	755
Ironbridge Gorge	45	1,827	1,276	2,378	37	1,439	951	1,926
Woodside	37	760	512	1,009	41	796	550	1,043
Total	**217**	**821**	**710**	**932**	**222**	**792**	**686**	**898**

Source: Office for National Statistics Annual Death Extracts, & Mid Year Population Estimates © Crown Copyright

There was a 2.3% increase in the total number of deaths in the study wards, with five more deaths recorded in 2003 than in 1999. Although ward level census estimates are not available for the period in question, this increase in deaths is not surprising given the population growth trend in South Telford (for example, the 6.2% increase in the population from 1991 to 2001 which was described in Section 3.3). None of the changes observed in the age-standardised mortality rates, either at ward level or across South Telford as a whole, were statistically significant.

4.3.3 Respiratory Morbidity

Table 4 compares hospital admission rates for acute pulmonary disease in the study wards to the Telford & Wrekin average position for children and adults, for the ten-year period 1995/6 to 2004/5. The data is provided in Appendices 1 and 2.

Table 4 : Ward-level Hospital Admission Rates for Acute Pulmonary Disease: Comparison with Telford & Wrekin Position

Ward	Five Year Period	Age Standardised Admission Rate (/100,000)	Age Standardised Admission Rate (/100,000)
		Under 15 years	Over 15 years
Madeley	1995/96-1999/00	Similar	**Lower**
	1996/97-2000/01	**Lower**	**Lower**
	1997/98-2001/02	**Lower**	**Lower**
	1998/99-2002/03	Similar	**Lower**
	1999/00-2003/04	Similar	**Lower**
	2000/01-2004/05	Similar	Similar
Dawley Magna	1995/96-1999/00	**Lower**	Similar
	1996/97-2000/01	**Lower**	Similar
	1997/98-2001/02	Similar	Similar
	1998/99-2002/03	Similar	Similar
	1999/00-2003/04	Similar	Similar
	2000/01-2004/05	Similar	Similar
Ironbridge Gorge	1995/96-1999/00	**Lower**	Similar
	1996/97-2000/01	**Lower**	Similar
	1997/98-2001/02	**Lower**	Similar
	1998/99-2002/03	**Lower**	Similar
	1999/00-2003/04	Similar	Similar
	2000/01-2004/05	**Higher**	**Lower**
Woodside	1995/96-1999/00	Similar	Similar
	1996/97-2000/01	Similar	Similar
	1997/98-2001/02	Similar	Similar
	1998/99-2002/03	**Higher**	**Higher**
	1999/00-2003/04	**Higher**	**Higher**
	2000/01-2004/05	**Higher**	**Higher**

Source: Telford & Wrekin Contract Minimum Datasets and Office for National Statistics 2001 Census © Crown Copyright

The most marked features of these analyses are:

- Overall, the similarity in admission rates in the study wards to the Telford & Wrekin average and the stability of this relationship over time
- That admission rates tend to be similar to or lower than the Telford & Wrekin average position in the two wards with the monitoring stations (Madeley and Dawley Magna)
- That admission rates in Woodside have been higher than the Telford & Wrekin average since 1998

4.3.4 Mortality from Myocardial Infarction, Cancer, Chronic Obstructive Pulmonary Disease and Suicide

Table 5 compares age standardised premature and all age, all cause and condition specific mortality in Telford & Wrekin and England and Wales. The table also indicates any significant trend in the Telford & Wrekin measures for the conditions under review when comparing the periods 1994 to 1998 and 1999 to 2003. The data is provided in Appendices 3 to 7 of the report.

Table 5: Telford & Wrekin Age Standardised Mortality Rates: Comparison with England & Wales

Year	All Cause		Myocardial Infarction		Cancer		Suicide and Undetermined Injury (All Age)	Chronic Obstructive Pulmonary Disease	
	Under <75	All Age	Under <75	All Age	Under <75	All Age		Under <75	All Age
1994	Similar	Similar	Similar	Similar	Similar	Similar	Similar	-	-
1995	**Higher**	**Higher**	Similar	Similar	Similar	Similar	Similar	-	-
1996	Similar	Similar	Similar	**Lower**	**Higher**	Similar	**Lower**	-	-
1997	Similar	Similar	Similar	Similar	Similar	Similar	Similar	-	-
1998	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	-	-
1999	**Higher**	**Higher**	Similar	Similar	**Higher**	Similar	Similar	-	-
2000	Similar	Similar	Similar	Similar	**Higher**	Similar	Similar	-	-
2001	**Higher**	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	Similar
2002	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
2003	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Significant trend, 1994-1998 and 1999-2003	-	↓	↓	↓	-	-	-	-	-

Source: Office for National Statistics Annual Vital Statistics 1 & 3 Tables, Mid Year Population Estimates © Crown Copyright

Comparing Telford & Wrekin to the national position, all cause all age mortality in Telford & Wrekin was significantly higher than the England and Wales average during 1995, 1999 and 2001. Local rates were not significantly different from the national average for the remaining years. All cause premature mortality showed a similar pattern. Rates in Telford & Wrekin were significantly higher than in England and Wales as a whole during 1995, 1998, 1999 and 2001 but not significantly different for the remaining years, including 2003.

Considering the period 1994 to 2003, all age mortality from myocardial infarction in Telford & Wrekin was significantly lower than the England & Wales average in 1996. Local rates were not significantly different from the national average for the remaining years. Premature mortality from myocardial infarction was not significantly different from the England and Wales average during any of the years in question. During the same period, all age cancer mortality in Telford & Wrekin was not significantly different to the England and Wales average for any year. Premature cancer mortality rates in Telford & Wrekin were significantly higher than the England and Wales average during 1996, 1999 and 2000 but were not significantly different for all other years. All age and premature mortality from suicide and undetermined death in Telford & Wrekin were not significantly different from the England and Wales average for any year, apart from 1996 when rates were significantly lower in Telford & Wrekin.

During the period 2001 to 2003, all age and premature mortality from chronic obstructive pulmonary disease in Telford & Wrekin was not significantly different from the England and Wales average.

Table 6 compares age standardised premature and all age, all cause and condition specific mortality in the study wards to the Telford & Wrekin average position. The table also indicates any significant trend in the ward-based measures for the conditions in question. The data is provided in Appendices 8 to 11 of the report.

Table 6: Ward-level Age Standardised Mortality Rates: Comparison with Telford & Wrekin

Ward	Five Year Period	All Cause		Myocardial Infarction		Cancer		Chronic Obstructive Pulmonary Disease	
		<75 years	All age	<75 years	All age	<75 years	All age	<75 years	All age
Madeley	1994-1998	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1995-1999	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1996-2000	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1997-2001	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1998-2002	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1999-2003	**Higher**	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar
Significant trend, 1994-1998 and 1999-2003		-	-	-	-	-	-	-	-
Dawley Magna	1994-1998	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1995-1999	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1996-2000	Similar	**Lower**	Similar	Similar	Similar	Similar	Similar	Similar
	1997-2001	Similar	**Lower**	Similar	Similar	Similar	Similar	Similar	Similar
	1998-2002	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1999-2003	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Significant trend, 1994-1998 and 1999-2003		-	-	-	-	-	-	-	-
Ironbridge Gorge	1994-1998	Similar	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar
	1995-1999	**Higher**	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar
	1996-2000	Similar	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar
	1997-2001	Similar	**Higher**	Similar	Similar	Similar	**Higher**	Similar	Similar
	1998-2002	Similar	**Higher**	Similar	Similar	Similar	**Higher**	Similar	Similar
	1999-2003	Similar	**Higher**	Similar	Similar	Similar	**Higher**	Similar	Similar
Significant trend, 1994-1998 and 1999-2003		-	-	-	-	-	-	-	-
Woodside	1994-1998	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1995-1999	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1996-2000	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1997-2001	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1998-2002	**Higher**	Similar	Similar	Similar	Similar	Similar	Similar	Similar
	1999-2003	Similar	Similar	Similar	Similar	Similar	Similar	Similar	Similar
Significant trend, 1994-1998 and 1999-2003		-	-	-	-	-	-	-	-

Source: Office for National Statistics Annual Death Extracts, 2001 Census Standard Tables for Wards ©Crown Copyright

The most marked features of these analyses are:

- The broad similarity between the Telford & Wrekin measures and the national position, with some fluctuation in all cause mortality and premature cancer mortality
- The broad similarity in the ward based measures to the Telford & Wrekin average and the stability of both this relationship and the ward based measures
- Considering the two wards with the monitoring stations, all cause premature mortality in Madeley has been higher than the Telford & Wrekin average since 1996, although the overall trend is stable and premature mortality rates for the main causes of death are not significantly different from the Telford & Wrekin position. Rates in Dawley Magna almost exactly mirror the Telford & Wrekin average positions
- All cause all age mortality is higher but stable in Ironbridge Gorge and all age cancer mortality has been higher since 1997

Equivalent ward-level analyses were conducted for all age mortality from suicide and undetermined death. The annual number of suicides and undetermined deaths at ward level each numbered under five for each ward for each year examined. Ward level rates were not significantly different from the Telford & Wrekin average position for each period examined.

4.3.5 Infant Mortality

Table 7 compares infant mortality rates in the study wards to the Telford & Wrekin average position. Infant mortality data is provided in Appendices 12 and 13. During the period 1994 to 2003, infant mortality in Telford & Wrekin was not significantly different from the England and Wales average and the trend was stable. At ward level, either no deaths were recorded or rates were similar to the Telford & Wrekin average position.

Table 7: Ward-level Infant Mortality Rates: Comparison with Telford & Wrekin

Ward	Five Year Period	Comparison of Infant Mortality Rates
Madeley	1994-1998	No infant deaths
	1995-1999	No infant deaths
	1996-2000	No infant deaths
	1997-2001	Similar
	1998-2002	Similar
	1999-2003	Similar
Dawley Magna	1994-1998	Similar
	1995-1999	Similar
	1996-2000	Similar
	1997-2001	Similar
	1998-2002	Similar
	1999-2003	Similar
Ironbridge Gorge	1994-1998	No infant deaths
	1995-1999	No infant deaths
	1996-2000	No infant deaths
	1997-2001	No infant deaths
	1998-2002	No infant deaths
	1999-2003	Similar
Woodside	1994-1998	Similar
	1995-1999	Similar
	1996-2000	Similar
	1997-2001	Similar
	1998-2002	Similar
	1999-2003	Similar

Source: Office for National Statistics Annual Vital Statistics 1 Tables ©Crown Copyright

4.4 Conclusions and Discussion

Comparing the periods 1991 to 1996 and 1998 to 2003, while it is correct that there was a larger increase in the absolute number of deaths in Telford & Wrekin than in Shrewsbury & Atcham, this trend was to be expected given the patterns of population growth in the two Boroughs. Infact, the age standardised mortality rate fell significantly in both areas and to a similar extent. The analysis does not support the claim that the power station is having a detrimental and differential effect on mortality in Telford & Wrekin.

Turning to the claim that there has been an increase in the number of deaths in the area surrounding the power station since 1999, the actual increase in the total number of deaths recorded in the study wards was five. Again, this finding is not surprising given the growth in the local population. None of the changes observed in age-standardised mortality rates were statistically significant. The analysis does not support the claim that the power station is having a detrimental effect on mortality in the area around the power station.

There is scientific evidence that industrial atmospheric pollutants can have short-term adverse impacts on respiratory function. Of the analyses conducted in this investigation, the analysis of hospital admission rates for acute pulmonary morbidity is likely to be the one most sensitive to any immediate local effects of emissions from the power station. However, Madeley and Dawley Magna, the two wards with monitoring stations, experienced admission rates which tended to be similar to or even lower than the Telford & Wrekin average position. Although Woodside has experienced relatively high admission rates since 1998, this observation is more likely to be due to causative factors associated with high levels of socioeconomic deprivation, Woodside being the most deprived ward in Telford & Wrekin. For example, the 2005 West Midlands Regional Lifestyle Survey has recently confirmed that, within Telford & Wrekin, smoking prevalence rates are significantly higher in the most deprived wards in the Borough.

Overall, the analysis of paediatric and adult admission rates for acute pulmonary morbidity did not demonstrate a geographic or temporal pattern which could reasonably be interpreted as evidence of a current local effect of the power station on respiratory health. Looking at this another way, other evidence that people living near the power station do not experience excess respiratory morbidity comes from a previous analysis of practice-based referral behaviour. In this study, of the 21 general practices in Telford & Wrekin, six were found to have admission rates for acute pulmonary conditions which were higher than the Telford & Wrekin average. Only one of these practices-Woodside-serves a population living within the four study wards.

Considering the analyses of mortality and comparisons between Telford & Wrekin and England and Wales, all cause all age and premature mortality and premature cancer mortality tended to fluctuate year on year in comparison with the national position, although there were no adverse trends overall. The other measures were more stable and again, there were no adverse trends. While recognising the clear limitations of Telford & Wrekin-wide mortality data in investigating effects from the power station, the analyses do not support a claim for a Telford & Wrekin-wide effect on mortality.

Considering the ward-level analyses of mortality, these demonstrated an overall similarity to the Telford & Wrekin average position and both the measures and the relationship with the Telford & Wrekin position were stable over the ten year period examined.

Within this overall picture, all cause premature mortality has been higher in Madeley since 1996, although, importantly, premature mortality rates for the individual main causes of death have remained similar to the Telford & Wrekin position. Madeley is also a relatively deprived ward, being the tenth most deprived of the 33 wards in Telford & Wrekin. Patterns of mortality in Dawley Magna, the other ward with a monitoring station, almost exactly mirror the overall position in Telford & Wrekin. In addition, all cause all age mortality is higher but stable in Ironbridge Gorge and within this, all age cancer mortality has been higher since 1997. However, Ironbridge Gorge is also exceptional within Telford & Wrekin for having a very high proportion of its deaths - 43% - occurring in a local care home for the elderly. The presence of this type of care home may be a powerful determinant of local mortality rates, an effect which would not be entirely controlled for by age standardisation. This type of effect has been noted previously in Telford & Wrekin, albeit as a result of an investigation within a different setting.[1] In the investigation, excessively high mortality apparently associated with two local general practitioners was credibly explained by a nursing home effect and the need for local knowledge when interpreting data was emphasised. Overall, the analyses of ward level mortality did not demonstrate a geographic or temporal pattern which could reasonably be interpreted as evidence of a current local effect of the power station on health.

Infant mortality rates in Telford & Wrekin do not differ significantly from the England and Wales position. Ward level rates are stable and while based on small numbers, do not differ significantly from the Telford & Wrekin position. The analysis of infant mortality did not demonstrate a geographic or temporal pattern which could reasonably be interpreted as evidence of a current local effect of the power station on infant health.

[1] Mohammed AM, Rathbone A, Myers P, Patel D, Onions H, Stevens A. An investigation into general practitioners associated with high patient mortality flagged up through the Shipman inquiry: retrospective analysis of routine data. British Medical Journal, June 2004; **328:** 1474-1477

4.5 Final Comment and Recommendations

It is very likely that Ironbridge Gorge power station will be exerting a number of direct and indirect effects on health. The plant produces atmospheric pollutants which can be harmful to health, although it complies with all current National Air Quality standards. However, as a generator of electricity for the national grid, the power station also supplies power for communities and individuals in their daily lives, providing, for example, heat and light for the home and workplace. The power station also provides employment, income and leisure opportunities for local people.

It is recognised that this investigation relied on a limited set of routinely available health data and that its design did not amount to a comprehensive scientific study of the local health impact of the power station. In particular, the study has not considered any cohort effects within the population living around the power station. However, with reference to its objectives, the investigation has failed to substantiate the existence of patterns of ill-health and mortality which could reasonably be interpreted as evidence that emissions from the power station are having an adverse impact on the health of local people.

The Director of Public Health will be making the following six recommendations to the Chief Executive of Telford & Wrekin PCT:

- That the PCT should formally receive a report of the work and position of the partner agencies in responding to the claims about the power station
- That the PCT should formally receive the report of the investigation led by the Director of Public Health into the specific claims being made about the effects of the power station on the health of local people
- That, in the context of a clear communication strategy, the PCT should consider putting these reports into the public domain, working with its partner agencies
- That the PCT should continue to work in close partnership with others to understand the performance and impact of the power station in the face of, for example, emerging scientific evidence and new legislation
- That the PCT should continue to monitor the health of people living in Telford & Wrekin, including people living in the wards around the power station
- That the PCT should consider and agree how it will communicate its position to the two individuals making the claims

Dr Catherine Woodward
Director of Public Health
Telford & Wrekin Primary Care Trust

APPENDICES

Appendix 14

Additional Information Requested by Professor Harrison

(a) Social Deprivation and Smoking Prevalence in the Study Wards

The table provides information from the Index of Multiple Deprivation 2000, rather than the more recent Index of Multiple Deprivation 2004, because the former provides ward level scores, while the latter provides scores at super output area level.

Ward	% of Adults who Smoke	95% Confidence Interval		Score: Index of Multiple Deprivation 2000
		Lower limit	Upper limit	
Madeley	24%	14%	37%	35.2
Dawley Magna	27%	19%	36%	29.3
Ironbridge Gorge	31%	13%	54%	12.8
Woodside	37%	27%	48%	47.0
Telford & Wrekin	**25%**	**23%**	**28%**	

Sources: West Midlands Regional Lifestyle Survey 2005; Index of Multiple Deprivation 2000, Department for Communities and Local Government http://www.communities.gov.uk/index.asp?id=1128449 , © Crown Copyright

(b) Statistical Methods

As many of the rates calculated were based on small numbers of deaths, five year rolling average rates were used.

Hospital admission and mortality rates were directly age-standardised to facilitate comparisons between different groups. The approach ensures that any differences in the age structure of groups are taken into account in the analyses, so removing the potentially statistically confounding impact of age. With particular reference to the directly standardised methodology, adjusted rates were derived by applying the category-specific rates to the European Standard Population.

To overcome the role of chance in accounting for observed differences, confidence intervals were used to give the range within which the true magnitude of effect lies with a set degree of assurance. 95% confidence intervals for the age-standardised rates were calculated using a normal approximation and standard errors generated using the method described by Breslow and Day.[2] For crude rates, 95% confidence intervals were calculated using the method described by Esteve, Benhamou and Rayond.[3]

As a measure of the trend in rates over time, the first five year rolling average position was compared to the final five year rolling average position for the measure and analysis in question. The change in rates was assessed using the 95% confidence interval for each position in order to establish any increases or decreases during the period in question.

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[2] Breslow NE, Day NE. Statistical Methods in Cancer Research Volume II: The Design and Analysis of Cohort Studies. International Agency for Research on Cancer, WHO. Lyon, 1987

[3] Esteve, Benhamou and Rayond. Statistical Methods in Cancer Research Volume IV: Descriptive Epidemiology. International Agency for Research on Cancer, WHO. Lyon, 1994

Both references are quoted from the National Centre for Health Outcomes Development (NCHOD) Clinical and Health Outcomes Knowledge Base http://nww.nchod.nhs.uk/