



Risk Assessment

Emissions to air from the former Bayer site at Hauxton, Cambridgeshire: 24 hour monitoring data

Non Technical Summary

The Health Protection Agency - Centre for Radiation, Chemical and Environmental Hazards (CRCE) have reviewed volatile organic compound (VOC) 24 hour monitoring data collected between 3 June and 9 November 2010 (2 previous summary reports considered data between 3 June and 8 October). There are 3 monitoring locations: one on site; and two on the site perimeter. 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 24 hour results indicate that 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.

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 remediation process involves excavation and remediation/treatment of contaminated soils and during the works 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. Air quality monitoring has been carried out both onsite and at the site boundary to monitor VOC concentrations.

Monitoring

Air quality monitoring over a 24 hour period has been carried out on site since 3 June 2010. The air quality sampling is carried out by the remediation contractor, Vertase, and subsequent analysis of the sampling tubes has been undertaken by a third party accredited laboratory. The monitoring is undertaken at 3 locations: one location towards the centre of the site (the substation), and two locations on the boundary of the site (the Mill House and the gardens). VOCs present in air are trapped onto absorbent material within sample tubes over a 24 day period, with samples taken 5 days a week (Monday to Friday inclusively). 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 (see attached). Similar air quality monitoring has been carried out over 28 day periods to identify the average VOC levels over a longer period.

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 08 December 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

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

Air quality monitoring results and discussion

Between 3 June and 9 November 2010, 24 hour monitoring was undertaken on 112 occasions. The maximum VOC concentrations for each 24 hour period are summarised in the accompanying summary sheet, which includes the sample location and appropriate health based standard or assessment levels for comparison purposes. Full copies of the air quality monitoring results are available separate to this report.

Data between 3 June and 16 September and between 3 June and 8 October was considered in 2 previous reports and this report will consider the total dataset (i.e. earlier reports together with the most recent data from 11 October to 9 November).

Toluene and tetrachloroethylene have been the most consistently detected VOCs within the 24 hour samples, at all sample locations.

Typically the highest concentrations are identified at the on-site monitoring location (i.e. the substation), as would be expected since it is closest to the works being undertaken, with lower concentrations found at the site perimeter. The maximum tetrachloroethylene concentration occurs at substation on 90 occasions; at the Mill House 11 times and at the gardens 3 times. (There are 8 occasions where tetrachloroethylene concentrations are less than 1 ppb). For toluene the maximum concentration occurs at the substation on 91 occasions; at the 11 Mill House and at the gardens 3 times. (There are 7 occasions where toluene concentrations are less than 1 ppb).

A review of results indicates that all 24 hour samples, except for five, are below the appropriate air quality guidelines and assessment levels. The exceptions are 4 samples taken at the on-site monitoring location and 1 at the Mill House, which indicate potentially elevated levels of toluene (in 3 samples) and tetrachloroethylene (in 3 samples).

Both toluene and tetrachloroethylene 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 and the long term Environmental Assessment Level (EAL) 507 ppb². The monitoring showed a maximum 24 hour airborne toluene concentration of 104 ppb, at the on-site substation on the 1 July 2010. Whilst this indicates a potential exceedance of the WHO air quality guideline, when the dataset is considered as a whole, this result is a single short term (24 hour) peak, with all other results (at all monitoring locations) below the guideline. The WHO air quality guideline should be applied as a weekly average and when this maximum peak result is considered with substation data over a weekly period the WHO guideline is unlikely to be exceeded. Furthermore, this peak concentration was detected on-site and would not necessarily be reflective of off-site levels.

Monitoring results from site perimeter on the 1 July 2010 support this, with lower levels of toluene detected (52 ppb at Hill House and 1.23 ppb at the gardens).

Further elevated results for toluene of 74.92 ppb and 100 ppb are identified on the 4 August 2010 and 5th October respectively, again at the on-site monitoring location. Associated monitoring results at the site perimeter during the same 24 hour period are significantly lower (0.21 ppb at Hill House and 4.11 ppb at the gardens on the 4th August and 11 ppb at Hill House and with no detection above 1 ppb at the gardens on the 5th October).

The long-term average WHO air quality guideline level for tetrachloroethylene is 37 ppb (250 micrograms per cubic metre)¹ and the long term Environmental Assessment Level (EAL) 509 ppb². The monitoring showed a maximum 24 hour airborne tetrachloroethylene concentration of 53 ppb, at the site substation on the 12 August 2010. Whilst this indicates a potential exceedance of the WHO air quality guideline, when the dataset is considered as a whole, this result is a single short term (24 hour) peak, with all other results below the guideline and a long-term average is unlikely to exceed the WHO guideline. Furthermore, monitoring results from the site perimeter on the 12 August are much lower: 0.05 ppb at Mill Hill and 2.81 ppb at the gardens.

Further elevated results for tetrachloroethylene of: 51 ppb at the substation on 5th October and 39 ppb at the Mill House on the 21st September are noted.

The 24 hour monitoring results are not significantly different from the 28 day monitoring results, although they do provide information on short-term peak concentrations on site and at the site boundary. The VOCs identified within the 24 hour monitoring and their concentrations are broadly similar to the 28 day monitoring. The two VOCs identified at the highest concentrations continue to be toluene and tetrachloroethylene.

Conclusions

Overall these 24 hour results do not alter the HPA's 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>