Withyhedge Air Quality Data Review

Public Health Wales 13th June 2024

GIG CYMRU NHS WALES
Iechyd Cyhoeddus Cymru
Public Health Wales

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Background

What follows is a public health assessment of the air quality monitoring data provided to Public Health Wales in the report "AIR QUALITY MONITORING INTERIM SUMMARY, REPORT 2 Report Number 2423r1v1d0524" on 13 May 2024.

This assessment is based on monitoring carried out at a number of locations around Withyhedge Landfill site between 1 March and 3 April 2024 (diffusion tubes - monitoring for hydrogen sulphide), on various dates in March and April 2024 (Jerome monitor - hydrogen sulphide) and from 8 March to 3 April 2024 (diffusion tubes – volatile organic compounds (VOCs)). Monitoring was carried out by Geotechnology Ltd., under contract from RML, and at locations chosen by Geotechnology Ltd. The monitoring generated data that has been used to inform short and long-term exposure risk.

Some diffusion tube data were gathered between 5 February and 1 March 2024, but were too limited to inform a full risk assessment; tubes were located on lamp posts at 2m above ground, so well above head height, and the data could only inform long-term exposure risk assessment.

Following an initial review of the report we sought points of clarification on 16 May 2024 (provided 22 May 2024, 'v2d0524'), with further clarification sought 23 May 2024 (provided 23 May 2024).

Our assessment is given as

1) A non-technical summary, and
2) A more detailed technical assessment

However, the conclusions of both are the same.

This assessment is updated from the verbal assessment provided by PHW to partners on 24 May 2024.

As more monitoring data become available, PHW will review its assessment.

Summary

Public Health Wales (PHW) has now reviewed the monitoring data provided by Geotechnology Ltd. These data were first provided to us in a report on 13 May 2024. We asked for further information on the data, which was provided on the 22 and 23 May 2024. This extra information was needed before we could complete our assessment.

This assessment is based on monitoring carried out by Geotechnology Ltd, under contract from RML, at a number of locations around Withyhedge Landfill site chosen by Geotechnology Ltd. between 1 March 2024 and 3 April 2024 (diffusion tubes – monitoring for hydrogen sulphide), on various dates in March 2024 and April 2024 (Jerome monitor – hydrogen sulphide) and from 8 March 2024 to 3 April 2024 (diffusion tubes – volatile organic compounds (VOCs)). The monitoring generated data that has been used to inform short and long-term exposure risk.

Some diffusion tube data were gathered between 5 February and 1 March 2024, but were too limited to inform a full risk assessment; tubes were located on lamp posts at 2m above ground, so well above head height, and the data could only inform long-term exposure risk assessment These data have not been reviewed again here.

The available data showed that, at times, measured levels of hydrogen sulphide in the air were above the World Health Organisation (WHO) odour annoyance guideline value. It should be noted that some very high hydrogen sulphide levels were recorded on occasion, but we were advised by Geotechnology Ltd. that these were error readings associated with monitor start-up. We were also told that there was not a strong odour at the time of these readings which would have been expected if they were correct.

Hydrogen sulphide is a gas that has a rotten egg smell. Our noses can smell very small amounts of hydrogen sulphide, even at levels that are too low to cause harm.

In the short-term, people exposed to odours at levels above the WHO guideline value may experience headaches, nausea, dizziness, watery eyes, stuffy nose, irritated throat, cough or wheeze, sleep problems and stress. These symptoms should ease when the odours pass.

The data suggest that risk to long-term (lifetime) health is likely to be low, but the longer the exposure occurs the greater any potential risk will become. It is not possible to say what "longer" is because this will be affected by many factors, including the frequency and intensity of the smells, wind speed and direction, individual sensitivity and exposure, and other health issues.

Therefore,

- PHW maintains that reducing the cause or source of offsite odours from the landfill site must be a priority to reduce exposure and any potential health effects on the local community.
- Public health advice to those exposed to the odours remains unchanged, namely:
    - Closing windows and doors when nasty smells occur, or when the wind is blowing from the landfill towards your home, can help to stop smells coming inside. But, DO NOT block windows or vents completely; this is because they provide air to vent cookers and heaters and help to control damp. Once an outdoor smell has passed, opening windows and doors will help get rid of any smells that are inside.
    - If you feel unwell or are worried about your health, you can contact NHS 111, a pharmacist, or your GP (999 can be used in an emergency).

This assessment will continue to be reviewed and updated as more monitoring data are made available to us. However, we still believe the most important priority should be to reduce off-site odours.

Technical Assessment

Introduction

Since Public Health Wales was informed of the concerns over odours from Withyhedge on 12 January 2024 we have recommended that action was taken to address the source of the odours and to carry out monitoring to inform a public health risk assessment.

In general terms, the type of data needed from air quality monitoring to inform a public health risk assessment includes details on the chemical components of the landfill odours, as well as concentrations of different chemicals over the short (e.g. 30 minute intervals) and longer (e.g. over weeks or months) term. These data would then be compared with any relevant health-based guidelines and an assessment made. Generally, the acceptable limits for short term exposure are higher than those for longer term exposure. Air monitoring data allow us to assess the level of risk to the population of the odours for human health.

In this case, "spot" monitoring has also been carried out and used to contribute to the short-term assessment.

The monitoring results presented for consideration have been collected by Geotechnology Ltd. They were provided to Public Health Wales in the report "AIR QUALITY MONITORING INTERIM SUMMARY, REPORT 2 Report Number 2423r1v1d0524" on 13 May 2024. Following an initial review of the report we sought points of clarification on 16 May 2024, clarification was provided 22 May 2024 (Report Number 2423r1v2d0524), with further information sought and provided 23 May 2024.

We have reviewed the data presented. The data were generated through monitoring carried out by Geotechnology Ltd., under contract from RML, and at locations chosen by Geotechnology Ltd. Some guidance was provided by the Air Quality Group (AQG). The monitoring generated data that has been used to inform short and long-term exposure risk.

We seek assurance from those familiar with local area that the off-site monitoring locations are reflective of places where members of the public could be expected to be present over the relevant exposure durations.

Guideline values

The following guidelines were used to carry out a public health risk assessment.

Source	***Time period***	***Guideline value***	***Note***
WHO air quality guidelines	30-minute (average)*	7 µg/m^3 (5 ppb)	Based on odour annoyance
	24-hour (average)	150 µg/m^3 (107 ppb)	Based on eye irritation in humans
ATSDR-MRL**	Intermediate (up to 1 year)	30 µg/m^3 (20 ppb)	Based on lesions of the nasal olfactory epithelium in rats.
US EPA RfC***	For assessment of lifetime exposure	2 µg/m^3 (1 ppb)	Based on lesions of the nasal olfactory epithelium in rats.
Acute Exposure Guideline Levels (AEGLs)****	10 minutes	0.75 ppm	

*The WHO guideline value of 7 µg/m^3 (5 ppb) over a 30-minute averaging period is a short-term odour value protective of odour annoyance[1]

** An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. They are derived for acute (>1, ≤14 days), intermediate (>14, <364 days), and chronic (365 days and longer) exposure durations[2].

*** An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime[3].

**** Acute Exposure Level Guidelines (AEGLs) are used by emergency planners and responders worldwide as guidance in dealing with rare, usually accidental, releases of chemicals into the air. AEGLS are expressed as specific concentrations of airborne chemicals at which health effects may occur. They are designed to protect the elderly and children, and other individuals who may be susceptible[4].

Hydrogen sulphide (diffusion tube results)

With regard to the diffusion tube monitoring results for H_2S at off-site locations, for the period 1 Mar to 3 Apr, our assessment from the earlier round of monitoring completed 5 Feb to 3 March remains valid;

Our ability to reach a conclusion as to the health impact based on these data is limited. The report provides some reassurance that long-term level of hydrogen sulphide in the community appear to be below health-based guidance values (see table above). We agree with the statement in the summary of the report; "the instantaneous concentration over the exposure period would have risen and fallen throughout the period". Diffusion tubes cannot provide any information on short-term peaks in concentration of hydrogen sulphide. Wind speed, wind direction and activity on the site could have resulted in higher concentrations at community locations for

[1] E71922.pdf (who.int) and Frequently Asked Questions (FAQ) | Environmental Odors | ATSDR (cdc.gov)
[2] Minimal Risk Levels (MRLs) – For Professionals|Toxic Substances Portal|ATSDR (cdc.gov)
[3] Hydrogen sulfide CASRN 7783-06-4 | DTXSID4024149 | IRIS | US EPA, ORD
[4] About Acute Exposure Guideline Levels (AEGLs) | US EPA

short periods that could have given rise to symptoms and annoyance experienced by those living nearby.

Hydrogen sulphide (instantaneous Jerome results)

Jerome monitoring provides short duration "spot" samples; it is important to note that concentrations may have been higher or lower outside of the sampling window. The data presented covers dates in March and April 2024.

With respect to instrument specification, the Jerome analysers employ gold film sensor technology and have a limit of detection of 5 µg/m^3 ± 1 µg/m^3 (3.4ppb ± 0.7ppb)(brookfieldengineering), which equates to approximately 20% confidence at the limit of detection. Potential interferences to the Jerome H_2S analyser include chlorine, ammonia, nitrogen dioxide and mercaptans. In conclusion, indicative Jerome portable hand-held analysers can be used to provide an indication of typical H_2S levels experienced in the community, but do not provide the confidence of other monitoring techniques. We acknowledge the observations of the consultant who carried out this monitoring, that low levels of H_2S have been recorded at sites unlikely to be influenced by the landfill (or other sources of hydrogen sulphide); we support the concerns of using this technique at concentrations of H_2S likely to be around the limit of detection. **We recommend that results of future monitoring exercises are presented alongside the observations of the monitoring operator of any odours present.**

The H_2S data presented are generally in the range 0-12.98ppb at various off-site locations. The operator of the monitor has noted that they can smell landfill odours where readings have shown higher concentrations. The operator of the monitor has also reported that they can smell no odour at the lower concentrations.

However, notable exceptions reported in the data are:-

- Spittal School (117.07ppb),
- Treffgarne, adj Church (138ppb) and,
- Locations unclear, 19, 20 and 22 April, (highest concentrations 1.758, 1.749 and 1.492ppm, respectively).

The report states "***The reader should note that the instrument does, on occasion, produce a high value at the start of a monitoring interval. This is understood to be related to sensor stability at the start of the monitoring interval – such values have been retained in the data presented".***

These data have been reported at the start of a monitoring exercise. **We recommend that if the monitoring report author believes that these**

data points are due to the way the monitor operates then it should be clearly recorded, along with a description of the odour by the operator of the monitor.

While we have considerable uncertainties with these data, if correct these measures suggest that H2S levels may occasionally be above Acute Exposure Level Guidelines (AEGLs) level 1 which suggests that people may have transient health effects, such as headache.

In conclusion, given the method uncertainty, and taking a conservative approach that results recorded as 5ppb could be 6ppb, there are occurrences where these results could be described as near or in excess of the World Health Organisation (WHO) guideline level for odour annoyance (5ppb or 7 µg/m^3, 30-minute average). When odours are above the WHO odour guideline level, there is potential for odour complaints and health effects.

Volatile organic compounds (VOCs) collected via diffusion tube

Diffusion tubes have been used to collect samples of Volatile Organic Compounds (VOCs) for off-site analysis, exposed between 8 March and 3 April. They have identified a number of compounds that will likely have a variety of sources; including the landfill, nature and other local human activity (e.g. vehicles, domestic and agricultural emissions). For some of the compounds identified, concentrations are higher off-site than on-site; landfill emissions would be expected to dilute and disperse away from the landfill, suggesting a source other than the landfill.

The report also states *"Wooden posts at D9 Rudbaxton Bridge appear to have been recently stained. It is not precisely known when this work was done but it was not before 21 March based on review of photographs".* Recent use of a wood preservative in proximity of the diffusion tube would influence the VOCs collected and the inclusion of these results in the public health risk assessment would be inappropriate.

The results have been compared against health-based standards and guideline values where these levels exist. Concentrations in air of these compounds are lower than appropriate health-based standards, guidelines, or assessment levels, and therefore, the risk to health from these substances is likely to be minimal.

Note on Tetracosane at Spittal School
The tube located at Spittal School (D2) identified a concentration of Tetracosane (36ug/m^3) which appears an outlier (the concentration is higher than on the landfill site). We were unable to find a health-based standard for us to make an assessment against, but there is evidence to suggest that Tetracosane contains no components considered to be either

persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB). Possible sources include aromatic plant oils and asphalt.

Conclusions

We have reviewed the data presented. They have been collected by Geotechnology Ltd., under contract from RML, and with some guidance from the AQG. We seek assurance from those familiar with local area that the off-site monitoring locations are reflective of places where members of the public could be expected to be present over the relevant exposure durations.

The monitoring techniques used provide an indication of the concentration in air of the compounds named, however concentrations could have been higher or lower at other times outside of this monitoring exercise due to site activity and weather conditions. These techniques also have a range of characteristics which present challenges when interpreting the data;

- Diffusion tubes have a long exposure time, averaging out peaks (and troughs) of gas concentrations.
- The Jerome analyser is operating close to its limit of detection (LoD), this LOD is near the health-based standards used in the public health risk assessment.
- VOC diffusion tubes can present artefact data because of laboratory techniques. Additionally, at low concentrations the technique has a low confidence in the compounds identified.

Hydrogen sulphide is an odorous chemical; the human nose is very sensitive to odours. Concentrations of H_2S were, at times, above the WHO odour annoyance guideline value (7 µg/m^3 (5 ppb)). Continuing exposure to odours above the annoyance guideline value may result in headache, nausea, dizziness, watery eyes, stuffy nose, irritated throat, cough or wheeze, sleep problems and stress. At H_2S concentrations below the WHO odour annoyance guideline value, odour may still be present. The more time spent above the guideline, the greater the likelihood of these symptoms being experienced and impacting on people's health and wellbeing.

The monitoring strategies should be designed to reassure the community that their concerns are being listened to and we support the inclusion of members of the community in the monitoring exercises. We acknowledge that no strategy is perfect and that regulators across the UK, dealing with sites such as this, are working together to learn about how best to carry out such monitoring.

Finally, we still believe the most important priority should be to reduce off-site odours. Public health advice to those exposed to the odours remains unchanged, namely:

- To keep doors and windows closed when the odours are present and to open them again when the odours have passed.
- To seek medical advice from your GP or NHS 111 if appropriate.