



# **A guide to assessing the health and wellbeing impacts of opencast mining**

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## About this guide

This guide has been written to help, support and advise individuals and organisations (local authorities, community members, voluntary organisations, local health boards, private developers and consultants and others) carrying out or considering carrying out a health impact assessment on an opencast mining proposal. It:

- Provides an introduction to opencast mining<sup>1</sup>
- Outlines the policy context in Wales
- Reviews literature on opencast mining and its potential impacts on the wider determinants of health
- Outlines the health impact assessment (HIA) process, how this relates to opencast proposals and developments and how to use the evidence to inform the HIA
- Discusses issues of environmental injustice and risk perception
- Examines the role of HIA in public inquiry
- Gives examples of completed opencast mining related HIAs
- Suggests the most effective ways to involve the public in HIAs of this kind
- Aims to summarise and demonstrate best practice relating to HIA and opencast in Wales and contribute to the formulation of more widely applicable principles

The guide focuses on the potential health impacts of opencast mining on the wider determinants of health in relation to local communities and the surrounding areas. Whilst there has been considerable research on the impacts of mining (opencast and deep) on the health of mine workers (Burdorf and Monstere 1991, Finkelman et al 2002, Boulanger and Gorman 2004, Stephens and Ahern 2001 and Gerschick et al 2009) there has been limited work on wider community health impacts of opencast mining.

## Scope of the literature review

The literature review offers an overview of the research evidence on the potential positive and negative health impacts of opencast mining. The focus of the review is on the health impacts on communities living and working near opencast mines rather than on occupational health and safety of people working on mining sites. Whilst the review does cover some areas that would be included within an Environmental Impact Assessment (EIA) these are addressed within the context of the wider determinants of health, and in conjunction with socio economic and other impacts. The potential climate change impacts of opencast mining on human health are not considered within the review.

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<sup>1</sup> Opencast mining is not always referred to as such. Alternative terms include land reclamation, coal recovery, open pit (United States) and surface mining. For the purpose of this guide the term opencast is used to encompass these terms.

# Section 1: Background

## Introduction

Mining is an essential for domestic and industrial energy production, both in the UK and throughout the world. Coal, clay, gold, iron and limestone are all extracted for energy generation and to make products that we use in our day to day lives. However, mining operations are often maligned for the perceived significance of environmental and associated health problems, and environmental issues have and continue to rise to predominance on the political landscape. With current world focus on the impacts of climate change there is something of a juxtaposition between the need for sustainable, clean mining methods and energy production and the fact that the natural resources such as fossil fuels are one of the mainstays of our economy despite the fact that burning fossil fuels for example has been identified as one of the main contributors to the current climate situation.

The production in 1981 of the 'Flowers' report highlighted the relationship between energy production and the environment, with a particular focus on the expansion of opencast mining. This report highlighted then need for balance between the need for coal and the need to minimise damage to the British countryside and maintain amenity space. It categorically stated that *'even if the greatest care is taken in both extraction of opencast coal and the subsequent restoration of the land...opencast mining has a severe impact on the environment in both the short and long term'*. The link between the environment and human health is clear: quality of life is determined by many factors some linked specifically to environmental factors and some to wider health issues outside of the traditional bio-physical model of health.

## History of coal production in the UK



Coal production in the UK reached a peak of 287 million tonnes in 1913 and the UK remained a net exporter of coal until the early 1980's by which time of the 130 million tonnes of annual output approximately 15.8 million tonnes was from opencast mines. Large scale coal mining developed during the Industrial Revolution in the 18<sup>th</sup> and 19<sup>th</sup> century, with coal providing the primary source of energy for industry and transportation. During this period coal extraction moved from small scale surface extraction to deep pit mining, and expanded rapidly through the late 19<sup>th</sup> and early 20<sup>th</sup> century.

### History of mining in Wales

There is evidence of mining activity in Wales dating back as far as 1261 but it was during the 19<sup>th</sup> century that mine shafts were sunk to complement the existing shallow mines and further exploit the plentiful coal seams. Mining has long been a significant industry in Wales and with this it was also often at the centre of working class discontent, with the Merthyr Rising (1831) and Newport Rising (1829) being examples of the growing awareness of the work force of their importance to the nation. Mining was regarded as a hazardous enterprise, resulting in many accidents and impacts on the long term health of miners. The Big Pit, opened in 1880, was the first mine in Wales large enough to hold two tramways. Economics and politics following World War 1 and 2, the depression, nationalisation and miners strike had a significant impact on mining in Wales and on 18<sup>th</sup> January 2008 Wales' last deep mine, Tower Colliery closed.

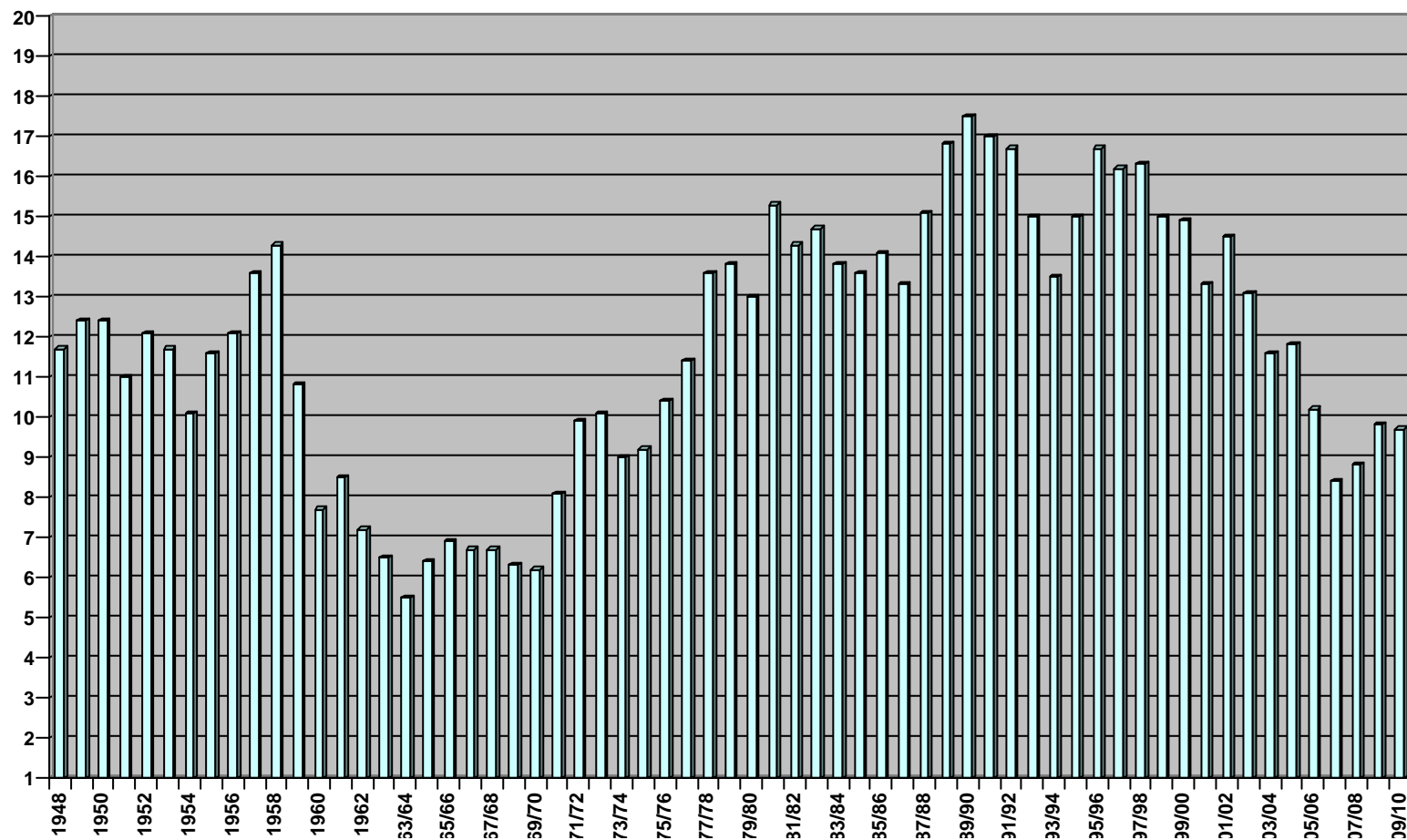


Figure 1: Summary of UK Coal Production from Opencast sites (1947 – 2010) UK Coal Authority ([www.coal.gov.uk](http://www.coal.gov.uk))

## Opencast coal mining: process and method

Opencast mining, a method of mining introduced in 1942 to maintain coal supplies during the Second World War, is a quarrying method that is viable where a coal seam is relatively near the land surface or where a pit can expose a number of seams within an acceptable depth (normally up to 100m in the UK). The rock lying over and under each seam (the 'overburden' and 'interburden' is excavated and stored nearby, exposing coal seams (including those that would be too thin to remove by deep mining) to be extracted. Capital and working costs are lower for opencast than underground mines and at the end of the working life of the mine the area is often filled using the overburden and restoration is undertaken.

The process of opencast mining is outlined in Beynon et al (2000), with reference to Hancock (1995); initially the overburden masking first coal seam is removed using electric rope shovels, also involving scraping the surface with a large steel bucket, consisting of a series of parallel cuts that progress across the site. This first cut (the box cut) excavates the coal seam by seam, using hydraulic shovels which dig out the coal and the overburden, transferring the matter to trucks for transportation via ramps to the surface. The excavation of the second cut forms a step between it and the box cut. These steps facilitate the movement of the trucks and the use of drag lines (which combine the function of the shovel and dump truck and involves a large bucket like construction with a serrated edge being attached to a chain and job, dragged along the surface of the coal seam and, once full, it is swung out of the hole and onto the stock pile).

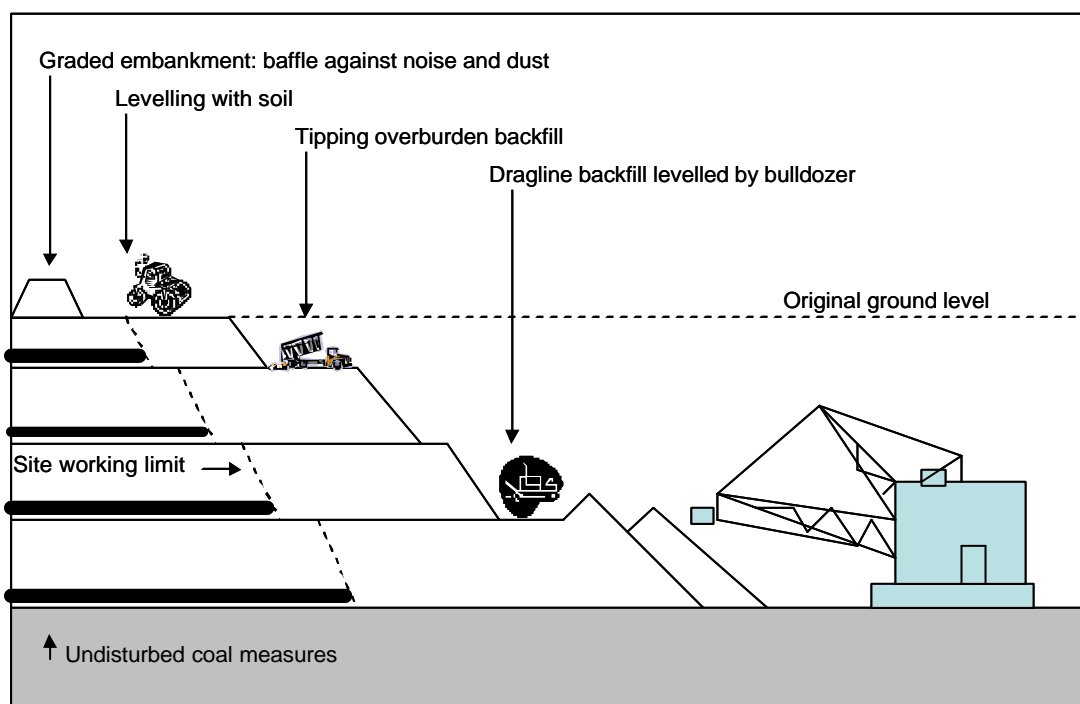


Figure 2: Opencast mining method  
Adapted from Beynon et al (2000)



## Coal mining in the United Kingdom

Coal mining in the UK passed into government control in 1947, and remained in public ownership until the 1980's and the decline of the industry after the miners' strike (1984-1985). The 1980's and 1990's saw significant change in the UK Coal industry, with the National Coal Board (by then British Coal) being privatised and pits sold off to private companies. At present there are approximately 35 coal mines in the UK with a significant number of applications in the pipeline or sites awaiting commencement of mining. Statistics show that whilst opencast coal production in England has decreased steadily since 1985 the pattern is less stable in Scotland and Wales:

Table 1: Summary of UK Coal Production from underground and opencast mining ([www.coal.gov.uk](http://www.coal.gov.uk))

	2009	2008	2007 <sup>2</sup>	2006 <sup>3</sup>	2005 <sup>4</sup>	2004 <sup>5</sup>	2003 <sup>6</sup>
<b>England</b>							
Underground	7396659	7817120	7327091	7710563	9759277	11081770	14093591
Opencast	2137394	2138567	1811264	1018294	1204281	2720132	3673614
<i>Combined</i>	<i>9534053</i>	<i>9955687</i>	<i>9138355</i>	<i>8728857</i>	<i>10963558</i>	<i>13801902</i>	<i>17767205</i>
<b>Wales</b>							
Underground	98842	110252	167937	439720	558014	431112	570878
Opencast	1597906	1632731	1082150	1251737	1209982	1426189	1176969
<i>Combined</i>	<i>1696748</i>	<i>1742983</i>	<i>1250088</i>	<i>1691456</i>	<i>1767996</i>	<i>1857301</i>	<i>1747847</i>
<b>Scotland</b>							
Underground	0	0	0	0	0	0	0
Opencast	6036770	5678068	5921288	6142640	7738667	7632127	6776041
<i>Combined</i>	<i>6036770</i>	<i>5678068</i>	<i>5921288</i>	<i>6142640</i>	<i>7738667</i>	<i>7632127</i>	<i>6776041</i>

At the time of writing there are currently eight operational opencast mining sites in Wales; one each in Carmarthenshire, Merthyr Tydfil and Powys, and five in Neath Port Talbot. The results from the 2008 Opencast Coal Survey report that in 2008 these Welsh sites combined produced approximately 1.6 million tonnes of saleable coal, an increase from the 2007 figure of approximately 1 million tonnes. Coal from opencast sites in Wales is used to run coal fired power stations within Wales and further afield.

Figure 4: Wales opencast production (1985 – 2007)

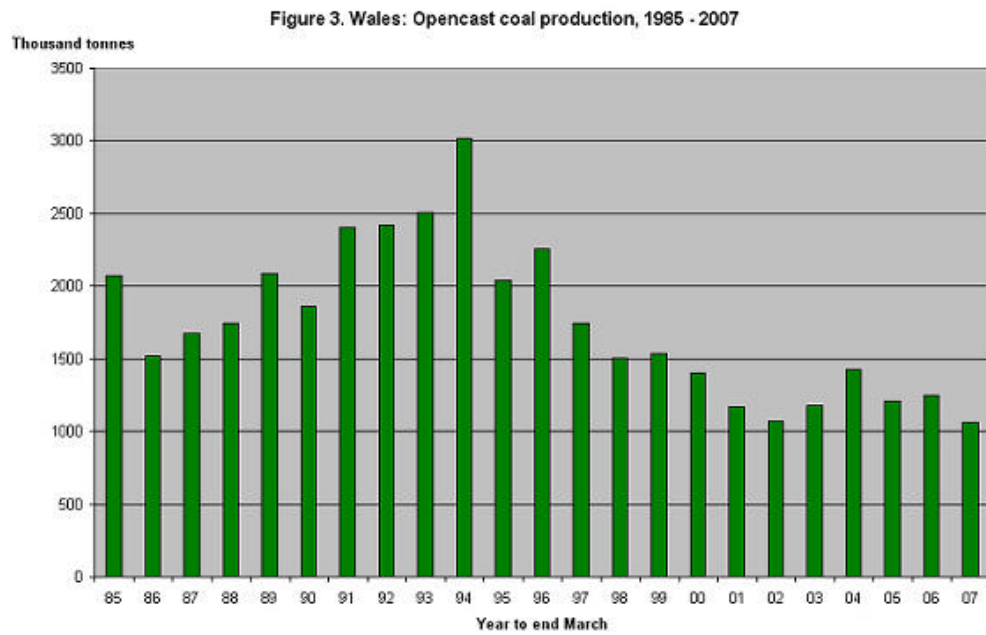
<sup>2</sup> April 2007 – March 2008

<sup>3</sup> April 2006 – March 2007

<sup>4</sup> April 2005 – March 2006

<sup>5</sup> April 2004 – March 2005

<sup>6</sup> April 2003 – March 2004



The opencast coal seams in Wales are concentrated within the south of the country, with the main mining areas being situated within the south Wales valleys: (needs to be redrawn showing mines in Wales: info available on [coalintheuk.org](http://coalintheuk.org))

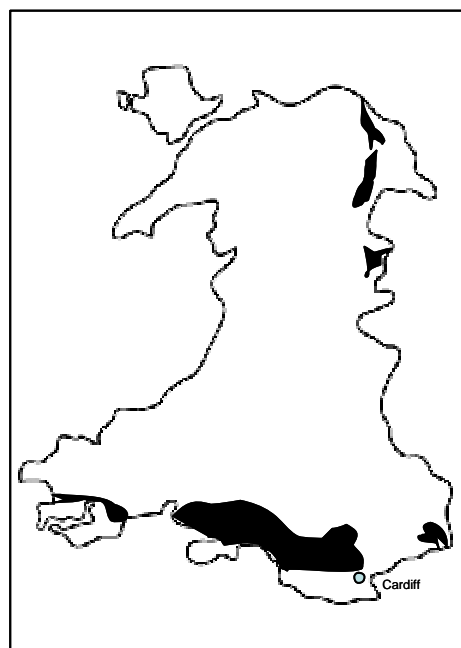


Figure 5: Areas of shallow coal deposits in Wales  
Adapted from Beynon et al (2001)

## **The economics of opencast**

There are a number of arguments frequently cited for the mining of coal through opencast methods, even in the face of significant protest from communities living in proximity to the sites. Arguments presented in defence of opencast coal mining include that it can be produced profitably at low cost; coal can be blended with deep mined coal to produce a more attractive product; that opencasting provides certain coals (anthracite and coking) that are in short supply in the UK and would otherwise have to be imported (Michael Spicer in Beynon et al (2000) p 71); that opencast mining is generally considered to have a lower production cost per tonne than deep mined coal, and as such provide greater economic benefit to the country. This however needs to be balanced against potential health impacts, the fact that by their nature extractive industries tend to be short term and transient hence not offering a long term solution to energy issues, and also against the wider climate change implications of reliance on coal and coal fired power stations as sustainable options for future energy production.

Part of opencast coal applications often focus on the promise of providing jobs for local people, hence improving the economic profile of what are often deprived areas. However, there is some question as to whether these jobs materialise, and even if they do, if local people possess the necessary skills to fill the roles. The issue of employment relating to opencast sites is discussed in more detail later in this guide.

A further argument presented in Beynon et al (2000) is that, for those companies operating both deep and opencast mines, in terms of cost, when one opencast coal site ceases production it may be more sensible to compare the costs of opening a new opencast site with the additional or marginal costs of obtaining the additional tonnage from existing deep mines. It would therefore be arguable that there would be many occasions when the presence of excess capacity in the deep mines would make deep mine coal more attractive in terms of cost (although this argument does not apply to those firms operating exclusively in the opencast sector); hence providing food for thought for the argument that opencast mining is more economically viable.

## **Policy context in Wales:**

### **Historical background and influences on current policy**

The One Wales agreement between the Labour and Plaid Cymru groups in the National Assembly (June 2007) set out a progressive agenda for the government of Wales. Part of this agreement was a commitment to a sustainable environment including the introduction of Health Impact Assessments for open cast coal applications, together with buffer zones, and with an emphasis on planners and developers working closely with local communities.

The Environment Strategy is the Welsh Assembly Government's long term strategy for the environment of Wales and has five key themes, of which sustainable resource use covers material consumption and waste, water, soils, minerals and aggregates. Coal is a non-renewable natural resource and as such, in order to meet peoples need for energy, is to be extracted following the key principles and overarching objectives of sustainable mineral extraction set out in the Minerals Planning Policy Wales (MPPW), to;

- Provide mineral resources to meet society's needs and to safeguard resources from sterilisation
- Protect areas of importance to natural or built heritage
- Limit the environmental impact of mineral extraction
- Achieve high standard restoration and beneficial after use
- Encourage efficient and appropriate use of minerals and the re-use and recycling of suitable minerals.

In January 2009 the Welsh Assembly Government published the Minerals Coal Technical Advice Note 2 (MTAN2) providing advice for local planning authorities, applicants and other stakeholders and applying to both surface (open cast) and underground coal mining. The Sustainable Development Scheme adopted by the National Assembly in November 2008 recognised that the environment is Wales' greatest asset and that there is inter dependency between this environment and the economy of Wales, and the need to best utilise finite resources whilst preserving the clean and protected natural, social, cultural and historic environment.

#### **Key policy documents relating to opencast mining in Wales**

One Wales

[http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/27\\_06\\_07\\_onewales.pdf](http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/27_06_07_onewales.pdf)

Minerals Planning Policy Wales

<http://wales.gov.uk/docrepos/40382/epc/planning/403821/403828/MPPW.pdf?lang=en>

Minerals Coal Technical Advice Note 2

<http://wales.gov.uk/docs/desh/policy/090120coalmtanen.pdf>

The MTAN2 suggests that consideration of potential impacts on human health of planning applications for coal working should be considered in a health impact assessment (HIA) to be carried out as part of the broader environmental impact assessment (EIA). HIA is a method by which scrutiny and assurance can be provided that the potential impacts on people's health have been considered and can be adequately controlled (see later section on what HIA is). The requirement for HIA to be conducted as part of the EIA is in recognition of the fact that, in order to address expressed concerns, in addition to the assessment of technical evidence, the local community should be properly involved and that their views concerning the application should be heard. It recognises that the outcomes of the HIA are particularly important for individuals and communities and that their participation in the process is vital. The weight attributed to public opinion and viewpoints within the HIA is emphasised;

*“Case law has identified that public perceptions of harm can be a material consideration in planning decision making even if not objectively justified by the facts. However, little or no weight should be attached to those perceptions if they cannot be justified, for example if international standards for protection of public health are met”*

Importantly the Coal TAN also emphasises that when health is to be balanced against other policy objectives (such as those relating to economic development or sustainability) that this should be done in full knowledge of the consequences whether they be positive or negative, these core aims being based on the United Nations Convention on the Rights of the Child<sup>7</sup>, which should be considered during the scoping phase of the HIA. Further to this, for major developments<sup>8</sup> or for particularly sensitive receptors a Health Assessment Panel is recommended to advice from pre application to post closure.

## **Coal mining and the local development plan (LDP)**

### **What is an LDP?**

The local development plan (LDP) sets out plans for what can be built and where over a 15 year period. Each local authority in Wales is required to produce an LDP for its area. As part of the LDP strategic environmental assessment and sustainability appraisal will be undertaken, and increasingly in Wales health impact assessments are being undertaken as part of the LDP development process.

<sup>7</sup> The Convention is a universally agreed set of non-negotiable standards and obligations. These basic standards or human rights set minimum entitlements and freedoms that should be respected by governments. They are founded on respect for the dignity and worth of each individual, regardless of race, colour, gender, language, religion, opinions, origins, wealth, birth status or ability and therefore apply to every human beings worldwide. With these rights comes the obligation on both governments and individuals not to infringe on the parallel rights of others.

<sup>8</sup> Although what is defined as a 'major development' is not specified within the Coal TAN document

MTAN2 states that where relevant Mineral Planning Authorities (MPAs) should set out their strategy for sustainable management of the coal resource in their LDP, directing coal away from sensitive locations and ensuring that any community or environmental impacts can be mitigated. In areas where coal should not be worked, buffer zones around existing and proposed coal working sites and areas to be safeguarded should be shown as a minimum requirement on the proposals map. In defining those areas where coal working is not acceptable MPAs are advised to take into account proximity to settlements (not within 500m) or within International and National Designations of environmental and cultural importance and the Strategic Environmental Assessment (SEA) and Sustainability Appraisal (SA) may also identify additional areas of constraint for the LDP period (for example cumulative air quality impacts or where there is clear evidence that coal development would have had an adverse effect on proposals to attract or retain investment in an area).

### **Buffer zone exclusions**

A buffer zone is described as an area of protection around permitted and proposed mineral workings and MPAs must clearly define and indicate these in LDPs. In Wales these buffer zones are 500m around permitted or proposed working (from the site boundary for opencast mining) to settlements and working is not permitted within these zones unless there are exceptional circumstances. Factors for consideration include:

- Where coal working provides the most effective solution to prevent risks to health and safety arising from previous mineral working
- To remediate land damaged by shallow coal workings or mine waste, where coal working seems to be the most sustainable option
- Where topography, natural features such as woodland, or existing development, would significantly and demonstrably mitigate impacts
- Where major roads or railways lie between the settlement and the proposed operational area and coal working would not result in cumulative and in-combination effects
- Where the surface expression of underground working does not include the significant handling or storage of the mineral or waste
- Where the proposal is of overriding significance for regeneration, employment and economy in the local area or
- Where extraction would be in advance of other, permanent, development which cannot reasonably be located elsewhere

Whilst Wales and Scotland both have 500m buffer zones (Scotland's being set out in Scottish Planning Policy 16) there are currently no such exclusions in place in England.

## **HIA within EIA**

In Wales a Draft Ministerial Interim Planning Policy statement (DMIPPS) was released for HIA relating to coal mining. It is suggested that a planning application that may have significant effects on human health should be accompanied by an HIA, carried out as part of the statutory EIA. Traditionally the health aspect of EIA has been limited to bio physical health impacts, not taking into account the wider determinants of health, although moves have been made to broaden the health scope of EIA relating to mining in Canada (Noble 2005). It is advised that this HIA should be undertaken looking not only at technical and scientific evidence (that should be rigorously assessed) but also involving and informing the local community. Research carried out by WHIASU (Chadderton 2008) suggests effective methods for involving the public within HIA, recognising that the outcomes of health impact assessments are important to the individuals, communities and publics that they affect, and reinforcing that their participation and involvement in the process is considered beneficial as it adds local context to the HIA. The suggestion that an HIA should be carried out as part of the EIA is not admission that such developments necessarily have negative impact – it is suggested as a way to address expressed concerns. It also provides an opportunity to identify mitigation options that will protect health and may be beneficial. Whilst HIA can be conducted as part of an EIA, it can also be conducted as a stand alone assessment (whilst still taking the Environmental Statement (ES) into consideration).

The MIPPS states that the HIA should examine the potential health impacts in order to reassure publics that a certain level of scrutiny has been provided. Case law (such as the HIA on the Margam opencast mine in South Wales, WHIASU 2005) has identified that public perceptions of harm can be a material consideration in planning decision making, even if not objectively justified by the facts. However the MTAN2 goes on to state that little or no weight should be attached to these perceptions if they cannot be justified, for example if accepted international standards for protection of public health are met. In disagreement with this, research by WHIASU has suggested that (specifically relating to issues of dust – see later section) that existing standards were developed at a time when tolerance for dust was greater, and that these standards may no longer be acceptable or appropriate.

## Section 2: Health Impact Assessment

### Health Impact Assessment: Typologies and Process

Health impact assessment provides a way of applying evidence of different kinds and within the local context to an opencast proposal in order to inform decision making. It is important that this should be timed appropriately – at a stage in the planning process where the proposal is sufficiently well defined, in adequate depth, that it is possible to assess the potential impacts and take necessary action to minimise health risks and maximise health benefits. Whilst HIA is not currently a statutory requirement, as outlined previously a HIA with community participation is strongly recommended for opencast proposals in Wales.

#### Definitions

HIA practitioners traditionally embrace a holistic view of health, understanding that health is more than simply the absence of disease, and is instead a state of complete physical, social, mental and spiritual wellbeing. HIA is defined as *A combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.* (European Centre for Health Policy, WHO Regional Office for Europe. Gothenburg Consensus Paper (1999))

HIA aims to support and add value to the decision making process through systematic analysis of potential health impacts and developing recommendations for the maximisation of positive benefits, minimisation of health risks, promotion of greater equity and reduction in health inequalities. HIA is concerned with the overall improvement of health and the distribution of health effects within a population as health impacts are unlikely to affect all population groups in the same way.



Whilst HIA is a flexible and adaptable assessment tool there are a number of key principles and values that underpin it:

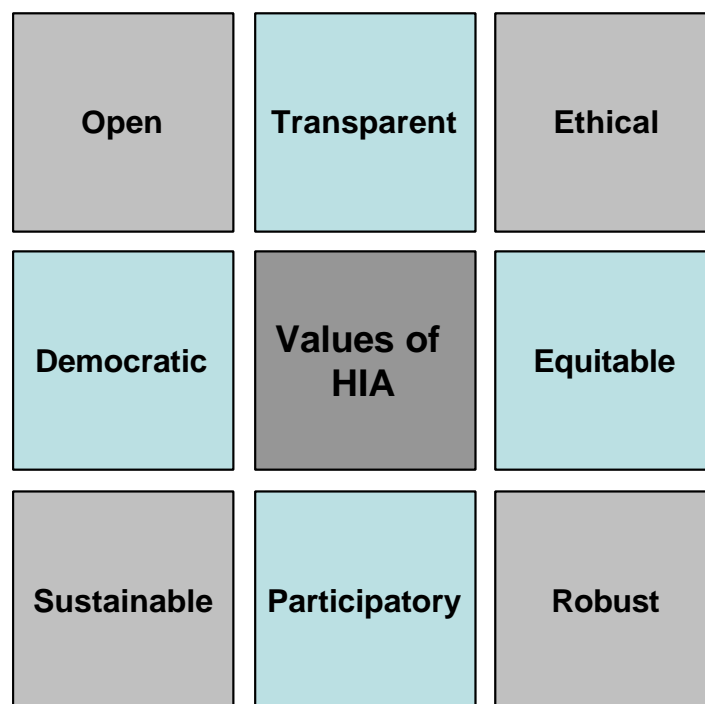


Figure 5: Principles of HIA

The HIA process should be **open**, involving a wide range of stakeholders; **transparent**, including the documenting of the process; **ethical** in its use of evidence and methods of participation; **equitable** through a presumption in favour of reducing health inequalities; **robust** in its methods for consideration of evidence and participation; **participatory** by actively engaging with and involving stakeholders from a wide range of organisations through appropriate methods; **sustainable** through consideration of impacts that are short and long term, direct and indirect in order to inform sustainably policies, programmes and projects and **democratic**, emphasising the rights of people to participate in major decisions that affect their lives and, through HIA, enabling people to actively participate and contribute to decision making processes.

### Types of HIA

The three types of HIA are prospective, concurrent and retrospective, with this being determined by the stage of the proposal when the HIA is undertaken, hence determining the level of influence any recommendations from the HIA are likely to have.

Prospective: this is the ideal way to carry out the HIA, at a stage where the proposal is under development and as such decision making can be influenced.

Concurrent: when the HIA takes place alongside the implementation of the proposal. Advantages include more detailed information about the proposal being available, but the potential to influence decision making may be reduced.

Retrospective: where the HIA is carried out after implementation of the proposal. This may be beneficial where a similar proposal is being considered and an assessment of health impacts of the existing proposal is required. This differs from evaluation as it focuses on how health has been affected which may not have been an explicit objective of the proposal.

HIA is a flexible and scalable tool and can be conducted at different levels depending on the proposal in question. Opencast mining it is likely that the proposals are complex, with many potential health impacts with a wide range of evidence to be considered on a range of determinants requiring assessment across a broad evidence base. Where local residents have conflicting or strong views about the potential impacts of opencast an assessment of the evidence is likely to be more challenging. It is unlikely that a desktop HIA (a quick process using only readily available evidence) would be suitable and investigate the health impacts in sufficient detail. A comprehensive HIA would allow consideration of the published research literature, expert knowledge with regards to local environmental, socio-economic and health conditions and community perspectives and concerns. More appropriate would be a comprehensive HIA, undertaken over a longer period of time and using more resources in order to examine the potential health impacts in depth. Alternatively, where time and resource constraints are in place, a rapid HIA (which sits between desktop and comprehensive) could be undertaken, building on HIAs of similar opencast applications. It is important to note that whilst HIA is a useful tool for assessing a wide range of health impacts, it may not be possible to 'use' HIA to prevent a development – rather its utility may be in suggesting mitigation measures to minimise negative health impacts and suggest potential positive ones.

There are five key steps in conducting health impact assessment, and although these appear to be linear in nature it is more likely that the HIA will be an iterative process, for example with stakeholder involvement raising additional issues for which evidence would be need to be examined. HIA relating to opencast proposals will follow these steps, with a particular focus on participation within the appraisal stage. The five steps are:

Step 1: Screening: Deciding whether an HIA is appropriate and necessary

Step 2: Scoping: Plan for what the scope of the HIA, how it will be managed and establishing roles and responsibilities

Step 3: Appraisal: Gathering, consideration and assessment of evidence, including building a community profile, reviewing literature and stakeholder involvement (through participatory workshops, focus groups, interviews etc.)

Step 4: Reporting and recommendations: these should be practical, achievable, wide ranging and a sensible number.

Step 5: Monitoring and evaluation: to assess impacts on health in the longer term and to assess whether the aims and objectives set at the outset of the HIA were achieved.

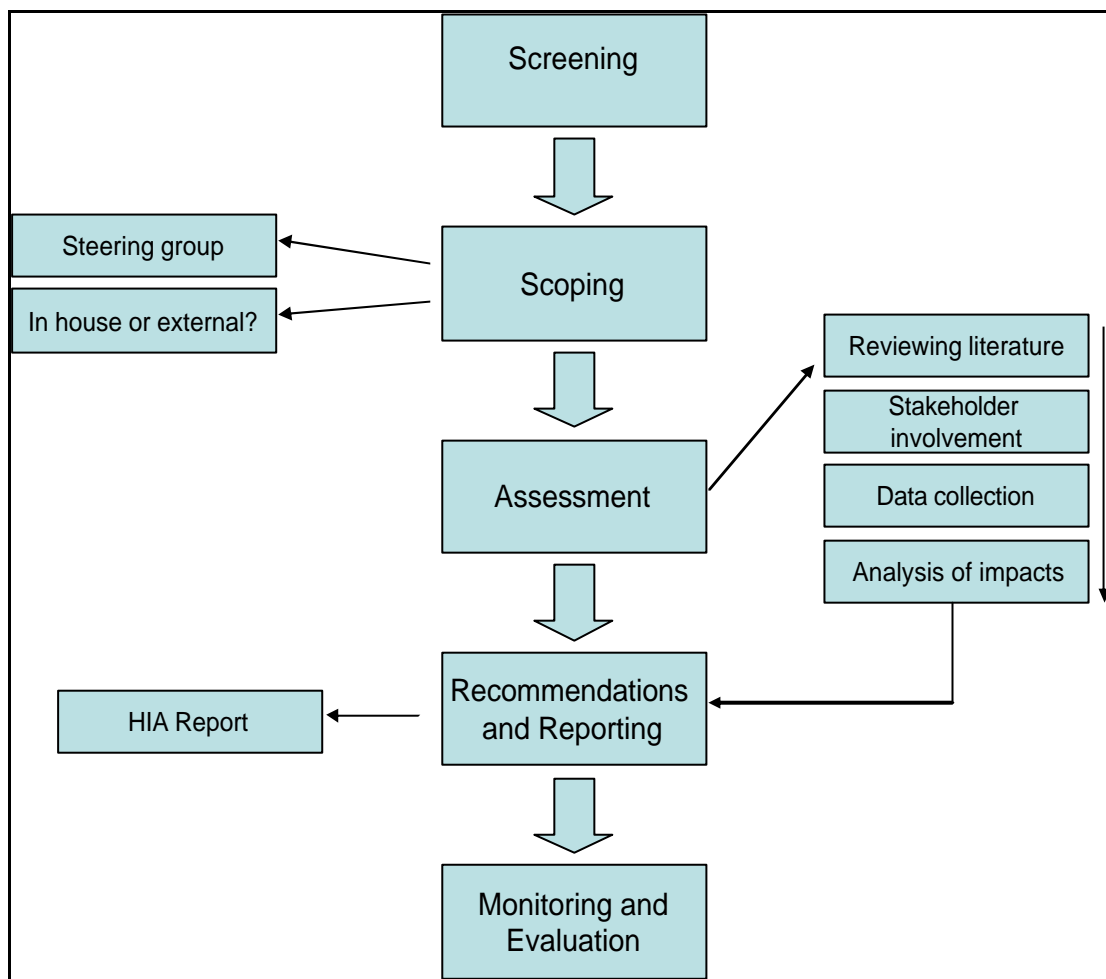


Figure 6: The HIA process

## Screening

Screening is a way to establish if an HIA on the opencast proposal in question is necessary and appropriate and, if so, what level of HIA should be conducted. This part of the HIA process is generally undertaken in house and there may be overlap between the screening and scoping stages.

Screening should be carried out by a screening group, likely to consist of statutory agencies able to effectively manage, provide input into and guide the HIA. Some or all members of the screening group may, later in the process, become members of the steering group. Where screening is being carried out by the developer or a consultant acting on their behalf it is important that key local stakeholders are involved in the process.

The screening process should include the following questions and areas for consideration:

- Whether the proposal is likely to impact on health
- Groups likely to be affected by the proposal in question: these may not always be apparent and by involving a wide range of stakeholders in the screening process less obvious groups may be identified.
- Determinants of health likely to be affected
- The possible scale of the impacts and whether these are likely to be positive or negative
- The severity and likelihood of the impact
- What evidence will be required and where this might be available
- The geographical and population scope of the proposal
- Are the time and resources to do an HIA available
- To what extent the HIA may be able to influence or change the proposal and/or decision making
- What type of HIA is needed
- Identifying members of the steering group (see Scoping)

Who should be involved?

Screening should ideally be carried out by more than one person and key stakeholders should be involved in the process. The advantages of a well rounded screening team include encouraging ownership of the HIA from the

outset, ensuring a wide range of views are represented and clarification of perspectives. A manageable number of people to be involved in screening is between 5 and 10. In the case of opencast proposals suggested groups and organisations to include within the screening process include:

- Public health practitioners
- Community development organisation
- Planning consultants/developers
- Local authority
- Key community members
- Voluntary organisations



A screening tool may be useful for this step in order to ensure that all involved are thinking along the same lines and to ensure all necessary questions and areas are addressed. The tool provides a means of recording information behind decisions made which could be important if justification is ever needed about why a HIA did or did not take place.

Prior to meeting with stakeholders a clear outline and description of the proposal and its rationale, aims and objectives should be circulated to all participants in good time before the screening meeting in order to ensure that members of the team are well prepared and fully understand the proposal to be considered.

Useful information to circulate to stakeholders as part of the opencast project profile would include:

- Context of the proposed development (new site, extension)
- Information on the project site (including maps)
- Options for site development
- Information on the locality (including other developments in the vicinity)
- Health and wellbeing policy context
- Community profile (education, housing, crime rates etc)

The final part of the screening process is making the decision as to whether or not an HIA is necessary and if so what level is appropriate. In the case of opencast proposals, due to their frequently contentious nature, it is likely that a comprehensive HIA with community participation will be recommended.

### **In-house or commissioning?**

The decision needs to be taken whether to conduct the HIA 'in house' or to engage an external consultant. There are pros and cons of both approaches. An external consultant could be used for a number of resource intensive tasks such as finding and analysing literature or other data, helping to frame recommendations and documenting decisions and may have more experience at undertaking the HIA process. There is also an issue relating to who commissions and pays for the HIA; if the HIA is commissioned by the developer (of the opencast site) there may be issues related to impartiality as

the developer has significant input into who may be included in the HIA and in what the final report contains, as well as issues relating to levels of community participation within the process.

At present it is not possible for the planning authority to insist on an HIA as part of the planning process as, unlike EIA, it is not a statutory requirement. Whilst the ideal situation may be for the HIA to be commissioned by the local authority and paid for by the developer this is not currently the case, and it is likely that going forward HIAs on opencast proposals will more often than not be conducted external consultants on behalf of site developers. In light of this it is essential that if an external consultant is brought in to undertake the HIA that the steering group maintain control of the process and ensure its quality

## **Scoping**

Having made the decision that an HIA is necessary, the scoping stage provides the foundations and plan for the rest of the HIA. The scope of the HIA should be determined, debated and agreed by the HIA team. Key questions for consideration within scoping are:

- Who are the relevant and/or vulnerable population groups to be considered?
- What are the timescales for the project?
- What financial and human resources are available?
- Roles and responsibilities of those involved?
- Who are the stakeholders?
- Geographical boundaries of the project?
- Impacts and determinants of health that should be focused on?
- What are the values of the HIA? (e.g. openness, transparency, participation, equity)
- What can the HIA realistically achieve or influence in terms of the specific proposal? Are there aspects that are non negotiable?
- What methods are to be used to gather the necessary evidence (both from the literature and from stakeholders)?

## **Establishment of a steering group**

A steering group is not essential but is advisable in the context of comprehensive HIA. It serves as an effective means of distributing tasks and helps promote wider participation and wider ownership of the process. In the context of more comprehensive health impact assessments, such as those relating to opencast developments a steering group consisting of key stakeholders can help to ensure that a wide range of views are represented and specific knowledge can be fed into the process. Examples of people you may want to include in the steering group for an HIA on an opencast proposal include:

- Local public health team
- Local authorities
- Community members
- Voluntary sector representatives
- Experts in health impact assessment
- Specialists in social science, epidemiology, environmental health, planning or health economics, as appropriate.

It is recommended that a chair of the steering group should be appointed as it may be the case that conflicting views may be expressed and as such final decisions will have to be made. The chair should be someone seen as impartial, decisive and diplomatic.

## Assessment

This is the key stage of the health impact assessment and aims to identify and define all potential health impacts and gather information about the potential nature, size, likelihood and distribution of the proposals impacts. This stage also provides the opportunity to identify possible ways to maximise health benefits and minimise or mitigate health risks, particularly where these relate to disadvantaged or vulnerable population groups.

Impacts may be identified by various methods including:

- Consulting with stakeholders either through a participatory workshop or focus groups
- Use of the screening checklist
- Reviewing the evidence and literature on the health effects of opencast mining
- Using the expertise of the HIA team either directly, or as access to specialised expertise

## Evidence and literature

Later sections of this guide outline key evidence and sources of evidence on the health impacts of opencast mining. However, the term ‘evidence’ may suggest that only those with expert knowledge or specialist skills are able to understand it, and that it is not accessible to lay people. It may also suggest that judgements cannot be made without scientific information to back them up. This can be misleading, and it should be recognised that some of the most valuable evidence is already available in the form of local insights and the focus should be on understanding the factors that affect peoples health and well being: ‘what matters’ as opposed to just ‘what works’.

### Qualitative and quantitative evidence

**Qualitative** evidence is evidence, data or information that is expressed in terms of the meaning of acts or events, which distinguishes between data in terms of quality or form rather than quantity. Emphasis is placed on developing understanding through looking for patterns within peoples words and actions and creating meaning from those patterns.

**Quantitative** evidence is evidence, information or data expressed in numerical terms. The objective of quantitative evidence is to develop and employ mathematical models, theories and/or hypotheses, focusing on the process of measurement.

Both types of evidence have an important role to play within HIA. Whilst quantitative evidence is useful to demonstrate the nature and scale of potential change, qualitative evidence adds depth and understanding that would otherwise be lacking.



For questions of a specialist nature relating to opencast proposals (e.g. what the likely impact on traffic flows is likely to be, what anticipated dust and particulate levels are likely, potential noise levels) then those with expert knowledge may be helpful. This knowledge may be available within the local authority, public health organisations, environmental health department, universities or local or national planners.

For information on how proposals are likely to affect local populations, local residents are able to provide their views on impacts on their living conditions and day to day lives. This evidence can provide valuable insights and contextual knowledge to add richness to the evidence and fill gaps that may be missing from the mainstream research evidence. Residents groups, existing community groups, Communities First and other local action or protest groups are a good starting point for collecting community views.

Policy analysis is particularly relevant in the context of opencast mining and it is important that the policy context is understood by all those involved in the HIA. An understanding of where the proposal fits in relation to other similar proposals and in the wider social, economic, political and relevant policy context will inform the assessment process and ensure that any recommendations from the HIA are appropriate. Having a steering group comprising a wide range of stakeholders, including decision makers, will help to ensure an understanding of the policy context and may help with the sometimes complex task of reviewing government and other agency policy documents. Local councillors, local authority members, elected members and other government representatives will be able to provide valuable input on policy issues.

## Reviewing the evidence

An important part of HIA is reviewing literature and deciding on which evidence to include within the appraisal stage. There are a number of essential components which need to be included, even in the most brief review, and it is important to ensure that the review is thorough, rigorous and robust (particularly in the case of controversial HIAs such as those relating to opencast proposals where there is the possibility that the HIA may be used as part of a public enquiry or appeal process). The London Health Observatory produced 'A Guide to Reviewing Published Evidence for use in Health Impact Assessment'<sup>9</sup> (2006) which aims to help with the review of published evidence (including scientific and research literature, internal documents and grey literature) which can then be integrated with other sources of evidence such as local data and stakeholder experience.

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<sup>9</sup> [http://www.lho.org.uk/Download/Public/10846/1/Reviewing%20Evidence-Final%20v6.4\\_230806.pdf](http://www.lho.org.uk/Download/Public/10846/1/Reviewing%20Evidence-Final%20v6.4_230806.pdf)



## Summary of sources of evidence

### Information on existing population

- Routinely collected local statistics
- Surveys of local conditions
- Community profiles
- Local concerns and anxieties (where documented)
- Secondary analysis of existing data
- Opinion surveys
- Census information
- Other local surveys or research

### Local knowledge

- Views of professionals with expertise and knowledge of specific local determinants
- Views of residents on the importance of local arrangements and in identifying gaps in professional knowledge
- Input from academics or professionals able to interpret local information or data in specialist areas
- Organisations which provide advice on particular subjects

### Wider evidence

- Research published in academic journals
- Research conducted or commissioned by statutory, voluntary or private organisations
- Predictions from models
- Case studies on similar proposals

Table 2: Summary of sources of evidence

## **Participatory workshops and focus groups**

One method of collecting qualitative evidence to inform the HIA is through participatory workshops. Invited representatives from a wide range of organisations and members of the public gather together to systematically consider perceptions of the wider determinants of health (see appendix 1) this to be done in either a half or full day session (depending on the nature, size and complexity of the proposal). These views can be considered alongside the published evidence and, if necessary, expert views on a particular determinant.

When deciding who to invite to the workshop it is important that all groups identified in the screening, including vulnerable groups, are invited to attend or be represented by advocates. Local authorities, health boards, relevant community and voluntary organisations should also be represented where possible. The benefit of the participatory workshop approach is that it enables a wide range of views to be represented and therefore a wide range of possible impacts to be considered and recorded, to later be fed into the HIA report and subsequent decision making.

However, there may be problems associated with this approach: members of the public may not be willing or able to speak openly within the group: this may particularly be the case with opencast proposals where the developer is invited to participate. Opencast developments can be particularly emotive and as such tensions could flare within the workshop environment. An alternative method for collecting evidence from different groups could be focus groups, either organised by who constitutes them or thematically (e.g. in the opencast context around local business, parents, outdoor pursuits). Focus groups facilitate the collection of rich qualitative information that can be fed into the HIA and, correctly managed and facilitated, are an excellent source of evidence on the views and experiences of particular population groups (Kitzinger 1995).

## **Involving members of the public as stakeholders**

The potential health impacts and the process of the HIA itself, particularly those relating to opencast mining, are likely to have impacts on communities living in proximity to the site. As previously discussed members of the public are important stakeholders within the HIA process, and their views, knowledge and experience add a further dimension to evidence.

Public and community involvement in HIA has been deemed problematic, with members of the public often being seen as a barrier to change and holding insufficient knowledge to be able to make a positive contribution to the process. It is members of the public who are affected by the issues or projects relating to the HIA, that the proposed changes would take place within their

communities, and that they held the knowledge and value of personal experience to be able to effectively inform the HIA, and highlighted that these positive contributions outweighed any of the more problematic issues. In terms of members of the public being ignorant of 'the facts' or 'of science'; rather than this being a reason for not including members of the public, it becomes part of the role of the public sector to present information in a way that would be accessible and understandable to members of the public, to enable them to participate effectively and be in possession of all necessary information. Although members of the public should be encouraged to participate in the HIA it is considered important for both the community and public sector to be realistic about how much weight community views would or could be attributed in the decision making process and there was admission from public sector representatives that often these views could become 'lost'. Key in improving the impact of community views is the point in the process at which the community are engaged; whether this was at the start of the process so they were being truly involved and engaged, or further down the line where they were serving a consultation role and validating decisions that had already been made. The provision of information prior to the HIA, both on the HIA process and the proposal itself contributes to buy in and success within the workshops and/or focus groups.

The benefits of public involvement in HIA include the contribution of local knowledge and personal experience, the building of relationships, empowerment and advocacy and key risks are the raising of expectations, consultation fatigue, upsetting the balance of the process, only engaging with the 'usual suspects' and managing input. In order to engage with a wider group of people is through the screening and scoping stages, driven by the concern of the HIA, ensuring sufficient time and routes to engagement to facilitate participation of relevant groups.

Enablers of public involvement include utilising existing links, the use of appropriate facilitation techniques and providing updates on the HIA and inhibitors include lack of time, lack of confidence, and apathetic attitude, the use of jargon and terminology that may not be user friendly, existing community tensions and mis-selling of HIA.

## **Reporting and recommendations**

Having collected, appraised and collated a wide range of information from the literature and from stakeholders, this needs to be presented in a format that is accessible and appropriate to the intended audience; in the case of opencast the relevant audience is likely to be the planning authority. Whilst within HIA there are many possible formats, in the case of HIA relating to opencast a more comprehensive report will likely be the most appropriate as the evidence on potential or perceived health impacts is likely to be vast. An executive summary is also a useful tool for dissemination and newsletters, posters and other appropriate means of communication could be used to disseminate findings and as a method of feeding back to those involved in the process.

The Wales HIA Support Unit (WHIASU) holds a collection of completed assessments on their website ([www.whiasu.wales.nhs.uk](http://www.whiasu.wales.nhs.uk)) and other websites such as the HIA Gateway ([www.hiagateway.org.uk](http://www.hiagateway.org.uk)) are also a valuable resource and reference point.

### **Suggested structure for HIA report**

- Executive summary
- What is HIA?
- Policy context
- HIA Methodology
  - Partners involved
  - Data and evidence collection
  - Objectives of the HIA
  - Community and baseline profiles
  - Literature and evidence review strategy
- Overview of proposal (including planning issues)
- Stakeholder involvement strategy
  - Methods of involvement
- Assessment and analysis of health impacts
- Mitigation and enhancement measures: Recommendations
- Conclusions
- References
- Appendices

When considering content and structure for an HIA report on an opencast proposal it may be useful to take into account that the report may be reviewed for quality assurance (see next section on monitoring and evaluation) using an established review tool. These tools enable the quality of an HIA report to be evaluated in a simple, quick and systematic manner. The review is likely to cover:

Context: including description of the site and policy framework, description of the project and public health profile

Management: Identification and prediction of potential health effects, governance and engagement

Assessment: description of health effects, risk assessment, analysis of distribution of effects

Reporting: discussion of results, recommendations, communication and layout.

### **Recommendations**

As part of the HIA process recommendations on how an aspect or aspects of the proposal in question could be changed or modified to maximise health benefit and minimise health risks are formed (by the steering group). These

recommendations should be relatively few in number, realistic, practical and achievable. Recommendations should be circulated amongst key decision makers related to the proposal in order to feed into the decision making process and inform decisions made.

## **Monitoring and evaluation**

As the aim of HIA is to inform decision making it is important to evaluate how the information was used, its usefulness as perceived by target audiences and whether or to what extent it influenced decision making and developments. Monitoring and evaluation also provide the opportunity to reflect on the HIA process and outcomes, what worked well and how issues were overcome.

Key areas to consider with regards to monitoring and evaluation include:

- How the HIA process was undertaken and how useful and valuable it was
- Whether the HIA added value to the decision making process
- If the recommendations were accepted and implemented by decision makers, and if not, why not
- Were the positive health effects maximised and negative effects minimised
- Are there any lessons to be learned for the future relating to participation and involvement of stakeholders?

In addition to monitoring and evaluating the role, influence and impact of the HIA, it may also be appropriate (within the HIA recommendations) to build in monitoring and evaluation measures for the proposed opencast site, to be adopted by the company as potential mitigation measures.

## **Review and quality assurance**

It is useful when assessing the quality of a completed HIA report to be able to make use of a simple, straightforward and systematic review tool. One such tool, produced by Ben Cave Associates (BCA) in 2009, offers a method of reviewing based on best practice standards for HIA, and is specifically focused on reviewing HIAs on development projects (of which an opencast mining HIA would be an example).

The questions included in the review tool are intended to cover key areas in HIA and to ensure that the assessment picks up on critical areas for public health.





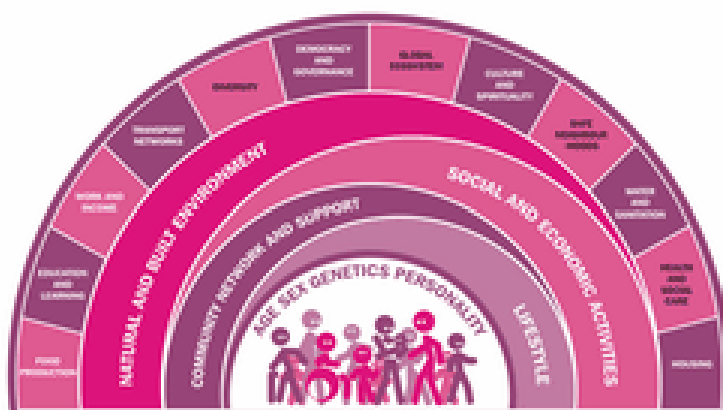
## Section 3: Evidence

### Opencast mining and health impacts

#### Introduction

Opencast mining developments are a feature of the landscape all over the UK. Due to the size and nature of the sites they are frequently opposed or disliked by those living in proximity. The health impacts of mining, positive and negative, perceived and actual, can be systematically assessed using the framework of health impact assessment (HIA). In recent years the license to operate for mining companies (and other industries) has become based on health performance in addition to social and environmental performance. This corporate social responsibility extends outside of the mine to the surrounding communities, including recognition that these communities should not be adversely affected by mining operations and that the significance of community health impacts should be considered within the planning process. HIA is a useful approach to help mining companies, local authorities, communities and other interested groups to better understand, consider, assess, highlight and mitigate potential positive and negative health impacts.

The potential health impacts of opencast mining can be considered in various categories, some of which would be considered within EIA (these being the more biophysical impacts of dust, noise and particulates for example) and those which would be classified under the scope of the wider determinants of health (for example those relating to mental health, wellbeing, community bonds and structures and amenity and heritage issues), relating not just to safe thresholds but also looking at impacts on day to day living within the home and community environment. The EIA may not also consider the impacts of the more 'environmental' factors on areas other than direct illness; for example excess dust may lead to increased anxiety and concern. The literature review revealed that much of the evidence relating to health impacts of opencast mining focuses on biophysical impacts and occupational health impacts for workers at opencast mines rather than considering the impacts on the wider determinants of health as they relate to the wider community.



Knowledge surrounding health and place is frequently contested, and there is an ongoing tension between the roles of 'lay' versus 'expert' knowledge and the part that each has to play in identification and assessment of health impacts (Elliott and Williams 2004). A growing number of epidemiological studies have proven community concerns relating to environmental hazards to be just in cases where exposure is chronic, ongoing and potentially cumulative (Brown 1992, Pless-Mullooli et al 2000). Conversely there are also studies whose findings were found to be at odds with concerns expressed by communities (McCarron et al 2000). Brown (2007) argues for the development of a 'critical epidemiology' that takes a health inequalities and socio-structural approach and connects this to questions of social justice. Community health concerns have also developed around planning matters and the citing of potential environmental hazards, with the possibility of negative impacts on health being frequently cited in the absence of firm epidemiological evidence. This 'popular epidemiology' (Brown 1992), whereby citizens challenge 'flawed' science and arm themselves with the knowledge and evidence to support their viewpoint hence questioning trust in 'expert' knowledge has been described as part of the process by which people become 'citizen scientists' (Irwin and Wynne 1996). However, uncertainty over potential impacts and absence of proof of safety of opencast developments has contributed to planning applications being turned down (Beynon et al 2000). HIA attempts to embrace conflicting views of what is considered to be credible evidence, this including experiential evidence of citizens, and embracing the concept of 'experience based expertise' (Collins and Evans 2002). Potential health impacts have been identified through various HIAs that have been conducted by different organisations (e.g. WHIASU 2005 and 2007) and these are examined and evidence presented below. Potential health impacts are addressed in turn, including specification of vulnerable groups where appropriate. Suggestions are then presented for possible mitigation measures in order to minimise potential negative impacts.

### **HIAs of opencast proposals**

Health Impact Assessment of the proposed extension to Margam Opencast Mine; WHIASU and National Public Health Service for Wales on behalf of the Margam Opencast and Health Steering Group (2005)  
<http://www.wales.nhs.uk/sites3/Documents/522/Kenfig%20Hill%20Final%20-%20Dec%202005.pdf>

A Report of a Health Impact Assessment Study of an Opencast Scheme at Ffos-y-Fran, Merthyr Tydfil. Ffos-y-Fran Health Impact Assessment Steering Group (2007)  
<http://www.wales.nhs.uk/sites3/Documents/522/FYF%20Final%20report%20June%202007.pdf>

(These are the only published HIAs relating to opencast mining. Others have been conducted, some with WHIASU involvement, but these are not in the public domain)

## Air quality

Open cast mining involves substantial drilling, blasting, use of drag lines and transportation of overburden all of which result in the discharge of fine particulates. The processes of excavating, waste removal, transportation loading and stockpiling of coal and fugitive emissions from spontaneous combustion of coal all produce further particulate matter. Whilst these particulates have an impact on environmental factors, the effects of both ambient air pollution and socioeconomic position on health are well documented, and a number of studies suggest that socioeconomic position may itself play a role in the epidemiology of disease and death associated with exposure to air pollution (Haan et al 1987, Krieger et al 1997, Marmot 2001, Anderson et al 1991, COEMAP 1998) and coal dust has been found to cause serious respiratory disease in miners (Jones et al 2002).

### Particles

Dust: particles too large to be inhaled, associated with irritation to the eyes, nose and throat.

PM<sub>10</sub>: the inhalable fraction

PM<sub>2.5</sub>: the fine fraction, also termed the respirable fraction.

It has been demonstrated that exposure to air pollution can cause irritation to the eyes, nose and throat, contribute to or cause respiratory diseases and is also linked to cardiovascular disease, in addition to a rise in hospital admissions (Barrat et al 1995). The UK Committee on Medical Effects of Air Pollution (COMEAP) states that there are clear associations between both daily and long term exposure to air pollution and cardiovascular system disorders, including increased hospital admissions and premature death, concluding that many of these effects are likely to be causal and, in the interests of public health, recommends applying a precautionary approach to planning. Epidemiological evidence of association between long term exposure to PM<sub>2.5</sub> and a reduction in life expectancy was also found by the

COEMAP committee. Acute exposure to particulate air pollution is linked in several studies with cardiovascular death, myocardial infarction, ventricular fibrillation, increased risk of sudden cardiac death (Dockery 2001, Peters 2001) as well as an increase in daily mortality (suggested by Schwartz (1993) whose study in 6 USA cities showed that  $PM_{10}$ ,  $PM_{2.5}$  and sulphate particles were associated with increased daily mortality, the strongest association being found with  $PM_{2.5}$ , the largest increases being deaths from obstructive pulmonary disease and ischemic heart disease). It has been also been found that reductions in particulate air pollution can lead to reductions in death rates; specifically Clancy (2002) found that a study of deaths before and after a ban on coal sales in Dublin found that average black smoke pollution fell by 70%, respiratory deaths fell by 15.5% and cardiovascular deaths by 10.3%. The consistent demonstration of population health effects associated with  $PM_{10}$  indicates that it is a relevant metric for air quality standards in spite of the important issues of  $PM_{10}$  composition and the relationship between ambient and personal exposure. Hendryx (2008) investigated the relationship between health indicators and residential proximity to coal mining in West Virginia. The study revealed that as coal production increased, health status worsened and rates of cardiopulmonary disease, lung disease, cardiovascular disease, diabetes and kidney disease increased.

The report entitled 'Particulate Matter in the United Kingdom', produced by the Department of Environment, Food and Rural Affairs (DEFRA) Air Quality Group in June 2005, highlights the relationship between both short and long term exposure to ambient  $PM_{10}$  levels and respiratory and cardiovascular illness and mortality (as well as other health effects), and the causal nature of these effects. The report also suggests that there it is not (currently) possible to discern whether there is a threshold particle concentration below which there are no adverse effects on population health, with susceptible subgroups being identified as those with pre-existing lung, heart or other disease and/or the elderly and children. Evidence from time series studies suggests that displacement of daily mortality and hospital admissions is not of just a few days, with deaths that are brought forward by air pollution are advanced by months to years (Schwartz 2001).

#### **Current thresholds**

The Air Quality (Wales) Regulations 2000 and Air Quality (Amendment) (Wales) Regulations 2002, in line with the wider UK Air Quality Standards (2007) prescribe that  $PM_{10}$  should not exceed 50 micrograms per cubic metre as a 24 hour mean with no more 35 exceedences in a 12 month period and an annual average not exceeding 40 micrograms per cubic metre, and for  $PM_{2.5}$  the target is not to exceed 25 micrograms per cubic metre, with a cut of 15% in Urban background exposure. These figures differ marginally for Scotland, where  $PM_{10}$  levels, whilst still not to exceed 50 micrograms per cubic metre, are not permitted more than 7 exceedences per year, and the limit for  $PM_{2.5}$  levels being half that for the rest of the UK, not to exceed 12 micrograms per cubic metre.

Current regulations do not require that smaller particles are monitored separately, however experts in the field suggest that these particles may be more harmful to health, for example Schwartz (2000) who identified that small particles (particularly sulphate particles) are more strongly associated with acute respiratory health effects in school children, and Kunzli (2000) who measured carotid intima-media thickness (CIMT), a measure of sub clinical atherosclerosis (thickening of the inner arterial wall) and exposure to PM<sub>2.5</sub> and found that for a cross sectional exposure contrast of 10 cubic metre CIMT increased significantly, especially in women over 60, thus providing epidemiological evidence of an association between atherosclerosis and fine particle ambient air pollution and support for previous work that also found women to be more susceptible to air pollution (Chen 2005).

Perhaps one of the most well known studies relating to air pollution and opencast mining is the work of Pless-Mullooli et al (2000) whose work examined whether *particulates from opencast mining impair children's respiratory health*, though a large scale epidemiological nationally funded study, followed by a qualitative study examining the health concerns and perceptions of parents from a social constructionist viewpoint, combining qualitative and quantitative methods and epidemiological and lay knowledge to broaden the scope of evidence. Sandweiss (1998) outlines the social constructionist approach as characterising the environment as an area in which competing social and cultural definitions and interests meet and come to be identified as issues as part of an interpretive process engaged in by competing claim makers, with the 2003 Pless-Mullooli epidemiological study focusing on non activist participants. The research set out to delineate local residents' meanings of risk within an everyday life context and to explore which risks seem relevant in specific settings and whether risks are an issue at all. The study had 3 main objectives: to examine health and environmental risk perceptions amongst parents whose children lived adjacent to opencast coal sites, to characterise risk perceptions in parents of children with and without asthma and to explore the utility of qualitative research methods used concurrently with epidemiological methods in an environmental health investigation. The study concluded that children in opencast communities were exposed to a small but significant amount of additional PM<sub>10</sub> to which opencast sites were a measurable contributor, and that GP consultations for respiratory conditions were higher in opencast communities during the core study period.

Prior to the work of Pless-Mullooli et al (1999/2003) Temple and Sykes (1992) published research on the links between asthma and open cast mining, examining a period of apparent excessive prescribing for asthma in the Glynneath area of South Wales in the early 1980's. The research showed a sustained and sudden change in new episodes of asthma from the time that the mine began excavation. However, this research was controversial and concerns were expressed over both the design of the study and the conclusions drawn from it (letters to BMJ, McBride et al and Afacan 1992); these criticisms were subsequently defended by the authors. Von Klot et al (2002) supported the hypothesis that asthma medication use and symptoms

increase in association with particulate air pollution and gaseous pollutants, although this study made no reference to opencast. A previous study (King 1997) monitored dust levels at the Derlwyn opencast site and found a positive association between PM<sub>10</sub> levels and winds from opencast workings. However, this study monitored dust from within the site boundary and closer to active operations than in other studies.

There is currently no requirement for local authorities to monitor PM<sub>10</sub> and PM<sub>2.5</sub> particulates separately, despite evidence on the potentially more harmful nature of the smaller particulates. This means that a local authority has no statutory means of controlling emissions of these smaller particles. Weeks (2003), in a study examining monitoring of respirable coal mine dust in underground coal mines from 1969 to 2000 concluded that employers should not be expected to regulate themselves and that to do so would be like 'the fox guarding the chicken coup'. The HIA report on the proposed extension of the opencast mine at Margam in South Wales (WHIASU 2005) suggests that as regulations refer to a 24 hour mean, it is possible that high particulate levels may be produced during the working day, but that these could be balanced against low night time readings when no work is taking place, therefore presenting the possibility that an opencast mine could produce damaging levels of PM<sub>10</sub> during the working day and additionally during the 35 days per year when exceeding the limit is permitted. Despite this seemingly limited protection, in this particular case PM<sub>10</sub> levels were found to compare favourably with other rural sites and were unlikely to breach national air quality initiatives.

## **Nitrogen Dioxide**

Nitrogen dioxide is emitted primarily by motor vehicles (WHO 2003) and whilst exposure to nitrogen dioxide at concentrations higher than ambient concentrations have the potential to adversely affect those exposed, uncertainty remains about the significance of this pollutant to directly impact on human health. Levels of nitrogen dioxide would obviously be dependent on volumes of on and off site traffic, although it is likely that any opencast development would lead to increased levels and any potential health impacts would need to be assessed.

## **Dust**

Dust is generally a collective name for solid particulate matter, in the size range of 1-75 microns in diameter. Whilst there is no precise definition of dust amounting to a nuisance, the figure of 200 milligrammes per square metre per day is suggested as a threshold (goodquarry.com). Nuisance dust reduces environmental amenity, soils surfaces, contaminates soil, vegetation and water, and has negative effects on personal comfort, amenity and health. This is often the case with coal dust as it is often particularly visible. The origins of this threshold are unknown but it is likely to derive from a time when tolerance for dust was far greater, meaning dust levels of this magnitude are no longer

deemed acceptable. As part of the health impact assessment supported by WHIASU (2005) the mining company recognised that coal dust in excess of 80 milligrammes per square metre per day would be likely to generate complaints from local residents. Petavratzi et al (2005) outlined the adverse impacts of dust, both in relation to human health and to the environment: in terms of human health impacts they state that exposure to any dust in excessive amounts can result in respiratory problems and identify lung damage, damage to the nose, throat, eyes and skin and gastrointestinal tract irritation through ingestion as some of the potential health risks associated with dust. WHO (2003) also found that coarse particles have been demonstrated to induce biological inflammation.

Elliott et al (1999) investigated the health risks attributed to air pollution in an urban industrial neighbourhood. They report that whilst priority pollutants were identified by scientific experts, consultation with community partners formed part of the rationale for the inclusion of 'black particulate fallout' as a priority pollutant, prior to a survey of residents around their perception of air pollution in the area, and comparison of this with perception of health risks associated with exposure to environmental contaminants. The highest ranked effect on daily life of the black soot is lifestyle disruption, including responses related to property damage, inability to hang laundry outdoors, keeping doors and windows shut. These findings are supported by the focus group research undertaken as part of the Margam HIA in South Wales (WHIASU 2005). Interestingly respondents classify these lifestyle factors to be health related, suggesting that they may be employing a wider definition of health or seeing future linkages between lifestyle factors and health outcomes.

The potential health impacts of particulate matter from opencast sites are frequently raised as health concerns by communities in close proximity to the sites. The 'Newcastle Study' (Department of Health 1999) reported that it is relevant to consider the contribution of opencast coal sites to  $PM_{10}$  levels in communities up to 1000m from a site. The potential for generation of dust at surface coal mining sites is related to the hardness of the materials being handled, the amount of handling and the size of the product, and dust is produced through blasting, handling operations, processing, haulage, coal stocking yards and wind across disturbed site sources. The likelihood is that the greater the volume handled, the greater the dust generation. Emission estimates from quarrying in the UK (which includes coal working) in 2001 were estimated at 20.6kt of  $PM_{10}$ , of which about 70% was greater than  $PM_{2.5}$  and 30% less; however the uncertainty of this estimate is 10-1000% (DEFRA 2005). Particulate matter is defined as any type of solid in the air in the form of smoke, dust and vapours which can remain suspended for extended periods. The WHO advises that there is 'no safe level' of fine particulate air pollution, micrometres in diameter ( $PM_{10}$ ) and  $PM_{2.5}$ , respirable particles which can penetrate deep into the respiratory system and are associated with increased hospital admissions for heart and lung diseases and premature death (Pope et al 2004). A study by Jones et al (2002) examined the characterisation of airborne particles collected within and proximal to an opencast coalmine in South Wales. Findings were that vehicle exhaust particles make up over 95%



of the ambient PM<sub>10</sub> and that diesel machinery on site would contribute to this (along with other sources).

### **Exposure effects**

The specific health effects for all particulates are believed to be:

Short term exposure: lung inflammatory reactions, respiratory symptoms, adverse effects on the cardiovascular system, increase in medication usage, increase in hospital admissions and increase in mortality

Long term exposure: increase in lower respiratory symptoms, reduction in lung function in children, increase in Chronic Obstructive Pulmonary Disease, reduction in lung function in adults and reduction in life expectancy

WHO, 2004

### **Air pollution and particulates: vulnerable groups**

Older people: Pope (2004) found that statistically significant associations are observed when examining the links between small particulate exposure and disease, suggesting that exposure to PM<sub>2.5</sub> may be one of the multiple factors that influence heart rate variability and blood markers of inflammation in elderly subjects. It has also been found that patients with implanted cardioverter defibrillators experience more life threatening arrhythmias, triggering discharge interventions during periods of elevated air pollution (Peters 2001). Particulates have also been associated with exacerbation of asthma in adults; a study examining the effects of fine and ultrafine particles found that the cumulative exposure over 14 days was linked with increased use of medication (von Klot 2002).

Children: The World Health Organisation (2004) states that there is evidence for possible interactions between exposure to air pollution and infections, and reducing air pollution could improve children's health: the relative increases in infections mainly being small, but the number of affected children in the population being high.

A study examining the effects of opencast mining on children's health (Pless-Mulloi 2000) found that children in opencast communities has significantly more GP consultations for respiratory illness within the study period than children in control communities and whilst no significant association was found between living in an opencast community and the rate of consultation for any reason, the odds of respiratory, eye and skin consultations and respiratory consultations were around 40% respectively higher in the majority of opencast communities considered in the study. There was little evidence of an association between living in an opencast community and the cumulative prevalence of wheeze, asthma or bronchitis or the period prevalence of

asthma attacks and their severity. Children in opencast communities were exposed to a small but significant amount of additional PM<sub>10</sub>, to which the opencast mines were a measureable contributor and small but significant associations were found between daily respiratory symptoms and daily concentrations of PM<sub>10</sub>. Research by Howell et al (2001) found that the association between PM<sub>10</sub> levels and prevalence and incidence of respiratory morbidity were generally positive with the proportion of shale particles and PM<sub>10</sub> levels higher in samples from opencast communities.

Other studies show that children are more sensitive to particulate pollution than adults; a study in Merseyside surveyed the parents of children to determine respiratory symptoms in areas where there was exposure to pollution from coal dust and in unexposed control areas (Brabin 1994); the study found that (after controlling for parental smoking and unemployment) it was found that wheeze, excess cough and school absences for respiratory symptoms were significantly higher in the group exposed to coal dust. In 2005 the WHO reported that epidemiological studies of outdoor air pollution, including PM<sub>10</sub>, found associations between exposure and health effects in children, often at levels well below WHO guidelines. The developing lung is more susceptible to air pollutants and studies have shown that the lung function of children living in areas with high levels of air pollution is lower, and whilst these effects are modest they are also cumulative and it is not certain whether these effects are reversible. The report also found that particulate pollution played an important role in the exacerbation of asthma in children but that there were not sufficient studies to determine the roles of different size particulates. As part of the wider debate around the health impacts of opencast mining, asthma is frequently mentioned and research has shown that communities exposed to polluting industries rely on their senses to assess air pollution levels (Bush 2001).

**Key points: Air pollution and dust**

- There are 2 types of particulates to be considered: PM10 and PM2.5
- Potential health impacts of air pollution include cardiovascular disease, irritation to eyes, nose and throat, and respiratory problems
- Thresholds for PM10 are 50 micrograms per cubic metre, and for PM 2.5 25 micrograms per cubic metre
- Potential health impacts of dust include lifestyle disruption, property damage and anxiety over health effects
- Most vulnerable groups are older people, children and those living in closest proximity to the site

## Noise

Noise is an important consideration in the context of opencast mining, and a factor that can potentially have serious health impacts across a wide range of determinants. Noise is generated on site from heavy plant, blasting and vibration, as well as from maintenance work (which would usually be carried out outside of regular working hours). This noise usually occurs in three phases: access to the coal reserve, extraction of coal and site reclamation (Krishnamurthy 2004) and also through the construction of access roads to the site. Also a consideration is the distance between the site and residential dwellings. Often mine operators make use of natural and/or artificial screens or baffles in order to minimise the transmission of noise from site and the impacts associated with noise are dependent on the strength of the noise source.

The WHO published a set of guidelines relating to community noise, including potential sources, quantification and potential effects (WHO 1999). Potential health effects identified include hearing loss or loss of hearing sensitivity, sleep disturbance, cardiovascular and physiological effects, mental health effects and behavioural effects, including poor performance by school children (Stansfield and Matheson 2003, WHO 1999, Health Evidence Bulletins 1999). Environmental noise has also been found to be responsible for interference with communication, cognitive performance and annoyance (Stansfield and Matheson 2003, WHO 1999). Stansfield and Matheson (2003) concluded that the effects of environmental noise are strongest for categories linked to quality of life (or the wider determinants of health in the context of HIA) as opposed to illness (or bio physical factors).

Meta- analysis has demonstrated that it is biologically plausible that noise exposure can contribute to the prevalence of cardiovascular disease, but that the mechanism is complex (van Kempen 2003). A further review (Stansfield et al 2000) found only weak association between noise in the community and CVD, but found that aircraft and road traffic noise were both associated with physiological symptoms and the use of psychotropic medicine, and a second review by the same author (Stansfield 2003) found that environmental noise was associated with hypertension. Stansfield et al (2000) and Berglund (1996) both reported that the negative psychological effects of noise are greater when the subject has no control over their own exposure, with Berglund also reporting that noise seems to produce respiratory impairments. However, these studies refer to meta-analysis or review level evidence, sometimes of over 200 individual studies of different types, including different levels of noise which may not be similar to those produced by an opencast site. Despite this there is a consistent message that exposure to increasing noise levels produces physical and physiological effects.

It is widely known that those people of lower socioeconomic status experience poorer health and greater health inequalities than those who are more affluent. It has been suggested that this poorer health may (at least in part) be related to chronic stress, including that caused by noise pollution (Baum 1999). It has also been found that external noise is a stressor in children

demonstrated by elevated systolic blood pressure in those exposed (Evans et al 2001).

In addition to these potential biophysical health impacts, noise also impacts on wider determinants of health and lifestyle factors including having to keep windows closed, sleep disturbance, annoyance when trying to enjoy gardens and other outdoor spaces, traffic noise (and vibration). Low frequency noise in particular can cause distress to people who are sensitive to its effects.

Prior to 1993 there were no national guidelines for setting noise limits from minerals workings. Noise related to opencast mining is produced not only through blasting and other on site activities but also by traffic, including rail traffic on and off site and at certain times, such as during construction and removal of baffle mounds and during blasting these noise levels may increase. When considering noise in the context of opencast mining MTAN2 outlines that unless the community and local benefits of coal mining clearly outweigh, amongst other considerations, the loss of amenity resulting from noise (the outdoor sound level from steady continuous noise would need not to exceed 55 dB  $L_{Aeq}$  1 hour in outdoor living areas), planning permission should be refused. The local climate should be taken into account, particularly in areas of tranquillity that should be preserved.

#### **Key points: Noise**

- Consideration of three phases: access to the coal reserve (including construction of access roads), coal excavation and land reclamation
- Potential health impacts of noise include hearing problems, sleep disturbance, cardiovascular effects and mental health issues
- Distance from site workings impacts on the levels of noise experienced and associated health impacts
- MTAN2 states that the outdoor sound level from continuous noise should not exceed 55 dB  $L_{Aeq}$  1 hour in outdoor living areas

## Visual impact

*“Opencast mining is one of the most environmentally destructive processes being carried out in the UK. The sites are among the most ugly examples of the ravages of industrial exploitation”*

The House of Commons Energy Select Committee (1987)

Welsh landscapes are considered a valuable asset in environmental, historic, touristic and recreational terms. Opencast coal extraction, unless carefully sited and mitigated, can be visually intrusive and may lead to a loss of skyline, views being obscured, lighting and machinery intruding into the landscape and potentially the loss of mature woodland and other landscape features. Visual impact needs to be taken into account in both the operational and restoration phases of the opencast site and MTAN2 states that adverse visual impact must be kept to an ‘acceptable level’ and that the magnitude of change is relatively objective and should incorporate the compatibility of the project with the surrounding landscape, duration of impacts, scale of development and reversibility of change.



Photograph of Margam Opencast Mine, South Wales

There has been some evidence that a pleasant view can promote health and wellbeing and that an unpleasant view can be detrimental; surgical patients whose recovery took place in a room with a view of trees had a shorter post operative hospital stay and took less pain relieving drugs than matched patients with a view of a brick wall, with nurses making more negative comments on the state of mind of the brick wall patients (Ulrich 1984). This is supported by research showing that natural views elicit positive feelings, reduce fear in stressed subjects and may block or reduce stressful thoughts

(Altman and Wholwill 1983). Visual impact is closely related to mental health and wellbeing and living in proximity to opencast sites, particularly when they can be viewed from the home has been identified as causing stress, depression and anxiety.

## Light pollution

Artificial light nuisance may be, but is not necessarily the same as light pollution. Artificial light nuisance is a source of light that is, in the opinion of a trained public health professional who makes an assessment on a case by case basis, interferes with someones use of their property and/or might be prejudicial to someones health (DEFRA 2006). Light pollution can be defined as any form of artifical light which shines outside the area it needs to illuminate, including light that is directed above the horizontal into the night sky or which creates danger by glare.

For reasons of safety and security it may be necessary for opencast sites to be lit outside of operational hours and also the site may need to be illuminated during operational hours of darkness, particularly during the winter months. Proximity to the site of residential dwellings is an important factor in consideration of light pollution. Environmental Protection UK ([www.environmental-protection.org.uk](http://www.environmental-protection.org.uk)) describe light pollution as artificial light that is allowed to illuminate, or intrude upon, areas not intended to be lit and suggest two types of light pollution, both of which may be appropriate in the context of opencast mining:

Intrusive light is the intrusion of over bright or poorly directed lights onto neighbouring property, which affect the neighbours' right to enjoy their own property. A typical example would be an inconsiderately directed security light shining into a bedroom window.

Skyglow is the orange glow seen over towns and roads from upward light.

Inconsiderate or incorrectly set lighting can have other effects:

- It produces glare which occurs when the over brightness of a light source against a dark background interferes with a person's ability to view an area or object, i.e. glare can conceal rather than reveal.
- It can detract from the architectural appearance of a building and even hide complex or attractive features.
- It can impact on the ecology and wildlife of an area, and affect the behavioural patterns of mammals, birds, insects and fish.
- The wasting of light is a waste of the energy which powers the light and is therefore a waste of resources and money.

The potential health impacts of light pollution have not been as well defined for humans as for wildlife, although epidemiological evidence points to a consistent association between exposure to indoor artificial night time light and health problems such as breast cancer (Davis et al 2001). The 24 hour day/night cycle known as the circadian clock impacts on physiological processes in all organisms, including humans. Disruption of the circadian clock (such as sleep disturbance) has been linked to medical disorders such as depression, insomnia, cardiovascular disease and cancers (Chepesiuk 2009, Sephton 2003, and McClung 2008). Evidence collected from people living in close proximity to an opencast mine in South Wales (WHIASU 2005)



showed that arc lighting from the site was making it impossible for them to see and enjoy the night sky and also causing sleep disturbance.

## **Vibration**

The majority of the literature on the health impacts on vibration focuses on the impacts of vibration on workers, and there is no literature relating specifically to the effects of mining related vibration on those in proximity to the site. However, vibration has been cited by residents as a cause for concern with reports that vibration from an opencast site could be felt in surrounding communities, causing anxiety and concern over potential structural damage to homes (WHIASU 2005). Bovenzi (2005) produced an overview of the potential effects of vibration as they relate to occupational health and safety. Many of the potential impacts and ill health effects caused by vibration are considered serious and may be an area for future research and monitoring relating to opencast communities. Even if the health effects of vibration are found to be perceived as opposed to actual they still have the potential to cause ill health indirectly through anxiety and stress, particularly cumulatively in conjunction with other health impacts.

## Loss of amenity and impact on physical activity

There has been much research showing the benefits of physical activity for mental and physical health and wellbeing. Higher levels of physical activity reduce overall mortality (US Department of Health and Human Services 1996) and physical activity has been found to be protective against cardiovascular disease, raised blood pressure, colon cancer, type II diabetes and obesity. Exercise improves health related quality of life, improves mood, encourages optimum skeletal development in children and may be helpful in preventing falls in the elderly. Outdoor physical activity such as jogging, cycling, walking and horse riding combine the benefits of exercise with enjoyment of outdoor environments, particularly in rural settings.

Walking outdoors is an inexpensive and convenient form of physical exercise, achievable by people of all ages. Ball et al (2001) examining determinants of physical activity found that a higher proportion of walkers were found amongst those reporting more convenient walking environments when looking at self reported or perceived environmental variables. For respondents whose residential environments have lots of greenery the likelihood of being physically active is three times as high and the likelihood of being overweight or obese is 40% less (Ellaway 2005).

Due to the location of coal seams in Wales, opencast sites are often situated within rural settings, frequently in areas already considered deprived. The size and nature of opencast mines they are likely to cause a significant loss of amenity and space for outdoor pursuits during the operational phase. The countryside may act as a free 'outdoor gym' that local people may be reluctant to make use of due to noise, dust, visual impact or other adverse impacts from the mine site. As previously outlined the construction of an opencast mine may also lead to loss of mature woodland, footbaths, bridleways or forestry trails hence significantly changing the character of an area and reducing amenity. In addition those local people without access to a car for transportation may be adversely affected.

Many opencast mining projects include plans for remediation of the site after operations have ceased, meaning that technically any loss of amenity would be 'temporary'. However, mining activity can continue for many years, and, for example, a 15 year operational period could constitute a whole childhood spent without access to pleasant outdoor space in close proximity to the home. It is also likely to be the case that remediation will be unable to restore the landscape to its previous state, hence changing the nature of the landscape permanently.

Sheail (1992) outlines the features of the 'amenity clause' which placed an obligation on select industries to take into account amenity, wildlife and outdoor recreation interests in the course of preparing and carrying out developmental schemes. In terms of opencast coal mining in 1988 the Department of the Environment extended the clause of the opencast coal agreement of 1958 to the fast expanding private sector. The revision stated that opencast mining proposals should include measures to '*mitigate any*

*adverse effect which the proposed activities may have on the natural beauty of the countryside and on any such flora, fauna, features, sites, buildings or objects*'. The protection of landscape and heritage should be a paramount consideration when assessing health impacts of a proposal. When considering options for remediation it should also be taken to account to what extent the site will be restored to its former state, or, if earmarked for development, what amenities will be provided as part of the remediation programme.

**Key points: Loss of amenity/impact on physical activity**

- Increased levels of physical activity have been found to be protective against cardiovascular disease and obesity, and improve mood and related quality of life
- More convenient walking environments lead to a higher proportion of walkers
- An opencast mine can change the nature of the local environment, potentially making it less accessible, with a loss of amenity for leisure pursuits and possibly disadvantaging some groups within the community (e.g. those without a car for transportation)

## Severance and social capital

Putnam (1995) describes social capital as encompassing '*...features of social life-networks, norms (including reciprocity) and trust – that enable participants to act together more effectively...*'. Social capital is defined with reference to networks that provide a basis for trust, co-operation and perceptions of safety, consisting of structural, relational and functional elements (Coleman 1988). The concept of social capital is sociological but used in a wide variety of contexts to refer to the connections created by social networks. Social capital is about the value of social networks, bonding similar people and bridging between diverse people, with norms of reciprocity (Dekker and Uslaner 2001). Social networks and resulting social capital form bonds between and within communities and individuals.

There is considerable evidence to suggest that higher levels of social capital and strong social networks within communities can contribute to better health (Berkman and Breslaw 1983) and the concept has been suggested as a key mechanism in the relationship between poverty and ill health. The mediating role of social networks and social capital in addressing issues relating to health and place has been examined (Cattell 2001) and key factors in influencing social networks and social capital were identified, these being neighbourhood characteristics and perceptions, poverty and social exclusion and social consciousness, all of which may play a role in the context of opencast mining proposals. Social capital has been linked to self-rated health and mortality rates with social capital variables significantly associated with middle age mortality, with levels of mistrust demonstrating the strongest association (Skrabski et al 2003). Social capital has also been found to be linked to walkable neighbourhoods with some neighbourhood environments encouraging and enabling the creation of social ties and some not (Leyden 2003) and the physical environment being important for community morale and social interaction (Forrest and Kearns 1999).

Due to the magnitude of opencast developments it may be the case that the operational site disconnects communities from one another through the removal of footpaths or perceptions of risk associated with travelling close to the site. Particularly disadvantaged will be those without cars or with limited mobility. Further severance of social networks may be caused by family members choosing to leave the area due to concerns over health impacts from the site. However it could be argued that the process of communities uniting to protest against opencast developments actually leads to an increase in social capital within those communities.

## **Mental health and wellbeing**

Many of the health impacts considered within the review of evidence have been environmentally related (particulates, dust, light pollution etc). However, it must be recognised that all of these impacts have direct or indirect effects on the mental health and wellbeing of those they affect. Bio physical impacts aside, actual or perceived exposure to environmental risks can lead to a significant increase in anxiety and stress amongst affected populations. In addition, those members of communities involved in protesting against opencast developments (and/or extensions to existing sites) may experience additional stress exacerbated by the process of protesting itself.

Many illnesses are related to stress (Brunner 1997) and correlations have been found between living in underprivileged areas and vulnerability to psychological or minor psychiatric problems (Harrison 1998). Frequent and prolonged activation of the 'fight or flight' response (such as that which may be produced by stress associated by proposed opencast developments) has been found to be maladaptive and may prove to be central in understanding the social distribution of cardiovascular and other diseases and recent stressful life events have also been shown to increase to and severity of respiratory infections (Brunner 1997) and correlations have been found between SES and frequency of environmental exposures to social or non social hazards (Haan et al 1987, Kreiger 1997). Social stress has also been found to have an effect on cell mediated immune function (Cohen et al 1992) and psychological distress as a factor in coronary heart disease as an increase in CHD cannot be explained solely by health behaviours, social isolation or work characteristics (Stansfield et al 2002). It has also been reported that disadvantaged areas make higher demands on primary care services and that many of the additional contacts related to psychological problems (Carlisle 1998), leading to the potential for increased GP consultations for mental health and wellbeing issues as a result of opencast related anxiety and stress. Stress can be caused by many factors, including the psychosocial environment, and contribute to health inequalities between groups by raising levels of cortisol in the body and thus contributing to high blood pressure. Those living with or protesting against opencast mine proposals and developments have expressed feelings of powerlessness (WHIASU 2005) and reports of low control, including low autonomy and decision latitude have been found to be predictors of coronary heart disease (Bosma et al 1997). There is limited and incomplete evidence but biological plausibility for the view that psychosocial factors may be important determinants of population health.

Opencast coal mines are often situated in rural areas. Beynon et al (2000) outline that once planning permission for an opencast site has been granted the nature, purpose and use of the land in question changes completely from a green space, woodland, derelict area or area of countryside to a major civil engineering site and place. We have previously discussed issues relating to screening, but it must be recognised that peoples views and living environment is irrevocably changed by such developments. Peoples reactions to opencast sites are often intensely emotional and are further compounded

by these physical changes, and Beynon et al (2000) describe the loss of a local landscape as having the potential to be as *'traumatic and intense an emotion as bereavement'* (p94) and highlights that these impacts are invariably underestimated by mining companies. It is hoped that in Wales the use of HIA in relation to opencast developments will go some way to ensuring that issues such as these will be considered more thoroughly and systematically as part of the planning process.

**Key points: Mental health and wellbeing**

- 'Environmental' facts have both direct and indirect impacts on the mental health and wellbeing of those affected by opencast developments
- Stress from protesting against opencast developments can lead to psychological problems and stress related cardiovascular and respiratory illnesses
- Visual impact, noise and dust can all cause significant distress and impact on mental health

## **Further health impacts relating to the wider determinants of health**

Socio-economic factors are linked closely to health and well being, and where opencast will impact on these factors within a community there is likely to be an impact on health.

### **Housing**

It is likely that houses situated near to opencast mine sites will have their value reduced by proximity to the site. Pless-Mulloli (2002) report that the impact on house value is the same whether the mine is operational or non operational. Reduction in house prices as a result of opencast developments may potentially have an impact on health and well-being through causing anxiety and stress. The character and perception of a neighbourhood may also be irrevocably changed by opencast.

### **Services and amenities**

It is possible that following reclamation of the site (after the operational period, length of time varying between sites) there may be improved services and amenities, and opportunities for employment. Remediation options vary between sites and proposals and may range from restoration to previous state, housing or industrial developments.

### **Employment and income**

Unemployment has a negative impact on health (Morris et al 1994) and has been associated with physical ill health, poor mental health effects, suicide, wellbeing, increased mortality and lower life expectancy, and alongside poor socio economic status is strongly associated with illness and premature death (Townsend and Davidson 1998).

Although opencast workings may provide limited work opportunities for local people (due to the need for specialist skills), remediation may improve employment prospects in what are often deprived areas. There may also be opportunities for education, skills and development and, if set out in the proposal, these should be considered within the HIA.

### **Transport**

It is likely that the creation of an opencast mining site will require changes to the road infrastructure in the locality on account of the higher volume of traffic including heavy goods vehicles (HGV's). The impact of increased road traffic on air quality has already been discussed, but there are other potential health impacts associated with site related transport that may need to be considered. Higher volumes of traffic on rural roads may result in an increase in road traffic accidents (30% of road crashes occur outside built up areas



(Department for Transport 2005)), an increase in traffic related noise and the potential for longer journey times for local people. This may also contribute to increased anxiety and stress, which, as previously discussed, is also detrimental to health<sup>10</sup>. The impact of noise, vibration and fumes from HGVs is an important issue; a critical assessment of 15 reviews of published studies of air pollution and adverse health effects concluded that associations were both valid and causal (Dab et al 2001). Whilst the individual health risks of air pollution are relatively small, the public health consequences are considerable (Kunzli et al 2000).

## **Safety**

Moffat et al (2003) conducted research into parents' perceptions of the health and environmental impact of opencast mining. Issues of concern to parents were presented, with the primary concern expressed being 'stranger danger', road traffic accidents and other environmental problems. There is often also community concern over fears that children may be able to access the sites and use them as play areas and that this could lead to injury.

## **Groundwater**

An assessment framework developed for Scotland to evaluate the potential impact of opencast mining on water quality (SEPA 2004) showed limited potential for List 1 substances (Mercury, Cadmium and associated compounds) to enter ground water, but there is significant potential for the migration of List II substances (e.g. copper, nickel, ammonia and fluoride). Whilst the quantities released are unlikely to cause significant impacts and would be considered fully within the EIA they may be a cause of stress and anxiety for local residents.

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<sup>10</sup> Health Scotland produced 'Health Impact Assessment of Transport Initiatives: A Guide' in 2007 which contains a review of literature on transport and health, provides summaries of completed HIAs of transport related topics and highlights sources of information and data about transport. The guide can be accessed at:  
[http://www.healthscotland.com/uploads/documents/5039-03686\\_NHSHIAGuideFinal1.pdf](http://www.healthscotland.com/uploads/documents/5039-03686_NHSHIAGuideFinal1.pdf)

## **HIA at public inquiry**

Over time the planning process relating to opencast developments has become more complex and less applications pass straight through. As public opinion has moved from acceptance towards protest and resistance more parties are becoming involved in the process as communities come to stand alongside local authorities and developers, this bringing with it tension and acrimonious discussion. As developers and their proposals come under increased scrutiny during the planning process they are increasingly required to defend and legitimise their plans, often as part of an appeal against rejection of an application.

The most common form of appeal in opencast developments is public inquiry, although it should be noted that appeal on written representations and hearings are also options. Public participation in the appeal process has become increasingly widespread, and public protest has led to increased refusal of planning permission and subsequent public inquiry. We have previously discussed barriers to and enablers of participation of the public within health impact assessment (Chadderton 2008) and the nature and structure of public inquiry may alienate members of the public. Further barriers may include members of the public who participate being accused of NIMBYism and the physical setting for public inquiry being intimidating (although this could be overcome by holding appeals in community settings as has happened in some cases).

The role that HIA can play within public inquiry is still in its infancy, but, particularly in Wales where HIAs on opencast developments are now required, it is likely that their importance and significance will develop over time. The HIA can be used as a form of evidence to demonstrate health impacts relating to the wider determinants of health that may not adequately have been covered within the environmental impact assessment (EIA). Furthermore HIA is a method of systematically analysing health impacts that can be used by communities wishing to express their concerns. As such the HIA needs to be robust, and, as discussed, make use of the best possible evidence if it is to be deemed credible. This is where quality assurance by independent assessors can be a useful check on content and quality.

**Table 3: Potential mitigation measures (examples)**

Health impact area	Potential mitigation measures
<b>Air quality and dust</b>	<p>Monitoring and regulation by local authorities both on and off site</p> <p>Use of static masts and mobile bowsers spraying a fine mist of water droplets on as much of the site as possible</p> <p>Gel coating of trucks transporting coal to prevent dust being deposited whilst coal is in transit</p> <p>Cumulative impacts of other developments in the vicinity need to be taken into account. Dutta et al (2004) proposed a methodology for cumulative impact assessment of opencast mining projects with special reference to air quality assessment within the framework of EIA.</p>
<b>Noise and vibration</b>	<p>Conditions relating to noise need to be attached to planning consent</p> <p>Use of artificial and/or natural baffle mounds and/or screens to minimise noise transmission</p> <p>Limits imposed on working and excavation hours</p> <p>Monitoring of vibration in relation to Statutory Nuisance levels</p>
<b>Visual impact</b>	<p>Limited shielding through the use of baffle mounds to screen</p>
<b>Mental wellbeing</b>	<p>Establishment of community liaison group consisting of the local authority and health board representatives, the developer and local residents. This group may go some way to improving communication and transparency of decision making.</p>
<b>Safety</b>	<p>Traffic assessment and limitation of vehicle numbers, routes and movement</p> <p>Commitment to remediation plans so that the disused site at the end of the operational period does not become a safety risk</p> <p>Appropriate security on site to prevent children gaining access</p>
<b>Amenity</b>	<p>Careful consideration to cultural and heritage aspects of the local environment</p> <p>Ensuring that areas in proximity to the site remain accessible and available for recreational purposes</p>
<b>Employment</b>	<p>Policy of employing local people wherever possible could be written into the proposal</p>

## **Doing a Health Impact Assessment of an opencast mining proposal: Questions to ask...**

Questions relating specifically relating to opencast mining HIA have been developed from other HIAs on the topic and from reviewing the literature and have been designed and developed to help those undertaking an opencast HIA.

### **Nature and extent of policy/ Features of local area/ Populations**

What are the specific changes proposed: a new site, extension to existing site?  
What are the aims of the proposal?  
What are the phases of the proposal: mining, excavation, remediation and how long are they likely to take?  
What is the geographical area affected by the proposal? What are the key features of the area?  
Who are the vulnerable population groups?  
Are there other similar developments in the area?

### **Is the proposal likely to impact on...?**

Air quality?  
Dust levels?  
Noise levels?  
Visual aspects?  
Light pollution?  
Amenity and physical activity?  
Social capital and social networks?  
Mental health and wellbeing?  
Housing?  
Services?  
Employment?  
Transport?

**Who do I need to involve?**  
**What is the best way to involve them?**  
**Who will manage the process?**  
**Who will carry out the HIA?**  
**Is there existing work that can be built upon?**  
**Are there cumulative impacts to be considered?**  
**What can realistically be achieved in terms of mitigation and through recommendations?**  
**Where can I find the evidence I need?**  
**Who will review and quality assure the HIA?**

## Appendix 1

### Health and well being determinants checklist for HIA\*

<b>1. Lifestyles</b>	<ul style="list-style-type: none"> <li>• Diet</li> <li>• Physical exercise</li> <li>• Use of alcohol, cigarettes, non prescribed drugs</li> <li>• Sexual activity</li> <li>• Other risk taking activity</li> </ul>
<b>2. Social and community influences on health</b>	<ul style="list-style-type: none"> <li>• Family organisation and roles</li> <li>• Citizen power and influence</li> <li>• Social support and social networks</li> <li>• Neighbourliness</li> <li>• Sense of belonging</li> <li>• Local pride</li> <li>• Divisions in community</li> <li>• Social isolation</li> <li>• Peer pressure</li> <li>• Community identity</li> <li>• Cultural and spiritual ethos</li> <li>• Racism</li> <li>• Other social exclusion</li> </ul>
<b>3. Living/environmental conditions affecting health</b>	<ul style="list-style-type: none"> <li>• Built environment</li> <li>• Neighbourhood design</li> <li>• Housing</li> <li>• Indoor environment</li> <li>• Noise</li> <li>• Air and water quality</li> <li>• Attractiveness of area</li> <li>• Community safety</li> <li>• Smell/odour</li> <li>• Waste disposal</li> <li>• Road hazards</li> <li>• Injury hazards</li> <li>• Quality and safety of play areas</li> </ul>
<b>4. Economic conditions affecting health</b>	<ul style="list-style-type: none"> <li>• Unemployment</li> <li>• Income</li> <li>• Economic inactivity</li> <li>• Type of employment</li> <li>• Workplace conditions</li> </ul>
<b>5. Access and quality of services</b>	<ul style="list-style-type: none"> <li>• Medical services</li> <li>• Other caring services</li> <li>• Careers advice</li> <li>• Shops and commercial services</li> <li>• Public amenities</li> <li>• Transport</li> <li>• Education and training</li> <li>• Information technology</li> </ul>
<b>6. Macro-economic, environmental and sustainability factors</b>	<ul style="list-style-type: none"> <li>• Government policies</li> <li>• Gross Domestic Product (GDP)</li> <li>• Economic development</li> <li>• Biological diversity</li> <li>• Climate</li> </ul>

\* Please note that this list is a guide and is not exhaustive

## Appendix 2

### Vulnerable and/or disadvantaged population groups

<b>1. Age related groups</b>	<ul style="list-style-type: none"><li>• Children and young people</li><li>• Older people</li></ul>
<b>2. Income related groups</b>	<ul style="list-style-type: none"><li>• People on low income</li><li>• Economically inactive</li><li>• Unemployed</li><li>• People who are unable to work due to ill health</li></ul>
<b>3. Groups who suffer discrimination or other social disadvantage</b>	<ul style="list-style-type: none"><li>• People with disabilities</li><li>• Refugee groups</li><li>• People seeking asylum</li><li>• Travellers</li><li>• Single parent families</li><li>• Lesbian and gay people</li><li>• Ethnic minority groups*</li><li>• Religious groups*</li></ul>
<b>4. Geographical issues</b>	<ul style="list-style-type: none"><li>• People living in areas known to exhibit poor economic and/or health indicators</li><li>• People living in isolated areas</li><li>• People unable to access services and facilities</li></ul>

Note: This list is a guide and not intended to be exhaustive.  
Target groups identified will depend on the nature of the proposal and the characteristics of the local population.  
The impact will also need to be assessed on the general adult population and/or assess the impact separately on men and women.  
\* may need to specify

**Appendix 3**  
**Screening tool**

**1. Title of proposal**

**2. Description, including key aims and objectives**

**3. Key population groups affected (vulnerable groups and other groups)**

**4. Summary of significant or moderate impacts**

**For each, outline potential positive or negative impacts and gaps, and groups likely to be affected**

Is the proposal likely to impact on, or have implications for:

**A. Individual lifestyles**

+	-
---	---

**B. Social and community influences**

+	-
---	---

### C. Living conditions

+	-

### D. Economic conditions

+	-

### E. Access and quality of services

+	-

### F. Other direct or indirect effects on health and wellbeing

+	-

## 5. Recommendations

Are the impacts that have been identified above enough to warrant an HIA?

If no, what are the reasons for not conducting an assessment?

If yes, outline next steps

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## Appendix 4

### Sources of evidence and information for HIA on opencast proposals

(This list is a guide and is not exhaustive)

Useful websites	
Minerals.co.uk	British Geological Survey centre for sustainable mineral development (good for statistics)
Coalintheuk.org	Mapping new coal across Britain
goodquarry.com	Examining measures to minimise the environment of surface minerals working
Whiasu.wales.nhs.uk	Guidance on HIA in general and opencast case studies
Hiagateway.org.uk	Depository of HIA case studies and guidance
Scotland.gov.uk Wales.gov.uk Direct.gov.uk	Government websites including information on coal and planning

Local statistics/census data	Ons.gov.uk Neighbourhood.statistics.gov.uk Statswales.gov.uk
Community profiles	Apho.org.uk Local health boards
Relevant 'experts'	Hpa.org.uk Environment-agency.gov.uk Dh.gov.uk Cmo.wales.gov.uk
Academic journals	Search Google scholar Journal databases Existing literature reviews University libraries
Case studies	Wales HIA Support Unit HIA Gateway Google search
Community views	Local residents groups Communities First Other community groups Local schools
Other research...	

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## Wales HIA Support Unit (WHIASU)

### Wales Health Impact Assessment Support Unit

WHIASU is a partnership between Cardiff University and Public Health Wales, funded by the Welsh Assembly Government. The unit has a Wales wide remit to:

- Support the development and effective use of HIA in Wales through building partnerships and collaborations with key statutory, voluntary, community organisations
- Build capacity for HIA through the delivery of training
- Provide information and advice to those conducting or interested in conducting health impact assessments
- Support communities wishing to undertake HIAs within their locality
- Quality assure HIAs undertaken both within and outside of the unit, to assess and improve HIA practice
- Raise the profile of HIA within Wales, the UK and internationally by providing web based resources, running training and workshop events, delivering conference presentations and publishing academic papers
- Conduct innovative research to inform the development of HIA and health in all policies

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