

Annex A

Literature Review

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A1 INTRODUCTION

A1.1 CONTENT

This *Annex* presents the summary of the literature review, which forms the evidence base for research relating to changes in health determinants and consequent health effects.

The *Annex* is presented in the following sections:

1. Review of HIAs related to waste management;
2. Air Quality;
3. Incineration and public health
4. Transport;
5. Noise;
6. Visual Environment;
7. Socioeconomics;
8. Social Capital;

A2 WASTE MANAGEMENT HEALTH IMPACT ASSESSMENTS

A2.1 CORNWALL ENERGY RECOVERY CENTRE, SITA

A2.1.1 The proposals

In 2006 Cornwall County Council awarded SITA a 30 year private finance initiative (PFI) contract, which resulted in SITA planning to build and operate the Cornwall Energy Recovery Centre (CERC) in St Dennis ⁽¹⁾. The centre will burn non recycled waste to produce electricity and heat in line with the need to reduce the amount of waste being sent to landfill as per EU Directives.

The CERC would be located 700m from the closest residential receptors at St Dennis village, with access from the A30 –the main trunk road in Cornwall. All the waste will be brought by road. The site is approximately 14 acres and is visible from parts of St Dennis. The stack will be 120m high. The plant will operate 24 hours a day, 7 days a weeks and will receive deliveries from 07.00-18.00 Monday to Friday and 07.00-13.00 on Saturdays. It is expected there will be around 60 two way heavy goods vehicle trips per day. The plant is likely to provide enough electricity for approximately 15,000 households and provide 50 jobs during operation.

The CERC is a conventional EfW and designed so that at all times waste is enclosed within the building. Air flows are managed so as to minimise odour release beyond the plant. The CERC will operate with a negative internal air pressure that sucks air in to feed the combustion process. The design of the CERC as a single ‘sealed’ structure is also intended to help minimise noise emissions from the plant.

A2.1.2 Findings of the HIA

The HIA concluded that

“there is no clear evidence that CERC emissions will pose a threat to health –although there is clearly a need to address people’s perceptions of the risk.”

A2.1.3 Recommendations of the HIA

Based on this the HIA went on to make the following recommendations:

1. SITA produces clear information about the CERC emissions to answer individual and community concerns.
2. SITA establish an easy, and effective, way for local people to contact SITA if they have any concerns.

(1) Cornwall Energy Recovery Centre, St Dennis Cornwall, Health Impact Assessment for the proposals for the development. Prepared for SITA by Ben Cave Associates Ltd February 2008.

3. The SITA site access road also be used by the clay lorries that access the area to try and minimise the number of lorries on the local roads.
4. The possibility of the use of biofuels for the waste lorries (to reduce pollution from lorries) should be considered.
5. SITA work with the authorities to identify ways to encourage local people to gain the jobs provided.
6. As many people as possible, including young people, are engaged in identifying the best ways of sustainably benefiting the local community. The HIA suggests that a 'Community Bus' service would benefit many people, especially people who are less well off.
7. The responsible authorities make good efforts to promote good community relations at all times between local people and any construction workers that come into the area.
8. The authorities and all interested parties consider how new attractions and 'centres of excellence' could be created in the local area to reverse economic decline.

A2.2 HOUSEHOLD WASTE INCINERATOR HULL

A2.2.1 Background

In 2001 a Household Waste Incinerator was proposed in Hull ⁽¹⁾. The local Health Authority undertook a health assessment of the proposals to determine the potential for health effects within the local area. The assessment was not a full HIA but contained many of the elements of a HIA including examining the evidence in order to gain a rational and unbiased insight into the health effects of the proposed incinerator and proposing mitigation to protect the health of the community. The work was carried out in response to the PCT's and local residents concerns about the health impacts of the proposed development. The incinerator project was abandoned.

A2.2.2 Findings and recommendations

The Health Authority report concluded ⁽²⁾:

1. Dioxins in the environment generally may cause adverse health effects, although there is very limited evidence that this is the case for low doses.

(1) Health Impact Assessment In Yorkshire and the Humber Region: Sheffield Hallam University- October 2004

(2) Information taken from Health Impact Assessment and Waste Management with particular reference to Incineration An Introductory Paper February 2005 Published by The Institute of Public Health in Ireland available at http://publichealth.ie/files/file/Waste_Management_and_Health_report.pdf

2. Evidence on health risks and incinerators and low doses of dioxins should be kept under review.
3. There is a substantial evidence base to suggest that modern incineration of household waste is unlikely to present a significant health hazard.
4. Where evidence of harmful emissions has been detected historically, these were either from hazardous waste or old systems that do not meet current regulations.
5. The issue of particle size may be important but is not yet completely understood.

A2.3 ***JERSEY ENERGY FROM WASTE HIA PARTS 1 AND 2.***

A2.3.1 ***Introduction***

The States of Jersey approved a Solid Waste Strategy in 2005. A key part of the implementation of the strategy was the replacement of the existing Energy from Waste (EfW) incinerator, located at Bellozanne with a modern, cleaner waste disposal facility. The new facility was planned to be on an industrial estate at La Collette in St Helier.

Two HIAs were undertaken one for the outline planning application and one for the detailed planning application. Both of the HIAs were described as rapid due to the nature of the assessment undertaken and both included consultation with the local community.

A2.3.2 ***Findings of Part One***

The initial HIA (for the outline planning application) concluded that:

1. The EfW proposal will have both positive and negative impacts.
2. The most significant positive impact in the longer term will potentially result from reductions in emissions from the development of an EU compliant EfW facility.
3. The main negative impacts are concerned with perceived risk from waste incineration, visual impact on the skyline, and concerns regarding traffic flows and congestion with potential impacts on wellbeing
4. It is speculated that there will be negative impacts on some staff potentially affected by the proposal, eg changing the location and possible nature of employment.
5. Positive and negative impacts may result due to the facility's impact on the local economy which could provide local jobs, but also potentially affect property prices, access and journey times for people living and working in the immediate area.

A2.3.3 Findings of Part Two

The second stage of the HIA for the detailed planning application concluded that:

1. The evidence from the HIA generally supports the Energy from Waste proposal.
2. Emissions from incineration and the traffic associated with the facility are the main health impacts although it was acknowledged that flue-gas emissions from new generation incinerators are generally much lower than old facilities and will not contribute significantly to the background level of air pollution if run and maintained properly but that it is not possible to be conclusive about whether new generation incinerators *per se* will not affect health.
3. Growth in the amount of traffic and therefore associated congestion and decreased air quality in combination with other developments could affect the health of the population. Although this may be mitigated by a construction traffic management strategy.
4. The visual impact of the site was a clear concern for a majority of community stakeholders and, although there is little evidence of the relationship with ill-health, it will be important to engage the community in decisions about how to make the EfW facility more attractive to residents and reduce this anxiety for them.
5. It will be important for the States to sustain and develop the communication and engagement work that commenced with the stage 1 HIA.
6. In addition to construction-related traffic, the contractor will need to ensure the specific health needs of migrant construction workers are adequately addressed.

A2.4 WALES WASTE STRATEGY

The Wales Waste Strategy⁽¹⁾ highlights the following positive and negative health impacts as a result of incineration with energy recovery, in general terms. The strategy includes the following statements on the consensus opinion about the positive and negative health impacts of such facilities:

“the consensus is that the potential positive health impacts – employment, energy from burning the waste and the safe disposal of waste - are likely to occur.”

(1) Wales 3 Regional Waste Plans 1st Review Strategic HIA – Main Report March 2008 Peter Brett Associates.

“the consensus is that for residents, there are likely to be quality of life, annoyance and nuisance impacts from: the visual look of the facility, noise, litter and increases in vehicular traffic.”

The strategy further considers the public perceptions of health risks of waste treatment facilities. The strategy outlines that in relation to waste treatment facilities the research literature shows that the major risks perceived by local communities are based on their existing concerns about their neighbourhood and can be divided into a range of issues:

1. technical design and operation concerns about the waste treatment facility itself and its associated activities such as traffic and air pollution as well as house prices and degradation and blight in the area etc;
2. planning and siting process concerns, in particular around why a site was chosen and a community's ability to have a say in siting; and
3. socio-political concerns about who is doing what, and how the new facility will change their sense of identity and sense of place, including the power and influence of stakeholders and the fact that communities tend to see themselves as less powerful and influential than public and private sector agencies, as well as damage to the sense of a good community.

It also states that *“all change involves a degree of uncertainty and this uncertainty tends to lead to increased anxiety, worry and concern”* which are known to have a negative health impact in terms of mental health and wellbeing.

The strategy goes on to indicate that:

“well designed, well operated and properly regulated waste treatment facilities are likely to have mainly positive and little or no negative impacts on the overall health and wellbeing of nearby communities and the employees working within them. Furthermore, those waste treatment technologies which further separate and segregate waste for recycling before treatment and have closed treatment processes are likely to have the most positive and the fewest negative impacts on the health and wellbeing of local communities and employees.”

However, as with many other studies, the strategy does suggest that the epidemiological evidence for health impacts is limited by methodological issues in the research.

A2.5 HEALTH IMPACT OF WASTE MANAGEMENT: ENVIRONMENT AGENCY

With regard to incinerators, the Agency⁽¹⁾ report concludes that:

(1) Health Impact Assessment of Waste Management: Methodological Aspects and Information Sources. Science Report P6-011/1/SR1 February 2005.

“Modern incinerators will emit pollutants into the environment, but it is unlikely that they would make a major contribution to the overall background level of air pollution in a particular area, if properly run and maintained. In many cases, incinerators do not make significant contributions to the overall level of pollution and emissions from other industries may present a greater hazard to health.”

However, it also indicates that the available evidence base is weak due to methodological issues in the epidemiological studies undertaken and suggests areas for further research including research around the presence of trace metals in emissions and compared to the background levels, use of biomarkers to determine levels of exposure, research into local food chains.

A2.6 POSITION STATEMENTS ON EFW FACILITIES

A2.6.1 The Health Protection Agency

The HPA in its position paper on ‘*The impact on health of emissions to air from municipal waste incinerators*’⁽¹⁾ concludes that:

“Modern, well managed incinerators make only a small contribution to local concentrations of air pollutants. It is possible that such small additions could have an impact on health but such effects, if they exist, are likely to be very small and not detectable. The Agency, not least through its role in advising Primary Care Trusts and Local Health Boards, will continue to work with regulators to ensure that incinerators do not contribute significantly to ill health.”

In summary, the HPA states in the position paper:

While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable. This view is based on detailed assessments of the effects of air pollutants on health and on the fact that modern and well managed municipal waste incinerators make only a very small contribution to local concentrations of air pollutants. The Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment has reviewed recent data and has concluded that there is no need to change its previous advice, namely that any potential risk of cancer due to residency near to municipal waste incinerators is exceedingly low and probably not measurable by the most modern techniques. Since any possible health effects are likely to be very small, if detectable, studies of public health around modern, well managed municipal waste incinerators are not recommended.

A2.6.2 The Environment Agency

The Environment Agency’s position on EFW⁽¹⁾ is as follows:

(1) http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1251473372218

'We believe that we need to create less waste, recycle more and maximise the use of residual waste in a safe and environmentally friendly way.'

'We believe that recovering energy from waste can contribute to a balanced energy policy.'

'We consider that it may be appropriate for local authorities to include energy from waste in their strategies and plans provided that:

- 1. it does not undermine preventing or minimising waste, re-use, recycling or composting.*
- 2. it forms part of a properly considered and appraised regional or local strategy.*
- 3. it is consistent with the statutory aim to establish an integrated and adequate network of waste disposal installations and enable waste to be disposed of in one of the nearest appropriate installations.*

We also consider that energy generated by incineration should be recovered as far as practicable, for example using Combined Heat and Power (CHP) schemes, consistent with the requirements of Best Available Techniques (BAT).'

A2.6.3 The Chartered Institute of Water and Environmental Management

The Chartered Institute of Water and Environmental Management (CIWEM) states the following ⁽²⁾:

1. CIWEM considers that energy recovery from waste has a legitimate role to play in the portfolio of sustainable waste management measures.
2. CIWEM supports wider use of combined heat and power (CHP), which represents the most efficient method of energy recovery from waste and encourages consideration of the role that it could play in reducing our reliance on conventional fossil fuels.
3. CIWEM considers that the Government should assess the current and likely future market for waste derived fuels that are still classified as waste – especially in high energy use industries where security and diversity of fuel supply could deliver a commercial advantage.
4. CIWEM urges the Government to support Europe-wide standard setting for waste derived fuels.
5. In the upcoming European negotiations on the Waste Framework Directive, CIWEM considers that there would be benefit in pressing

(1) http://www.environment-agency.gov.uk/static/documents/Leisure/WIP_position_statement.pdf

(2) http://www.ciwem.org/policy/policies/energy_recovery_from_waste.asp

for the de-classification as “waste” those refuse-derived fuels (RDFs) which are of sufficiently high quality. The Institution also considers that there is a need for greater research and development on RDFs in order to increase the proportion which may be co-fired without any reduction in emissions standards and we urge the Government to support this.

6. If EfW is to deliver real benefit to the UK then more should be done at a strategic and planning level to encourage the uptake of CHP which improves the efficiency of energy recovery considerably.
7. CIWEM considers that Energy from Waste (EfW) has a significant role to play in meeting the Landfill Directive targets for the diversion of biodegradable municipal waste from landfill.
8. CIWEM considers that the public perception of energy from waste is clouded by past performance and that stringent emissions standards which must now be adhered to are such that EfW should provide no greater air pollution than many common and widely accepted sources.

A2.6.4 Overview

The above position statements all show a level of support for Energy from Waste by interested and influential organisations in terms of helping to meet waste directive targets and if the waste hierarchy is met by reducing and recycling first. None of these organisations consider the health risk to be significant for modern incinerators.

A3 AIR QUALITY

A3.1 INTRODUCTION

This section describes the current state of knowledge on the effects of air pollution on human health – it is not specific to the incineration of waste. Since EfW facilities are combustion processes and emit a number of pollutants common in the atmosphere, there is a significant amount of evidence that can be applied to the assessment of health effects resulting from EfW emissions.

The health effects of air pollution have been studied intensively over the past two decades in a range of studies worldwide. In recent years, research activity has increased significantly, especially in relation to the effects of particles on human health. This has been stimulated, in part, by the realisation amongst policy makers that air pollution has not, in fact, been eliminated as a cause of premature mortality, even if the severe episodes in past decades when coal burning was commonplace are no longer experienced. The sources of air pollution vary and have changed over time; for example, in recent years there has been a fall in industrial emissions and a rise in vehicular air pollution.

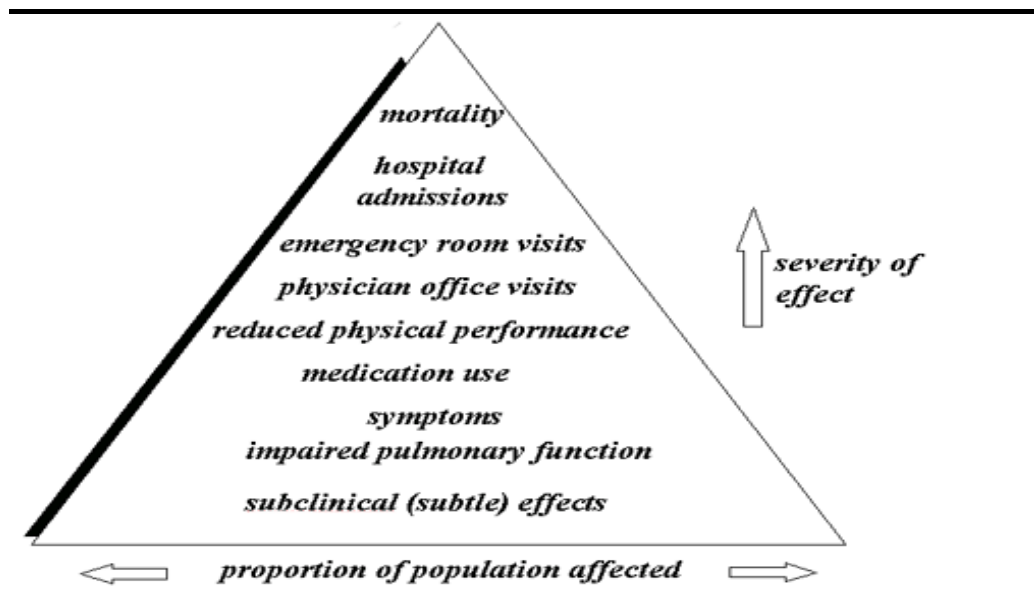
According to the WHO ⁽¹⁾ key or classical air pollutants consist of the following:

1. sulphur dioxide;
2. nitrogen dioxide;
3. carbon monoxide;
4. ozone;
5. suspended particulate matter; and
6. lead.

Road traffic emits a large number of substances, including carbon monoxide, nitrogen oxides, sulphur dioxide, particulate matter, benzene, formaldehyde and polycyclic aromatic hydrocarbons.

Exposure to outdoor air pollution is associated with both acute and chronic health effects, ranging from irritation to death. Based on the WHO definition of health, which is used as the basis for health impact assessment, all of these outcomes should be assessed, though this is rarely achieved because our knowledge is incomplete. The severity of the health effect is inversely related to its frequency and can be described in the air pollution ‘health pyramid’ developed in America:

(1) WHO Guidelines for air quality Geneva 2000

Figure 3.1 *Air pollution health pyramid*

Source: American Thoracic Society 2000

Pollutants may act independently or synergistically on human health. It is therefore not always appropriate to assess the health effects of pollutants on a pollutant by pollutant basis and then add the effects together.

A3.2 *CARDIOVASCULAR EFFECTS OF AIR POLLUTION*

A3.2.1 *COMEAP*

The Committee on UK Medical Effects of Air Pollution (COMEAP) published a report in February 2006 that assessed the possible effects of outdoor air pollutants on cardiovascular disease within the UK ⁽¹⁾.

The report presents a review of the literature on the cardiovascular effects of air pollution that leads to the following conclusions:

1. Clear associations have been reported between daily and long term exposure to air pollutants and the effects on the cardiovascular system, including death and hospital admission.
2. The association seen between air pollution and cardiovascular effects is likely to be causal and therefore the precautionary principle ⁽²⁾ should be adopted.

(1) COMEAP (2006) Cardiovascular Disease and Air Pollution. Department of Health. Available at http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@ab/documents/digitalasset/dh_096815.pdf

(2) The precautionary principle is the 'better safe than sorry' approach to assessing and managing health risks especially those associated with environmental hazards. Where there is sufficient evidence to believe that a risk exists, prudence and ethical norms and values require that action be taken to reduce or minimise that risk, even if the evidence is not conclusive (A Dictionary of Epidemiology, Fourth edition, Last)

3. That it is not possible to be certain which components of the ambient pollution mixture is responsible for the health effects, but that particulate matter is likely to play a part.

Therefore, COMEAP concluded that there is a causal link between air pollution and cardiovascular effects which is important for public health. However, the impact of factors such as family history, smoking and hypertension will have a greater impact.

The subsequent COMEAP report, published in 2009, on the effects on mortality of long-term exposure to air pollution ⁽¹⁾, also contains important material on the cardiovascular effects, since it is thought that much of the mortality observed is attributable to cardiovascular effects.

A3.2.2 *Mechanism of Action*

Two mechanisms have been proposed to explain the association between particulate matter and cardiovascular effects which are not mutually exclusive. Both are based on the suggestion that inhaled pollutants will cause an inflammatory response but have yet to be proved and do not explain the relationship between cardiovascular diseases and gaseous pollutants. The possibility that long term exposure to particles contributes to plaque formation in arteries is a strong one.

A3.2.3 *Effects of Short Term Exposure*

Evidence exists of an association (of similar strength and statistical significance) between daily average concentrations of a number of 'classical' pollutants and the daily number of deaths and hospital admissions related to cardiovascular disease (CVD). There is, however, no evidence to suggest daily ozone levels are associated with hospital admissions for CVD.

A3.2.4 *Effects of Long Term Exposure*

The evidence of the effects of long term exposure to air pollutants on CVD is growing and current thinking is that such exposure contributes to a loss of life years. Even if the associations are relatively weak, in terms of the number of people exposed, the public health impact is large and therefore the precautionary principle has been adopted by COMEAP.

A3.2.5 *Attributable Air Pollutant*

It is not possible to determine which ambient pollutant(s) are exerting the effect, but the COMEAP report suggests that fine particles play a part. The Committee also notes that;

(1) COMEAP (2009) Long term exposure to air pollution: effect on mortality. Department of Health. Available at : http://www.dh.gov.uk/ab/COMEAP/DH_108448

1. "Particles are likely to be playing an important part in causing the health outcomes described."
2. "Our tentative conclusion is that neither nitrogen oxides nor carbon monoxide, at ambient concentrations, are as likely to be causally linked with cardiovascular disease as are fine particles."
3. "We are unable to come to firm conclusions regarding the importance of the associations between ozone and cardiovascular disease. "
4. "As regards sulphur dioxide, evidence from both short and long term studies suggests an association with cardiovascular disease."

A3.3 HEALTH EFFECTS ASSOCIATED WITH POLLUTANTS

A3.3.1 Particulate Matter

Particulate matter describes airborne solid particles and/or droplets which vary in size, composition and origin. PM is a mixture of particles that can adversely affect human health, damage materials, and form atmospheric haze that degrades visibility. PM is usually divided into different classes based on size, ranging from total suspended matter (TSP) to PM_{2.5} (particles less than 2.5 microns in aerodynamic diameter) ⁽¹⁾. The source of the particulate matter will affect the toxicity of the particles.

Evidence suggests that fine particle size fractions (PM_{2.5}) are more hazardous to health than larger particle size fractions (PM₁₀), although these still have a negative health effect. Positive implications of reductions in ambient PM concentrations on public health have been shown after the introduction of clean air legislation ⁽²⁾.

Health outcomes associated with short term exposure to particulate matter include:

1. Lung inflammatory reactions;
2. Respiratory symptoms;
3. Adverse effects on the cardiovascular system;
4. Increased medication usage;
5. Increased hospital admissions; and
6. Increase in mortality.

Long term exposure to particulate matter is associated with;

1. Increase in lower respiratory symptoms;
2. Reduction in lung function in children;
3. Increase in chronic obstructive pulmonary disease (COPD);
4. Reduction in lung function in adults; and

(1) Definition of PM from <http://envirocitizen.inknoise.com/cleanenergy/2005/02/14/0001>

(2) Health aspects of air pollution with Particulate matter, ozone and Nitrogen dioxide. Report on a WHO working group Bonn Germany January 2003

5. Reduction in life expectancy, owing mainly to cardiopulmonary mortality and probably to lung cancer.

The evidence concludes in summary:

1. There is strong evidence that exposure to particulate matter brings forward all non traumatic deaths;
2. There is moderate evidence that long term exposure increases death from respiratory and cardiovascular diseases and that and COPD and asthma in the over 65s;
3. There is moderate evidence that particulate matter increases emergency hospital admissions for all circulatory, respiratory and heart diseases;
4. Chronic exposure to increased concentrations of particulate matter also increases deaths; and
5. There is a linear relationship ⁽¹⁾ between and health effects with no known threshold ⁽²⁾ supported by the WHO but with a cautionary note that the linear relationship can not be extrapolated below 20 μgm^{-3} or above 200 μgm^{-3} as these are outside the range of the observed PM_{10} ⁽³⁾

The public health implications of the long-term effects of exposure to PM are an order of magnitude greater than those of the short-term effects as measured by life years lost, although it is difficult to disentangle the two entirely ⁽⁴⁾. The WHO, therefore, recommends guidelines for both short and long term exposure levels.

A3.3.2 Nitrogen Dioxide

Health effects associated with short term exposure to ambient levels of nitrogen dioxide include;

1. Effects on pulmonary function, particularly in asthmatics;
2. An increase in airway allergic inflammatory reactions;
3. An Increase in hospital admissions; and
4. An increase in mortality.

The health effects associated with long term exposure include;

1. Reduction in lung function; and
2. Increased probability of respiratory symptoms.

In summary the evidence suggests that

(1) This means that the percentage chance of an outcome remains the same for a given increment in the pollutant

(2) Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide. Report of a WHO working group Bonn Germany January 2003

(3) WHO Regional Office for Europe (2000) Air Quality Guidelines for Europe, 91 (2nd ed) edn

(4) WHO (2004) Health Aspects of Air Pollution- results from the WHO project "systematic review of health aspects of air pollution in Europe" available at www.who.euro.int

1. A linear relationship between health outcomes and NO₂ exists and no threshold level has yet been established.
2. Causality has yet to be established between health effects and NO₂.
3. Health risks from nitrogen dioxide may result from NO₂ itself or its reaction products, including O₃ and secondary particles.
4. Associations between NO₂ and health effects need to be interpreted with caution, since it could be that NO₂ is in fact acting as a 'marker' for other pollutants associated with road traffic emissions.
5. The WHO '*uncertainty remains about the significance of nitrogen dioxide as a pollutant with a direct impact on human health at the current ambient air concentrations in the EU and there is still no firm basis for selecting a particular concentration as a long term guideline for nitrogen dioxide*' ⁽¹⁾.
6. The setting of a 40µgm⁻³ as an annual average may not be justified, although it may be a useful precautionary principle.
7. Nitrogen dioxide is associated with circulatory deaths, emergency admissions for asthma in younger adults and emergency admissions for cardiac diseases.
8. There have been no recent peer reviewed studies which have shown that a reduction in NO₂ has a positive impact on public health ⁽²⁾.

A3.3.3 Sulphur Dioxide

In summary the evidence on health effects and Sulphur Dioxide states that:

1. Linearity in the dose response relationships and report that there is no evidence that there is any threshold below which the effects do not occur.
2. There is evidence that sulphur dioxide causes symptoms in asthmatics, as it is a potent irritant and induces reversible change in lung function in both children and adults.
3. Sulphur dioxide is also related to all cause mortality, cardiovascular deaths and respiratory deaths and admissions.

(1) WHO (2004) Health Aspects of Air Pollution- results from the WHO project "systematic review of Health aspects of air pollution in Europe" available at www.who.euro.int.

(2) Health aspects of air pollution with Particulate matter, ozone and Nitrogen dioxide. Report on a WHO working group Bonn Germany January 2003

A3.3.4 Other Pollutants

A wide variety of other pollutants are also known to result in health effects, but they are of less significance in terms of health for populations, as their ambient concentrations tend to be small. Many of these are considered in terms of risk, since they are carcinogens, such as some volatile organic compounds.

A3.4 THE CLEAN AIR FOR EUROPE PROGRAMME

Clean Air for Europe (CAFE) is a European Commission programme of technical analysis and policy development. The CAFE programme developed a methodology for assessing the health impacts of changing air pollution and for cost benefit analysis of any change. CAFE adopts a no threshold assumption as the primary basis for its quantification methodology; this assumption is consistent with a variety of other studies such as those by the USEPA.

CAFE uses the following approach to quantifying acute health effects for air for those pollutants where epidemiology has identified an association is encapsulated by the following linear equation:

$$\Delta E = \beta \times \Delta C \times P \times E,$$

where: $(\Delta)E$ = (change in) background rate of events;

β = exposure-response coefficient;

ΔC = change in concentration of pollutant;

P = population exposed.

Although the epidemiological studies are based on 24-hour concentrations of pollutants, an assumption of no lower threshold of effect means that the relative risk ratios can be applied to annual average concentrations, making the computation much simpler.

Acute morbidity related to exposure to particulate matter is considered by CAFE for the following outcomes:

1. Chronic bronchitis (adults);
2. Respiratory hospital admissions;
3. Cardiac hospital admissions;
4. Restricted activity days (adults);
5. Respiratory medication use (adults);
6. Respiratory medication use (children);
7. Lower respiratory system symptom days (children) and;
8. Lower respiratory system symptom days (adults).

For mortality, takes the view that the results should be expressed in terms of life years lost, rather than numbers of deaths. This represents the current consensus view of the subject and is also consistent with the view of COMEAP.

The CAFE methodology takes the increased incidence of certain health outcomes (based on relative risks) for exposure to particulate matter as shown in *Table A3.1* below. These increased incidences are from studies that are statistically significant at a conventional 5% level, with one exception.

Table A3.1 *Increases in Health Outcomes from Exposure to an Additional 1 µg m⁻³ PM*

| Health Outcome | Increase (based on Relative Risk) ⁽¹⁾ | PM type |
|---|--|-------------------|
| <i>Chronic exposure</i> | | |
| Change in mortality hazards | 0.6% | PM _{2.5} |
| Chronic bronchitis (attack rates) | 0.7% | PM ₁₀ |
| <i>Acute Exposure</i> | | |
| Cardiovascular hospital admissions | 0.06% | PM ₁₀ |
| Respiratory hospital admissions | 0.114% | PM ₁₀ |
| Consultation with GPs (asthma, April – Sept, 15 – 64 years age) | 0.25% | PM ₁₀ |
| Restricted Activity Days | 0.0475% | PM _{2.5} |
| Lower respiratory symptoms (wheeze, shortness of breath, phlegm production) (in children) | 0.0004% | PM ₁₀ |
| Lower respiratory symptoms (in adults) | 0.0017% | PM ₁₀ |

(1)Relative Risk: The relative risk estimates the magnitude of an association between exposure and disease and indicates the likelihood of developing the disease in an exposed group relative to those who have not been exposed. It is defined as the ratio of the incidence of disease in the exposed group divided by the corresponding incidence of disease in the non exposed group.

A3.5 *VULNERABLE GROUPS*

Groups that are particularly vulnerable to exposure from air pollution include foetuses, young children, the elderly, those with cardio-respiratory disease and the socio-economically deprived.

A3.6 *DUST*

A3.6.1 *Introduction*

The potential for dust to be emitted during construction is strongly dependent on the type of activities taking place, on wind speed and on whether winds carry emitted particles towards sensitive receptors, such as hospitals, schools and residential property.

A3.6.2 *Health Effects of Dust*

Dust emissions arising from construction activities can cause outside the site boundary causing annoyance to neighbours by the soiling of property, in particular, windows, cars and washed clothes that have been hung out to dry.

Construction sites are a temporary operation and some degree of nuisance would normally be tolerated if the activity lasts for no more than a few months. Recent studies by the Building Research Establishment also suggest that nuisance is unlikely to occur at distances greater than 50 metres from a construction site boundary ⁽¹⁾. One particular study ⁽²⁾ has also shown that at least half the people living within 50 metres of the site boundary of a road construction scheme were seriously bothered by construction nuisance due to dust, but that beyond 100 metres less than 20 percent of the people were seriously bothered.

(1) Buildings Research Establishment (BRE) (2003). Control of dust from construction and demolition activities. Kukadia, V., Upton, S. and Hall, D. BRE Bookshop, London. February 2003.

(2) Baughan, C.J. (1980) Nuisance from road construction : a study at the A31 Poulner Lane Diversion, Ringwood: TRRL Supplementary Report 562. In: Design Manual for Roads and Bridges, 1994.

A4 INCINERATION AND PUBLIC HEALTH

A4.1 INTRODUCTION

A dominant concern and anxiety within host communities where a new EfW plant is proposed relates to the emissions to atmosphere of a number of substances. In recent times, the emerging knowledge relating to particles and health has reinforced such concerns. In terms of the available evidence, this is more than adequately addressed by the preceding section on general air pollution. There is nothing unique about particles generated by incineration relative to other combustion processes and every reason to suppose that the effect of such particles on human health at the population level is entirely similar to that observed in the large scale epidemiological studies.

A more long standing concern relates to substances such as dioxins and metals, which have been associated with waste incineration. Any health effects from exposure to these substances would be through prolonged exposure and manifest themselves as chronic effects. Some of the substances are carcinogens and a fear commonly expressed is that the incidence of cancer will increase.

Unsurprisingly, given that waste incineration is a waste treatment practice with a long history, there is a wealth of scientific literature examining the evidence for health effects in the vicinity of incinerators. This section provides a review of the most useful literature. It is not intended as a comprehensive review, which would occupy a report in itself.

A number of literature reviews have been carried out and these provide a useful point of reference for the range of literature available ⁽¹⁾ ⁽²⁾ ⁽³⁾ ⁽⁴⁾ . The conclusions drawn are variable and sometimes reflect the views and affiliations of the authors.

A4.2 SOURCES AND CHARACTERISTICS OF DIOXINS

Dioxins are emitted from many sources including vehicles, bonfires, domestic and industrial combustion process. Uncontrolled burning of waste is a major source of dioxin emissions. The main route of dioxin exposure is through food.

(1) Allsopp M, Costner P and Johnston P. Incineration and human health: State of knowledge of the impacts of waste incinerators and human health, Environmental science and pollution research 8(2) 141-145 (2001)

(2) Health effects of waste incineration: A review of Epidemiologic studies. Hu and Shy, Journal of air and waste management association 51:1100-1109
July 2001

(3) Health Risks of Air Pollution from Incinerators: a perspective. Rabl and Spadaro Waste Management and Research;16;365-388 1998

(4) Incineration and Human Health, State of Knowledge of the impacts of waste incinerators on Human Health. Michelle Allsopp et al Greenpeace research laboratories

Each year many new publications on aspects of the toxicology and epidemiology of dioxins appear. Dioxin concentrations in food and the general environment throughout the western world have been falling, but public concern and new research results in frequent evaluations of acceptable levels of these chemicals (by national and international bodies). Many of the new studies showing effects of dioxins come from the Far East, where general pollution levels have been rising.

The overall conclusion of many studies is that at body burden levels, within an order of magnitude of those found in the general western population, subtle adverse effects may occur. However, it should be noted that body burden of dioxins have been falling over the past two decades in Europe and this trend appears to be continuing. This is confirmed by a DEFRA review (2004) ⁽¹⁾, which stated that even in a rural environment any increased deposition of dioxins from an incinerator would be too small to be of concern with regard to health.

The consensus view is that dioxins increase the risk for all cancers combined. However, the magnitude of this increase appears to be low and no statistically significant increase in any particular type of cancer has been identified. A substantial dioxin exposure leads to elevated incidence of cardiovascular disease and diabetes although other studies challenge this conclusion. In workers a persistent skin condition (termed chloro-acne) may occur handling contaminated materials. In animals dioxin is a teratogen. There is clear evidence of immune suppression following exposure as a foetus. However, there is no good evidence among exposed communities such as the Sevaso population of impaired immune competence. In other human studies there is some rather limited evidence of effects on the immune system. There is insufficient information from human studies to determine the threshold level directly. In a number of studies dioxins were found to be endocrine disrupters, a property it has in common with a number of persistent polyhalogenated aromatic chemicals.

Dioxins are generated from many processes as trace contaminants. The levels of individual congeners (related structures) of dioxins vary considerably by source. In view of this fact a standardised form of expressing the overall toxicity is required. The internationally accepted form is to use Toxicological Equivalents (TEQs), which is based on an allocation of a toxicity rating to each congener (so called toxic equivalency factor TEF). The most potent - 2, 3, 7, 8-tetrachlorodibenzodioxane (TCDD) - is assigned a value of 1 and the remaining 17 dioxin congeners with chlorine in the 2, 3, 7 and/or 8 positions are assigned a value lower than 1. A TEQ for a particular source can be calculated using measurements of the percentage of each congener in the total amount of dioxin, and its concentration.

Ingestion is the primary exposure route in relation to dioxins. In order to give guidance on acceptable levels of exposure, the World Health Organization (WHO) has held a series of expert meetings to determine

(1) DEFRA (2004) Review of environmental and health effects of waste management, HMSO: London

a tolerable intake of dioxins to which a human can be exposed throughout life without harm. In the latest of such expert meetings held in 2001, the Joint FAO/WHO Expert Committee on Food Additives (FECFA) performed an updated comprehensive risk assessment of PCDDs, PCDFs, and 'dioxin-like' PCBs. The experts concluded that a tolerable intake could be established for dioxins on the basis of the assumption that there is a threshold for all effects, including cancer. The long half-lives of PCDDs, PCDFs and "dioxin-like" PCBs mean that each daily ingestion has a small or even a negligible effect on overall intake. In order to assess long- or short-term risks to health due to these substances, total or average intake should be assessed over months, and the tolerable intake should be assessed over a period of at least one month. The experts established a provisional tolerable monthly intake (PTMI) of 70 picogram/kg per month. This level is the amount of dioxins that can be ingested over lifetime without detectable health effects.

Most countries have not set ambient air quality guidelines or standards for dioxins in air and have concentrated on applying the WHO standards for dioxins in food instead.

A4.3 EXPOSURE AND BIO-MONITORING STUDIES

An evaluation of the likely impacts arising from emissions from the operation of an incinerators/waste to energy plant can be made by considering the available publications on:

1. Measurements of air, soil and plant levels of certain chemicals of interest (exposure investigations); and
2. Measurements of certain chemicals of interest in human blood and breast milk (biological monitoring).

The focus of research in the last two decades has been on measurements of dioxins and metals as these are most likely to persist in the environments. Dioxin concentrations in ambient air are very low, in part a reflection of their very low volatility. Maximum quarterly concentrations of dioxins and furans in major cities in the UK range from 33.4-169.2 fgTEQ m⁻³. In parallel, the emissions from modern waste to energy plants in the EU countries are a minimum of 2 -3 orders of magnitude lower than was the case in the 1950s and 1960s.

An investigation of dioxin concentrations in soil and vegetation around a MSW waste- to-energy plant in Spain by Domingo *et al* (2001) ⁽¹⁾ that emitted somewhat higher levels of dioxins that are currently permitted, resulted in the conclusion that, "in comparison with other emission sources of PCDD/Fs in the same area" (traffic, other industrial activities, bonfires) "the current PCDD/F emissions from the MSW incinerator

(1) Domingo JL, Schuhmacher M, Granero S and De Kok HAM (2001) 'Temporal variation of PCDD/PCDF levels in environmental samples collected near an old municipal waste incinerator' *Environ Monitoring and Assessment*, **69**:175-193

would be of small significance for the population living in the neighbourhood of the MSW incinerator”.

Caserini *et al* (2004) ⁽¹⁾ examined air and soil concentrations of dioxins around three MSW incinerators in Italy. At all three sites, dioxin concentrations in soil were at the lower limit of the average values for rural areas. Mari *et al* (2007) carried out a temporal assessment of environmental contamination around a modern hazardous waste incinerator. The authors' conclusion was that the incinerator did not significantly increase dioxin concentrations in soils around the plant.

Marti-Cid *et al* (2008) ⁽²⁾ measured PCDD/PCDFs in foodstuffs in Tarragona (Spain) near a hazardous waste incinerator (in operation since 1998). The authors concluded that the concentrations of dioxin were higher prior to the installation of the incinerator and concluded that 'the notable decrease in the atmospheric levels of PCDD/PCDFs over the world would explain notable differences between the results in the dietary intake in the base line, 2002 and current surveys'.

Both for humans and animals the intake of dioxins (and dioxin-like materials) is influenced by the nature of their diet, regardless of age. Diet high in fat (particularly oily fish) will lead to relatively high intake of dioxins. In an investigation of the blood levels of dioxins in a local population, Spanish authors compared measurements made in individuals before and for two years after a new MSW waste to energy plant became operational (Gonzales *et al* 2000) ⁽³⁾. Two population groups were selected: one living within 1.5km of the plant and the other 3.5-4 km away. There was a control group, which lived in an area without an incinerator. All three populations showed increased blood levels of dioxins over the two-year period regardless of the distance from the incinerator.

Measurements of the dioxin levels of populations living within 1 km of a MSW waste –to-energy plant was conducted in Japan by Yoshida *et al* (2000) ⁽⁴⁾. The findings were compared with the assessed dioxin levels of the general population in the country. The results showed a trend to lower levels of dioxins in the blood lipids and milk lipids in the residents around the MSW waste- to -energy plant than the average for the general population. Levels of dioxins were very variable within each population. This meant that different routes of dioxin exposure were likely. The authors concluded that living close to a modern waste-to-energy plant does not result in increased body levels of dioxins.

(1) Caserini S, Cernuschi S, Giugliano M, Grosso M, Lonati G, Mattaini P (2004) 'Air and soil dioxin levels at three sites in Italy in proximity to MSW incinerator plants' *Chemosphere* 54, 1279-1287

(2) Marti-Cid, Bocio A and Domingo JL (2008) 'Dietary exposure to PCDD/PCDFs by individuals living near a hazardous waste incinerator in Catalonia, Spain: temporal trend' *Chemosphere* 70, 158-159

(3) Gonzales CA, Kogevinas M, Gadea E, Huici A, Basch A, Bleda MJ, Ergo OP (2000) 'Biomonitoring study of people living near or working at a municipal solid-waste incinerator before and after two years of operation' *Arch Environ Health* 55, 259-267

(4) Yoshida K, Ikeda S, Nakanishi J (2000) 'Assessment of human health risk of dioxins in Japan' *Chemosphere* 40:177-185

The same trend was observed in the vicinity of a modern hazardous waste incinerator (Evans *et al* , 2000) ⁽¹⁾ . In the test group the blood levels of dioxin actually decreased (the samples taken from the pre-incineration period were compared with four months of incineration of the contaminated material). The control group was 15 or more kilometres away from an incinerator. A similar, but smaller, reduction was also found in the control population. Two studies conducted in Portugal found no increase in either blood levels or in breast milk in the local population in the vicinity of modern incinerators compared to a control population (Reis *et al* 2007a, 2007b) ⁽²⁾ ⁽³⁾ .

Measurements of dioxin in air around waste incinerators that are performing to current EU emission standards indicate ambient air levels that are indistinguishable from those in other urban locations. There is little or no indication of increased blood or other breast milk levels of dioxins. Numerous studies also show that background dioxin levels have been falling in food over the past decade. Kulkarni *et al* (2008) ⁽⁴⁾ stated 'over the past several years there has been a shift in the major sources of dioxins in large part due to regulations and focused voluntary efforts.'

The published literature in relation to dioxins and modern incinerators may be summarised as follows:

1. No detectable increases in blood levels, breast milk levels or umbilical cord blood samples;
2. No detectable increases in contamination of plants or animals;
3. No measurable increases in soil or air concentrations.

A4.4

EPIDEMIOLOGICAL STUDIES

Epidemiological investigations have looked at various diseases in populations living around incinerators compared with the incidence of the same diseases in 'control populations' in terms of the incidence of:

1. effects on the lung;
2. cancers; and
3. reproductive effects.

An important constraint in reviewing the data is that the key studies are all retrospective and therefore are focussed on incinerators that are poorly performing by today's standards. A selection of papers from the

(1)Evans RG, Shadel BN, Roberts DW, Clardy S, Jordan-Izaguirre D, Patterson DD, Needham LL,(2000)'Dioxin incinerator emissions exposure study Times Beach, Missouri' *Chemosphere*, 40: 1063-1074

(2) Reis MF, Miguel JP, Sampaio C, Aguiar P, Melim JM, Papke O (2007a)'Biomonitoring of PCDD/Fs in populations living near Portuguese solid waste incinerators: Levels in human milk' *Chemosphere* 67: S231- 237

(3) Reis MF, Miguel JP, Sampaio C, Aguiar P, Melim JM, Papke O (2007b)'Determinants of dioxins and furans in blood of non-occupationally exposed populations living near Portuguese solid waste incinerators' *Chemosphere* 67: S224- 230

(4) Kulkarni Ps, Crespo JG and Afonso CAM (2008)' Dioxin sources and current remediation technologies- A review' *Environ Int* 34, 139-153

literature are briefly summarised here. (A complete review would form a report in itself.)

Roberts and Chen (2006) ⁽¹⁾ assessed the potential health impacts of a waste to energy plant, designed to burn 52,500 tons of refuse derived fuel (RDF) annually (assuming current EU regulations on emissions are in force). Making the worst case scenario that the plant could emit the maximum permitted levels of every chemical of interest throughout the normal operating period, they calculated the impact on the local population of 25,000. They estimated that if the plant operated for 25 years it might contribute to a cancer increase of 0.018 per million of population. In addition, 0.46 deaths per million of the population might be brought forward due to sulphur dioxide and 0.02 deaths per million brought forward due to particles. The overall risk of dying as a consequence of the plants operation calculated to be 2.49×10^{-7} . The overall conclusion is that the impact of the proposed plant on the health of the local community would be negligible.

Hu *et al*, (2001)⁽²⁾ investigated chronic health effects in communities living near to three separate MSW incinerators in the USA (which performed to levels that are substandard to the current EU ones between 1992 and 1994). Participants in the study were assessed each year by a spirometric test. The results were not statistically significant between lung function and proximity of residence to any of the three incinerators.

Gray *et al* (1994) ⁽³⁾ compared the prevalence of asthma, in children living around a sludge burning incinerator and in a control area. No significant differences were found. Miyake *et al* (2005) ⁽⁴⁾ examined the possible contribution to respiratory symptoms (and some other effects) in young Japanese school children whose schools were near incinerators. The authors conclude that the presence of a school close to the incinerators causes a small increase in the prevalence of one or more of the symptoms. However the design of this study makes the interpretation of the findings very difficult.

The main contributor to foetal abnormalities appears to be genetic. The overall level of congenital abnormalities in the UK is generally rather constant from year to year. Dolk and Vrijheid (2003) ⁽⁵⁾ reviewed the epidemiological studies for correlations between congenital abnormalities and exposure to chemicals associated with environmental pollution and considered a number of possible causes and contributory factors. The authors concluded that there are relatively few environmental pollution sources for which strong conclusions can be

(1) Roberts RJ, Chen M (2006) 'Waste incineration – how big is the health risk? A quantitative method to allow comparison with other health risks' *J of Public Health* 28(3):261-266

(2) Hu SW, Hazucha M, Shy C (2001,a) Waste incineration and pulmonary function; an epidemiologic study of six communities, *Air and Waste Manage Assoc*, 51, 1185-1194

(3) Gray, E.J.; Peat, J.K.; Mellis, C.M.; Harrington, J.; Woolcock, A.J (1994). Asthma Severity and Morbidity in a Population Sample of Sydney School children' *NZ J. Med.* 24, 168-175

(4) Miyake Y *et al* (2005) Relationship between distance of schools from the nearest municipal waste incinerator plant and child health in Japan. *Environ Epidemiology* 20, 1023-1029

(5) Dolk H and Vrijheid M (2003) 'The impact of environmental pollution on congenital anomalies' *British Medical Bulletin* 68:25-45

drawn regarding their potential to cause congenital abnormalities. A Japanese study of adverse reproductive outcomes (in relation to proximity to 63 municipal solid waste incinerators) did not find any statistically significant outcomes within the distance of 2 to 10 km from the incinerators (Tango *et al*, 2004) ⁽¹⁾. However, it showed a peak-decline in risk with distance for infant deaths with all congenital malformations combined. Cresswell *et al*, (2003) ⁽²⁾ conducted a study in a population around the Byker (Newcastle-upon-Tyne) waste combustion plant. No significant overall association between the number of congenital abnormalities and geographical proximity to the plant was found in the study.

Zambon *et al* (2007) ⁽³⁾ investigated the incidence of sarcomas in a case control study involving individuals living in an area which had some 22 incinerators of various kinds as well as a number of other industrial plants. The data were collected in the 1990s and relate to old incinerators. They found an increased incidence of sarcomas which they attributed to dioxins. No direct evidence was put forward to link the sarcomas either to the incinerators or to dioxins.

A Finnish research project which studied the association between soft-tissue sarcoma and dioxin identified that the highest risk of sarcoma was found at low levels of dioxin concentration (Tuomisto *et al*, 2004) ⁽⁴⁾. No increased risk associated with increased dioxin concentration was found.

One of the best conducted studies on possible adult cancer risks was that of Elliott *et al*, (1996) ⁽⁵⁾. They used postcode data to investigate the cancer incidence among 14 million people living near any of the 72 MSW incinerators in the UK. A statistically significant trend for a decline in risk was observed with increasing distance from the incinerators for all cancers combined (and for stomach, liver and lung cancers specifically). When allowance was made for socio-economic deprivation scores in each location no adverse effects could be identified.

Knox (2000) ⁽⁶⁾ studied possible health risks to children from both landfill and incineration emissions the study focused exclusively on child deaths from cancer (both solid tumours and leukaemias). Knox's view was that with proximity (7.5-km) to very old MSW waste incinerators and old hospital incinerators there was a small increased relative risk for children to develop cancer. If these very old incinerators are omitted, there is no identifiable increased cancer risk. Knox

(1)Tango T, Fujita T, Tanihata T, Minowa M, Doi Y, Kato N, Kunikane S, Uchiyama I, Tanaka M, Uehata T (2004) 'Risk of adverse reproductive outcomes associated with proximity to municipal solid waste incinerator with high dioxin emission level in Japan' *J Epidemiol* **14**(3):83-93

(2) Cresswell PA, J. E. S. Scott, S. Pattenden and M. Vrijheid(2003)'Risk of congenital anomalies near the Byker waste combustion plant' *J of Public Health* **25**(3):237-242

(3) Zambon P, Ricci P, Bovo E, Casula A, Gattolin M, Fiore AR, Chiosi F and Guzzinati S (2007) 'Sarcoma risk and dioxin emissions from incinerators and industrial plants: a population-based case-control study (Italy)' *Environmental Health*, **6**, 19

(4) Tuomisto JT, Pekkanen J, Kiviranta H, Tukianen E, Vartiainen T and Tuomisto J (2004)' Soft-tissue sarcoma and dioxin: a case-control study' *Int J Cancer*, 198:893-900

(5) Elliott t P, Shaddick G, Kleinschmidt I, Jolley D, Walls P, Beresford J and Gruny G (1996)' Cancer incidence near municipal solid waste incinerators in Great Britain', *Brit J Cancer*, **73**, 702-710

(6) Knox EG((2000)'Childhood cancers, birthplaces, incinerators and landfill sites' in *Int J of Epidemiology*, 29:391-397

acknowledged that this 'seemed to exonerate the more modern plants' (built in the 1960s and 1970s). In another review, the authors stated that there is no clear relationship between childhood cancer and incinerator emissions, even if some results were statistically significant (Franchini *et al*, 2004) ⁽¹⁾ .

The published literature in relation to health effects is retrospective and do not include modern incinerators. The findings for older incinerators with substantially higher emissions may be summarised as follows:

1. No consistent increase in the incidence of respiratory effects;
2. No consistent increase in the incidence of reproductive effects or effects on the developing foetus;
3. No detectable increase in childhood cancers;
4. A possible small increase in sarcomas; and
5. No identifiable increase in other cancers.

(1) Franchini M, Rial M, Buiatt E, Bianchi F (2004)'Health effects of exposure to waste incinerator emissions: a review of epidemiological studies' *Ann Ist Super Sanita*, **40**(1):101-115

A5 TRANSPORT

A5.1 INTRODUCTION

The Acheson report in 1997 ⁽¹⁾ stated that,

‘The primary function of transport is in enabling people to access goods and services. In doing so it promotes health indirectly through the achievement and maintenance of social networks. Some forms of transport, such as cycling and walking, promote health directly by increasing physical activity and the reduction of obesity. Lack of transport may damage health by denying access to people, goods and services and by directing resources from other necessities. Furthermore, transport may damage health directly, most notably by accidental injury and air pollution’.

This view is supported by the WHO; they propose that transport plays a vital role in the health and well-being of communities by providing access to a range of services and amenities required to treat, manage and promote healthy living. Transport facilitates access to jobs, education and markets and plays a key role in the economy of most countries ⁽²⁾.

However, transport policies and infrastructure can also have a negative impact on health in terms of injuries and deaths associated with transport accidents, noise pollution and air pollution, resulting in cardiovascular and respiratory deaths. A more sedentary lifestyle (resulting in non communicable diseases and early mortality) is also associated motor vehicle usage ⁽³⁾.

The pathways by which these health impacts can occur involves complex interactions between various aspects of transport and how this impacts on the health of the population.

The following section outlines the number of ways transport can impact on health (or health pathways) both positively and negatively. These are largely based on the impact of private and public transport systems, as this is most relevant.

(1) Acheson D (1998). Independent inquiry into inequalities in health report. London The Stationery Office

(2) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

(3) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

A5.2 *TRANSPORT AND NOISE*

According to the WHO ⁽¹⁾ the following health effects are associated with transportation noise:

1. impaired communication;
2. disturbed sleep;
3. difficulties with performance;
4. annoyance;
5. increased aggression;
6. heart disease and hypertension; and
7. hearing impairment.

Transportation is the main source of noise pollution in Europe; road traffic is the main noise source for communities, with the exception of those that live by airports or rail lines.

A5.3 *TRANSPORT AND AIR POLLUTION*

The health effects of air pollutants emitted from transport modes with combustion processes are covered elsewhere in this report.

A5.4 *TRANSPORT ACCIDENTS AND INJURY*

Unlike exposure to air pollution and noise, changes in rates of injury and death associated with accidents and can be directly attributed to changes in flows.

Road accidents account for the most significant share of all transport accidents both in terms of the absolute number of deaths and the number of deaths per km travelled. In the EU27 over 400 times as many people die on the road as in rail accidents ⁽²⁾. In terms of passenger km travelled, death rates are highest by road, then rail, while deaths by air and sea are much lower still ⁽³⁾.

In Great Britain in 2008, there were approximately 230,905 casualties of all severities on roads. The number of people killed or seriously injured in 2008 was 40% below the 1994-1998 average and the number of children killed or seriously injured fell by 59% with the slight causality rate falling by 36% ⁽⁴⁾ .

(1) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

(2) Transport in figures- statistical pocketbook, European Commissions, 2010

(3) Transport in figures- statistical pocketbook, European Commissions, 2010

(4) Department for Transport (2008), Reported Road Casualties Great Britain 2008 – Annual Report

Table A5.1 Killed and seriously injured (KSI) casualties and slight casualty rate: GB 2005

| Accident type | Number | | | | 2005: % change over: | |
|---|-------------------|--------|--------|--------|----------------------|-----------------|
| | 1994-1998 average | 2003 | 2004 | 2005 | 2004 | 1994-98 average |
| KSI casualties | 47,656 | 37,215 | 34,351 | 32,155 | -6 | -33 |
| Child KSI casualties | 6,860 | 4,100 | 3,905 | 3,472 | -11 | -49 |
| Rate of slight casualties per 100million vehicle km | 61 | 51 | 49 | 47 | -3 | -23 |

Source: Review of progress towards the 2010 casualty reduction targets. Rashmeeta Singh and David Marrott, Transport Statistics: Road Safety, Department for Transport.

However, the level of reductions vary between different road users; the number of motorcyclists reported killed or seriously injured was 7% smaller in 2008 compared to the 1994-1998 average. Compared with the 1994-1998 average, the number of pedal cyclists KSI casualties in 2008 was 31% lower and the number of pedestrian KSI casualties was 39% lower ⁽¹⁾.

Traffic accidents can also have an effect on the psychological health of those involved; studies into this have found that some 14% of survivors suffer from post traumatic stress disorders and 25% have some psychiatric problems one year later ⁽²⁾

A5.5 WALKING AND CYCLING

Walking and cycling as a form of transport is associated with two important health benefits:

1. Reducing the use of motorised transport and therefore noise, air pollution and accident rates; and
2. Increased physical activity ⁽³⁾.

The number of walking and cycling trips in Europe remains small with only 5% of all trips in the EU made by bicycle in 1995 ⁽⁴⁾ and in the UK in 2005 cycles made up just 1% of road traffic in Great Britain ⁽⁵⁾. The average time spent walking or cycling per person per day for travel purposes has decreased from 11.94 minutes walking in 1995 to 10.15 minutes walking in 2007 and from 0.92 minutes cycling in 1995 to 0.81 minutes cycling in 2007 ⁽⁶⁾.

(1) Reported Road Casualties Great Britain 2008, Department for Transport, 2009.

(2) Goldberg and Gara. (2000) A typology of psychiatric reactions to motor vehicle accidents. Psychopathology 1990 23:15-20. World Health Organization. Transport, environment and health. WHO Regional Publications, European Series. No.89

(3) World Health Organisation (2000). "Transport, environment and health". World Health Organisation, Regional Office for Europe, Copenhagen

(4) World Health Organisation (2000). "Transport, environment and health". World Health Organisation, Regional Office for Europe, Copenhagen

(5) Transport Statistics Bulletin Traffic in Great Britain 2005 Department for Transport

(6) Department for Transport, Transport Trends 2009, Section 8 – Health and the Environment

Increased intensity in road traffic can have a restricting impact on cycling and walking, by reducing the number of access routes and increasing the fear of accidents. This impact has not been quantified, although observers have argued that the impact is similar to that of tobacco on heart disease ⁽¹⁾.

Fear of accidents has in part reduced the number of miles that people walk. For example, in the UK between the years of 1975/6 and 1994 there has been a 17% decline in the miles walked.⁽²⁾ Transport constrains physical activity – walking and cycling have decreased steadily as shown in *Table A3.2* below. Furthermore, parents fear the risk of accidents and therefore are increasingly escorting their children to school.

Table A5.2 *Miles travelled per person per year, cycling and walking, UK*

| | 1975/76 | 1985/86 | 1992/94 | 1998/2000 | 2002 | 2003 |
|---------|---------|---------|---------|-----------|------|------|
| Walking | 255 | 244 | 199 | 192 | 189 | 192 |
| Cycling | 51 | 44 | 38 | 39 | 33 | 34 |

Note: 2003 figures are provisional
Source: DfT, 2003

Perception of dangerous road traffic for pedestrians and cyclists can lead to reduced physical activity and therefore reduced fitness.

A5.6 *TRANSPORT AND WELLBEING*

A5.6.1 *Overview*

There is a demonstrable link between strong social networks and health, where good social networks can provide emotional, professional and social support vital to good health and wellbeing. Transport, particularly road transport, can disrupt such social networks through the creation of barriers preventing or reducing community interaction. This may be as a consequence of new roads separating communities or through an increase in road traffic through existing areas. This can also occur when new rail corridors or airport runways are built which alter community interaction by placing a physical barrier in communities.

Regular exposure to traffic and congestion can impair health and satisfaction with life. Congestion constrains movement and leads to increased stress and frustration, and aggression, which in turn can lead to increased likelihood of a crash or accident ⁽³⁾. Traffic noise can also cause nervousness, depression, sleeplessness and irritability.

(1) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

(2) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

(3) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

A5.6.2 Community Severance

Community severance is the separation of different areas within a community by the flow of traffic and can break networks leading to the changes in support networks affecting social capital.

Rail tracks and roads can form a physical barrier between communities which can result in community severance and the breakdown of community networks.

The risk and severity of health effects from community severance is relative, dependent upon a number of additional factors and can only be appraised qualitatively.

Several studies have shown that outdoor space for children to use shrinks significantly as road traffic increases. This has an impact on the extent to which children are exposed to physical activity, and this can have longer-term effects on their physical wellbeing as well as academic performance ⁽¹⁾ and mental health ⁽²⁾.

A5.6.3 Social Inclusion

Access to transportation allows for social inclusion; if people are unable to access transport due to a lack of public transport, cost or difficulties in access then social exclusion can result. This lack of access to transport options is referred to as transport poverty and as a consequence people have a lack of choice of destinations, activities and access to amenities, jobs and health care facilities.

A5.6.4 Transport and Vulnerable Groups

Those in lower socio-economic groups are also at a higher risk of being involved in a traffic accidents, especially children. This can be explained in part by higher traffic volumes and speeds in poorer areas, as well as increased exposure if families do not have cars. Children are a particularly vulnerable group with one in every three accidents involving a person under 25 ⁽³⁾.

It can therefore be seen that poorer socio-economic groups, children, women and the elderly are most likely to suffer from negative health effects of transport, especially if they are frequent pedestrians or cyclists.

(1) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

(2) Tim Gill (2005) Let our children Roam Free *The Ecologist Online* 23/09/2005

(3) World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series. No.89

A6 NOISE

A6.1 HEALTH EFFECTS OF NOISE

Noise has the potential to affect health in a variety of ways; some of the effects can be auditory and occur as a direct impact of the noise. Direct auditory effects usually result in damage to the ear and, in particular, damage to the inner ear. Acoustic limiting values are recommended to avoid inner ear damage.

There are also a wide range of non auditory health effects that may be associated with exposure to environmental noise, although the pathways and strength of association for these are not fully understood. Examples of non auditory health effects include:

1. Annoyance;
2. Night time effects;
3. Effects on children;
4. Mental Health;
5. Cognitive performance;
6. Cardiovascular and physiological; and
7. Foetal effects.

Many of these health effects have been associated with environmental noise, although some are more obviously associated with occupational noise exposure, such as the cardiovascular effects.

A6.2 SPEECH INTERFERENCE

Speech is subject to masking by noise; it is possible to measure the amount of interference that noise has on speech both subjectively and objectively. Environmental noise, especially varying and intermittent noise, can interfere with activities involving speech. Above 45-55 dB L_{Aeq} for the elderly or impaired and 55-65 dB L_{Aeq} for all others it has been suggested that speech may be disturbed (WHO Guidelines 1999).

A6.3 ANNOYANCE

Annoyance is the most investigated non auditory health effect of noise and is defined as the feeling of resentment, displeasure, discomfort, dissatisfaction or offence which occurs when noise interferes with thoughts, feelings or activities.

The concept of 'community annoyance' was developed to provide one comprehensive term to describe the overall community response to noise including both degradation of outdoor activities and interference with indoor activities. As it is generally assumed that the population will

habituate to noise exposures, community annoyance is an aggregate community response to long term steady state exposure conditions ⁽¹⁾.

The following factors associated with noise are thought to generate more annoyance ⁽²⁾:

1. loudness, frequency and duration;
2. increasing intensity;
3. increased frequency;
4. duration of noise; and
5. high frequency.

The extent of an adverse response to noise, however described or reported, is also influenced by numerous non-acoustic factors such as:

1. Demographic;
2. Attitudinal; and
3. Situational factors.

These factors are able to work in both directions either in favour or against the relationship between noise and the outcome variable. Miedema and Vos have also noted that:

“Persons, who experience fear related to the transportation that causes the noise, report higher annoyance compared to persons who do not experience such fear. The effect of fear on annoyance is found for all three modes of transportation, but it appears that only few persons associate high fear with railway traffic. “

Annoyance was also found to increase slightly if the person's educational and occupational status is higher and if the dwelling is owned rather than rented, if a person does not depend on the noise source, and if the use of the transportation that causes the noise is low.

The contemporary technical rationale for assessing the effects of transportation noise on communities rests on a dose response relationship as proposed by Schultz in 1978. The curve has since been updated to include new studies ⁽³⁾ ⁽⁴⁾. The curve is a descriptive relationship between noise exposure and community annoyance and uses L_{DN} , which is an indicator of noise levels based on a weighted day-night average.

The curve predicts shows that for every decibel increase in noise on the graph there is increase of between 1 and 3% more people who are highly annoyed.

(1) Finegold *et al* (2003) Historical development and current status of exposure-response relationships between transportation noise and community annoyance *Internoise* <http://www.netsympo.com>

(2) The health effects of environmental noise- other than hearing loss, May 2004 enHealth Council Australia

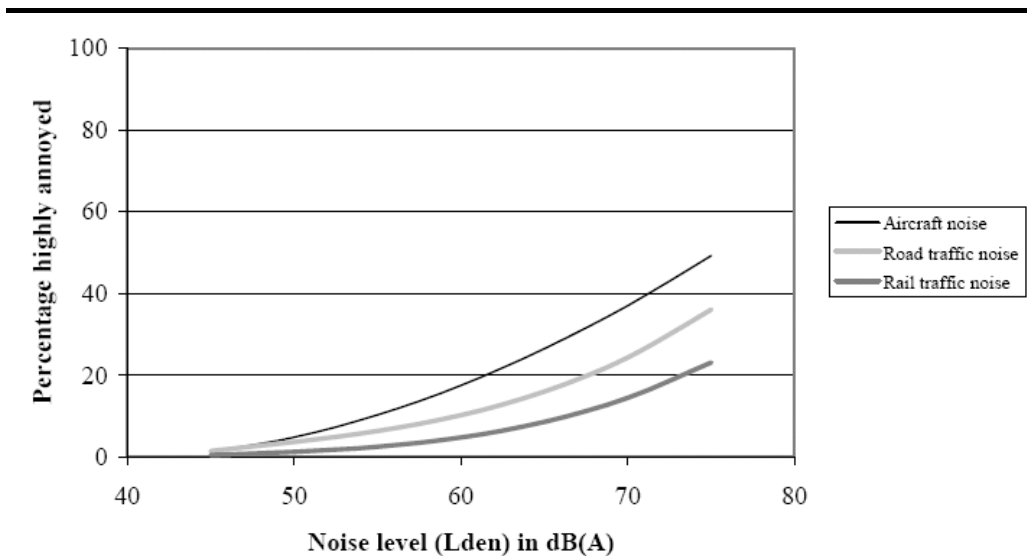
(3) Fidell *et al*. 1991: Updating a dosage-effect relationship for the prevalence of annoyance due to general transportation noise. *J Acoustical Society of America*; **89**(1)221-23

(4) Finegold *et al* 1994 Community annoyance and sleep disturbance: updated criteria for assessing the impacts of general transportation noise on people. *Noise Control Eng J*; **42**(1):25-30

Limitations of the curve include that it is applied equally to rural and urban settings despite noise being created differently in these environments. Other limitations of the curve include the fact that the composition and character of community noise is variable and the curve assumes that all types of noise causes the same amounts of annoyance.

Evidence cited by Miedema suggests that trains are the least annoying source of transportation noise, as shown by the % highly annoyed value shown in *Figure A6.1*, with aircraft noise being the most annoying source.

Figure A6.1 *Exposure -effect relationships for the association between noise (expressed as L_{den}) from different sources and annoyance.*



Source: Selection and evaluation of exposure- effects relationships for health impact assessment in the field of noise and health 2005 RIVM report 630400001.

Most of the annoyance was associated with decreased power of concentration and there was no evidence of habituation, as residents of over 10 years were just as annoyed as those who had lived in the area for less than 10 years.

Noise mitigation measures were found to have an impact on the level of annoyance, as among those with treble glazing only 24% reported annoyance which rose to 41% among those with double glazing or less. ⁽¹⁾

A6.4 *NIGHT TIME EFFECTS*

The WHO guidelines conclude that sleep disturbance is a major effect of environmental noise and that exposure may cause primary effects during sleep and secondary effects after the exposure. Certain groups are more likely to be effected by sleep disturbance according to the

(1) Bluhm *et al* (2005) Health Effects of Noise from Railway Traffic - The HEAT Study, Presented at the Internoise 2005 conference

WHO such as the elderly, newborn, shift workers and persons with physical or mental disorders.

Sleep is necessary to restore biological processes and sleep disturbances can result in decreased day time efficiency and long term health impairment. The effects of sleep disturbance may manifest themselves in a number of ways: in sleep behaviour (time spent awake), structure of sleep, increased body movement, physiological responses such as cardiovascular responses or as effects in the period after sleep (mood and performance the next day).

Noise at certain levels can cause awakening and above these levels it can induce sleep changes disturbing the slow wave sleep (SWS) which is thought to be the most restorative part of sleep. Any loss of SWS is thought to be detrimental to health and may impact on the immune system.

Sleep deprivation is known to affect any individual's performance the next day and ability to function. Repeated arousals (which may not lead to complete consciousness) during sleep can also systematically reduce day time awareness, depending on the frequency of the arousals and the age of the subject, as well as disrupting circadian rhythms (the daily cycle).

Evidence from various studies suggests that rail noise causes the least sleep disturbance of all sources of transport noise in line with annoyance.

These figures are based on a number of field studies into sleep disturbance in relation to noise and represent best estimates for L_{night} which were available at the time taking into account no other factors.

Evidence from the HEAT study showed that inadequate sleep was reported to a high degree in noise exposed group, a much higher degree of sleep problems was observed when the bedroom window was positioned towards the exposed side (ie facing the railway track). Amongst those whose bedroom window faced the railway track, 35% reported problems compared to 9% amongst those whose bedroom windows faced in other directions ⁽¹⁾.

A6.5 *PHYSIOLOGICAL AND CARDIOVASCULAR EFFECTS*

There is a plausible connection between exposure to noise that provokes a high degree of annoyance and physiological responses such as stress, hypertension and effects to the cardiovascular system, including acute myocardial infarction. This is most usefully summarised in the work of Babisch ⁽²⁾.

(1) Bluhm et al (2005) Health Effects of Noise from Railway Traffic - The HEAT Study, Presented at the Internoise 2005 conference

(2) Babisch W (2006) Transportation noise and cardiovascular risk Review and Synthesis of epidemiological studies, dose effect curve and estimation. WaBoLu-Hefte 01/06 <http://www.umweltdaten.de/publikationen/fpdf-l/2997.pdf>

The full range of evidence is not presented here, as the noise levels resulting from the Covanta proposal are not sufficiently high to cause any physiological effects.

A7 VISUAL ENVIRONMENT AND HEALTH

A7.1 INTRODUCTION

People attach considerable importance to the quality of their surroundings and the prosperity of an area can be influenced to a considerable degree by its image.

The presence of a visual disturbance increases the perceived risk to health, as it is a constant reminder and provides a focus for concerns. Visual presence is linked to the level of risk that people perceive and can become a focus for concern and anxiety.

A7.2 NATURAL ENVIRONMENT

Natural environments are associated with greater restorative advantage (e.g. less anger) and physiological advantage (e.g. blood pressure) after administration of stressors ⁽¹⁾. The mechanism for these outcomes is not fully understood. Maller *et al* ⁽²⁾, in their paper on nature and healthy people, state that initial findings indicate that nature plays a vital role in human health and wellbeing.

A7.3 BUILT ENVIRONMENT

The built environment impacts on public health and the way that people utilise their environments. As environments deteriorate, then so does the physical and mental health of the people that live in them ⁽³⁾. Health benefits can result when people live and work in accessible, safe and well designed environments. The built environment influences physical activity; positive environmental determinants of activity, including enjoyable scenery, encourage participation in physical activity. Additionally, people are more likely to use parks and paths that are easy to get to and are well maintained ⁽⁴⁾.

A7.4 LIGHT POLLUTION

Evidence suggests that people are becoming more sensitive to the stray light that is being directed towards their property and windows ⁽⁵⁾.

(1) Passchier *et al* (1999) Public Health Impact of Large airports, RIVM

(2) Maller, Townsend *et al*, (2006) Healthy nature healthy people: 'contact with Nature' as an upstream health promotion intervention for populations. *Health Promotion International* Vol 21 No 1 2006

(3) Richard Jackson and Chris Kochitzky, Creating a healthy environment: the impact of the built environment on public health, Centre for Disease Control and Prevention.

(4) CDC (1999) Neighbourhood safety and the prevalence of physical inactivity -selected states *Mor Mortal Wkly Rep* 48(7):143-6

(5) Carl Shaflik, Environmental effects of roadway lighting, Technical Paper prepared at University of British Columbia, Department of Civil Engineering

Light trespass can be described as the effects of light or illuminance that strays from its intended purpose allowing some of the light to fall on lawns, houses, etc, resulting in annoyance and upset due to stray light on property or windows. Probably the most annoying aspect of light pollution is glare. Glare, which can be described as unwanted source of luminance can cause annoyance, discomfort, or loss of visual performance and visibility. For some people any amount of obtrusive lighting is considered an annoyance. This is subjective, however, and depends on the individual ⁽¹⁾.

From April 2006 artificial lighting has become subject to the criminal law of statutory nuisance, this is defined as "artificial light emitted from premises so as to be prejudicial to health or a nuisance". It constitutes a statutory nuisance under the Environmental Protection Act 1990 (provision added by the Clean Neighbourhoods and Environment Act 2005). However, this does not apply to artificial light from the following:

1. airports;
2. harbour premises;
3. railway premises;
4. tramway premises;
5. bus stations and any associated facilities;
6. public service vehicle operating centres;
7. goods vehicle operating centres;
8. lighthouses; and
9. prisons.

A7.5 ENVIRONMENTAL PREFERENCES

Studies have shown that adults consistently prefer environments which can be classified as natural with a predominance of trees, water etc, regardless of how spectacular the environment is. When structures are put into predominantly natural environments then preference for the landscape tends to be greater when structures are congruent (fit in) with the natural environment. Structures which are incongruent with the landscape reduce liking of the landscape or area in which they are placed ⁽²⁾.

(1) Carl Shaffik, Environmental effects of roadway lighting, Technical Paper prepared at University of British Columbia, Department of Civil Engineering

(2) Passchier *et al* (1999): Public Health Impact of Large airports, RIVM

A8 SOCIO-ECONOMIC IMPACTS AND HEALTH

A8.1 INTRODUCTION

Evidence suggests that those who are unemployed have poorer health than those in employment ⁽¹⁾ and overwhelmingly the literature looks at the association between unemployment and health. There is no direct evidence of the health benefits of moving from unemployment to employment. It has often been assumed, however, that the relationship between unemployment and poor health is reversible (therefore becoming employed and employment is associated with good health).

Unemployment falls unevenly on different population subgroups, ethnic minorities and young people face the highest rates of unemployment ⁽²⁾. Those who are disabled and older workers are also likely to have lower employment status. These groups are also more likely to be in insecure employment and poorly paid employment. For those involved in manual work then poor health is more likely to have an adverse effect on employment than for those involved in non manual work ⁽³⁾.

A8.2 EMPLOYMENT AND UNEMPLOYMENT

A8.2.1 Health Effects

Unemployed individuals are more likely to report illness and injury as well as psychological symptoms such as demoralisation. Health outcomes that have been associated with unemployment or unfavourable employment include:

1. Physical health effects;
2. Mental Health effects;
3. Suicide;
4. Well Being;
5. Role functioning;
6. Poor self reported health;
7. Increased mortality; and
8. Life expectancy.

Conversely, the WHO identifies a number of ways in which employment can have a positive effect on mental health including:

1. Structuring time – the absence of which can be a psychological burden;
2. Social contact – with colleagues and friends;
3. Involvement in a collective effort or activity; and

(1) Mathers C.D. and Schofield DJ (1998) The health consequences of unemployment: the evidence. *Medical Journal of Australia* **168**; 178-182

(2) Dooley *et al* (1996) Health and Unemployment: *Annual Review of Public Health*;17:449-65

(3) Bartley M and Owen C (1996) Relation between socioeconomic status, employment and health during economic change 1973-93 *British Medical Journal*: 445-449

4. Regular activity.

Employment is also thought to help define an individual's role in society and help form social relationships.

A8.2.2 Relationship between Employment and Health

Individual unemployment and mortality

1. Unemployed middle aged men in England are less healthy and have higher mortality than employed men ⁽¹⁾.
2. Men who became unemployed or retired for reasons other than ill health had a significantly raised risk of dying compared to continuously employed men which suggests that non-employment even in apparently healthy men was associated with increased mortality and that there is a causal relationship between unemployment and mortality.
3. Evidence for causality is further strengthened by the fact that neither health related behaviour nor social factors explained the differences in mortality that were seen and that relative risks were similar in non-manual and manual workers ⁽²⁾.
4. Gerdtham *et al* ⁽³⁾ found that being unemployed significantly increases the risk of death by 46% with no significant difference based on gender. Unemployment was not associated with deaths from cancer or deaths due to external causes such as accidents and homicide. A non-significant association between unemployment and cardiovascular disease was seen and unemployment was significantly associated with deaths due to suicide and "other causes".

A8.2.3 Neighbourhood Unemployment and Mortality

1. Studies have shown that living in deprived neighbourhoods is related to higher mortality rates independent of individual socio-economic characteristics. However, the mechanism of action is not understood ⁽⁴⁾.
2. A pattern of increasing hazard ratios of mortality with increasing neighbourhood unemployment rates was found in samples of six countries.
3. There was no evidence that the association between neighbourhood unemployment and mortality was substantially modified by country context among the six countries studied.

(1) Morris et al (1994) Loss of employment and mortality *BMJ* **308**:1135-1139

(2) Morris et al (1994) Loss of employment and mortality *BMJ* **308**:1135-1139

(3) Gerdtham et al (2003) A note on the effect of unemployment on mortality, *Journal of Health Economics* **22** 505-518

(4) Van Lenthe *et al* (2005) Neighbourhood unemployment and all cause mortality: a comparison of six countries *Journal of Epidemiology and Community Health* **59** 231-237

4. Improving health of populations in general and reducing socio-economic inequalities in health requires targeting on both people and places.

A8.2.4 Social Context- Level of Unemployment

Studies from a variety of European countries have compared the mortality risk in relation to employment status during different levels of unemployment, by comparing time periods and areas with different levels of unemployment. The findings from these studies are inconsistent; however, evidence does suggest that individuals who are unemployed when unemployment rates are low may special characteristics, which make them more vulnerable to poor health.

A8.2.5 Employment Status and Conditions

Research has shown the importance of unemployment, job security and employment conditions on health and in particular on chronic disease aetiology. A study by Bartley *et al* concluded that:

“Having secure employment in favourable working conditions greatly reduces the risk of healthy people developing limiting illness. Secure employment increases the likelihood of recovery.”

This conclusion was based on the finding that men and women in the least favourable employment conditions (routine occupations) nearly four times more likely to become ill than those in the most favourable (professional and managerial).

Those who found insecure re-employment was also associated with poorer mental health outcomes than those in secure employment. These results cannot be explained by changes in financial strain, psychosocial factors or health related behaviours ⁽¹⁾.

When a person has high demands and low control in their work, they are more likely to suffer poor health. There are cases when unemployment has a positive effect on health: for those in stressful jobs and for individuals that work in unhealthy environments.

(1) Wheaton B (1990) Life transitions role histories and mental health. *American Sociology review* 55:209-23

A8.3 **INCOME**

A8.3.1 **Introduction**

It is widely accepted that income affects health, with increased income often cited as being beneficial to health. There are many studies that show that those with low incomes have poorer health than those in high income groups ⁽¹⁾.

A8.3.2 **Population Income**

Evidence shows that income inequalities across countries or regions are not strongly associated with life expectancy as differences seen in life expectancy and mortality can be explained away by individual level factors ⁽²⁾ such as individual income and lifestyle risk factors such as smoking. This is supported by the following studies:

1. A Danish study ⁽³⁾ where income inequality did not predict mortality for any level of individual income;
2. A Japanese study ⁽⁴⁾ where income inequalities did not predict self rated health; and
3. An American study ⁽⁵⁾ where income inequalities did not predict common mental or physical health disorders.

A8.3.3 **Individual Income**

1. There is a well established inverse relationship between individual income levels and mortality ⁽⁶⁾.
2. The relationship between income and health is graded: the greater the income, the better the health. The relationship is not strictly linear though. Above a middle threshold, higher income is less proportionately related to improved health.
3. Long-term income may be more important for health than short-run income and that income change has a smaller effect on health than income level ⁽⁷⁾.

(1) Marmot M (2002) The influence of income on health: views of an epidemiologist. *Health Affairs*; 31-46.

Ecob B, Davey Smith G (1999). Income and health: what is the nature of the relationship? *Social Science and Medicine*; **48**: 693-705. Benzeval M, Judge K (2001). Income and health: the time dimension. *Social Science and Medicine*; **52**: 1371-1390.

Deaton A. (2002) Policy implications of the gradient of health and wealth. *Health Affairs*; **21**:13-28.

(2) Mackenbach (2002) Income inequality and population health, Evidence favouring a negative correlation between income inequality and life expectancy has disappeared *BMJ* **324** 1-2

(3) Osler et al (2002) Income inequality, individual income and mortality in Danish Adults: analysis of pooled data from two cohort studies *BMJ* **324** 13-17

(4) Shibuya et al (2002) Individual income, income distribution and self rated health in Japan: cross sectional analysis of nationally representative sample *BMJ* **324** 16-20

(5) Sturm et al (2002) Relations of income inequality and family income to chronic medical conditions and mental health disorders: national survey *BMJ* **324** 20-25

(6) Osler et al (2002) Income inequality, individual income and mortality in Danish Adults: analysis of pooled data from two cohort studies *BMJ* **324** 13-17

(7) Benzeval M, Judge K (2001). Income and health: the time dimension. *Soc Sci Med*; **52**(9):1371-90.

4. Decreases in income seem to be related to declining health but increases in income are less clearly related to health improvement ⁽¹⁾. Reversibility of the relationship cannot therefore be assumed. Data on increases in income and health change have not been published.

A8.4 HOUSING

Housing is a major determinant of health. In the context of the Covanta proposal, the only conceivable effect could be on the price of houses bought and sold in the vicinity. The evidence base for the effect on house prices of EfW facilities is very weak, with only one study in Massachusetts that reports directly on the topic. Some work has been commissioned by Defra on the related topic of landfill and there is also a review by the Centre for Economic and Business Research on behalf of Lewes District Council as part of the East Sussex Waste Plan public inquiry.

The US study was conducted by Kiel and McClain ⁽²⁾ and used data relating to an incinerator proposal in North Andover over the period 1974 to 1992. The incinerator became operational in 1985. North Andover is a town of 9,724 households spread over an area of 27.85 square miles and located 24 miles north of Boston. The technique used by the study is to model house prices using regression analysis to establish the sensitivity of house prices to a number of different factors, including the distance from the EfW facility.

The study investigated how house prices change over time from before any information was publicly available through the construction period, early operations and mature operations. The first reports of an incinerator in North Andover appeared in the local press in late 1978, groundbreaking took place in 1983 and operations began in 1985. Systematic changes in the size or elaborateness of houses sold over the period were taken into account by controlling for variables relating to the type of property including the age of the property, the living area, the number of rooms and number of bathrooms, the size of the plot. The study also included a detailed description of each property's location including the distance from the incinerator, the distance from the central business district, the distance from the main highway junction and whether the property had a lakeside location. Again these factors were controlled for in the regression analysis to ensure that there was not a market shift towards selling less (say lakefront) properties.

Regional trends in property prices were taken into account by indexing house prices to average house price changes in the Boston area. Changes in prices are therefore relative to the regional average, to exclude the possibility that any results were due to regional trends in house prices.

(1) Benzeval M, Judge K (2001). Income and health: the time dimension. *Soc Sci Med*;52(9):1371-90.

(2) Kiel KA and McClain KT (1995) House prices Through Siting Decision Stages: the Case of an Incinerator from Rumor to Operation. *Journal of Environmental Economics and Management* 28 241 - 255

The study design did not take into account the nature and timing of other local events in the statistical analysis. It is therefore possible that some other local event near the incinerator could have affected local house prices. However, as the effect demonstrated by Kiel and McClain is related to distance from the EfW incinerator, any other factor would have to be have its centre here. Kiel and McClain do consider this and report that no significant changes in factors known to affect house prices (such as changes in the areas skill set or ethnicity) occurred in the area.

The study found that:

“the evidence suggests that the incinerator is a negative externality for North Andover overall”

The ongoing effect was found to have an impact on house prices of \$6607 per mile, against an average house price at the time of \$242,242. The effect was evident up to a distance of 3.5 miles. The study found evidence that house prices close to the incinerator dropped relative to prices elsewhere on rumour of the new site, fell further when construction began, fell further still when operations began and recovered slightly after four years of operation, although they were still significantly lower than they would otherwise have been. Until construction commences, there is some doubt over whether the facility will exist and this is reflected by a less significant impact in prices. The slight lessening of the impact after several years may reflect the fact that some concerns over the facility are discovered to be groundless.

This single study provides some limited evidence that an EfW proposal might have some impact on local house prices and is useful because it is a time series. By itself, however, it is not sufficient to be convincing and it is based on a housing market outside the UK.

The CEBR evidence given to the East Sussex inquiry included some limited original research into the impact of incinerators on house prices. This was based on a comparison of house prices close to incinerators with house prices in other local areas, using the prices of houses in postcode sectors containing incinerators with those in neighbouring postcode sectors at different distances.

The analysis was based on the relative price of houses near incinerators with prices elsewhere and the analysis included 259 data points from around the following EfW facilities:

1. Cleveland;
2. SELCHP;
3. Tyseley;
4. Dundee;
5. Coventry;
6. Dudley;
7. Stoke;
8. Nottingham;
9. Bolton;

10. Sheffield; and
11. Isle of Wight (Refuse Derived Fuel facility).

This cross-sectional study did find a small effect within about 1.5 km from the EfW facilities, although it should be noted that the use of postcode sectors does introduce some spatial errors into the analysis and the approach does make it difficult to eliminate confounding factors. For example, it is impossible to know from this approach whether EfW facilities are typically sited in areas with lower prices or they are, in fact, the cause of lower house prices.

The CEBR review of house prices is contradicted by a review carried out by Cluttons on behalf of Onyx South Downs (now Veolia), in relation to its application to build and operate an EfW facility at Newhaven. In this work, Cluttons examined actual prices recorded in transactions in the North Quay area of Newhaven between 2000 and 2005, while the proposal was being promoted and discussed. The conclusion was that prices appeared to have risen in line with prices elsewhere in the region over this period. This conclusion was supported by an examination of prices in residential and commercial transactions in the vicinity of the three EfW facilities in Hampshire, before and after the plants became operational. In each case, prices continued to rise.

A8.5

SUMMARY

The evidence linking employment or income to health has many limitations. However, suitable estimates for use in a modelling framework are available for income and mortality and employment and mortality. For other health effects, such as long term illness, depression etc, the body of evidence on the observed relationship is much smaller and therefore not suitable for quantification.

It should be noted that the impacts of unemployment and impacts of income can not be added together as this will result in double counting of any effects as income is both a mediator and a confounder of the effect of employment status on mortality and employment also mediates and confounds income.

A9 SOCIAL CAPITAL AND HEALTH

A9.1 INTRODUCTION

The concept of social capital and the controversies surrounding its definition, determinants, outcomes and measurement are presented in the literature review. Research findings supporting a link between social capital and health and others challenging such a link are then presented, as well as possible explanations as to why making a link between social capital and health can be problematic.

A9.2 DEFINITIONS

Many different definitions of social capital exist. At its broadest, social capital represents the degree of connectedness in communities and the quality and quantity of social relations in a given population. It refers to the processes between people that establish networks, norms and social trust, and facilitate coordination and cooperation for mutual benefit.

The OECD describes social capital as “networks together with shared norms, values and understandings that facilitate co-operation within or among groups” ⁽¹⁾. This definition is commonly used in the UK and has been adopted by the Office for National Statistics.

The three key authors that have developed the concept of social capital have approached the concept in the following ways:

1. as people’s sense of belonging to their community, community cooperation, reciprocity and trust, and positive attitudes to community institutions that include participation in community activities or civic engagement.⁽²⁾
2. in terms of networks and connections: the individual’s contact with these networks and connections results in exchange, obligations and shared identity that provides potential support and access to resources.⁽³⁾
3. as a resource of social relations between families and communities.⁽⁴⁾

Szreter and Woolcock warn against the importance of overplaying the concept of social capital: “Social capital is not a magic wand for improving society, nor is it a self contained comprehensive theory. It is a

(1) Cited in Social Capital, A Review of the Literature, Office for National Statistics, 2001

(2) Putnam (1993, 1995), cited in Assessing People’s Perception of their Neighbourhood and Community Involvement, HDA, 2001

(3) Bourdieu (1986), cited in Assessing People’s Perception of their Neighbourhood and Community Involvement, HDA, 2001

(4) Coleman (1988), cited in Assessing People’s Perception of their Neighbourhood and Community Involvement, HDA, 2001

useful concept which focuses our attention on an important set of resources inherent in relationships, networks, associations and norms".⁽¹⁾

A9.3 ***DIFFERENT TYPES OF SOCIAL CAPITAL***

Three types of social capital have been distinguished:⁽²⁾

1. *Bonding social capital* refers to trusting and co-operative relations between members of a network who are similar in terms of social identity (e.g. ethnicity);
2. *Bridging social capital* refers to connections between those who are unlike each other "yet are more or like each other in terms of their status and power"⁽³⁾ e.g. horizontal ties in society; and
3. *Linking social capital* refers to "the norms of respect and networks of trusting relationships between people who are interacting across explicit, formal, or institutionalised power or authority gradients in society" e.g. vertical ties in society.⁽⁴⁾

One of the Key debates is whether bridging or bonding social capital is more important as bridging supports links across communities. However, bonding social capital provides a protective role in communities especially for minority groups and while bridging social capital is important and should be aimed for this should not be achieved at the expense of bonding social capital⁽⁵⁾.

A9.4 ***DETERMINANTS OF SOCIAL CAPITAL***

There is no consensus as to what are the determinants of social capital, with some research identifying individual characteristics such as marital status as the key determinants, and others adopting a much broader view, and including elements such as television and the welfare state as determinants.

Halpern distinguishes correlates and determinants of social capital:

1. Correlates cannot be altered and may therefore help in predicting levels of social capital in a community, e.g., sex and age; and;

(1) Health by association? Social capital, social theory, and the political economy of public health, Szreter et al., Volume 33, no. 4, International Epidemiological Association, 2004

(2) Reconciling the three accounts of social capital, Kawachi et al., International Epidemiological Association, Volume 33, no.4, 2004

(3) Szreter and Woolcock, cited in Reconciling the three accounts of social capital, Kawachi et al., International Journal of Epidemiology, Volume 33, no.4, 2004

(4) Szreter and Woolcock, cited in Reconciling the three accounts of social capital, Kawachi et al., International Journal of Epidemiology, Volume 33, no.4, 2004

(5) Social Capital Indicators in the UK: A research project for the Commission for Racial Equality. Ben Cave Associates 2007

2. Determinants are factors that can be altered and therefore offer ways of building social capital and a guide for policy, e.g. education, cultural activities and social organisations.

He also distinguishes micro, meso and macro levels of causes of social capital:

1. *Micro*: biology and personality, culture, age, inequality, family, trends, class, education, work, religion, personalised consumption;
2. *Meso*: schools and communities, ethnic and social heterogeneity, mobility, transport, physical environment; and;
3. *Macro*: history, economics, labour market, welfare state, individual values ⁽¹⁾.

A9.5 MEASURING SOCIAL CAPITAL

In 2003, the National Statistics Office published a paper recommending measuring social capital around the following five areas:

1. Civic participation: the propensity to vote, to take action on local or national issues;
2. Social networks and support: contacts with friends and relatives;
3. Social participation: involvement in groups and voluntary activities;
4. Reciprocity and trust: giving and receiving favours, trust of other people and institutions such as the government and police; and
5. Views about the area: not strictly a measure of social capital, but required for the analysis and interpretation of the social capital measures, and includes satisfaction with living in the area and problems in the area. ⁽²⁾

The questionnaire included questions on perception of crime in the area, perception of the extent people from different backgrounds get along, perception of whether lost property would be returned or stolen in the area, perception of whether the respondent was in a situation to influence local decisions. ⁽³⁾

A9.6 THE LINK BETWEEN SOCIAL CAPITAL AND HEALTH

A9.6.1 Modelling the Link between Social Capital and Health

The model below, from the HDA, conceptualises the link between structural factors and social capital, social capital and health, and

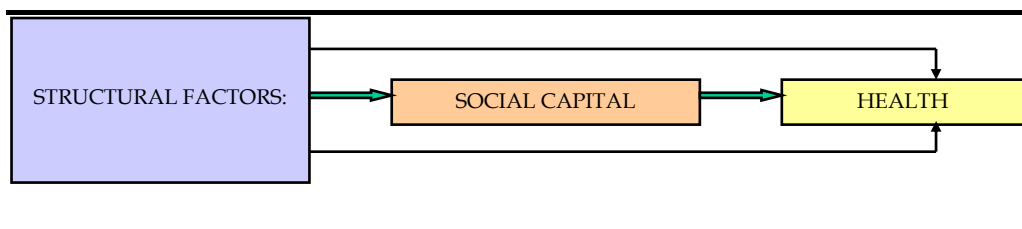
(1) Social Capital, Polity Press, Halpern, 2005

(2) Office for National Statistics 2005 Measurement in social capital in the UK

(3) http://www.statistics.gov.uk/socialcapital/downloads/harmonisation_steve_5.pdf

structural factors and health. In this model, the HDA uses factors such as age, sex, marital status and household social class.

Figure A9.1 Link between Social Capital and Health ⁽¹⁾



The model shows that:

1. Social capital may have its own direct effect on health;
2. Social capital may mediate or moderate the effects of structural factors on health;
3. structural factors can be both a determinant of social capital and of health; and
4. structural factors can impact on health independently of social capital.

This latter point means that there is a possibility for social capital to act as a moderator or mediator linking or structural factors and health. High levels of social capital for individuals in otherwise structurally disadvantageous positions may reduce the risk of ill health, and, conversely, low levels of social capital for those in otherwise structurally advantageous positions may increase the risk of ill health. Moreover, the erosion of social capital within a community thus leaves the more structurally disadvantaged community members in a more vulnerable position with regards to health. ⁽²⁾

A9.6.2 Evidence base supporting the Link between Social Capital and Health

Much of the research undertaken in this field recognises a link between social capital and health, albeit often tentatively.

The concept of social capital has been recognised as useful in helping to understand health in its complex social context⁽³⁾. Moreover, the concept allows for the examination of how networks and connections can act as a buffer against deprivation, providing access to health resources, support and information ⁽⁴⁾.

⁽¹⁾ Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

⁽²⁾ Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

⁽³⁾ Howe and Shiell (2000) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

⁽⁴⁾ Campbell, 1999, Gillies 1998 cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

Social and civic participation: are linked with better health chances ⁽¹⁾. This is particularly true for older people, as research has found significant links between social participation and health in older people ⁽²⁾. Moreover, social and civic participation can affect health independently of other structural socioeconomic indicators, for example, lower levels of smoking were found in people most actively engaged in community life. This however, is only true for some indicators of social capital ⁽³⁾.

Trust and reciprocity: the higher the level of trust within the community, the lower the probability of reporting poor self-rated health among trusting individuals ⁽⁴⁾.

Social networks and support: may have physiological effects through the hormonal system on the body's response to stress and functioning of the immune system ⁽⁵⁾. Social networks and support are also associated with reduced risk of cardiovascular disease, and once ill, people with good social support have better prognoses. For example, social support is associated with reduced levels of mortality from cardiovascular disease ⁽⁶⁾.

Some research suggests that social capital can explain a proportion of life expectancy, infant mortality rate, heart disease, violent crime and self-rated health ⁽⁷⁾.

Social capital and mental health: with regards to mental health, research has found a link between low levels of social capital and common mental illness. It has been hypothesised that social capital could reduce the effects of negative life events (e.g. loss of job) and long term difficulties (e.g. poor physical health).

Social participation: has been found to reduce the likelihood of an onset of common mental illness and, it has been associated with higher chance of recovery for those with poor self-rated health. However, it has also been suggested that social capital play only minor roles in the processes leading to the onset of and recovery from common mental illness and poor self-rated health ⁽⁸⁾.

(1) Wolf and Bruhn cited in Poor people, poor places, and poor health: the mediating role of social networks and social capital, Cattell, Social Science and Medicine, Volume 52, 2001

(2) Veenstra (2000) cited in Social Capital for Health: issues of definition, measurement and links to health, NHS Development Agency, 2004

(3) Cooper (1999) cited in Social Capital for Health: issues of definition, measurement and links to health, NHS Development Agency, 2004

(4) Social Capital Community Benchmark Survey in the US, 2002, cited in Reconciling the three accounts of social capital, Kawachi et al., International Epidemiological Association, Volume 33, no.4, 2004

(5) Health Impact Assessment for Regeneration Projects, Volume 2, Selected Evidence Base, Cave et al., Queen Mary University and Breaking the Cycle, East London and the City Health Action Zone

(6) Health Impact Assessment for Regeneration Projects, Volume 2, Selected Evidence Base, Cave et al., Queen Mary University and Breaking the Cycle, East London and the City Health Action Zone

(7) Cited in Measuring social capital within health surveys: key issues, Harpham et al, Health Policy and Planning, Volume 17, Oxford University Press, 2002

(8) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

Social networks and support: may have a direct effect in promoting a sense of control in one's life and self worth ⁽¹⁾. Better social support is associated with lower levels of anxiety and depression, reduced likelihood of common mental illness and increased likelihood of recovery from mental illness ⁽²⁾. There may be gender differences in the importance for health of social support ⁽³⁾.

A9.6.3 Evidence Base Challenging the Link between Social Capital and Health

Although the majority of the research reviewed recognises the link between social capital and health, these ideas are nonetheless heavily contested. Even supporters of a link often offer their findings tentatively. Many critics of the research into social capital and health believe that social capital links to health outcomes are either non-existent, negligible, insufficiently based on evidence, or of little relevance. In particular:

1. Some research suggests that social capital measures have little or no effect on health indicators ⁽⁴⁾.
2. There is a lack of evidence that health was higher in the "community golden ages" of the past ⁽⁵⁾.
3. The direction of the relationship between social capital indicators and health is not always consistent, indicating that the positive health advantages of high levels of social capital cannot always be assumed.
4. The socioeconomic structural factors which determine levels of social capital are far greater than the moderator or mediator effect social capital can introduce. Consequently, social capital has less power to predict health than some other more familiar indicators of socioeconomic status ⁽⁶⁾.
5. Some research suggests that neighbourhood social cohesion and individual social support are not highly correlated, and, in the context of health, social support at the individual level may matter more than social cohesion ⁽⁷⁾.

(1) Health Impact Assessment for Regeneration Projects, Volume 2, Selected Evidence Base, Cave et al., Queen Mary University and Breaking the Cycle, East London and the City Health Action Zone

(2) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(3) Health Impact Assessment for Regeneration Projects, Volume 2, Selected Evidence Base, Cave et al., Queen Mary University and Breaking the Cycle, East London and the City Health Action Zone

(4) Blaxter and Poland (2002) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(5) Blaxter (2004) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(6) Cooper (1999) cited in Social capital, NHS Development Agency, 2004

(7) Bartley et al. (2004) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

6. The direction of causation between social capital and health is not always clear: it could be that high levels of social capital are influenced by the levels of health in the community ⁽¹⁾.

There is concern that the current research on social capital related to healthcare is overstressing the concept and its relevance to health ⁽²⁾.

A9.7

CONCLUSIONS

As suggested by the literature review, the current body of research tentatively suggests that there is a link between social capital and health outcomes, with regards to both physical and mental health. The existence of a causal relation between enhancement or erosion of social capital and health outcomes is contested. Moreover, there is no consensus that particular social capital indicators can be linked to particular health outcomes. The conclusion as to whether a relationship or causal link exists may depend on definitions of social capital and health, the methodology, the context and the particular health outcome.

(1) Morgan and Swann (2004) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(2) Portes (1998) cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

Annex B

Community Profile

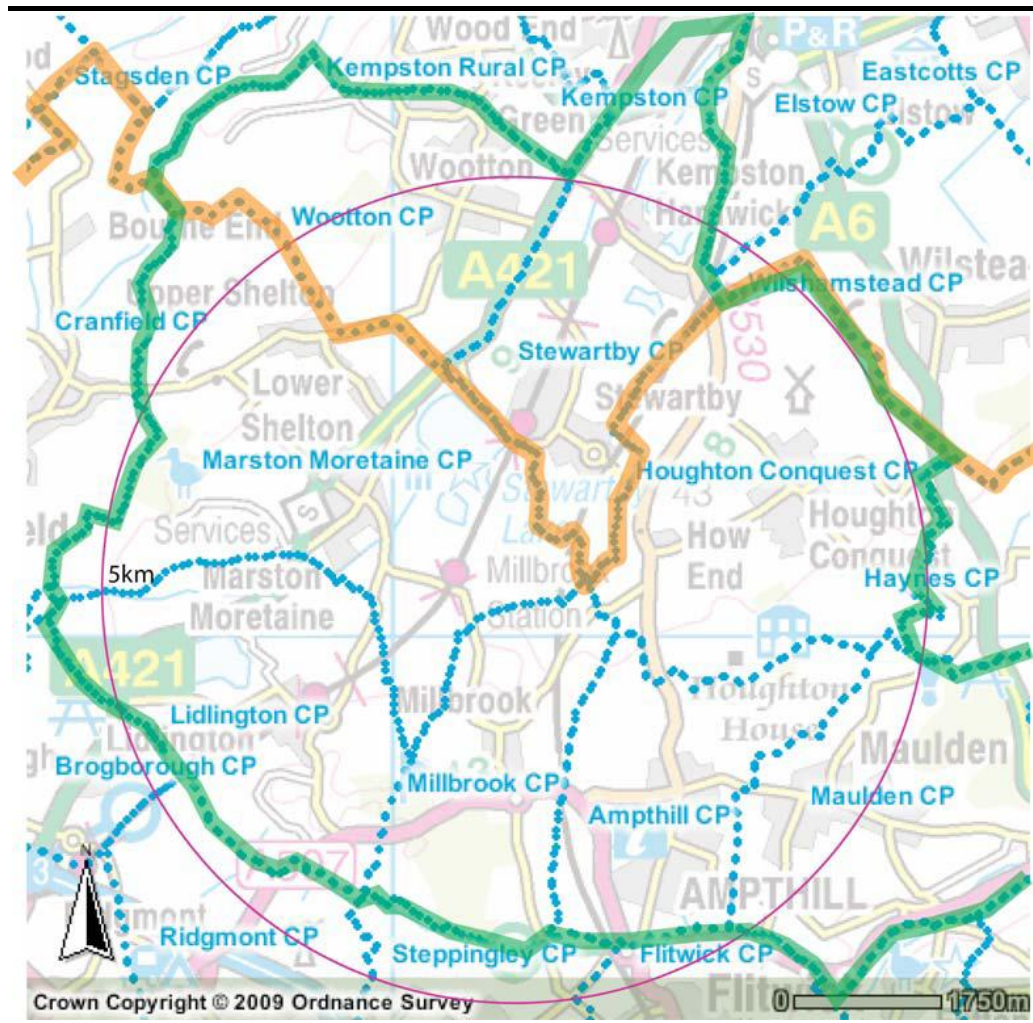
B1**COMMUNITY PROFILE**

The Proposed Application Site is located in Marston Ward, in Central Bedfordshire Local Authority. It is located in close proximity to the administrative boundary of Bedford Borough Council and Wootton Ward where the village of Stewartby is located.

Information on Marston, Wootton, Ampthill and Maulden and Houghton Conquest (M & HC) Wards, Central Bedfordshire Local Authority (LA) and Bedford Borough has been gathered to be able to profile the communities that could be impacted by the Project. The aim of this profile is to understand the differing susceptibilities to health impacts and receiving of benefits as a result of variations in social and demographic status and relative deprivation in the communities profiled.

Covanta believes that those within close proximity to the proposed application site should be given a greater opportunity to be engaged with. After careful consideration, we propose a direct mail consultation footprint of 5km adjusted to reflect parish council boundaries (please see outline map below).

The proposed footprint has been chosen to accommodate existing parish councils and to avoid splitting villages or local areas along artificial boundaries. The 5km footprint is also deemed to be appropriate from a near neighbour issues context. The choice of parish council divisions also relates to stakeholder engagement by ensuring that parish/ town councils, the closest level of local representation, are consulted as a minimum.

Figure B1.1 5km direct mail consultation boundaries**B1.1.1 Population****B1.1.2 Size and Age Distribution**

The table below shows the breakdown of the population by gender within Marston, Wootton, Ampthill and M & HC Wards as well as Central Bedfordshire LA and Bedford Borough. The LA, Borough and Wards mirror the gender ratio in England with a slightly higher percentage of females than males in all areas. The table also shows that Marston Ward (where the Project is located) has a much smaller population than Wootton Ward, with both only representing only four percent of the total population of either the Local Authority or Borough that they line within.

Table B1.1 Population Data by Gender (2001)

| Area | Males (%) | Females (%) | Total |
|---------------------------------------|-----------|-------------|------------|
| Marston Ward | 49.1 | 50.9 | 4,830 |
| Wootton Ward | 49.4 | 50.6 | 5,441 |
| Ampthill Ward | 48.7 | 51.3 | 6897 |
| Maulden and Houghton Conquest Ward | 48.6 | 51.4 | 2900 |
| Central Bedfordshire LA | 49.7 | 50.3 | 233,661 |
| Bedford Borough | 49.4 | 50.6 | 147,911 |
| England | 48.7 | 51.3 | 49,138,831 |

Source: Census 2001 – www.statistics.gov.uk

The age structure of a population indicates both the current and strategic (future) requirements of an area. A younger population, for example, may require additional access to schools, safe recreation play facilities and the development of future employments opportunities, while aging populations are likely to require a greater focus on health care, living support, accessibility and social networks. The age structure of the Wards, Local Authority and Borough which the Project is situated in or close to is shown below in *Table B1.2*.

Table B1.2 Population Data by Age (2001)

| | 0-14 (%) | 15-24 (%) | 25-34 (%) | 35-44 (%) | 45-59 (%) | 60-69 (%) | 70+ (%) |
|--|----------|-----------|-----------|-----------|-----------|-----------|---------|
| Marston Ward | 21.5 | 9.0 | 16.7 | 18.9 | 18.2 | 7.9 | 7.9 |
| Wootton Ward | 20.3 | 10.4 | 13.4 | 16.1 | 20.5 | 9.1 | 10.2 |
| Ampthill Ward | 21.6 | 8.2 | 12.9 | 17.9 | 19.9 | 9.3 | 10.3 |
| Maulden and Houghton Conquest Ward | 19.7 | 8.9 | 9.8 | 17.3 | 23.1 | 9.6 | 11.7 |
| Central Bedfordshire LA | 20.2 | 10.7 | 13.9 | 16.9 | 20.1 | 8.8 | 9.4 |
| Bedford Borough | 19.4 | 12.7 | 14.8 | 14.8 | 18.9 | 8.7 | 10.8 |
| England | 18.9 | 12.2 | 14.4 | 14.9 | 18.9 | 9.3 | 11.5 |

Source: Census 2001 – www.statistics.gov.uk

Table B1.2 shows that, broadly speaking, the age structure of the population in Central Bedfordshire LA, Bedford Borough and all the affected Wards is very similar to that of England as a whole. All four Wards appear to have a higher than average percent of people within the 0-14 age range compared to the LA or Borough that they lie within. In addition Marston has a notably lower population of those within the 60 and above age range compared to the other Wards and nationwide.

Population density provides a measure of the number of people living in an area. It is higher in urban areas, and lower in rural areas. *Table B1.3*

shows how the Wards compare to each other and to England as a whole. Marston Ward is far less densely populated than the regional and national averages; Ampthill Ward, conversely, is much more densely populated than the average density and almost three times that of neighbouring Marston Ward.

Table B1.3 Population Density (2001)

| Area | Persons per hectare |
|------------------------------------|---------------------|
| Marston Ward | 1.8 |
| Wootton Ward | 3.3 |
| Ampthill Ward | 4.6 |
| Maulden and Houghton Conquest Ward | 2.7 |
| Central Bedfordshire LA | 3.3 |
| Bedford Borough | 3.1 |
| UK | 3.8 |

Source: Census 2001 – www.statistics.gov.uk

B1.1.3 Ethnicity

Epidemiological evidence suggests that minority groups often experience fewer socio-economic and physical health benefits; this may be a result of discrimination, levels of education, or even language barriers ⁽¹⁾.

Table B1.4 shows that the population around the Proposed Application Site is dominated by white people with, on average, less than four percent of the population being black or from another ethnic minority. Members of these ethnic minorities are therefore more likely to experience feelings of isolation and exclusion from society as a whole. However, Bedford Borough as a whole has a higher than national average of people of mixed ethnicity.

Table B1.4 Ethnicity (2001)

| Area | White (%) | Asian or Asian British (%) | Mixed (%) | Black or Black British (%) | Chinese or Other Ethnic Group (%) |
|------------------------------------|-----------|----------------------------|-----------|----------------------------|-----------------------------------|
| Marston Ward | 97.5 | 0.8 | 0.7 | 0.5 | 0.6 |
| Wootton Ward | 96.0 | 1.0 | 2.1 | 0.6 | 0.3 |
| Ampthill Ward | 98.2 | 0.5 | 0.8 | 0.2 | 0.3 |
| Maulden and Houghton Conquest Ward | 98.8 | 0.5 | 0.5 | 0.0 | 0.2 |
| Central Bedfordshire LA | 97.3 | 0.9 | 0.9 | 0.5 | 0.4 |

(1) Samje C (1995) Health, Race and Ethnicity: Making Sense of the Evidence. King's Fund Institute: London.

| Area | White (%) | Asian or Asian British (%) | Mixed (%) | Black or Black British (%) | Chinese or Other Ethnic Group (%) |
|-----------------|-----------|----------------------------|-----------|----------------------------|-----------------------------------|
| Bedford Borough | 87.0 | 2.0 | 7.7 | 2.6 | 0.7 |
| England | 90.9 | 1.3 | 4.6 | 2.3 | 0.9 |

Source: Census 2001 – www.statistics.gov.uk

B1.1.4 Religion

The concept of a minority group can also be applied to religions, as with ethnicity. Those in minority religions may experience feelings of exclusion and a loss of social networks and support that comes from shared religious celebrations and worship.

Table B1.5 shows the proportion of individuals professing different types of faith in the study area. The significant majority of the population is Christian in all cases, with the second highest majority stating no religion. The four Wards generally reflect the religious composition of Central Bedfordshire LA closely. Wootton, however, has a notably higher proportion of Sikhs than the surrounding areas and the national average. With the exception of Buddhists in M & HC Ward, all other religious groups (included in the 2001 census) are represented in all the wards.

In addition Bedford Borough has a higher Muslim, Sikh and Hindu population than both England as a whole and Central Bedfordshire.

Table B1.5 Religion (2001)

| | Marston Ward | Wootton Ward | Amphill Ward | Maulden and Houghton Conquest Ward | Central Bedfordshire LA | Bedford Borough | England |
|-------------------------|--------------|--------------|--------------|------------------------------------|-------------------------|-----------------|---------|
| Christian (%) | 76.6 | 75.9 | 75.8 | 81.2 | 74.9 | 68.8 | 71.7 |
| Buddhist (%) | 0.2 | 0.1 | 0.2 | 0.0 | 0.1 | 0.2 | 0.3 |
| Hindu (%) | 0.1 | 0.6 | 0.3 | 0.1 | 0.4 | 1.7 | 1.1 |
| Jewish (%) | 0.3 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.5 |
| Muslim (%) | 0.1 | 0.2 | 0.2 | 0.1 | 0.3 | 3.3 | 3.1 |
| Sikh (%) | 0.3 | 1.1 | 0.1 | 0.1 | 0.2 | 1.9 | 0.7 |
| Other religions (%) | 0.2 | 0.4 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 |
| No religion (%) | 15.8 | 15.4 | 16.7 | 12.8 | 16.9 | 14.9 | 14.6 |
| Religion not stated (%) | 6.5 | 6.2 | 6.5 | 5.4 | 6.8 | 8.8 | 7.7 |

Source: Census 2001 – www.statistics.gov.uk

B1.2 EDUCATION, SKILLS AND TRAINING

Education is an important determinant of health and influences almost every aspect of health including lifestyle, coping skills, future employment prospects and subsequent income, quality of housing and healthcare. Improving the quality and level of education is therefore a national imperative. The percentage of the population of the local Borough and Wards affected by the Facility site with various levels of qualifications are shown in Table B1.6.

Table B1.6 Education and Qualification Levels (2001)

| | Marston Ward | Wootton Ward | Amphill Ward | Maulden and Houghton | Central Bedfordshire LA | Bedford Borough | England |
|---|--------------|--------------|--------------|----------------------|-------------------------|-----------------|------------|
| Total number of schoolchildren and full-time students aged 16-74 | 3,471 | 3,908 | 4883 | 2105 | 169,382 | 106,897 | 35,532,091 |
| People aged 16-74 with no qualifications (%) | 24.9 | 26.2 | 18.8 | 24.6 | 24.6 | 25.6 | 28.9 |
| People aged 16-74 who attained level 1 (%) | 19.7 | 20.0 | 17.9 | 16.1 | 19.7 | 17.4 | 16.6 |
| People aged 16-74 who attained level 2 (%) | 22.9 | 21.6 | 20.3 | 21.2 | 22.0 | 19.9 | 19.4 |
| People aged 16-74 who attained level 3 (%) | 6.6 | 6.7 | 8.3 | 7.3 | 7.5 | 8.1 | 8.3 |
| People aged 16-74 who attained level 4 / 5 (%) | 18.9 | 17.6 | 28.0 | 22.7 | 18.7 | 21.8 | 19.9 |
| People aged 16-74 with other qualifications / level unknown (%) | 7.1 | 8.0 | 6.7 | 8.2 | 7.6 | 7.2 | 6.9 |
| Level 1: 1+ O level, GCSE, CSE pass any grade, NVQ level 1 or foundation GNVQ | | | | | | | |
| Level 2: 5+ O levels 5+ CSE's (grade one) 5+ GCSE's (A-C), School certificate, 1+ A/AS level, NVQ level 2 or Intermediate GNVQ. | | | | | | | |
| Level 3: 2+A levels, 4+ AS levels, Higher School Certificate, NVQ level 3, Advanced GNVQ. | | | | | | | |
| Level 4/5: First Degree, Higher Degree, NVQ level 4 and 5, HNC, HND, Qualified teacher status, Qualified Medical Doctor, Qualified Dentist, Qualified Nurse, Midwife, Health Visitor. | | | | | | | |
| Other Qualifications e.g. City and Guilds, RSA, BTEC or professional qualifications | | | | | | | |

Source: Census Data 2001 – www.statistics.gov.uk

All wards and the Borough or LA that they lie within show a lower proportion of their population having no qualifications than across England as a whole. This is particularly true of Amphill Ward, where only 19% of the population have no formal qualifications, compared to 29% across England.

Marston, Wootton and M&HC Wards all show comparable educational profiles with regard to the distribution of educational levels achieved. In

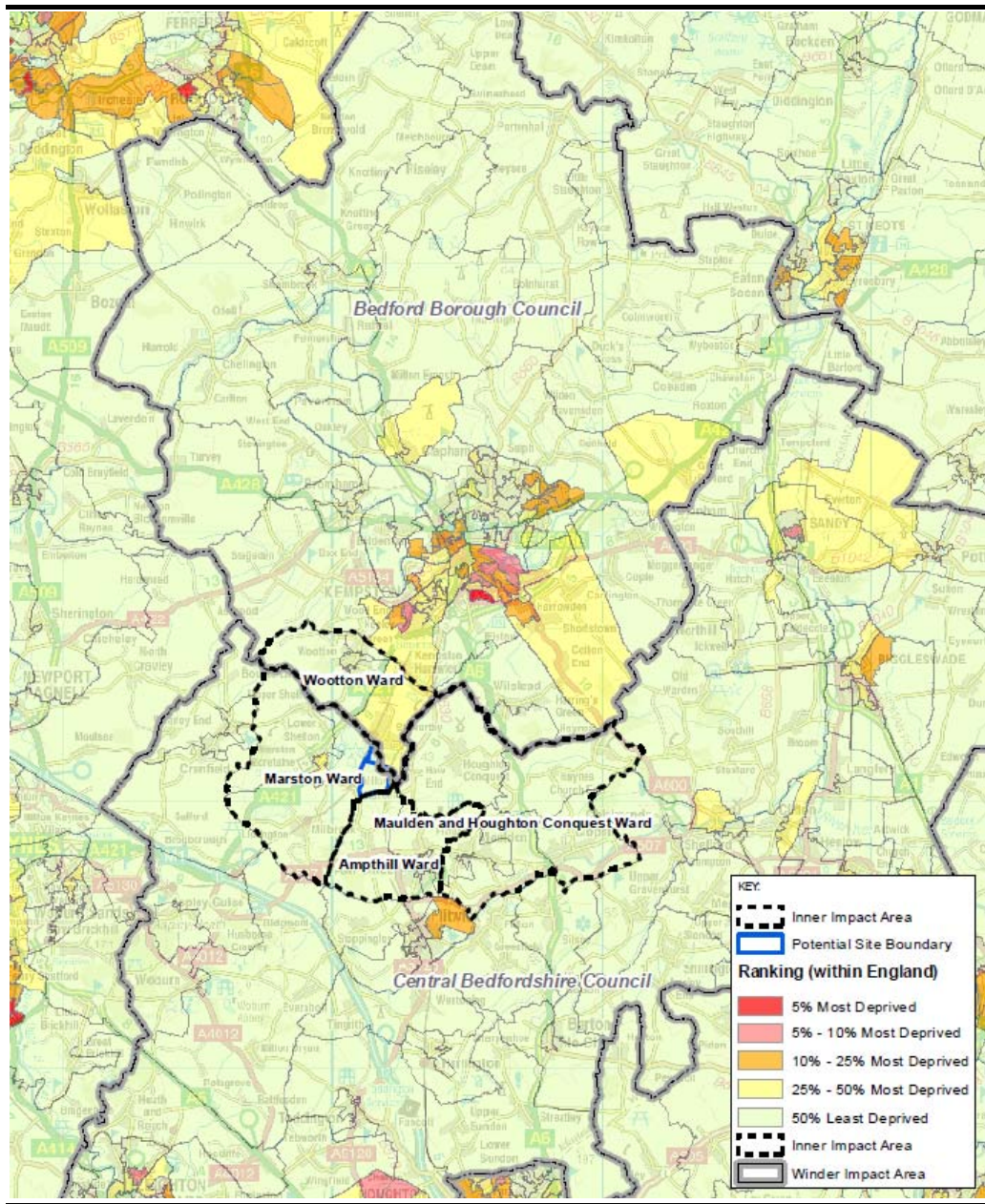
addition to its low level of unqualified residents, the Ward of Ampthill further deviates from this profile by showing a much higher proportion of people with the highest level of qualifications than is the other wards, Borough it lies in or England as a whole.

Figure B1.2 maps the deprivation in terms of education, skills and training in the area based on the following indicators:

1. Average test score of pupils at Key Stage 2 (2 year weighted average, 2004–2005), Source: Pupil Level Annual School Census (PLASC), National Pupil Database (NPD).
2. Average test score of pupils at Key Stage 3 (2 year weighted average, 2004–2005), Source: PLASC, NPD.
3. Best of 8 average capped points score at Key Stage 4 (this includes results of GCSEs, GNVQs and other vocational equivalents) (2 year weighted average, 2004–2005), Source: PLASC, NPD.
4. Proportion of young people not staying on in school or non-advanced education above the age of 16 (2005), Source: HMRC Child Benefit (CB) data.
5. Secondary school absence rate (2 year average 2004–2005), Source: DCSF absence data, PLASC.
6. Proportion of those aged under 21 not entering higher education (4 year average, 2002–2005), Source: Universities and Colleges Admission Service (UCAS), Higher Education Statistics Agency (HESA).
7. Proportion of working age adults with no or low qualifications (2001) Source: Census 2001.

It can be seen that half of Wootton Ward is classified as being in the 25-50% most deprived areas in the country. A small section Marston Ward is also classified in at this level. The remainder of the other wards is otherwise classed amongst the least deprived areas in England with regard to education.

Figure B1.2 IMD Education, Skills and Training Deprivation



B1.3**EMPLOYMENT AND INCOME**

Income and employment influence a range of factors including access to housing, education, services and social networks as well as diet, lifestyle and coping skills. These in turn are key determinants of a variety of physical and mental health impacts and ultimately health and well-being.

Table B1.7 shows the level of economic activity in the area. On average all four Wards have higher levels of full time and part time employment than the nation as a whole.

Unemployment in all four Wards is equal to or less than the Borough and LA that they lie within and England as a whole. In all four Wards and both Bedford Borough and Central Bedfordshire LA the percentage of people permanently sick/disabled is lower than the national average. The proportion of the population looking after home or family however is broadly in line with England as a whole for the Wards, Borough and LA.

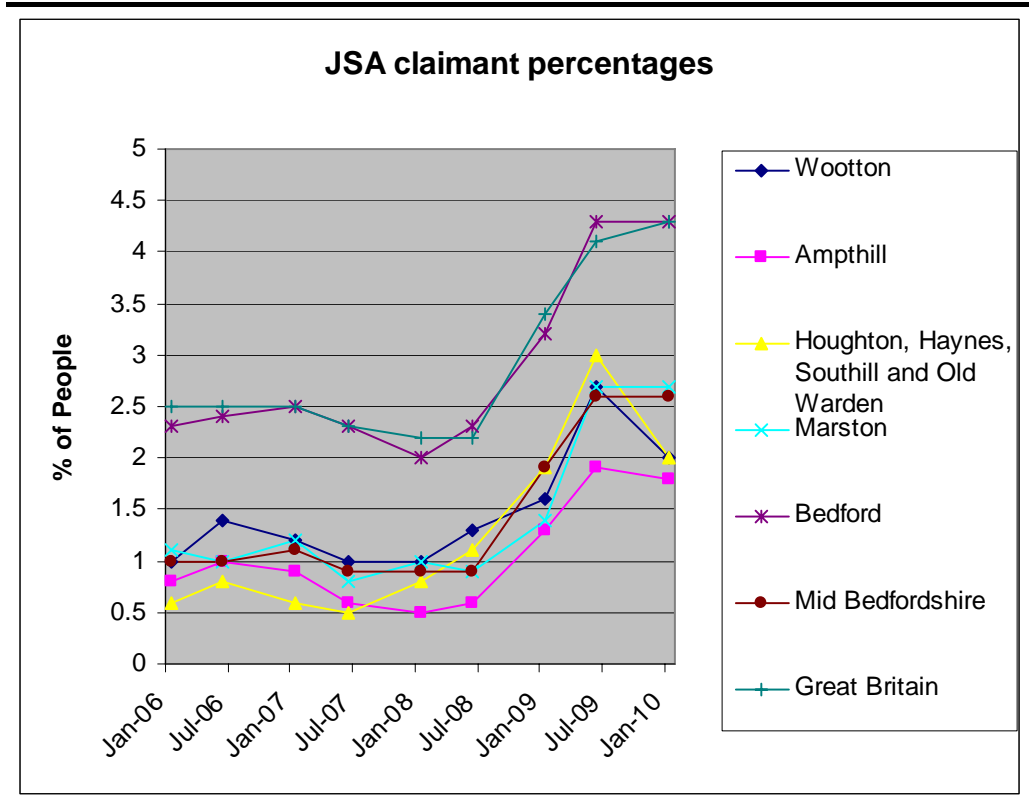
Table B1.7 *Economic Activity of the Population aged 16-74 (2001)*

| | Marston Ward | Wootton Ward | Amphill Ward | Maulden and Houghton Conquest Ward | Central Bedfordshire LA | Bedford Borough | England |
|--|--------------|--------------|--------------|------------------------------------|-------------------------|-----------------|---------|
| Full-time employed (%) | 50.8 | 47.3 | 45.2 | 47.6 | 47.6 | 43.9 | 40.8 |
| Part-time employed (%) | 12.0 | 14.0 | 12.6 | 12.2 | 12.2 | 11.6 | 11.8 |
| Self Employed (%) | 9.9 | 8.3 | 11.2 | 14.6 | 9.7 | 8.0 | 8.3 |
| Unemployed (%) | 2.1 | 2.1 | 1.7 | 2.14 | 2.1 | 3.1 | 3.4 |
| Economically active student (%) | 1.7 | 2.2 | 1.9 | 2.2 | 2.2 | 2.8 | 2.6 |
| Retired (%) | 9.2 | 13.5 | 14.3 | 12.3 | 12.3 | 12.6 | 13.5 |
| Economically inactive student (%) | 2.1 | 2.6 | 3.0 | 2.9 | 2.9 | 4.8 | 4.7 |
| Looking after home / family (%) | 6.2 | 5.5 | 6.4 | 6.3 | 6.3 | 6.1 | 6.5 |
| Permanently sick / disabled (%) | 4.0 | 3.0 | 2.2 | 2.9 | 2.9 | 3.9 | 5.3 |
| Other Economically inactive (%) | 2.1 | 1.5 | 1.5 | 1.9 | 1.9 | 3.1 | 3.1 |

Source: Census Data 2001 – www.statistics.gov.uk

The graph below shows the percentage of population of working age claiming Job Seekers' Allowance (JSA) between January 2006 and January 2010.

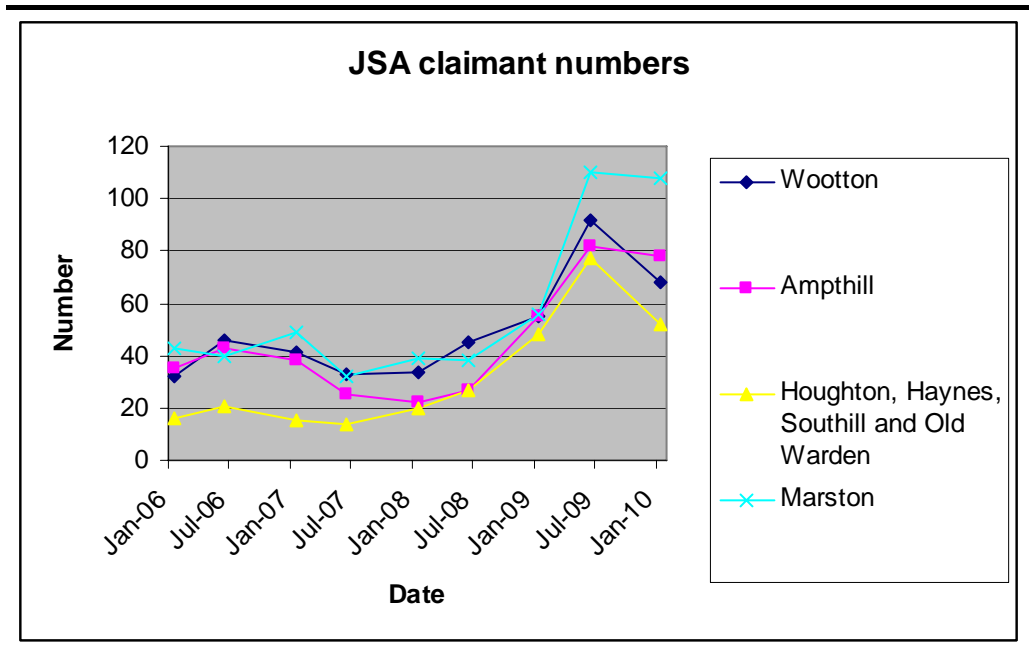
Figure B1.3 JSA Claimant Percentages



The graph shows that all four wards are below the national average for the percentage of JSA claimants. For comparison, Bedford and Mid-Bedfordshire statistics have been included. The graph shows that Bedford experiences a similar level of JSA claimants to the national average. In comparison, Mid Bedfordshire has a lower number of claimants. All four wards in the IIA show a similar pattern to Mid Bedfordshire.

Across all wards and at the local authority and the national levels, there has been an increase in the percentage of JSA claimants, which has been most noticeable from July 2008. This is to be expected as a result of the economic recession that the UK has recently experienced.

The graph below presents the number of JSA claimants in the IIA between January 2006 and January 2010. It demonstrates that Marston has a highest number of claimants in the IIA.

Figure B1.4 JSA Claimant Numbers

In January 2006 a total of 126 people were claiming JSA across the four wards in the IIA, this compares with a total of 306 people claiming JSA in January 2010. This indicates a significant increase of those unemployed within the IIA.

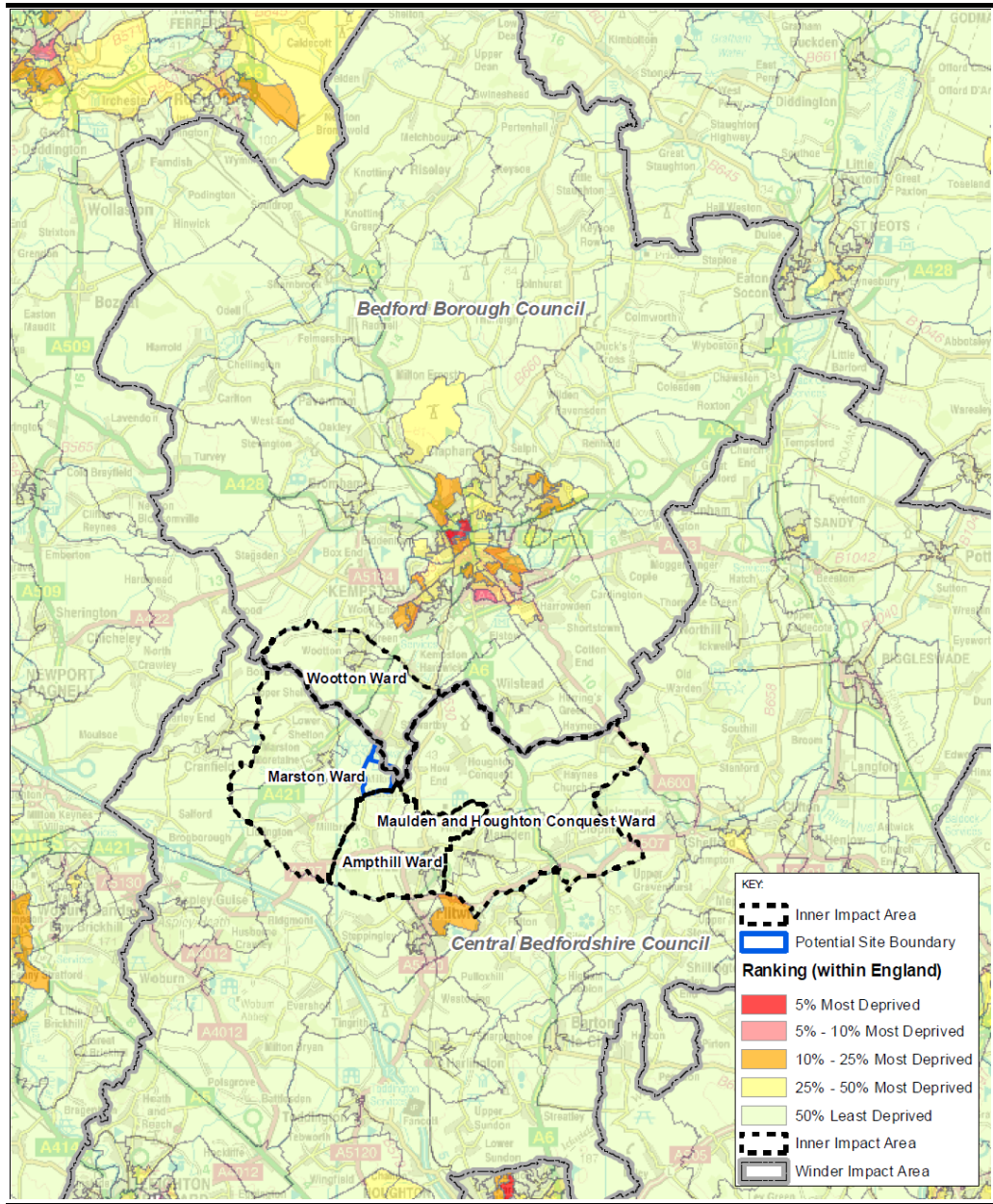
Figure B1.5 maps employment deprivation levels in the area based on the following indicators:

1. Recipients of Jobseekers Allowance (both contribution-based and income-based) for men aged 18–64 and women aged 18–59 (Source: DWP 2005)
2. Participants in the New Deal for the 18–24s who are not in receipt of JSA (Source: DWP 2005)
3. Participants in the New Deal for 25+ who are not in receipt of JSA (Source: DWP 2005)
4. Participants in the New Deal for Lone Parents (after initial interview) (Source: DWP 2005)
5. Incapacity Benefit recipients aged 18–59 (women); 18–64 (men) (Source: DWP2005)
6. Severe Disablement Allowance recipients aged 18–59 (women); 18–64 (men) (Source: DWP 2005)

The map shows that all four Wards fall within the 50% least deprived areas in England with regard to employment. This is also the categorization for both Bedford Borough and Central Bedfordshire LA,

the main deviation from this being the city of Bedford and its immediate surrounds.

Figure B1.5 IMD Employment



B1.4**TRANSPORT**

Transport plays a vital role in the health and well-being of communities through the provision of access to a range of services and amenities required to treat illness as well as to manage and promote healthy living.

Any activity that promotes a modal shift to public or green transport will contribute to a healthier lifestyle and environment, reduce the reliance on the use of non renewable fuels, reduce emissions to air, diminish risk from accident and injury, and promote physical activity. Equally those who own their own cars are more able to access jobs and services outside of their local area and are less likely to suffer from social exclusion than those who do not. As can be seen from the evidence base, there is a strong correlation between deprivation and road traffic accidents; childhood pedestrian mortality also shows a steep social gradient ⁽¹⁾. Car ownership roughly correlates with housing ownership and is an indicator of wealth for many areas in the country also.

Rural communities are often less well served by public transport than their urban counterparts as these routes may not be seen as profitable; this increases the reliance on the use of cars in these communities.

The level of car ownership in all wards is significantly higher than the national average. This is reflected strongly in M & HC and Marston Wards, where over 50% of households have two or more cars.

Table B1.8 Car Ownership (Percentage of households)

| | Marston Ward | Wootton Ward | Ampthill Ward | Maulden and Houghton Conquest Ward | Central Bedfordshire LA | Bedford Borough | England |
|-------------------------------|--------------|--------------|---------------|------------------------------------|-------------------------|-----------------|---------|
| No car or van | 10.9 | 13.4 | 14.0 | 11.4 | 14.9 | 22.0 | 26.8 |
| 1 car or van | 36.9 | 40.7 | 39.7 | 34.4 | 40.9 | 42.8 | 43.7 |
| 2 or more cars or vans | 52.2 | 45.9 | 46.3 | 54.1 | 44.2 | 35.3 | 29.5 |

Source: Census 2001 – www.statistics.gov.uk

B1.5**HOUSING**

Housing is an oft underrated determinant of health. It is not only required to provide shelter, security and a family base, but the quality of housing is also associated with economic, social, mental and physical

(1) Roberts. (1996). Does the decline in childhood mortality vary by social class. BMJ.

well-being ⁽¹⁾. The health impacts associated with poor housing can include a range of physical illness brought on from poor shelter and subsequent exposure to cold, damp or pollutants ⁽²⁾. The risk of communicable diseases is increased if there is overcrowding, while stress related and mental illness can be brought about through a lack of affordable housing or high rent ⁽³⁾. As a result, deprived communities, children and the elderly ⁽⁴⁾ are particularly sensitive to health outcomes associated with poor housing.

Additionally, home ownership is also an indicator of wealth. The types of households that are available in an area are an indicator of the relative wealth of the area. Factors influencing housing and subsequent health outcomes therefore reflect the quality, distribution, overcrowding, affordability and ownership of homes.

All the wards have a low percentage of flats, maisonettes or apartments compared England as a whole, with Marston Ward having the lowest percentage (1.7%) and Ampthill having the highest percentage out of the wards (11.3%). The predominant housing in the wards is either detached or semi-detached accommodation. Over half of the population of M & HC Ward live in detached, semi detached houses or bungalows, which is more than double the national average and significantly higher than the borough it lies in. Marston Ward is the ward with the highest percentage of people living in terraced housing, however this percent is similar to the rest of England.

Table B1.9 *Proportion of Different Household Types (2001)*

| | Marston Ward | Wootton Ward | Ampthill Ward | Maulden and Houghton Conquest wards | Central Bedfordshire LA | Bedford Borough | England |
|---|--------------|--------------|---------------|-------------------------------------|-------------------------|-----------------|---------|
| Detached house or Bungalow (%) | 31.8 | 34.7 | 38.4 | 51.0 | 29.7 | 27.7 | 22.5 |
| Semi-detached house or bungalow (%) | 38.1 | 37.8 | 31.0 | 22.0 | 36.0 | 32.7 | 31.6 |
| Terraced house or bungalow (including end terrace) (%) | 28.3 | 21.7 | 19.3 | 19.6 | 26.0 | 22.6 | 25.8 |
| Flat; maisonette or apartment (%) | 1.7 | 5.0 | 11.3 | 3.0 | 9.9 | 16.1 | 19.7 |
| Mobile or temporary structure (%) | 0.0 | 0.8 | 0 | 4.2 | 1.2 | 0.9 | 0.4 |

Source: Census 2001 – www.statistics.gov.uk

(1) Journal of Social Issues, Vol 59/3, 03. The Residential Context of Health. The European Network for Housing Research
 (2) Platt S., Martin C., Hunt S. and Lewis C. (1989). Damp housing, mould growth and symptomatic health state. British Medical Journal, 298:1673-8.

(3) Shaw M., Darling D., Gordon D. and Davey Smith G. (1999). The Widening Gap: Health Inequalities and Policy in Britain. Bristol: The Policy Press.

(4) Savage A. (1988). Warmth in Winter: Evaluation of an Information Pack for Elderly People. Cardiff: Cardiff University of Wales College of Medicine Research Team for the Care of the Elderly.

Housing tenure is illustrated in *Table B1.10* and shows that the percentage of people that own their home outright or with a mortgage in all of the wards, Borough and LA far higher than the national average. Home ownership is also higher in the Wards overall than the Borough and LA they lie within. In all four Wards the most common form of rented accommodation is that rented from Housing Associations, this percentage is far higher than the England average indicating that the area is deprived in terms of housing.

Table B1.10 Tenure Type (2001)

| Tenure Type | Marston Ward | Wootton Ward | Amphill Ward | Maulden and Houghton Conquest Ward | Central Bedfordshire LA | Bedford Borough | England |
|---|--------------|--------------|--------------|------------------------------------|-------------------------|-----------------|---------|
| Owns outright or with a mortgage (%) | 79.3 | 80.7 | 82.2 | 78.9 | 77.2 | 72.4 | 68.7 |
| Rented from Council (local authority) (%) | 0.9 | 0.8 | 1.1 | 0.7 | 8.7 | 1.4 | 13.2 |
| Rented from Housing Association/ Registered Social Landlord (%) | 10.9 | 9.8 | 9.6 | 13.2 | 5.3 | 14.4 | 6.1 |
| Rented from Private landlord or letting agency (%) | 6.5 | 3.9 | 4.9 | 4.1 | 5.6 | 8.8 | 8.8 |
| Rented from Other (%) | 2.4 | 4.8 | 1.9 | 3.0 | 3.1 | 3.0 | 3.2 |

Source: Census 2001 – www.statistics.gov.uk

Figure B1.6 maps the deprivation in terms of barriers to housing and services based on the following indicators:

1. Household overcrowding (Source: 2001 Census)
2. District level rate of acceptances under the homelessness provisions of the 1996 Housing Act, assigned to the constituent LSOAs (Source: Communities and Local Government, 2005)
3. Difficulty of Access to owner-occupation (Source: modelled estimates produced by Heriot-Watt University, 2005)
4. Road distance to a GP surgery (Source: National Health Service Information Authority, 2005)
5. Road distance to a general store or supermarket (Source: MapInfo Ltd, 2005)
6. Road distance to a primary school (Source: DfES, 2004–05)

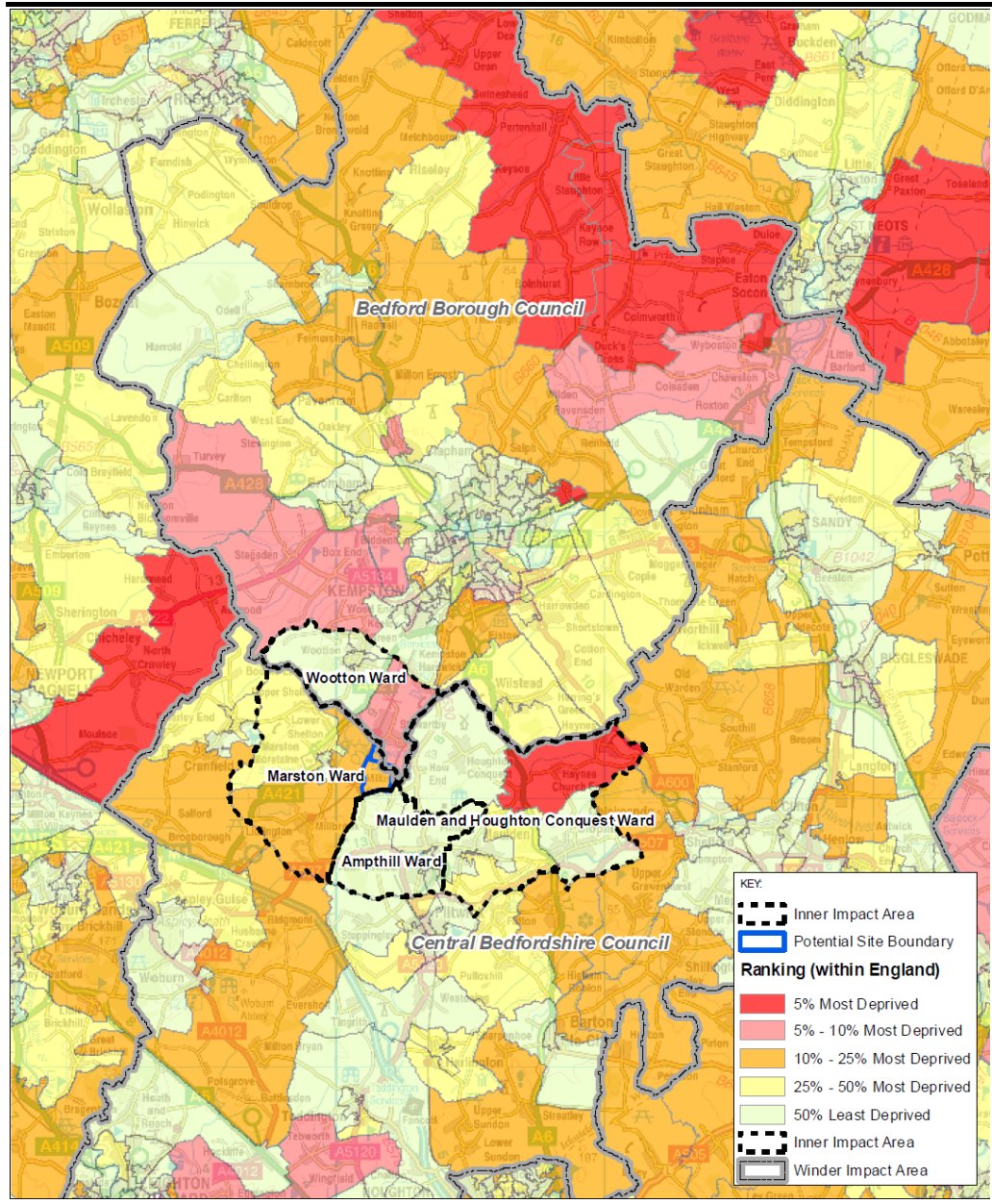
7. Road distance to a Post Office or sub post office (Source: Post Office Ltd, 2005)

The map shows the entire of Ampthill Ward and half of both Wootton and Marston and Houghton Conquest wards to be in the 50% least deprived areas in England in terms of barriers to housing and services. However, the other half of Wootton Ward is classified amongst the most deprived 10% of England in terms of housing, and the north-eastern third of Marston and Houghton Conquest wards is classified amongst the 5% most deprived.

Marston Ward has no areas of extreme positive or negative deprivation, despite being bordered by Wards showing just such extremes, the entire ward is categorized as being between the top 10 and 50% most deprived in terms of housing.

These variations in deprivation are likely to be influenced by the indicators determining distance to various services due to the rural nature of the area.

Figure B1.6 IMD Housing



B1.6**CRIME****B1.6.1****Crime and Health**

The study 'Exploring the Impacts of Crime on Health and Health Services: a feasibility study' ⁽¹⁾ concluded that crime has serious health impacts, both direct and indirect. Violent crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Furthermore, theft and burglary can materially affect living standards and have psychological effects for the people involved, with consequences for health.

Individuals who have been the victims of violence and other forms of crime often suffer damage to their health beyond immediate injuries. Damage to physical health can result from the stress caused by the experience of victimisation: for example, the heart attack suffered by the elderly victim of burglary or the self-harm induced by abuse.

Fear from crime and antisocial behaviour may also have significant effects on health. In particular, older people, women and children may become constrained in their use of public spaces and make more use of car transport. They may withdraw from social life, including interaction with neighbours, and avoid going out at night. They may take protective or defensive action which can in itself pose a threat to health; for example, carrying a weapon, or barricading themselves in their homes ⁽²⁾.

Violence also disproportionately affects certain groups in society, including young people and those who are deprived. The British Crime Survey shows that these unequal risks extend to other types of crime, such as burglary and vehicle-related theft. In many ways these inequalities mirror those which are found in health, suggesting that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in contemporary Britain.

Table B1.11 *Crime - Rate per 1000 resident population*

| | Central Bedfordshire LA | Bedford Borough | England |
|------------------------------------|-------------------------|-----------------|---------|
| Violence Against the Person | 8.7 | 13.2 | 17.1 |
| Robbery | 0.8 | 1.7 | 1.6 |
| Burglary in a Dwelling | 5.6 | 5.0 | 5.6 |
| Theft of a Motor Vehicle | 2.1 | 2.3 | 2.8 |
| Theft from a Vehicle | 7.8 | 7.2 | 7.6 |

Source: Notifiable Offences by the police 2008/09

(1) Ro Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

(2) Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

It can be seen from *Table B1.11* that within Bedford Borough and Central Bedfordshire LA the rate of crime is generally similar or lower compared to the national average. Therefore it can be considered a relatively safe place to live and theoretically relatively free from fear of crime.

Crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Fear of crime can lead to a wide range of psychological disorders and self-limited mobility, while exposure to crime may increase the incidence of health-damaging behaviour, such as smoking or excessive alcohol consumption ⁽¹⁾. The level of crime in the four Wards is also likely to be low like the Borough and LA they lie within as they are located in a more rural setting.

The British Crime Survey suggests that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in Britain today ⁽²⁾. From these data it can be seen that this community is not being subjected to poor health due to crime.

It should be noted that the figures presented in *Table B1.11* only reflect crime that has been reported; under reporting, particularly for domestic crime, is common. The effects of domestic crime are therefore underestimated especially if people are victims multiple times. The health impacts of crime also extend beyond the victims to witnesses and relatives.

Figure B1.7 shows a map of levels of crime in the area based on the following indicators:

1. Burglary (4 recorded crime offence types, Police Force data for April 2004-March 2005, constrained to Crime and Disorder Reduction Partnership (CDRP) level)
2. Theft (5 recorded crime offence types, Police Force data for April 2004-March 2005, constrained to CDRP level)
3. Criminal damage (10 recorded crime offence types, Police Force data for April 2004-March 2005, constrained to CDRP level)

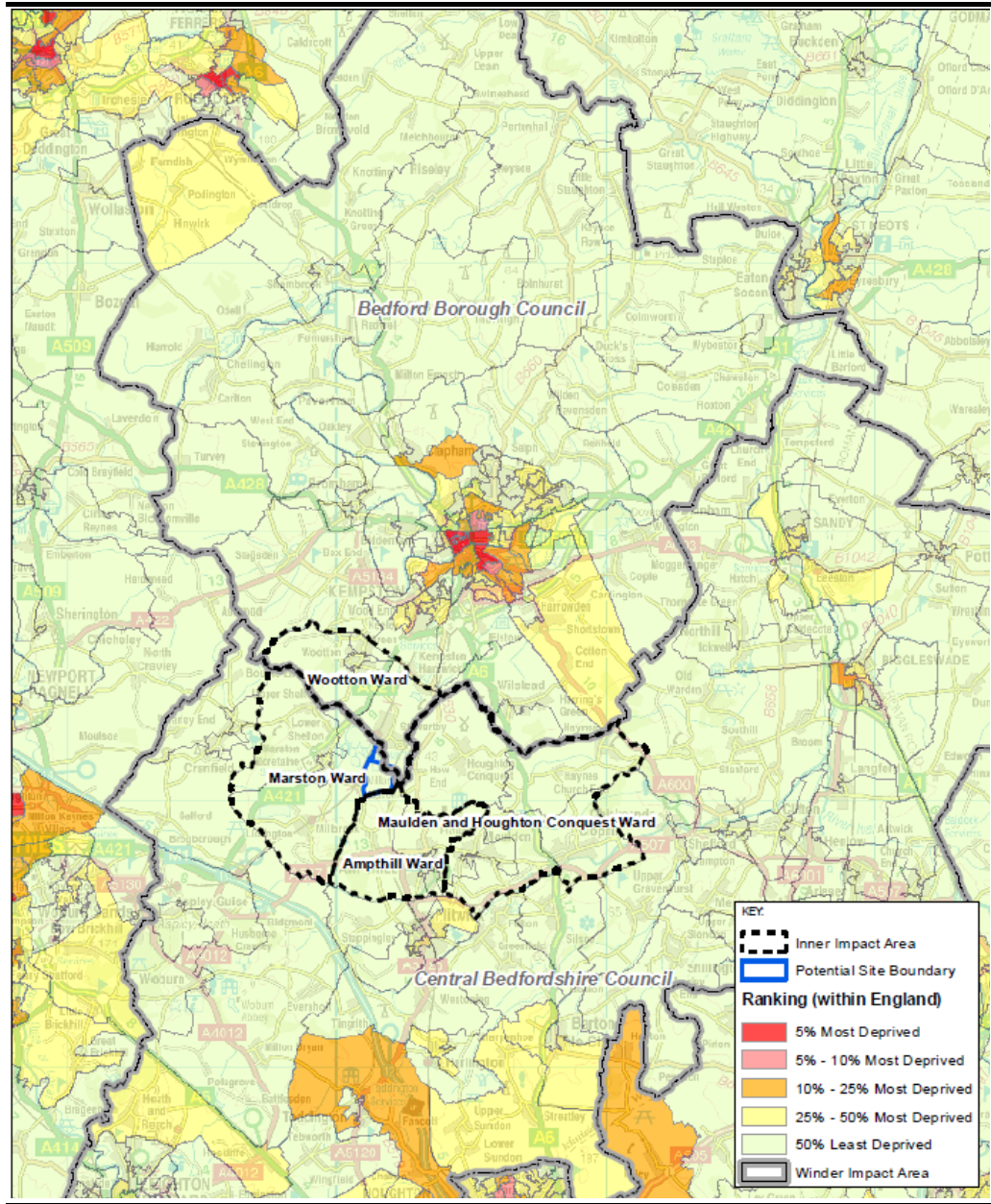
(1) Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

(2) Mirrlees-Black C, Mayhew P, Percy A. The 1996 British Crime Survey. Home Office Statistical Bulletin. London: Home Office, 1996.

4. Violence (14 recorded crime offence types, Police Force data for April 2004-March 2005, constrained to CDRP level).

The map reflects the same findings as shown in *Table B1.11* and that all four Wards in the 50% least deprived in terms of crime.

Figure B1.7 IMD Crime



B1.6.2 *Health of the community*

The 2001 Census asked people to describe their self perceived health over the preceding 12 months as 'good', 'fairly good' or 'not good', as well as recording those with a long term illness. This is a subjective measure of health and an indication of general health rather than recorded health events. It is however, a useful tool in obtaining local community perceptions of health and is shown for the Wards, Borough and LA affected by the development in *Table B1.12* below.

Table B1.12 *The Proportion of the Residents rating themselves in Different Health Categories (2001)*

| | Marston Ward | Wootton Ward | Amphill Ward | Maulden and Houghton Conquest Ward | Central Bedfordshire LA | Bedford Borough | England |
|---------------------------------------|--------------|--------------|--------------|------------------------------------|-------------------------|-----------------|---------|
| Good Health (%) | 73.6 | 73.3 | 75.2 | 73.4 | 73.3 | 71.4 | 68.8 |
| Fairly Good Health (%) | 19.9 | 20.6 | 19.2 | 20.4 | 20.4 | 21.3 | 22.2 |
| Not Good Health (%) | 6.5 | 6.1 | 5.6 | 6.2 | 6.3 | 7.3 | 9.0 |
| Limiting long term illness (%) | 13.5 | 13.7 | 12.6 | - | 13.5 | 15.6 | 17.9 |

Source: Census 2001 – www.statistics.gov.uk

A higher proportion of local residents in the four Wards consider their health as 'good' compared to the averages for England and, less notably, Bedford Borough and Central Bedfordshire LA. All four Wards show a similar profile, including lower levels people in 'Not Good Health' or suffering limiting long term illness. Amphill ward is particularly notable, with over 75% of its residents feeling to be in 'Good Health' and the lowest proportion of people reporting limiting long term illness

The health of people in the area can also be assessed using estimates of life expectancy. Areas with a life expectancy lower than the average tend to have poorer health than areas with higher levels of life expectancy. *Table B1.13* below shows how life expectancy at birth for males and females in the wider impact area are similar but slightly higher than that of the England averages, suggesting there is not deprivation in terms of health in the area.

Table B1.13 *Life Expectancy at Birth*

| | Central Bedfordshire LA | Bedford Borough | England |
|----------------------------------|-------------------------|-----------------|---------|
| Life Expectancy (Males) | 79.1 | 78.6 | 77.9 |
| Life Expectancy (Females) | 82.5 | 82.1 | 82.0 |

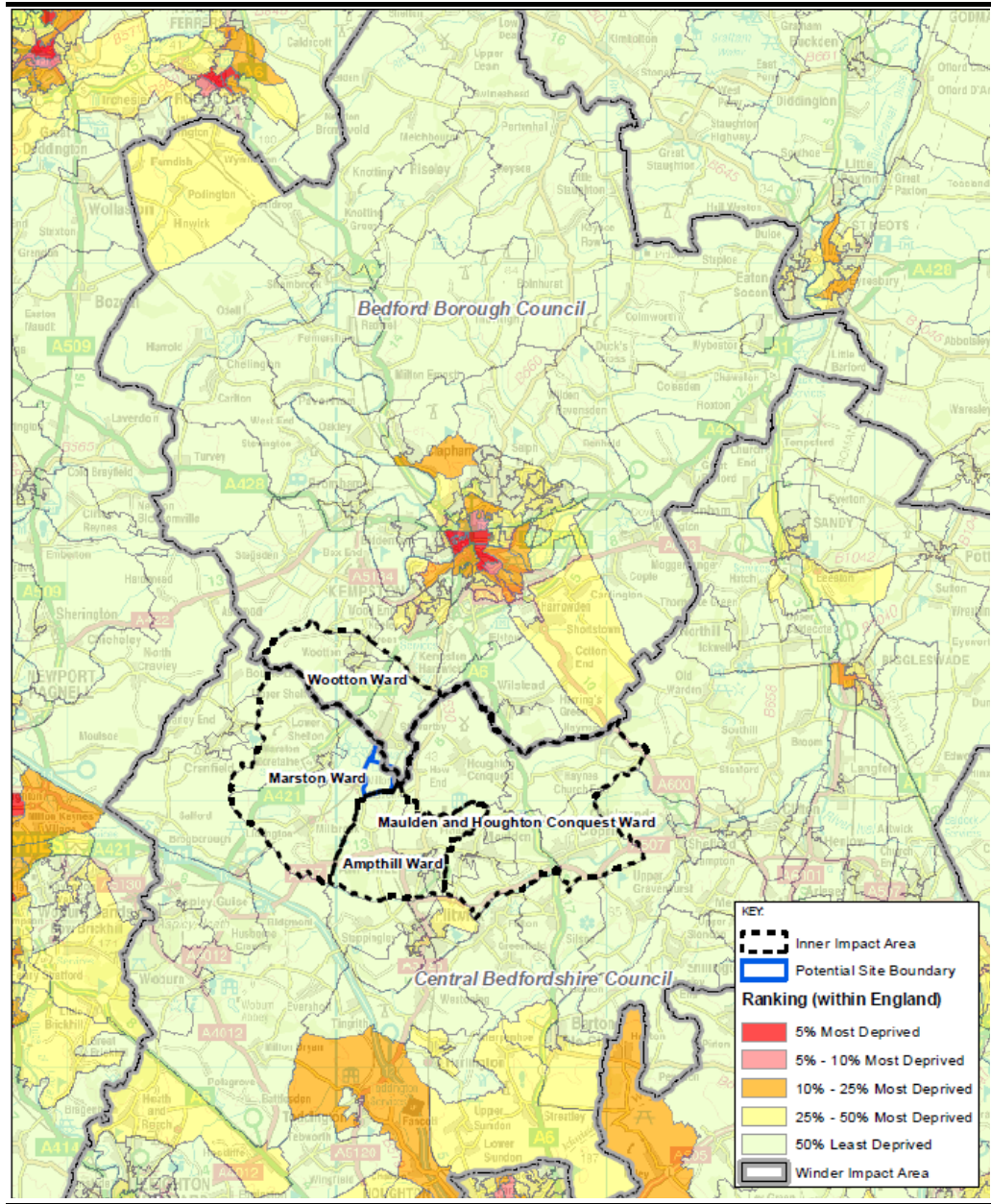
Source: Office for National Statistics (2006 -2008)

Figure B1.8 maps deprivation in terms of health and disability, based on the following indicators:

1. Years of Potential Life Lost (YPLL) (2001 to 2005, Source: ONS).
2. Comparative Illness and Disability Ratio (CIDR) (2005, Source: DWP).
3. Measures of acute morbidity, derived from Hospital Episode Statistics (April 2003 to March 2005, Source: Department of Health).
4. The proportion of adults under 60 suffering from mood or anxiety disorders based on prescribing (2005, Source: Prescribing Pricing Authority), suicide mortality rate (2001 to 2005, source: ONS), hospital episode (ICD-10 F3–F4) (April 2003 to March 2005, Source: Department of Health) and health benefits data (ICD-10 F3–F4) (2005, Source: DWP).

The map indicates good levels of health in the area as all Wards are classed as being in the 50% least deprived in the country with regard to health and disability.

Figure B1.8 IMD Health



A particularly important indicator of health is cardiovascular disease, which can develop through a number of physical and 'lifestyle' risk factors such as raised blood lipid levels, smoking, raised blood pressure, diabetes, obesity and physical activity to that effect. Coronary Heart Disease is one of the main health problems associated with cardiovascular disease and includes angina (chest pain on exertion), heart attacks (myocardial infarction) and heart failure.

. From this it can be seen that both areas have a lower level of life lost due to coronary heart disease than across England as a whole.

Table B1.14 shows the mortality levels from coronary heart disease in Central Bedfordshire LA and Bedford Borough. From this it can be seen that both areas have a lower level of life lost due to coronary heart disease than across England as a whole.

Table B1.14 Mortality from Coronary Heart Disease

| | Central Bedfordshire LA | Bedford Borough | England |
|--|-------------------------|-----------------|---------|
| Directly Standardised Average Annual Years of Life Lost (per 10,000)2004/05 | 31.62 | 46.99 | 48.52 |

Source: <http://www.heartstats.org/datapage.asp?id=7998>

Annex C

Stakeholder Engagement

C.1 **'STRATEGIC STAKEHOLDER' HIA EVENT, THE FOREST CENTRE, 25TH MAY 2010**

C.1.1 **PERCEIVED HEALTH AND WELL BEING IMPACTS ASSOCIATED WITH THE PROJECT**

C.1.1.1 **Emissions and Air Quality**

1. Local people are concerned about nanoparticles and the impact of health.
2. Concern about the distance airborne pollutants will travel and their effect on health.
3. Emissions to air and the presence of temperature inversions, which was a problem in the past with the Stewartby Brick Works and Brogborough Landfill.
4. There is no evidence associating asthma with the former Brickworks. However, GPs in the area were reported to believe that the industry contributed to the levels of asthma.

C.1.1.1 **Road Traffic**

1. Increase in traffic will cause annoyance.
2. Brogborough landfill caused an increase in transport, congestion and waste from lorry drivers. There is concern that the project will cause this to happen again.
3. Lorries will drive in convoy, causing congestion.
4. Litter will be blown off the lorries into the surrounding area.

C.1.1.1 **Noise**

1. Noise from lorries.

C.1.1.1 **Visual**

1. Anxiety will be caused due to the project being visible and the presence of the building.

C.1.1.1 Green Space

1. Even if there is increased accessibility and more footpaths, people will be put off using the area and the Forest Centre due to the project being located so close by.

C.1.1.1 Odour

1. There was an issue with odour from Brogborough landfill; therefore people will anticipate the same from the project.

C.1.1.1 Fly Ash

1. The local community are anxious about the impacts fly ash produced from the facility might have and how this can affect health.
2. The local community are worried the ash will be toxic and even radioactive.

C.1.1.8 Employment

1. Workforce intrusion is not considered an issue and 'is the least of peoples concerns'.
2. Most people in the area commute to London, Luton or Milton Keynes, as there are no jobs in the immediate area.
3. The jobs associated with the project are low level distribution jobs and are therefore not what people in the area look for in a job.
4. Closing the brickworks did not have a huge impact in the area in terms of unemployment levels.
5. There are not many people in the area with manual skills to work at the facility.

C.1.1.8 Trust

1. There is a lack of trust in the area between communities and the waste industry as a result of the Brogborough Landfill, which stayed open for longer than anticipated. The landfill was not landscaped when it closed and there was an odour issue.
2. Local people do not trust Covanta due to their safety record and environmental care in USA (information obtained through internet searches).

3. People have a pre-existing attitude towards Covanta which is going to be very hard to overcome.

C.1.1.8 General Comments

1. The more elderly generation in the area remember the Brick Works and the negative impact it had on the area and peoples health.
2. Locals want to understand the reason for the boundary of cheap electricity.
3. The Vale is seen as a dumping ground. First there was the Brick Works, then Brogborough Landfill and now this.
4. People are worried about being able to sell their houses, due to the close proximity to the facility and the perception of being close to an incinerator.
5. Whether there will be actual impacts on health there will be perceived health impacts. Pre- existing conditions will get blamed on the facility. However, participants thought that the frustration in the local community with regards to the project will disappear over time.

C.1.1.11 RECOMMENDATIONS

1. The visitor centre should be open for school trips and other interested groups so they are able to learn about what happens at the facility.
2. The facility should use the railway line to bring waste in instead of using lorries.
3. The emissions monitoring data that Covanta submit to the Environment Agency (EA) should be publicly available. Covanta needs to prove that these emissions are not harmful to the public.
4. Emissions data should be available in the visitors centre to help to increase trust in Covanta.
5. A code of conduct for lorry drivers could be enforced, eg lorries are not allowed to enter the site before 7am.
6. Covanta need to justify that they are ethical and environmentally sound to the local community, as they have had bad experiences with industry in the area in the past.
7. The visitor centre could be used like the Forest Centre and could be used as a community facility to hold functions etc.

C.2 **COMMUNITY HIA EVENT, STEWARTBY VILLAGE HALL, 5TH JUNE 2010**

C.2.1 **PERCEIVED HEALTH AND WELL BEING IMPACTS ASSOCIATED WITH THE PROJECT**

C.2.1.1 **Emissions and Air Quality**

1. Concern was expressed about all other sources of emissions in the area, such as A421, and the cumulative impact of this.
2. The impact of emissions on agriculture and of the ingestion risk from pollutants entering the food chain – in particular via local products.
3. Concern over the quality and composition of emissions from the stack.
4. Emissions from vehicles.
5. Polluted rain and surface run-off leading to contaminated water.
6. Effects of the proposed wind turbine on the dispersion of emissions.

C.2.1.1 **Road Traffic**

1. Increased traffic on the local road networks particularly along Green Lane and the A421, increasing the risk of accidents, in particular, motorcycle accidents.

C.2.1.1 **Noise**

1. Noise disturbance from vehicle movements.
2. Noise impacts for residents living in a rural location will affect their quality of life.
3. Impact from noise on mental health due to distress, loss of sleep and decreased wellbeing.
4. People in the area have a “human right to a peaceful rural existence”.

C.2.1.1 Visual

1. There will be a visual impact which will be enhanced by the cumulative impact of other proposed developments in the area eg wind farm.
2. Appearance/presence of RRF would detract from the visual character and enjoyment of the site area.

C.2.1.1 Green Space

1. The facility will inhibit the use of green areas and footpaths due to the visual impact of the stack and buildings
2. Reduction in air quality over the Forest of Marston Vale

C.2.1.1 Fly and Bottom Ash

1. If there are road traffic accidents with lorries carrying fly ash, does this pose a health hazard?
2. Concerned about the risk of exposure to dioxins in fly ash and the risk of public exposure if an accident occurs at the facility or involving transport lorries.
3. Concern about the handling and disposal of fly ash.
4. health risks of bottom ash and its use in the construction industry.
5. Concerns around a repeat of the Byker incident when ash containing large amounts of dioxins was spread onto footpaths and mixed with soil for allotments

C.2.1.1 Employment

1. People are not too concerned with the potential influx of construction workers as there have been no issues with the construction workers associated with the A421.
2. Employment benefits will be minimal, especially for local people.

C.2.1.1 Trust

1. There is currently a low level of trust with Covanta, which local residents feel is deteriorating.

2. There is concern about EA regulators and their ability to ensure there are no disasters at the facility which may impact the community.
3. Concern was expressed that the EA do not enforce restriction or revoke licenses if pollution limits are breached by developers/facilities.
4. There is concern that there will be an expansion of the waste permit once operational to include other wastes such as hazardous, clinical and medical waste. Concern regarded quality but primarily the effect the change in waste might have on emissions.
5. There is concern around Covanta's operations in the USA and integrity of the organisation.

C.2.1.1 General Comments

1. Concern over the impact of house prices and people being unable to sell their homes.
2. Covanta newsletters are not being received by people in the area.
3. Impact on stress/mental health collective. There was a collective sigh of relief when the Brickworks and landfill closed. Stress levels consequently reduced, now they will go up again.

C.2.1.1 Recommendations

1. Real time emissions data published on the web.
2. Monitoring results backed up and confirmed by EA.
3. Ongoing investment in technology to lower emissions by Covanta.
4. Measures put in place to detect metals, clinical waste and radioactive material to prevent them being put in the incinerator.
5. Waste to be transported by rail or barge rather than road
6. Funding for medical research into the health impacts on the local communities.
7. Fund for assistance to cope with resultant stress causing mental health issues.
8. Communication of a disaster management plan and assessment of Health impact of worst case scenarios

9. Retrospective fitting of any new best practice filters.

C.3 COMMUNITY HIA EVENT, THE FOREST CENTRE, 8TH JUNE 2010**C.3.1 PERCEIVED HEALTH AND WELL BEING IMPACTS ASSOCIATED WITH THE PROJECT****C.3.1.1 Emissions and Air Quality**

1. Participants were keen to understand the difference between what emissions will come out of the proposed facility compared to what came out of the Brickworks.
2. Air quality impacts associated with increased traffic on the roads.
3. Concern over emissions exceeding permitted levels.
4. Concern over plume height.
5. Participants felt that there was already a history of asthma in the area, which improved when the Brickworks closed down. There is the worry that this problem will increase again with emissions from the facility and increased traffic.
6. Concern over cancer related to emissions.

C.3.1.2 Road Traffic

1. The A421 will not be able to take the increase in traffic.
2. Increased traffic will cause congestion and more accidents on the roads.

C.3.1.2 Noise

1. Noise levels in the area are low since Brogborough Landfill closed. Concern that noise levels will increase again.
2. Increase noise associated with traffic.

C.3.1.2 Visual

1. The visual impact of the facility will impact on peoples' health (wellbeing).
2. The design of the facility is very box like and ugly.

C.3.1.2 Green Space

1. People will not want to use the area anymore for recreation, which will also negatively impact tourism.

C.3.1.2 Fly Ash

1. Will dust from the fly ash that comes out of the facility be a health hazard?

C.3.1.2 Employment

1. The construction workforce will be too small to notice in the area.
2. When the plant becomes operational, any jobs will be specialist and therefore will not go to local people; however this is not a concern.

C.3.1.2 Trust

1. People are concerned that there is a lot of uncertainty in what the composition of emissions will actually be and that Covanta does not know this information.
2. There is lack of trust and worry about what waste will be put into the facility and that the wrong type of waste will be burnt.
3. The question was raised of future scientific research revealing a health effect associated with incineration emissions that are currently unknown.
4. There is a lack of trust within the community of the EA and the rigour of their regulation and enforcement. This is, in part, borne of the experience of the brickworks and landfill operations.
5. The EA limits are set by government and the EA only monitors some pollutants in line with regulations and will not monitor other pollutants of concern. There is a feeling that Covanta will breach limits as the EA will not be monitoring every pollutant and some will not be monitored on a continuous basis.
6. There is mistrust in the reliability of air quality figures presented in the ES, following the reports of Covanta being fined in the USA for breaches of permits.
7. People expressed an opinion that if there was an accident or emergency event there is no way of getting rid of Covanta (analogy of BP oil being leaked in the US currently).

8. There is local perception that Covanta will become friendly with the EA and then be allowed to breach air quality limits.

C.3.1.2 General Comments

1. Participants commented that the Brickworks served a social purpose by providing employment to a whole community; this project, however, does not.
2. The risks associated with this project are too high.
3. Participants said that waste should be disposed of close to where it is produced and expressed disquiet about having to take other counties waste. 'Bedfordshire is like a tipping ground'.
4. One participant noted that the health problems of not disposing of waste and having waste management facilities, such as the proposed project, could be far greater.
5. Health impacts will be felt most in the younger generations.
6. People will develop mental and physiological health impacts due to the project.
7. If recycling rates increase, there won't be enough available rubbish for the incinerator and therefore other waste types will start being burnt.
8. People will be unable to sell their houses which will cause stress and mental illness.
9. The community fund is a bribe and 10% cheaper electricity is an insult.
10. No one will use the Forest Centre as they are now considered as being in Covanta's 'pockets'. One participant has withdrawn their voluntary services from the Forest Centre due to the proposal.

C.3.1.2 Recommendations

1. Rail links should be used to bring waste instead of the roads.
2. Sealable trucks should do round trips, bringing in waste and taking away fly ash, to reduce HGV numbers.
3. The facility could be designed to look nice, maybe being grassed on top.

4. A swimming pool for the community could be provided by Covanta which is heated by the heat produced.
5. The facility should look and be cutting edge.
6. The facility should be 25% of the proposed size.
7. The community fund should be £50 million so the community actually benefit.

Presentation Given at the HIA Workshops



Health Impact Assessment of Rookery South Resource Recovery Facility

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The aim of the meeting is to:

1. Explain and describe

- the Rookery South Resource Recovery Facility and;
- the Health Impact Assessment process

2. Discover your views and concerns about the scheme in terms of health impacts

3. Enable you have an opportunity to help us develop recommendations that will maximise positive and minimise negative health impacts

The findings of the engagement are important and will be used to inform the Health Impact Assessment.

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Who are we?

- **Environmental Resources Management (ERM)** is an *independent* consultancy company.
- We have been commissioned by Covanta to assess potential health impacts of the proposed Resource Recovery Facility.
- A key part of our role is to engage with groups and individuals in the local area (including local authority workers, health workers and the public) to discuss potential health impacts.

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Site Map



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The proposed project...

- Energy from Waste (EfW) Facility exporting enough electricity to meet the needs of approximately 82,500 homes.
- Materials Recovery Facility (MRF) recovering secondary aggregate and metals from the EfW process.
- 20 lorry HGV park
- New access from Green Lane
- Underground connection to the National Grid

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What is a Resources Recovery Facility?

- **Household and business waste will be burnt at high temperature, producing steam to drive turbines to produce electricity.**
- **Electricity will be fed into the National Grid.**
- **Ash and residual metals will be transferred to the Material Recovery Facility. Metals will be recycled and bottom ash will be recovered for use in the construction industry.**

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Time Table

- **Planning application –Summer 2010**
- **Construction would commence in Summer 2011**
- **The Facility would open between February 2014 to September 2014.**

Construction

- **Construction** will last for 39 months when there will be an average of **180 people** required each month.
- **Working hours** will be 07.00 to 19.00 Monday to Friday (excluding Bank Holidays) and 07.00 – 13.00 on Saturdays.
- **Additional employment opportunities** as a result of construction

Operation

- **The EfW plant will operate 24hours a day, 365 days a year.**
- **The MRF will operate 07.00-18.00 Mon-Fri and 07.00-14.00 Sat and closed on Sun.**
- **Approximately 61 full time equivalent jobs will be created by operation of the facility.**

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Transportation

- **For the nominal plant throughput, approximately 180 HGV deliveries per day would be generated, along with approximately 90 other vehicles accessing site.**
- **The majority (between 75% and 90%) of HGV deliveries would take place between 8am and 5pm but for operational flexibility Covanta need the ability to move HGVs between 5am and 11pm.**

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Community Investment

- Proposed 10% rebate on electricity bills to 8,500 homes in Millbrook, Stewartby, Marston Moretaine, Houghton Conquest, Lidlington, Ampthill and Wooton.
- Proposed Community Trust Fund £150,000 in 1st year of operation and £50,000 each year after.
- Proposed Forest of Marston Vale Trust Fund of £250,000 in 1st year and £50,000 each year after.
- Visitors Centre.
- Proposed strategy to enhance severed footpaths.

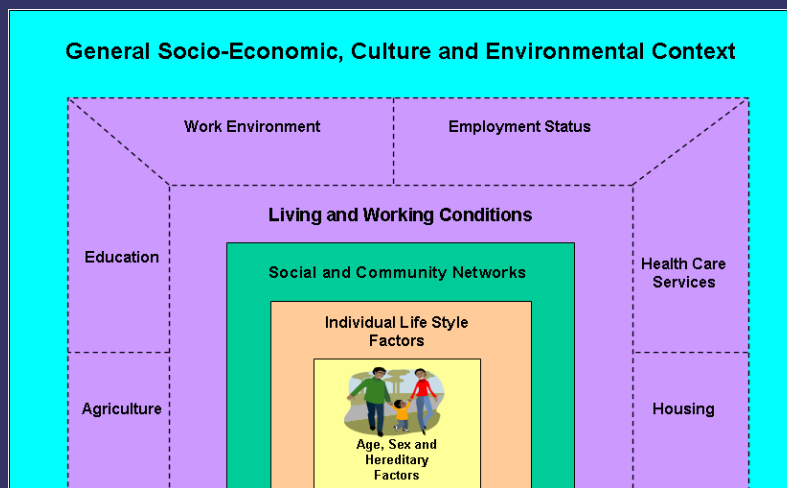
What is HIA?

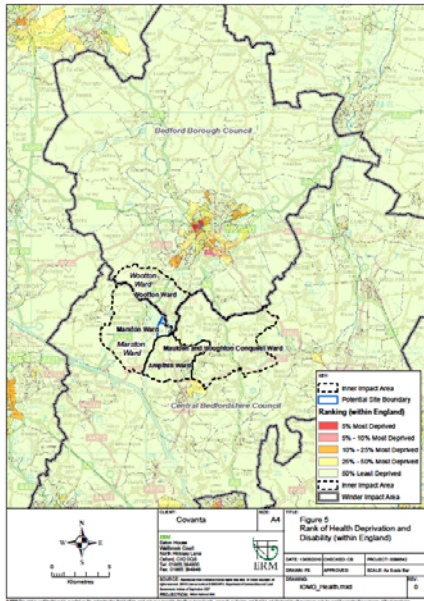
- **A tool to *identify* and *manage* the potential human health impacts resulting from a project**
- **HIA gives communities a voice in the process, to ensure that all effects are captured**

What is Health?

- **Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity - WHO 1948**

Socio-Economic Model of Health





Current health status in Bedfordshire

(based on self reported census data)

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Some of the factors that **might** affect health and wellbeing:

- Traffic and road safety
- Landscape / visual impacts
- Noise
- Air quality
- Employment
- The natural environment / green space
- Social capital

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Social capital

- Social capital represents the social cohesion in communities i.e. processes between people the establish networks, relationships, ways of behaviour and trust
- Many factors affect social capital e.g. *Inward migration of people or large numbers of commuters can change the way people live and interact in a community*
- Some research suggests that high levels of social capital are associated with positive health and wellbeing

Activities:

Identify Key Health Issues

1. Using post it notes list as many health impacts as you can think of and stick onto flip charts in relation to:

- a) The proposed project and physical health
- b) The proposed project and well being

Write both Positive and Negative impacts and include anything you can think of.

and then....

1. Discuss how you feel the project will influence local peoples' health.
2. Prioritise the potential impacts on health, based on 'post its' and discussion.
3. Develop recommendations to maximise positive and minimise negative health impacts.

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ERM

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HIA timetable

- **data collection, profile and scope: May 2010**
- **stakeholder engagement: 24 May – mid June**
- **workshops on 25 May, 5 June and 8 June**
- **assessment phase: June**
- **report submission: mid July**

Key Facts and Figures

- **The nominal capacity of the EfW plant is 585,000 tonnes/year not exceeding 645,000 tonnes/year.**
- **Operations area covers 13.76ha of the 95ha Rookery South site.**
- **The stack is 105m high while the roof of the building is 43m.**

Upgraded Access Junction

- Access will be at the same location as existing access.
- Green Lane will be widened to provide a Ghost Right Turn Lane.
- A central island pedestrian refuge will be provided on Green Lane to aid crossing of the road.
- The access road will also have a centre island.
- verge and pavement works will be undertaken.
- vehicles entering and exiting the site via the access road will have to stop at a barrier controlled by a security gate.

Annex D

Covanta's Response to the HIA



Covanta Response to the ERM Rookery HIA

Introduction

Covanta welcome the independent Health Impact Assessment (HIA) report and is pleased to read that the issues and recommendations it contains echoes the information the Company has addressed in the Environmental Statement and other documentation accompanying its application for development consent to the Infrastructure Planning Commission.

Although the HIA is not a statutory requirement, when NHS Bedfordshire had a change of stance and decided it would like to see a full HIA commissioned, Covanta had no hesitation in engaging suitably qualified consultants.

There has been some debate over the timing of the research for this HIA report - which was commissioned towards the end of an extensive and robust 20 month consultation period. Covanta firmly believes sufficient time and resource has been given to the HIA to ensure its findings would be informed, legitimate and pertinent. By conducting the research towards the end of the consultation programme it meant there was a sufficient supply of information and awareness amongst both the general public and professionals. This enabled a concentration of effort to be directed towards understanding the health and well-being impacts of our proposed development. There has been sufficient time to address the recommendations of the HIA within the parameters of the Project prior to the submission of the application to the IPC.

The methodology and approach taken in the HIA is well documented in the report on the HIA by ERM. We would only wish to add our thanks to all those who worked with the consultancy team for their time, effort and honest contributions.

Responses to the recommendations of the Health Impact Assessment

The HIA was conducted, researched and reported back to Covanta independently.

The Assessment raised a number of good ideas. The purpose of this report is to act as a response to the HIA's recommendations. For ease of cross referencing we have not tried to prioritise our responses, rather we have followed the order they appear in the HIA Report itself.

General recommendations

Ensure that tree planting is carried out in such a way as to achieve the maximum and the earliest screening.

The screening strategy within the Application Site includes earth bunding, new planting and management of existing planting.

Planting for the RRF is illustrated in the Environmental Statement (see Chapter 3) and Design and Access Statement. With reference to new planting the Landscaping Strategy is to develop two lines of woodland screening; one on the outer edges of Rookery South Pit to the south, west and east; and the second comprising planting within Rookery South Pit. Within the pit itself planting is proposed on the extensive screening bund around the Operations Area to the south and east and a line of tree planting to the west. Just to the north of the Operations Area (but still within the pit base) extensive tree planting of woody blocks is proposed and larger standard trees are proposed in the Operations Area itself.

The woodland planting would comprise forestry stock, ideally sourced from a local nursery. The sizes and species of proposed planting have been discussed with the Marston Vale Trust based on their extensive experience of plant establishment in the Millennium Country Park. In addition, planting along the south western portion of the screen bund has been specified with areas of planting at a slightly larger size to give more immediate effect in the more exposed area where the tipping hall ramp rises out of the pit base. Planting plans are contained in the Application detailing planting stock and location. The strategy is to generally plant small stock that will establish quickly and put on early growth and provide good screening, and avoiding planting large stock that is likely to go into 'shock' and provide poor growth and likely high failure rates. This strategy accords with good practice. The implementation of the Landscape Strategy will be secured by a requirement attached to the any Development Consent Order (DCO) authorizing the Project.

Existing planting in the north and north west of the Application Site and the existing woody area at the south east corner of Rookery South Pit would be retained and managed for ongoing screening effects. Discussions with the Marston Vale Trust regarding the use of existing woodland planting and localised reinforcement within the Country Park itself have also been progressed and will be secured by way of a legal agreement with the Trust and/or a Development Consent Obligation under s106 Town and Country Planning Act 1990 (as amended) (DCOb).

Ensure open communications and sharing of information including:

- *The display of emissions data on the web site and in the visitor centre in a form that is accessible and as close to real time as possible.*

Covanta wishes to work with the established Community Liaison Panel to agree the best and most helpful way of publicly displaying its emissions data. In particular it believes the information should be in terms the general public understands and that the indices should relate to the permitted levels (according to prevailing legislation and the Environmental Permit).

This information will be displayed in the visitor centre/education facility to be provided within the EfW Facility and, if desired, at other public buildings. It will also be accessible on the Company's website. Information which must be supplied to the monitoring authority (the Environment Agency) will also be made publicly available although this will be a more complex series of measurements and analysis. We will include this as a legal obligation in the DCOB.

The Community Liaison Panel already has the authority to request Covanta staff or its consultants to attend meetings to be quizzed over technical matters. This includes being able to ask questions about emissions data. The Community Liaison Panel will continue following implementation of the Project and the DCOB will maintain these arrangements.

- *The provision of information on Covanta's operations and issues globally (notably in the USA).*

Covanta already has a global web site which identifies European, Asian and American operations. The company's information policy is one of honesty and transparency and it has never sought to hide information (other than that which is commercially sensitive) from public examination.

In recent years campaigners opposed to Energy-from-Waste have used – and misused – information from the web site in an attempt to persuade people against our technologies and operational practices. Usually the claims made against us are inaccurate or distortions. The public also gathers information from protest and environmental groups who disagree with our waste management solutions.

However, we respect the freedom of international communications and do not seek to stop people expressing their fears and concerns.

In addition the media is a very strong additional force watching and commenting upon our operations. The Company has nothing to hide – nor does it attempt to do so. We will continue to use the web site to distribute information about the Company and its world wide operations.

- *The production and distribution of regular newsletters describing project progress, highlights, emissions data and any formal breaches of permit*

The company has produced a number of information guides (leaflet, newsletter, exhibition, press advertisements, on-line information) and it has been pro-active in distributing printed information to those living closest to the proposed development (some 15,000 addresses).

This programme of information dissemination will continue throughout the planning, construction and operational phases of the Project's life.

In the future, the degree of detail and frequency of publication will be determined in part by the wishes and expectations of the local communities – especially the Community Liaison Panel - to ensure it is meeting all reasonable expectations. We will include this as a legal obligation in the DCOB.

Any Permit breaches will be reported.

- *A demonstration that the processes and procedures for dealing with bottom ash and fly ash cannot result in harm, even in the event of road traffic accidents*

The Community Liaison Panel had already asked this question and a full presentation followed by a question and answer session took place at CLP meeting 11 dealing with bottom ash. The note of that debate has been published on the Covanta (Rookery CLP) web site. We are happy to provide further information on these areas should this be helpful.

Provide transparency around the methodology used to develop community benefits programmes

Community benefit programmes fall broadly into two categories:

- measures to mitigate against the impact or enhance the surroundings as part of an overall planning approach and,
- measures which demonstrate good neighbourliness and help with the well-being of the immediate area.

In both instances, we believe these “benefits” work best on a bespoke basis and should come from the communities they are intended to serve. Therefore consultations held with statutory and prescribed consultees tend to inform and generate ideas while bodies such as Parish Councils, local schools and the Community Liaison Panel are encouraged to come forward with very local suggestions and ideas. Local initiatives are likely to be funded via a Trust Fund. We will include this as an obligation in the DCOB.

Establish a community complaints procedure in addition to the retention of the Community Liaison Panel

Covanta already has a complaints procedure which covers general inquiries as well as inquiries during the construction and operational phases. This sets out:

- 1) methods of communication (telephone, email, letter, face-to-face);
- 2) how to make a complaint and how the complaint will be addressed – and how quickly; and
- 3) a complaints review panel for those who feel the complaint has not been addressed properly.

This complaints procedure will be publicised and explained to the CLP and the wider local community. We will include this as a legal obligation in the DCOB.

Communicate the plans for responding to accidents within the Operations Area, as contained on the Environmental Permit application – for example.

The Project does not, in itself, pose a serious risk. Covanta has a long track record of successful and safe operations - as does the industry as a whole. However, Covanta will implement an Emergency Plan following consultation with the local authorities and the emergency services. It will also consult the

Community Liaison Panel. The Plan will address all eventualities such as a major fire, explosion, collapse of a structure, serious injuries, spillages and exposure to toxic substances.

The Plan will also address the appropriate response to natural occurrences (lightning storm or flooding) and security issues (such as civil unrest or acts of terrorism).

The Plan will detail who will be responsible for what; the resources and equipment available and a clear procedure for dealing with any emergency. This will include the frequency required for testing equipment, personnel and the robustness of the Plan. It will include a medical emergency plan for dealing with injuries.

Periodic drills, including liaison with external organisations, training and the incorporation of lessons learned, will also form part of the Plan.

Covanta will communicate the potential for hazards to employees, subcontractors and site visitors. It will also ensure the public living in the neighbourhood (and the emergency services serving the area) are aware of the Plan and how to access public safety information contained within it.

Our primary goal is to operate a safe plant but in the unlikely event of a problem occurring we will have a rehearsed and resourced Emergency Plan ready to minimise its impact. The requirement for such a Plan is contained within the regulations governing the operation of the Facility and will form part of any Environmental Permit for the Facility.

Construction recommendations

Ensure contractors are signed up to the Considerate Constructors Scheme and that they operate best practice in this regards.

Covanta is committed to high standards of construction practice on all its construction sites. We will register the Rookery South site with the Considerate Constructors Scheme and will require all its contractors to observe the scheme's site code. This will be a requirement of the Code of Construction Practice imposed by requirements attached to the DCO.

Communicate information regarding construction activities throughout the construction period to the most local communities

Covanta will give the local community advance notice of its intention to begin construction works on site. It will then provide an update at regular intervals based around key milestones which might have a local impact.

There will be a member of staff able to assist with telephone inquires made to a dedicated and publicised telephone information line. Further and more detailed information will be published on the Covanta Rookery web pages.

Updates will also be provided to the Parish Councils, the local media and the Community Liaison Panel. Information will also be posted at the site entrance.

The CLP will be asked to judge the effectiveness of these communications and Covanta will keep these procedures under review so that improvements can be made as may be necessary.

This will be a requirement of the Code of Construction Practice which itself will need to be adhered to as part of any issued DCO.

Ensure that the construction site area is secure and not vulnerable to trespass

Covanta will employ the services of a site security contractor who will undertake general duties in accordance with the construction security plan. This plan identifies potential security threats including:

1. unintentional or accidental interference by unauthorised persons;
2. intentional acts of vandalism or sabotage; and
3. theft of plant, equipment and materials.

From a security point of view, the facilities that may be the target of third party interference include:

1. the construction site;
2. access roads;
3. the conservation areas; and
4. transportation of goods from vendors.

Covanta will employ the services of a security contractor who is a member of the British Security Industry Association. They will help with the implementation of the site security strategy and identify any shortcomings in the plan.

During the construction phase, Covanta and its subcontractors will develop and implement security procedures to protect personnel and materials. This will include the detection and exclusion of unauthorised persons from the site.

This will be a requirement of the Code of Construction Practice which itself will be made part of any issued DCO.

Operational recommendations

Implement an effective maintenance and upgrading of the facility as appropriate including fitting of best practice technology when available, as directed by the Environment Agency as part of the Environmental Review.

All facilities permanent and temporary shall be operated and maintained within their intended use and design envelope to ensure safe, secure, healthy and environmentally sound performance.

This shall be achieved through:

1. effective procedures;
2. structured inspections and actions management;
3. maintenance programs;
4. quality equipment and materials;
5. competent personnel; and
6. application of best industry practices.

Covanta will follow the Environment Agency's policy of regular and formal reviews of best practice as detailed in the Environmental Permit.

Appropriate and sensible procedures should be put in place to prevent inappropriate waste being put in the furnace and these procedures should be explained to the Community Liaison Panel.

Checks will be made on the paperwork accompanying each delivery to ensure that only waste for which the plant has been designed will be accepted at the Facility.

Vehicles entering the tipping hall will be selected on a random basis for inspection of their waste load. The selected loads will be discharged onto the tipping hall floor and visually inspected. Any unacceptable items will be separated and stored in either a designated quarantine area or bulky storage bay within the tipping hall.

Commercial and industrial waste deliveries will be accompanied by a waste transfer note which will identify the wastes in each delivery. If unacceptable wastes are listed on the waste transfer note, the delivery will be rejected. Similarly, if the waste, on inspection, does not match the waste transfer note then the delivery will be rejected.

Radioactive detectors would be installed in the vicinity of the weighbridges within the Operations Area to detect any loads which contain radioactive material. Any such loads would be rejected and returned to the source.

This topic was covered in the Community Liaison Panel meeting on 19 July 2010. These operating requirements will be a condition of the Environmental Permit that will be required to operate the Project.

Covanta has been able to positively respond to all the concerns raised in the HIA but it has not closed its ears. Through continued dialogue with bodies such as the local authorities, parish councils, the Community Liaison Panel and the NHS, the company will strive to allay unnecessary fears and work hard at being a good and responsive neighbour.

A handwritten signature in black ink that reads "Malcolm Chilton". The signature is written in a cursive, slightly slanted style.

Malcolm Chilton

Managing Director