12 October 2010

Risk Assessment

Emissions to air from the former Bayer site at Hauxton, Cambridgeshire

Non Technical Summary

The Health Protection Agency - Centre for Radiation, Chemical and Environmental Hazards (CRCE) have reviewed the latest volatile organic compound (VOC) monitoring data collected at the Hauxton site perimeter between 6 August and 3 September 2010. This data has been considered in relation to potential toxicological effects from emissions due to the remediation work at the former Bayer site in Hauxton.

It is important to make a distinction between concerns about odour and any toxicological effect from exposure to chemicals. The role of CRCE is to produce interpretation of results in relation to potential toxicological effects. Some background information about odours has been provided as odours appear to be the main concern to members of the public, but the monitoring results are not relevant to the assessment of odours. The human nose is very sensitive to odours, and many substances that are perceived as odorous are usually present at levels below which there is a direct toxicological effect. Odours can cause nuisance amongst the population possibly leading to stress and anxiety. Some people may experience symptoms such as nausea, headaches or dizziness, as a reaction to odours even when the substances that cause those smells are themselves not harmful to health. It cannot be excluded that some resident's symptoms may be as a result of their reaction to particular odours and all efforts should be taken to reduce off-site odours to as low as is reasonably practical.

The data provided to the HPA have been compared to available health based air quality guidelines and standards or assessment levels for the individual VOCs identified. Where the concentrations in air are shown to be lower than appropriate standards it may be assessed that the risk to health is minimal.

The latest results do not alter the HPA assessment that VOC emissions from the site are not of concern toxicologically and are therefore very unlikely to pose a risk to the nearby residents' health.

Background

Site

The former Bayer CropScience site near Hauxton, South Cambridgeshire, was previously used for the production of agrochemicals including pesticides and herbicides, which over time have contaminated the soil and groundwater. Due to the risk posed to the groundwater and nearby watercourses, the site was determined as Contaminated Land in 2003 by South Cambridgeshire District Council (SCDC) under Part IIa of the Environmental Protection Act 1990 and designated a Special Site for regulation by the Environment Agency (EA). The site requires remediation as it cannot be left in its contaminated state as it poses a potential threat to the Riddy Brook and River Cam. The remediation work is being carried out under an Environmental Permit issued by the EA and planning consent by SCDC.

During the remediation process contaminated soils are being excavated for remediation/treatment and contaminants previously trapped in the ground may be emitted into the air. An assessment of the contaminants on site suggests that the emissions may include a range of chemicals classed

as volatile organic compounds (VOCs). Some VOCs have odorant properties i.e. have a smell, whereas other VOCs do not smell. The conditions imposed by the Environmental Permit require environmental monitoring, including air quality monitoring to take place. Air quality monitoring has been carried out both onsite and at the site boundary to monitor VOC concentrations.

Monitoring

Air quality monitoring has been carried out on site since 18 February 2010, one month before the start of the remediation. The air quality sampling is carried out under the terms of the Environmental Permit by the remediation contractor, Vertase, and subsequent analysis of the sampling tubes has been undertaken by a third party accredited laboratory. The monitoring was undertaken at a number of locations at the perimeter of the site as shown on the accompanying map. VOCs present in air are trapped onto absorbent material within sample tubes over a 28 day period. The sample tubes are then analysed for the amount of VOC that has been absorbed. These amounts are then converted to concentrations of the VOCs in air. The highest concentrations of the top ten VOCs detected are provided on the South Cambridgeshire District Council website. Similar air quality monitoring has been carried out over 24 hour periods to identify the average VOC levels over a shorter term to highlight any temporary peaks in the VOC level.

Six sets of monthly monitoring results have been provided, this document provides an update from the 28 day monitoring obtained during month 6 described in Table 1. Data from month 6 includes results from two off-site locations, one in Church Road Hauxton and another on Queen's Drive Harston.

Table 1: 28 day sampling periods around Hauxton remediation works

Sample name	Date of sampling
Baseline (pre-works)	18/2/10 - 18/3/10
Month 1	18/3/10 - 15/4/10
Month 2	15/4/10 - 13/5/10
Month 3	13/5/10 – 10/6/10
Month 4	10/6/10 – 8/7/10
Month 5	8/7/10 – 5/8/10
Month 6	5/8/10 - 3/9/10

Scope

The Centre for Radiation, Chemical and Environmental Hazards (CRCE), of the Health Protection Agency (HPA) have been asked to review the monthly and 24 hour air quality monitoring results, and assess them with respect to potential risks to human health. All interpretations contained in this document are based on the monitoring results supplied to CRCE by the site regulators up to the 12 October 2010.

It is important to make a distinction between concerns about odour and any toxicological effect from exposure to chemicals. The role of CRCE is to produce interpretation of results in relation to potential toxicological effects. Some background information about odours has been provided as odours appear to be the main concern to members of the public, but the monitoring results provided are not relevant to the assessment of odours.

The human nose is very sensitive to odours, and many substances that are perceived as odorous are usually present at levels below which there is a direct toxicological effect.

Odours can cause nuisance amongst the population possibly leading to stress and anxiety. Some people may experience symptoms such as nausea, headaches or dizziness, as a reaction to odours even when the substances that cause those smells are themselves not harmful to health.

It cannot be excluded that some resident's symptoms may be as a result of their reaction to particular odours and all efforts should be taken to reduce off-site odours to as low as is reasonably practical.

Odours often consist of a mixture of substances. Each chemical substance may be detected analytically, however this cannot be translated into what odour is perceived. Odour nuisance will depend upon the frequency and duration of odour perception; therefore the EA and LA are monitoring nuisance complaints. An odour diary is available to download from the South Cambridgeshire District Council (SCDC) web site, or people can ring the Environment Agency's hotline on 0800 80 70 60 to report odour problems.

Methodology

Air quality standards and assessment levels

The data provided to the HPA have been compared to available health based air quality guidelines and standards or assessment levels for the individual VOCs identified. Where the concentrations in air are shown to be lower than appropriate standards it may be assessed that the risk to health is minimal. There are a variety of health based standards and assessment levels that have been calculated by a number of organisations. The hierarchy of standards and assessment levels is shown below:

- World Health Organisation air quality guidelines
- European air quality standards
- UK air quality standards
- Other UK air quality assessment levels
- National air quality assessment levels (other than UK)
- Comparison with standard of a different VOC from similar family

Units conversion

In order to be able to compare monitoring results with standards the concentrations need to be derived in the same unit of measurement. The air quality monitoring results are provided in parts per billion (ppb), and some air quality standards are expressed in micrograms per cubic metre. Therefore these need to be converted using the equation shown in box 1:

Box 1: Conversion of concentration Y in micrograms per cubic metre to X parts per billion

$$X \text{ ppb} = (Y \text{ µg/m}^3) * (24.45) / (\text{molecular weight of VOC})$$

Air quality monitoring results and discussion

Table 2 shows a summary of the highest VOC concentrations from the monitoring results compared to the health based standard or assessment level, and the sample location. Full copies of the air quality monitoring results are available on the South Cambridgeshire District Council website.

Table 2: Summary of results from Month 6 monitoring

Volatile organic compound	Air quality standard (ppb)	Concentration (ppb)	Monitoring Location
Toluene	69 WHO Air quality guideline [weekly average]	0.29	Church Road
		0.26	Queens Close
		1.40	N
		2.14	SE
		3.33	E
		3.61	NE
		0.60	NW
		0.66	W
		1.39	SW
Tetrachloroethylene	37 WHO Air quality guideline [long term average]	0.03	Church Road
		0.10	Queens Close
		0.95	NW
		4.27	SE
		11.87	E
		6.84	NE
		1.06	N
		1.1	W
		1.98	SW
Naphthalene	101 UK Environmental assessment levels for the protection of human health for air [annual mean]	6.36	Church Road
		0.63	N
Xylenes	1,016 UK Environmental assessment levels for the protection of human health for air (total xylenes) [annual mean]	1.05	NE
		0.85	SE
Hexane	204 UK Environmental assessment levels for the protection of human health for air	1.45	N
Methylcyclopentane	No chemical specific levels available. For comparison use:	1.06	N
3-Methylpentane	204 UK Environmental assessment levels for the protection of human health for air for Hexane 600000 UK Long-term workplace exposure limit for pentane	1.01	N

Table 2 shows a summary of the monitoring results from the samples collected between 6/8/10 and 3/910 (Month 6). The two VOCs identified at the highest concentrations continue to be toluene and tetrachloroethylene.

Toluene and tetrachloroethylene were detected at all the sampling locations. Both of these chemicals have World Health Organisation (WHO) health based guidelines. The weekly average WHO air quality guideline level for toluene is 69 ppb (260 micrograms per cubic metre)[1]. The monitoring showed a maximum airborne toluene concentration of 3.61 ppb. This is considerably lower than the WHO standard. The long-term average WHO air quality guideline level for tetrachloroethylene is 37 ppb (250 micrograms per cubic metre)[1]. The monitoring showed a maximum tetrachloroethylene concentration of 11.87 ppb which is lower than the WHO standard.

Naphthalene was found at a maximum concentration of 6.36 ppb. There is no WHO, European or UK air quality standard for naphthalene. A study cited in an EU risk assessment reported indoor naphthalene concentrations of up to 15.25 ppb (80 µg m^{-3})[3]. An EAL has been derived for naphthalene[2]. The concentration of naphthalene detected at the site boundary is significantly lower than the long term EAL (101 ppb)[2]. A health criteria value has been derived for naphthalene for lifetime exposures of 0.6 ppb, however short term exposures above this level would not be expected to produce any adverse effects.

Xylene was found in the samples at a maximum of 1.05 ppb. There is no WHO, European or UK air quality standard for xylene. An EAL has been derived for xylene[2]. The concentration of xylene detected at the site boundary is significantly lower than the long term EAL (1016 ppb) which is protective of human health[2].

Hexane was found in the samples with a maximum concentration of 1.45 ppb. There is no WHO, European or UK air quality standard for hexane. An EAL has been derived for hexane[2]. The concentration of hexane detected at the site boundary is significantly lower than the long term EAL (204 ppb)[2].

Methylcyclopentane and 3-methylpentane are also identified within samples at maximum concentrations of 1.06 ppb and 1.01 ppb respectively. There is no WHO, European or UK air quality standard for methylcyclopentane or 3-methylpentane. A review of research literature did not locate any other UK or national air quality guidelines or assessment thresholds for methylcyclopentane or 3-methylpentane. In the absence of set thresholds a comparison may be made with the standard for another substance. Both hexane and pentane are structurally similar chemicals. The concentrations of methylcyclopentane and 3-methylpentane are below the long-term EAL for hexane (204 ppb). In the absence of environmental standards for pentane, it is noted that the UK long-term workplace exposure limit is 600000 ppb[4] (as 8 hour time weighted averaged). It is recognised that this is an occupational standard and will not account for particular population sensitivities within a public setting such as the elderly or the young. However, the concentrations of methylcyclopentane and 3-methylpentane detected at site are significantly lower than the occupational guideline and are not expected to produce any adverse effects.

Many other VOCs were detected at very low levels around the site perimeter; however all of these were also below a concentration of 1 ppb. The VOC levels detected at the monitoring sites in Church Road, Hauxton and Queens Close, Harston were also all below the 1ppb level with the exception of naphthalene at 6.36 ppb Church Road. Naphthalene was not detected above 1 pbb in any of the other results from the site boundary which suggests that there is a potential alternative source near to Church Road.

Conclusions

Overall these results do not alter the HPAs opinion that the VOC emissions from the site are not of concern toxicologically and are therefore very unlikely to pose a risk to the nearby residents short or long term health.

The HPA shall assess future monitoring results to continually review the risk to public health from the site’s remediation.

References

1) WHO (2000) Air quality guidelines for Europe; second edition Copenhagen,WHO Regional Office for Europe, 2000 (WHO regional publications. European series; No 91). http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf

2) Environment Agency (2010) H1 Environmental Risk Assessment – annex f v2.1 http://publications.environment-agency.gov.uk/pdf/GEHO0410BSIL-e-e.pdf

3) European Chemicals Bureau (2003), European Union Risk Assessment Report, Naphthalene. http://ecb.jrc.ec.europa.eu/documents/Existing-Chemicals/RISK_ASSESSMENT/REPORT/naphthalenereport020.pdf

4) Health and Safety Executive (2007), EH40/2005 Workplace Exposure Limits
Table 1: List of approved workplace exposure limits (as consolidated with amendments October 2007) http://www.hse.gov.uk/coshh/table1.pdf

Appendix – Map of monitoring locations