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# Hanson Cement Investigation: Final Report

**Agencies:** Public Health Wales, Betsi Cadwaladr University Health Board, Environment Agency Wales, Food Standards Agency, Health Protection Agency, Health and Safety Executive, Flintshire County Council

**Date:** 5 July 2012

**Version:** 1

**Publication/ Distribution:** Public (Internet)

## About the Report:

This Report brings together all the elements of the Investigation (led by Public Health Wales) to understand and respond to the concerns of community leaders and residents living near to the Hanson Cement works in Padeswood, Flintshire. It is supported by detailed Technical Reports produced by expert members of the multiagency Investigation Response Team; copies are available on the Public Health Wales website [www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) and in hard copy at local libraries in the area. These provide the detailed information from which the responses provided in this Report are drawn, and each is referenced at the end of the response(s) to which it is relevant.

The Report provides responses to each of the concerns identified during the early part of the investigation. In answer to the overarching question, "Are emissions from Hanson Cement harmful to health?" The Investigation Response Team found no evidence that emissions from Hanson Cement have resulted in harm to physical health and no evidence of any persistent increase in ill-health, but found that the health of people living near the site was generally as good or better than that of those living elsewhere in Wales.

The Investigation Response Team has recommended that:

- Communication and engagement is improved between Hanson Cement, public agencies and bodies and the local community in order to rebuild trust
- All relevant monitoring and sampling is reviewed by regulatory agencies
- No further investigations into the concerns relating to the health of the local population are required, unless new evidence comes to light from routine monitoring and surveillance

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# 1 Background

In April 2010, Mrs Edwina Hart AM MBE, Minister for Health and Social Services asked Public Health Wales, as an independent agency, to work with other interested agencies and the local community to gain a better understanding of the health concerns associated with the cement works and provide appropriate expert advice and support in response. These concerns followed several incidents relating to Hanson Cement (formerly known as Castle Cement Ltd) over the previous few years.

## 1.1 Investigation Response Team

An Investigation Response Team was established to investigate health concerns raised by local community leaders over the Hanson Cement works in Padeswood, Flintshire. The Investigation Response Team was chaired by Mr Andrew Jones, Executive Director of Public Health Betsi Cadwaladr University Health Board, and comprised colleagues from:

- Public Health Wales
- Betsi Cadwaladr University Health Board
- Flintshire County Council
- Environment Agency Wales
- Food Standards Agency
- Health Protection Agency – Centre for Radiation, Chemical and Environmental Hazards (Wales)
- Health and Safety Executive

## 1.2 Scope of the investigation

In order to respond to the request from the Minister, and following the clarification of concerns expressed by local community leaders and people living near the Hanson Cement site, the Investigation Response Team was set up. The terms of reference for the investigation were:

- Work with local community to gain a better understanding of the public health concerns associated with the Hanson Cement plant
- Provide appropriate expert advice and support in response to public health concerns raised
- Set up a comprehensive approach to implement the scope of the investigation

Areas that were not addressed by the investigation were:

- Animal health issues
- Comparisons with health outcomes around other cement works

- Issues related to the composition and use of the final product

### **1.3 Sub Groups**

The Investigation Response Team identified four sub groups to take responsibility for key elements of work to fully address the issues raised. They were:

- Environmental health risk assessment sub group
- Health information sub group
- Communication sub group
- Community engagement sub group

### **1.4 Meetings with community representatives**

The Investigation Response Team met in public on six occasions, in the presence of more than 20 invited community representatives. This was a forum to update community representatives on the investigation progress, present findings as they became available and encourage discussion and challenge throughout the process. A media briefing took place before each meeting to assist with the sharing of information to the wider community. Following each meeting a newsletter was sent to over 19,000 local homes to update local residents on findings and progress.

In addition, the Chair of the Investigation Response Team met on a number of occasions with officers and elected representatives from local town and community councils, Flintshire County Council, Community Health Council and also with local Members of Parliament and Assembly Members. Public Health Wales facilitated community engagement processes with representatives of local community groups to seek out and understand concerns.

## 2 History of the plant

1948	Cement works first established in Padeswood. Kiln 1 and Kiln 2 ('wet' kilns) commissioned.
1967	Kiln 3 (a 'dry', more thermally efficient kiln) commissioned.
1990	Pollution control legislation now governed by the Environmental Protection Act. Required relevant industries to obtain an Authorisation (i.e. permission that specified the conditions under which certain processes could operate) from the relevant enforcing authority.
1993	Her Majesty's Inspectorate of Pollution (a predecessor of the Environment Agency) issued the first Authorisation to the cement works in Padeswood.
Jan 1999	Planning application for Kiln 4 submitted to Flintshire County Council.
1999	Environment Agency Wales prosecutes Hanson Cement for failing to control excessive dust escapes ('fugitive emissions').
Jan 2000	Planning permission for Kiln 4 granted.
2000	Environment Agency Wales prosecutes Hanson Cement for discharging fuel oil into Black Brook which runs through the grounds of Hanson Cement and an adjacent farm.
2000	Environment Agency Wales receives application for a Pollution Prevention and Control (PPC) Permit for Kiln 4 including the use of waste derived fuels.
2000	Local campaigning group raises concerns with North Wales Health Authority about cancer clusters in the area. These were investigated by the Health Authority and the Welsh Cancer Intelligence and Surveillance Unit.  No evidence of increased incidence of cancer around the cement works was found <sup>1</sup> . It was concluded that incorrect handling of cancer registration data was considered to have resulted in spurious cancer clusters and unnecessary public alarm.
2000	National Assembly for Wales announces a Public Inquiry into the planning application on the grounds that it raised planning issues of more than local importance.

<sup>1</sup> Roberts JR, Steward J, John G (2003) *Cement, cancers and clusters: an investigation of a claim of a local excess cancer risk related to a cement works*, Journal of Public Health Medicine, Vol. 25, No. 4, pp. 351-357 <http://jpubhealth.oxfordjournals.org/content/25/4/351.long>

	The Inquiry considered the effects on public health, visual impact, employment and national policies.
March 2002	Public Inquiry upholds the decision to grant planning consent for Kiln 4.
2004	Environment Agency Wales issues Pollution Prevention and Control permit.
2005	Kiln 4 was commissioned. Kilns 1, 2 and 3 decommissioned.
2006	Environment Agency Wales serves two Enforcement Notices to address issues relating to noise and excessive fugitive dust emissions, and prosecutes for earlier dioxin breaches in 2004.
2007	Environment Agency Wales serves an Enforcement Notice to address issues relating to noise, fires and fugitive dust emissions.
2008	Environment Agency Wales serves an Enforcement Notice to address problems identified with new landfill site.
2009	Significant cement dust release as a result of pipe work failure.
2010	Environment Agency Wales prosecutes Hanson Cement on four charges relating to dust, noise and fires.

## 2.1 Hanson Cement and the local community

There are a number of ways that Hanson Cement communicate with and offer support to the local community, including:

- Hanson Cement Liaison Committee. This meets four times a year and has representatives of local residents, town and community councils, Flintshire County Council, Environment Agency Wales, Betsi Cadwaladr University Health Board, National Farmers Union, Ramblers Association as well as Hanson Cement.
- "Open Door" newsletter distributed locally
- Open days
- Donations to local groups
- Use of their football ground and facilities by local teams

## 3 Methods

### 3.1 The public health assessment process

The Investigation Response Team adapted the public health assessment process used by the Agency for Toxic Substances and Disease Registry (ATSDR, 2005) in the USA. This is recognised internationally as being a very thorough approach to finding out whether hazardous waste sites or environmental releases might harm people's health. The main elements of the process are summarised below.

#### 3.1.1 Engaging with the local community and seeking to identify and understand their concerns

The Investigation Response Team considered that engaging and communicating with the community residents was fundamental to the investigation process. The Investigation Response Team has had ongoing engagement with local community representatives, people who have contributed directly to the investigation and the wider community, throughout the investigation.

In Phase 1 of the engagement process, views and concerns were invited and actively sought from all parts of the community. A wide range of methods were used to capture people's views, including:

- Six focus groups inviting attendance from 107 community groups
- One focus group for Hanson Cement employees
- Two community drop-in sessions
- Seven community walkabouts
- Telephone answer machine
- Written contact points from May – November 2010 for letters or e-mails
- Letters/questionnaires sent to 47 primary care services, 10 school councils and the youth service

The opportunities to engage with the process were advertised in over 19,000 newsletters sent to local homes. Forty posters were displayed locally, four press releases were issued. Local newspapers, the Flintshire Children and Young People's web forum and newsletter were all used to raise awareness of the investigation and the opportunities to become involved in it.

All the identified concerns and questions were documented and presented to the Investigation Response Team meeting in public in December 2010. Following this meeting they were placed on the Public Health Wales

Hanson Cement Investigation web pages:  
([www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)).

Residents were alerted to this by a newsletter. The document was agreed by the local community representatives attending the meetings in public as a comprehensive list of the concerns needing investigation.

Throughout the investigation, the Investigation Response Team has been keen to take all possible steps to present what is often quite technical information in a way that is relevant to, and understood by, the people whose concerns prompted the investigation. As each sub-group completed a piece of work, the findings of the technical reports were presented at a series of meetings of community representatives, held in public. This provided opportunities for local people to discuss the information with those who had produced the reports, as it became available.

Phase 2 of the engagement process, to inform and feedback the results of the investigation (presented in the draft final report) took place from January – June 2012.

The focus of the engagement was to seek community members' views on:

- How well the draft final report answered the concerns that had been raised
- Whether the content of the report was easy to understand
- Whether there were any concerns about the content of the report
- Whether the layout and style of the report was appropriate and helped to communicate the findings

Three drop-in sessions were arranged, and members of the Investigation Response Team attended meetings of community groups at their request. People also telephoned, emailed and contacted the team by letter to comment on and/or seek further clarification on issues.

A report describing the purpose, methods, key issues relating to these four areas and other comments about the draft final report of the investigation has been prepared. The information received during this second phase of engagement has influenced the style and content of this final report. An overview of all the comments received (including those that related to issues outside the scope of the investigation or the engagement process) is provided in the Hanson Cement Investigation: Community Engagement (Phase 2) Report.  
([www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608))

### **3.1.2 Assessing environmental hazards and analysing environmental monitoring results**

Environmental monitoring data from the site and community locations were analysed. Information about fine dusts (particulates), dioxins, oxides of nitrogen, sulphur dioxide, carbon monoxide and metals was analysed. Comparisons were made against health based standards or the lower emission limits, as appropriate.

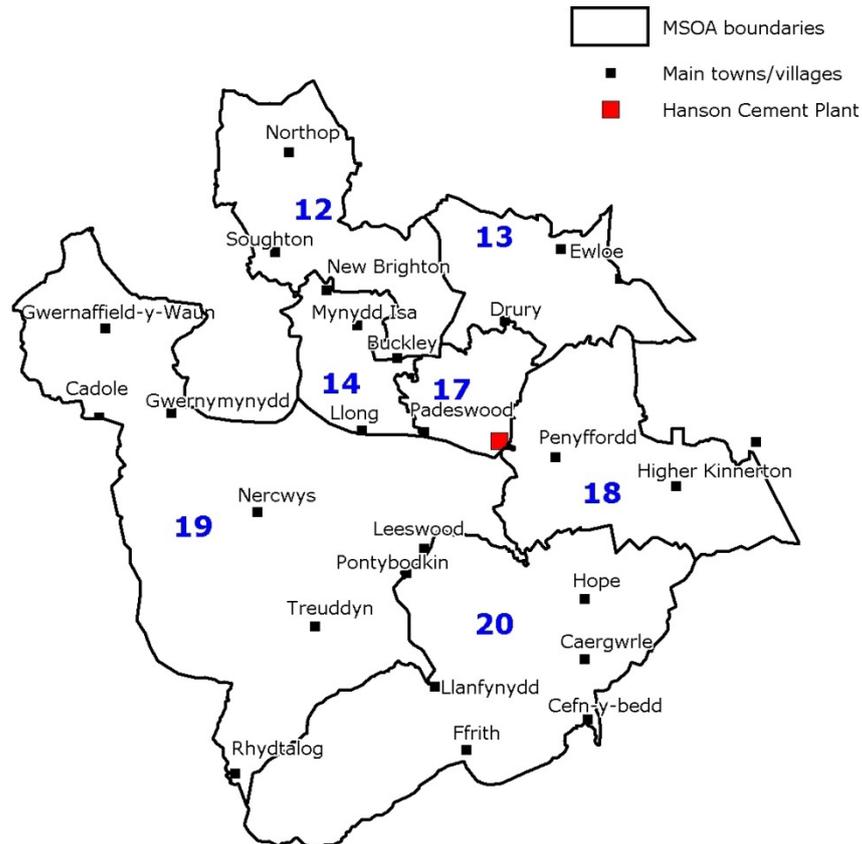
Complaints received by Hanson Cement, Flintshire County Council and Environment Agency Wales were analysed to determine the range of issues which prompted complaints, and the geographical areas from which complaints were made. The effects of coarse dusts, noise, odour and smoke were assessed.

### **3.1.3 Addressing concerns about health in the local area**

The Public Health Wales Observatory and the Welsh Cancer Intelligence and Surveillance Unit of Public Health Wales undertook detailed analyses of health data for the communities in the areas around Hanson Cement. The main areas used for analysis are shown in Figure 1. The areas outlined are boundaries, known as "Middle Super Output Areas" (MSOAs) each containing about 7,500 people. MSOAs were judged to offer the best opportunity for local detail while allowing for robust statistical analyses.

Section 5.3 in the Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement (<http://howis.wales.nhs.uk/sitesplus/888/page/38320>), and Appendices 4 and 5 provide further explanation about the reasons for choosing MSOAs as the areas for analysis.

Figure 1

**Map of Middle Super Output Areas in the vicinity of Hanson Cement Plant**

Produced by Public Health Wales Observatory  
© Crown Copyright and database right 2012. Ordnance Survey 100044810

General health data was analysed and described for these seven defined areas surrounding Hanson Cement. Comparisons were made with Wales, North Wales and Flintshire. Analysis was also undertaken for different age groups.

Three different types of analysis of cancer data were also undertaken, looking at:

- rates of the specific cancer types raised as concerns by the local community, for each of the seven areas
- any evidence of clusters of cancers in local communities
- whether cancer rates within two kilometres of the site were different to those between two and five kilometres from the site

**3.1.4 Peer Review**

Elements of health data analysis were independently peer reviewed by experts elsewhere in the UK, who were unconnected with this investigation. This introduced independent rigour to the investigation to

help to promote community confidence in the way the investigation had been carried out and trust in the outcomes it produces. The organisations that supported the peer review included the West Midlands Public Health Observatory and the South West Cancer Intelligence Service.

### **3.1.5 Format of the Report**

This report is structured around the 87 questions that relate to the documented community concerns that were agreed and published following the initial community engagement process. They are divided into sections related to their topic area. The response for each is summarised briefly, with more detail following where appropriate.

The 'further information' section following each response lists the technical reports produced for the investigation (and other links) that provide the background to the response given. Links with other questions in the document that relate to similar issues are also provided.

A summary of the final report of the investigation is provided in Appendix 1.

Other appendices provide some additional general information to aid understanding.

## 4 Responses to community concerns

### 4.1 Overarching Question

#### 1 Are emissions from Hanson Cement harmful to health?

The Investigation Response Team found no evidence that emissions from Hanson Cement have resulted in harm to physical health.

Whilst the particulate and gaseous emissions from Hanson Cement may in themselves present hazards (in that they have the potential to cause harm), the level of risk that they present (i.e. the likelihood that an undesirable event ('harm') will happen) is minimal. The levels of emissions, (apart from exceptions noted below), were within safety limits and so did not pose a risk to health.

No evidence of any persistent increase in ill-health was found, but the health of people living near the site was generally as good, or better, than that of those living elsewhere in Wales.

The Investigation Response Team recognise the longstanding and continuing concerns of a number of local residents about whether living near the Hanson Cement site is harmful to health. All the different strands to the investigation focussed on finding out the answer to this question.

The Investigation Response Team considered all the emissions from the site and whether these could cause harm to people's health. It also looked at the environmental monitoring data to assess whether these emissions had contributed to a breach of any health based standards.

The Investigation Response Team, in addition, considered the health outcomes of the people living in the communities around Hanson Cement. In particular, it looked for health outcomes that were of concern to the community and those that could potentially be associated with the emissions.

The emissions from the site that were considered include particulates (PM<sub>10</sub>), dioxins, oxides of sulphur, nitrogen and carbon along with metals. Other pollutants of concern were associated with nuisance and included coarse dusts, noise, odour and smoke.

High level exposure to all these emissions has the potential to impact adversely on health. However, the environmental monitoring data examined from 2000 - 2010, showed that in the vast majority of

cases the emissions were within the health based standards set in the UK. These standards are set so as to be protective of health. They are based on International guidelines and have a safety margin built into them.

The Investigation Response Team noted that there were some breaches of emission limits, which are technically achievable for this type of process but well below the health based levels. In particular, there were breaches in permitted levels of dioxin emissions to air occasions in 2004 and 2008. Community fears of invisible pollutants such as these can give rise to concern. However, the main source of human exposure to dioxins is through the food chain. The investigation team concluded that the risk of these increased emissions to air to the local community was considered very low.

The assessment of potential nuisance and associated complaints showed that on occasions, coarse dust and noise emissions had given rise to repeated complaints from some parts of the community.

Reported environmental nuisance exposures indicate that there is an impact on the community, although environmental sources other than Hanson cement may also play a part. However, based on the data and information received, such effects are likely to be annoyance-related, impacting on wellbeing and quality of life, and are unlikely to affect physical health.

To consider health outcomes locally, routinely collected health information was analysed and described. It showed that general health is good or better in the areas near the Hanson Cement works compared to that typical for Wales. Notably, new diagnoses of cancer, deaths from cancer and admissions to hospital from respiratory conditions are similar to or better than that typically seen for Wales.

However, in one of the seven areas examined – Hope, Caergwrle and Llanfynydd - the figure for new diagnoses of cancer was seen to be significantly higher than Wales as a whole. There are 13 other locations in North Wales, not near to the cement works, where similar rates can be found. The Investigation Response Team decided to look at this finding in more detail.

To respond to concerns relating to alleged cancer clusters, examination of routinely collected cancer information, covering a longer diagnosis period of 18 years (1991-2008), was undertaken. This analysis found that the rates of new diagnoses of cancers in the seven areas around the Hanson Cement plant are not higher than is expected and are similar to those of Wales and Flintshire. In addition, there was no evidence of consistent clusters of cancer or cancer types over time in the local area.

Further analysis of the areas of Hope, Caergwrle and Llanfynydd showed a statistically significant incidence of bowel cancer was found to have contributed to the finding for the period 2004-2008. This finding was not repeated in other time periods examined. Bowel cancer is the third most common cancer and risk factors are mainly associated with lifestyle, including diet.

Ongoing routine surveillance of cancer shows that unfortunately cancer is common but survival rates are improving. A level of increased awareness of cancer in local communities is therefore understandable.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement

Age patterns and health: Supplemental report to 'A descriptive analysis of health in the vicinity of the Hanson Cement Plant'

Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit

Review of particulate matter by the Health Protection Agency *n.b. This is a very large document and may take awhile to download*

Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Review of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide and Metals by the Health Protection Agency

## 4.2 General Health Questions

### 2 Does the community suffer more ill-health than a normal comparable population?

General health is good or better in the areas near the Hanson Cement works compared to that typical for Wales.

New diagnoses of cancer, deaths from cancer and admissions to hospital from respiratory conditions are similar to or better than that typical for Wales.

No evidence of consistent clusters of cancer or cancer types in the geographical areas or over time were found in the local area.

Whilst general health is good, in one of the seven areas examined, which includes Hope, Caergwrle and Llanfynydd, the figure for new diagnoses of cancer is statistically significantly higher than Wales as a whole for the period 2004-2008. There are 13 other locations in North Wales, not near to the cement works, where similar rates can be found. The Investigation Response Team decided to look at this finding in more detail.

To respond to concerns relating to perceived cancer clusters examination of routinely collected cancer information, covering a longer diagnosis period of 18 years (1991-2008), found that the rates of new diagnoses of cancers in the seven areas around the Hanson Cement plant are similar to those of Wales and Flintshire.

Further analysis of the areas of Hope, Caergwrle and Llanfynydd showed a statistically significant incidence of bowel cancer which was found to have contributed to this finding. Bowel cancer is the third most common cancer in the UK, and is mainly associated with lifestyle factors, including diet.

No evidence of consistent clusters of cancer or cancer types in geographical areas or over time were found in the local area.

Ongoing routine surveillance of cancer shows that cancer is common; the number of cases of cancer diagnosed over the last fifteen year period in Wales shows an increasing trend for both males and females.

Early detection and treatments for cancer mean that cancer survival continues to improve. It would also appear that more people feel able to talk about their diagnosis with family and friends than has happened in the past, especially if they know others in the same situation. A level of increased awareness of cancer in local communities is therefore perhaps understandable.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement

Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit

### 3 a) What is the age profile of disease?

The age profile for the health indicators examined was largely similar in the area surrounding Hanson Cement to Wales as a whole.

Health data was examined by age bands for diseases causing most concern to local communities. They included emergency admissions for respiratory disease, including among infants and cancer incidence. Deaths from all causes, from respiratory diseases, cancers and infant deaths were also included.

### b) Is there a deviation from the normal age?

**Refers to concern regarding premature illness and mortality. Another reference to a case of childhood cancer.**

There is no evidence of conditions occurring more frequently amongst younger people or of any excess infant mortality in the area surrounding Hanson Cement. Similarly, the rate of childhood cancer is similar to the Flintshire and Wales rates.

*Further information:*

Hanson Investigation Library

<http://howis.wales.nhs.uk/sitesplus/888/page/38320>

Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit

Age patterns and health: Supplemental report to 'A descriptive analysis of health in the vicinity of the Hanson Cement Plant'

### 4 a) Are there higher rates of infant mortality and morbidity?

There is no evidence of higher rates of infant mortality or morbidity in the area around the Hanson site.

Infant mortality rates were examined for the areas around Hanson Cement and compared with the Wales rate. Infant deaths are rare. For this reason a longer time period, 2001-2009 was used for analysis. The analysis showed that the area surrounding the Hanson Cement Plant is slightly lower than the Wales rate, although it is based on a relatively small number of events.

Emergency admissions for respiratory disease among infants were used as an indicator of infant morbidity. Again this analysis showed a

similar (slightly lower) rate in the vicinity of the plant to the all Wales rate.

**b) What are the upwind and downwind figures for infant mortality and morbidity, by electoral ward?**

This analysis was not undertaken. Advice from the Health Protection Agency was that although the predominant wind direction is from the North West, in reality the wind does blow in all directions and varies at different locations in the surrounding area, depending on geographical features such as hills and valleys. Therefore, the wind does not consistently blow in one direction and there is little to distinguish "upwind" and "downwind" areas.

**c) Why were infant mortality and morbidity data available, by ward, to Michael Ryan in relation to the Edmonton Incinerator, yet advice from health experts is that no such records are available?**

Mortality data is collected for small areas but can only be made available subject to restrictions. Rules governing the use and sharing of data prevent data being disclosed when only small numbers are involved. This is to protect the confidentiality of those affected. Small numbers of events are also more difficult to interpret due to the role of chance effects.

Similar restrictions apply to episodes of infant ill health (morbidity) such as hospital admissions.

To answer the questions of concern detailed analysis was undertaken combining data from the local areas to ensure it was sufficient for robust and meaningful analysis and subsequent publication.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of particulate matter by the Health Protection Agency *n.b.*  
*This is a very large document and may take awhile to download*

Age patterns and health: Supplemental report to 'A descriptive analysis of health in the vicinity of the Hanson Cement Plant'

*Questions 7, 17c, and 42b also relate to child health concerns*

## 4.3 Cancers

### 5 Are there “pockets of cancer” in certain geographical areas?

#### Areas mentioned:

- **12 cancer sufferers in 22 residences in a mile stretch of one road, Buckley.**
- **Penymynydd and Penyffordd**
- **Buckley Bistre East, Buckley and Bistre West**

There is no evidence of consistent clusters of cancer or cancer types over time in the local area.

The number of cases of cancer diagnosed over the last fifteen year period in Wales shows an increasing trend for both males and females. Although cancer is a common disease, it is of great concern to those directly affected, along with their families, friends and neighbours. The fact that it is a common disease can sometimes raise very real concerns locally that there is a direct cause. There are many different types of cancers and each is associated with different risk factors that impact on the chance of getting the disease.

To put this in context, there are approximately 18,000 cases of cancer diagnosed each year in Wales. About one in three people develop cancer in their lifetime. In addition, there are many different types of cancer affecting different parts of the body. A large number of factors impact on the chance of getting cancer including tobacco smoke, dietary factors, obesity and exercise, infectious agents and occupation.

Early detection and treatments for cancer mean that cancer survival continues to improve. It would also appear that more people feel able to talk about their diagnosis with family and friends than has happened in the past, especially if they know others in the same situation. A level of increased awareness of cancer in local communities is therefore perhaps understandable.

The Welsh Cancer Intelligence and Surveillance Unit for Public Health Wales analysed all data covering a diagnosis period of 18 years (1991-2008). They looked at all the cancer types raised as concerns by the local community. Three types of analysis were undertaken:

- **Incidence of cancer:**

The analysis has found that the rates of new diagnoses of cancers in the seven areas around the Hanson Cement plant are similar to those of Wales and Flintshire. Some statistically significant results were found. However, this must be seen in context. The Welsh Cancer

Intelligence and Surveillance Unit conducted 672 separate statistical tests as part of the investigation and statistical theory predicts that on average 33 statistically significant results would arise just by chance. Twenty two statistically significant results were found and 650 non-significant results which are within the limits of chance variation. In fact, when a statistical correction was made for multiple testing there are no significant results.

- Cluster analysis:

This analysis revealed some statistically significant results but none of these could be related to living near the plant. Rather they reflected large scale variation in background risk factors mainly associated with lifestyle choices, for example, smoking and diet. This is a pattern seen in other areas of Wales.

- Radius analysis:

This did not reveal any statistically significant difference between the rate of diagnosis of new cases of cancer in residents living within 2km radius of the plant compared with those living outside this radius but within 5km.

One local area, which includes Hope, Caergwrle and Llanfynydd was identified in the Descriptive Health Analysis Report (January 2011) as having a statistically significant incidence of all cancers compared with the Wales average.

The Welsh Cancer Intelligence and Surveillance Unit examined this finding looking at different types of cancer incidence over the same five-year period (2004-2008). A statistically significant increased incidence of bowel cancer was found to have contributed to the finding for the period 2004-2008. This finding was not repeated in other time periods examined. Bowel cancer is the third most common cancer and risk factors are mainly associated with lifestyle, including diet.

When the 2003-2008 period data from the first method, MSOA cancer incidence analysis, was compared with the five-year time period described above, the results were no longer statistically significantly higher in Hope, Caergwrle and Llanfynydd.

These results should be seen in the wider context of cancer in North Wales. There are many types of cancer and each of them is associated with different causes. Research shows that lifestyle factors such as smoking and alcohol misuse cause about 33 per cent of cancers. Dietary factors cause about 35 per cent of cancers and occupational factors cause about four per cent of cancers. Environmental factors such as pollution, e.g. from all industrial sources and vehicles, cause about two per cent of cancers.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit

Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement

*Questions 6, 7, 13 and 27b also relate to concerns about cancer*

**6 Do the communities around Hanson Cement suffer more cancer than other comparable communities?**

**Specific cancers include throat, thyroid, lung, bowel, colon, oesophageal, prostate, kidney, uterine, breast, thyroid, lymphoma, non-Hodgkin's lymphoma, myelodysplasia, multiple myeloma, pancreatic, oesophageal, skin and eye. Also benign brain tumour.**

No evidence of consistent clusters of cancer, cancer types in geographical areas or over time were found in the local area.

On examining the types of cancer identified by the community as of concern, for each of the seven local areas surrounding the plant, comparisons were made with both Wales and Flintshire average incidence. In total 672 separate analyses were undertaken and on average 33 statistically significant results would be expected to arise just by chance.

650 of the 672 showed results were similar to Wales and/or Flintshire. 22 were statistically significant different to the Wales and/or Flintshire average. Fourteen were higher and 8 lower. This is lower than expected. When a statistical correction is made for the effect of multiple testing there are no significant results.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit

*Questions 5, 7, 13 and 27b also relate to concerns about cancer*

## 7 Is there a risk of children contracting cancer in areas downwind of the plant?

Analysis of available data showed that cancer rates in children in the areas near Hanson Cement were not significantly different to Wales or Flintshire.

Cancer in children is a rare occurrence. Analysis was undertaken and rates in the areas near Hanson Cement were not significantly different to Wales or Flintshire. Results involving counts less than five were not published to protect the confidentiality of those affected.

This analysis was not undertaken for areas "downwind" of the plant. Advice from Health Protection Agency experts was that although the predominant wind direction is from the North West, in reality the wind blows in all directions and varies at different locations in the surrounding area, depending on its geographical features such as hills and valleys. Therefore, the wind does not consistently blow in one direction and there is little to distinguish "upwind" and "downwind" areas.

It may be reassuring to note that evidence from the analysis of emissions from Hanson Cement show that emissions have generally reduced over the last ten years. Further analysis of the air quality locally shows it to be good and it has improved as a result of more general reductions in emissions from industry and traffic. This is mirrored elsewhere in the UK.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

[Analysis of cancer by the Welsh Cancer Intelligence and Surveillance Unit](#)

[Review of particulate matter by the Health Protection Agency](#) *n.b. This is a very large document and may take awhile to download*

*Questions 4, 17c, and 42b also relate to child health*

*Questions 5, 6, 13 and 27b also relate to concerns about cancer*

## 4.4 Respiratory health

### 8 Are there general increased levels of respiratory disease in the community?

#### Includes asthma and chest problems

There is no evidence of increased levels of acute respiratory disease in the area surrounding the plant.

The rates of deaths from respiratory disease, emergency hospital admissions for respiratory disease, admissions to hospital for chronic obstructive pulmonary disease (COPD) and emergency admissions to hospital for both asthma and respiratory infections were all examined. All are broadly similar to that experienced for Wales as a whole.

However, there is a lack of routine data on respiratory disease that does not require hospital admission or cause death that could be used in small area analyses such as were undertaken for this investigation. GP practices may use different codes to record symptoms, (although this is expected to be more consistent for asthma and COPD for contractual reasons), and there is a range of software systems that mean collating data across practices is difficult.

People registered at a GP practice reside in geographical areas which do not necessarily correspond to the MSOA for that practice; this makes GP data difficult to analyse in the context of this investigation.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement (pages 56-69).

## 4.5 Other health related concerns

### 9 Are there increases in other acute health problems in the communities near the plant?

Acute health problems include respiratory infections, dry coughs, sore and dry throats, dry mouth, dryness and sores in eyes, stinging eyes, nostrils and loss of sense of smell, loss of voice, colds, headaches, sinus problems, skin rashes and swollen lips. Also reports of dust and dioxin sensitivity.

There was no evidence of increased levels of acute health problems in the communities near the plant.

There was no evidence found among hospital or mortality data of other acute health problems among communities living near the plant.

There is a lack of routine data on symptoms and conditions that do not require hospital admission or cause death that could be used in small area analyses such as were undertaken for this investigation. Many of the problems or symptoms listed may not result in visits to healthcare professionals. GP practices may use different codes to record symptoms, and there is a range of software systems that mean collating data across practices is difficult. People registered at a GP practice reside in geographical areas which do not necessarily correspond to the MSOA for that practice; this makes GP data difficult to analyse in the context of this investigation.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement

## 10 Are there increases in other health problems in the communities near the plant?

**Other health issues raised include: myelodysplasia, high blood pressure, heart problems, myalgic encephalopathy (ME), Chronic Fatigue Syndrome (CFS).**

There was no evidence of increased levels of acute health problems in the communities near the plant

Routinely collected health information was analysed for the period 2004-2008. This analysis also included circulatory disease (a group of conditions including high blood pressure and heart disease) and an analysis of coronary heart disease. Some of the health issues raised are not recorded and accessible in a reliable way that would allow robust analysis.

There is a lack of routine data on symptoms and conditions that do not require hospital admission or cause death that could be used in small area analyses such as were undertaken for this investigation. Conditions such as high blood pressure often do not have any

symptoms and so may not result in a visit to a health care professional. GP practices may use different codes to record symptoms (although this is expected to be more consistent for coronary heart disease and high blood pressure for contractual reasons), and there is a range of software systems that mean collating data across practices is difficult. People registered at a GP practice reside in geographical areas which do not necessarily correspond to the MSOA for that practice; this makes GP data difficult to analyse in the context of this investigation.

Similarly, there is no reliable data about the prevalence of chronic fatigue syndrome / myalgic encephalopathy (ME), nor about myelodysplasia. Therefore the Investigation Response Team did not examine these conditions.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement

**11 a) Is someone monitoring health complaints in the area, reviewing GP records for more accurate analysis of possible health problems?**

Routine monitoring of health in all areas across Wales is undertaken as part of the work of the health boards and Public Health Wales. No specific additional monitoring is in place for the community living around Hanson Cement.

Routine monitoring of health in all areas across Wales is undertaken as part of the work of the Health Boards and Public Health Wales. It is concerned with specific diseases and conditions, and does not include monitoring of non-specific symptoms. The Public Health Wales Observatory analyses health data for use by local Health Boards and partners. The Welsh Cancer Intelligence and Surveillance Unit analyse and report on all cancer registrations in Wales. The health challenges facing communities across North Wales are included in the annual report and supporting documentation of the Executive Director of Public Health, Betsi Cadwaladr University Health Board.

GP practices may use different codes to record symptoms, and there is a range of software systems that mean collating data across practices is difficult. People registered at a GP practice reside in geographical areas which do not necessarily correspond to the MSOA

for that practice; this makes GP data difficult to analyse in the context of this investigation.

*Further information:*

[Betsi Cadwaladr University Health Board:](http://www.wales.nhs.uk/sitesplus/888/page/46346)  
<http://www.wales.nhs.uk/sitesplus/888/page/46346>

[Executive Director of Public Health: Annual Report 2011](#)

[Executive Director of Public Health: Interim Annual Report 2010](#)

[North Wales Profile 2011](#) *Very large document so may take several minutes to download*

[Profile of North Wales \(2010\)](#) *Very large document so may take several minutes to download*

**b) What body burden testing, if any (in relation to chemical and dioxins in the human body for the local population) has been carried out by the Health Authorities in the emission dispersal areas of the Hanson Works?** *(This question was omitted from agreed "Questions of Community Concern" document in error).*

There is no routine testing of biological levels of chemicals or dioxins in the local population.

To undertake such testing would involve invasive tests on the local population and comparator populations. There is no evidence to suggest such tests are necessary.

Emissions from the plant are monitored as a requirement of the permit issued by Environment Agency Wales.

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Environment Agency Wales Dioxins Factsheet

*Questions 32 and 33 also relate to dioxins*

## 4.6 Occupational Health

### 12 Are there occupational health exposures of concern?

**Specific reference to dusts and asbestos exposures.**

There are no current occupational health exposures of concern at the Hanson site.

The Health and Safety Executive has considered its records for this premises and put together an expert team who visited the site. The team looked at site records, processes, control measures and personal monitoring of employees to address concerns.

Although workers could potentially be exposed to hazardous substances at Hanson Cement, control measures are and have been in place to prevent this risk of harm. These include reliable and effective measures to eliminate or reduce risk of exposures to substances hazardous to health (including dusts) as required by regulations.

There are asbestos containing materials on site. The location and condition of these materials has been identified and recorded by Hanson Cement. An asbestos management plan is in place, which meets the requirements of the Health and Safety Executive's guidance and complies with the requirements of the law.

These findings together with the results of personal monitoring conclude that there are no current occupational health exposures of concern at the site.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Health & Safety Executive Response to Occupational Exposure Issues

### 13 Are there increased cancers in employees/former employees?

**Specific cancers include throat, breast, lung, prostate, kidney, bowel as well as unspecified cancers.**

There were no reports of cases of cancer or chronic respiratory disease reported as attributable to working at the plant.

The possibility that some of the cases of cancer occurring in the workforce might be occupational in origin cannot be excluded absolutely.

The Health and Safety Executive investigation included:

- Questioning of the occupational health doctor involved with the site since 1999
- A review of exit medicals that are carried out on employees prior to them leaving the company
- Claims against the company
- Death certificates received by the company for pension purposes 1997 - 2010

It is possible for cases of some common cancers, such as lung cancer, to be due to occupational exposures, but not recognised as such because they have no features that distinguish them from cases due to other causes, such as smoking. Therefore, the possibility that some of the cases of cancer occurring in the workforce might be occupational in origin cannot be excluded absolutely.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Health & Safety Executive Response to Occupational Exposure Issues

*Questions 5, 6, 7 and 27b also relate to concerns about cancer*

#### **14 Can health surveillance records be made available for consideration?**

The Health and Safety Executive Occupational Health Inspector examined the records from 2000 to 2010 as part of this investigation.

The health surveillance records were made available to the Health and Safety Executive Occupational Health Inspector, who examined the records from 2000 to 2010 as part of this investigation. For reasons of patient confidentiality, details of these records are not available to the public. During the period examined, no cases of occupational ill health were identified by the occupational health nurse employed by the company. There were no referrals onto the occupational health doctor for occupational ill health. In addition, no reports of occupational ill health were reported to the Health and

Safety Executive during the period 2001 to 2011, as required by law. However the features of the legislation relating to disease reporting are such that some cases of work-related disease, particularly for diseases that take a long time to develop, may have not been included in the reporting arrangements.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Health & Safety  
Executive Response to Occupational Exposure Issues

## 4.7 Other concerns: animal health

### 15 What are the animal health issues?

Animal health issues were not included in this investigation.

The investigation undertaken has focused on people's health only, in line with the request from the Minister for Health and Social Services. Animal health is outside the scope of the investigation although the assessment in terms of the food chain was considered.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

### 16 Can contaminated water from the landfill site cause abortion in animals drinking the water?

Animal health issues were not included in this investigation.

The investigation undertaken has focused on people's health only, in line with the request from the Minister for Health and Social Services. Animal health is outside the scope of the investigation although the assessment in terms of the food chain was considered. Monitoring of leachate, groundwater and Black Brook is detailed in the Environment Agency Wales report.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of Dioxins Data  
by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the  
vicinity of Hanson Cement by the Food Standards Agency

Environment Agency Wales Questions of Concern Answered (*Section  
6.2 and Appendix B*)

*Questions 40 and 41 also relate to concerns about water*

## 4.8 Emissions

### 17 a) What are the safe limits for daily human intake of each of the chemical substances capable of being emitted from the works during the cement making process from start to finish?

The objectives for air quality and dietary intake of interest are  
provided in the table below.

The UK Air Quality Objectives and the European Union (EU) Air  
Quality Limit Values are based on health effects in relation to  
exposure. The European Union target and limit values are often  
derived from the World Health Organisation air quality guidelines.  
Limits are expressed differently for different chemical exposures,  
depending on the type of risk they pose. For example the limits for  
dioxins are Tolerable Daily or Weekly Intakes as the main risk is from  
ingestion of dioxins in foods while, chemicals that pose a risk from  
inhalation are expressed as a unit per cubic metre of air. The table  
below gives the established and respected ways of presenting the  
recommended safe limits for the time periods specified.

The air quality limits and dietary intake limits for the substances of  
interest are:

Particulates  PM <sub>10</sub>	Annual mean = 40 µg/m <sup>3</sup> 24 hour mean = 50 µg/m <sup>3</sup> <u>Short term exposures:</u> <i>Low</i> = 0-64 µg/m <sup>3</sup> 24 hour average (micrograms per cubic metre) <i>Moderate</i> = 65 - 94 µg/m <sup>3</sup> 24 hour average <i>High</i> = 95 - 127 µg/m <sup>3</sup> 24 hour average <i>Very High</i> = 128+ µg/m <sup>3</sup> 24 hour average
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Dioxins	2 pg/kg bw per day (picograms per kilogram of bodyweight)
Nitrogen Dioxide	Annual mean = 40 µg/m <sup>3</sup> 1 hour mean = 200 µg/m <sup>3</sup> <i>Short term exposures:</i> <i>Low</i> = 0-286 µg/m <sup>3</sup> 8 hour average <i>Moderate</i> = 287 - 572 µg/m <sup>3</sup> 8 hour average <i>High</i> = 573 - 763 µg/m <sup>3</sup> 8 hour average <i>Very High</i> = 764+ µg/m <sup>3</sup> 8 hour average
Carbon Monoxide	Maximum daily running 8 hour mean – 10 mg/m <sup>3</sup> <i>Short term exposures:</i> <i>Low</i> = 0-11.5 mg/m <sup>3</sup> 8 hour average (milligrams per cubic metre) <i>Moderate</i> = 11.6 – 17.3 mg/m <sup>3</sup> 8 hour average <i>High</i> = 17.4 – 23.1 mg/m <sup>3</sup> 8 hour average <i>Very High</i> = 23.2+ mg/m <sup>3</sup> 8 hour average
Sulphur dioxide	24 hour mean = 125 µg/m <sup>3</sup> 15 minute mean = 266 µg/m <sup>3</sup> <i>Short term exposures:</i> <i>Low</i> = 0 – 265 µg/m <sup>3</sup> 15 minute average <i>Moderate</i> = 266 – 531 µg/m <sup>3</sup> 15 minute average <i>High</i> = 532 – 1063 µg/m <sup>3</sup> 15 minute average <i>Very High</i> = 1064+ µg/m <sup>3</sup> 15 minute average
Arsenic	<i>Air quality:</i> 5 ng/m <sup>3</sup> annual mean (nanogram per cubic metre) EU 4 <sup>th</sup> daughter directive target value <i>Dietary intake:</i> No relevant tolerable intakes or reference doses. Due to their harmful properties, and the uncertainty as to threshold levels for those harmful effects, exposure should be as low as reasonably practical (ALARP).
Nickel	<i>Air quality:</i> 20 ng/m <sup>3</sup> annual mean (nanogram per cubic metre) EU 4 <sup>th</sup> daughter directive target value <i>Dietary intake:</i> 5 µg (microgram)/kg body weight World Health Organisation Tolerable Daily Intake
Lead	<i>Air quality:</i> 0.5 µg/m <sup>3</sup> annual mean (microgram per cubic metre) EU 4 <sup>th</sup> daughter directive target value

	<i>Dietary intake:</i> No relevant tolerable intakes or reference doses. Due to their harmful properties, and the uncertainty as to threshold levels for those harmful effects, exposure should be as low as reasonably practical (ALARP).
Mercury	<i>Air quality:</i> inorganic mercury vapour 1 µg/m <sup>3</sup> (microgram per cubic metre) World Health Organisation Air Quality guideline (2000)  <i>Dietary intake:</i> 5 µg (microgram)/kg body weight provisional Tolerable Weekly Intake
Cadmium	<i>Air quality:</i> 5 ng/m <sup>3</sup> annual mean (nanogram per cubic metre) EU 4 <sup>th</sup> daughter directive target value  <i>Dietary intake:</i> 2.5 µg (microgram)/kg body weight European Food Safety Authority Tolerable Weekly Intake
Thallium	<i>Air quality:</i> There is no current standard for ambient air. The Health Protection Agency has used the current Environmental Assessment Level used by the Environment Agency in industrial permitting of 1 µg/m <sup>3</sup> . This is based upon the Workplace Exposure Level (WEL) and adapted to be protective of the general population.

### b) When and how were they established?

The Committee on Toxicity and the Committee on Medical Effects of Air Pollutants are responsible for recommending safe exposure limits.

The Tolerable Daily or Weekly Intake is calculated based on a level where there is no observed adverse affect in the most sensitive people in the population. It has an uncertainty factor built in as a safety margin, usually in the order of 100. The Tolerable Daily or Weekly Intake therefore incorporates a large safety factor and is conservative. The Tolerable Daily Intake for Dioxins was introduced in 2001 by the Committee on Toxicity in 2001 and reaffirmed in 2007.

The air pollution health bandings and the potential impact on the health of people who are sensitive to air pollution are approved by the Committee on Medical Effects of Air Pollutants (COMEAP). COMEAP considers international evidence and guidelines in this process, including that of the World Health Organisation.

**c) How are children monitored during the years from infancy weight to adult weight and how are calculations tabulated?**

Children are weighed at intervals by health professionals. Routine data on children's weights and heights are held on the National Community Child Health Database.

Bio-monitoring for environmental pollutants is not routinely undertaken.

Monitoring of weight gain in children is routine. Bio-monitoring for environmental pollutants is not routinely undertaken.

All children are weighed at birth. This data is collected from across Wales and available through the National Community Child Health Database. The weight of children together with other developmental checks is taken at regular intervals by health visiting staff. Across Wales children are weighed in early school years by school nursing staff. The approach to this is being standardised through the establishment of a Child Measurement Programme. In some areas children are weighed at a later point in school also. Height and weight is generally recorded, which allows the calculation of the Body Mass Index (BMI) which is useful for the assessment of whether weight is in the normal range, underweight, overweight or obese.

In relation to bio-monitoring, although it is analytically possible, these measurements are within the realm of research programmes and would require careful planning and ethical approval.

Bio-monitoring measurements reflect an integrated position (the sum of all exposures in a given time frame), and typically do not allow the identification of exposure from one particular source, whether natural or man-made, airborne, water-borne, food borne, etc.

In addition, the correlation between measured levels of pollutants (e.g. in blood or urine) and health effects may be difficult to establish, making interpretation of results difficult. Bio-monitoring may be helpful for some metals, such as lead, but this would only be undertaken if clinically indicated.

**d) How are the products of incomplete combustion factored into this?**

Emissions that have the potential impact on health, including products of incomplete combustion, are monitored in two main ways.

The permit requires monitoring of a range of exhaust gases in the stack.

Air quality is monitored and assessed in communities.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Review of particulate matter by the Health Protection Agency *n.b. This is a very large document and may take awhile to download*

Review of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide and Metals by the Health Protection Agency

*For more information about the Child Measurement Programme, please go to <http://www.wales.nhs.uk/sitesplus/888/page/56237>,*

*Questions 4, 7 and 42b also relate to child health*

## **18 How are the emissions from overnight kiln flushes monitored?**

**Reference to witness report of unusual black, dense emissions at night.**

The main monitoring on the site for fugitive dust emissions is by closed circuit television (CCTV).

Kiln flushes are unplanned events which can occur at any time, day or night, when raw materials build up in the pre-heater tower and are released suddenly as dust into the atmosphere. There is no specific monitoring for kiln flushes, but the kiln stack and clinker cooler exhaust are monitored continuously for dust emissions, which will include unplanned (i.e. kiln flushes) as well as planned emissions.

Improved closed circuit television (CCTV) monitoring around the site alerts the company to fugitive dust emissions, which must be notified to Environment Agency Wales.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency Wales Questions of Concern Answered

*Questions 36 and 37 relate to the appearance of the plume*

*Question 47 also relates to kiln flushing*

## 19 What are the hazards associated with milling cement?

The main evidence of hazards associated with cement is for those who are exposed through their occupations. Reviews of evidence have been carried out by the Health and Safety Executive indicating risks of respiratory conditions and skin sensitisation with direct contact with cement. There is no consistent scientific evidence to support an association with cement dust and cancer. There is currently a lack of published literature on the health risks for communities living near cement plants.

## 20 a) What are the emissions?

There are a range of emissions from the manufacture of cement. The main ones of interest are:

- Particulates (fine dusts)
- Dioxins
- Oxides of nitrogen, sulphur and carbon
- Metals
- Nuisance emissions of coarse dust, noise, odour and smoke

Other site emissions or wastes include:

- Landfill gas
- Leachate (liquid percolating through the waste, including rainwater) from the landfill site
- Surface water

## b) Are they harmful – all the time, sometimes or not at all?

All of the emissions have the *potential* to cause harm to health.

However, there were no exceedances of annual air quality objectives, and therefore no significant direct impact of airborne emissions on public health.

All air pollutants have the potential to adversely affect human health, particularly when ambient concentrations are elevated and exposure occurs over long periods of time. As a result, health-based UK Air Quality Objectives (as set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland) are in place. These health-based standards are intended to be protective of the most vulnerable in society.

In assessing whether the emissions are harmful, comparisons of emission levels were made against health based standards. Comparisons were also made against tighter emission standards where it is technically possible to operate well below the health based standards. European law requires that industry should use the "Best Available Techniques" (BAT) that are technically achievable, commercially available and economically viable. The limits in the permit for Hanson are set to meet the BAT requirements.

Local air quality is good and is improving. There were no exceedances of annual air quality objectives and therefore no significant direct impact of airborne emissions on public health. The vast majority of air quality data available was continuous in nature and so the review was able to take into account any short-term variations.

There were breaches of the dioxin emission limit values during 2004 and 2008, but these were well below the health based standards. The impact of these to the community is mainly through the food chain and is considered very low.

In addition, there were breaches of permit limits for oxides of nitrogen from Kilns 1 and 2 between 2002-2003. Also, one ambient pollution episode was noted during 2007/08, in Penyffordd, with the 1 hour air quality standard being breached on 36 occasions and local pollution levels reaching high to very high, with potential for transient health effects on susceptible individuals. However it was not possible to attribute this episode to activities at the cement works and the event was extremely localised being detected at only one of the 2 monitors in Penyffordd. Despite these observations, no exceedances of the annual air quality objectives were recorded at the Hanson Cement monitor.

The Investigation Response Team noted that there were occasional breaches in permit limits, for metals from the plant, but they were compliant in the main with regulatory limits and demonstrated significant improvements to performance following commissioning of Kiln 4. The results of Department for the Environment and Rural Affairs studies, in 2001, confirmed that metals emissions from Hanson Cement were consistent with or better than those from other UK installations.

Reported environmental nuisance exposures indicate that there is an impact on the community, although environmental sources other than Hanson Cement may also play a part. However, based on the data and information reviewed, such effects are likely to be annoyance-related, impacting upon broader wellbeing and quality of life, and unlikely to affect physical health.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of particulate matter by the Health Protection Agency *n.b.*  
*This is a very large document and may take awhile to download*

Review of Dioxins Data by the Health Protection Agency

Environment Agency Wales Questions of Concern Answered (*Section 6.2 and Appendix B*)

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Report of the Nuisance Subgroup (Environmental Risk Assessment)

Review of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide and Metals by the Health Protection Agency

**21 What are the chemical and dioxin emission rates and quantities and fuel type during start up and shut down (planned or emergency) compared to those during optimum running conditions?**

The emissions of nitrogen oxides and volatile organic compounds are lower during the start up process than during normal operation but concentration of sulphur dioxide is higher. Emissions of particulates (fine dusts) are similar to those during normal operation. Dioxin emissions are not measured during start up and shutdown. During start up emissions will be similar to any other process burning gas oil or diesel.

The monitoring of dioxin levels at start up and shut down is not a regulatory requirement. However, the Waste Incineration Directive (WID) imposes strict operational controls during these times.

Gaseous emission monitoring requirements are defined in the WID which imposes strict operational control during these times. For example, no alternative fuels are to be fed in during start up, and interlocks are required to prevent waste from being fed into the co-incinerator before the required temperatures are reached either at start up or during operation.

The main mechanism for dioxin formation in cement kilns is considered to be de-novo synthesis. This requires the presence of hydrocarbons, chlorides, a catalyst, temperatures between 200 and

450°C (maximum synthesis happens at 300-325°C) and a long retention time in the temperature window. It is important that, as gases leave the kiln system, they should be cooled rapidly through the 200–450°C temperature range to ensure that the period of time when dioxins could be formed is minimised. Other measures to control dioxin emissions from cement kilns include not using waste fuel feeding during start up and shut down.

The process of shut down takes about five minutes. At this point there is no further production of nitrogen oxides or sulphur dioxide. The main kiln filter and cooler filter continue to operate throughout the shut down until the kiln has cooled. Therefore particulate matter emission concentrations will be comparable with those under normal operating conditions although the volume flows will be lower and so the mass releases will be lower.

In an emergency shutdown (for example, following a power failure) releases from the kiln will be similar to those described above for normal shut down.

**a) What duration are these emissions present/created for, per procedure?**

The emissions of nitrogen oxides and volatile organic compounds are lower during the start up process than during normal operation but concentrations of sulphur dioxide are higher. Emissions of particulates (fine dusts) are similar to those during normal operation. Dioxin emissions are not measured during start up and shutdown. During start up emissions will be similar to any other process burning gas oil or diesel. The start up takes 36 hours and the shut down i.e. stopping the kiln (induced draft fan, raw material feed and fuel feed) is the same for planned and emergency shut down and takes about five minutes.

**b) How do these emissions behave in terms of atmospheric dispersal compared to emission created during optimum running conditions?**

During start up and shut down the volume flow rates are significantly lower than during normal operations, therefore the mass rate of emissions will also be significantly lower. The temperature at the stack exit is typically slightly lower than the 125°C during normal operation and therefore dispersion will be over a slightly smaller area than normal operational conditions, given similar weather conditions.

**c) How do these emissions compare to the licensed levels of emission for the site?**

The emissions at start up and shut down are lower or similar to those for normal operation.

Gaseous emission monitoring requirements are defined in the Waste Incineration Directive (WID) which imposes strict operational control during start up and shut down.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered Sections 3.9, 3.10 and 6.9

**22 How can the relevant authorities be properly aware of the full weight and chemical makeup of the total emissions from the site (high and low level point sources), when only stack emission measurements are the official record and no emission monitoring is required at lower throughputs of raw materials or during shut down process (emergency or planned)?**

The regulated emission points comprise not only the stack but also the Kiln 4 cooler exhaust and the mills. All have continuous emission monitors.

Hanson Cement also has a legal duty to notify Environment Agency Wales of adverse events.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency Wales Questions of Concern Answered (Section 3.10)

**23 The dispersion modelling appears to be based on non linear fallout, but experience shows a narrow linear area of impact and dusting. How do the authorities know that residents in those impacted areas have not been subjected to burdens of harmful chemical substances that may in time cause serious and possibly terminal illness?**

Modelled data has now been superseded by real monitoring data. This shows that air quality is good and improving.

Modelling is used to predict and assess emissions from a regulated process to ambient air and the impact this may have on compliance

with air quality standards. Where there is ambient monitoring data, this provides an actual measure of exposure to emissions from the site or any other sources. The reviews undertaken by the Health Protection Agency as part of the investigation used measured ambient air quality data.

Modelling undertaken as part of a permit application assesses the dispersion of a plume in all directions over a period of time, using 2 to 3 years of meteorological data (including wind speed and direction) and the local topography (the features on the surface of an area of land). This may identify one direction of dispersal as being dominant. The modelling undertaken for PM<sub>10</sub> particulates is conservative and assumes there is no fallout from the plume as it disperses. The mathematical relationship between concentration in air and distance from the stack, as the plume disperses, is non-linear but is independent of direction.

This is part of the legal assessment process for any applications for new processes with emissions to air, or changes to existing processes.

The modelling undertaken as part of the permitting process has now been surpassed by actual monitoring data that shows that local air quality is good and improving.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of particulate matter by the Health Protection Agency *n.b.*  
*This is a very large document and may take awhile to download*

**24 Is the model for plume coverage, as detailed in the application for the company's licensing purposes still valid and if not, what is the difference?**

The modelling undertaken at the time of the application is still valid.

The software and associated guidance have not changed sufficiently to affect the conclusions made at the time of permitting. There have been no changes to operations at the site that would change any of the data put in to the model.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 2.2*)

**25 What areas are deemed to receive the heaviest impact following receipt of the data from Emission Watch?**

Air quality in the area was good, and no elevated public health risks were identified. However in general, better air quality was observed at Spon Green and Penyffordd South monitoring locations when compared to Buckley South and Penyffordd Central.

Emissions Watch, a local charitable organisation, set up four particulate monitors around the Hanson Cement plant in response to local concerns regarding the plant emissions. An additional monitor was installed at the end of November 2007. These monitors measure particulate matter in ambient air but, as with all community based monitoring, do not distinguish the source.

Air quality in the area was generally good. Data collected over a ten year period demonstrated that PM<sub>10</sub> levels decreased over the study period and were significantly below the air quality objective annual mean value 40µg m<sup>-3</sup>. Air quality compares favourably with other locations in Wales, specifically air pollutant measurements were low at Spon Green and Penyffordd South when compared to Buckley South and Penyffordd Central. It should be noted that air quality observations at Penyffordd Central were very similar to those observed at the Environment Agency Wales' mobile monitoring facility nearby.

In the area around Hanson Cement air quality was considered good and annual particulate concentrations were lower than the majority of other monitoring positions located around Wales which form part of the Department for Environment and Rural Affairs Automatic Urban and Rural Network. No exceedances of the annual air quality objective for PM<sub>10</sub> were recorded. In public health terms there was no evidence to suggest there is an elevated risk associated with the local exposures to air pollutants in the area around Hanson Cement.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of particulate matter by the Health Protection Agency *n.b. This is a very large document and may take awhile to download*

**26 a) Are there heavy metal emissions – copper, magnesium and cadmium?**

Copper, magnesium, cadmium are found in the emissions, so too are arsenic, lead, mercury, nickel and thallium.

The environmental permit requires the emissions from Kiln 4 to be monitored for a number of substances on a regular basis. This includes copper and cadmium. Other metals include arsenic, lead, mercury, nickel and thallium. Magnesium is found in the leachate from the landfill site.

**b) Could this contribute to ill health?**

High exposures to heavy metals have the potential to impact adversely on health. However, the levels of heavy metal emissions recorded at Hanson Cement generally comply with emission limit values which are protective of health.

Despite occasional breaches in limits, emissions of metals from the plant were compliant with regulatory limits in the main and demonstrated significant improvements to performance following commissioning of Kiln 4. The results of Department for the Environment and Rural Affairs studies confirmed that metals emissions from Hanson Cement were consistent with or better than those from other UK installations, whilst national inventory datasets demonstrate that emissions of metals are likely to be higher in other parts of the Wales, again suggesting that emissions are unlikely to have significantly impacted air quality or public health.

Analysis of samples of milk and soil show that levels of metals are comparable or lower than elsewhere in the UK and do not pose a risk to consumer safety.

*Further Information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide and Metals by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Environment Agency Wales Questions of Concern Answered (*Section 6.6*)

## 4.9 Dust

### 27 a) Is dust emitted harmful to health?

Fine dust particles of less than 10 micrometers in size have the potential to harm health as they can be inhaled into the lungs. Nasal hair and mucus prevent larger particles (coarse dust greater than 10µm in diameter) entering the body, so the potential for harm is low.

The presence of coarse dust, however, can cause annoyance and give rise to indirect health concerns and is likely to impact on wellbeing and quality of life.

A review of fine dusts (particulates) in local air was undertaken by the Centre for Radiation Chemical and Environmental Hazards (Wales), which is part of the Health Protection Agency.

Fine dust particles of less than 10 micrometers in size are known as PM<sub>10</sub> particles, and are not visible to the naked eye. They are of concern in health terms, as below this diameter particles have the greatest potential to penetrate deep into the lungs and inflame lung tissue. Fine particles are present everywhere and come from both natural sources such as sea salt, dust from sand storms, as well as from people's activity, such as industry and road traffic.

*Long term exposure* to PM<sub>10</sub> (which by definition also includes PM<sub>2.5</sub>, PM<sub>1</sub> and PM<sub>0.1</sub> (i.e. nano-particles) since they are components of PM<sub>10</sub>) has been associated with increased mortality risk from cardiovascular (heart) disease and lung cancer. *Short term exposure* has been linked with cardio-respiratory morbidity and mortality. The exact biological mechanism whereby particles cause damage is not clear; it may be related to particle diameter, mass concentration, surface area, particle number concentration as well as chemical composition. It must be emphasised that none of this is proven and is the subject of ongoing research.

The review of particulate matter by the Health Protection Agency found that PM<sub>10</sub> emissions from point sources (i.e. chimneys) at the plant only contribute a small proportion of regional emissions. In 2008 the cement works was responsible for only 1.6% of total recorded point source emissions within 15 miles of the plant and less than 9% of recorded point source emissions for the whole of Flintshire. It concluded that air quality relating to particulate matter is good, comparing favourably with other parts of the UK. It is comparable with air quality in a typical rural community or small town

in the UK. UK limits for particulate pollution in air were not exceeded in the area around the plant during the study period.

In addition, the data demonstrates that there has also been a continual improvement in air quality around the cement works over this period. This is in line with a UK-wide improvement in air quality which can be attributed to better controls on, and regulation of, industrial and road traffic emissions.

Some local community representatives have expressed additional concerns that the chemical makeup of the fine particles could also contribute to ill health. Advice from the Health Protection Agency is that it is the small particle size that is known to be important in the reaction of the lung tissue. Whether the chemical composition of the particle could also play a part is the subject of ongoing research and is not yet resolved. It is an important research question that is currently being explored. However, based on current international epidemiological research, particle size is a reasonable measure of likely health impact; particle chemical composition may or may not be a modulator of toxicity. Until the outcomes of this research are known, there remains uncertainty regarding the importance of the chemical composition. The evidence of risk using particle size as the measured parameter is well established.

Larger dust particles or coarse dusts greater than 10µm can be associated with nuisance. Whilst this does not directly affect physical health it can impact adversely on wellbeing through annoyance and raising health concerns with local residents. Monitoring results show there is high variability between monthly deposited dust levels. More reliable annual dust deposit results have indicated that higher levels of dust occurred between 2006 and 2009. The average rate of deposited dust varied between 24 and 895mg/m<sup>2</sup>/day (milligrams per metre squared a day). These levels exceeded the nuisance guideline value of 200mg/m<sup>2</sup>/day on some occasions but there was insufficient evidence to link these results to Hanson Cement activities and emissions.

An assessment of the composition of dust samples taken at the time of complaints showed that up to 22% of the samples may be attributed to the cement works. The majority were not attributable to the cement works as they contained substances such as weathered natural minerals, pollen, organic fibres, salt and 'general dust'.

#### **b) Is it carcinogenic?**

There is no consistent scientific evidence to support an association between cement dust and cancer.

The main evidence of hazards associated with cement is for those who are exposed through their occupations. Reviews of evidence have been carried out by the Health and Safety Executive indicating risks of respiratory conditions and skin sensitisation with close and direct contact with cement. There is a lack of reliable evidence on the health risks for communities living in the vicinity of cement plants.

Numerous peer reviewed studies of populations living around cement works have been published, none of which have demonstrated that cement dust causes cancer.

### **c) What is in the dust?**

**Includes visible dust, smoke, fallout and very small particle size and long term exposure implications to health.**

Analysis of dust samples identified limestone, sand and cement, cement clinker, weathered natural minerals, pollen, organic fibres, and 'general dust' possibly of organic origin and also associated with road gritting.

Samples of dusts from windowsills, cars and caravans locally indicate 10 per cent of the samples may be attributable to the cement works (including both raw materials – limestone, sand and product - and cement clinker) The main mineral components in cement clinker are silicates, aluminates and ferrites of the element calcium (Tri-calcium silicate, Di-calcium silicate, Calcium aluminate, Calcium ferrite). Minor mineral constituents in cement clinker include uncombined calcium oxide ("free lime"), magnesium oxide, and alkali sulphates. Approximately 12 per cent had a minor component which may be attributable to the cement works. This means that less than a quarter of dust samples collected in response to complaints were attributable to Hanson Cement.

Samples which were not attributable to the cement works contained a range of substances including weathered natural minerals, pollen, organic fibres, and 'general dust' possibly of organic origin and also associated with road gritting.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Review of particulate matter by the Health Protection Agency *n.b.*  
*This is a very large document and may take awhile to download*

Environment Agency Wales Questions of Concern Answered

Question 29 also relates to dust composition

## 28 Can the dust emissions cause repeated dry coughs?

The evidence linking dust emissions and dry cough is inconclusive.

There is scientific evidence from occupational exposures in reviews undertaken by the Health and Safety Executive to suggest the existence of respiratory conditions with exposure to cement dust. In relation to exposures to fine particulates (PM<sub>10</sub> particles) there is a lack of consistent evidence to support an effect on health of short term exposures. There was some evidence of a causal relationship between the smaller parts of PM<sub>10</sub>, known as PM<sub>2.5</sub>, and respiratory conditions such as chronic cough. However, it can be difficult to determine the cause of common respiratory illness such as dry cough.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

## 29 What are the results of dust tested from windowsills?

Analysis of dust samples identified limestone, sand and cement, cement clinker, weathered natural minerals, pollen, organic fibres, and 'general dust' possibly of organic origin and also associated with road gritting.

From January 2008 Hanson Cement has used an external laboratory to test dust samples arising from complaints. Samples were taken from properties (including windowsills), cars and caravans.

Evaluation of results provided by Hanson Cement indicated approximately 10 per cent of the samples maybe attributable to the cement works (including both raw materials – limestone, sand and product - and cement clinker) and approximately 12 per cent had a minor component which maybe attributable to the cement works. This means that less than a quarter of dust samples collected were attributable to Hanson Cement.

Samples which were not attributable to the cement works contained a range of substances including weathered natural minerals, pollen, organic fibres, 'general dust' possibly of organic origin and also associated with road gritting.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 6.7*)

Question 27c also relates to dust composition

### **30 Why will Hanson Cement pay to clean dust from cars on some occasions but not all?**

Cars are only washed if there is a likelihood that dust came from Hanson Cement.

Hanson Cement have confirmed that in the past there was no way of determining whether dust on cars had originated from Hanson Cement, so cars were washed when there had been a significant fugitive emission, and also on request as a gesture of goodwill. Since the commissioning of the new kiln, dust emissions have greatly reduced, and now dust samples are analysed, together with information about weather conditions. Only cars with samples consistent with Hanson Cement dust are cleaned.

## **4.10 Noise**

### **31 What is the impact of noise emissions on the community?**

**Background information: Noise is constant when the plant is operating and noisier than the old kilns when in full production.**

The investigation identified only two locations where continuous ambient night time monitoring exceeded the 45dB permit level on occasions. These elevated levels caused anxiety and concern to local residents.

Noise above the general background has the potential to impact on health but not at the levels observed locally. Elevated levels (55-80dB) of noise have been reported in published literature to cause physical hearing impairments, high blood pressure, heart disease and stroke, annoyance and sleep disturbance.

Ambient noise monitoring measurements include noise from all sources in the vicinity of the monitor. The continuous noise monitors are unmanned, and so attribution of peaks to any environmental noise source cannot be made. Consultants are present during the

boundary noise monitoring required by the permit, and are able to record increase noise from passing traffic, dogs barking and other environmental contributors.

Complaints received by the Flintshire County Council, Environment Agency Wales and Hanson Cement have been analysed over the period 2000-2010. Noise complaints were the second most common types of complaint after dust. The number of complaints ranged from 11 to 291 per year, peaking in 2007. There is no apparent correlation between the wind direction or speed and the receipt of noise complaints. The presence of the variable noise frequency component to the night time noise levels also suggested that a number of different noise sources may be contributing to levels recorded. Noise data has also indicated that the receipt of noise complaints is not directly associated with the operation of specific plant as the plant equipment is shown to operate in a variety of combinations without complaint.

Boundary noise monitoring is undertaken monthly at seven sites as required by the local planning authority and five further sites as required by the Environment Agency Wales permit. Measurements are taken monthly for one hour in daylight and 15 minutes at night. Boundary noise monitoring has not shown any exceedances of limits which could be attributed to Hanson Cement.

In response to complaints, continuous noise monitors have been located at 3 locations close to the boundary for periods of time ranging from two to six months. This monitoring has shown exceedances of night time limits at two of those properties. These events caused nuisance and concern to the residents.

Hanson Cement has since carried out a major improvement programme to reduce noise from the site, in particular, by enclosing much of the plant and fitting silencers.

*Further Information:*

Hanson Investigation Library

<http://www.wales.nhs.uk/sitesplus/888/page/49608>

Report of the Nuisance Subgroup (Environmental Risk Assessment)

## 4.11 Dioxins

### 32 a) What are dioxins?

Dioxins are the common name given to classes of chemicals known as polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans.

Dioxins are mainly formed from the incomplete burning of organic materials in the presence of chlorine. As such they are a by-product of both natural combustion processes (e.g. forest fires) and people's activity (e.g. waste combustion and bonfires).

### b) What is the impact of dioxins on health?

Dioxins are threshold carcinogens - they have the potential to cause cancer, but not when exposures are below the Tolerable Daily Intake (TDI). The TDI refers to a lifetime exposure as opposed to (relatively) short term exposures. Based on current evidence, short term exposures do not support a risk of cancer. However, short term, high dose exposure to dioxins may result in skin conditions such as chloracne<sup>2</sup>. Prolonged, high dose exposure to dioxins can affect the immune and reproductive systems and development of the unborn child.

The risk to the population around Hanson Cement (from dioxins) is the same as to any population because the main route of exposure is through consumption of food.

When dioxins settle on the ground or in water they can be taken up by plants and animals, particularly grazing animals. Dioxins can then accumulate in fat. The main route of exposure for people is from the consumption of food products, particularly fatty products such as meat, milk, eggs and fish. The Food Standards Agency recommends that people eat a wide variety of foods from a range of sources. UK studies have shown that dioxin levels in foods have reduced by 85 per cent since 1982.

### c) What do they mean for local health?

Dioxin emissions are regulated at levels well below levels that could cause harm to health. Occasional breaches of emissions levels have

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<sup>2</sup> Dioxins and their effects on human health: Fact sheet N°225 (May 2010)  
<http://www.who.int/mediacentre/factsheets/fs225/en/>

not breached health based standards and are therefore unlikely to lead to ill health in the surrounding communities.

Emissions of dioxins from Hanson Cement have fallen markedly during the study period, 2000-2010. This is due to the replacement of the older Kilns 1-3 with a new Kiln 4 in 2005. Since Kiln 4 uses waste as a fuel, it is required to comply with the Waste Incineration Directive. This means that very strict emission limits are applied based on what is technically achievable for the process. Such emission limits are protective of health and as such provide an exposure that is less than the internationally agreed TDI. It is unlikely that occasional breaches of the emission standards would lead to ill health in the surrounding communities.

Significantly elevated concentrations of dioxins were emitted from Kiln 3 during 2004. However, assessment at that time, using modelled exposure, indicated that the most vulnerable exposed individuals would receive a dose which did not significantly exceed the tolerable daily intake.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Environment Agency Wales Dioxins Factsheet

*Questions 11 and 33 also relate to dioxins*

### **33 a) What are the local dioxin levels?**

No results from local dioxin testing of milk, soil and vegetation have exceeded the regulatory limit or action level.

The most recent (2009) *milk* samples, taken from the bulk tank at Dyke farm showed dioxin levels were lower than in previous years.

Local levels of dioxins in *soil* in 2006 were within expected parameters for soils in rural areas, and similar to the levels in 2005. Samples were also taken from a Penyffordd residential property in 2008. Although this result was high, it was not outside the range of results expected from soils in rural Wales.

Levels of dioxins in *vegetation* peaked during 2006, and have since decreased.

The actual dioxin levels are described in the Food Standard Agency's Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement report.

Over the last 20 years there has been a significant reduction in the total amount of dioxins emitted into the atmosphere in the UK. When total emissions are examined at a regional level it is clear that dioxin emissions are primarily linked to the more populated North Eastern side of the County of Flintshire, immediately adjacent to the coastline and in more populated areas such as Mold and Buckley.

### **b) What are the stack dioxin emission levels?**

The environmental permit sets a concentration limit for dioxin emissions of 0.1 ng/m<sup>3</sup> (1 nanogram is equal to 1,000,000,000th of a gram). The company is required to monitor stack dioxin emissions twice a year.

The monitoring results are well below this limit, with the exception of the two instances below:

High dioxin levels were recorded in the *old* Kilns at the end of 2004 as a result of the type of raw material used at the time. Environment Agency Wales prosecuted Castle Cement (now Hanson Cement) in 2006, partly based on these high results.

Dioxin levels above the limit were also recorded in 2008 *during a trial to burn solid recovered fuel* in the Kiln. Investigations showed this breach happened as a result of feed arrangements and high temperatures in the conditioning tower. The trial was stopped until both these issues were resolved.

Hanson Cement was identified as the largest point source emitter of dioxins in Flintshire in 2008 and is the sixth largest point source emitter in Wales. However, in order to put that into context, it should be noted that emissions from Hanson Cement accounted for only one per cent of the total combined emissions from the highest ten point source emitters in Wales that year. Furthermore, on a regional basis there are significantly greater recorded emissions from an industrial plant immediately adjacent to the county boundary.

### **c) How are dioxins prevented from entering the atmosphere?**

The main way that dioxins are prevented from entering the atmosphere is by controlling the temperature of the process and rapid cooling of the gases released.

The main way that dioxins are prevented from entering the atmosphere is by controlling the temperature of the process and rapid cooling of the gases released. Dioxins are formed between 200-450°C and decompose quickly above 925°C. The kiln is maintained at 1450°C and gases leaving the stack are cooled rapidly to around 160°C. At this temperature dioxins are mainly solid and collected in the bag filter. Bag filter dust is returned into the kiln process.

#### **d) Is there a need for ongoing monitoring?**

The environmental permit requires Hanson Cement to monitor the kiln for dioxins twice a year. This requirement is in line with the Waste Incineration Directive.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of Dioxins Data by the Health Protection Agency

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Environment Agency Wales Questions of Concern Answered (Sections 6.3, 6.4 and 6.5, pg 20)

Questions 11 and 32 also relate to dioxins

## **4.12 Odour**

### **34 What is the impact of odour emissions on the community?**

**Reference to smells that are toxic, foul smelling, detergent/plastic smelling, sulphurous and distinct. Smells that can be almost tasted.**

Odour emissions can cause annoyance, and impact on people's sense of wellbeing and quality of life. However, the effects are generally short lived.

Odour complaints are more difficult to investigate due to their transient nature and the subjective differences in tolerance between

individuals detecting odours. In the 10 year period of complaint analysis 2000-2010, the highest number of odour complaints was 58 recorded in 2008.

Two studies have been undertaken to investigate odour complaints. In 2007, AES (Analytical & Environmental Services), on behalf of Hanson Cement, investigated the odour concentration and characteristic for the main Kiln 4 stack gases. These were combined with the dispersion modelling results from the permit application. The results suggested that there could be ground level concentrations at or above the "just detected" level on a few occasions in a year.

In 2008 odour complaints were reviewed by Environment Agency Wales and Hanson Cement, mapping complaints received and having regard to the previous study. A map of complaints was produced showing wind direction and speed for each of the locations. Of the 39 complaints plotted, 29 could not be attributed to Hanson due to either wind direction or other sources being identified as the cause. The remaining 10 were geographically scattered around the works site. There was nothing obviously unusual with kiln operation at the time of the complaints. It was noted that there were a number of other sites in the vicinity of Hanson which could cause odours e.g. waste sites, sewage works, manufacturing units and farms. Also, fires and cable burning had been reported. The mapping exercise showed that the locations of the complaints were at a distance from the site indicating that, if Hanson was the odour source, then release was at high level, e.g. chimney stack, rather than low level.

Whilst the studies are not definitive there is an indication that Hanson may be the cause of some of the odour complaints, the most likely source being the Kiln 4 stack. The presence of sulphur dioxide and nitrogen oxides in the stack gases could contribute to the odour. These are controlled by the permit in line with the Waste Incineration Directive. They are continuously monitored. However, complaints may arise from unusual weather conditions resulting in plume grounding rather than diluting and dispersing at height.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Report of the Nuisance Subgroup (Environmental Risk Assessment)

### 35 Why are odours worse during firing up and closing down the kiln?

The firing up and closing down processes are different, and may give rise to different odours compared with general operation.

During the warm up of the kiln different fuels are used. Gas oil is used for the first 24 hours followed by 12 hours with coal. Coal contains higher sulphur content than alternative fuels. This may cause an increase in odour.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 3.11*)

## 4.13 Smoke

### 36 Why do we see different coloured smoke if the filters are working properly?

The plume visible from Hanson Cement is water vapour not smoke.

The appearance of the plume is influenced by the position of the observer in relation to the sun and the plume.

This plume is produced when the warm, moist air leaving the stack mixes with ambient air and cools until it condenses to form small water droplets.

The colour of the water vapour plume is influenced by the direction of the sun in relation to the plume. Back-lit plumes are darker and can look like smoke. Front-lit plumes are white.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 3.6, pg 9*)

*Questions 18 and 37 also relate to the appearance of the plume*

### 37 Why is there more smoke in the night and early hours compared to the day?

Weather conditions, especially air temperature and humidity, will determine whether or not the plume is visible.

The plume is more likely to be visible when the air is cooler and wetter. As the air cools and becomes more humid at night, the plume is more likely to be visible then.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 3.6, pg 9*)

*Questions 18 and 36 also relate to the appearance of the plume*

## 4.14 Waste and water

### 38 Has hazardous waste been buried on site?

It is possible that some waste which would now be considered hazardous was accepted on site during the lifetime of the landfill, prior to a change in the Hazardous Waste Regulations in 2005.

Waste was deposited at a landfill on the site between 1949 and 2002. A Waste Disposal Licence was issued by Alyn and Deeside Waste Regulation Authority in 1987 to cover this. This allowed the deposit of cement manufacturing waste which was inert and non-toxic. An application to close the landfill was made in 2002. At that time it was classified as non-hazardous. However, all the waste was deposited before the Hazardous Waste Regulations 2005 came into force. These changed the classification of a number of materials which may be in the landfill.

A variation to the permit was granted in 2007 to create a new landfill on site. Although the landfill was built it has never been used. This has now been removed from the permit and Hanson will restore the area.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 5.1, 5.2 and 5.3*)

Environment Agency Wales Landfill Factsheet

### **39 What monitoring is carried out to ensure there is no risk to public health?**

Leachate (liquid that has filtered through the waste), surface water, ground water and gases are monitored to detect any risk to the environment or people's health.

Hanson Cement must continue to monitor leachate, surface water, gas and groundwater periodically for a number of parameters as a requirement of their original licence. This will continue until Environment Agency Wales is satisfied that this landfill poses no future environmental risk.

The monitoring requirements in the licence are sufficient to make certain that any landfill related issues can be detected and remediation plans implemented if required.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 5.2 and 5.3*)

### **40 Have any discharges from the waste burial sites affected any water courses in the vicinity, purposefully or accidentally?**

The groundwater has been impacted locally as a result of leachate, and this has had an impact on local surface water directly downstream. Slightly elevated levels of ammoniacal nitrogen and pH (a measure of acidity) have been found.

Comparing the metal levels in the groundwater with drinking water standards, all concentrations are within the drinking water standards, with the exception of nickel in one of the boreholes inside the site boundary, immediately adjacent to the landfill.

There is little difference between upstream and downstream concentrations of metals in surface water except for copper, nickel and iron which are higher in the tributary downstream of the site. Metal concentrations in the surface water downstream of the site

meet both the drinking water standards and standards to protect aquatic life.

The landfill site does not have an engineered lining system, as historically this was not a regulatory requirement. This means that any water infiltrating the site could pass through the landfill and into the groundwater. An engineered cap was installed in 2004 /2005, which had the immediate effect of reducing the amount of water entering the waste mass and therefore reducing the amount of leachate produced. The leachate, groundwater and surface water are all monitored by Hanson Cement and the data supplied to Environment Agency Wales. The data shows that the quality has been improving since the cap was installed.

Hanson Cement recently proposed an outline for an improvement programme to further reduce the impact of the landfill on surface water and groundwater. This programme includes the improvement of the leachate collection system and installing additional monitoring boreholes.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 5.4, pg 17*)

*Questions 16 and 41 also relate to concerns about water*

**41 Water from the stream near the landfill waste has a tainted chemical smell / changes colour. Also the sediment may be contaminated. Is this monitored?**

Environment Agency Wales currently undertakes monthly monitoring downstream of the discharges from Hanson Cement.

As part of the environmental permit for the historic landfill, Hanson Cement is required to monitor groundwater and surface water. Reports are submitted to Environment Agency Wales on a quarterly basis for assessment.

The site is also permitted to discharge drainage from the cement works via a settlement lagoon. This is monitored on a weekly basis. Results are submitted to Environment Agency Wales each quarter to be assessed.

Sediment sampling in the brook around Castle Cement was undertaken in 2004 and 2006, in relation to the Kiln 4 planning conditions. In 2007 further sampling was undertaken, including additional sites, in relation to planning conditions for the new landfill. This was done in the tributary of the Black Brook, upstream and downstream of the site. Analysis included metals, dioxins and furans, and polychlorinated biphenyls (PCBs).

The metal and organochlorine concentrations in sediment were higher immediately downstream of the old landfill. Samples taken further downstream were very similar to upstream samples indicating that any impact is very localised.

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (Section 5.5)

*Questions 16 and 40 also relate to concerns about water*

## 4.15 Food Chain

### 42 a) Is it safe to eat the fruit and vegetables in my garden? Referring to risk from metals.

The results for the soil samples taken at a local farm between 2004 and 2007, and from a residential property in 2008 are comparable with the levels found in soil during the Food Standard Agency's UK 2006 Allotment Survey. Therefore, they do not pose a risk to consumer safety.

Food Standards Agency advice for all consumers of allotment produce is to thoroughly wash and peel before consumption and to ensure a varied diet from a variety of sources.

The 2004 results for a different farm did show moderately elevated levels of arsenic and lead and a relatively high result for cadmium when compared with the results of the UK soil and herbage pollutant survey 2007. Given the levels found, washing and peeling would be sufficient to ensure that consumers are protected and food is safe.

### b) If not, it is safe for young children to play in the garden?

The standard advice for all young children and adults playing or working in the garden is to ensure hands are washed after activities

and before eating. There are no additional concerns to children's safety arising from the investigation.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

Questions 4, 7 and 17c, also relate to child health

**43 What are the effects of emissions, especially dioxins on the local food chain e.g. milk, farm animals, crops?**

The Food Standards Agency has assessed all samples of soil, vegetation and milk between 2004 and 2009. The results for soil, vegetation and milk have been within the regulatory limits or action levels.

The Food Standards Agency's national advice is to all consumers of allotment produce to:

- Thoroughly wash your hands after gathering
- Thoroughly wash and peel all produce prior to consumption
- Consume products from different sources and not to source all of your produce from the same plot.

Based on the assessment of the sample results provided to the Agency, this advice on allotment produce is sufficient to mitigate any risks to local consumers.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency

## 4.16 Process

### 44 Is the kiln used as an incinerator or co incinerator?

The kiln is not used as an incinerator, it is a co-incinerator. It makes use of the energy content of wastes directly in the manufacture of cement.

An incinerator burns waste to dispose of it. A co-incinerator burns waste mainly to generate energy or produce a material product.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 3.3*)

### 45 Why is the kiln being used as an incinerator?

The kiln is not used as an incinerator, it is a co-incinerator. It makes use of the energy content of wastes directly in the manufacture of cement.

This reduces the need for non-renewable fossil fuels and is an effective way to dispose of wastes that may otherwise go to landfill.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (*Section 3.3*)

### 46 Does the incinerator operate when the plant is not making cement?

The kiln is not used as an incinerator, it is a co-incinerator, which only operates when it is making cement clinker.

Clinker is often made in a continuous run of the kiln and stock piled for milling over a longer period of time. Milling and cement production will therefore continue even when the kiln is not operating.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 3.3*)

#### **47 What is flushing of the kiln?**

A kiln flush is an unplanned event that occurs when raw materials build up in the pre-heater tower and are suddenly released.

The kiln flush results in a dust release to the atmosphere. There is continuous emission monitoring of the kiln and Hanson Cement must also notify Environment Agency Wales of such events. In addition, closed circuit television (CCTV) is used to monitor events on the site.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

*Question 46 also relates to flushing*

#### **48 a) What alternative fuels are being burned?**

The alternative fuels, known as waste derived fuels that are permitted for the kiln are chipped used tyres, Cemfuel, Profuel, Solid Recovered Fuel and Meat and Bone Meal.

- Chipped, used tyres.
- Cemfuel, which is a liquid that is manufactured to a detailed specification from a range of wastes including paint and ink residues, spent solvents and oils.
- Profuel, which is manufactured from solid wastes, principally paper, plastics, fibre and textiles.
- SRF (Solid Recovered Fuel) which is bio-degraded and shredded combustible waste, mainly consisting of paper and plastics.
- MBM (Meat and Bone Meal) which is a solid non-hazardous biofuel produced by sterilising and grinding abattoir waste.

#### **b) What is being incinerated?**

Gas oil or kerosene is used to start up the kiln, which is then fuelled by coal and petcoke until a high temperature is achieved. Once this stability is achieved the alternative fuels, above, may be used.

n.b. As previously described (in the answers to Questions 44, 45 and 46), the kiln is a co-incinerator, not an incinerator. Question 48(b) has therefore been interpreted as '*what is being burned?*'

### **c) Are carcinogenic and toxic materials being burned?**

Cemfuel is described in the safety data sheet as Flammable, Toxic and Carcinogenic (Risk Phrase R40: limited evidence of a carcinogenic effect, due to furfuryl alcohol present at typically 1-5%).

Other materials being burned are chipped used tyres, Profuel, SRF and MBM. Waste that could be flammable, toxic or corrosive is classed in the waste regulations as 'hazardous'.

Cemfuel is the only alternative fuel permitted for use at Hanson Cement classed as 'hazardous'.

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Sections 4.1, 4.2 and 4.3)*

Environment Agency Wales Fuels Factsheet

*Questions 53 and 54 also relate to the fuels / material used in the plant*

### **49 Are chipped tyres sourced entirely from tyres manufactured to UK standard or do they include tyres sourced from all manufacturers?**

End of life tyres include tyres sourced from all manufacturers.

Further information:

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

(Section 4.8)

## 50 What is the chemical composition of tyres?

Tyres are made up of numerous different rubber compounds, different types of carbon black, fillers like clay and silica, and chemicals and minerals added to allow or accelerate vulcanisation (the process that makes rubber more durable). The tyres also have different types of fabric for reinforcement and several kinds and sizes of steel. The following trace metals are found in tyres: arsenic, cadmium, cobalt, chromium, copper, mercury, manganese, nickel, lead, antimony, tin, thallium, vanadium and zinc.

The current permit at Hanson Cement specifies the minimum calorific value (energy value when burned) and the maximum concentration of sulphur in the tyres used in this process.

Whole and chipped tyres have a high calorific value similar to coal. They also have the benefit that the steel reinforcing in the tyre is recycled and incorporated into the cement, thereby reducing the amount of iron which has to be added as a raw material into the cement.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Section 4.4)*

Cook C and Kemm J (2002): Health Impact Assessment Report on a proposal to substitute chopped tyres for some of the coal as fuel in cement kiln [www.apho.org.uk/resource/view.aspx?RID=44206](http://www.apho.org.uk/resource/view.aspx?RID=44206)

## 51 What tests have been done for the dispersion of chemicals from a tyre upon combustion?

The Committee on the Medical Effects of Air Pollutants (COMEAP) have studied health effects of the use of tyres as fuels. It concluded that when used tyres and Substitute Liquid Fuel (SLF) were used in accordance with a defined protocol, then their use "was, in

*comparison with the use of coal as a fuel, unlikely to cause an increased risk to health".<sup>3</sup>*

Studies reported by the Committee on the Medical Effects of Air Pollutants (COMEAP) in 2005 and 2008 on the use of waste derived fuels (including tyres) in cement kilns, reviewed the emissions during the use of these fuels. This protocol (Substitute Fuels Protocol for use on Cement and Lime Kilns) has since been superseded by legislation.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Section 4.5)*

## **52 Who performs the independent test on the alternative fuels being used?**

Waste derived fuels are analysed by the fuel supplier. Audit samples are analysed by Hanson Cement.

The operating permit requires that all new waste derived fuels undergo a feasibility trial (subject to Environment Agency Wales approval) before their routine use.

The sampling and analysis of each fuel is based on the potential for the fuel to vary. The analyses of materials such as tyres and MBM, which are more consistent in nature, are carried out less frequently than Cemfuel and SRF which are potentially more variable in quality.

All waste derived fuels are analysed for calorific value, carbon content and biomass by independent laboratories for EUETS (European Union Emission Trading Scheme) compliance purposes.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency  
Wales Questions of Concern Answered

<sup>3</sup> COMEAP/2005/08 Use of Substitute Fuels in Cement Kilns (Advice on Level of Substitution) – page 1  
<http://comeap.org.uk/documents/statements/55-2009-and-2008-statements-and-supporting-papers.html>

(Section 4.6)

Environment Agency Wales Regulatory Role Factsheet

**53 a) Are there differences in emissions when burning alternative fuels?**

The emission limits remain the same for the process, whatever the fuel used. The use of waste derived fuels reduces emissions of some key pollutants (e.g. nitrogen oxides).

The Committee on the Medical Effects of Air Pollutants (COMEAP), in 2005, 2008 and 2009 reviewed the emissions of a range of waste derived fuels in cement kilns. The Committee concluded that when waste derived fuels were used in accordance with a defined protocol, then their use *"was, in comparison with the use of coal as a fuel, unlikely to cause an increased risk to health"*.

**b) Is any difference significant to human health?**

Burning alternative fuels is unlikely to cause an increased risk to health. Furthermore, the use of waste derived fuels reduced emissions of some key pollutants e.g. nitrogen oxides.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

(Section 4.7)

Questions 48 and 54 also relate to the fuels / material used in the plant

**54 What materials are being used in the plant?**

The raw materials in the process are limestone, sand and pulverised fuel ash (produced in the generation of electricity from coal-fired power stations). Gypsum is added in the milling stage.

Gas oil or kerosene is used to start up the kiln. It is then fuelled by coal and petcoke. The alternative fuels, known as waste derived fuels that are permitted for the kiln are:

- Chipped, used tyres

- Cemfuel which is a liquid that is manufactured to a detailed specification from a range of wastes including paint and ink residues, spent solvents and oils.
- Profuel which is manufactured from solid wastes, principally paper, plastics, fibre and textiles.
- SRF (Solid Recovered Fuel) which is bio-degraded and shredded combustible waste, mainly consisting of paper and plastics.
- MBM (Meat and Bone Meal) which is a solid non-hazardous biofuel produced by sterilising and grinding abattoir waste.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Section 3.1)*

*Questions 48 and 53 also relate to the fuels / material used in the plant*

## **55 When and for how long does the plant open and run?**

The plant has permission to run 24 hours a day, 365 days of the year.

The actual operating hours of the plant are decided by Hanson Cement, based on varying demand for cement.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered *(Section 3.1)*

## **56 Is there a better way to provide the products that Hanson provides?**

Cement is an established product, used throughout the construction industry. New cement manufacturing techniques and alternatives to conventional cement are being developed. However, none appear to be at a significant commercially viable stage.

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (*Section 7.1*)

**57 Such a process was refused in the USA on the grounds of toxic pollution, if this is true why is it allowed in this country?**

The investigation found no record of a refusal to allow a process similar to that used by Hanson Cement in the USA.

The Investigation Response Team has made numerous enquiries with local community representatives, and through them, with experts who have advised local representatives and officials of the European Parliament. No evidence has been found to support this statement that "*such a process was refused in the USA on the grounds of toxic pollution*".

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (*Section 7.2*)

**58 What are the impacts of the disposal of bottom/fly ash?**

The process at Hanson Cement does not produce bottom or fly ash, therefore there are no risks associated with its disposal.

The process at the Hanson site produces *filtered dust* which is recycled on site within the process, and *by-pass dust* which is taken off-site for removal of soluble chlorides (which affect the quality of cement) by washing. The residual material is returned to use in the cement manufacturing process.

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 5.6*)

**59 What is the long term effect of the breakdown of concrete/cement?**

Concrete, which includes cement, is a very stable product, hence its widespread use in construction. It does not readily break down and is not associated with public health problems.

**4.17 Regulation****60 How many complaints have been received by the Environment Agency Wales in the last 10 years relating to Hanson?**

Complaints were received directly by Environment Agency Wales, by Flintshire County Council and by Hanson Cement.

The total number of complaints was 2,318. Of these, 1,437 were recorded by Environment Agency Wales.

Data was analysed from all the sources described above.

The total number of complaints recorded over the ten-year period studied was 2,318. Those complaining all believed that Hanson Cement activities were responsible for the problem that they were complaining about. The range of complaints received varied from 62 in 2001, to a peak of 656 in 2007. Those complaining directly to Environment Agency Wales amounted to 1,437 with a range from 16 in 2001 to 506 in 2007.

**How many of these incidents involved:****a) Dust**

1,146 complaints related to dust, with the range from 22 in 2002 to a peak of 294 in 2007.

**b) Noise**

755 complaints related to noise, with a range from 11 in 2001 to 291 in 2007.

**c) Odour**

274 complaints related to odour, with a range from eight in 2001 to 58 in 2008.

**d) A combination**

143 other complaints were recorded and included smoke and water, with a range from four in 2001 to a peak of 41 in 2007.

Further information:

Hanson Investigation Library:

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Report of the Nuisance Subgroup (Environmental Risk Assessment)

## **61 a) How are complaints handled by the Environment Agency Wales?**

Environment Agency Wales has a National Incident Recording System to record and report incidents and complaints. Calls are logged by the Regional Communications Centre (0800 807060), given a unique reference number and then forwarded directly to the Regulatory Team or Standby Officer to begin the assessment.

For issues about regulated sites, details of the call are also forwarded to the site operator (subject to Data Protection Act and confidentiality arrangements) to investigate.

The findings of the investigation are fed back to the complainant if requested.

## **b) Are all complaints recorded or just those with a log number?**

All complaints received by the Regional Communications Centre are recorded and given a unique reference number.

## **c) How many complaints are investigated by the Environment Agency Wales?**

All complaints received by Environment Agency Wales are investigated.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

(Sections 2.4, 2.5 and 2.6)

## 62 How are complaints handled by Hanson Cement?

Hanson Cement has a management system for incident recording and reporting. Complaints are received, logged, investigated and then reported back to the complainant.

If the investigation shows that the complaint resulted from a breach of permit conditions then Hanson Cement must:

- Notify Environment Agency Wales.
- Put measures in place to stop the breach and prevent it happening again.
- These preventative measures are put into place after a review of the proposals by Environment Agency Wales.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

*(Section 2.7)*

## 63 What are the control measures around breaches of permit conditions?

Environment Agency Wales must be notified of all breaches of permit conditions, without delay.

Where breaches of permit conditions occur at the Hanson site (for example it exceeds an emission limit or has a fugitive release) the company must take measures to return to compliance with its permit conditions. Hanson Cement must notify Environment Agency Wales without delay, thoroughly investigate the incident, put measures in place to stop the breach and prevent it happening again. These measures are reviewed by Environment Agency Wales before they are implemented to ensure they will resolve the problem. Environment Agency Wales will also consider any appropriate enforcement response.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered

(Section 2.8, pg 6)

Environment Agency Wales Regulatory Role Factsheet

**64 If a breach occurs at what point is it assessed for impact on public health?**

In relation to '*at what point in time*' the assessment is carried out immediately. Environment Agency Wales must be notified of all breaches of permit conditions, without delay.

In relation to '*at what level of severity*', where a breach is likely to have an impact on public health the potential for exposure is assessed immediately by Public Health Wales and the Health Protection Agency, using the criteria listed below, and appropriate control measures implemented as required.

**Releases to air:**

Can people breathe it?

Will it settle on food crops?

Will food animals be exposed to it?

**Releases to water:**

Is there a drinking water or crop watering abstraction point downstream?

Can people get into it?

Could people eat any fish that have died in polluted water?

Could groundwater be contaminated?

**Releases to land:**

Do people have direct contact with it?

Could they eat crops grown on it?

Could groundwater be affected?

If any of these criteria are met, or if the chemical released is likely to be of particular public concern, (e.g. dioxins), Environment Agency Wales will notify both Public Health Wales and the Health Protection Agency. Where a breach is likely to have an impact on public health using those criteria, the risk to the public is immediately assessed by

Public Health Wales and the Health Protection Agency, and appropriate control measures implemented as required.

If food producing animals are grazing on the land Public Health Wales would request that the Food Standards Agency should be informed.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Section 2.8, pg 6)*

Environment Agency Wales Regulatory Role Factsheet

## **65 What public health action has been taken following breaches and/or fugitive emissions?**

In 2005, Environment Agency Wales served an enforcement notice to limit the operation of one of the (older) kilns due to elevated levels of dioxin emissions from the site. In response, an expert public health advisory group was convened to assess the health risks posed by this release. It noted that harmful effects of dioxins on health are dependent on long-term, high dose exposures, and concluded that the short-term exposure to elevated dioxin emissions in this incident was not likely to result in an increased risk of adverse health effects.

In support of the legal case taken by Environment Agency Wales against Hanson Cement, a joint expert witness statement was produced in January 2010. This considered the potential health impacts of permit exceedances on the site and of releases as a result of reported site fires. The statement pointed out that the emissions had the *potential* to cause adverse health effects, but there was no evidence of any actual individual cases of harm in the local population. It stated that, if these were to have occurred, "*it would not have been possible to attribute their cause as they would have been few in number, affecting people with pre-existing disease, and probably combined with other stress factors*".

## **66 Emission limits:**

### **a) How are the limits used determined?**

The pollutant emission limits used have their origins in European law and guidance.

European law requires that industries should use the “Best Available Techniques” that are technically achievable, commercially available and economically viable. The European guidance sets indicative emission limits that should be achievable. Other legal limits are set in specific legislation e.g. the Waste Incineration Directive. This applies to the co-incineration of wastes at Hanson Cement.

Information on what compliance monitoring is undertaken and how it is checked is provided in the responses to Q68a and Q70 in this Report. The Technical Report '[Environment Agency Wales Questions of Concern Answered](#)' also provides further details. See sections 6.8, 6.13 and Appendix B).

### **b) How are the limits used made?**

Actual emission limits for the Hanson Cement works site are set by Environment Agency Wales, using European guidance. Where specific limits have been set (e.g. by the Waste Incineration Directive) these must be used as a minimum to protect both local health and the environment.

Environment Agency Wales uses the indicative emission levels as a reference when setting site-specific emission limit values (ELVs) in individual permits. Environment Agency Wales also takes into account local site-specific factors such as the technical characteristics of the installation, geographical location and local environmental conditions. It then considers whether it should set a tighter, or less strict, limit than the indicative emission level.

### **c) How are they verified?**

Actual emissions to air, land and water are monitored as a requirement of the permit issued by Environment Agency Wales. Results must be provided on a regular basis to Environment Agency Wales for verification.

Emission limits for the Hanson site are set by Environment Agency Wales, using European guidance. Where specific limits have been set (e.g. by the Waste Incineration Directive) these must be used as a minimum.

### **d) Are these safe?**

Emission limits are set on the precautionary principle that exposures should be kept to the lowest level possible. Emission limits, like air quality objectives for pollutant concentrations in ambient air, have

been set in line with the well established evidence base, to ensure protection of human health.

Air quality objectives apply to ambient or background air quality and are set to protect human health, using a well established evidence base. They have built-in safety margins and are intended to be protective of the most vulnerable in society, for example infants. To understand the effect of an industrial site on air quality, the Environment Agency creates a model of the way emissions are predicted to be distributed as part of a permit application. This takes account of the existing background concentrations of the same substances that would be released by the proposed process, and helps to determine safe permit limits.

**e) How can an averaged level determine whether or not, during the period, a serious risk to health has not occurred at a specific point in time?**

When reporting the levels of pollutants in the air, an average level over a defined time period is used. For short term exposures the average is over an 8 or 24 hour period. For chronic exposures an annual average is used. These averaging periods have been determined, using the available evidence bases, to protect human health. It also enables comparisons with the evidence base to determine associated public health risk.

Since levels of pollutants can fluctuate considerably over relatively short periods of time and small geographical areas, some breaches of exposure limits are allowed over defined longer periods of time (e.g. a year). This is only allowed where impacts are unlikely to be noticed even by individuals who know that they are sensitive to pollutants.

That said, short term exposures to significantly elevated air pollutants have been associated with increased cardio-vascular and respiratory symptoms, such as asthma, and admission to hospital. Longer term exposures have been associated with more serious cardio-respiratory consequences, such as heart disease. Short term episodes might cause alarm and public health concern. To put these short term 'peaks' in context and better understand their potential impacts, COMEAP has developed an air quality index for key pollutants. This sets out likely health effects from short term exposures for sensitive individuals, such as those predisposed to asthma.

Local authorities in the UK are required to carry out reviews and assessments for air quality in their areas. This involves measuring air pollution and trying to predict how it will change in the next few years with regard to specified air quality objectives. If a local authority finds

any places where the objectives are not likely to be achieved, it must declare an Air Quality Management Area. There are currently no Air Quality Management Areas in North Wales.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 2.1, pg 2*)

Review of particulate matter by the Health Protection Agency *n.b.*  
*This is a very large document and may take awhile to download*

**67 Should the permit be changed to include monitoring during start up and cool down of the kiln?**

The current permit requires continuous emission monitoring of the kiln. This operates during both start up and cool down of the kiln. No permit change is required.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

(Section 3.12, pg 12)

**68 What monitoring and sampling is done by all organisations and agencies involved in relation to the site:**

**a) For regulatory purposes?**

The *kiln stack* is monitored continually for particulate matter, volatile organic carbon, hydrogen chloride, carbon monoxide, sulphur dioxide and oxides of nitrogen. Periodic monitoring also takes place to measure metals, dioxins and other trace chemicals.

The *cement mills* are continuously monitored for emissions of particulate matter.

Monitoring at both the kiln stack and mills takes place after dust and gases have gone through equipment that reduces emissions.

*Water* is monitored in the tributary to Black Brook for suspended solids, pH, biological oxygen demand, temperature, flow, oil and grease.

*Noise* is monitored on the perimeter of the site.

*Particulates, sulphur dioxide and nitrogen dioxide* are currently continuously monitored at the Penyffordd Bowling Club.

*Soil, moss and milk* samples have been taken from various locations for dioxin and furan analysis. Soil and milk sampling was a pre-operating condition as part of the permit for Kiln 4 and continued for a number of years after it was commissioned. This requirement is currently being reviewed.

**b) Is it monitored 24 hours?**

The operation of the kiln stack and the cement mills is monitored continuously.

Additional monitoring also takes place every six months. Water sampling is completed on a weekly basis. Noise monitoring is monthly. The monitoring at Penyffordd Bowling Club is continuous.

**c) At what stages of the process is it monitored?**

All site sampling takes place after emissions have passed through equipment that reduces emissions.

In relation to '*at what stages*', the details of the monitoring required by the permit are provided in the response to Question 68(a) (above).

In relation to '*where*', the locations of the monitoring points are listed in Appendix B (page 32) of the Technical Report '[Environment Agency Wales Questions of Concern Answered](#)'.

**d) What sampling or testing is done (includes air, soil, milk, water and human tests)?**

Samples are taken for analysis of gas and water emissions from the works; landfill gas, leachate, groundwater, surface water from the landfill plus soil, vegetation and milk. There are also occasional samples of dusts following community complaints. There are no human tests although personal sampling monitors are worn by some employees.

**e) Who analyses the data?**

Who undertakes chemical analysis of samples will depend on the nature of the sample (water, air, food) and the organisation that took the sample.

Surface water quality samples collected by Environment Agency Wales (from receiving water courses) will be analysed by the Environment Agency's National Laboratory Service. Water samples collected by or on behalf of Hanson Cement, to meet the weekly requirements of their permit, will be analysed by a UKAS (United Kingdom Accreditation Service<sup>4</sup>) accredited laboratory.

For milk samples, the analysis is also done by a UKAS accredited laboratory, and the results are forwarded to the Food Standards Agency for information and comment.

Specialist data, such as noise, are analysed by a competent contractor. Process related data such as stack emissions are analysed by the site personnel who are legally required to inform Environment Agency Wales if permit breaches occur.

**f) Is it sufficient?**

The monitoring requirements are sufficient to meet the requirements of the environmental permit as required to comply with legislation, which is protective of public health.

Whilst emissions from Hanson Cement may in themselves present *hazards* (in that they have the potential to cause harm), the level of *risk* that they present (i.e. the likelihood that an undesirable event ('harm') will happen) is minimal. In scientific and health research of this kind, it is not possible to state that there is 'no risk' of harm, as the complexity of the issues is such that there can never be this level of certainty.

The level of site specific and ambient air quality monitoring data available from all sources to inform the Hanson Investigation was deemed sufficient to allow robust conclusions to be made.

Data were used to assess both permit compliance and ambient air quality with appropriate standards. The level of monitoring and testing complies with all the requirements set for cement works, and is sufficient to protect public health. All principal pollutants have been

<sup>4</sup> <http://www.ukas.com/default.asp>

outlined in the Technical Reports produced for the investigation. The health standards for all pollutants have been looked at, and are not being breached.

However, in reviewing all the monitoring data, the Investigation Response Team identified a problem with the Hanson Cement monitor for PM<sub>10</sub> particles. This monitoring was undertaken by a contractor on behalf of Hanson Cement. It failed to identify ambient levels, similar to other monitors in the area, including those of Emission Watch. This was brought to the attention of Environment Agency Wales and Hanson Cement for further investigation and appropriate action.

### **Request for 24 hr monitoring**

The kiln stack and the cement mills are monitored continuously, 24 hours a day, 365 days a year.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered

*(Sections 6.9, 6.10, 6.11 and 6.12, pg 22)*

Environment Agency Wales Regulatory Role Factsheet

## **69 Where are the monitors placed and who analyses them?**

Monitors are sited both within the plant and at different locations around the site. Process related samples e.g. stack emissions are analysed by Hanson Cement who must inform Environment Agency Wales if levels exceed the permit level.

The response to Question 68(a) (above) provides information on the monitoring that is undertaken for regulatory purposes.

All site sampling takes place after emissions have passed through equipment that reduces emissions. Other monitoring takes place at the boundary or in the community to assess off site impact. Specialist data, such as noise, are analysed by a competent contractor. Process related data such as stack emissions are analysed by the site personnel who are legally required to inform Environment Agency Wales if permit breaches occur.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered Section 6.2 and Appendix B (page 32)

Assessment of the milk, soil and vegetation samples taken in the vicinity of Hanson Cement by the Food Standards Agency & Annexe 1 of FSA Report

Review of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide and Metals by the Health Protection Agency

## **70 How can we know the information/monitoring is conducted independently and accurately?**

The Investigation Response Team has no grounds to believe the information and monitoring has not been provided to the required professional standards.

The independence and accuracy of the monitoring of the kiln is assured through the requirement to meet the standards set in Environment Agency Wales's Operator Monitoring Assessment Scheme. The Environmental Permitting Regulations require Operator Self Monitoring, and as such is not independent of the operator.

All sampling required by the permit must meet minimum standards and the contractors must be suitably qualified. Environment Agency Wales completes an annual check monitoring of selected process limits. It also has a scheme known as Operator Monitor Assessment (OMA) which applies to all processes regulated under the Environmental Permitting Regulations. An OMA audit involves interviewing relevant site personnel, viewing appropriate documentation and inspecting the monitoring location(s).

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered Section 6.13

## **71 Who is responsible for the calibration and maintenance of the monitoring units and is this done appropriately?**

Hanson Cement is required by its environmental permit to ensure all monitoring equipment is of Monitoring Certification Scheme standard, where applicable.

As such this equipment has to be calibrated and maintained by competent accredited personnel. This is normally completed by an accredited contractor.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 6.14*)

**72 a) Do Environment Agency Wales consider data gathered by Emission Watch, particularly for night time peaks?**

The raw data has not been used by Environment Agency Wales, who met with Emission Watch to discuss the use of data from Emission Watch monitors. The Investigation Response Team has used the data from Emissions Watch monitoring in the investigation.

The existing raw data has not been used by Environment Agency Wales. Discussions and correspondence have taken place between Environment Agency Wales and Emission Watch. In particular, the discussions have focused on the equipment used, possible causes of error in readings (for example the issue of high readings when water vapour is present), calibration and audit of the Emission Watch instruments, locations and data handling. Environment Agency Wales has offered assistance to Emission Watch to address these issues.

The Investigation Response Team has used the data from Emissions Watch monitoring in the investigation.

**b) Has the Environment Agency Wales taken action following this data?**

Environment Agency Wales has offered support to Emissions Watch and Environment Agency Wales specialists have inspected the monitoring stations.

Environment Agency Wales reported that no validated information was received by them from Emissions Watch.

The Investigation Response Team has used the data from Emissions Watch monitoring in the investigation.

**c) What were the results of the monitoring to detect low level fugitive emissions from the site by the Environment Agency**

**Wales over a summer period? This followed the identification of 14 sites where visible unscheduled emissions occurred by CANK (Campaign Against New Kiln).**

Monitoring was undertaken by Hanson Cement to comply with an enforcement notice in 2007. This resulted in the installation of additional CCTV cameras to monitor for fugitive dust.

The monitoring to detect low level emissions was undertaken by Hanson Cement to comply with an Enforcement Notice served by Environment Agency Wales in 2007. This required improved monitoring of fugitive dust emissions by appropriate deployment of staff and installation of additional CCTV cameras. Hanson Cement employed temporary staff to monitor, by observation, for fugitive dust releases (primarily from the upper half of the tower which was not covered by CCTV) until additional CCTV cameras were installed. No releases were observed by the temporary staff.

The Environment Agency monitoring (by CCTV) identified a major release from the tower. There was no quantitative monitoring of fugitive dust emissions. No breaches of the air quality standards were found over the review period.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (*Sections 6.15, 6.16 and 6.17*)

**73 a) How many regulated industries are there within a ten mile radius of Hanson works?**

There are 268 regulated processes within a ten mile radius of Hanson Cement. Of these 136 sites are regulated by Environment Agency Wales and 132 by local authorities.

**b) How are the overlapping burdens of permissible emissions in total, calculated as safe by verifiable measurement?**

The Environmental Permitting Regulations require emissions from new processes to be modelled so that cumulative impacts can be considered.

As part of the permitting process under the Environmental Permitting Regulations, emissions from a new process are modelled to assess their impact on existing background concentrations and compliance

with air quality standards. New and existing developments are considered in the context of emissions in the vicinity from other sources so that cumulative impacts are considered.

All air quality data from all sources available to the Investigation Response Team were analysed, to allow the contribution from the Hanson site to be seen in the context of the surrounding area. Therefore much data which was not required by the site permit, including the atmospheric monitoring undertaken by Emissions Watch, Environment Agency Wales and Hanson Cement over the investigation period, and the longer term atmospheric monitoring data collected by Flintshire County Council monitoring equipment sited in the areas most likely to be polluted (i.e. near major roads).

All ambient air quality monitoring is assessed against health based standards. Modelling is used to estimate the contribution of emissions from the site to pollutant levels as measured by the off-site ambient monitors.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 7.4*)

**74 Why has the “What’s in my back yard” website of the Environment Agency Wales been ‘dumbed down’ and obfuscated to the point that annual comparisons of emissions of chemicals can no longer be made?**

The reporting requirements for the Pollution Inventory (which is the basis for the information provided on the ‘What’s in your back yard?’ website) are reviewed every three years to take in any changes in legislative requirements. This can result in a change in the chemicals that are required to be reported.

The website has also been reformatted, but still contains all of the Pollution Inventory information.

The website can be accessed directly at <http://www.environment-agency.gov.uk/homeandleisure/37793.aspx>, or via the home page for the Environment Agency ([www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)): click on the “At home and leisure” tab, and then select “What’s in your back yard” from the menu on the left. Selecting “Go straight to maps” at the top of the page then gives a number of options. Emissions to air are covered in sections “Air Pollution” and “Industrial Pollution”. Click

on one of these options, and enter the postcode for the site (CH7 4HB). A click on the icon on the map will provide the annual emissions data.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

Environment Agency Wales Questions of Concern Answered (*Section 7.5*)

**75 Why was the planning application railroaded through the planning authority by councillors when the majority of residents were against it?**

It is understood that the planning application process for Kiln 4 took a year to complete. The application was received in January 1999 and was determined in January 2000.

## 4.18 Investigation process

**76 Why was there the initial short period for people to express their views to the Investigation Response Team?**

This period informed the initial planning of the investigation. It was followed by a comprehensive community engagement process.

The initial short period for consultation in May and June 2010 was to establish the types of concerns. This informed the initial planning of the investigation and the types of specialist advice that would need to be involved in understanding and responding to local concerns.

It was followed by a comprehensive community engagement process from September to November 2010. This is described in Section 3.1.1, above.

**77 Can views and concerns from all parts of the community be submitted into the investigation?**

Yes, the Investigation Response Team employed a wide variety of methods to actively engage with all sections of the community, both in terms of identifying concerns relating to Hanson Cement, and sharing the findings as the work has progressed.

Views and concerns were invited and sought from all parts of the community. A wide range of methods were used in the first phase, including:

- Six focus groups inviting attendance from 107 community groups
- One focus group for Hanson Cement employees
- Two community drop in sessions
- Seven community walkabouts
- Telephone answer machine
- Written contact points from May – November 2010 for letters or e-mails
- Letters/questionnaires sent to 47 primary care services, 10 school councils and the youth service

These opportunities were advertised in over 19,000 newsletters sent to local homes, 40 posters displayed locally, four press releases and on the Public Health Wales website. They were reported locally in the press and in the Flintshire Children and Young People's web forum and newsletter.

Following the publication of the draft version of the Final Report in December 2011, a second period of engagement took place, which concluded at the end of April 2012. Members of the Investigation Response Team held a series of drop-in sessions, and responded to requests from community groups and individuals to discuss the draft Report and listen to people's comments about it, to inform the final version. Discussions were broad ranging, covering

- How well the draft Final Report answered the concerns that had been raised
- Whether the content of the report was easy to understand
- Whether there were any concerns about the content of the report
- Whether the layout and style of the report was appropriate and helped to communicate the findings

Feedback from this process is reported in the Hanson Cement Investigation Community Engagement (Phase 2), Report and has been taken into account in the production of this Final Report.

*Further information:*

Hanson Cement Investigation: community engagement (Phase 2) report

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

## **78 How do we capture positive comments?**

The engagement processes were designed and implemented to capture positive comments about Hanson Cement as well as concerns and other comments.

## **79 Can the response team consult the following document: The health effects of waste incinerators, 4th report of the British Society of Ecological Medicine (2nd Edition), authors: Dr Jeremy Thompson & Dr Honer Anthony?**

The Investigation Response Team has consulted this and other documents.

This document was consulted as part of the work of the investigation.

## **80 Can you consider past complaints from residents to other stakeholders e.g. local authority, Hanson Cement and Environment Agency Wales?**

All complaints from 2000 to 2010 about Hanson Cement were considered. These included those received by Flintshire County Council Environment Agency Wales and Hanson Cement.

Further information:

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Report of the Nuisance Subgroup (Environmental Risk Assessment)

## **81 Has other voluntary emission data been considered?**

The Investigation Response Team has used the data from Emissions Watch monitoring in the investigation.

Emission Watch is a voluntary group that monitored emissions at several locations around the Hanson site.

*Further information:*

Hanson Investigation Library

[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Review of particulate matter by the Health Protection Agency *n.b. This is a very large document and may take awhile to download*

**82 We have been involved in other consultations and investigations over the last 20 years and do not feel we have been listened to or that action we require has been undertaken. Why will it be different this time?**

The Investigation Response Team considers that engaging, involving and communicating with the community residents whose concerns prompted this investigation is fundamental to the success of the process.

Throughout the investigation, an open and inclusive approach has been taken. It is hoped that this will promote confidence and trust in the process, its findings and the conclusions that can be drawn from them.

There has been ongoing engagement with local community representatives and local residents, as well as the wider community throughout the investigation. This process ensured that community concerns were captured and documented, and shared with community representatives before being agreed and finalised. This report seeks to respond to the concerns raised.

The information from each stage has been fed back to the meetings in public held by the Investigation Response Team, and on the Public Health Wales website. Following each meeting in public, newsletters have been delivered to over 19,000 homes in the area and provided in local libraries to keep residents updated.

Circulating the draft report was a key part of the information sharing process. The Investigation Response Team has taken steps throughout the investigation process to ensure that community representatives and local residents have been able to participate fully in opportunities to discuss what has been found and what it means for people living in the area.

This final report of the investigation has taken the feedback and comments on the draft report into account.

**83 a) Has any information been gathered or used from other similar comparator plants across the UK/Europe?**

Information about permit requirements for cement plants across England and Wales has been reviewed and considered by the Environment Agency .

The Environment Agency has carried out a statutory permit review of the England and Wales cement sector. A major part of the review was to compare current (at the time of the review) permit requirements with the very latest environmental standards described by the European legislative guidance.

**b) Is there anything to learn in other situations that can be applied here?**

The statutory permit sector review carried out by the Environment Agency resulted in changes that consolidated and updated permits to reflect changes in legislation. This led to greater attention being focussed on ammonia emissions and on further minimising releases of fine dust (particulates) from the cement mills at the Hanson site.

Following the review, the cement sector permits were varied in 2010 to:

- Implement decisions following the statutory review
- Bring earlier variations into an up-to-date, consolidated permit
- Modernise the entire permit to reflect the changes in legislation

Minor changes were made to the Hanson Cement permit to include an ammonia limit on the stack (ammonia is added to reduce nitrogen oxide emissions) and to introduce two improvement conditions. These required Hanson Cement to

- assess and produce a report on the environmental impacts of ammonia emissions from the stack
- produce a project plan setting out how releases of particulates from all significant non-kiln sources would be minimised and at least reduced to < 10-20  $\mu\text{g}/\text{m}^3$  as a daily average by 30 June 2014 (the current limit for the cement mills is 30  $\mu\text{g}/\text{m}^3$  and for the clinker cooler exhaust 50  $\mu\text{g}/\text{m}^3$ )

*Further information:*

Hanson Investigation Library  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608) Environment Agency  
Wales Questions of Concern Answered (*Section 7.3*)

## 4.19 Trust

### 84 How do we rebuild trust in public agencies?

Trust is based on mutual understanding and respect. This is helped by openly sharing information (unless there are legal reasons why this cannot happen), and valuing the different backgrounds of individuals and organisations. Existing community engagement has not provided sufficient information to local communities. Recommendations from the investigation include improved communication and engagement between public agencies and bodies, Hanson Cement and the local community.

It is acknowledged that trust has broken down between sectors of the community, Hanson Cement and public agencies and bodies. Even though community engagement has and continues to take place, it has not been sufficient to reassure the community. This is evident by the request to the Minister for this investigation.

The process of rebuilding trust will need careful consideration. The involvement of the community in this process is of key importance. Public agencies will need to reflect on previous engagement and their responses with a critical eye and with the benefit of community feedback with a view to meeting local needs. This may involve consideration of making monitoring results and enforcement action more accessible to local communities.

Recommendations in this report include a call for improved communication and engagement with communities which will assist with this process.

## 4.20 Other Questions

### 85 Why was there no full Health Impact assessment (HIA) carried out?

There is no legal requirement to carry out a Health Impact Assessment during the planning or permitting processes. However, an assessment of potential public health impacts associated with the commissioning of Kiln 4 and the decommissioning of Kilns 1, 2 and 3 was carried out in June 2003. It concluded that residents living near

the site were very unlikely to suffer harmful effects from authorised emissions, and compared to previous emissions from the site, any risks to health would be further reduced due to lower levels of pollutant emissions from Kiln 4.

A Health Impact Assessment is not a legal requirement of the planning or permitting process. However, it is a legal requirement of the permitting process to consult with the local health board. The purpose of this is to consider any implications on public health as local health boards have a legal duty to protect and improve the health and wellbeing of the population they serve.

In June 2003, an assessment of the potential public health impacts associated with the proposal to construct a fourth kiln, to replace Kilns 1, 2 and 3, was made. This was undertaken with the support of environmental public health specialists.

The assessment considered that the likely health implications, in absolute terms, would be extremely small - below any level that would be visible in local health statistics or detected by special health studies. It concluded that residents living in the vicinity of the site, including the most vulnerable members of the most exposed communities, were very unlikely to suffer harmful effects from authorised emissions of any pollutant from the proposed development of Kiln 4. In addition, compared to previous emissions from the site, any risks to health would be further reduced due to lower levels of pollutant emissions.

#### **86 How many of the staff and managers live within the area?**

Hanson Cement has confirmed that three quarters of employees (staff and managers) live within the local area described by the investigation.

#### **87 Was there any conclusion to previous investigation around cancer levels/clusters?**

A previous investigation (carried out in 2003) of cancer levels / clusters found no evidence of increased cancer incidence or of cancer clusters around the cement works. This study was published in a peer reviewed journal.

With specific regard to cancer-related concerns, much work has been undertaken previously by public health agencies to investigate allegations of increased cancer rates in the vicinity of the site. Due to

the often long periods between possible exposure and development of cancers, such investigations are extremely difficult and complex.

However, an epidemiological study undertaken in 2003 investigated claims by a campaigning group of a cancer cluster associated with the site. The results showed that there were no statistically significant differences between cancer rates amongst those living in the immediate vicinity of the cement works and the population living in the surrounding wider geographical area. In conclusion, the study found no evidence of increased cancer incidence around the cement works and suggested that incorrect handling of cancer registration data can result in spurious cancer clusters and unnecessary public alarm.

*Further information:*

Roberts JR, Steward J, John G (2003) *Cement, cancers and clusters: an investigation of a claim of a local excess cancer risk related to a cement works*, Journal of Public Health Medicine, Vol. 25, No. 4, pp. 351-357 <http://jpubhealth.oxfordjournals.org/content/25/4/351.long>

## 5 Conclusions and Recommendations

The Investigation Response Team recognises that the content of this Report may not match the expectations of all community representatives and residents who are concerned about the health of the local population.

The conclusions and recommendations have been reached after extensive in depth analysis over a two year period.

The views expressed during the community engagement process have been taken very seriously and have influenced the style and language of this final report. The process was set up to ensure the report accurately addressed the community's concerns and was easy to understand.

The community engagement process has shown that some members of the community have been reassured by the investigation. However, it has been recognised that others continue to have concerns which they feel have not been resolved.

### Communication, engagement and trust

#### Recommendation 1:

**Communication and engagement is improved between Hanson Cement, public agencies and bodies and the local community in order to rebuild trust.**

Having considered a wide range of information and listened to community members and representatives, the Investigation Response Team is of the opinion that this investigation resulted primarily from a breakdown of trust between sectors of the community, public agencies and bodies, and Hanson Cement.

The most important recommendation is for all parties to work together, in the interest of community health and well-being, to rebuild trust. This process will need careful consideration and the involvement of the community is of key importance. Some processes to share information and engage with the local communities are already in existence. However, public agencies and bodies, and the company, will need to reflect on previous community engagement and their responses to requests for information with a critical eye. All should work with local communities to proactively provide information, respond to issues raised and work positively to continue to improve engagement and understanding, and build open and trusting relationships. It is likely that this will involve consideration of making all relevant information more available and accessible to local communities.

## Environmental monitoring

### **Recommendation 2:**

**All relevant monitoring and sampling is reviewed by regulatory agencies.**

Evidence based controls on the environment and food are in place across the UK to protect health. This report demonstrates the extent of monitoring, sampling and regulation that takes place for this industrial site. This should provide a level of assurance to local communities.

However, in light of the concerns raised by the community and the findings of this report, including the detailed technical reports that have informed it, it is recommended that all relevant monitoring and sampling is reviewed by regulatory agencies. This should result in:

- a) A decision as to whether all existing monitoring and sampling is effective, necessary and appropriately coordinated
- b) Improved understanding and confidence in the local community of the purpose, limitations, results and outcomes of any such monitoring and sampling undertaken, in the context of the protection of health and wellbeing
- c) A review and appropriate actions by Environment Agency Wales relating to the scrutiny of monitoring data provided by Hanson Cement

## Health of the local population

### **Recommendation 3:**

**No further investigations into the concerns relating to the health of the local population are required unless new evidence comes to light from routine monitoring and surveillance.**

This investigation has outlined the range of routine health information that is available and the surveillance (e.g. of new cases of cancer) that is routinely undertaken. The investigation has looked in detail at this information, and has concluded that the general health of the communities in the areas near Hanson Cement is good or better than that typical for Wales. No evidence of persistent increased ill-health in the population living near the site (compared with those living elsewhere in Wales or North Wales) was found. New diagnoses of cancer, deaths from cancer and admissions to hospital from respiratory conditions are similar to or better than that typical for Wales. No evidence of consistent clusters of cancer or cancer types in the geographical areas or over time were found in the local area.

No further investigations into the concerns relating to health effects of exposures to emissions from Hanson Cement are required unless new evidence comes to light from routine monitoring and surveillance.

The investigation found no evidence that emissions from Hanson Cement have resulted in harm to physical health.

## APPENDIX 1

# Summary of the Hanson Cement Investigation Final Report

Conducted by Public Health Wales, in partnership with Betsi Cadwaladr University Health Board, Environment Agency Wales, Food Standards Agency, Health Protection Agency, Health and Safety Executive, Flintshire County Council.

June 2012

### Background

In April 2010 the Minister for Health and Social Services received a letter from community representatives living near the Hanson Cement works (formerly Castle Cement) in Padeswood, Flintshire. The letter outlined concerns about the effects of the cement works on the health of local people.

The Minister asked Public Health Wales to find out more about the concerns, investigate them and then report back to the community with the findings.

Public Health Wales asked other experts to join the investigation team. These included:

- Betsi Cadwaladr University Health Board
- Health Protection Agency
- Environment Agency Wales
- Food Standards Agency
- Flintshire County Council
- Health and Safety Executive

Four groups were formed to investigate:

- How to understand the local community's concerns better
- Whether the dust and gases (emissions) and waste from the cement work pose a risk to local people's health
- The health of the local community and whether there was poorer health than expected
- How to make people aware of the investigation and report its work.

### Findings

Overall the Investigation found

- no evidence that emissions from Hanson Cement have resulted in harm to physical health, and

- no evidence of any persistent increase in ill-health, but the health of people living near the site was generally as good, or better, than that of those living elsewhere in Wales

Three recommendations were made:

- Communication and engagement is improved between Hanson Cement, public agencies and bodies and the local community in order to rebuild trust
- All relevant monitoring and sampling is reviewed by regulatory agencies
- No further investigations into the concerns relating to health effects of exposures to emissions from Hanson Cement are required unless new evidence comes to light from routine monitoring and surveillance

More detail about people's concerns and the investigations that were carried out is given below.

### **Community engagement**

Since May 2010, 60 people have written to the investigation team to share their concerns.

From June 2010 an answer phone service was set up so that local people could leave a record of their concerns. Ten people left a message.

In October and November 2010, invitations were sent to 107 local community groups to come to six focus groups to discuss concerns. A total of 17 people attended four focus groups. Two focus groups were cancelled due to lack of attendance. A focus group for Hanson Cement staff was also held.

Also in October and November 2010, seven 'walkabouts' took place where Public Health Wales staff approached local residents and asked whether they had any concerns or comments. A total of 70 residents responded.

In November 2010 two drop-in sessions were held to give local people the chance to discuss their concerns with Public Health Wales staff. A total of 25 responses were given.

A total of 180 people chose to give their views on Hanson Cement through the various engagement methods. However, a number of people chose not to share their views or said that they were not concerned.

Of those who did have concerns, the most common were to do with the health effects of living near to the cement works, especially in relation to

cancer, lung and chest problem (respiratory disease), and dust and gases (emissions).

People wanted answers to questions about:

- Whether people living near Hanson Cement get more health problems such as asthma, chest problems or cancer, than people living in other areas
- The dusts (particulates) and gases that are given off by the cement works, and whether they are harmful to health
- The process used to make the cement, and how the process is checked to make sure that it is safe

The views collected during this process were reported back to the local community and the investigation team to inform the work of the expert groups.

As the investigation progressed, the findings of the expert groups were presented as they became available, at a series of public meetings. This allowed community representatives to discuss and ask questions about the different strands of work throughout the process.

Following the publication of the draft Final Report of the investigation in December 2011, a second phase of engagement took place. The focus of 'Phase 2' was to seek community members' views on

- How well the draft Final Report answered the concerns that had been raised
- Whether the content of the report was easy to understand
- Whether there were any concerns about the content of the report
- Whether the layout and style of the report was appropriate and helped to communicate the findings

Public Health Wales staff arranged three 'drop-in' sessions in community venues, and attended a further five meetings by invitation. Written, telephone and one-to-one meetings provided input from fourteen other sources.

The views and comments collected the community engagement process have been taken very seriously and have influenced the presentation of the information in the final report.

## **Health information**

The investigation team looked at the health of people living in the areas around the Hanson Cement works. The purpose of this was to see how the health of people living there compared with people in Flintshire and people in the whole of Wales.

This research used routinely collected health data to see if poor health could be linked in any way to the dust and gases given off at the cement works.

Overall, people living near the cement works have good general health. Their health is as good as or better than the health of people in Wales as a whole.

However, in the area covering Hope, Caergwrle and Llanfynydd the figure for new cases of cancer was slightly higher than expected for Wales as a whole.

The Welsh Cancer Intelligence and Surveillance Unit, part of Public Health Wales, also looked in detail at cancer in the local area.

It looked at cancer data for the areas closest to the cement works, for Flintshire and for Wales as a whole for an 18 year period from 1991 to 2008. Three different types of scientific tests were done to see if there was any evidence that there is more cancer in people living near the cement works.

The results showed that there is no evidence of consistent clusters of cancer or cancer types over time in the local area.

The higher rate of new cases of cancer found previously in Hope, Caergwrle and Llanfynydd was looked at in greater detail. When additional scientific tests were done, it was found that this was a chance clustering because there was no pattern over time of a higher rate of new cancer cases in this area.

It is important to remember that some clustering will always happen as a result of chance. For example, if you mix 100 red beads with 100 white beads they will not always mix perfectly. Some red beads will group together and some white beads will group together. This is called random distribution and shows that clusters can occur by chance.

The expert cancer group did not find any patterns or clustering of cancer cases that could be related to living near to the cement works beyond those that would be expected to occur by chance.

More than 1 in 3 people will develop some form of cancer during their lifetime. Breast, lung, colorectal (including bowel), and prostate cancer are the most common cancers in the UK.

Cancer survival rates continue to improve because of early detection and better treatment, so we would still expect to see some cancer in the local

community. The investigation team recognise that cancer causes concern for those with the disease, their family, friends and neighbours.

### **Environmental risk assessment**

The investigation team also looked at the air quality in the local area and the types of dust and gases given off by the cement works.

The expert group checked a range of different records from 2000 to 2010 to see which dust and gases have been found in the air around the cement works. They checked how much dust and gas is given off when cement is being produced.

The expert group noted that the dust and gases given off includes very small particles of different chemicals which can only be seen under a microscope. If enough of these small particles get deep into the lungs they can cause health problems.

Results show that the levels of dust and gases given off at the cement works are within UK safety limits and therefore are not considered a risk to health.

The investigation team was asked whether the local community should be concerned about what the small particles consist of. Scientific evidence shows that it is the particle size, rather than particle content, that can cause health problems. Therefore, research focused on particle size.

Records showed that during the period of the study levels of gases were at times above the permitted limits. Appropriate enforcement action was taken by Environment Agency Wales. However, these levels were still well within the safety limits set for the UK.

Overall, the quality of air around the cement works has got better over the last 10 years. This is linked to an overall improvement in air quality in the whole of the UK which is mainly because there are better standards to reduce pollution from industry and vehicles.

Information from complaints about Hanson Cement showed that noise and dust were the main reasons for complaints. Complaints about smoke and smell were also received. Of all the complaints made, Hanson Cement was only found to be the cause for some of them.

The investigation team said that nuisance factors like noise and dust may have the potential to have an effect on well-being and quality of life for some people in the local area, but are unlikely to have an effect on people's long term physical health.

The Food Standards Agency assessed samples of soil, vegetation and milk between 2004 and 2009. The results have all been within regulatory limits. The Agency's advice for all consumers of allotment produce is to thoroughly wash and peel before consumption, and to ensure a varied diet from a variety of sources.

### **Communicating the work of the investigation**

Since May 2010, six meetings have been held in public with local community leaders and the investigation team. Many individual meetings between experts and concerned members of the community have also been held to talk about concerns and the work of the investigation in more detail.

Eight press releases have been issued by Public Health Wales to make people aware of the investigation, ask people to share their concerns, and update people on the investigation's work. These have all been in English and Welsh.

Since October 2010, five newsletters have been sent to over 19,000 homes closest to the cement works. The newsletters give people an update on the work of the investigation that has been presented to local community leaders at the meetings in public. These have all been in English and Welsh.

Web pages for the investigation have also been created. They can be found at [www.publichealthwales.org/hansoncementinvestigation](http://www.publichealthwales.org/hansoncementinvestigation)  
The web pages are in English and Welsh.

All of the press releases, newsletters, presentations, minutes of meetings in public and the reports of the expert groups are available on the web pages under the Hanson library section  
[www.wales.nhs.uk/sitesplus/888/page/49608](http://www.wales.nhs.uk/sitesplus/888/page/49608)

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## APPENDIX 4

### Defining geographical areas for analysis of health information

The Office for National Statistics has developed a way to divide populations to provide health information that is meaningful, is affected less by the random way disease occurs in a population, and allows for comparison between areas. This approach puts greater emphasis on the numbers of people within the area, and less on the geographical boundaries (e.g. rivers and roads) that have historically been used to divide populations.

These new areas are called Super Output Areas (SOAs). These are specifically designed to enable information on small areas to be presented in a clear, consistent and reliable way. SOAs are grouped into three levels:

- Lower Super Output Areas – containing about 1500 people
- Middle Super Output Areas – containing about 7500 people
- Upper Super Output Areas – containing about 31000 people.

When undertaking analysis of health information, there are two key requirements. The first is that the areas chosen are small enough to be able to provide the fine detail required. The second is that the data to be analysed are robust and that the results can therefore be relied upon. Unfortunately, these two requirements tend to conflict with one another. The finer the detail, the less robust the data tend to be. This is because the smaller the area, the lower the number of events (for example, deaths or admissions to hospital). When the number of events is low there tends to be a lot of variation from year to year which happens on a purely random basis. This serves to hide the 'true' underlying picture.

Therefore, the geography selected for small area analysis of health tends to be a compromise between these two competing requirements. For this piece of work MSOAs have been judged to be the best compromise. MSOAs allow us to show a good range of data in reasonably fine detail.

Public Health Wales has used Middle Super Output Areas to respond to community concerns because they provide the best compromise of an area small enough to focus on, whilst being large enough to ensure the information (and any conclusions drawn from this information) is sufficiently robust and less likely to be affected by the random way disease occurs.

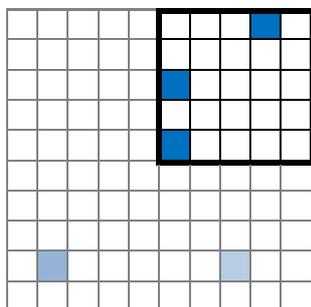
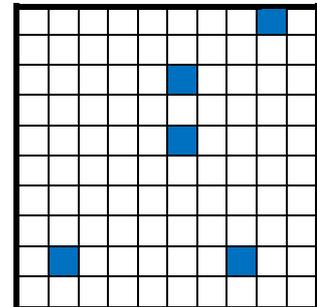
More information on Middle Super Output Areas can be found in the [Health information report, January 2011: Descriptive analysis of health in the vicinity of Hanson Cement](#).

## APPENDIX 5

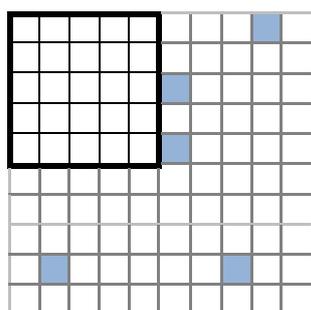
### Understanding statistics in small areas

Health data is often reported on a national level, for a very large population, but when information on a more local level is needed it is important to carefully define the population size to report about. If we choose a population that is too small, the normal variation that occurs can appear magnified and makes interpreting this data more problematic.

Take for example a population of 100 people. In a normal year we might expect 5 people to have a heart attack and these would occur randomly in the population (represented by the blue squares on the grid). We can calculate the rate of heart attacks in this population as 5 out of 100, or 5%.



If we wanted information on a smaller section of that population we might choose to look at those people living in the upper right of the grid. Here there are 3 people with heart attacks out of a total of 25 - a rate of 12%.



Just by reducing the size of the population we look at, the effects of the random distribution of disease can become magnified – so it would appear that the rate of heart attacks in the top right of the grid is more than double that of the population as a whole.

If instead we looked at the people living in the upper left of the grid, we would find that no people have had a heart attack; it would appear that this would give a rate of zero.

Focussing on too small an area means the random way that heart attacks (or any other health condition) occur might give us very different information in different small areas when compared with the information for the bigger area of which they are part. This might be falsely reassuring, or falsely alarming when compared to the whole population rate of 5%.

In reality, even a population of hundreds of people is too small for a robust analysis, i.e. an analysis that accounts for the effects of the random distribution of disease. A population of several thousand people is needed before we can be confident that our findings are unlikely to be due to chance variation.

## APPENDIX 6

### Routinely available health information

A vast amount of information is regularly collected and helps to build a picture of the health of people in Wales. Some of this data is collected for the sole purpose of learning about the health of the nation, whilst some is collected for other reasons. Information from the census for example is not specific to health but contains invaluable information that can be used by health analysts.

Routine data is not designed to investigate specific health concerns, but can be used to give a picture of population health. Routine data from North Wales is collated on a regular basis and features in the annual report by the Executive Director of Public Health.

When health information is published it is usually anonymised. This means that it is not possible to identify the individual person to whom it relates. When this information is analysed it is often done so by national or local area, this allows local and national comparisons year on year.

Public Health Wales collates and manages various data sets and sources including: antimicrobial resistance, notifications of infectious diseases, Congenital Anomaly Register and Information Service (CARIS), healthcare associated infections, immunisations and vaccines, pharmacosurveillance, screening services and Welsh Cancer Intelligence and Surveillance Unit (WCISU).

Public Health surveillance is also undertaken by other organisations, resulting in useful data sources including the All Wales Perinatal Survey (AWPS) and Welsh Oral Health Information Unit (WOHIU).

Surveys often provide information sampled from a population that otherwise would not be available, e.g. smoking status. Health service data sources are also essential to public health intelligence work, although data must be interpreted with care as it is usually collected for other purposes. Administrative data includes birth and deaths registrations.

More information on specific data sources is provided below.

## ***Data and Health Intelligence***

**Antimicrobial Resistance:** The main focus of the [Welsh Antimicrobial Resistance Programme Surveillance Unit](#) is to collate, analyse and feedback data relating to antimicrobial resistance (resistance to the medicines used to treat infections) to clinicians across Wales.

**Cancer:** The [Welsh Cancer Intelligence and Surveillance Unit's \(WCISU\)](#) primary aim is the systematic collection, analysis and dissemination of information about cancer incidence, mortality and survival within the resident Welsh population. Such information is used to make judgements about the demand for screening and treatment, the effectiveness of these services, epidemiological research into the causes of cancer, research into cancer prevention, clinical research and for the education of the public.

**Communicable Diseases and Infections:** One of the roles of the [Public Health Wales Communicable Disease Surveillance Centre \(CDSC\)](#) is to undertake surveillance of communicable disease and infection in Wales and disseminate relevant, accurate and timely information.

**Congenital Anomalies (birth defects):** The [Congenital Anomaly Register and Information Service \(CARIS\)](#) collects information about any foetus or baby who has or is suspected of having a congenital anomaly and whose mother is normally resident in Wales at time of birth. It includes babies in whom anomalies are diagnosed at any time from conception to the end of the first year of life. Data collection commenced on 1st January 1998 and includes any baby where pregnancy ended after this date.

**Healthcare Associated Infections (HCAI):** One of the remits of [The Welsh Healthcare Associated Infection Programme \(WHAIP\)](#) is to collate data provided by the NHS Trusts and compile reports on HCAI rates in Wales.

**Immunisation and Vaccines:** One of the roles of the [Vaccine Preventable Disease Programme \(VPDP\)](#) is to provide statistical information about vaccination uptake rates in Wales.

**Pharmacosurveillance:** The [Pharmaceutical Public Health Team](#) utilise prescribing and over-the-counter sales data to monitor the prescribing and supply of medicines.

**Screening:** Screening services publish regular reports relating to uptake and detection rates for the screening programmes in Wales.

### ***Surveys, health service and administrative data***

**Census:** The Census has been undertaken every 10 years (with the most recent in 2011) by the Office for National Statistics (ONS) and is the most comprehensive population survey, covering all households in the UK.

**[Health Behaviour in School-aged Children \(HBSC\) Survey](#):** A cross-national research study conducted in collaboration with the World Health Organisation (WHO) Regional Office for Europe. The study aims to gain new insight into, and increase our understanding of young people's health and well-being, health behaviours and their social context.

**[Welsh Health Survey](#):** Provides information about the health of people in Wales, the way they use health services and the things that can affect people's health. The survey was developed to meet a range of needs, including providing estimates of health status, health-related lifestyle and health service use at national (Wales) level, for population sub-groups (such as age, sex, socio-economic group) and for local authorities.

### ***Health service data***

**[National Community Child Health Database \(NCCHD\)](#):** Derived from health board administrative community child health systems. NCCHD consists of anonymised records for all children born, resident or treated in Wales born after 1987.

**Hospital Inpatient data: ([Patient Episode Database for Wales \(PEDW\)](#)):** The Patient Episode Database for Wales is managed by the NHS Wales Informatics Service (NWIS). PEDW records all episodes of inpatient and day case activity in NHS Wales hospitals, which includes planned and emergency admissions, minor and major operations, and hospital stays for giving birth. Hospital activity for Welsh residents treated in other UK nations (primarily England) is also included.

**Quality outcome framework (QOF), General Medical Services**

**Contract:** The data cover a range of indicators which are part of the new GP contract. These include management of chronic conditions, the patient experience, how the practice is organised and specific services such as cervical screening and maternity services. Practices are awarded points according to the number of indicators they meet and they receive funding accordingly. [Annual QOF data](#) are also available.

***Administrative data***

**[Birth registrations](#):** The Office for National Statistics (ONS) collates and validates birth registrations data. Data are available for residents of England and Wales by area of residence, sex and birthweight.

**[Death registrations](#):** Individual records for death registrations are sent on a weekly basis from the Registrars' offices across England and Wales to the Office for National Statistics (ONS). The Office for National Statistics collates and validates the data. Data are available for residents of England and Wales by area of residence, age, sex and underlying cause of death.

***More information***

Further information on the sources described above, and other data used by the NHS in Wales can be found on the Public Health Wales Observatory website: <http://www.publichealthwalesobservatory.wales.nhs.uk/> and the statistics and data section of the Health in Wales website: <http://www.wales.nhs.uk/statisticsanddata>

## Appendix 7

### Understanding risk

Everybody is exposed to risk every day - from falling out of bed to the morning commute, there are countless ways in which we could come to harm. Most people don't stop to think about these risks as they are inherent to almost every situation we might come across.

#### What is risk?

In its basic form, risk tells us how likely it is that an adverse event will occur. This is sometimes referred to as the "probability", the "odds", or the "chance" that this event will happen. We also consider the magnitude of the event when referring to risk, so that an event that might cause death may be considered higher risk than one that causes only slight injury. Some terms that are often used when talking about risk are:

- Risk** the likelihood that an undesirable event will happen, taking into account the magnitude of that event (e.g. a car crash)
- Harm** an adverse outcome (e.g. illness, injury or death)
- Hazard** a circumstance or thing with the potential to cause harm (e.g. driving to work)

How much risk we are prepared to accept is very much dependent on a number of factors. For example, things we have little or no control over (e.g. genetically modified crops) are generally considered to be less acceptable than ones that we actively choose to engage in (e.g. cigarette smoking), and things that we can see (e.g. a busy road) are likely to cause less alarm than those we cannot (e.g. radiation).

The context of the risk is also important. A surgeon may consider performing a "high risk" operation on someone in whom it would be their only chance of survival, but would be unlikely to even consider it for an otherwise healthy person. How we decide whether a risk is acceptable depends on the circumstances.

#### Levels of risk

In health and scientific research, we often refer to hazards that have "minimal" or "negligible" risk. What we generally mean is that the risk is so low that we consider it to be unimportant. We would be wrong to use the term "no risk" because no-one can ever be absolutely certain.

Hazards that are referred to as "low risk" may have the potential to cause harm, but are unlikely to do so. A large earthquake, for example, would cause serious harm, but the likelihood of this occurring in north Wales is

so small that we consider it to be low risk. Similarly, exposure to pollutants for prolonged periods at levels above those considered safe has the potential to cause harm, but the likelihood of this occurring is low.

*References:*

Risk and Regulation Advisory Council (2009) *A Practical Guide to Public Risk Communication*. <http://www.bis.gov.uk/files/file51458.pdf>

British Medical Association Board of Science (2012) Risk: what's your perspective? <http://bma.org.uk/-/media/Files/PDFs/Working%20for%20change/Improving%20health/riskwhatsyourperspective2012.pdf>

## Appendix 8

### Organisational roles

#### Public Health Wales

##### Who they are

Public Health Wales is an NHS Trust that was established in 2009.

##### What they do

Public Health Wales has four main functions

- To provide and manage a range of public health, health protection, healthcare improvement, health advisory, child protection and microbiological laboratory services and services relating to the surveillance, prevention and control of communicable diseases;
- To develop and maintain arrangements for making information about matters related to the protection and improvement of health in Wales available to the public; to undertake and commission research into such matters and to contribute to the provision and development of training in such matters;
- To undertake the systematic collection, analysis and dissemination of information about the health of the people of Wales in particular including cancer incidence, mortality and survival; and prevalence of congenital anomalies; and
- To provide, manage, monitor, evaluate and conduct research into screening of health conditions and screening of health related matters.

#### ***Welsh Cancer Intelligence & Surveillance Unit***

##### Who they are

The Welsh Cancer Intelligence and Surveillance Unit (WCISU) is the National Cancer Registry for Wales and is part of Public Health Wales.

##### What they do

Their primary role is to record, store and report on all incidence of cancer for the resident population of Wales wherever they are treated. Registration of cancer in Wales has been undertaken for almost 50 years and the current database holds around 686,000 records.

WCISU uses the data collected to monitor trends in cancer and provide information relating to incidence, survival and mortality.

## ***Public Health Wales Observatory***

### **Who they are**

The Public Health Wales Observatory is a specialist team within Public Health Wales who are skilled in data analysis, evidence finding and knowledge management.

### **What they do**

They help local and national partners to better understand public health issues, providing meaningful information in ways that can be understood. The Observatory has close links with other Public Health Observatories across the UK and Ireland to share information and intelligence in order to build up a better picture of the health of populations.

## **Betsi Cadwaladr University Health Board**

### **Who they are**

Betsi Cadwaladr University Health Board (BCUHB) is an NHS trust and the largest health organisation in Wales.

### **What they do**

They provide a full range of primary, community, mental health and acute hospital services for a population of around 676,000 people across the six counties of North Wales (Anglesey, Gwynedd, Conwy, Denbighshire, Flintshire and Wrexham) as well as some parts of mid Wales, Cheshire and Shropshire.

They employ around 16,772 staff and have an annual budget of around £1.2 billion. They are responsible for the operation of three district general hospitals (Ysbyty Gwynedd in Bangor, Ysbyty Glan Clwyd in Bodelwyddan and Wrexham Maelor Hospital) as well as 22 other acute and community hospitals and a network of over 90 health centres, clinics, community health team bases and mental health units. The Health Board also coordinates the work of 121 GP practices and NHS services provided by North Wales' dentists, opticians and pharmacies.

## **Food Standards Agency**

### **Who they are**

The Food Standards Agency (FSA) is an independent Government department set up in 2000 to protect the public's health and consumer interests in relation to food. The FSA is accountable to both the National Assembly and, via Health Ministers, to Parliament.

## What they do

The Food Standards Agency is responsible for food safety and food hygiene across the UK. They work with local authorities to enforce food safety regulations and commission research related to food safety.

The FSA retains responsibility for labelling policy in Scotland, Wales and Northern Ireland, and for nutrition policy in Scotland and Northern Ireland. Responsibility for nutrition policy in Wales lies with the Welsh Government.

Key areas of work for the Agency in Wales are:

- Protecting consumers - through effective enforcement and monitoring, working closely with Welsh Local Authorities;
- Reducing food borne illness - working with industry and enforcers to minimise contamination, and promoting public awareness of safe food handling;
- Ensuring food safety - for example, by contributing to UK action to ensure that chemicals do not compromise food safety, and that BSE controls are properly enforced;
- Supporting consumer choice - through accurate and meaningful labelling and by making publicly available information on food safety issues, survey results and enforcement activity.

## Flintshire County Council

### Who they are

Flintshire County Council is the democratically elected local government body responsible for delivering a wide range of services within the county.

### What they do

They are responsible for delivering and maintaining a wide variety of local services including education, housing, leisure facilities, social services, environmental health, refuse and recycling services and public transport.

The council is democratically accountable through elections held every four years. It is funded mainly by revenue from the Welsh Government with the remaining income generated from council tax. Although the Welsh Government sets the broad policy agenda, it is the role of the County Council as to how this is delivered on a local level.

Many of the functions of the local authority involve close partnership working with other organisations such as the NHS, police and so on.

## Environment Agency Wales

### Who they are

Environment Agency Wales is a Welsh Government Sponsored Body, while also being part of the Environment Agency for England and Wales. As a Welsh Government Sponsored Body, they obtain much of their funding and direction from the Welsh Government, and report back to them.

### What they do

Like the rest of the Environment Agency, they have wide responsibilities for managing the environment. They protect and improve the places where people work, live and play all over Wales. To do this, they have three main roles:

- Environmental operator - they manage the risk of flooding, issue warnings and work with communities to help them find solutions to flood risk. They create and improve habitats for water-based wildlife and also provide angling and boating facilities so that people can enjoy the water environment. When pollution occurs they act to minimise any environmental damage, identify the source and stop any further pollution.
- Environmental regulator - they ensure environmental legislation is implemented properly and regulate a range of business. To do this they give advice and issue permits, authorisations and consents. If things go wrong and pollution occurs, they prosecute those responsible.
- Environmental adviser and partner - they work closely with partners to achieve better environmental outcomes. As an independent adviser on environmental matters, they share information and expertise, and support collective decisions that will give Wales a prosperous and sustainable future. They undertake extensive environmental monitoring and scientific research so that they have the best available evidence and knowledge to help them fulfil their roles.

## Health & Safety Executive

### Who they are

The Health & Safety Executive (HSE) is the national body responsible for work-related health, safety and illness. They are an independent regulator that acts in the public interest to reduce work-related death and serious injury in workplaces.

## What they do

The HSE was established to support the Government's strategic aims and targets for health and safety at work. Their main aim is to secure the health, safety and welfare of people at work and protect others from risks to health and safety from work activity.

The HSE also ensures that the major hazard industries (such as nuclear, petrochemicals and offshore oil and gas) manage and control the risks around their work to a high standard which enhances assurance and allows these industries to operate with a high degree of public acceptance.

They have four main duties:

- Propose and set necessary standards for health and safety performance
- Secure compliance with those standards
- Carry out research and publish the results and provide and information and advisory service
- Provide a Minister of the Crown on request with information and expert advice.

The HSE often works alongside Local Authorities in performing their regulatory duties.

## Health Protection Agency, Centre for Radiation, Chemical and Environmental Hazards

### Who they are

The Centre for Radiation Chemical and Environmental Hazards (CRCE) is part of the Health Protection Agency (HPA) which is an independent UK organisation set up by the government in 2003 to protect the public from threats to their health from infectious diseases and environmental hazards.

In Wales, the Health Protection Division of Public Health Wales carries out the same role as the HPA in England, but some of the more specialist expertise, for example the CRCE, is shared by the two organisations.

### What they do

The CRCE provides advice, research and services to protect the public from hazards resulting from exposure to chemicals and poisons, radiation, ultrasound and infrasound. The Centre also takes a lead role on behalf of

the HPA for the public health effects of climate change and extreme environmental events such as flooding.

The Centre's headquarters are at Chilton, Oxfordshire. There are also specialist radiation centres at Leeds and Glasgow and specialist chemical centres in Birmingham, Cardiff, London and Nottingham. CRCE also commissions the [National Poisons Information Service \(NPIS\)](#) which provide 24/7 advice on treatments and poisonings.

The functions of the CRCE are to advance knowledge about protection, provide laboratory and technical services, run training courses, provide expert information and advise government and other bodies as appropriate.

## Appendix 9

### Glossary of terms

acute disease	A disease that is usually of rapid onset and relatively short duration (rather than a chronic disease which is of gradual onset and long duration).
airborne emissions	The release into the air of waste products from the manufacturing process. These may be as gas, vapour or small particles.
ambient pollution	The normal or background pollution that is found in a particular area.
Best available Technique (BAT)	A term used to describe the methods that are considered to be most effective at reducing pollution. Regulators often use these alongside other considerations (such as local environmental conditions etc.) to determine the limits for emissions.
body burden testing	The testing for the total amount of a chemical or number of chemicals found in a person at a specific point in time. Some chemicals are eliminated from the body whilst others may accumulate over time, so the body burden will change as time passes.
cancer cluster	A cluster of cancer cases (see: cluster).
cancer incidence	The number of new cases of cancer diagnosed in a given area over a defined period of time.
cement clinker	Lumps of material that is the first stage in making cement. They are formed by heating limestone and clay together until it clumps. The clinker is usually then ground down and mixed with gypsum to form the powdered cement.
Child Measurement Programme	The national programme that is run by Public Health Wales, with the aim of collecting data on the height and weight of all children in Wales.
childhood cancer	Cancer that occurs during childhood (0-14 years of age).
cluster analysis	Investigation of a cluster of disease (often cancer) that aims to determine its importance (see also: cancer cluster).
clusters	An unusual aggregation, real or perceived, of health events that are grouped together in time and space. Most clusters occur randomly and are of no significance.
coarse dust	Dust that consists of larger (coarser) particles.

COMEAP	Committee on the Medical Effects of Air Pollutants. A committee of independent experts that provides advice to the government on all matters concerning the effects of air pollutants on health.
commissioned	Something that is in service or has been granted permission to be in service.
comparator populations	A population that is used as a comparison and that has a similar profile (in terms of age, sex, deprivation etc.) to the one being compared. The comparator population usually differs in one respect (e.g. exposure to a particular hazard) so that the effect of this can be estimated.
control measures	Actions that are put into place to reduce or minimise risks.
decommissioned	Something that is out of service or no longer has permission to be in service.
dry kilns	A kiln that uses dry raw materials (rather than slurry that is used in wet kilns) to make cement clinker. Dry kilns are more efficient than wet kilns.
effects	The result of a cause.
environmental monitoring	The processes and activities that are used to assess the quality of the environment. This usually involves taking samples which are later analysed.
exceedances	Episodes where the level of emissions is greater than the limit set by the regulator.
fine dusts	Dusts that consist of small (fine) particles (see also: coarse dust).
fine particles of less than 10 micrometres in size known as PM10	Very small (microscopic) pieces of solid matter (see also: particulate matter)
focus group	A method of research used to explore opinions through facilitated discussions of a small group of people.
food chain	The sequence or hierarchy of organisms in an environment, e.g. plants are eaten by herbivores which are in turn eaten by carnivores.
fugitive dust/emissions	Emissions from any point other than those defined in the permit e.g. unplanned release of dust from a pipe fracture.
groundwater	Water that is located beneath the surface of the earth in the soil or rock (rather than on it as a sea, lake or river).
hazardous substances	A substance that has the potential to cause harm.

health based standards	A standard that is set based on the sole requirement of protecting human health.
health indicators	A characteristic of a person, population, or environment that can be measured and used to describe the health of that person/population/environment. For example the number of hospital admissions as a result of heart attacks is an indicator of the health of that population.
health outcomes	A change in the health of an individual or population that can be attributed to an intervention(s). For example a fall in the number of smoking related illnesses as a result of the smoking ban.
high and low level point sources	Refers to the locations where emissions occur (e.g. a chimney is a point source because the emissions come from one 'point'). A high level source is one that is above ground (e.g. a chimney stack); a low level source is close to or at ground level.
high level exposure	Exposure to a hazard at levels above those that are considered safe.
incidents	An occurrence or event - in this report it usually refers to an adverse event.
incomplete combustion	The process whereby fuel is burnt when there is insufficient oxygen. This results in the release of waste products.
independently peer reviewed	A process where research is reviewed by independent experts in that particular field, to ensure that it is valid. This process is often used before research is published to ensure it is of sufficient quality.
infant mortality	Death in children before they reach one year of age. The infant mortality rate is a measure of how many children under one year old die per year.
ingestion	Eating.
inhalation	Breathing in.
landfill site	A site where waste material is deposited and later covered over or buried.
leachate	Liquid that contains substances dissolved from the material it passes through. Often used to describe the water that flows out of waste sites.
limit values	Usually refers to the level at which emissions are permitted - i.e. The limit value is the level up to which a certain emission is allowed.

Middle Super Output Areas	A standardised area based on population numbers rather than geographical boundaries that are used for the collection and publication of small area statistics. MSOAs are often used instead of electoral wards because they contain similar numbers of people (approximately 7500) making comparisons between areas easier.
morbidity	Relating to disease or ill health.
mortality	Relating to death.
nuisance	In this report, the term 'nuisance' has a non-legal and general meaning that implies an annoyance to someone who has been subjected involuntarily to an environmental factor such as noise, dust or odour. The term 'statutory nuisance' has a legal definition under the Environmental Protection Act 1990.
occupational health	Relating to the health of workers or employees.
particulate matter	Small (usually microscopic) bits of solid material that are suspended in air.
plume coverage	The area that a plume or 'cloud' of emissions covers.
potential health impacts	The possible changes that could occur in people's health (in response to a hazard).
precautionary principle	The precautionary principle justifies taking preventive measures (e.g. setting emission limits at the lowest achievable level) even when there is no proof that the thing in question can cause harm. In other words, just because we cannot prove a particular emission is harmful we still set limits for that emission to be as low as possible.
public inquiry	A review of events and actions that is conducted in a public (rather than private) arena.
radius analysis	A method of analysis that looks at the area around a particular location, e.g. in a circular pattern around the site of interest.
rates	A measure of the frequency of occurrence of a phenomenon. In health terms it is used to describe the frequency with which an event occurs in a defined population.
risk	The likelihood that an undesirable event will happen
routine surveillance	Regular analysis, interpretation and feedback of systematically collected data. It is often used to monitor health outcomes (see also: health outcomes).

routinely collected health information	Information relating to health that is collected regularly. Examples of such data might be the number of hospital admissions for a particular disease, or the information that is collected by the cancer registry on the number and types of cancer within Wales.
spurious cancer clusters	A cancer cluster that is considered to be of no significance (often because the cancers are of different types and so not related).
statistically significant	Something that on analysis is likely to be of true significance rather than a chance finding.
survival rates	The proportion of survivors in a particular group. Often measured at intervals, e.g. a 5 year survival rate for a particular disease is the proportion of people still alive 5 years after diagnosis of that disease.
susceptible individuals	People who are more likely to suffer effects of an exposure, e.g. fair skinned people are more susceptible to sunburn than darker skinned people.
target values	A level that is being worked towards, e.g. pollution target levels describe the amount of pollution in the environment that regulators and authorities need to ensure business and industry are making plans to reduce emissions to. These may be different to limit values which are a legal requirement.
TDI (Tolerable Daily Intake)	TDIs are applied to chemical contaminants in food and drinking water. A TDI is the amount of a particular substance (contaminant) that can be taken in daily for a lifetime without a serious risk to health.
transient health effects	Changes in health that are usually brief and result in no long term problems, e.g. a rise in hay fever symptoms as a result of high pollen counts.
trend	Used to describe a pattern over time.
wet kilns	A kiln that uses a slurry (or 'wet' mix) of raw materials to produce cement clinker (see also: dry kiln). Most modern kilns are dry kilns.