

Air sampling 25 May 2022

Test results from the grab sampling of ambient air conducted on 25 May returned detectable concentrations of hydrogen sulphide (H₂S) in most, but not all, of the samples that were downwind of the CWTP. These concentrations are noted on the map attached which also shows sample location and wind direction. Wind speeds were very light (1-2 m/s) throughout the sampling period with variable wind directions but generally from the WSW or SW wind direction. Some of the earlier samples were under NW direction.

The test laboratory reports the H₂S concentrations in parts per billion (ppb). One ppb is equal to one-thousandth of a part per million (ppm) which is the unit used more commonly in publications.

The H₂S concentrations shown on the map have been expressed as ppm rather than ppb.

Health and odour properties of H₂S

Potential health impacts and odorous properties of H₂S are described in the ESR summary sheet published in October 2019 (<https://www.esr.cri.nz/assets/Hydrogen-Sulphide-Fact-Sheet.pdf>). H₂S is a colourless gas with the characteristic odour of rotten eggs. It is responsible for the characteristic odour associated with geothermal areas such as Hanmer Springs or Rotorua.

The odour threshold is the term used to define the concentration in air when H₂S can be detected by the human nose. The odour threshold varies from person to person, and on whether other odorous substances are present in the air that may mask the presence of H₂S. A commonly used and conservative value for the odour threshold is 0.0005 ppm, although much higher odour threshold concentrations have also been reported in literature. The concentrations that have been measured in the ambient air around the CWTP are much higher than this odour threshold, meaning that H₂S is expected to be clearly smelt at times by nearby residents or workers.

H₂S is odorous at much lower concentrations in ambient air than the concentrations that may cause health impacts. The concentrations of concern for potential health impact risk are neatly summarised in the ESR sheet:

Air quality criteria (ppm)		Time average	Critical effect(s)
(Ca) OEHHA ^a	0.03	1-hr	Nervous system. Headache, nausea, physiological responses to odour
MfE ^b	0.005	1-hr	Set to protect against nuisance odour
AEGL-1 ^c	0.75	10-min	Notable discomfort, irritation
AEGL-2 ^c	41	10-min	Irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape
AEGL-3 ^c	76	10-min	Life threatening adverse health effects or death

^a (California) Office of Environmental Health Hazard Assessment ⁵

^b Ministry for the Environment National Ambient Air Quality Guideline ¹

^c (US) National Academies of Sciences Acute Exposure Guideline Levels ⁶

A correction to this fact sheet has been issued by ESR this week which essentially halves the criteria for the OEHHA and MfE categories, due to previously unreported errors in unit conversions. The corrected values are shown in the table.

Comments on sampling results from 25 May

The concentrations of H₂S measured on 25 May clearly show a decrease in H₂S concentrations with increasing distance from the CWTP. Samples collected near Bromley School, and the residential areas to the southwest of the CWTP did not detect any H₂S on 25 May, due to the westerly wind conditions.

The concentrations that have been measured in the ambient air around the CWTP are much lower than the acute exposure guideline levels for notable irritation and discomfort (which is 0.75 ppm) or more serious health effects (above 41 ppm).

These air samples are collected over a very short time period (less than one minute) and therefore do not indicate longer term concentrations. The sampling methodology is being modified so that longer term representative samples can be collected, and the equipment to enable this methodology has been delivered and deployed today.

It is noted that the H₂S concentrations at each sampling site do not always correlate well with the observed odour intensity. This is likely due to the presence of low concentrations of other highly odorous compounds such as methyl mercaptan and other reduced sulphides or volatile organic compounds that are also released within the air emissions from sewage treatment and compost production.

Methyl Mercaptan

Methyl mercaptan has been detected in some samples on both 18 May and 25 May although only in samples taken within the CWTP boundary. All samples collected in air outside the CWTP boundary were below the detection limit of 0.002 ppm. The New Zealand Workplace Exposure Standards, Edition 13 effective from April 2022, gives a workplace exposure standard for methyl mercaptan of 0.5ppm as an 8-hour average.

Methyl mercaptan is odorous at extremely small concentrations. Published odour threshold values for methyl mercaptan vary, but the compound can typically be detected as an odour at a concentration of about 0.0001-0.0005 ppm. The test method that the Council is using can measure methyl mercaptan concentrations down to as low as 0.002ppm, which is much lower than the workplace exposure standard but higher than the odour threshold - meaning the methyl mercaptan could be present in the ambient air, and causing noticeable odour, and not be able to be detected by the test method.

Next steps

Collection of ambient air samples will continue on a weekly basis to establish more information about the range of H₂S and other chemical concentrations in the suburbs downwind of the CWTP.

Data collected from the H₂S continuous sampling will be reviewed, with the location of the monitor rotated around different sites to build up a picture of the range of H₂S concentrations occurring in different parts of the Bromley community.

Certificate of Analysis

Te Hononga Civic Offices
53 Hereford Street, Christchurch

Lab reference: 22-0024
Submitted by: Nigel Grant

Kurt Scoringe
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Date received: 25/05/2022
Date analyzed: 25/05/2022
Report date: 25/05/2022
Order No:
Reference: 25th-May-2022

Laboratory ID	22-0024-1	22-0024-2	22-0024-3	22-0024-4	22-0024-5	22-0024-6
Customer ID	Site 1 - Cuthberts/Ruru	Site 2 - Cuthberts Rd. Plant Gates	Site 3a - Shortland St.	Site 4a - SH74 Met Site	Site 5 - SH74 by Dam	Site 6a - Affordable Storage
Sampling time	25/05/2022, 10:58	25/05/2022, 11:04	25/05/2022, 11:15	25/05/2022, 10:10	25/05/2022, 10:15	25/05/2022, 10:20

Analyte (CAS)	Unit	22-0024-1	22-0024-2	22-0024-3	22-0024-4	22-0024-5	22-0024-6
monoterpenes	ppbv	<LOQ	2764	8	18	17	7
ammonia (7664-41-7)	ppbv	133	<LOQ	57	<LOQ	<LOQ	<LOQ
benzene (71-43-2)	ppbv	<LOQ	93	15	4	<LOQ	<LOQ
carbon disulfide (75-15-0)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
carbonyl sulfide (463-58-1)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
decamethylcyclopentasiloxane (541-02-6)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
dimethyl disulfide (624-92-0)	ppbv	1	44	<LOQ	<LOQ	<LOQ	<LOQ
ethanol (64-17-5)	ppbv	67	34	21	27	24	<LOQ
ethyl mercaptan + dimethyl sulphide	ppbv	<LOQ	11	<LOQ	<LOQ	<LOQ	<LOQ
heptanes	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
hydrogen sulphide (7783-06-4)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	445	22
pentanes	ppbv	22	<LOQ	<LOQ	<LOQ	<LOQ	8
methane (74-82-8)	ppbv	1699	4706	1662	2023	2617	2131
methanol (67-56-1)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
methyl mercaptan (74-93-1)	ppbv	<LOQ	5	<LOQ	<LOQ	5	<LOQ
styrene (100-42-5)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	3
xylenes + ethylbenzene	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

Lab reference: 22-0024

Report date: 25/05/2022

Certificate of Analysis

Laboratory ID		22-0024-7	22-0024-8	22-0024-9	22-0024-10	22-0024-11	22-0024-12
Customer ID		Site 10 - Bromley Sch.	Site 11 - Memorial Cemetery	Site 12 - St.Johns/ Seascape	Site 14 - Cadock St.	Site 15 - 103 Cuthberts Rd.	Site 16 - Kumho Tyres
Sampling time		25/05/2022, 10:45	25/05/2022, 10:51	25/05/2022, 10:30	25/05/2022, 09:50	25/05/2022, 11:10	25/05/2022, 11:20

Analyte (CAS)	Unit	22-0024-7	22-0024-8	22-0024-9	22-0024-10	22-0024-11	22-0024-12
monoterpenes	ppbv	9	5	7	1861	17	3
ammonia (7664-41-7)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	144	<LOQ
benzene (71-43-2)	ppbv	<LOQ	<LOQ	<LOQ	37	9	4
carbon disulfide (75-15-0)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
carbonyl sulfide (463-58-1)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
decamethylcyclopentasiloxane (541-02-6)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
dimethyl disulfide (624-92-0)	ppbv	<LOQ	<LOQ	<LOQ	27	2	<LOQ
ethanol (64-17-5)	ppbv	61	64	22	29	85	<LOQ
ethyl mercaptan + dimethyl sulphide	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
heptanes	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
hydrogen sulphide (7783-06-4)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	10	47
pentanes	ppbv	<LOQ	12	<LOQ	<LOQ	15	<LOQ
methane (74-82-8)	ppbv	1551	1275	1079	1784	1226	1616
methanol (67-56-1)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
methyl mercaptan (74-93-1)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
styrene (100-42-5)	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
xylenes + ethylbenzene	ppbv	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

Lab reference: 22-0024

Report date:

25/05/2022

Certificate of Analysis

Laboratory ID		22-0024-13	22-0024-14
Customer ID		Site 17- Breezes Rd. Stump	Site 18- Breezes/ Shortland
Sampling time		25/05/2022, 11:40	25/05/2022, 11:45

LOQ, estimated, ppbv	Uncertainty, relative, estimated (n=28), %
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Analyte (CAS)	Unit		
monoterpenes	ppbv	845	49
ammonia (7664-41-7)	ppbv	<LOQ	<LOQ
benzene (71-43-2)	ppbv	36	8
carbon disulfide (75-15-0)	ppbv	<LOQ	<LOQ
carbonyl sulfide (463-58-1)	ppbv	<LOQ	<LOQ
decamethylcyclopenta siloxane (541-02-6)	ppbv	<LOQ	<LOQ
dimethyl disulfide (624-92-0)	ppbv	14	2
ethanol (64-17-5)	ppbv	<LOQ	20
ethyl mercaptan + dimethyl sulphide	ppbv	<LOQ	<LOQ
heptanes	ppbv	<LOQ	<LOQ
hydrogen sulphide (7783-06-4)	ppbv	16	69
pentanes	ppbv	<LOQ	12
methane (74-82-8)	ppbv	1888	1293
methanol (67-56-1)	ppbv	<LOQ	<LOQ
methyl mercaptan (74-93-1)	ppbv	<LOQ	<LOQ
styrene (100-42-5)	ppbv	<LOQ	<LOQ
xylenes + ethylbenzene	ppbv	<LOQ	<LOQ

2	3
43	2
3	8
24	6
13	4
3	26
1	6
18	4
2	10
34	7
8	9
8	5
700	4
9	5
2	11
1	14
2	8

Method approver:



Anatoly Chernyshev, PhD
Director

Method Summary

The samples were analysed as received using direct injection – Selected Ion Flow Tube Mass Spectrometry (SIFT-MS) in Mass Scan Mode (reporting limit is 100 ppbv) and Selected Ion Mode (LOQ as in the table).

Report Notes

The samples were received in acceptable condition. **Wind direction during sampling: WSW (light). New components detected and added to the SIM method: ammonia.** Compounds added on client's request: carbonyl sulphide, carbon disulphide, dimethyl disulphide, ethyl mercaptan + dimethyl sulphide.

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