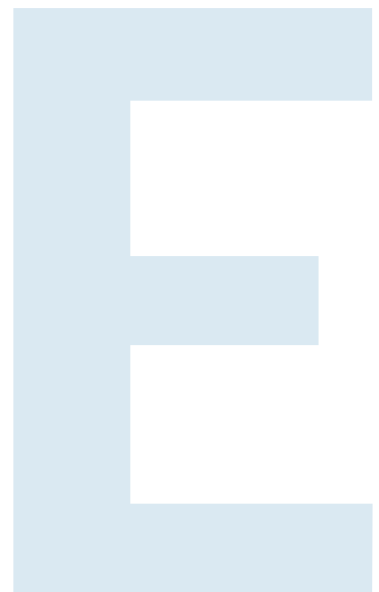


Technical Report E

Health Risk Assessment



Redvale Landfill Expansion

Screening Health Risk Assessment

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Executive summary

Redvale Landfill is currently scheduled to cease accepting waste in December 2028. Due to a delay in the authorisation and establishment of the replacement Auckland Regional Landfill (ARL), a transition plan is required. To address this potential gap in critical landfill infrastructure for residual waste disposal in the Auckland region, WM New Zealand (WMNZ) is proposing to extend the operation of Redvale Landfill to the end of 2036 and develop 4.56 Mm³ of additional airspace at the existing facility.

Tonkin & Taylor Ltd (T+T) has been engaged by WMNZ to undertake a Screening Human Health Risk Assessment (SHRA) to evaluate, on a conservative basis, whether contaminants discharged from the landfill could pose unacceptable health risks to people living and working in the surrounding area. This report forms part of a suite of technical reports prepared for WMNZ for inclusion in a substantive application for resource consent under the Fast-track Approvals Act 2024.

The SHRA is a screening-level assessment that intentionally adopts conservative assumptions to identify whether any exposure pathways may warrant more detailed evaluation. Because the Project primarily extends the duration of landfill operations rather than materially increasing peak emission rates, the SHRA has been undertaken on a cumulative basis, assessing the combined off-site effects of the existing consented landfill and the proposed expansion.

A Conceptual Site Model (CSM) was developed to evaluate all potential contaminant sources, transport pathways, and off-site receptors. Of all evaluated pathways, only inhalation of airborne contaminants (a complete pathway) and potential exposure via irrigation of a commercial tomato crop using water from the Rangitopuni Stream (a potentially complete pathway, in the event of leachate seepage through the engineered lining system) have been carried forward for quantitative assessment. All other pathways have been screened out on the basis of the absence of plausible receptors, or negligible risk due to very low contaminant concentrations.

The key findings of the SHRA are that:

- **Inhalation risks:** Airborne emissions from landfill gas (LFG) generators, the leachate evaporator (BeneVap), and fugitive LFG have been modelled using conservative assumptions (including assuming worst-case impacts from each source occur simultaneously at the same receptor). For chronic (long-term) exposure to threshold substances, the cumulative Hazard Index (HI) is 0.07, which is below the negligible threshold of 0.1.
For chronic exposure to non-threshold (carcinogenic) substances, the cumulative screening ratio is 0.28, which is well below a value of 1.0 that would correspond to an incremental lifetime cancer risk of 1 in 100,000 (the acceptable risk level adopted for this assessment). Formaldehyde is the only individual substance where the non-threshold (cancer risk) assessment result exceeds the negligible threshold, but it remains well within the acceptable range. The assessment also confirms that even applying a conservative ten-fold additional safety factor for children's sensitivity to benzene, the risk remains negligible.
The potential for acute (short-term) health effects is also assessed as acceptable, with a cumulative acute HI of 0.55.
- **Surface water risks:** The potential for contaminants in leachate and stormwater to reach the Rangitopuni Stream and contribute to human exposure via crop irrigation has been assessed. Conservative modelling of potential leachate seepage through the engineered lining system, through groundwater, and into the Rangitopuni Stream shows that risks to public health from use of stream water for tomato irrigation are negligible (the highest Hazard Quotient (HQ) for any individual contaminant is 2.55×10^{-5} , compared to an acceptable value of 1.0).

Stormwater from the site can contain metals such as zinc and copper associated with vehicle movements. However, monitoring shows no statistically significant difference in metal concentrations in the Rangitopuni Stream upstream and downstream of the site discharges, indicating that any contribution from site discharges is not distinguishable from background variability. The risk to public health associated with stormwater discharges is therefore assessed as not posing an unacceptable health risk.

- **Roof-collected drinking water risks:** The risk associated with contaminants depositing on roofs used for drinking water collection have been considered. The physical properties (high volatility and low water solubility) of the contaminants associated with discharges to air at the Landfill mean they have negligible tendency to accumulate on roof surfaces or dissolve in rainwater. However, this has been identified as a pathway of community concern. The assessment confirms there is negligible potential for these contaminants to be present at concentrations of concern in roof-collected drinking water.

Overall, the SHRA demonstrates on a conservative screening-level basis that, with current and proposed controls in place, the extension of Redvale Landfill does not pose unacceptable risks to human health via any identified exposure pathway.

1 Introduction

1.1 Background

Tonkin & Taylor Ltd (T+T) has been engaged by WMNZ to undertake a Screening Human Health Risk Assessment (SHRA) to evaluate, on a conservative basis, whether contaminants discharged from the landfill could pose unacceptable health risks to people living and working in the surrounding area. This report forms part of a suite of technical reports prepared for WMNZ for inclusion in a substantive application for resource consent under the Fast-track Approvals Act 2024.

This report sets out a Screening Human Health Risk Assessment (SHRA) that evaluates, on a conservative basis, whether contaminants discharged from the landfill could pose unacceptable health risks offsite. This SHRA is intended to support the Assessment of Environmental Effects (AEE).

1.2 Site description

The Redvale Landfill is located in Dairy Flat, to the north of Auckland, approximately 9 km northwest of Albany and 1 km west of State Highway 1. Redvale Landfill, including the existing landfilling area and buffer zones, occupies approximately 168 ha in area (being the WMNZ landholdings). The landfill is divided into five main sub-areas for the purpose of describing the work within this application, known as the Northern, Eastern, Western, South-Western and South-Eastern Property.

The Landfill is accessed from the south-east along Landfill Access Road off Dairy Flat Highway, with Horseshoe Bush Road running along part of the northern boundary of the Landfill area. A tributary of the Rangitopuni Stream runs eastwards along the northern and eastern site boundaries towards the Dairy Flat Highway. A full description of the site is provided in the AEE prepared for the project.

1.3 Project description

Redvale Landfill is one of only two landfill sites in the Auckland region that can receive >350,000 tonnes of waste annually to service the approximately 1.5 million tonnes of waste that the Auckland Region produces each year. Redvale Landfill is currently scheduled to cease accepting waste in December 2028. Due to a delay in the authorisation and establishment of the replacement Auckland Regional Landfill (ARL), a transition plan is required. To address this potential gap in critical landfill infrastructure for residual waste disposal in the Auckland region, WM New Zealand (WMNZ) is proposing to extend the operation of Redvale Landfill to the end of 2036 and develop 4.56 Mm³ of additional airspace at the existing facility. The Project includes:

- **Class 1 landfill expansion:** placement of waste within the existing landfill footprint, involving the removal of final cover and steepening of the final cap slope to accommodate additional waste.
- **Class 2 footprint extension:** extension of the landfill to the southwest of the Class 1 area to accommodate disposal of waste meeting Class 2 landfill waste acceptance criteria (WAC).
- **Relocation of ancillary activities:** the relocation of ancillary activities to allow for the placement of waste.
- **Sediment Retention Ponds:** The removal and filling in of Sediment Retention Pond 6 and the Office Pond while enlarging Pond 1 to capture and treat the stormwater from these catchments.

Under the proposal, ancillary activities for the management of landfill gas (LFG) and leachate, as they relate to emissions to air, will continue in a similar manner to present. The Energy Centre will continue to primarily manage collected LFG by burning in LFG-fired electricity generators, with enclosed ground flares available as a backup. The site presently has 15 nominal 1 MW generators (typically 14 operating). Future LFG generation with the project is expected to be only slightly higher than current levels and able to be managed with 15 generators operating at any one time. The three existing flares will continue to be able to accommodate the entire volume of collected LFG if the generators are not available.

Leachate is contained within the landfill and collected in an enclosed system. A leachate evaporator is used to reduce the volume of leachate that needs to be managed and the residual sludge from the evaporator is returned to the landfill. Stormwater run-off which has been in contact with refuse is kept separate from stormwater from all other places at the Site and is treated as leachate. The project will maintain operation of the existing BeneVap leachate evaporator unit prior to waste filling occurring in the area of the landfill footprint occupied by the BeneVap. At this stage, the BeneVap will be decommissioned and removed from the site and leachate will instead be trucked off site for disposal at an appropriate facility.

Stormwater run-off from the landfill footprint and industrial and trade activity (ITA) areas is controlled to avoid erosion and passed through treatment ponds to reduce sediment and contaminant discharges. This includes stormwater from the landfill footprint, including earthworks construction areas, as well as the workshop, generator centre, and water from the wheel wash. The treated stormwater is discharged to the Rangitopuni Stream.

LFG and leachate management infrastructure would continue in substantially the same form as existing operations.

A full description of the proposal is included in the Assessment of Environmental Effects (AEE) report prepared for the Project.

2 Approach

2.1 Approach to assessing Project impacts

The Project seeks to extend the operational life of the existing consented Redvale Landfill. If the Project does not proceed, LFG and leachate will continue to be generated from the existing consented landfill for many years after waste placement ceases. Accordingly, the Project primarily extends the duration over which these emissions, and their associated effects, may occur rather than increasing their peak magnitude. For example, the maximum annual rate of LFG collection and destruction at the Energy Centre is not expected to materially increase as a result of the Project. Instead, management of similar annual volumes of LFG would be required over a longer period.

The screening health risk assessment (SHRA) has been undertaken using conservative assumptions, including the assumption that receptors experience lifetime exposure to contaminant concentrations modelled for the worst-case year. Under this approach, the estimated health risks are unchanged with the Project because the worst-case exposure is the same for the existing consented landfill and with the proposed expansion. Consequently, the screening assessment does not readily distinguish between the contributions of the existing consented landfill and the Project.

Quantifying the Project's incremental contribution would require a more detailed time-varying assessment, such as calculating time-weighted exposures over the full operational and post-closure period. Such an assessment would involve significant additional effort and is not considered warranted where cumulative risks are demonstrated to comply with the relevant health-based screening criteria.

Accordingly, this SHRA has been undertaken on a cumulative basis, assessing the combined off-site effects of the existing consented landfill and the proposed landfill expansion.

2.2 Screening assessment steps

The SHRA generally follows the established framework for a risk assessment, as shown in Figure 2.1. The first four steps of this framework (excluding risk management) are relevant to the preparation of a risk assessment to be submitted with resource consent applications.

This SHRA generally follows the steps set out in Figure 2.1, but some steps have been adapted for a screening level of evaluation, as discussed below.

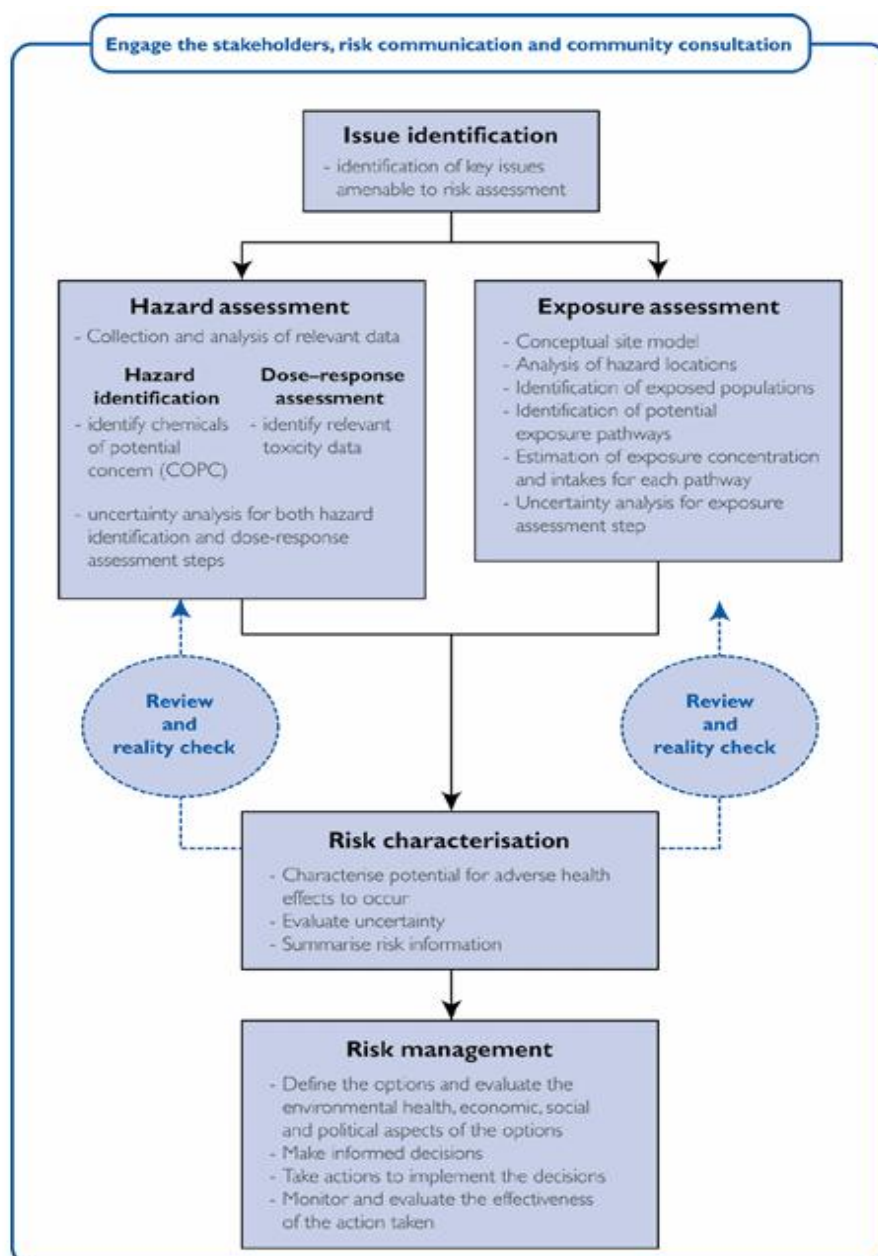


Figure 2.1: Health risk assessment model (source: EnHealth, 2012¹)

¹ Environmental Health Australia (EnHealth). (2012). Environmental health risk assessment: Guidelines for assessing human health risks from environmental hazards.

Each of the assessment steps is briefly summarised below. Where these steps have departed from a standard approach, this is noted in the relevant section.

Issue identification

The issue for this SHRA is the potential for adverse health effects on people from exposure to contaminants from the Redvale Landfill. The main potential contaminant sources at the site are LFG and leachate, which are generated within the landfill from the municipal solid waste received at the site. As this SHRA has been prepared to support resource consent applications, it is focused on effects beyond the site boundary and does not explicitly assess effects on people working at the Landfill (whose health and safety is managed under the Health and Safety at Work Act).

Hazard assessment (Section 3)

The hazard assessment involves identifying the contaminants of potential concern, the nature of potential effects on human health and dose-response relationships.

As this is a screening assessment, all contaminants for which source concentration data (e.g. concentrations in emissions to air or leachate) is available have been included as contaminants of potential concern.

As this is a screening level health risk assessment, a detailed 'dose response assessment' has not been carried out. Health-based screening criteria have been selected based on a hierarchy of published health-based guideline values, with preference being given to New Zealand standards or guidelines where they exist. In limited cases, it has been necessary to derive screening criteria from published data.

Exposure assessment (Section 4)

A Conceptual Site Model (CSM) has been developed to identify all potential sources of contaminants, off-site human receptors (e.g. dwellings), and the pathways by which receptors may come into contact with contaminants.

The identified potential exposure pathways have been assessed to determine whether they are:

- Complete (i.e., where a source, transport pathway, and receptor all exist)
- Potentially complete, which is generally where there are no ongoing contaminant emissions, but these could occur and there is a transport pathway and receptor. An example is the potential for leachate seepage through the landfill liner into groundwater and transport to surface water.
- Incomplete (i.e. cannot practically occur as there is no plausible pathway or receptor).

For all complete exposure pathways, worst-case concentrations in environmental media (e.g. air, water or soil) at the point of exposure, resulting from the discharges from the site, have been estimated. These estimates are drawn from other relevant technical assessments of discharges to air, groundwater and surface water that have been prepared to accompany this application for the Project:

- Tonkin + Taylor (2026). Air quality and odour technical assessment – ARL-TP: Redvale Landfill (Air Quality Assessment)
- Tonkin + Taylor (2026). Hydrogeological assessment report – ARL-TP: Redvale Landfill (Hydrogeological Assessment)
- Tonkin + Taylor (2026). Stormwater, ITA and Sediment Assessment – ARL-TP: Redvale Landfill (Stormwater Assessment)

A key methodology adaptation (compared to the flow diagram shown in Figure 2.1) is that the risks associated with some pathways have been assessed qualitatively as part of the exposure assessment. This adapted approach has been used because it simplifies the Risk Characterisation discussions and enables it to focus on exposure pathways that are both complete (i.e. there is a complete pathway for exposure to contaminants between the source and receptor) and material (i.e. non-negligible).

Step 3: Risk characterisation (Section 5)

The worst-case concentrations in environmental media are compared to the health-based screening criteria to derive:

- Screening Hazard Quotients (HQs) for non-carcinogenic effects ($HQ < 1$ = acceptable). The HQ is the ratio between the predicted media concentration and the screening assessment criterion.
- Screening ratios, expressed as a fraction of the risk-based screening criterion (< 1.0 = acceptable). The screening ratio is the ratio of the predicted media concentration to the risk-based screening criterion (the concentration in air or water corresponding to a 1 in 100,000 (1×10^{-5}) incremental lifetime cancer risk).

For clarity, this report uses “acceptable” to mean the media concentration is below the relevant health-based screening criterion, while “negligible” refers to a fraction of that criterion ($HQ < 0.01$ or risk-based screening ratio less than 0.1, as discussed in Section 5.1).

A more detailed assessment (using more realistic assumptions) would only be required where the screening HQ or risk-based screening ratio are greater than 1.

3 Hazard assessment

3.1 Contaminant sources and contaminants of potential concern

The primary source of contaminants associated with the Redvale Landfill is the municipal solid waste that has been accepted over its operational life. The contaminants are mobilised and transported from the waste mass via two principal media:

- Leachate, which is the liquid that is produced when rainwater percolates through the waste, collecting dissolved and suspended contaminants. Contaminants present in leachate include heavy metals, oils and greases, ammonia and organic compounds.
- LFG, which is generated from the biological and chemical decomposition of waste. LFG contains volatile contaminants – i.e. contaminants that have high enough vapour pressure that they will move from waste material into the gas inside the landfill. LFG primarily comprises carbon dioxide and methane, which have low toxicity. However, it contains trace amounts of various volatile organic compounds (VOCs) and reduced sulphur compounds.

There are systems in place to contain and manage both leachate and LFG to avoid or minimise the release of contaminants to the environment.

As the landfill has been operating for many decades, there is a large body of data to characterise contaminant levels in leachate, LFG, and the stack emissions from the LFG-fired generators and leachate evaporator (BeneVap). The suite of contaminants tested in these media was determined based on a range of factors, including:

- Published data on the nature and likely concentrations of contaminants associated with landfills

- Technical assessments undertaken to support previous resource consent applications for the Landfill
- Consideration of emerging contaminants, such as per- and polyfluoroalkyl substances (PFAS).

A conservative approach has been adopted and all contaminants in leachate, LFG and stack emissions for which testing data and appropriate health-based screening criteria are available have been included as contaminants of potential concern.

Other potential sources of contaminants that have been considered in the SHRA are:

- Contaminants present in dusty waste or daily cover (which can include lightly contaminated soils).
- Contaminants present in stormwater, such as zinc and copper that are associated with vehicle movements.

Some of the contaminants present in the discharges from the landfill are odorous. Odour can affect human health through a biological and psychological stress response, which can occur when chemical concentrations are below levels that would cause systemic toxicity. The offensive nature of some odours triggers a sensory warning system in the body. This sensory stimulation leads to physiological symptoms—such as headaches, nausea, eye irritation, and sleep disturbance—as well as mental health impacts like anxiety. The potential for health effects of odour from the Project are not assessed in this SHRA but have been considered in a separate report prepared for the Project.

3.2 Health-based screening criteria

3.2.1 Introduction

For this screening level health risk assessment, the ‘dose response assessment’ comprises the selection of published health-based guideline values for the contaminants of potential concern. These health-based guideline values are adopted as health-based screening criteria.

The health-based screening criteria have generally been selected based on a hierarchy of published health-based guideline values, with preference being given to New Zealand standards or guidelines where they exist.

With respect to potential human health effects, substances can be described as ‘threshold’ or ‘non-threshold’ substances. A different approach has been used for the selection of health-based screening criteria for threshold and non-threshold substances, as discussed in the following sub-sections.

3.2.2 Selection of health-based screening criteria for threshold substances

Threshold substances are substances with an identifiable exposure level or dose below which no adverse health effects are expected to occur.

Inhalation exposure

Health-based screening criteria for inhalation exposure to threshold substances have been selected using the following hierarchy:

- 1 New Zealand ambient air quality standards and guidelines.
- 2 US EPA Integrated Risk Information System (IRIS) Reference Concentrations (RfC).
- 3 California Office of Environmental Health Hazard Assessment (OEHHA) chronic Reference Exposure Levels (REL).
- 4 Texas Commission on Environmental Quality (TCEQ) chronic Effects Screening Levels (ESL).

The only exception to the use of this hierarchy is in relation to the screening criterion for benzene. The New Zealand ambient air quality guideline for benzene is $3.6 \mu\text{g}/\text{m}^3$ (annual average) based on cancer risk. Cancer risk from exposure to benzene has been assessed using a risk-based screening criterion (discussed below). Therefore, to assess the potential for non-cancer effects of benzene, the OEHHA REL value of $3 \mu\text{g}/\text{m}^3$ (annual average) has been adopted as the screening criterion.

Ingestion exposure

For exposure to contaminants in water (e.g. via drinking water or recreational contact), the health-based screening criteria have been selected from the Maximum Acceptable Values in the New Zealand Drinking Water Standards (MAV) or Australian drinking water guidelines.

Where published drinking water MAV or guidelines have not been identified for a contaminant of potential interest, a health-based screening criterion has been estimated based on the Reference Dose published by the US EPA. The Reference Dose is expressed in mg per kg body weight per day has been converted to an equivalent concentration in water assuming that a person weighs 80 kg and drinks 2 Litres of water per day.

3.2.3 Selection of health-based screening criteria for non-threshold substances

Substances that cause cancer by inducing genetic damage are referred to as genotoxic carcinogens or non-threshold substances. Toxicological values for genotoxic carcinogens are expressed as a 'slope factor' (for oral exposure) or 'unit risk' (for inhalation exposure). These are defined as the upper-bound probability of an individual developing cancer from a lifetime of exposure to a specified contaminant dose² or concentration in air.³ Slope factors and unit risks assume a linear dose response relationship with no lower threshold of effect.

Inhalation unit risks and oral slope factors can be converted to the concentrations in air or water that correspond to a specified increase in lifetime cancer risk. For example, based on the World Health Organization (WHO) inhalation unit risk for benzene of 7.8×10^{-6} per $\mu\text{g}/\text{m}^3$, a benzene concentration of $1.28 \mu\text{g}/\text{m}^3$ corresponds to an incremental lifetime cancer risk of 1 in 100,000 (1×10^{-5}).⁴

Inhalation unit risks and oral slope factors for each contaminant of potential concern have been selected using the following hierarchy:

- 1 US EPA Integrated Risk Information System.
- 2 California Office of Environmental Health Hazard Assessment.

International health and environmental agencies generally use excess lifetime cancer risks on the order of 1 in a million (1×10^{-6}) and 1 in 100,000 (1×10^{-5}) as de minimis or not of concern, while the U.S. EPA typically manages carcinogenic risks within an overall acceptable range of 1 in a million (1×10^{-6}) and 1 in 10,000 (1×10^{-4}).^{5,6} In New Zealand, an acceptable incremental lifetime cancer risk of less than 1 in 100,000 (1×10^{-5}) was used to derive the soil contaminant standards in the National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil)⁷ and the MAVs for drinking water.

² Dose is typically expressed in milligrams of contaminant per kg body weight per day (mg/kg bw-day).

³ Concentrations in air are typically expressed in micrograms per m^3 ($\mu\text{g}/\text{m}^3$).

⁴ Calculated from: $1 \times 10^{-5} / 7.8 \times 10^{-6} = 1.28$

⁵ World Health Organization. (2022). Guidelines for drinking-water quality: Fourth Edition incorporating the first and second addenda. p 38

⁶ Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part D (Final, December 2001), Chapter 4, "Risk Evaluations During the Feasibility Study. p 4-2

⁷ Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

Accordingly, the screening criteria for non-threshold substances adopted in this assessment have been derived by converting the selected inhalation unit risks and oral slope factors into concentrations in air and water that correspond to an incremental lifetime cancer risk of 1×10^{-5} .

There are substances that induce cancer via non-genotoxic mechanisms, meaning there is a threshold below which they do not induce cancer (i.e. they could be assessed as threshold compounds). For the purposes of this screening assessment, it has been assumed that there is no threshold for cancer effects for all substances with a slope factor or unit risk published by the US EPA or OEHHA. This approach is conservative, as not all of these substances will act via a genotoxic mechanism.

3.2.4 Selection of health-based screening criteria for acute effects

Health-based guidelines generally assume long-term continuous exposure and are usually based on chronic (lifetime) exposure. However, some of the contaminants of potential concern identified in the emissions to air from the project have potential effects, such as airway irritation, that can arise from short term (acute) exposure.

Health-based screening criteria for acute effects have been selected using the following hierarchy:

- 1 California Office of Environmental Health Hazard Assessment (OEHHA) acute Reference Exposure Levels (REL).
- 2 Texas Commission on Environmental Quality (TCEQ) acute Effects Screening Levels (ESL).

The potential for acute health effects has been evaluated for all substances in the source testing data where acute RELs or ESLs have been determined by OEHHA or the TCEQ.

3.3 Health-based screening criteria for children

Children have a smaller body weight and different inhalation and ingestion rates compared to adults and are often considered separately in a detailed health risk assessment.

The screening criteria adopted in this assessment are mostly based on values published by the US EPA and OEHHA. These agencies state that their criteria are intended to be protective of the general population including sensitive sub-groups (which include children).^{8,9}

Drinking water exposure

As discussed in Section 3.2.2, it has been necessary to estimate health-based drinking water assessment criteria for some contaminants where published drinking water MAVs are not available. For these contaminants, the screening criteria was derived from the USEPA Reference Dose, using drinking water intake factors representative of adults.

To confirm that these estimated values are also appropriate to be applied to children's exposure, the drinking water intake factors (body weight, ingestion rate, etc) for children and adults have been compared (see Appendix B). The difference in intake factors between children and adults is small, meaning that it would only be necessary to consider effects on children in more detail if the screening health risks were close to acceptable levels.

⁸ <https://www.epa.gov/iris/basic-information-about-integrated-risk-information-system>

⁹ <https://oehha.ca.gov/sites/default/files/media/downloads/cnr/noncancersdfinal.pdf>. p12

Inhalation exposure to benzene

Children are known to be particularly vulnerable to adverse health effects from benzene exposure and there is some uncertainty about whether the US EPA unit risk for benzene is sufficiently protective of children. One approach to addressing this uncertainty, which has been adopted in this screening level assessment, is to consider the implications of applying an additional ten-fold factor of safety in the calculations for cumulative benzene exposure.

4 Exposure assessment

4.1 Introduction

The exposure assessment presented in the section evaluates each of the identified potential pathways for exposure to contaminants from the Project to determine whether there is a complete exposure pathway. The identified potential pathways and receptors are summarised in the Conceptual Site Model presented in Section 4.6. Only complete or potentially complete exposure pathways, i.e. those where there are a source, transport mechanism and receptor, are carried forward for quantitative assessment in Section 5.

4.2 Potential exposure to contaminants in leachate

4.2.1 Introduction

The landfill includes an engineered lining system and leachate collection system. The collected leachate is stored in enclosed tanks and can be managed in several different ways. These include treatment through a leachate evaporator and placement of the residual sludge back in the landfill and, alternatively, transporting the leachate off-site for disposal.

There are three potential mechanisms for contaminants in leachate to be released from the landfill, namely:

- Seepage of leachate through the lining system into groundwater.
- Leachate entering the stormwater system at the site and being released via the stormwater treatment ponds.
- Contaminants released to air from the leachate evaporator (BeneVap).

The first two mechanisms identified above would involve a failure of the leachate control system, while emissions from the leachate evaporator are an ongoing discharge to air.

4.2.2 Contaminants of potential concern

The Hydrogeological Assessment identifies the contaminants of potential concern in leachate and these are reproduced in Appendix G of this report. The contaminants of potential concern in leachate are based on the WasteMINZ (Waste Management Institute New Zealand) Technical Guidelines, Class 1 WAC.¹⁰ This approach to identifying contaminants of potential concern is considered reasonable for the purpose of this SHRA as the waste acceptance criteria have been developed considering the contaminants most likely to be present in landfill leachate (based on their presence in the waste and leaching characteristics).

¹⁰ Waste Management Institute New Zealand (WasteMINZ) September 2023. Technical Guidelines for Disposal to Land Revision 3.1.

A subset of the contaminants present in leachate can be released to air from the leachate evaporator. These principally comprise ammonia and volatile organic compounds that are evaporated along with the water. The contaminants of potential concern in the leachate evaporator emissions to air are set out in Appendix E.

4.2.3 Pathway assessment

4.2.3.1 Potential for contaminants in groundwater

The Hydrogeological Assessment describes the geology and groundwater conditions underlying the site and considers the potential for leachate to escape through the lining system and enter groundwater.¹¹ Leachate levels in the landfill are monitored to ensure compliance with regulatory requirements and to maintain an inward hydraulic gradient. This means that across most of the landfill, and provided leachate levels are appropriately managed, groundwater would tend to want to flow into the landfill, rather than leachate escaping outwards, if there were a failure in the lining system. Monitoring of downgradient groundwater quality around the existing landfill indicates no significant changes over time and no evidence of leachate impact.

A nearby commercial tomato growing operation holds a resource consent to take water from the Rangitopuni Stream for irrigation. Therefore, there is the potential (in the event of leachate seepage through the lining system) for contaminants to enter groundwater and subsequently be released to surface water in the Rangitopuni Stream and subsequent human exposure from the use of water from the Stream for irrigation of tomato plants (i.e. contaminants being taken up into the fruit).

The other identified potential exposure pathway is the incidental ingestion of water during recreational activities. No specific recreational uses of the Rangitopuni Stream have been identified, however this pathway has been considered for completeness.

4.2.3.2 Potential for contaminants in surface water

The Stormwater, ITA and Sediment Assessment considers potential pathways for leachate to enter the stormwater system on the site. The engineering and operational controls at the site are designed to keep leachate and stormwater separate. Any surface water that drains onto the open working face and associated areas including the tipping pad is treated as leachate and managed as such. Leachate is not treated or disposed via the stormwater ponds.

There are procedures and systems to monitor and identify the potential for leachate to enter the stormwater system, including:

- Leachate storage tanks are bunded and any water collected in the bunds is tested to ensure it is free of leachate before being discharged to the stormwater system.
- Weekly inspections of the landfill surface to look out for any evidence of leachate breakouts and any malfunctioning or leaking associated with the leachate collection system.
- Continuous monitoring of conductivity at the inlet to the ponds as an indicator of the presence of leachate in surface water, including automated notification from site-operated telemetry system if pond inlet conductivity exceeds the trigger limits.
- Monitoring of contaminants at pond outlets.

¹¹ The conservative assumptions used in the hydrogeological modelling are set out in Section 6.2.9 of the Hydrogeological assessment.

If a leachate breakout is identified, or leachate is identified in surface water, the landfill has contingency procedures in place to identify and remedy any unplanned release as quickly as practicable. This includes stopping the release of stormwater from the pond. Trigger levels and contingency measures are set out in the Leachate Monitoring and Contingency Plan (Section 4.6 of the Landfill Management Plan) and the Stormwater Monitoring and Contingency Plan (section 4.4 of the Landfill Management Plan). Consequently, there is considered to be negligible risk of ongoing release of contaminants in leachate via stormwater.

4.2.3.3 Contaminants in discharges to air from leachate evaporator

The primary function of the leachate evaporator (BeneVap) is to reduce the volume of collected leachate by evaporating the water from it. The system operates at relatively low temperatures, below 90°C.

This low-temperature process means that only relatively volatile contaminants, mainly VOCs and reduced sulphur compounds, are released from the leachate along with the water vapour and discharged to air. The emissions from the BeneVap have been tested and dispersion modelling has been used to estimate off-site concentrations of contaminants in air at the closest residential receptor.

4.3 Potential exposure to contaminants in landfill gas

4.3.1 Introduction

LFG is a natural byproduct of the degradation of organic waste. It consists mainly of methane (typically approximately 50 %) and carbon dioxide, with trace amounts of other substances including odorous reduced sulphur compounds (including hydrogen sulphide) and volatile organic compounds (VOCs).

As described in Section 4 of the Air Quality and Odour Technical Assessment, a network of wells and pipes collects the LFG and directs it to an Energy Centre, where it is used as fuel in generators to create electricity. Flares are principally used as a backup system to burn and destroy the LFG when the generators are not available, such as during maintenance or power grid outages.

The peak rate of LFG generation, which will occur around the year the landfill ceases accepting waste, is estimated to be around 8,000 Nm³/hour. The overall destruction efficiency of LFG is expected to be greater than 90% (increasing to more than 95% once the final landfill cap is installed). The balance of the LFG not collected and destroyed in the Energy Centre generally permeates through the landfill cap and is bioremediated by bacteria and natural processes within the cap layer. Surface methane emission measurements at a well-run landfill facility (such as Redvale Landfill) show that there is typically no detectable methane at the surface of the final cap (in the absence of cracks or defects in the capping layer).

4.3.2 Pathway assessment and contaminants of potential concern

4.3.2.1 Discharges to air from combustion of landfill gas

The primary purpose of burning the LFG is to destroy methane and other harmful compounds. However, the combustion process is not 100% efficient. This means that a small fraction of the original contaminants, such as VOCs and methane, are not completely destroyed and are released into the atmosphere.

Burning the LFG also creates the following combustion products, which are discharged into the air via the generator and flare exhaust stacks:

- Oxides of nitrogen (NO_x)
- Carbon monoxide (CO)
- Sulphur dioxide (SO₂)
- Fine particulate matter (PM_{2.5} and PM₁₀).

The potential health effects of these combustion products have been assessed in the Air Quality and Odour Technical Assessment by comparing modelled concentrations with relevant New Zealand air quality standards and guidelines. As this assessment shows modelled (and measured, where available) concentrations in ambient air are well below the relevant New Zealand air quality standards and guidelines, and these contaminants are not present in other sources (e.g. leachate), they have not been considered further in this SHRA.

Stack testing has been undertaken on the generator emissions to characterise residual emissions of VOCs and reduced sulphur compounds. The dispersion modelling presented in the Air Quality Assessment has been used to estimate off-site concentrations as a result of emissions from the generators.

As discussed in the Air Quality and Odour Technical Assessment, the flare emissions disperse more readily due to the higher thermal buoyancy of the plumes from the flares compared to a series of generators (resulting in lower modelled contaminant concentrations). Consequently, if the SHRA shows that there is no unacceptable health risk related to the emissions from the generators, this conclusion will also apply to the effects of emissions from the flares.

4.3.2.2 Fugitive emissions of landfill gas

Notwithstanding the efficient capture and destruction of LFG, a small amount will escape (referred to as fugitive emissions) from the open working face area. The LFG collection wells used at Redvale Landfill are described as “Norfolk pine” wells because they combine horizontal collectors at varying depths, which connect into the vertical well. This design allows for collection of LFG close to and underneath (at depth) the working face, which results in improved collection efficiency compared to other landfills not using this design. However, it is still necessary to carefully manage the vacuum applied to wells in this area to avoid drawing air (oxygen) into the waste mass.

The amount of uncontrolled LFG emissions escaping from the working face has been estimated assuming that the “source” of fugitive emissions is the waste mass underneath the working face (see Appendix D). The LFG has been tested for a comprehensive suite of contaminants on a number of occasions since 1999. The suite of contaminants included in the testing is based on a list of “typical” contaminants in LFG developed by the US EPA. All contaminants measured in the LFG testing have been included in the screening health risk calculations.

The dispersion modelling presented in the Air Quality Assessment has been used to estimate off-site concentrations as a result of fugitive emissions of LFG.

4.3.2.3 Potential for deposition and accumulation of airborne contaminants

Contaminants released into the air from the generators or in fugitive LFG can theoretically deposit onto the soil or onto surfaces via wet or dry deposition processes. Depending on their physical and chemical properties, contaminants deposited onto roofs could be entrained in water used for drinking and ongoing deposition could result in accumulation in the soil.

4.3.3 Monitoring of VOCs and reduced sulphur compounds in air

The purpose of the SHRA is to assess the risk health effects associated with contaminants from the Landfill. Exposure to VOCs and reduced sulphur compounds from the Landfill has been estimated based on dispersion modelling of emissions from the sources identified in the previous sub-sections (emissions from the generators and fugitive LFG). WMNZ has also commissioned monitoring of cumulative levels of VOCs and reduced sulphur compounds in air at the Landfill to support the findings of the SHRA. This monitoring will reflect the cumulative effects of the landfill and other sources of these contaminants in the area, such as motor vehicle emissions.

The air monitoring programme will be carried out over a 12-month period and, at the time of writing, seven-months of data are available. The interim air monitoring report is provided at Appendix H. In summary, no reduced sulphur compounds have been detected at any monitoring location to date. VOCs were detected at low concentrations, and the highest seven-month average concentrations reported for the compounds assessed were below the relevant chronic health-based assessment criteria. At this stage of the monitoring programme, there is no indication in the monitoring data of elevated levels of VOCs or reduced sulphur compounds (relative to assessment criteria) related to the Redvale Landfill.

4.4 Potential exposure to contaminants in stormwater

As discussed in Section 4.2.3.2, the landfill stormwater system is designed to separate leachate from stormwater. Therefore, the contaminants associated with stormwater are restricted to those typically present in urban stormwater, particularly metals, which are derived from vehicle movements on site roadways and erosion of soil.

The Stormwater, ITA and Sediment Assessment discusses the effects of stormwater discharges from the site on water quality in the Rangitopuni Stream, based on reviewing monitoring data at the point of discharge and in the receiving environment.

The contaminants associated with stormwater from the site that are of interest from a human health perspective include:

- Aluminium
- Arsenic
- Boron
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Nickel

Potential exposure pathways to these contaminants include recreational exposure in the Rangitopuni Stream (noting that no recreational uses have been identified) and irrigation of the tomato greenhouse discussed in Section 4.2.3.1

The Stormwater, Sediment and ITA Assessment describes the effects of the site stormwater discharges on water quality in the Rangitopuni Stream. This includes a statistical comparison of monitoring data from the receiving environment immediately upstream and downstream of the site discharge has been considered. These sites are referred to as Site 2 and Site 3, respectively. The difference in concentrations measured at Site 3 (downstream) compared to Site 2 (upstream) can be inferred to reflect the contribution from the Site discharges.

The stormwater assessment concludes that there is no statistically significant difference in metal concentrations in the stream at Site 3 (downstream of the site discharges) compared to Site 2 (upstream of the site discharges). This means that any contribution from site discharges is not distinguishable from background variability within the monitoring dataset. The detection limits for the analyses of metals in stormwater are relatively low compared to the screening assessment criteria (mostly Drinking Water MAVs). Therefore, it can be concluded that any risk associated with the use of water from the Rangitopuni Stream to irrigate tomatoes or contact recreation is unchanged irrespective of the Project or ongoing discharges from the currently consented landfill.

For this reason, although the stormwater pathway is assessed as complete, it has not been carried forward for a detailed assessment in Section 5.

4.5 Potential exposure to contaminants in dust

Dust can be generated from earthworks and construction activities or from placement of dusty waste, such as contaminated soils, in the landfill. Dust from earthworks and construction will generally be free of any appreciable contamination as it will be the movement of materials already existing onsite.

All commercial and industrial wastes are accepted subject to a manifest and specific waste acceptance procedures. Potentially dusty wastes are identified through this process and their receipt and placement are carefully managed. This can include a requirement for the waste generators to wet materials prior to delivery, where necessary.

Dusty wastes are treated as special wastes and any special handling requirements are identified at the time of establishing the disposal contract. Dusty wastes are received with prior notice and are mixed into the waste mass during tipping to minimise the generation of dust. Under the Landfill Management Plan¹², at least one water cart will be active on a full-time basis and available to further wet dusty materials, if required. Based on the use of these well-established controls, dust emissions from placement of waste will be negligible beyond approximately 100 m of the immediate working area. As the nearest sensitive receptors are at least 140 m the closest point of waste placement, there are no receptors that could be materially impacted by dust from waste materials.

There is potential for some dust to be generated from soil cover materials due to wind resuspension. This will typically only occur under dry conditions at wind speeds greater than about 7 m/s. The acceptance criteria for soils used as daily cover at Redvale Landfill are principally based on soil contaminant standards for recreational land use in the NES Soil or, where there is no relevant value in the NES Soil, the Australian National Environment Protection Council (NEPC) Health Investigation Levels for recreational land uses. The soil contaminant standards that apply at rural residential land uses are typically 5 to 10 times lower than the criteria for recreational land uses. This means that there would need to be very high rates of dust depositing onto soils (e.g. mixing 1 kg of cover material to every kg of existing soil) at neighbouring sites for contaminant concentrations to reach the applicable soil contaminant standards. Given the available separation distance, the risk of this occurring is negligible.

¹² Section 3.2.3.6 Disposal of the Landfill Management Plan

For the reasons outlined above, the dust pathway (from cover material and dusty waste) is assessed as a potentially complete pathway; however, quantitative risk assessment is not required because materials placed at the site are required to meet stringent acceptance criteria and robust dust suppression controls are in place.

4.6 Conceptual site model

The conceptual site model in Table 4.1 identifies all complete and potentially complete pathways, of all evaluated pathways, only inhalation of airborne contaminants and potential exposure via irrigation of a commercial tomato crop with surface water from the Rangitopuni Stream (that may contain contaminants from site stormwater or leachate, in the event of seepage through the lining system) are considered *complete or potentially complete pathways*. All other pathways are screened out due to absence of plausible source-receptor pathways.

Table 4.1: Conceptual site model

Source	Pathway	Receptors	Discussion	Complete
Leachate	Leachate to groundwater → → use of groundwater for drinking water.	Groundwater takes for potable supply (none identified).	No identified consented groundwater takes for potable water.	Incomplete
Leachate	Leachate to groundwater → surface water → irrigation of crops.	Public consumers of store-brought produce.	The risk of leachate being released into groundwater is very low. However, the potential for leachate to enter groundwater and be released to surface water in the Rangitopuni Stream has been evaluated for completeness. Water from the Rangitopuni Stream is not used for human consumption but a consent is held to take water from the Rangitopuni Stream for irrigation of tomatoes.	Potentially complete (in the unlikely event of leachate seepage through the liner)
Leachate	Leachate to surface water → irrigation of crops.	Public consumers of store-brought produce.	The landfill design is intended to avoid the presence of leachate in surface water and there are systems to detect and contain stormwater if this occurred.	Incomplete

Source	Pathway	Receptors	Discussion	Complete
Stormwater	Contaminants in stormwater → surface water → irrigation of crops.	Public consumers of store-brought produce.	Site stormwater will contain typical urban stormwater contaminants, such as metals associated with vehicle movements at the site. Site stormwater is discharged to the Rangitopuni Stream. Water from the Rangitopuni Stream is not used for human consumption but a consent is held to take water from the Rangitopuni Stream for irrigation of tomatoes.	Complete
Stormwater	Contaminants in stormwater → surface water → use of water from the Stream for drinking water.	Potable water supply from Stream (none identified)	No identified surface water takes for potable water from the Rangitopuni Stream downstream of the Landfill.	Incomplete
Stormwater	Contaminants in stormwater → surface water → recreational contact.	Public accessing the Rangitopuni Stream.	No recreational uses of the Rangitopuni Stream have been identified in the vicinity of the landfill, however recreational contact cannot be excluded.	Potentially complete
Discharges to air	Inhalation of airborne contaminants.	Residential neighbours and other sensitive receptors.	Contaminants are released to air from the landfill-gas fired generators, leachate evaporator (BeneVap) and fugitive emissions of LFG.	Complete
Discharges to air	Air discharges → deposition onto roofs → roof-collected drinking water.	Residential neighbours and other sensitive receptors.	The gaseous contaminants in discharges to air from the landfill are volatile organic compounds and reduced sulphur compounds that are highly volatile, have low solubility in water and do not tend to bind to particulate matter.	Complete, but risk is negligible due to the physical properties of the contaminants

Source	Pathway	Receptors	Discussion	Complete
Dusty waste	Windborne transport of dust from the placement of dusty waste.	Residential neighbours and other sensitive receptors.	The waste acceptance criteria and controls in place for dusty waste, which include use of water for dust suppression and covering with other waste materials, mean that the potential for wind entrainment of dust from dusty waste is low. In addition, the separation distance to sensitive receptors means that, even if there were dust generated, there is a very low potential for it to reach sensitive receptors at detectable levels.	Potentially complete (in the event of dust control failure) Qualitative assessment shows risk is negligible given dust controls and separation distance.
Cover material	Windborne transport of cover material.	Residential neighbours and other sensitive receptors.	The soil used for cover material must meet recreational soil contaminant standards and therefore, with minimal dilution, would meet health-based standards for rural residential soils.	Potentially complete Potentially complete (in the event of dust control failure). Qualitative assessment shows risk is negligible due to the low levels of contaminants allowed in soil used for cover material so not carried forward to detailed assessment.

5 Risk characterisation

5.1 Introduction

The risk characterisation step of the SHRA involves comparing the estimated exposure to a chemical (e.g. the concentration in air or water) with the health-based screening criterion.

Threshold substances

The potential for health effects from exposure to threshold substances is expressed in terms of the Hazard Quotient (HQ), which is the ratio between the media concentration and the health-based screening criterion. A HQ less than 1 indicates there are not expected to be adverse health effects.

For the purposes of this screening assessment, a HQ less than 0.01 and a Hazard Index (HI) less than 0.1 are described as negligible. This is used to communicate the results of the screening assessment and is not itself a separate health-based criterion.

If the calculated HQ (using conservative screening assumptions) is greater than 1, a more detailed evaluation of potential exposure using more realistic exposure assumptions would be warranted.

Non-threshold compounds

As discussed in Section 3.2.3, for non-threshold substances, New Zealand guidance typically uses an acceptable incremental lifetime cancer risk of less than 1 in 100,000 (1×10^{-5}). Risk-based screening criteria have been derived by converting published inhalation unit risks and oral slope factors to the equivalent concentration in air or water that corresponds to a 1×10^{-5} increase in cancer risk.

In this SHRA, the potential for health effects from exposure to non-threshold substances has been expressed as a fraction of the risk-based screening criterion (the ratio of the predicted media concentration to the risk-based screening criterion). Using this approach, a ratio of 1.0 is equivalent to an increased cancer risk of 1×10^{-5} , which is considered to be acceptable.

In the absence of specific New Zealand guidance, a tiered approach has been used in this report to describe the significance of the screening evaluation (expressed as a fraction of the risk-based screening criterion):

- A screening ratio of less than 0.1 of the risk-based screening criterion (corresponding to a risk of less than 1 per million) indicates the risk is negligible.
- A screening ratio of less than 1.0 of the risk-based screening criterion (corresponding to a risk of less than 1 per 100,000) indicates the risk is acceptable.

If the screening ratio exceeds 1.0, a more detailed evaluation of potential exposure using more realistic exposure assumptions would be warranted.

Cumulative exposure to a contaminant via multiple Project pathways

Where there is the potential for a receptor to be exposed to a particular contaminant via multiple pathways, the HQs or risk-based screening ratios for each pathway can be added together, to provide a conservative screening assessment of cumulative exposure to that substance (via different pathways). The sum of HQs for a particular contaminant is referred to as the Hazard Index (HI) and, in this SHRA, the sum of the risk-based screening ratios for a particular contaminant is referred to as the cumulative risk-based screening ratio.

Cumulative exposure to different contaminants

In certain circumstances, the risk of health effects from exposure to different substances can be added together to understand the potential for impacts on people from the mix of contaminants and ways of being exposed. It is strictly only correct to do this for chemicals that have similar health effects, for example adding together the risks for all substances that affect a particular organ system. For this reason, we can be confident that cumulative effects are very unlikely to occur if:

- the sum of all the Hazard Indices for all threshold contaminants, regardless of their health endpoints, is less than 1.0; and
- the sum of all the risk-based screening ratios for all non-threshold contaminants is less than 1.0.

If either of these summed values exceeds 1.0 a more detailed assessment should be carried out to more realistically evaluate the risk of cumulative effects.

5.2 Use of water from the Rangitopuni Stream for irrigation

The potentially complete exposure pathway, in the event that leachate seeped through the lining system into groundwater (which is unlikely), is the use of water from the Rangitopuni Stream to irrigate tomato plants at a commercial greenhouse. The receptors for this pathway are public consumers of the tomatoes.

The Hydrogeological Assessment sets out the predicted concentrations in the Rangitopuni Stream of contaminants of potential concern in leachate, in the event of seepage of leachate through the liner system. The contaminants of potential concern that are modelled to be present at the highest concentrations are predominantly metals.

Bioaccumulation factors for heavy metals in tomato plants (based on uptake from soils) are reported as being less than 1.¹³ Although bioaccumulation from irrigation water can be higher than from soils, significant bioaccumulation of metals in tomato fruit is not expected to occur. This is because tomato fruit receives over 90% of its water through phloem rather than xylem. Since phloem carries very little dissolved metals, and the fruit's outer wall strongly resists xylem water entry, metals have limited pathways to reach the fruit.¹⁴ Similarly, lipophilic contaminants (such as aniline), which tend to bind onto organic matter, will also tend not to accumulate in tomato fruit because of the high water content (and low lipid content) of the fruit. Overall, this means that the concentrations of these contaminants in tomato fruit are expected to be less than the concentration in irrigation water.

The mean consumption of tomatoes for an adult male in the 2009 NZ Total Dietary Study was 31 grams per day (compared to 2 L per day of drinking water). Therefore, even allowing for a small difference in the density of tomato fruit compared to water, the risk associated with ingestion of tomatoes can be conservatively assessed based on comparing the concentration in irrigation water against health-based screening criteria for drinking water. The assessment calculations for this pathway are set out in Appendix G.

The modelled concentrations in the Stream are significantly lower than the toxicity factors and risk-based screening concentration, resulting in extremely small HQ and risk-based evaluation values.

¹³ Zhou H., Yang W-T., Zhou X., Liu L., Gu, J-F., Wang, W-L., et al. (2016) Accumulation of Heavy Metals in Vegetable Species Planted in Contaminated Soils and the Health Risk Assessment. *International Journal of Environmental Research and Public Health* 13, 289.

¹⁴ Malone M and Andrews J. ((2001). The distribution of xylem hydraulic resistance in the fruiting truss of tomato. *Plant, Cell and Environment* (2001) 24, 565–570

The highest HQ for any contaminant (aniline) is 2.55×10^{-5} (0.0000255) compared to the acceptable value of 1.

Hydrophilic contaminants may have a greater tendency (compared to metals and lipophilic contaminants) to bioaccumulate in tomato fruit. However, the calculations demonstrate that there are very large margins of safety (greater than a million) compared to levels that would be of concern. It is almost certain that bioaccumulation factors would be orders of magnitude below levels that would result in an unacceptable health risk.

Consequently, the risk of health effects from seepage of leachate through the lining system (if it were to occur), transport of contaminants to the Rangitopuni Stream via groundwater and subsequent use of water from the Stream to irrigate tomato plants is assessed as negligible.

5.3 Inhalation exposure

5.3.1 Introduction

The risk calculations for each of the identified potential inhalation exposure pathways (contaminants in generator exhaust, fugitive LFG and emissions from the leachate evaporator) are set out in Appendices C (generator emissions), D (fugitive LFG) and E (leachate evaporator emissions). The tables in these appendices set out the calculated HQs and risk-based screening ratios for each pathway. The key findings of the inhalation risk assessment are summarised in the following sub-sections.

5.3.2 Assessment of potential for chronic effects

The risk calculations for chronic inhalation exposure are summarised in Table 5.2 and Table 5.3. These calculations are based on comparing the predicted annual average concentration at the most impacted off-site receptor with the relevant health-based screening criterion. The values in these tables are presented to 3 decimal places, which is unrealistically precise. However, they have been left in this format to enable the reader to compare the effects of different contaminants and pathways.

Chronic exposure to airborne contaminants is mostly associated with the generator exhaust emissions, with much smaller exposure contributions from contaminants in fugitive LFG and the leachate evaporator. This finding is to be expected as, while the generators effectively reduce contaminant emissions by burning the collected LFG, they are the largest source of emissions to air at the site.

As discussed in Section 5.1, for the purposes of this screening assessment, a HQ less than 0.01 and a HI less than 0.1 are described as negligible. For threshold substances (see Table 5.1), the cumulative chronic hazard index (HI) is 0.070, which is considered to represent a negligible potential for effects.

For non-threshold substances (see Table 5.2), the cumulative screening ratio is 0.28, which is below the value of 1.0 equivalent to the acceptable risk level of 1×10^{-5} . The screening ratio for all individual substances is considered to be negligible apart from formaldehyde, which is considered to be acceptable. Overall, the cumulative risk of cancer effects is considered to be acceptable.

As discussed in Section 3.3, children may be more susceptible to benzene exposure and this is sometimes addressed at a screening level by applying a ten-fold additional safety factor to the toxicity factor for benzene when considering exposure by children. The cumulative risk-based screening ratio for benzene is 0.008. Applying an additional ten-fold safety factor would increase this value to 0.08 which remains a negligible risk. Therefore, the results of the screening assessment are unchanged by a more conservative assessment of potential exposure to benzene by children at the most-impacted dwelling.

Table 5.1 Evaluation of chronic effects of inhalation exposure to threshold substances (including only substances where the HI is ≥ 0.001)

Hazard Index	Hazard quotient (Hazard quotient greater than 1 indicates more detailed assessment required) ^a			Hazard Index ^b	Overall assessment
	Generator exhaust	BeneVap	Fugitive landfill gas		
1,3-Butadiene	0.001	<0.001	<0.001	0.002	Negligible
Acetaldehyde	0.007	<0.001	<0.001	0.007	Negligible
Carbonyl sulphide	0.003	<0.001	<0.001	0.004	Negligible
Disulphide, dimethyl	0.002	<0.001	<0.001	0.002	Negligible
Ethane, 1,2-dibromo-		<0.001	0.002	0.002	Negligible
Ethanethiol	0.002		<0.001	0.002	Negligible
Formaldehyde	0.015	<0.001	<0.001	0.015	Negligible
Hydrogen sulphide	0.013	<0.001	0.009	0.022	Negligible
Methanethiol	0.008	<0.001	<0.001	0.009	Negligible
Propane, 1,2-dibromo-3-chloro-			0.001	0.001	Negligible
Sum of HQ/HI ^b	0.051	0.001	0.012	0.070	Negligible

Notes:

- a. A blank value in the cell indicates that substance has not been measured from this source.
- b. These values are from the unrounded calculation sheets, including substances with HQ < 0.001, and may differ from the sum of the individual values in this table, which are rounded to three significant figures.

Table 5.2: Evaluation of increased cancer risk from chronic inhalation exposure to non-threshold substances (including only substances where the cumulative risk-based ratio is >0.001)

Substance	Screening evaluation expressed as a fraction of the risk-based screening criterion (value greater than 1.0 indicates more detailed assessment required) ^a			Cumulative evaluation (sum of project pathways) ^b	Cumulative ratio (sum of project pathways)
	Generator exhaust	BeneVap	Fugitive landfill gas		
1,3-Butadiene	0.006	0.005	<0.0001	0.011	Negligible
2-Propenenitrile	0.007	<0.0001	<0.0001	0.008	Negligible
Acetaldehyde	0.013	<0.0001	<0.0001	0.014	Negligible
Benzene	0.008	<0.0001	<0.0001	0.008	Negligible
Carbon Tetrachloride	0.021	<0.0001	<0.0001	0.022	Negligible
Ethane, 1,1,2-trichloro-	0.007	<0.0001	0.001	0.008	Negligible
Ethene, chloro-	0.013	<0.0001	<0.0001	0.013	Negligible
Ethylbenzene	<0.0001	<0.0001	<0.0001	0.001	Negligible
Formaldehyde	0.118	<0.0001	<0.0001	0.119	Acceptable
Methylene chloride	0.002	<0.0001	<0.0001	0.002	Negligible
Naphthalene	0.003	<0.0001	<0.0001	0.003	Negligible

Substance	Screening evaluation expressed as a fraction of the risk-based screening criterion (value greater than 1.0 indicates more detailed assessment required) ^a			Cumulative evaluation (sum of project pathways) ^b	Cumulative ratio (sum of project pathways)
	Generator exhaust	BeneVap	Fugitive landfill gas		
Propane, 1,2-dibromo-3-chloro-			0.002	0.002	Negligible
Trichloromethane	0.063	<0.0001	0.007	0.070	Negligible
Sum screening risk values ^b	0.261 (0.261)	0.005 (0.006)	0.010 (0.016)	0.282 (0.284)	Acceptable

Notes:

- A blank value in a cell indicates that substance has not been included in the analytical suite for this source.
- Values in brackets are from the unrounded calculation sheets, including substances with a screening evaluation < 0.0001 of the risk-based screening criterion, and differ from the sum of the individual values shown in this table, which are rounded to three significant figures.

5.3.3 Assessment of potential for acute effects

Potential acute health effects from inhalation have been evaluated for the same three emission sources considered in the screening assessment of chronic exposure. For acute effects, the maximum predicted short-term (1-hour average) ground-level concentration at the most impacted off-site receptor has been compared with relevant health-based short-term inhalation criteria. The assessment calculations are summarised in Table 5.3.

In terms of source contribution, generator emissions and fugitive LFG are the principal contributors to potential acute inhalation effects, whereas the contribution from the leachate evaporator is minimal. This pattern is consistent with the nature of the contaminants driving the acute assessment, particularly reduced sulphur compounds, which are more strongly associated with fugitive LFG emissions.

The acute HQs have been summed across Project pathways to derive a cumulative acute HI. The cumulative acute HI for all assessed substances and Project pathways is 0.5. Using the same classification approach as for chronic effects, the potential for health effects from short-term exposure to airborne contaminants arising from the Project is considered to be acceptable.

Table 5.3 Evaluation of acute effects of inhalation exposure to threshold substances (including only substances where the HI is ≥ 0.001)

Substance	Hazard quotient (Hazard quotient greater than 1 indicates more detailed assessment required) ^a			Hazard Index ^b	Overall assessment
	Generator exhaust	BeneVap	Fugitive landfill gas		
2-Butanethiol			0.009	0.009	Negligible
Acetaldehyde	0.004	<0.001	<0.001	0.004	Negligible
Benzene	0.010	<0.001	0.003	0.014	Acceptable
Carbon disulphide	<0.001	<0.001	0.001	0.001	Negligible
Carbonyl sulphide	0.001	<0.001	0.009	0.011	Acceptable
Dimethyl sulphide	0.014		0.054	0.068	Acceptable
Disulphide, dimethyl	0.005	<0.001	0.002	0.007	Negligible

Substance	Hazard quotient (Hazard quotient greater than 1 indicates more detailed assessment required) ^a			Hazard Index ^b	Overall assessment
	Generator exhaust	BeneVap	Fugitive landfill gas		
Ethanethiol	0.068		0.059	0.128	Acceptable
Formaldehyde	0.053	<0.001	<0.001	0.054	Acceptable
Hydrogen sulphide	0.016	<0.001	0.041	0.057	Acceptable
Methanethiol	0.119	<0.001	0.044	0.163	Acceptable
Propane, 1,2-dibromo-3-chloro-			0.007	0.007	Negligible
Trichloromethane	0.005	<0.001	0.006	0.011	Acceptable
Sum screening risk values ^b	0.295	<0.001	0.237	0.545	Acceptable

Notes:

- A blank value in a cell indicates that substance has not been included in the analytical suite for this source.
- These values are from the unrounded calculation sheets, including substances with a risk < 0.01% of the acceptable risk, and may differ from the sum of the individual values in this table, which are rounded to three significant figures.

5.4 Roof-collected drinking water and soils

5.4.1 Introduction

There are two mechanisms for the deposition of vapour-phase contaminants like VOCs:

- Dry deposition: This process is driven by diffusion and gravity, allowing gaseous contaminants to settle on surfaces.
- Wet deposition: This can occur if contaminants dissolve into falling raindrops and are brought to the ground or if gas phase contaminants bind onto particles, which are then scavenged from the air. An evaluation of the physical parameters of the VOCs and reduced sulphur compounds that are the contaminants of interest for this assessment shows that wet deposition is not a significant pathway. This is due to their low solubility in water and low affinity for organic material water (see Appendix F).

VOCs and reduced sulphur compounds can deposit onto surfaces or the soil via dry deposition. However, several processes work to remove them, the most important being volatilisation. By their nature, once they have deposited onto surfaces or soil, these compounds have a strong tendency to re-volatilise rapidly back into the atmosphere.

5.4.2 Roof-collected drinking water

As the landfill is located in a rural area where most neighbours will collect roof water for potable supply, the potential for contaminants to deposit onto roofs and enter roof-collected drinking water has been considered in detail (see Appendix F). This assessment includes:

- Using the CALPUFF dispersion model to estimate the annual dry deposition of contaminants at the most impacted receptor. This very conservative screening assessment has focussed on the emissions from the generator as this is the source that dominates the inhalation pathway;

- A highly conservative screening assessment, assuming that the entire mass that could theoretically deposit (via dry deposition) onto a roof over the course of a year is entrained in drinking water. This shows that for all but one of the compounds in the generator emissions, there would be no unacceptable health risk from this unrealistically conservative scenario; and
- An estimate has been made of the volatilisation half-life of the only contaminant that is not “screened out” using the approach described above (vinyl chloride). This shows that the half-life is of the order of seconds, meaning that it is very unlikely VOCs would be present on the roof surface and available to be entrained in rainwater.

The assessment in Appendix F shows that there is negligible potential for contaminants discharged to air from the landfill to be entrained in roof-collected drinking water and consumed.

5.4.3 Accumulation in soil

Similar to roof deposition, the potential exists for dry deposition of airborne contaminants onto soils around the site. The same physical processes that would rapidly evaporate these contaminants off roof surfaces also apply to soil deposition. In addition, there is very limited potential for VOCs and reduced sulphur compounds to persist and accumulate in the soil environment because they have a low affinity to organic material and are broken down by:

- Abiotic degradation: This includes chemical reactions like oxidation from exposure to sunlight and air.
- Biotic degradation: This involves microbes in the soil consuming the compounds as a source of food and energy, breaking them down into simpler, less harmful substances.

For these reasons, the risk of exposure via accumulation in soils is even lower than the risk of exposure via roof collected drinking water, which has been assessed as negligible.

5.5 Cumulative exposure via all pathways combined

No receptors have been identified that are likely to be exposed to the same contaminant via both inhalation and ingestion pathways.

6 Conclusions

Overall, the SHRA demonstrates on a conservative screening-level basis that, with current and proposed controls in place, the ongoing operations and expansion of Redvale Landfill do not pose unacceptable risks to human health via any identified exposure pathways.

The key findings of the SHRA are:

- **Inhalation risks:** Exposure to airborne emissions from LFG generators, the leachate evaporator, and fugitive LFG has been modelled. Even using conservative assumptions (such as the worst-case impacts of each source all occurring at the same receptor), the potential for health effects from chronic (long term) and acute (short term) exposure to airborne contaminants arising from the Project is considered to be acceptable.
- **Surface water risks:** The potential for contaminants in leachate and stormwater to reach surface water (Rangitopuni Stream) and contribute to exposure via crop irrigation has been assessed. There is no statistically significant difference between metals concentrations upstream and downstream of the landfill discharges. Conservative modelling of potential leachate seepage through the lining system and into groundwater showed that risks to public health from this pathway are negligible.
- **Roof-collected drinking water risks:** Community concerns about contaminants depositing on roofs used for drinking water collection have been considered. The physical properties (high volatility and low water solubility) of the contaminants associated with discharges to air at the Landfill mean they have negligible tendency to accumulate on roof surfaces or dissolve in rainwater. The assessment confirms there is negligible potential for these contaminants to be present at concentrations of concern in roof-collected drinking water.

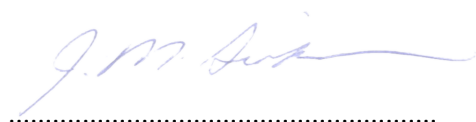
7 Applicability

This report has been prepared for the exclusive use of our client WM New Zealand, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application under the Fast-track Approvals Act 2024 and that an Expert Panel as the consenting authority will use this report for the purpose of assessing that application. We understand and agree that this report will be used by the Expert Panel in undertaking its regulatory functions.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Lead author:



Jenny Simpson
Technical Director - Environmental Engineering

Authorised for Tonkin & Taylor Ltd by:



Simonne Eldridge
Project Director

JMS

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Appendix A Code of Conduct

Compliance with the Environment Court Practice Note 2023

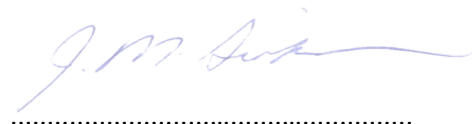
I confirm that, in my capacity as lead author of this report, I have read and abided by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses contained in the Practice Note 2023.

I am a Technical Director at Tonkin & Taylor Ltd (T+T), where I specialise in air quality and hazardous substances management. I have been employed at T+T for over 25 years. Prior to joining T+T, I worked in the fertiliser and speciality chemicals industry.

I have over 25 years' experience in the assessment and management of air quality, including the evaluation of risks to human health. I am a Fellow of the Clean Air Society of Australia and New Zealand. I hold the following qualifications – Bachelor of Engineering (Chemical and Materials) and a Diploma in Environmental Management, both from the University of Auckland.

Recent relevant projects and services that I have been involved with include:

- Proposed Auckland Regional Landfill - preparation of the air quality and odour assessment and screening health risk assessment for a proposed new landfill.
- Tirohia Landfill - preparation of the air quality and odour assessment for a proposed new phase of development.
- New Zealand Steel, Glenbrook – preparation of technical air quality assessment and Screening Health Risk Assessment for potential exposure to contaminants via water and air to support applications for replacement consents for discharges to air and water from the Steel Mill.
- Redvale Landfill – preparation of various technical assessments to support applications for changes to consent conditions, new (replacement) air discharge consent and land use consent



.....
Jennifer Simpson

Technical Director – Environmental Engineering

Appendix B Ingestion screening criteria

Where published drinking water MAV or guidelines have not been identified for a contaminant of potential interest, a health-based screening criterion has been estimated based on the Reference Dose published by the US EPA.

The Reference Dose (in units of mg per kg body weight per day) has been converted to an equivalent concentration in water using exposure factors representative of an adult.

Ingestion intake factors vary for children and adults due to differences in ingestion rates and body weight. The difference in intake factors has been checked to ensure that the derived health-based screening criteria (based on adult intake factors) are also protective of children.

The Intake Factor for ingestion of drinking water is calculated as follows:

$$\text{Intake Factor} = \frac{\text{IngR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Where:

IngR = Ingestion Rate, in L/hour. Drinking water ingestion rates recommended by EnHealth (2012) are 2 L/day for adults and 0.4 L/day for children. The adult drinking water rate ingestion rate has also been used for school age children.

ET= Exposure Time in hours per day. Typical values used in New Zealand are 24 hours per day in a residential setting and 8 hours per day in an occupational setting or school.

EF = Exposure Frequency in days/year. Typical values used in New Zealand are 350 days per year for rural residential exposure and 200 days per year for school exposure.

ED = Exposure Duration (in years). The exposure durations selected are 30 years for residential exposure, 1 year for exposure as a 2- to 3-year-old and 8 years exposure at school.

BW = Body Weight. Typical values used in New Zealand are 15 kg for children (2 to 3 years) and 80 kg for adults. For school children (5 to 12 years old), an average weight of 29 kg has been calculated based on 50th percentile values from the Australia and New Zealand Growth Charts¹⁵

AT = Averaging Time, or the time over which exposure is averaged. This is equal to the exposure duration for threshold substances. For non-threshold substances the exposure is averaged over a lifetime, which is assumed to be 75 years x 365 days.

Intake Factors are presented below for three scenarios:

- Exposure by an adult in a residential setting (threshold and non-threshold compounds)
- Exposure by a child (2 to 3 years old) in a residential setting (threshold compounds)
- Exposure over a 30-year period; 8 years as a school child 5 to 12 years old and 22 years as an adult (non-threshold compounds).

¹⁵ <https://anzsped.org/clinical-resources-links/growth-growth-charts/>

As noted above, the calculations differ slightly for threshold compounds (shown in Table Appendix B.1), which are averaged over the exposure duration, and non-threshold compounds (shown in Table Appendix B.2), which are averaged over a lifetime.

This analysis shows that assessing adult exposure via drinking water is indicative of exposure to children and adults for both threshold and non-threshold compounds, although there is a slightly increased intake factor for children. This difference would need to be considered if the results of the SHRA indicated that the risks from exposure via ingestion pathways were approaching acceptable risk levels. However, as discussed in Sections 5.2 and 5.4, the health risks from ingestion pathways are extremely small and therefore a detailed consideration of childhood exposure is not warranted as it would not alter the conclusions of the SHRA.

Table Appendix B.1: Comparison of drinking water ingestion intake factors for threshold compounds

Parameter	Adult exposure in residential setting	Child exposure in residential setting (2- to 3-year old)
IngR (L/day)	2	0.4
IngR (L/hour)	0.083	0.017
ET (hours/day)	24	24
EF (days per year)	350	350
ED (years)	30	1
BW (kg)	80	15
AT (days)	10950	365
Intake Factor (L/kg-day)	0.024	0.026

Table Appendix B.2: Comparison of drinking water ingestion intake factors for non-threshold compounds

Parameter	Adult exposure in residential setting	Age-adjusted exposure in residential setting (8 years as a schoolchild and 22 years as adult)
IngR (L/hour)	0.083	0.083
ET (hours/day)	24	24
EF (days per year)	350	350
ED (years)	30	30
BW (kg)	80	66.4
AT (days)	27375	27375
Intake Factor (L/kg-day)	0.010	0.012

Appendix C Generator emissions screening assessment

C1 Source characteristics

Stack emission testing for VOCs and reduced sulphur compounds in the generator exhaust stacks has been carried out in 2019, 2024 and 2025. On each occasion, three of the generator stacks were tested, giving a total dataset of 9 rounds of testing.

Representative worst-case concentrations of contaminants in the generator exhausts have been determined as follows:

- The maximum concentration measured over all the testing has generally been adopted.
- If a compound has been analysed but never detected, a concentration equal to half the limit of detection (LOD) has been used.

C2 Worst-case exposure concentration

A conservative exposure concentration, representative of the most impacted off-site sensitive receptor has been estimated based on the dispersion modelling described in the Air Quality Assessment.

The ratio between the concentration of a contaminant in the generator exhaust and the concentration at the most impacted receptor can be used as a 'dilution factor' and applied to the stack concentration of all contaminants. The dilution factors adopted to estimate the worst case acute (1-hour average) and chronic (annual average) impacts are shown in Table Appendix C.1

Table Appendix C.1: Dilution factors calculated from generator NO_x emission modelling

Stack concentration (µg/m ³)	Modelled concentration at most impacted receptor (µg/m ³)	Ratio of modelled to stack concentration	Dilution factor used in screening assessment
500,000	274 (1-hour average)	1,824	1,800
	10.1 (annual average)	49,395	49,000

C3 Risk calculations

The results of the risk calculations are set out in the following tables:

- Table Appendix C.2 sets out the risk calculations for chronic exposure to threshold substances in the generator exhausts.
- Table Appendix C.3 sets out the risk calculations for chronic exposure to non-threshold substances in the generator exhausts
- Table Appendix C.4 sets out the risk calculations for acute exposure to threshold substances in the generator exhausts

C4 Key findings

The key findings of the assessment of exposure to contaminants from the generator exhausts is that:

For odour-generating compounds, toxicological human health risk is distinguished here from odour annoyance and amenity effects, which are addressed separately in the Air Quality Assessment.

- The health risk associated with acute and chronic exposure to threshold substances in the generator exhausts is **negligible** for most substances (HQ less than 0.01). There are three substances where the risk is assessed as **acceptable** (HQ greater than 0.01 but less than 1).
- The health risk associated with chronic exposure to non-threshold substances in the generator exhausts is **negligible** (less than 0.1) for all substances apart from formaldehyde where the risk is assessed as **acceptable** (greater than 0.1 but less than 1).

Table Appendix C.2: Risk characterisation for chronic exposure to threshold substances in generator exhausts

Substance	Maximum concentration in generator exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
1,3-Butadiene	100	0.002	2	IRIS RfC	1.02E-03	0.001	Negligible
1-Butanol	60	0.001	61	Texas ESL	2.02E-05	<0.001	Negligible
1-Propanol	1190	0.024	246	Texas ESL	9.87E-05	<0.001	Negligible
2-Butanone	86	0.002	5000	IRIS RfC	3.51E-07	<0.001	Negligible
2-Propenenitrile	52	0.001	2	IRIS RfC	5.30E-04	<0.001	Negligible
Acetaldehyde	2974	0.061	9	IRIS RfC	6.74E-03	0.007	Negligible
Acetone	2131	0.043	4800	Texas ESL	9.06E-06	<0.001	Negligible
Acetonitrile	73	0.001	60	IRIS RfC	2.47E-05	<0.001	Negligible
Ammonia	190	0.004	500	IRIS RfC	7.75E-06	<0.001	Negligible
Benzene	491	0.010	3 ^b	OEHHA REL	3.34E-04	<0.001	Negligible
Benzene, chloro-	432	0.009	1000	OEHHA REL	8.81E-06	<0.001	Negligible
Carbon disulphide	895	0.018	700	IRIS RfC	2.61E-05	<0.001	Negligible
Carbon Tetrachloride	1716	0.035	100	IRIS RfC	3.50E-04	<0.001	Negligible
Carbonyl sulphide	1611	0.033	10	OEHHA REL	3.29E-03	0.003	Negligible
Chloromethane	335	0.007	90	IRIS RfC	7.59E-05	<0.001	Negligible
Decane	1587	0.032	330	Texas ESL	9.82E-05	<0.001	Negligible
Dimethyl sulphide	190	0.004	25	Texas ESL	1.55E-04	<0.001	Negligible
Disulphide, dimethyl	188	0.004	2	Texas ESL	1.92E-03	0.002	Negligible

Substance	Maximum concentration in generator exhaust (µg/m³)	Maximum concentration at receptor (µg/m³) ^a	Health-based screening criterion (µg/m³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethane, 1,1,1-trichloro-	1488	0.030	5000	IRIS RfC	6.07E-06	<0.001	Negligible
Ethane, 1,1,2-trichloro-	198	0.004	55	Texas ESL	7.34E-05	<0.001	Negligible
Ethanethiol	123	0.003	1.3	Texas ESL	1.92E-03	0.002	Negligible
Ethanol	514	0.010	1880	Texas ESL	5.58E-06	<0.001	Negligible
Ethene, chloro-	700	0.014	100	IRIS RfC	1.43E-04	<0.001	Negligible
Ethyl Acetate	983	0.020	1440	Texas ESL	1.39E-05	<0.001	Negligible
Ethyl Chloride	1055	0.022	10000	IRIS RfC	2.15E-06	<0.001	Negligible
Formaldehyde	5274 ^c	0.108	7	IRIS RfC	1.54E-02	0.015	Acceptable
Methanethiol	406	0.008	1	Texas ESL	8.28E-03	0.008	Negligible
Methyl Alcohol	1037	0.021	20000	IRIS RfC	1.06E-06	<0.001	Negligible
Methyl Isobutyl Ketone	34	0.001	3000	IRIS RfC	2.30E-07	<0.001	Negligible
Methyl methacrylate	1117	0.023	700	IRIS RfC	3.26E-05	<0.001	Negligible
Methylene chloride	947	0.019	400	OEHHA REL	4.83E-05	<0.001	Negligible
Naphthalene	40	0.001	3	IRIS RfC	2.69E-04	<0.001	Negligible
Styrene	1162	0.024	1000	IRIS RfC	2.37E-05	<0.001	Negligible
Tetrachloroethylene	142	0.003	40	IRIS RfC	7.26E-05	<0.001	Negligible
Toluene	1103	0.023	5000	IRIS RfC	4.50E-06	<0.001	Negligible
Trichloroethylene	48	0.001	2	IRIS RfC	4.86E-04	<0.001	Negligible
Trichloromethane	1332	0.027	300	OEHHA REL	9.06E-05	<0.001	Negligible
xylene ^d	96	0.002	100	IRIS RfC	1.97E-05	<0.001	Negligible

Substance	Maximum concentration in generator exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethylene, 1,2-dichloro-, (Z)-	170	0.003	790	Texas ESL	4.39E-06	<0.001	Negligible
Hydrogen sulphide	1237	0.025	2	IRIS RfC	1.26E-02	0.013	Acceptable
1,3,5-Trimethylbenzene	27	0.001	60	IRIS RfC	9.12E-06	<0.001	Negligible

Notes:

a Rounded to three significant figures.

b The New Zealand ambient air quality guideline for benzene is $3.6 \mu\text{g}/\text{m}^3$ (annual average). The lower OEHHA REL value has been used in this assessment.

c An isolated value of $16078 \mu\text{g}/\text{m}^3$ formaldehyde was removed from the dataset. This is considered to be an anomalous result as the concentrations in the other two generators on the days before and after were 1072 and $2546 \mu\text{g}/\text{m}^3$, respectively.

d The analytical method measures the combined concentration of xylene and ethylbenzene as they have the same molecular weight. Threshold effects have been assessed based on the toxicity factor for xylene, as it has a lower IRIS RfC than ethylbenzene.

Table Appendix C.3: Risk characterisation for chronic exposure to non-threshold substances in generator exhausts

Substance	Maximum concentration in generator exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$) (Concentration equivalent to a 1 per 100,000 risk)	Source	Screening evaluation ratio (fraction of the risk-based screening criterion (value greater than 1.0 indicates more detailed assessment required))	Overall assessment
1,3-Butadiene	100	0.002	3.33E-01	IRIS	0.0061	Negligible
2-Propenenitrile	52	0.001	1.47E-01	IRIS	0.0072	Negligible
Acetaldehyde	2974	0.061	4.55E+00	IRIS	0.0134	Negligible
Benzene	491	0.010	1.28E+00	IRIS	0.0078	Negligible
Carbon Tetrachloride	1716	0.035	1.67E+00	IRIS	0.021	Negligible
Ethane, 1,1,2-trichloro-	198	0.004	6.25E-01	IRIS	0.0065	Negligible
Ethene, chloro-	700	0.014	1.14E+00	IRIS	0.0126	Negligible
Formaldehyde	5274 ^b	0.108	9.09E-01	IRIS	0.118	Acceptable
Methylene chloride	947	0.019	1.00E+01	OEHHA	0.0019	Negligible
Naphthalene	40	0.001	2.94E-01	OEHHA	0.0027	Negligible
Tetrachloroethylene	142	0.003	3.85E+01	IRIS	<0.0001	Negligible
Trichloroethylene	48	0.001	2.08E+00	IRIS	<0.0001	Negligible
Trichloromethane	1332	0.027	4.35E-01	IRIS	0.0625	Negligible
ethylbenzene	96 ^c	0.002	4.00E+00	OEHHA	<0.0001	Negligible

Notes:

a Rounded to three significant figures.

b An isolated value of 16078 $\mu\text{g}/\text{m}^3$ formaldehyde was removed from the dataset. This is considered to be an anomalous result as the concentrations in the other two generators on the days before and after were 1072 and 2546 $\mu\text{g}/\text{m}^3$, respectively.

c The analytical method measures the combined concentration of xylene and ethylbenzene as they have the same molecular weight. Non-threshold effects have been assessed based on the toxicity factor for ethylbenzene.

Table Appendix C.4: Risk characterisation for acute exposure to threshold substances in generator exhausts

Substance	Maximum concentration in generator exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
1,3-Butadiene	100	0.056	660	OEHHA REL	8.42E-05	<0.001	Negligible
1-Butanol	60	0.033	610	Texas ESL	5.49E-05	<0.001	Negligible
1-Propanol	1190	0.661	2460	Texas ESL	2.69E-04	<0.001	Negligible
2-Butanone	86	0.048	13000	OEHHA REL	3.68E-06	<0.001	Negligible
2-Propenenitrile	52	0.029	330	Texas ESL	8.74E-05	<0.001	Negligible
Acetaldehyde	2974	1.652	470	OEHHA REL	3.52E-03	0.004	Negligible
Acetone	2131	1.184	7800	Texas ESL	1.52E-04	<0.001	Negligible
Acetonitrile	73	0.040	340	Texas ESL	1.19E-04	<0.001	Negligible
Ammonia	190	0.106	3200	OEHHA REL	3.30E-05	<0.001	Negligible
Benzene	491	0.273	27	OEHHA REL	1.01E-02	0.010	Acceptable
Benzene, chloro-	432	0.240	460	Texas ESL	5.22E-04	<0.001	Negligible
Carbon disulphide	895	0.497	6200	OEHHA REL	8.02E-05	<0.001	Negligible
Carbon Tetrachloride	1716	0.953	1900	OEHHA REL	5.02E-04	<0.001	Negligible
Carbonyl sulphide	1611	0.895	660	OEHHA REL	1.36E-03	0.001	Negligible
Chloromethane	335	0.186	1030	Texas ESL	1.81E-04	<0.001	Negligible
Decane	1587	0.882	1700	Texas ESL	5.19E-04	<0.001	Negligible
Dimethyl sulphide	190	0.105	7.6	Texas ESL	1.39E-02	0.014	Acceptable
Disulphide, dimethyl	188	0.105	20	Texas ESL	5.24E-03	0.005	Negligible
Ethane, 1,1,1-trichloro-	1488	0.827	68000	OEHHA REL	1.22E-05	<0.001	Negligible
Ethane, 1,1,2-trichloro-	198	0.110	550	Texas ESL	2.00E-04	<0.001	Negligible

Substance	Maximum concentration in generator exhaust (µg/m ³)	Maximum concentration at receptor (µg/m ³) ^a	Health-based screening criterion (µg/m ³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethanethiol	123	0.068	1	Texas ESL	6.81E-02	0.068	Acceptable
Ethanol	514	0.285	18800	Texas ESL	1.52E-05	<0.001	Negligible
Ethene, chloro-	700	0.389	180000	OEHHA REL	2.16E-06	<0.001	Negligible
Ethyl Acetate	983	0.546	3100	Texas ESL	1.76E-04	<0.001	Negligible
Ethyl Chloride	1055	0.586	2700	Texas ESL	2.17E-04	<0.001	Negligible
Formaldehyde	5274 ^b	2.930	55	OEHHA REL	5.33E-02	0.053	Acceptable
Methanethiol	406	0.225	1.9	Texas ESL	1.19E-01	0.119	Acceptable
Methyl Alcohol	1037	0.576	28000	OEHHA REL	2.06E-05	<0.001	Negligible
Methyl Isobutyl Ketone	34	0.019	820	Texas ESL	2.29E-05	<0.001	Negligible
Methyl methacrylate	1117	0.620	860	Texas ESL	7.21E-04	<0.001	Negligible
Methylene chloride	947	0.526	14000	OEHHA REL	3.76E-05	<0.001	Negligible
Naphthalene	40	0.022	440	Texas ESL	5.00E-05	<0.001	Negligible
Styrene	1162	0.645	21000	OEHHA REL	3.07E-05	<0.001	Negligible
Tetrachloroethylene	142	0.079	20000	OEHHA REL	3.95E-06	<0.001	Negligible
Trichloroethylene	48	0.026	540	Texas ESL	4.90E-05	<0.001	Negligible
Trichloromethane	1332	0.740	150	OEHHA REL	4.93E-03	0.005	Negligible
Xylenes ^c	96	0.054	2200	Texas ESL	2.43E-05	<0.001	Negligible
Ethylene, 1,2-dichloro-, (Z)-	170	0.094	7900	Texas ESL	1.20E-05	<0.001	Negligible
Hydrogen sulphide	1237	0.687	42	OEHHA REL	1.64E-02	0.016	Acceptable
1,3,5-Trimethylbenzene	27	0.015	2400	OEHHA REL	6.21E-06	<0.001	Negligible

Notes:

a Rounded to three significant figures.

- b An isolated value of 16078 $\mu\text{g}/\text{m}^3$ formaldehyde was removed from the dataset. This is considered to be an anomalous result as the concentrations in the other two generators on the days before and after were 1072 and 2546 $\mu\text{g}/\text{m}^3$, respectively.
- c The analytical method measures the combined concentration of xylene and ethylbenzene as they have the same molecular weight. Threshold effects have been assessed based on the toxicity factor for xylene, as it has a lower Texas acute ESL than ethylbenzene.

Appendix D Fugitive landfill gas emissions screening assessment

D1 Source characteristics

The peak rate of LFG generation is estimated to be around 8,000 Nm³/hour, which is expected to remain consistent up until landfill closure. Once a landfill is closed, the LFG collection efficiency is assumed to be at least 95%, with the balance of (uncollected) LFG percolating through the cap and being treated by bioremediation i.e. negligible fugitive emissions.

While the landfill is still accepting waste, the quantum of uncontrolled LFG emissions can be estimated on an area coverage basis. The total area of the Class 1 landfill footprint at Redvale Landfill (which does not change with the Project) is 570,120 m². The maximum open area (under daily cover) will be approximately 7,500 m². Therefore, it is assumed, in the first instance, that 562,500 / 570,000 or 98.68% of LFG (7,894 m³/hour) is either collected by the LFG management system or treated by bioremediation through the cap.

Further consideration is then required of the balance of approximately 106 m³/hour LFG. The norfolk pine LFG collection well system used by WMNZ is progressively developed as the landfill is filled, meaning that there will be effective capture of LFG in the deeper, older areas of waste beneath the active filling area. The depth of new putrescible waste that would be authorised by the Project varies from 0 m to 21 m. Therefore, assuming a maximum 10 m lift, the fugitive LFG emissions from the working face are conservatively assumed to comprise 1/2 the volume of LFG generated in the waste volume under this area, i.e 52 m³/hour.

If all of this LFG were conservatively assumed to be released through a 900 m² working face (rather than dispersed over the 7,500 m² area under daily cover), this equates to a surface emission rate of 0.058 m³/m²-hour.

Analysis of the raw LFG for VOCs and reduced sulphur compounds has been carried out at least annually since 1999. The range of parameters tested has varied over the monitoring rounds so there are multiple analytical results for some compounds and only one result for others.

Representative worst-case concentrations of contaminants in the LFG, for use in assessing the risk from chronic exposure, have been determined as follows:

- Where there are fewer than 10 analytical results for a parameter, the maximum concentration has been used.
- Where there are 10 or more analytical results for a parameter, the average concentration measured over all the testing has been used.
- Where a compound has been analysed but not detected, a concentration equal to half the limit of detection (LOD) has been used.

The risk from acute exposure has been assessed based on the highest measured concentration (or half the limit of detection if the substance has never been detected).

D2 Worst-case exposure concentration

A conservative exposure concentration, representative of the most impacted off-site sensitive receptor, has been estimated based on the dispersion modelling described in the Air Quality Assessment and an estimated worst case fugitive LFG emission rate of 52 m³/hour from a 900 m² working face (calculated as described above).

The odour modelling was based on a flux of 0.36 OU/m²/s from a 900 m² working face. Assuming a flow rate of 52 m³/hour, this is equivalent to an odour concentration of 22,431 OU.

The ratio between the modelled concentration of an odour in the flux from the working face and the odour concentration at the most impacted receptor can be used as a 'dilution factor' and applied to the concentrations of all contaminants in the LFG. The dilution factors adopted to estimate the worst case acute (1-hour average) and chronic (annual average) impacts are shown in Table Appendix D.1

Table Appendix D.1: Dilution factors calculated from working face odour emission modelling

Odour concentration (OU)	Modelled concentration at most impacted receptor (OU)	Ratio of modelled to stack concentration	Dilution factor used in screening assessment
22431	0.0317 (1-hour average)	7.08×10^5	700,000
	0.000876 (annual average)	2.56×10^7	25,000,000

D3 Risk calculations

Because of the comprehensive testing that has been undertaken on the LFG, over 200 substances have been included in the risk assessment calculations. For ease of presentation, only substances with a hazard quotient greater than 0.001 or an increased cancer risk greater than 0.1% of the acceptable risk have been included in the summary tables.

The results of the risk calculations are set out in the following tables:

- Table Appendix D.2 sets out the risk calculations for chronic exposure to threshold substances in fugitive LFG.
- Table Appendix D.3 sets out the risk calculations for chronic exposure to non-threshold substances in fugitive LFG.
- Table Appendix D.4 sets out the risk calculations for acute exposure to threshold substances in fugitive LFG.

D4 Key findings

The key findings of the assessment of exposure to contaminants from fugitive LFG emissions are that:

- The health risk associated with chronic exposure to both threshold and non-threshold substances in fugitive LFG is negligible (HQ less than 0.01 or screening ratio less than 0.1).
- The health risk associated with acute exposure to threshold substances in LFG is generally **negligible** (HQ less than 0.01). There are a small number of substances, particularly hydrogen sulphide and reduced sulphur compounds, where the risk is assessed as **acceptable** (HQ greater than 0.01 but less than 1).

Table Appendix D.2: Risk characterisation for chronic exposure to threshold substances in fugitive landfill gas (only contaminants with HQ ≥ 0.001)

Substance	Maximum concentration in LFG (µg/m³)	Maximum concentration at receptor (µg/m³) ^a	Health-based screening criterion (µg/m³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethane, 1,2-dibromo-	8976	3.59E-04	0.22	Texas ESL	1.63E-03	0.002	Negligible
Propane, 1,2-dibromo-3-chloro-	279	1.11E-05	0.01	Texas ESL	1.11E-03	0.001	Negligible
Hydrogen sulphide	450349	1.80E-02	2	IRIS RfC	9.01E-03	0.009	Negligible

Table Appendix D.3: Risk characterisation for chronic exposure to non-threshold substances in fugitive landfill gas (only contaminants with a risk greater than 0.1% of the acceptable risk)

Substance	Maximum concentration in LFG (µg/m³)	Maximum concentration at receptor (µg/m³) ^a	Health-based screening criterion (µg/m³) (Concentration equivalent to a 1 per 100,000 incremental risk)	Source	Screening evaluation ratio (fraction of the risk-based screening criterion (value greater than 1.0 indicates more detailed assessment required))	Overall assessment
Ethane, 1,1,2-trichloro-	22442	8.98E-04	6.25E-01	IRIS	0.0014	Negligible
Propane, 1,2-dibromo-3-chloro-	279	1.11E-05	5.26E-03	OEHHA	0.0021	Negligible
Trichloromethane	80453	3.22E-03	4.35E-01	IRIS	0.0074	Negligible

Table Appendix D.4: Risk characterisation for acute exposure to threshold substances in fugitive landfill gas (only contaminants with HQ ≥ 0.001)

Substance	Maximum concentration in LFG (µg/m³)	Maximum concentration at receptor (µg/m³) ^a	Health-based screening criterion (µg/m³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
2-Butanethiol	2165	0.003	0.33	Texas ESL	9.37E-03	0.009	Negligible
Benzene	61881	0.088	27	OEHHA REL	3.27E-03	0.003	Negligible
Carbon disulphide	5435271	7.765	6200	OEHHA REL	1.25E-03	0.001	Negligible
Carbonyl sulphide	4288111	6.126	660	OEHHA REL	9.28E-03	0.009	Negligible
Dimethyl sulphide	288286	0.412	7.6	Texas ESL	5.42E-02	0.054	Acceptable
Disulphide, dimethyl	26600	0.038	20	Texas ESL	1.90E-03	0.002	Negligible
Ethanethiol	41604	0.059	1	Texas ESL	5.94E-02	0.059	Acceptable
Methanethiol	58148	0.083	1.9	Texas ESL	4.37E-02	0.044	Acceptable
Propane, 1,2-dibromo-3-chloro-	500	0.001	0.1	Texas ESL	7.14E-03	0.007	Negligible
Trichloromethane	644474	0.921	150	OEHHA REL	6.14E-03	0.006	Negligible
Hydrogen sulphide	1201928	1.717	42	OEHHA REL	4.09E-02	0.041	Acceptable

Notes:

^a Rounded to three significant figures.

Appendix E BeneVap emissions screening assessment

E1 Source characteristics

Stack emission testing for VOCs and reduced sulphur compounds in the BeneVap has been carried out on one occasion. The representative concentrations of contaminants in the BeneVap exhausts have been determined based on the average measured concentration, using half the detection limit for any individual test result below the detection limit.

A limitation of this screening assessment is that the BeneVap has only been tested on one occasion. However, this is considered to be adequate as the results show negligible risk with a large (orders of magnitude) margin of safety.

E2 Worst-case exposure concentration

A conservative exposure concentration, representative of the most impacted off-site sensitive receptor has been estimated based on the dispersion modelling described in the Air Quality Assessment.

The ratio between the concentration of a contaminant in the BeneVap exhaust and the concentration at the most impacted receptor can be used as a 'dilution factor' and applied to the stack concentration of all contaminants. The dilution factors adopted to estimate the worst case acute (1-hour average) and chronic (annual average) impacts are shown in Table Appendix E.1.

Table Appendix E.1: Dilution factors calculated from BeneVap PM₁₀ emission modelling

Stack concentration (µg/m ³)	Modelled concentration at most impacted receptor (µg/m ³)	Ratio of modelled to stack concentration	Dilution factor used in screening assessment
1,639,340	100 (1-hour average)	16,393	16,000
	2.8 (annual average)	596,125	596,000

E3 Risk calculations

The results of the risk calculations are set out in the following tables:

- Table Appendix E.2 sets out the risk calculations for chronic exposure to threshold substances in BeneVap exhausts
- Table Appendix E.3 sets out the risk calculations for chronic exposure to non-threshold substances in BeneVap exhausts

E4 Key findings

The health risks associated with chronic and acute exposure to all contaminants in the BeneVap exhausts are negligible (HQ less than 0.01 or screening ratio less than 0.1).

Table Appendix E.2: Risk characterisation for chronic exposure to threshold substances in BeneVap exhausts

Substance	Maximum concentration in BeneVap exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
1,3-Butadiene	910	0.0015	2	IRIS RfC	7.64E-04	<0.001	Negligible
2-Butanone	3	<0.0001	5000	IRIS RfC	9.90E-10	<0.001	Negligible
2-Propenenitrile	33	<0.0001	2	IRIS RfC	2.79E-05	<0.001	Negligible
Acetaldehyde	873	0.0015	9	IRIS RfC	1.63E-04	<0.001	Negligible
Acetone	434	0.0007	4800	Texas ESL	1.52E-07	<0.001	Negligible
Acetonitrile	50	<0.0001	60	IRIS RfC	1.40E-06	<0.001	Negligible
Ammonia	11	<0.0001	500	IRIS RfC	3.59E-08	<0.001	Negligible
Benzene, chloro-	16	<0.0001	1000	OEHHA REL	2.60E-08	<0.001	Negligible
Carbon disulphide	133	0.0002	700	IRIS RfC	3.20E-07	<0.001	Negligible
Carbon Tetrachloride	6	<0.0001	100	IRIS RfC	9.85E-08	<0.001	Negligible
Carbonyl sulphide	90	0.0002	10	OEHHA REL	1.50E-05	<0.001	Negligible
Chloromethane	106	0.0002	90	IRIS RfC	1.97E-06	<0.001	Negligible
Disulphide, dimethyl	18	<0.0001	2	Texas ESL	1.53E-05	<0.001	Negligible
Ethane, 1,1,1-trichloro-	32	<0.0001	5000	IRIS RfC	1.06E-08	<0.001	Negligible
Ethane, 1,1,2,2-tetrachloro-	11	<0.0001	7	Texas ESL	2.69E-06	<0.001	Negligible
Ethane, 1,1,2-trichloro-	45	<0.0001	55	Texas ESL	1.37E-06	<0.001	Negligible
Ethane, 1,2-dibromo-	2	<0.0001	0.22	Texas ESL	1.17E-05	<0.001	Negligible
Ethane, 1,2-dichloro-	43	<0.0001	400	OEHHA REL	1.82E-07	<0.001	Negligible

Substance	Maximum concentration in BeneVap exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethanol	156	0.0003	1880	Texas ESL	1.39E-07	<0.001	Negligible
Ethene, chloro-	57	<0.0001	100	IRIS RfC	9.61E-07	<0.001	Negligible
Ethyl Chloride	146	0.0002	10000	IRIS RfC	2.45E-08	<0.001	Negligible
Formaldehyde	12	<0.0001	7	IRIS RfC	2.93E-06	<0.001	Negligible
Methanethiol	22	<0.0001	1	Texas ESL	3.76E-05	<0.001	Negligible
Methyl Alcohol	314	0.0005	20000	IRIS RfC	2.63E-08	<0.001	Negligible
Methylene chloride	29	<0.0001	400	OEHHA REL	1.20E-07	<0.001	Negligible
Naphthalene	5	<0.0001	3	IRIS RfC	3.03E-06	<0.001	Negligible
n-Hexane	111	0.0002	700	IRIS RfC	2.66E-07	<0.001	Negligible
Styrene	49	<0.0001	1000	IRIS RfC	8.20E-08	<0.001	Negligible
Hydrogen sulphide	4	<0.0001	2	IRIS RfC	3.66E-06	<0.001	Negligible
Benzene ^b	131	0.0002	3	OEHHA REL	7.34E-06	<0.001	Negligible
mercury	4	<0.0001	0.03	OEHHA REL	2.24E-04	<0.001	Negligible
ethylbenzene	2	<0.0001	1000	IRIS RfC	2.55E-09	<0.001	Negligible
xylene	2	<0.0001	100	IRIS RfC	2.55E-08	<0.001	Negligible
Tetrachloroethylene	41	<0.0001	40	IRIS RfC	1.72E-06	<0.001	Negligible
Trichloroethylene	3	<0.0001	2	IRIS RfC	2.71E-06	<0.001	Negligible
Trichloromethane	83	0.0001	300	OEHHA REL	4.63E-07	<0.001	Negligible

Notes:

a Rounded to four significant figures.

b The New Zealand ambient air quality guideline for benzene is 3.6 $\mu\text{g}/\text{m}^3$ (annual average). The lower OEHHA REL value has been used in this assessment.

Table Appendix E.3: Risk characterisation for chronic exposure to non-threshold substances in BeneVap exhausts

Substance	Maximum concentration in BeneVap exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration at receptor ($\mu\text{g}/\text{m}^3$) ^a	Health-based screening criterion ($\mu\text{g}/\text{m}^3$) (Concentration equivalent to a 1 per 100,000 incremental risk)	Source	Screening evaluation ratio (value greater than 1.0 indicates more detailed assessment required)	Overall assessment
1,3-Butadiene	910	0.0015	3.33E-01	IRIS	0.0046	Negligible
2-Propenenitrile	33	<0.0001	1.47E-01	IRIS	<0.0001	Negligible
Acetaldehyde	873	0.0015	4.55E+00	IRIS	<0.0001	Negligible
Carbon Tetrachloride	6	<0.0001	1.67E+00	IRIS	<0.0001	Negligible
Ethane, 1,1,2,2-tetrachloro-	11	<0.0001	1.72E-01	OEHHA	<0.0001	Negligible
Ethane, 1,1,2-trichloro-	45	<0.0001	6.25E-01	IRIS	<0.0001	Negligible
Ethane, 1,2-dichloro-	43	<0.0001	3.85E-01	IRIS	<0.0001	Negligible
Ethene, chloro-	57	<0.0001	1.14E+00	IRIS	<0.0001	Negligible
Formaldehyde	12	<0.0001	9.09E-01	IRIS	<0.0001	Negligible
Methylene chloride	29	<0.0001	1.00E+01	OEHHA	<0.0001	Negligible
Naphthalene	5	<0.0001	2.94E-01	OEHHA	<0.0001	Negligible
Benzene	131	0.0002	1.28E+00	IRIS	<0.0001	Negligible
ethylbenzene	2	<0.0001	4.00E+00	OEHHA	<0.0001	Negligible
Tetrachloroethylene	41	<0.0001	3.85E+01	IRIS	<0.0001	Negligible
Trichloroethylene	3	<0.0001	2.08E+00	IRIS	<0.0001	Negligible
Trichloromethane	83	0.0001	4.35E-01	IRIS	<0.0001	Negligible

Table Appendix E.4: Risk characterisation for acute exposure to threshold substances in BeneVap exhausts

Substance	Maximum concentration in generator exhaust (µg/m ³)	Maximum concentration at receptor (µg/m ³) ^a	Health-based screening criterion (µg/m ³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
1,3-Butadiene	910	0.0569	660	OEHHA REL	8.62E-05	<0.001	Negligible
2-Butanone	3	0.0002	13000	OEHHA REL	1.42E-08	<0.001	Negligible
2-Propenenitrile	33	0.0021	330	Texas ESL	6.29E-06	<0.001	Negligible
Acetaldehyde	873	0.0546	470	OEHHA REL	1.16E-04	<0.001	Negligible
Acetone	434	0.0271	7800	Texas ESL	3.47E-06	<0.001	Negligible
Acetonitrile	50	0.0031	340	Texas ESL	9.18E-06	<0.001	Negligible
Ammonia	11	0.0007	3200	OEHHA REL	2.09E-07	<0.001	Negligible
Benzene, chloro-	16	0.0010	460	Texas ESL	2.11E-06	<0.001	Negligible
Carbon disulphide	133	0.0083	6200	OEHHA REL	1.34E-06	<0.001	Negligible
Carbon Tetrachloride	6	0.0004	1900	OEHHA REL	1.93E-07	<0.001	Negligible
Carbonyl sulphide	90	0.0056	660	OEHHA REL	8.48E-06	<0.001	Negligible
Chloromethane	106	0.0066	1030	Texas ESL	6.42E-06	<0.001	Negligible
Disulphide, dimethyl	18	0.0011	20	Texas ESL	5.70E-05	<0.001	Negligible
Ethane, 1,1,1-trichloro-	32	0.0020	68000	OEHHA REL	2.91E-08	<0.001	Negligible
Ethane, 1,1,2,2-tetrachloro-	11	0.0007	70	Texas ESL	1.00E-05	<0.001	Negligible
Ethane, 1,1,2-trichloro-	45	0.0028	550	Texas ESL	5.10E-06	<0.001	Negligible
Ethane, 1,2-dibromo-	2	<0.0001	150	Texas ESL	6.40E-07	<0.001	Negligible
Ethane, 1,2-dichloro-	43	0.0027	650	Texas ESL	4.18E-06	<0.001	Negligible
Ethanol	156	0.0097	18800	Texas ESL	5.19E-07	<0.001	Negligible
Ethene, chloro-	57	0.0036	180000	OEHHA REL	1.99E-08	<0.001	Negligible

Substance	Maximum concentration in generator exhaust (µg/m ³)	Maximum concentration at receptor (µg/m ³) ^a	Health-based screening criterion (µg/m ³)	Source	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places)	
Ethyl Chloride	146	0.0091	2700	Texas ESL	3.38E-06	<0.001	Negligible
Formaldehyde	12	0.0008	55	OEHHA REL	1.39E-05	<0.001	Negligible
Methanethiol	22	0.0014	1.9	Texas ESL	7.38E-04	<0.001	Negligible
Methyl Alcohol	314	0.0196	28000	OEHHA REL	7.00E-07	<0.001	Negligible
Methylene chloride	29	0.0018	14000	OEHHA REL	1.28E-07	<0.001	Negligible
Naphthalene	5	0.0003	440	Texas ESL	7.70E-07	<0.001	Negligible
n-Hexane	111	0.0069	5600	Texas ESL	1.24E-06	<0.001	Negligible
Styrene	49	0.0031	21000	OEHHA REL	1.45E-07	<0.001	Negligible
Hydrogen sulphide	4	0.0003	42	OEHHA REL	6.48E-06	<0.001	Negligible
Benzene	131	0.0082	27	OEHHA REL	3.04E-04	<0.001	Negligible
mercury	4	0.0003	0.6	OEHHA REL	4.17E-04	<0.001	Negligible
ethylbenzene	2	<0.0001	26000	Texas ESL	3.65E-09	<0.001	Negligible
xylene	2	<0.0001	2200	Texas ESL	4.31E-08	<0.001	Negligible
Tetrachloroethylene	41	0.0026	20000	OEHHA REL	1.28E-07	<0.001	Negligible
Trichloroethylene	3	0.0002	540	Texas ESL	3.73E-07	<0.001	Negligible
Trichloromethane	83	0.0052	150	OEHHA REL	3.45E-05	<0.001	Negligible

Notes:

a Rounded to four significant figures

Appendix F Evaluation of deposition and volatilisation pathways

F1 Introduction

Vapour-phase contaminants released into the air can deposit onto surfaces via two mechanisms:

- Dry deposition: This process is driven by diffusion and gravity, allowing gaseous contaminants to settle on surfaces.
- Wet deposition: This can occur if contaminants dissolve into falling raindrops and are brought to the ground (gas dissolution) or if gas phase contaminants bind onto particles, which are then scavenged from the air (particle scavenging).

Gaseous contaminants can be absorbed onto very thin film layers (comprising a mix of organic and inorganic material) that form on impermeable surfaces, such as a painted steel roof. The physical properties of a gas determine the extent to which it will attach to this thin film or to airborne particles, and the rate to which it will re-volatilise back into the air.

As explained in the following sub-sections, the physical properties of these substances, in particular their high volatility and low affinity for organic surfaces, mean they have a strong tendency to remain in, or rapidly return to, the gas phase rather than accumulate on surfaces where they could be entrained into roof-collected drinking water.

F2 Particle scavenging

The tendency for a chemical to associate with organic matter in airborne particles (and potentially be subject to particle scavenging) or to attach to organic films on impermeable surfaces can be characterised using the octanol–air partition coefficient (K_{OA}) of the substance. K_{OA} is the ratio of the substance's concentration in octanol¹⁶ over its concentration in air ($C_{octanol}/C_{air}$).¹⁷

$\log K_{OA}$ can be calculated from published values of the octanol–water partition coefficient (K_{OW}) and the unitless Henry's law constant for each substance using the following formula:

$$\log K_{OA} = \log K_{OW} + \log H$$

where H is the unitless Henry's law constant in the solubility form ($H = C_{water}/C_{air}$), derived from the published molar solubility constant using:

$$H \text{ (unitless)} = H \text{ (mol/L/atm)} \times R \times T, \text{ where } R = 0.08206 \text{ L}\cdot\text{atm/mol}\cdot\text{K} \text{ and } T \text{ is temperature in K}$$

These parameters ($\log K_{OA}$, $\log K_{OW}$ and H (unitless)) are tabulated in Table Appendix F.1 for the gases measured in the generator emissions.

High values of $\log K_{OA}$ indicate that a substance has an affinity with organic material. This means that scavenging may be important even when gas solubility is low.¹⁸ Conversely, substances with a

¹⁶ Octanol is an organic solvent, which is widely used in environmental science as a proxy for natural organic matter such as the lipids and fats found in soil particles, plant tissue, and atmospheric aerosols.

¹⁷ Baskaran S and Wania F. (2023). Applications of the octanol-air partitioning ratio: A critical review. *Environmental Science: Atmospheres*.

¹⁸ Pankow J. (1994). An absorption model of gas/particle partitioning of organic compounds in the atmosphere *Atmospheric Environment*, 28(2), p. 185-188.

low value of $\log K_{OA}$ (less than 10) will tend to partition to the gas phase and remain in the atmosphere, as illustrated in Figure Appendix F.1.¹⁹

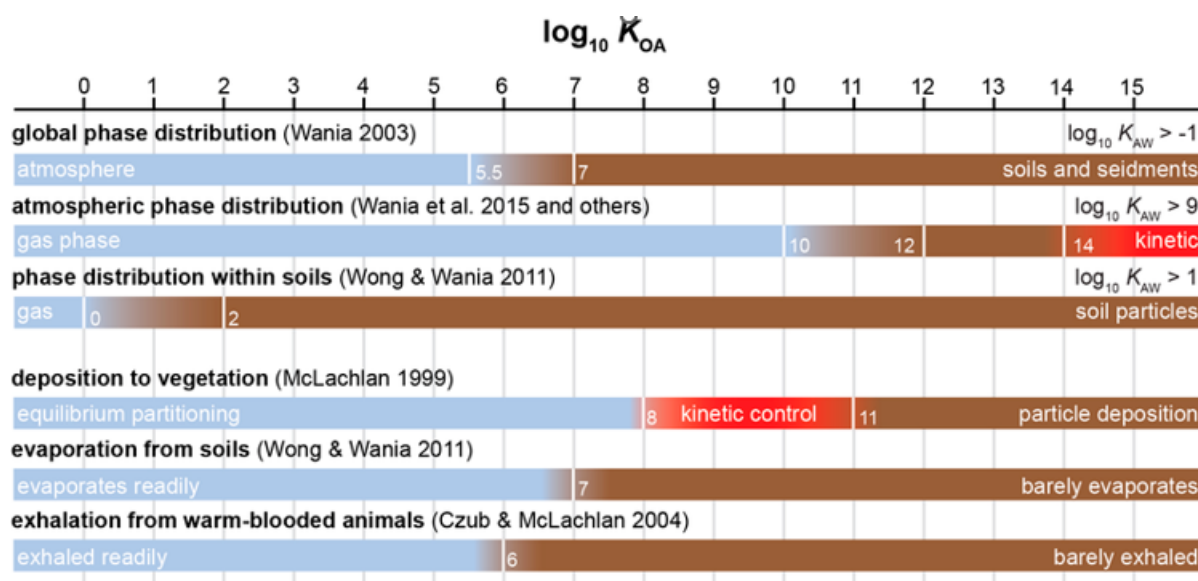


Figure Appendix F.1: Relationship between K_{OA} range and the environmental fate of common contaminants (partial reproduction of Figure 3 from Baskaran S and Wania F (2023))

The values of $\log K_{OA}$ (see Table Appendix F.1) for all the VOCs and reduced sulphur compounds measured in the generator emissions are less than 10. Therefore, these substances are expected to remain in the gas phase and not be associated with particles. Consequently, wet deposition via particle scavenging is unlikely to be a meaningful pathway for deposition of these substances.

Table Appendix F.1: Physical properties of contaminants of interest

Substance	Henry's law constant ^a	Henry's law constant	Octanol–water partition coefficient (logKow) ^b	Octanol–air partition coefficient (logKOA)
	(mol L/atm)	(unitless)	(unitless)	(unitless)
1,3-Butadiene	0.067	1.64	1.99	2.2
1-Butanol	4.442	108.70	0.88	2.92
1-Propanol	13.183	322.58	0.25	2.76
2-Butanone	18.244	446.43	0.29	2.94
2-Propenenitrile	1.362	33.33	0.017	1.54
Acetaldehyde	4.541	111.11	0.45	2.5
Acetone	27.427	671.14	-0.24	2.59
Acetonitrile	4.087	100.00	-0.34	1.66
Ammonia	0.100	2.44	-1.32	-0.93
Aniline	25.541	625.00	0.91	3.71
Benzene	0.186	4.55	2.13	2.79

¹⁹ Baskaran S and Wania F. (2023). Applications of the octanol-air partitioning ratio: A critical review. Environmental Science: Atmospheres.

Substance	Henry's law constant ^a	Henry's law constant	Octanol–water partition coefficient (logKow) ^b	Octanol–air partition coefficient (logKOA)
	(mol L/atm)	(unitless)	(unitless)	(unitless)
Benzene, chloro-	0.243	5.95	2.84	3.62
Carbon disulphide	0.100	2.44	1.84	2.23
Carbon tetrachloride	0.034	0.84	2.64	2.56
Carbonyl sulphide	0.064	1.56	0.35	0.54
Chloromethane	0.128	3.13	0.31	0.81
Decane	0.024	0.59	5.98	5.75
Dimethyl sulphide	0.105	2.56	1.62	2.03
Disulphide, dimethyl	0.341	8.33	2.4	3.32
Ethane, 1,1,1-trichloro-	0.055	1.35	2.49	2.62
Ethane, 1,1,2-trichloro-	0.045	1.11	2.42	2.47
Ethanethiol	0.409	10.00	0.81	1.81
Ethanol	45.917	1123.60	-0.35	2.7
Ethene, chloro-	0.036	0.88	1.36	1.3
Ethyl Acetate	6.487	158.73	1.37	3.57
Ethyl Chloride	0.100	2.44	0.34	0.73
Formaldehyde	136.221	3333.33	-0.77	2.75
Methanethiol	0.545	13.33	0.87	2
Methyl alcohol	194.602	4761.90	-0.77	2.91
Methyl isobutyl ketone	6.287	153.85	1.9	4.09
Methyl methacrylate	9.081	222.22	1.89	4.24
Methylene chloride	0.397	9.71	1.25	2.24
Naphthalene	0.444	10.87	3.55	4.59
Styrene	0.095	2.33	2.95	3.32
Tetrachloroethylene	0.056	1.36	2.53	2.66
Trichloroethylene	0.110	2.70	2.42	2.85
Trichloromethane	0.264	6.45	1.97	2.78
Ethylene, 1,2-dichloro-, (Z)-	0.065	1.59	2.03	2.23
Hydrogen sulphide	0.105	2.56	-1.4	-0.99
1,3,5-Trimethylbenzene	0.372	9.09	3.39	4.35

Notes:

a Henry's law constants have been obtained from R. Sander: Compilation of Henry's law constants (version 5.0.0) for water as solvent, Atmos. Chem. Phys., 23, 10901-12440 (2023) at <https://henry.mpch-mainz.gwdg.de/henry/index.html>

b Kow values have generally been obtained from PubChem and ECHA registration dossiers

F3 Gas dissolution into water droplets

Wet deposition can occur if contaminants in the air dissolve into falling raindrops. This process is largely driven by the solubility of a substance in water.

Gas dissolution strength can be characterised using the Henry's law constant for a substance. Henry's law constant (solubility form) is the ratio of the substance's concentration in water to its concentration in the air at equilibrium ($C_{\text{water}}/C_{\text{air}}$). In this form, a larger value of Henry's law constant means that the gas is more easily dissolved into rain. In this assessment, Henry's law constants are taken from Sander (2023) in units of mol/L/atm and converted to unitless form for use in the K_{OA} calculation, as shown in Table Appendix F.1.

The timescale of dissolution of a gas into water droplets is important to whether rain washout is a realistic pathway. This is because if a substance does not dissolve easily, very little will be picked up by raindrops while they fall.

During a continuous rain event, the timescale for wet deposition reduces rapidly with increasing Henry's law constant (increasing solubility) and plateaus at around 4 to 6 hours for gases with a Henry's law constant of greater than about 100,000 mol L/atm at 25 °C. For very insoluble gases, with a Henry's law constant below approximately 1,000 mol L/atm, the timescale of wet deposition is more than 100 hours.²⁰

The values of Henry's law constant (see second column of Table Appendix F.1) for all the gases measured in the generator emissions are less than 1,000 mol L/atm and the timescale of wet deposition will far exceed the duration of a typical rainfall event in the Auckland region (typically of the order of 3 to 7 hours²¹). This means that the contaminants of interest will not dissolve into raindrops to any meaningful extent during a rainfall event. Wet deposition via gas dissolution can therefore be dismissed as a credible exposure pathway for these contaminants

F4 Dry deposition

F4.1 Introduction

Dry deposition of a gas is a physical and chemical process where a contaminant is transported by wind turbulence toward the ground, crosses a calm boundary layer via molecular diffusion, and is finally retained at the surface through physical adsorption, chemical reaction, or dissolution into surface moisture.²²

As discussed above, the VOCs and reduced sulphur compounds considered in this assessment have low solubility and a low affinity for organic material. In practice, this means that the rate of dry deposition for the contaminants of interest is governed almost entirely by physical transport through the boundary layer, rather than by chemical affinity for the surface.

A highly conservative screening assessment has been carried out, assuming that the entire mass of contaminant that could deposit (via dry deposition) onto a roof (at the worst-case receptor) over the course of a year is entrained in drinking water. Given the volatility of the contaminants of interest, the concentrations estimated using this method are unrealistically high. However, this approach has been used as an initial screen to identify whether there are any contaminants that warrant further consideration (at a screening level) of evaporation off the roof surface.

²⁰ Crutzen PJ and Lawrence MG. (2000). The Impact of Precipitation Scavenging on the Transport of Trace Gases: A 3-Dimensional Model Sensitivity Study. *Journal of Atmospheric Chemistry* **37**, 81–112

²¹ Auckland Regional Council. (2003). Stormwater management devices: Design guidelines manual. p 6-8

²² The full dry deposition framework also includes retention on biological surfaces but the focus here is on impermeable roof surfaces.

F4.2 Modelling dry deposition rates

The CALPUFF dispersion model, used in the Air Quality Assessment to predict maximum ground level concentrations of contaminants, has been used to model the rate of dry deposition of gaseous contaminants.

The deposition modelling has been based on emissions from the generators, as this is the dominant air exposure pathway (see Section 5.3). The stack parameters are the same as those used in the Air Quality Assessment. The modelling was based on a nominal contaminant stack concentration of 1 mg/m³, enabling the deposition results to be scaled across all contaminants.

The CALPUFF dispersion model uses a resistance model to calculate dry deposition rates. CALPUFF includes a limited database of physical properties (which does not include all contaminants assessed here) and allows the user to input the following chemical-specific resistance parameters for chemicals not in the database:

- Molecular diffusivity (cm²/s) – related to molecular weight. A higher molecular weight leads to lower molecular diffusion rate and lower deposition.
- Mesophyll resistance (s/cm) - the resistance to a gas being taken up by the internal, wet cells of a plant leaf after it has entered through the stomata.
- Surface reactivity value (unitless) - characterising the reactivity of the depositing gas with environmental surfaces.

Representative deposition rates were calculated for a subset of contaminants of interest for this assessment (benzene, carbon tetrachloride, ethene, chloro- and trichloroethylene). These contaminants were chosen because of their toxicity and because the necessary diffusivity factors could be found in the literature.

In the absence of compound-specific measurements of surface reactivity, uniform values of alpha star, reactivity and mesophyll resistance were applied across all species. These values are consistent with the parameterisation used for moderately reactive, moderately soluble organic gases in the Wesely scheme as implemented in CALPUFF. Applying the same values to all species is considered a reasonable and appropriately conservative assumption given that the deposition velocities of these compounds are governed principally by their diffusivity, and that there is expected to be low affinity to the roof surface.

The species parameters adopted in the deposition modelling are summarised in the table below.

Table Appendix F.2: Gas-phase dry deposition parameters adopted for each contaminant

Substance	Molecular weight (g/mol)	Diffusivity (cm ² /s)	Alpha star	Reactivity	Mesophyll resistance (s/cm)
Benzene	78.11	0.089	1	8	20
Carbon tetrachloride	153.82	0.062	1	8	20
Ethene, chloro-	62.5	0.102	1	8	20
Trichloroethylene	131.39	0.082	1	8	20

The resulting deposition rates were between 0.92 and 0.96 mg/m²-year per mg/m³ contaminant in the generator exhaust. Based on this, a value of 0.95 mg/m²-year per mg/m³ contaminant (at the higher end of the range, so a conservative choice) was adopted as a generalised deposition rate that was applied to all listed VOCs.

F4.3 Highly conservative screening assessment

As a conservative screening assessment, an unrealistically high estimate of the concentration of each contaminant in roof-collected water was made based on the contaminant deposition rate, a roof area of 300 m² and annual rainfall of 1200 mm. The concentration in roof-collected water is independent of the assumed roof area as a larger roof intercepts more contaminant but also collects proportionally more rainwater, so the two effects cancel. This makes the result insensitive to the assumed roof area of 300 m².

The results of the highly conservative screening assessment are shown in Table Appendix F.3 and Table Appendix F.4. As noted above, this assumes that the entire mass of contaminant that could deposit onto a roof (at the worst-case receptor) over the course of a year is entrained in drinking water. Even with this very conservative assumption, most contaminants have negligible hazard quotients (well below 0.01). The only contaminant for which the screen does not give a negligible result is vinyl chloride (ethene, chloro-), which is assessed further in Section F5.2.

Table Appendix F.3: Conservative (not realistic) screening assessment of estimated concentrations in roof-collected water (threshold substances)

Substance ^b	Maximum concentration in generator exhaust (µg/m ³)	Maximum concentration in roof-collected water (mg/L) ^a	IRIS RfD (mg/kg-day)	Health-based screening criterion (mg/L)	Hazard quotient (HQ greater than 1 indicates more detailed assessment required)		Overall assessment
					Hazard quotient (scientific number format)	Hazard quotient (rounded to three decimal places) ^a	
2-Butanone	86	6.81E-05	1	40	1.70E-06	<0.001	Negligible
2-Propenenitrile	52	4.11E-05	0.0006	0.024	1.71E-03	0.002	Negligible
Acetone	2131	1.69E-03	0.9	36	4.69E-05	<0.001	Negligible
Acetonitrile	73	5.76E-05	0.1	4	1.44E-05	<0.001	Negligible
Aniline	1039	8.22E-04	0.001	0.04	2.06E-02	0.021	Acceptable
Benzene, chloro-	432	3.42E-04	0.02	0.8	4.27E-04	<0.001	Negligible
Carbon Tetrachloride	1716	1.36E-03	0.0007	0.028	4.85E-02	0.049	Acceptable
Ethane, 1,1,1-trichloro-	1488	1.18E-03	2	80	1.47E-05	<0.001	Negligible
Ethane, 1,1,2-trichloro-	198	1.57E-04	0.004	0.16	9.79E-04	<0.001	Negligible
Formaldehyde	16078	1.27E-02	0.2	8	1.59E-03	0.002	Negligible
Methyl Alcohol	1037	8.21E-04	2	80	1.03E-05	<0.001	Negligible
Naphthalene	40	3.13E-05	0.02	0.8	3.92E-05	<0.001	Negligible
Styrene	1162	9.20E-04	0.2	8	1.15E-04	<0.001	Negligible
Toluene	1103	8.73E-04	0.08	3.2	2.73E-04	<0.001	Negligible
Trichloromethane	1332	1.05E-03	0.01	0.4	2.64E-03	0.003	Negligible
Ethylene, 1,2-dichloro-, (Z)-	170	1.35E-04	0.01	0.4	3.36E-04	<0.001	Negligible

Notes:

a Rounded to three significant figures.

b Decane has been excluded from this table as the USEPA has not established a RfD that could be used to establish a screening criterion

Table Appendix F.4: Conservative (not realistic) screening assessment of estimated concentrations in roof-collected water (non-threshold substances)

Substance	Maximum concentration in generator exhaust ($\mu\text{g}/\text{m}^3$)	Maximum concentration in roof-collected water (mg/L) ^a	IRIS Slope Factor 1/($\text{mg}/\text{kg}\cdot\text{day}$)	Risk-based screening criterion (mg/L) (Concentration equivalent to a 1 per 100,000 incremental risk) ^a	Screening evaluation ratio (value greater than 1.0 indicates more detailed assessment required)	Overall assessment
2-Propenenitrile	52	4.11E-05	0.54	7.41E-04	0.06	Negligible
Aniline	1039	8.22E-04	0.0057	7.02E-02	0.01	Negligible
Benzene	871	6.90E-04	0.055	7.27E-03	0.09	Negligible
Carbon Tetrachloride	1716	1.36E-03	0.07	5.71E-03	0.24	Acceptable
Ethane, 1,1,2-trichloro-	198	1.57E-04	0.057	7.02E-03	0.02	Negligible
Ethene, chloro-	700	5.54E-04	1.5	8.14E-04	2.08	More assessment required
Tetrachloroethylene	142	1.13E-04	0.0021	1.90E-01	<0.001	Negligible
Trichloroethylene	1028	8.14E-04	0.052	7.69E-03	0.11	Acceptable

Notes:

^a Rounded to three significant figures.

F5 Re-volatilisation from roof surfaces

F5.1 Overview

The screening assessment presented in the previous sub-section does not consider the rate at which dry deposition is offset by re-volatilisation off the roof surface.

The low $\log K_{OA}$ values of the contaminants of potential concern, indicate that they are unlikely to bind to organic films on roof surfaces and, where they are deposited onto a surface (via dry deposition), they will rapidly re-volatilise. Consequently, even where these substances deposit onto a roof, they are unlikely to remain on the surface long enough to be entrained in rainwater.

Table Appendix F.5 presents a step-by-step calculation of the volatilisation half-life for naphthalene, the substance with the highest $\log K_{OA}$ (4.59) of any substance evaluated in Table Appendix F.3, and therefore the one for which the roof surface film retains deposited contaminant most strongly.

This calculation uses a two-step process:

- Estimate the surface/air partition coefficient (K_{SA}) using a simple film model.
- Estimate the volatilisation half-life using a mass transfer model.

In simple terms, K_{SA} measures how strongly the substance is held in the surface film relative to the air immediately above it; a higher value means it is harder to remove. K_g measures how quickly the substance can transfer back to the air through the boundary layer; a higher value means faster escape. Together these give the half-life: the time for half the surface mass to re-volatilise back to the atmosphere

The calculation shows that the half-life for naphthalene is approximately 76 seconds and therefore any deposited naphthalene will re-volatilise too rapidly to be present at material concentrations during a rainfall event. The same conclusion applies to all other substances in the assessment with $\log K_{OA}$ below 4.59.

Table Appendix F.5: Step-by-step calculation of volatilisation half-life for naphthalene (highest log K_{OA} substance)

Step	Parameter	Formula	Value	Units	Description
1	K_{SA} - surface-air partition coefficient	$K_{SA} = K_{OA} \times \delta$ $= 38,905 \times 1 \times 10^{-6}$	3.89×10^{-2}	m	Represents how strongly naphthalene partitions into the thin organic film on the roof surface relative to the overlying air. The higher this value, the more contaminant the film can hold, and the longer volatilisation takes.
2	D - molecular diffusivity of naphthalene in air	$D_{naph} = D_{VC} \times \sqrt{MW_{VC} / MW_{naph}}$ $= 1.02 \times 10^{-5} \times \sqrt{62.5 / 128.17}$	7.12×10^{-6}	m ² /s	Heavier molecules diffuse more slowly through air.
3	Re - Reynolds number	$Re = u \times L / \nu$ $= 0.5 \times 20 / 1.55 \times 10^{-5}$	6.45×10^5	(dimensionless)	Characterises the airflow regime over the roof: laminar (smooth) vs turbulent (chaotic). The threshold is $Re = 5 \times 10^5$. At $Re = 6.45 \times 10^5$, flow is in the mixed boundary layer regime. This governs which formula is used in Step 5. Note: Re is the same for all substances (same wind speed, roof length, and air viscosity).
4	Sc - Schmidt number	$Sc = \nu / D$ $= 1.55 \times 10^{-5} / 7.12 \times 10^{-6}$	2.18	(dimensionless)	The ratio of air's kinematic viscosity to the substance's molecular diffusivity. A higher Sc (heavier, slower-diffusing molecule) gives a slightly higher Sherwood number in Step 5.
5	Sh - Sherwood number	$Sh = (0.037 \times Re^{0.8} - 871) \times Sc^{1/3}$ $= (0.037 \times 44,436 - 871) \times 1.296$ $= 773 \times 1.296$	1,002	(dimensionless)	Quantifies how efficiently the airflow sweeps contaminant away from the roof surface. The higher the Sh , the faster gas-phase removal. The mixed boundary layer correlation is used because $Re > 5 \times 10^5$. The 871 term accounts for the laminar portion near the leading edge of the roof.
6	K_g - gas-side mass transfer coefficient	$K_g = Sh \times D / L$ $= 1,002 \times 7.12 \times 10^{-6} / 20.0$	3.57×10^{-4}	m/s	The speed at which the airflow above the roof removes volatilised contaminant from the surface boundary layer, expressed as an equivalent velocity. A higher K_g means faster removal.
7	$T_{1/2}$ - volatilisation half-life	$T_{1/2} = \ln(2) \times K_{SA} / K_g$ $= 0.6931 \times 3.89 \times 10^{-2} / 3.57 \times 10^{-4}$	75.6 s (~1.3 min)	s	The time for half of the deposited naphthalene to evaporate back into the air. The half-life of naphthalene is calculated to be 76 seconds.

Notes:

u = wind speed (0.5 m/s) (conservative low-wind assumption)

L = roof length (20 m)

ν = kinematic viscosity of air ($1.55 \times 10^{-5} \text{ m}^2/\text{s}$ at 20°C)

δ = surface film thickness ($1 \times 10^{-6} \text{ m}$ — upper end of estimated range for dirty painted exterior, adopted as the conservative choice as it maximises K_{SA} and therefore $T_{1/2}$).

Molecular diffusivity scaled from vinyl chloride reference value using Chapman–Enskog $MW^{-1/2}$ scaling.

Log K_{OA} for naphthalene from Table Appendix F.1.

F5.2 Estimate of vinyl chloride (ethylene, chloro-) half-life on painted roof

Vinyl chloride has been evaluated in more detail as it was not screened out by the very conservative screening assessment described in Section F4.2. The log K_{OA} value for vinyl chloride is 1.3. This is a lower value than naphthalene, meaning that vinyl chloride has an even lower affinity than naphthalene to surfaces films and will volatilise more quickly than naphthalene.

The calculations for the surface/air partition coefficient and half-life of vinyl chloride are set below using the same approach as in the previous sub-section. This indicates that the half-life of vinyl chloride on an impermeable surface (like a painted steel roof) is less than 0.1 second at a wind speed of 0.5 m/s and temperature of 20 to 25°C.

With a half-life less than one second, it is very unlikely that any vinyl chloride that deposited on a roof surface would remain there long enough to be entrained in rainwater. Consequently there is not expected to be any material exposure to vinyl chloride (as a result of landfill-related emissions) in roof collected drinking water, and the risk of health effects from such exposure is considered to be negligible.

Table Appendix F.6: Step-by-step calculation of volatilisation half-life for vinyl chloride

Step	Parameter	Formula	Value	Units
1	Surface–air partition coefficient K_{SA}	$K_{SA} = K_{OA} \times \delta$ $K_{OA} = 10^{\log K_{OA}} = 10^{1.3} = 19.95$ $K_{SA} = 19.95 \times 1 \times 10^{-6}$	2.00×10^{-5}	m
2	Molecular diffusivity of vinyl chloride in air D	Literature value at 25°C (Perry's Chemical Engineers' Handbook)	1.02×10^{-5}	m ² /s
3	Reynolds number Re	$Re = U \times L / \nu$ $= 0.5 \times 20 / 1.55 \times 10^{-5}$	6.45×10^5	Dimensionless
4	Schmidt number Sc	$Sc = \nu / D$ $= 1.55 \times 10^{-5} / 1.02 \times 10^{-5}$	1.52	Dimensionless
5	Sherwood number Sh	$Sh = (0.037 \times Re^{0.8} - 871) \times Sc^{1/3}$ $= (0.037 \times 44,436 - 871) \times 1.15$ $= (1,644 - 871) \times 1.15$ $= 773 \times 1.15$	888	Dimensionless
6	Gas-side mass transfer coefficient K_g	$K_g = Sh \times D / L$ $= 888 \times 1.02 \times 10^{-5} / 20$	4.53×10^{-4}	m/s
7	Volatilisation half-life $T_{1/2}$	$T_{1/2} = \ln(2) \times K_{SA} / K_g$ $= 0.693 \times 2.00 \times 10^{-5} / 4.53 \times 10^{-4}$	3.1×10^{-2}	s (< 0.1 s)

Notes:

u = wind speed (0.5 m/s) (conservative low-wind assumption)

L = roof length (20 m)

ν = kinematic viscosity of air (1.55×10^{-5} m²/s at 20°C)

δ = surface film thickness (1×10^{-6} m — upper end of estimated range for dirty painted exterior, adopted as the conservative choice as it maximises K_{SA} and therefore $T_{1/2}$).

Log K_{OA} for vinyl chloride from Table Appendix F.1.

Appendix G Irrigation (groundwater pathway) assessment

G1 Source characteristics

The contaminants of potential concern and exposure concentrations set out in this Appendix are taken from the Hydrogeological Assessment.

Representative concentrations in leachate, used as inputs to the fate and transport model, are based on the 95% upper confidence level over the last 10 years, or the or full leachate testing record where less than 10 years data is available.²³

G2 Health-based screening criteria

Health-based screening criteria have been adopted as described in Section 3.2 of this report. These are based on drinking-water guidelines, on the basis that these will also be protective of exposure to contaminants in tomato fruit.²⁴

For per- and polyfluoroalkyl substances (PFAS) compounds, the Australian drinking water guidelines have been adopted as health-based screening criteria.

G3 Worst-case exposure concentration

Steady-state concentrations in groundwater at the Rangitopuni Stream have been estimated based on upper bound concentrations of contaminants in leachate and using a fate and transport model as outlined in the Hydrogeological Assessment. These concentrations would only occur if there were seepage of leachate through the liner system. The modelling has adopted a number of conservative assumptions, including no degradation of inorganic contaminants. This is discussed further in Section 6.2.9 of the Hydrogeological Assessment.

The concentrations used in the risk characterisation are based on the predicted concentrations set out in Appendix D Table 3 of the Hydrogeological Assessment.

G4 Risk calculations and key findings

Table Appendix G.1 and Table Appendix G.2 set out the risk characterisation calculations for threshold and non-threshold effects, respectively.

The health risks associated with chronic exposure to both threshold and non-threshold compounds via the assessed irrigation pathway, if leachate seeped through the landfill liner as assessed in the Hydrogeological Assessment, are negligible (HQ less than 0.01 or screening ratio less than 0.1).

²³ Hydrogeological Assessment, page 34.

²⁴ As discussed in Section 5.2, the concentration of contaminants in tomato fruit is likely to be less than in irrigation water and the amount of tomato eaten per day is less than the amount of drinking water consumed. Therefore, it follows that if there would be no unacceptable risk from drinking the irrigation water (i.e. it meets the drinking water guidelines) there would also be no unacceptable risk from exposure to contaminants in tomatoes irrigated with that water.

Table Appendix G.1: Risk characterisation for chronic exposure to threshold substances via irrigation pathway

Substance	Predicted steady state concentration in surface water (mg/L)	(Hazard quotient (HQ) greater than 1 indicates more detailed assessment required)		
		Reference dose (mg/kg-day)	Health-based screening criterion (mg/L)	Hazard quotient
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	2.1E-105	0.0001	0.004	<0.001
1-Propene, 1,3-dichloro-	2.8E-105	0.02	0.8	<0.001
2,4,6-trichlorophenol	1.9E-47	0.003	0.12	<0.001
2,4-Dichlorophenol	1.2E-105	0.003	0.12	<0.001
2,4-Dichlorophenoxyacetic acid (2,4-D)	1.9E-104	0.01	0.4	<0.001
2,4-dinitrotoluene	6.2E-70	0.002	0.08	<0.001
2-Butanone	6.0E-102	1	40	<0.001
Aniline	1.0E-06	0.001	0.04	<0.001
Antimony	1.0E-09	0.0004	0.016	<0.001
Barium	5.5E-07	0.2	8	<0.001
Benzene, 1,2-dichloro-	2.0E-105	0.09	3.6	<0.001
Benzene, 1,4-dichloro-	5.4E-105	0.1	4	<0.001
Benzene, chloro-	1.9E-105	0.02	0.8	<0.001
Boron	2.7E-06	0.2	8	<0.001
Carbon Tetrachloride	3.1E-108	0.0007	0.028	<0.001
Copper	1.7E-08	0.04	1.6	<0.001
Endrin	3.2E-105	0.00003	0.0012	<0.001
Ethane, 1,1,2,2-tetrachloro-	2.0E-105	0.004	0.16	<0.001
Ethane, 1,1,2-trichloro-	1.5E-50	0.004	0.16	<0.001
Ethane, 1,2-dichloro-	5.3E-55	0.002	0.08	<0.001
Ethene, 1,1-dichloro-	1.9E-105	0.05	2	<0.001
Ethylbenzene	8.3E-104	0.1	4	<0.001
Ethylene, 1,2-dichloro-, (E)-	3.3E-28	0.02	0.8	<0.001
Ethylene, 1,2-dichloro-, (Z)-	3.6E-24	0.01	0.4	<0.001
Fluoride	9.1E-08	0.06	2.4	<0.001
Hexachlorobenzene	3.4E-105	0.0008	0.032	<0.001
mercury	6.3E-11	0.0003	0.012	<0.001
Methane, bromodichloro-	1.5E-07	0.02	0.8	<0.001

Substance	Predicted steady state concentration in surface water (mg/L)	(Hazard quotient (HQ) greater than 1 indicates more detailed assessment required)		
		Reference dose (mg/kg-day)	Health-based screening criterion (mg/L)	Hazard quotient
Methane, dibromochloro-	2.7E-104	0.02	0.8	<0.001
Methane, tribromo-	7.6E-85	0.02	0.8	<0.001
Methoxychlor	1.9E-104	0.005	0.2	<0.001
Naphthalene	1.9E-104	0.02	0.8	<0.001
Nitrobenzene	4.6E-96	0.0005	0.02	<0.001
Pentachlorophenol	1.4E-83	0.03	1.2	<0.001
Perfluoroheptanoic acid (PFHpA)	4.7E-11		5.60E-04	<0.001
Perfluorohexanesulfonate (PFHxS)	1.1E-10		7.00E-05	<0.001
Perfluorooctane sulfonic acid (PFOS)	6.1E-11		7.00E-05	<0.001
Perfluorooctanoic acid (PFOA)	9.5E-11		5.60E-04	<0.001
Phenol	3.7E-103	0.3	12	<0.001
Propane, 1,2-dichloro-	6.2E-31	0.006	0.24	<0.001
Pyridine	9.3E-105	0.02	0.8	<0.001
Silver	2.0E-10	0.005	0.2	<0.001
Tetrachloroethylene	4.8E-80	0.01	0.4	<0.001
Toluene	5.2E-107	0.08	3.2	<0.001
Toxaphene	9.3E-106	0.00005	0.002	<0.001
Trichloroethylene	2.4E-43	0.0005	0.02	<0.001
Trichloromethane	2.4E-36	0.01	0.4	<0.001
Vanadium	1.1E-08	0.009	0.36	<0.001
xylene (mixed)	5.0E-103	0.2	8	<0.001
zinc	5.7E-08	0.3	12	<0.001
Hazard Index				<0.001 (2.9E-05)

Table Appendix G.2: Risk characterisation for chronic exposure to non-threshold substances via irrigation pathway

Substance	Predicted steady state concentration in surface water (mg/L)	Screening evaluation ratio (value greater than 1.0 indicates more detailed assessment required)		
		Slope Factor (1/(mg/kg-day))	Health-based screening criterion (mg/L)	Fraction of the health-based screening criterion
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-	2.1E-105	0.078	5.1E-03	<0.001
1-Propene, 1,3-dichloro-	2.8E-105	0.1	4.0E-03	<0.001
2,4,6-trichlorophenol	1.9E-47	0.011	3.6E-02	<0.001
Aniline	1.0E-06	0.0057	7.0E-02	<0.001
Benzene	1.2E-55	0.055	7.3E-03	<0.001
Carbon Tetrachloride	3.1E-108	0.07	5.7E-03	<0.001
Ethane, 1,1,2,2-tetrachloro-	2.0E-105	0.2	2.0E-03	<0.001
Ethane, 1,1,2-trichloro-	1.5E-50	0.057	7.0E-03	<0.001
Ethane, 1,2-dichloro-	5.3E-55	0.091	4.4E-03	<0.001
Ethene, chloro-	6.3E-20	1.5	2.7E-04	<0.001
Heptachlor	3.2E-105	4.5	8.9E-05	<0.001
Hexachlorobenzene	3.4E-105	1.6	2.5E-04	<0.001
Hexachloroethane	3.3E-105	0.04	1.0E-02	<0.001
Methane, bromodichloro-	1.5E-07	0.062	6.5E-03	<0.001
Methane, dibromochloro-	2.7E-104	0.084	4.8E-03	<0.001
Methane, tribromo-	7.6E-85	0.0079	5.1E-02	<0.001
Pentachlorophenol	1.4E-83	0.4	1.0E-03	<0.001
Tetrachloroethylene	4.8E-80	0.0021	1.9E-01	<0.001
Toxaphene	9.3E-106	1.1	3.6E-04	<0.001
Trichloroethylene	2.4E-43	0.052	7.7E-03	<0.001
Sum of screening evaluations (fraction of risk-based screening criterion)				<0.001 (0.0038)

Appendix H Interim air monitoring summary report

Interim Air Monitoring Summary Report - Volatile organic and reduced sulphur compounds

Redvale Landfill

Prepared for: WM New Zealand

Prepared by: Tonkin & Taylor Ltd

Job Number: 1092369.3000 v1.0

Date: August 2026

Title: Interim Air Monitoring Summary Report - Volatile organic and reduced sulphur compounds - Redvale Landfill

Date	Version	Description	Prepared by	Reviewed by	Authorised by
August 2026	1	Final report	M Kahrilas	J Simpson	S Eldridge

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1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by WM New Zealand (WMNZ) to prepare a monitoring programme for volatile organic compounds (VOCs) and reduced sulphur compounds at the Redvale Landfill and to prepare a summary report of the monitoring results.

Potential sources of VOCs and reduced sulphur compounds associated with the Redvale Landfill include:

- Fugitive emissions of landfill gas.
- Exhaust emissions from the landfill gas-fired generators and flares.
- Exhaust emissions from the leachate evaporator unit (BeneVap).
- Exhaust and evaporative emissions from trucks and mobile plant.

Contributors to background concentrations of VOCs (unrelated to the Redvale Landfill) include transport emissions (motor vehicle exhaust and evaporative emission) and domestic heating. Reduced sulphur compounds are produced from a range of natural sources, including decomposition of vegetation and animal manure.

The monitoring for VOCs was undertaken using Radiello samplers and the monitoring for reduced sulphur compounds was undertaken using whole air canister samplers (see further description in Section 2).

Sampling locations are shown on Figure 1.1. Locations S02 to S09 are located within the WMNZ landholding and S01 is located at the Dairy Flat School.

The sampling programme consisted of:

- Radiello samplers at 9 locations (S01 to S09).
- 6L canisters at 4 locations (S02, S05, S07 and S09).

Sampling commenced in late November 2025 and will continue for a 12-month period so the results (expressed as the annual average concentration) can be compared to published air quality guidelines or assessment criteria. This interim report covers the period late November 2025 to early July 2026 (approximately 7 months).



Figure 1.1: Air sampling locations (Source: T+T MapViewer).

2 Sampling and analysis

2.1 Radiello sampling for VOCs

Outdoor air samples were collected using radiello samplers and analysed for VOC compounds. Radiello samplers are diffusive (passive) sampling devices that can collect samples of VOCs in the air without the need for an active pump. They are filled with a chemical adsorbent. Airborne molecules diffuse into the sampler and become trapped on the chemical adsorbent. Once the sampling period is complete, the sampling cartridge is sealed and sent to a laboratory for analysis.

The air samples were collected from nine sample locations around Redvale Landfill (S01 through S09). The sample locations were set up to be 1 to 1.5 metres (m) above ground level and 1.5 to 4.5 m away from structures that may affect air flow. Minor modifications to this height were made for site S01 for security.

The radiello samples were collected within an outdoor shelter and with a backing plate using white diffusive bodies (RAD120) and VOC solvent desorption cartridges (RAD130). For the first 6 months, the radiello samples were collected over 2-week periods. This was subsequently increased to 4-week periods to reduce the frequency of sample collection and analysis.

The radiello samples were deployed and collected according to Table 2.1.

Table 2.1: Radiello sample schedule

Sample event	Start date	End date	Sample duration
Round 1	20 November 2025	4 December 2025*	2 weeks
Round 2	4 December 2025	18 December 2025*	
Round 3	18 December 2025	5 January 2026	
Round 4	5 January 2026	19 January 2026	
Round 5	19 January 2026	3 February 2026	
Round 6	3 February 2026	17 February 2026	
Round 7**	17 February 2026	4 March 2026	
Round 8**	4 March 2026	18 March 2026	
Round 9	18 March 2026	30 March 2026	
Round 10	30 March 2026	13 April 2026	
Round 11	13 April 2026	28 April 2026	
Round 12	28 April 2026	11 May 2026	
Round 13	11 May 2026	8 June 2026	4 weeks
Round 14	8 June 2026	6 July 2026	

Notes:

* The samplers at S01 were retrieved on different days to S02 to S09 in December 2025.

** Results were not recorded from sample location S02 in Round 7 and Round 8 and S07 in Round 8 due to missing samples at the time of collection.

2.2 Canister sampling for reduced sulphur compounds

Whole air samples were collected using 6L Summa canisters and analysed for sulphur compounds. Summa canisters are stainless steel vessels that are supplied under a vacuum. A flow controller is connected to the inlet of the canister allowing whole air samples to be collected at a known rate over a set period.

The air samples were collected from four locations around the Redvale Landfill (S02, S05, S07 and S09). The samples were taken from 1 to 1.5 m above ground level and 1.5 to 4.5 m away from structures that may affect air flow or street/access roads.

The canisters were collected in individually certified, 6L canisters with a flow controller set to collect a 24-hour time-integrated sample. The canister samples were collected according to Table 2.2.

Table 2.2: Canister sample schedule

Sample event	Start date	End date
Round 1	20 November 2025	21 November 2025
Round 2	4 December 2025	5 December 2025
Round 3	14 January 2026	15 January 2026
Round 4	3 February 2026	4 February 2026
Round 5	18 March 2026	19 March 2026
Round 6	13 April 2026	14 April 2026
Round 7	11 May 2026	12 May 2026
Round 8	8 June 2026	9 June 2026

Sample event	Start date	End date
Round 9	6 July 2026	7 July 2026

The samples were analysed for sulphur compounds by USEPA TO-15 method with sulphur gas speciation. The requested reporting limit for analytes was 10 parts per billion (ppb). However, the practical quantification limit for samples varied due to sample dilution, interference from non-target compounds, or other laboratory issues. Analysis was conducted by a National Association of Testing Authorities (NATA)-certified laboratory using appropriate analytical practices for TO-15 analysis.

2.3 Sample analysis

Air samples were submitted under standard chain-of-custody protocol to SGS Melbourne EH&S (SGS) of Notting Hill, Victoria, Australia. The radiello samples were analysed for VOCs by solvent desorption Method MA5. The canister samples were analysed for reduced sulphur compounds using a Gas Chromatograph with Sulphur Chemiluminescence Detector (GC-SCD) by Method MA1113.

2.4 Data quality assurance

The sample results were reported to the reporting limit (RL) for each compound. T+T performed a data quality review upon receipt of the analytical reports from the laboratory. The data quality review included a data completeness check of each data package, a transcription check for sample results, and a thorough review of all laboratory reporting forms, including for quality assurance/quality control (QA/QC) samples.

A field duplicate sample was collected at S08 for VOC analysis. Where analytes were detected in both the primary and duplicate sample, the relative percent differences (RPDs) of the results have been calculated (see Appendix B). The RPD for contaminants present at higher concentrations was relatively small, for example the highest RPD for BTEX was 15% (the difference between 0.6 $\mu\text{g}/\text{m}^3$ and 0.7 $\mu\text{g}/\text{m}^3$). The highest RPD was 67%, which is attributable to the low concentrations recorded (i.e. the difference between 0.1 $\mu\text{g}/\text{m}^3$ and 0.2 $\mu\text{g}/\text{m}^3$). Overall, the RPDs for the duplicate samples at S08 are considered acceptable.

3 Results and discussion

3.1 Comparison of results with assessment criteria

To date, there have not been any detections of reduced sulphur compounds at any sample location. Therefore this, and the following, sub-sections focus on the results for VOCs.

The full tabulated results are presented in Appendix A. Table 3.1 summarises the results by presenting the seven-month average concentration at each monitoring site, for all compounds where there have been three or more positive detections at any individual site (i.e. the contaminants most commonly detected). The average concentration has been calculated conservatively by using the reported detection limit where the sample result was reported as a “non-detect”.

Table 3.1: Summary of VOC monitoring results: seven-month average concentration by location ($\mu\text{g}/\text{m}^3$)

VOC compound	Max positive detections at a single site	S01	S02	S03	S04	S05	S06	S07	S08	S09	S08.1 duplicate
<i>Number of samples (n)</i>		14	12	14	14	14	14	13	14	14	14
124-Trimethylbenzene	12	0.101	0.093	0.094	0.091	0.092	0.161	0.108	0.184	0.108	0.194
3-Methylpentane	8	0.072	0.067	0.067	0.067	0.066	0.067	0.065	0.097	0.073	0.100
Benzene	3	0.094	0.072	0.064	0.063	0.063	0.063	0.062	0.067	0.064	0.067
Butyl acetate	8	0.076	0.075	0.076	0.076	0.076	0.121	0.075	0.111	0.088	0.118
Carbon tetrachloride	14	0.252	0.254	0.269	0.245	0.240	0.248	0.247	0.251	0.234	0.255
Cyclohexane	13	0.092	0.086	0.084	0.088	0.087	0.125	0.084	0.215	0.106	0.229
Ethyl acetate	10	0.068	0.065	0.063	0.070	0.064	0.152	0.069	0.134	0.080	0.134
Ethylbenzene	14	0.081	0.070	0.071	0.070	0.069	0.123	0.072	0.154	0.083	0.162
Isooctane	5	0.087	0.084	0.086	0.083	0.083	0.084	0.082	0.106	0.085	0.107
m&p-Xylenes	14	0.131	0.094	0.098	0.098	0.094	0.278	0.158	0.339	0.164	0.339
Methylcyclohexane	11	0.082	0.070	0.071	0.071	0.071	0.079	0.072	0.132	0.081	0.131
Methylcyclopentane	9	0.074	0.064	0.068	0.065	0.065	0.069	0.064	0.102	0.070	0.107
Methylethylketone	12	0.100	0.101	0.179	0.159	0.115	0.242	0.146	0.323	0.167	0.329
Methylisobutylketone	3	0.068	0.067	0.070	0.068	0.068	0.079	0.067	0.072	0.068	0.074
n-decane	8	0.115	0.119	0.119	0.119	0.119	0.137	0.121	0.131	0.121	0.138
n-Heptane	13	0.091	0.077	0.088	0.096	0.079	0.113	0.090	0.154	0.090	0.170
n-Hexane	12	0.102	0.085	0.090	0.088	0.076	0.087	0.084	0.176	0.116	0.183

VOC compound	Max positive detections at a single site	S01	S02	S03	S04	S05	S06	S07	S08	S09	S08.1 duplicate
N-Nonane	6	0.097	0.095	0.096	0.096	0.096	0.102	0.095	0.098	0.096	0.104
N-Undecane	4	0.196	0.185	0.196	0.189	0.189	0.189	0.194	0.209	0.196	0.194
o-Xylene	10	0.084	0.071	0.071	0.072	0.072	0.112	0.074	0.148	0.088	0.150
Toluene	14	0.636	0.417	0.344	0.251	0.269	0.518	0.332	0.786	0.410	0.829
Aggregate / derived parameters (calculated totals – not individually measured compounds)											
Xylenes	14	0.154	0.116	0.110	0.110	0.107	0.357	0.179	0.454	0.194	0.469
Total BTEX	14	0.814	0.508	0.414	0.344	0.338	0.986	0.522	1.400	0.636	1.457

Notes:

- Compounds have been listed in this table where they have three or more positive detections at any individual site within S01 to S09.
- Values shown are averages of all samples at each location. Non-detect results reported as “<” have been averaged using the reported detection limit.
- S08.1 is a co-located duplicate series.

To provide context for these results, Table 3.2 compares the maximum measured concentration (as a seven-month average) at any site with relevant health-based assessment criteria intended to be protective of effects from chronic (long term exposure). The assessment criteria are expressed as an annual average concentration.

The assessment criteria have been selected using the following hierarchy:

- 1 US EPA Integrated Risk Information System (IRIS) Reference Concentrations (RfC).
- 2 California Office of Environmental Health Hazard Assessment (OEHHA) chronic Reference Exposure Levels (REL).
- 3 Texas Commission on Environmental Quality (TCEQ) chronic Effects Screening Levels (ESL).

The New Zealand ambient air quality guideline for benzene is 3.6 µg/m³ (annual average). However, for comparative purposes, the OEHHA REL value of 3 µg/m³ (annual average) is shown in Table 3.2.

Table 3.2: Comparison of highest measured average concentration with assessment criterion

VOC compound	Highest average concentration (µg/m ³ , 7-month average) ^a	Assessment criterion (µg/m ³ , annual average)	Source
124-Trimethylbenzene	0.19	60	IRIS
3-Methylpentane	0.10	200	TEXAS ESL
Benzene	0.09	3	OEHHA
Butyl acetate	0.12	1400	TEXAS ESL
Carbon tetrachloride	0.27	100	IRIS
Cyclohexane	0.23	6000	IRIS
Ethyl acetate	0.15	1440	TEXAS ESL
Ethylbenzene	0.16	1000	IRIS
Isooctane	0.11	540	TEXAS ESL
m&p-Xylenes	0.34	100	IRIS
Methylcyclohexane	0.13	1610	TEXAS ESL
Methylcyclopentane	0.11	260	TEXAS ESL
Methylethylketone	0.33	5000	IRIS
Methylisobutylketone	0.08	3000	IRIS
n-decane	0.14	330	TEXAS ESL
n-Heptane	0.17	2700	TEXAS ESL
n-Hexane	0.18	7000	OEHHA
N-Nonane	0.10	450	TEXAS ESL
N-Undecane	0.21	350	TEXAS ESL
o-Xylene	0.15	100	IRIS
Toluene	0.83	5000	IRIS

Notes:

- a. Results rounded to two decimal places. Non-detect results reported as "<" have been averaged using the reported detection limit.

3.2 Spatial distribution of VOCs

3.2.1 Introduction

The sampling points were established taking into account predominant wind directions and generally in pairs so that any pattern of changing concentrations with distance from the landfill footprint could be identified.

A wind rose for the sampling period (1 November 2025 to 31 July 2026) from the data collected at North Shore Airport, is presented in Figure 3.1. The wind rose includes the full months of November 2025 and July 2026 so covers a slightly longer period compared to the monitoring data. This does not affect the conclusions of the assessment as the purpose of the wind rose is only to illustrate predominant wind directions.

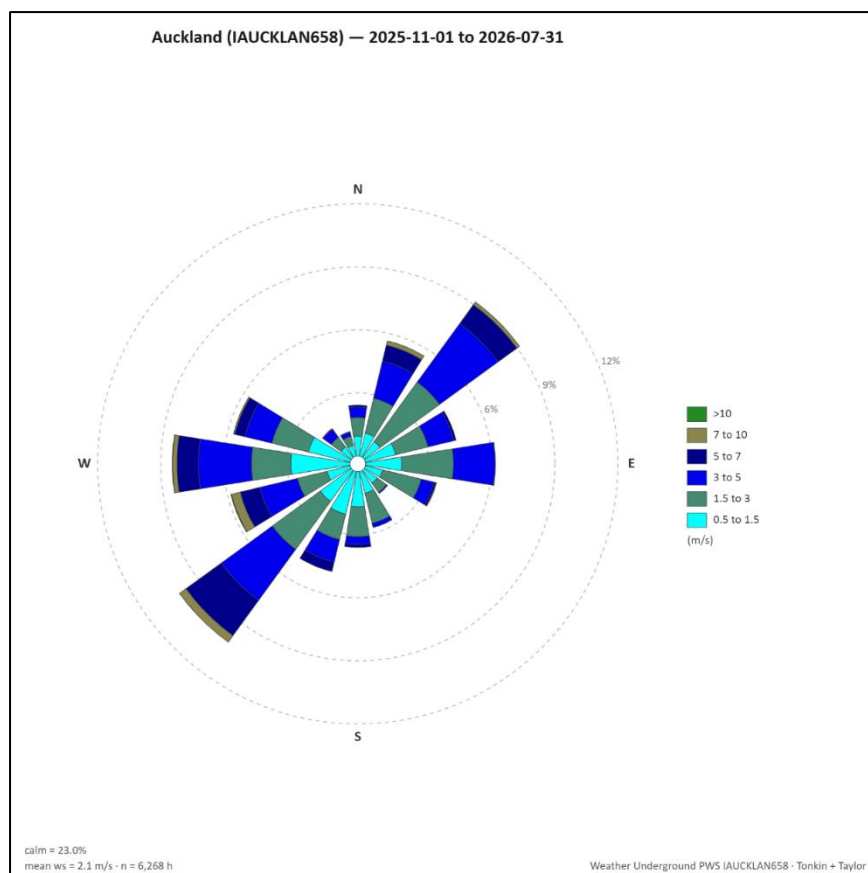


Figure 3.1: Wind rose for North Shore Airport (1 November 2025 to 31 July 2026).

The compounds that were found most frequently in the monitoring data were:

- Carbon tetrachloride.
- BTEX, particularly m- and p-xylene and toluene.

“Dot plots” have been used to illustrate the spatial variability in the average concentration of these VOCs. The size of the dot is proportional to the measured concentration.

3.2.2 Carbon tetrachloride:

A dot plot of the average concentration of carbon tetrachloride at each sample location is shown in Figure 3.2.

Carbon tetrachloride is present in ambient air globally because it is a persistent compound historically released from a range of industrial activities and used as a solvent. Globally, levels of carbon tetrachloride in the air have been reducing steadily since the late 1980s. Current (2023/24) background levels of carbon tetrachloride measured at Cape Grim, Tasmania, are approximately 72 parts per trillion (approximately $0.46 \mu\text{g}/\text{m}^3$ @ 20°C). This suggests that levels of carbon tetrachloride around Redvale Landfill are consistent with southern hemisphere background levels and there is no indication of significant localised influences.



Figure 3.2: Average concentrations of carbon tetrachloride at each sample location ($\mu\text{g}/\text{m}^3$, 7-month average).

3.2.3 BTEX Compounds

BTEX refers to the sum of benzene, toluene, ethylbenzene and xylene. A dot plot of the average concentration of total BTEX at each sample location is shown in Figure 3.3. The main source of BTEX in ambient air is from combustion of fossil fuels, particularly exhaust emissions from motor vehicles.

The pattern of BTEX concentrations at and around the Redvale Landfill is consistent with exhaust emissions from truck movements and on-site machinery, and vehicles on public roads, being the main local sources.

Auckland Council has historically undertaken monitoring for BTEX, which was primarily focused on highly traffic impacted sites (e.g. Khyber Pass and Penrose) or near a petrol station (Crowhurst Street). The monitoring data shows a trend of reducing concentrations over time. The most recent data is from 2013, where recorded annual BTEX concentrations were: Penrose ($0.75 \mu\text{g}/\text{m}^3$), Crowhurst Street ($3.7 \mu\text{g}/\text{m}^3$) and Khyber Pass ($2.3 \mu\text{g}/\text{m}^3$). The highest BTEX concentration recorded within the Landfill was $1.5 \mu\text{g}/\text{m}^3$.

The most recent monitoring data that T+T is aware of, that is relevant to levels of BTEX, is monitoring for benzene only undertaken by the Bay of Plenty Regional Council from June 2024 to June 2025. Measured annual average benzene concentrations at residential and moderately traffic impacted sites were generally between 0.2 and 0.4 $\mu\text{g}/\text{m}^3$. This can be compared to < 0.1 $\mu\text{g}/\text{m}^3$ (7-month average) benzene measured at all sites in and around the Redvale Landfill.

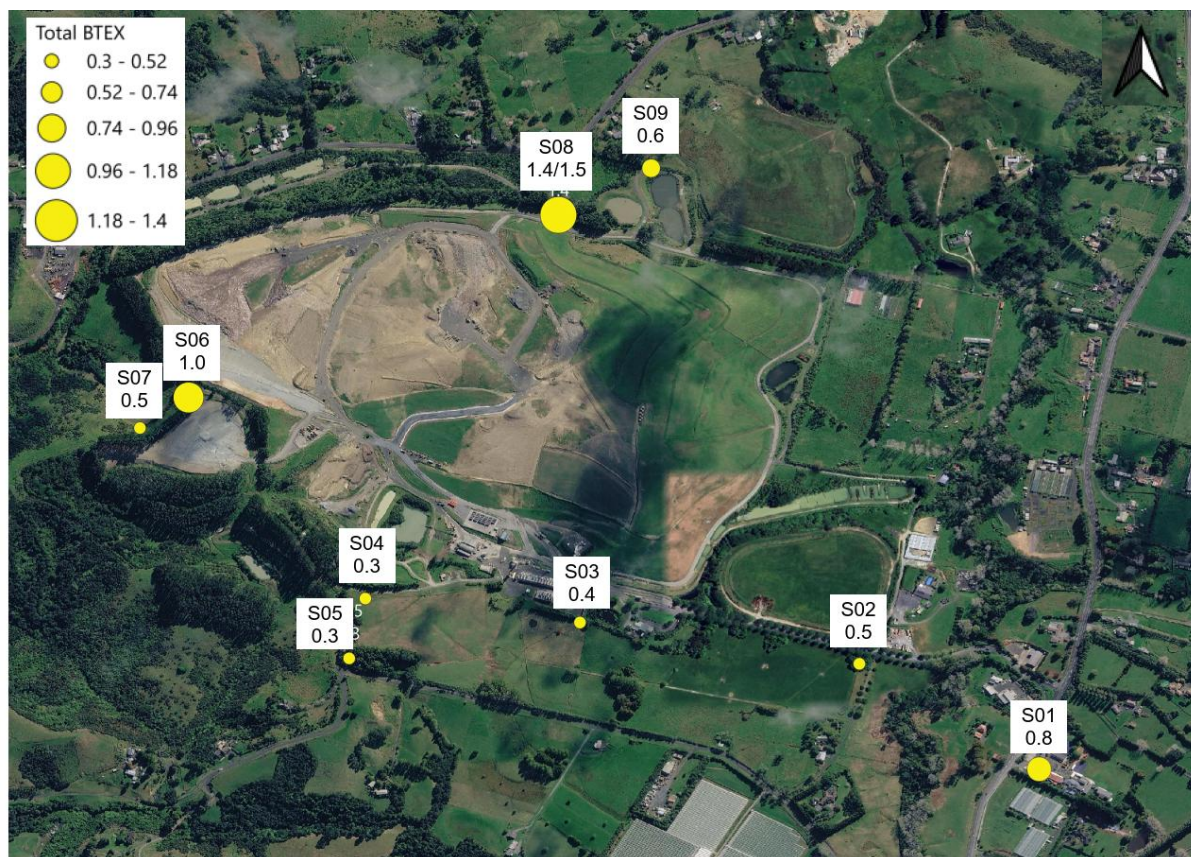


Figure 3.3: Average total BTEX concentrations for each sample location reported in $\mu\text{g}/\text{m}^3$.

4 Conclusions

This report presents an interim summary of the first approximately seven months of monitoring completed for the 12-month VOC and reduced sulphur compound monitoring programme at Redvale Landfill. Monitoring commenced in late November 2025, and this interim assessment covers results available to early July 2026. The findings should therefore be interpreted as indicative of the monitoring period to date, rather than as final annual average results.

No reduced sulphur compounds have been detected at any monitoring location to date. VOCs were detected at low concentrations, and the highest seven-month average concentrations reported for the compounds assessed were below the relevant chronic health-based assessment criteria. Carbon tetrachloride concentrations were broadly consistent across the monitoring locations and appear to be consistent with regional/background concentrations, rather than indicating a localised landfill-related source. The spatial pattern of BTEX concentrations is generally consistent with expected local influences from vehicle movements, truck activity and mobile plant, in combination with public road traffic sources. The concentrations of benzene measured at and around the site were relatively low compared to concentrations measured at urban sites elsewhere in New Zealand.

At this stage, there is no indication in the monitoring data of elevated levels of VOCs or reduced sulphur compounds (relative to assessment criteria) related to the Redvale Landfill.

Monitoring should continue for the full 12-month programme to provide a complete annual dataset and enable final comparison with annual average assessment criteria.

5 Applicability

This report has been prepared for the exclusive use of our client WM New Zealand, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application under the Fast-track Approvals Act 2024 and that an Expert Panel as the consenting authority will use this report for the purpose of assessing that application. We understand and agree that this report will be used by the Expert Panel in undertaking its regulatory functions.

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Appendix A Results summary tables

Table Appendix A.1: VOC monitoring results ($\mu\text{g}/\text{m}^3$)

Notes:

- All results are reported in $\mu\text{g}/\text{m}^3$

- Samples have been analysed for volatile organic compounds by the use of solvent desorption VOC radiello by Method MA5.

Sample Name	Sample Location	Sample End Date	1-Methoxy-2-propanol	1-Methoxy-2-propyl acetate	1,1,1-Trichloroethane	1,2-Dichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	1,4-Dichlorobenzene	2-butoxyethanol	2-Methylpentane	2-ethylhexanol	3-Methylpentane	Benzene	Bromochloromethane	Butanol	Butyl acetate	Carbon tetrachloride	Chlorobenzene	Cyclohexane	Cyclohexanone	Ethyl-tert-butyl ether
ME386975.001	S01	5/12/2025	<0.094	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.064	<0.074	<0.070	<0.086	0.3	<0.076	0.2	<0.076	<0.084
ME387360.001	S01	22/12/2025	<0.077	<0.071	<0.069	<0.064	<0.085	<0.055	<0.083	<0.076	<0.061	<0.099	<0.061	<0.053	<0.061	<0.057	<0.071	0.3	<0.063	<0.079	<0.063	<0.070
ME387498.001	S01	5/01/2026	<0.093	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	<0.094	<0.075	<0.084
ME387836.001	S01	19/01/2026	<0.092	<0.084	<0.082	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	<0.094	<0.074	<0.083
ME388420.001	S01	3/02/2026	<0.086	<0.079	<0.076	<0.072	<0.095	<0.061	<0.093	<0.085	<0.068	<0.11	<0.068	<0.059	<0.068	<0.064	<0.079	0.3	<0.070	<0.088	<0.070	<0.078
ME388477.001	S01	17/02/2026	<0.093	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	<0.095	<0.075	<0.084
ME388734.001	S01	4/03/2026	<0.087	<0.080	<0.078	<0.073	<0.096	<0.062	<0.094	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.4	<0.071	<0.089	<0.071	<0.079
ME389000.001	S01	18/03/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	0.3	<0.12	0.1	0.1	<0.074	<0.070	<0.086	0.2	<0.076	0.1	<0.076	<0.085
ME389152.001	S01	30/03/2026	<0.11	<0.10	<0.097	<0.091	<0.12	<0.078	<0.12	<0.11	<0.086	<0.14	<0.086	<0.075	<0.086	<0.081	<0.10	<0.090	<0.088	<0.11	<0.088	<0.099
ME389566.001	S01	13/04/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389735.001	S01	28/04/2026	<0.089	<0.081	<0.079	<0.074	<0.098	<0.063	<0.096	<0.087	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.081	0.2	<0.072	<0.091	<0.072	<0.080
ME390110.001	S01	11/05/2026	<0.10	<0.094	<0.091	<0.086	<0.11	<0.073	<0.11	<0.10	<0.081	<0.13	<0.081	<0.071	<0.081	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.093
ME390497.001	S01	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.010	<0.0028	<0.0043	<0.0039	0.010	<0.0051	0.008	0.021	<0.0031	<0.0030	<0.0037	0.036	<0.0032	0.007	<0.0032	<0.0036
ME391220.001	S01	6/07/2026	<0.049	<0.045	<0.043	<0.040	0.2	<0.035	<0.052	<0.048	<0.038	<0.062	0.1	0.5	<0.038	<0.036	<0.045	0.3	<0.039	<0.049	<0.039	<0.044
ME386974.001	S02	4/12/2025	<0.093	<0.085	<0.083	<0.078	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	<0.095	<0.075	<0.084
ME387251.001	S02	18/12/2025	<0.093	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.086	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.001	S02	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.001	S02	19/01/2026	<0.092	<0.084	<0.081	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	<0.094	<0.074	<0.083
ME388421.001	S02	3/02/2026	<0.087	<0.079	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.079	0.3	<0.070	<0.088	<0.070	<0.078
ME388476.001	S02	17/02/2026	<0.092	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.083
ME389153.001	S02	30/03/2026	<0.11	<0.10	<0.097	<0.091	<0.12	<0.078	<0.12	<0.11	<0.086	<0.14	<0.086	<0.075	<0.086	<0.082	<0.10	0.2	<0.089	<0.11	<0.089	<0.099
ME389565.001	S02	13/04/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389734.001	S02	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.087	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.080
ME390109.001	S02	11/05/2026	<0.10	<0.094	<0.091	<0.085	<0.11	<0.073	<0.11	<0.10	<0.080	<0.13	<0.080	<0.070	<0.080	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.092
ME390496.001	S02	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.009	<0.0028	<0.0043	<0.0039	0.016	<0.0051	0.007	0.013	<0.0031	<0.0030	<0.0037	0.038	<0.0032	0.006	<0.0032	<0.0036
ME391219.001	S02	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.11	<0.035	<0.052	<0.048	<0.038	<0.062	0.075	0.21	<0.038	<0.036	<0.045	0.41	<0.039	0.083	<0.039	<0.044

Sample Name	Sample Location	Sample End Date	1-Methoxy-2-propanol	1-Methoxy-2-propyl acetate	1,1,1-Trichloroethane	1,2-Dichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	1,4-Dichlorobenzene	2-butoxyethanol	2-Methylpentane	2-ethylhexanol	3-Methylpentane	Benzene	Bromochloromethane	Butanol	Butyl acetate	Carbon tetrachloride	Chlorobenzene	Cyclohexane	Cyclohexanone	Ethyl-tert-butyl ether
ME386974.002	S03	4/12/2025	<0.093	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	<0.095	<0.075	<0.084
ME387251.002	S03	18/12/2025	<0.093	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.086	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.002	S03	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.002	S03	19/01/2026	<0.092	<0.084	<0.081	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	<0.094	<0.074	<0.083
ME388421.002	S03	3/02/2026	<0.087	<0.080	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.080	0.3	<0.070	<0.088	<0.070	<0.078
ME388476.002	S03	17/02/2026	<0.092	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.083
ME388735.001	S03	4/03/2026	<0.088	<0.080	<0.078	<0.073	<0.096	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.4	<0.071	<0.089	<0.071	<0.079
ME388800.001	S03	18/03/2026	<0.094	<0.086	<0.084	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389153.002	S03	30/03/2026	<0.11	<0.10	<0.097	<0.091	<0.12	<0.078	<0.12	<0.11	<0.086	<0.14	<0.086	<0.075	<0.086	<0.081	<0.10	0.2	<0.088	<0.11	0.1	<0.098
ME389565.002	S03	13/04/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389734.002	S03	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.087	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.080
ME390109.002	S03	11/05/2026	<0.10	<0.093	<0.090	<0.085	<0.11	<0.073	<0.11	<0.10	<0.080	<0.13	<0.080	<0.070	<0.080	<0.076	<0.093	0.2	<0.082	<0.10	<0.082	<0.092
ME390496.002	S03	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.008	<0.0028	<0.0043	<0.0039	0.009	<0.0051	0.006	0.011	<0.0031	<0.0030	<0.0037	0.040	<0.0032	<0.0041	<0.0032	<0.0036
ME391219.002	S03	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.11	<0.035	<0.052	<0.048	<0.038	<0.062	0.066	0.13	<0.038	0.061	<0.045	0.42	<0.039	<0.050	<0.039	<0.044
ME386974.003	S04	4/12/2025	<0.093	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.084
ME387251.003	S04	18/12/2025	<0.093	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.086	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.003	S04	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.003	S04	19/01/2026	<0.092	<0.084	<0.081	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.2	<0.074	0.1	<0.074	<0.083
ME388421.003	S04	3/02/2026	<0.087	<0.079	<0.077	<0.072	<0.095	<0.062	<0.093	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.079	0.2	<0.070	<0.088	<0.070	<0.078
ME388476.003	S04	17/02/2026	<0.092	<0.084	<0.082	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.075	<0.094	<0.075	<0.083
ME388735.002	S04	4/03/2026	<0.088	<0.081	<0.078	<0.073	<0.097	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.081	0.3	<0.071	<0.090	<0.071	<0.079
ME388800.002	S04	18/03/2026	<0.094	<0.086	<0.084	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389153.003	S04	30/03/2026	<0.11	<0.099	<0.096	<0.090	<0.12	<0.078	<0.12	<0.11	<0.085	<0.14	<0.085	<0.075	<0.085	<0.081	<0.099	0.2	<0.088	<0.11	<0.088	<0.098
ME389565.003	S04	13/04/2026	<0.094	<0.086	<0.084	<0.079	<0.10	<0.067	<0.10	<0.093	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389734.003	S04	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.087	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.080
ME390109.003	S04	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.1	<0.073	<0.11	<0.10	0.1	<0.13	<0.080	<0.070	<0.080	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.092
ME390496.003	S04	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.012	<0.0028	<0.0043	<0.0039	0.038	<0.0051	0.007	0.011	<0.0031	<0.0030	0.004	0.036	<0.0032	0.011	<0.0032	<0.0036
ME391219.003	S04	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.070	<0.035	<0.053	<0.048	<0.038	<0.062	0.060	0.11	<0.038	<0.036	<0.045	0.39	<0.039	0.082	<0.039	<0.044
ME386974.004	S05	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.1	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	<0.095	<0.075	<0.084
ME387251.004	S05	18/12/2025	<0.093	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.086	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.004	S05	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065

Sample Name	Sample Location	Sample End Date	1-Methoxy-2-propanol	1-Methoxy-2-propyl acetate	1,1,1-Trichloroethane	1,2-Dichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	1,4-Dichlorobenzene	2-butoxyethanol	2-Methylpentane	2-ethylhexanol	3-Methylpentane	Benzene	Bromochloromethane	Butanol	Butyl acetate	Carbon tetrachloride	Chlorobenzene	Cyclohexane	Cyclohexanone	Ethyl-tert-butyl ether
ME387835.004	S05	19/01/2026	<0.092	<0.084	<0.081	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.2	<0.074	<0.094	<0.074	<0.083
ME388421.004	S05	3/02/2026	<0.087	<0.080	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.080	0.2	<0.070	<0.088	<0.070	<0.078
ME388476.004	S05	17/02/2026	<0.092	<0.085	<0.082	<0.077	<0.10	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.2	<0.075	<0.094	<0.075	<0.083
ME388735.003	S05	4/03/2026	<0.088	<0.080	<0.078	<0.073	<0.096	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.3	<0.071	<0.089	<0.071	<0.079
ME388800.003	S05	18/03/2026	<0.094	<0.086	<0.084	<0.079	<0.10	<0.067	<0.10	<0.093	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389153.004	S05	30/03/2026	<0.11	<0.099	<0.096	<0.090	<0.12	<0.077	<0.12	<0.11	<0.085	<0.14	<0.085	<0.075	<0.085	<0.081	<0.099	0.2	<0.088	<0.11	<0.088	<0.098
ME389565.004	S05	13/04/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	<0.096	<0.076	<0.085
ME389734.004	S05	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.088	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.080
ME390109.004	S05	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.1	<0.073	<0.11	<0.10	0.1	<0.13	<0.080	<0.070	<0.080	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.092
ME390496.004	S05	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.012	<0.0028	<0.0043	<0.0039	0.036	<0.0051	0.006	0.011	<0.0031	<0.0030	0.004	0.029	<0.0032	0.010	<0.0032	<0.0036
ME391219.004	S05	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.082	<0.035	<0.052	<0.048	<0.038	<0.062	0.045	0.11	<0.038	<0.036	<0.045	0.43	<0.039	0.092	<0.039	<0.044
ME386974.005	S06	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.1	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.084
ME387251.005	S06	18/12/2025	<0.093	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	0.1	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.005	S06	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.005	S06	19/01/2026	<0.092	<0.084	<0.081	<0.077	0.2	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	0.1	0.3	<0.074	0.2	<0.074	<0.083
ME388421.005	S06	3/02/2026	<0.087	<0.079	<0.077	<0.072	0.1	<0.062	<0.093	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.079	0.2	<0.070	0.1	<0.070	<0.078
ME388476.005	S06	17/02/2026	<0.092	<0.084	<0.082	<0.077	0.5	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	0.2	0.3	<0.075	0.2	<0.075	<0.083
ME388735.004	S06	4/03/2026	<0.088	<0.081	<0.078	<0.073	0.2	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	0.1	0.3	<0.071	0.1	<0.071	<0.079
ME388800.004	S06	18/03/2026	<0.094	<0.086	<0.084	<0.078	0.2	<0.067	<0.10	<0.093	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	0.2	0.2	<0.076	0.2	<0.076	<0.085
ME389153.005	S06	30/03/2026	<0.11	<0.099	<0.096	<0.090	0.2	<0.077	<0.12	<0.11	<0.085	<0.14	<0.085	<0.074	<0.085	<0.080	0.4	0.2	<0.087	0.2	<0.087	<0.097
ME389565.005	S06	13/04/2026	<0.094	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.3	<0.076	0.1	<0.076	<0.085
ME389734.005	S06	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.088	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.081
ME390109.005	S06	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.2	<0.073	<0.11	<0.10	<0.080	<0.13	<0.080	<0.070	<0.080	<0.076	<0.094	0.2	<0.083	0.2	<0.083	<0.092
ME390496.005	S06	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.013	<0.0028	<0.0043	<0.0039	0.037	<0.0051	0.006	0.009	<0.0031	<0.0030	0.008	0.026	<0.0032	0.009	<0.0032	<0.0036
ME391219.005	S06	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.16	<0.035	<0.053	<0.048	<0.038	<0.062	0.062	0.11	<0.038	<0.036	0.1	0.45	<0.039	0.087	<0.039	<0.044
ME386974.006	S07	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.2	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.084
ME387251.006	S07	18/12/2025	<0.093	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	<0.086	0.3	<0.076	<0.095	<0.076	<0.084
ME387497.006	S07	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.006	S07	19/01/2026	<0.092	<0.084	<0.081	<0.077	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	<0.094	<0.074	<0.083
ME388421.006	S07	3/02/2026	<0.087	<0.079	<0.077	<0.072	<0.095	<0.062	<0.093	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.079	0.3	<0.070	<0.088	<0.070	<0.078
ME388476.006	S07	17/02/2026	<0.092	<0.084	<0.082	<0.077	0.2	<0.066	<0.099	<0.091	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.075	0.1	<0.075	<0.083

Sample Name	Sample Location	Sample End Date	1-Methoxy-2-propanol	1-Methoxy-2-propyl acetate	1,1,1-Trichloroethane	1,2-Dichloropropane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	1,4-Dichlorobenzene	2-butoxyethanol	2-Methylpentane	2-ethylhexanol	3-Methylpentane	Benzene	Bromochloromethane	Butanol	Butyl acetate	Carbon tetrachloride	Chlorobenzene	Cyclohexane	Cyclohexanone	Ethyl-tert-butyl ether
ME388735.005	S07	4/03/2026	<0.088	<0.081	<0.078	<0.073	0.1	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.081	0.3	<0.071	<0.090	<0.071	<0.079
ME389153.006	S07	30/03/2026	<0.11	<0.099	<0.096	<0.090	<0.12	<0.077	<0.12	<0.11	<0.085	<0.14	<0.085	<0.074	<0.085	<0.080	<0.099	0.2	<0.087	<0.11	<0.087	<0.098
ME389565.006	S07	13/04/2026	<0.094	<0.087	<0.084	<0.079	<0.10	<0.067	<0.10	<0.093	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.087	0.2	<0.076	<0.096	<0.076	<0.085
ME389734.006	S07	28/04/2026	<0.089	<0.082	<0.079	<0.074	<0.098	<0.064	<0.096	<0.088	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	<0.091	<0.072	<0.080
ME390109.006	S07	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.1	<0.073	<0.11	<0.10	<0.080	<0.13	<0.080	<0.070	<0.080	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.092
ME390496.006	S07	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.010	<0.0028	<0.0043	<0.0039	<0.0031	<0.0051	0.005	0.009	<0.0031	<0.0030	0.006	0.025	<0.0032	0.005	<0.0032	<0.0036
ME391219.006	S07	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.098	<0.035	<0.053	<0.048	<0.038	<0.062	0.045	0.097	<0.038	<0.036	<0.045	0.38	<0.039	<0.050	<0.039	<0.044
ME386974.007	S08	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.2	<0.066	<0.10	<0.091	<0.073	<0.12	<0.073	<0.064	<0.073	<0.069	0.1	0.3	<0.075	0.2	<0.075	<0.084
ME387251.007	S08	18/12/2025	<0.094	<0.086	<0.083	<0.078	0.2	<0.067	<0.10	<0.092	0.3	<0.12	0.1	<0.064	<0.074	<0.070	0.2	0.3	<0.076	0.3	<0.076	<0.084
ME387497.007	S08	5/01/2026	<0.072	<0.066	<0.064	<0.060	0.1	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.007	S08	19/01/2026	<0.092	<0.084	<0.081	<0.076	0.1	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	0.1	<0.074	<0.083
ME388421.007	S08	3/02/2026	<0.087	<0.080	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.080	0.2	<0.070	0.1	<0.070	<0.078
ME388476.007	S08	17/02/2026	<0.092	<0.084	<0.082	<0.077	<0.10	<0.066	<0.099	<0.091	<0.072	<0.12	<0.072	<0.063	<0.072	<0.069	<0.084	0.3	<0.075	0.1	<0.075	<0.083
ME388735.006	S08	4/03/2026	<0.088	<0.080	<0.078	<0.073	0.2	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.3	<0.071	0.3	<0.071	<0.079
ME388800.005	S08	18/03/2026	<0.094	<0.087	<0.084	<0.079	0.3	<0.067	<0.10	<0.093	<0.074	<0.12	0.3	0.1	<0.074	<0.070	<0.087	0.3	<0.076	0.5	<0.076	<0.085
ME389153.007	S08	30/03/2026	<0.11	<0.10	<0.096	<0.091	<0.12	<0.078	<0.12	<0.11	<0.085	<0.14	<0.085	<0.075	<0.085	<0.081	<0.10	0.2	<0.088	0.2	<0.088	<0.098
ME389565.007	S08	13/04/2026	<0.094	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	<0.074	<0.12	0.1	<0.064	<0.074	<0.070	<0.086	0.3	<0.076	0.1	<0.076	<0.084
ME389734.007	S08	28/04/2026	<0.089	<0.082	<0.079	<0.074	0.3	<0.064	<0.096	<0.087	<0.070	<0.11	0.1	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	0.3	<0.072	<0.080
ME390109.007	S08	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.1	<0.073	<0.11	<0.10	<0.081	<0.13	<0.081	<0.070	<0.081	<0.076	<0.094	0.2	<0.083	0.2	<0.083	<0.092
ME390496.007	S08	8/06/2026	<0.0040	<0.0036	<0.0035	<0.0033	0.024	<0.0028	<0.0043	<0.0039	0.069	<0.0051	0.015	0.013	<0.0031	<0.0030	0.011	0.032	<0.0032	0.030	<0.0032	<0.0036
ME391219.007	S08	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.64	<0.035	<0.052	<0.048	<0.038	<0.062	0.17	0.13	<0.038	0.17	0.4	0.38	<0.039	0.51	<0.039	<0.044
ME386974.008	S08.1	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.2	<0.066	<0.10	<0.091	<0.073	<0.12	0.1	<0.064	<0.073	<0.069	0.1	0.3	<0.075	0.1	0.1	<0.084
ME387251.008	S08.1	18/12/2025	<0.094	<0.086	<0.083	<0.078	0.2	<0.067	<0.10	<0.092	0.4	<0.12	0.1	<0.064	<0.074	<0.070	0.3	0.3	<0.076	0.3	<0.076	<0.084
ME387497.008	S08.1	5/01/2026	<0.072	<0.066	<0.064	<0.060	0.1	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.008	S08.1	19/01/2026	<0.092	<0.084	<0.081	<0.076	0.1	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	0.2	<0.074	<0.083
ME388421.008	S08.1	3/02/2026	<0.087	<0.080	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.080	0.3	<0.070	0.1	<0.070	<0.078
ME388476.008	S08.1	17/02/2026	<0.092	<0.084	<0.082	<0.077	<0.10	<0.066	<0.099	<0.091	<0.072	<0.12	<0.072	<0.063	<0.072	<0.069	<0.084	0.3	<0.075	0.2	<0.075	<0.083
ME388735.007	S08.1	4/03/2026	<0.088	<0.080	<0.078	<0.073	0.2	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.3	<0.071	0.3	<0.071	<0.079
ME388800.006	S08.1	18/03/2026	<0.094	<0.087	<0.084	<0.079	0.4	<0.067	<0.10	<0.093	<0.074	<0.12	0.3	0.1	<0.074	<0.070	<0.087	0.3	<0.076	0.5	<0.076	<0.085
ME389153.008	S08.1	30/03/2026	<0.11	<0.10	<0.096	<0.091	0.1	<0.078	<0.12	<0.11	<0.085	<0.14	0.1	<0.075	<0.085	<0.081	<0.10	0.2	<0.088	0.2	<0.088	<0.098
ME389565.008	S08.1	13/04/2026	<0.094	<0.086	<0.083	<0.078	0.2	<0.067	<0.10	<0.092	<0.074	<0.12	0.1	<0.064	<0.074	<0.070	<0.086	0.3	<0.076	0.2	<0.076	<0.084

Sample Name	Sample Location	Sample End Date	1-Methoxy-2-propanol	1-Methoxy-2-propyl acetate	1,1,1-Trichloroethane	1,2-Dichloropropane	124-Trimethylbenzene	12-Dichloroethane	14-Dichlorobenzene	2-butoxyethanol	2-Methylpentane	2-ethylhexanol	3-Methylpentane	Benzene	Bromochloromethane	Butanol	Butyl acetate	Carbon tetrachloride	Chlorobenzene	Cyclohexane	Cyclohexanone	Ethyl-tert-butyl ether
ME389734.008	S08.1	28/04/2026	<0.089	<0.082	<0.079	<0.074	0.3	<0.064	<0.096	<0.087	<0.070	<0.11	0.1	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	0.3	<0.072	<0.080
ME390109.008	S08.1	11/05/2026	<0.10	<0.094	<0.091	<0.085	0.1	<0.073	<0.11	<0.10	<0.081	<0.13	<0.081	<0.070	<0.081	<0.076	<0.094	0.2	<0.083	0.2	<0.083	<0.092
ME390496.008	S08.1	8/06/2026	<0.0040	<0.0036	<0.0035	<0.0033	0.025	<0.0028	<0.0043	<0.0039	0.077	<0.0051	0.014	0.012	<0.0031	<0.0030	0.011	0.036	<0.0032	0.027	<0.0032	<0.0036
ME391219.008	S08.1	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.6	<0.035	<0.052	<0.048	<0.038	<0.062	0.17	0.13	<0.038	0.29	0.4	0.33	<0.039	0.5	<0.039	<0.044
ME386974.009	S09	4/12/2025	<0.093	<0.085	<0.082	<0.077	0.1	<0.066	<0.10	<0.091	<0.073	<0.12	0.1	<0.064	<0.073	<0.069	<0.085	0.3	<0.075	0.1	<0.075	<0.084
ME387251.009	S09	18/12/2025	<0.094	<0.086	<0.083	<0.078	0.1	<0.067	<0.10	<0.092	0.3	<0.12	<0.074	<0.064	<0.074	<0.070	0.1	0.2	<0.076	0.1	<0.076	<0.084
ME387497.009	S09	5/01/2026	<0.072	<0.066	<0.064	<0.060	<0.079	<0.052	<0.078	<0.071	<0.057	<0.092	<0.057	<0.050	<0.057	<0.054	<0.066	0.2	<0.058	<0.074	<0.058	<0.065
ME387835.009	S09	19/01/2026	<0.092	<0.084	<0.081	<0.076	<0.10	<0.066	<0.099	<0.090	<0.072	<0.12	<0.072	<0.063	<0.072	<0.068	<0.084	0.3	<0.074	<0.093	<0.074	<0.083
ME388421.009	S09	3/02/2026	<0.087	<0.079	<0.077	<0.072	<0.095	<0.062	<0.094	<0.085	<0.068	<0.11	<0.068	<0.060	<0.068	<0.064	<0.079	0.2	<0.070	<0.088	<0.070	<0.078
ME388476.009	S09	17/02/2026	<0.092	<0.085	<0.082	<0.077	<0.10	<0.066	<0.099	<0.091	<0.072	<0.12	<0.072	<0.063	<0.072	<0.069	<0.085	0.3	<0.075	<0.094	<0.075	<0.083
ME388735.008	S09	4/03/2026	<0.088	<0.080	<0.078	<0.073	0.1	<0.063	<0.095	<0.086	<0.069	<0.11	<0.069	<0.060	<0.069	<0.065	<0.080	0.3	<0.071	0.1	<0.071	<0.079
ME388800.007	S09	18/03/2026	<0.094	<0.087	<0.084	<0.079	0.1	<0.067	<0.10	<0.093	<0.074	<0.12	0.1	<0.065	<0.074	<0.070	<0.087	0.3	<0.076	0.2	<0.076	<0.085
ME389153.009	S09	30/03/2026	<0.11	<0.10	<0.096	<0.091	<0.12	<0.078	<0.12	<0.11	<0.085	<0.14	<0.085	<0.075	<0.085	<0.081	<0.10	0.2	<0.088	<0.11	<0.088	<0.098
ME389565.009	S09	13/04/2026	<0.094	<0.086	<0.083	<0.078	<0.10	<0.067	<0.10	<0.092	<0.074	<0.12	<0.074	<0.065	<0.074	<0.070	<0.086	0.2	<0.076	<0.096	<0.076	<0.085
ME389734.009	S09	28/04/2026	<0.089	<0.082	<0.079	<0.074	0.1	<0.064	<0.096	<0.087	<0.070	<0.11	<0.070	<0.061	<0.070	<0.066	<0.082	0.2	<0.072	0.1	<0.072	<0.080
ME390109.009	S09	11/05/2026	<0.10	<0.094	<0.091	<0.085	<0.11	<0.073	<0.11	<0.10	<0.081	<0.13	<0.081	<0.070	<0.081	<0.076	<0.094	0.2	<0.083	<0.10	<0.083	<0.092
ME390496.009	S09	8/06/2026	<0.0040	<0.0037	<0.0035	<0.0033	0.012	<0.0028	<0.0043	<0.0039	0.013	<0.0051	0.007	0.011	<0.0031	<0.0030	0.005	0.021	<0.0032	0.009	<0.0032	<0.0036
ME391219.009	S09	6/07/2026	<0.049	<0.045	<0.043	<0.041	0.29	<0.035	<0.052	<0.048	<0.038	<0.062	0.092	0.12	<0.038	0.065	0.2	0.35	<0.039	0.22	<0.039	<0.044

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isooctane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME386975.001	S01	5/12/2025	<0.066	<0.076	<0.067	<0.094	<0.089	0.1	0.2	0.1	0.2	<0.077	<0.076	<0.079	0.2	0.2	0.1	<0.097	<0.21	<0.11
ME387360.001	S01	22/12/2025	<0.055	<0.063	<0.055	<0.077	<0.073	<0.061	<0.064	<0.061	0.1	<0.064	<0.063	<0.065	<0.099	<0.073	<0.064	<0.080	<0.17	<0.089
ME387498.001	S01	5/01/2026	<0.065	<0.075	<0.066	<0.093	<0.088	0.1	<0.077	<0.073	0.1	<0.076	<0.075	<0.078	<0.12	<0.088	<0.077	<0.096	<0.20	<0.11
ME387836.001	S01	19/01/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.3	<0.077	<0.072	0.1	<0.075	<0.074	<0.078	<0.12	<0.087	<0.077	<0.095	<0.20	<0.11

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isocetane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME388420.001	S01	3/02/2026	<0.061	<0.070	<0.061	<0.086	<0.082	<0.068	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.089	<0.19	<0.099
ME388477.001	S01	17/02/2026	0.2	<0.075	<0.066	<0.093	<0.088	<0.073	<0.077	<0.073	0.1	<0.076	<0.075	<0.079	<0.12	0.1	0.2	<0.096	<0.20	<0.11
ME388734.001	S01	4/03/2026	<0.062	<0.071	<0.062	<0.087	<0.083	<0.069	<0.073	<0.069	0.1	<0.072	<0.071	<0.074	<0.11	<0.083	0.1	<0.091	<0.19	<0.10
ME389000.001	S01	18/03/2026	<0.066	<0.076	<0.067	<0.094	<0.089	0.1	<0.078	0.1	<0.085	<0.077	<0.076	<0.080	<0.12	<0.089	0.2	<0.098	<0.21	<0.11
ME389152.001	S01	30/03/2026	<0.077	<0.088	<0.078	<0.11	<0.10	<0.086	<0.091	<0.086	<0.099	<0.090	<0.088	<0.093	<0.14	<0.10	<0.091	<0.11	<0.24	<0.13
ME389566.001	S01	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	<0.074	<0.078	<0.074	0.1	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME389735.001	S01	28/04/2026	<0.063	<0.072	<0.063	<0.089	<0.084	0.1	<0.074	<0.070	0.1	<0.073	<0.072	<0.075	<0.11	<0.084	<0.074	<0.092	<0.20	<0.10
ME390110.001	S01	11/05/2026	<0.073	<0.083	<0.073	<0.10	<0.098	<0.081	<0.086	<0.081	0.1	<0.084	<0.083	<0.087	<0.13	<0.098	<0.086	<0.11	<0.23	<0.12
ME390497.001	S01	8/06/2026	<0.0028	0.009	<0.0028	0.006	<0.0038	0.022	0.005	0.007	0.011	<0.0033	<0.0032	<0.0034	0.005	0.007	0.015	<0.0041	<0.0088	0.005
ME391220.001	S01	6/07/2026	<0.034	0.2	<0.035	0.1	<0.046	0.6	0.1	0.1	0.1	<0.040	<0.039	<0.041	0.1	0.1	0.2	0.1	<0.11	<0.056
ME386974.001	S02	4/12/2025	<0.066	<0.075	<0.066	<0.093	<0.088	0.2	<0.078	<0.073	0.2	<0.076	<0.075	<0.079	0.3	<0.088	<0.078	<0.097	<0.20	<0.11
ME387251.001	S02	18/12/2025	<0.066	<0.076	<0.067	<0.093	<0.089	<0.073	<0.078	<0.073	0.1	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME387497.001	S02	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	<0.057	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.001	S02	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	<0.072	<0.077	<0.072	0.1	<0.075	<0.074	<0.078	<0.12	<0.087	<0.077	<0.095	<0.20	<0.11
ME388421.001	S02	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	<0.068	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.001	S02	17/02/2026	<0.065	<0.075	<0.066	<0.092	<0.088	<0.073	<0.077	<0.073	0.1	<0.076	<0.075	<0.078	<0.12	<0.088	0.2	<0.096	<0.20	<0.11
ME389153.001	S02	30/03/2026	<0.077	<0.089	<0.078	<0.11	<0.10	0.1	<0.091	<0.086	<0.099	<0.090	<0.089	<0.093	<0.14	<0.10	<0.091	<0.11	<0.24	<0.13
ME389565.001	S02	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	<0.074	<0.078	<0.074	0.1	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME389734.001	S02	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.084	0.1	<0.074	<0.070	0.1	<0.073	<0.072	<0.075	<0.11	<0.084	<0.074	<0.092	<0.20	<0.10
ME390109.001	S02	11/05/2026	<0.072	<0.083	<0.073	<0.10	<0.097	0.1	<0.085	<0.080	0.1	<0.084	<0.083	<0.087	<0.13	<0.097	<0.085	<0.11	<0.23	<0.12
ME390496.001	S02	8/06/2026		0.006	<0.0028	0.007	<0.0038	0.015	<0.0033	0.004	0.013	<0.0033	<0.0032	<0.0034	<0.0051	0.005	0.011	<0.0041	<0.0088	<0.0046
ME391219.001	S02	6/07/2026	0.060	0.084	<0.035	0.078	<0.046	0.2	0.064	<0.038	0.1	<0.040	<0.039	<0.041	<0.062	<0.046	0.12	<0.050	<0.11	<0.056
ME386974.002	S03	4/12/2025	<0.066	<0.075	<0.066	<0.093	<0.088	0.2	<0.077	<0.073	0.2	0.1	<0.075	<0.079	0.3	0.2	0.1	<0.096	<0.20	<0.11
ME387251.002	S03	18/12/2025	<0.066	<0.076	<0.067	<0.093	<0.089	0.1	<0.078	<0.073	0.2	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME387497.002	S03	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.2	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.002	S03	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.2	<0.075	<0.074	<0.078	<0.12	<0.087	<0.077	<0.095	<0.20	<0.11
ME388421.002	S03	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	<0.068	<0.072	<0.068	0.2	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.002	S03	17/02/2026	<0.065	<0.075	<0.066	<0.092	<0.088	0.1	<0.077	<0.073	0.3	<0.076	<0.075	<0.078	<0.12	0.1	0.2	<0.096	<0.20	<0.11
ME388735.001	S03	4/03/2026	<0.062	<0.071	<0.063	<0.088	<0.083	0.1	<0.073	<0.069	0.2	<0.072	<0.071	<0.074	<0.11	<0.083	0.1	<0.091	<0.19	<0.10
ME388800.001	S03	18/03/2026	<0.066	<0.076	<0.067	<0.094	<0.089	<0.074	<0.078	<0.074	<0.085	<0.077	<0.076	<0.080	<0.12	<0.089	0.1	<0.098	<0.21	<0.11
ME389153.002	S03	30/03/2026	<0.077	<0.088	<0.078	<0.11	<0.10	<0.086	<0.091	<0.086	<0.098	<0.089	<0.088	<0.092	<0.14	<0.10	<0.091	<0.11	<0.24	<0.12
ME389565.002	S03	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	<0.074	<0.078	<0.074	0.2	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isooctane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME389734.002	S03	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.084	0.1	<0.074	<0.070	0.2	<0.073	<0.072	<0.075	<0.11	<0.084	0.1	<0.092	<0.20	<0.10
ME390109.002	S03	11/05/2026	<0.072	<0.082	<0.073	<0.10	<0.097	0.1	<0.085	<0.080	0.2	<0.084	<0.082	<0.086	<0.13	<0.097	<0.085	<0.11	<0.22	<0.12
ME390496.002	S03	8/06/2026		0.007	<0.0028	0.006	<0.0038	0.014	<0.0033	0.004	0.016	<0.0033	<0.0032	<0.0034	<0.0051	0.007	0.010	<0.0041	<0.0088	<0.0046
ME391219.002	S03	6/07/2026	0.045	0.095	<0.035	0.087	<0.046	0.16	0.068	0.083	0.2	<0.040	<0.039	<0.041	<0.062	0.060	0.11	<0.050	<0.11	<0.056
ME386974.003	S04	4/12/2025	0.1	<0.075	<0.066	<0.093	<0.088	0.2	0.1	<0.073	0.2	<0.076	<0.075	<0.079	0.3	0.2	0.1	<0.096	<0.20	<0.11
ME387251.003	S04	18/12/2025	0.1	<0.076	<0.067	<0.093	<0.089	0.1	<0.078	<0.073	0.2	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME387497.003	S04	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.2	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.003	S04	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.2	<0.075	<0.074	<0.078	<0.12	<0.087	<0.077	<0.095	<0.20	<0.11
ME388421.003	S04	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	<0.068	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.003	S04	17/02/2026	<0.065	<0.075	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.2	<0.076	<0.075	<0.078	<0.12	0.1	0.2	<0.096	<0.20	<0.11
ME388735.002	S04	4/03/2026	<0.062	<0.071	<0.063	<0.088	<0.083	<0.069	<0.073	<0.069	0.2	<0.072	<0.071	<0.074	<0.11	<0.083	0.1	<0.091	<0.19	<0.10
ME388800.002	S04	18/03/2026	<0.066	<0.076	<0.067	<0.094	<0.089	0.1	<0.078	<0.074	<0.085	<0.077	<0.076	<0.080	<0.12	<0.089	0.1	<0.098	<0.21	<0.11
ME389153.003	S04	30/03/2026	<0.077	<0.088	<0.078	<0.11	<0.10	0.1	<0.090	<0.085	<0.098	<0.089	<0.088	<0.092	<0.14	<0.10	<0.090	<0.11	<0.24	<0.12
ME389565.003	S04	13/04/2026	<0.067	<0.076	<0.067	<0.094	<0.089	<0.074	<0.079	<0.074	0.1	<0.077	<0.076	<0.080	<0.12	<0.089	<0.079	<0.098	<0.21	<0.11
ME389734.003	S04	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.084	0.1	<0.074	<0.070	0.1	<0.073	<0.072	<0.075	<0.11	<0.084	<0.074	<0.092	<0.20	<0.10
ME390109.003	S04	11/05/2026	<0.072	<0.083	<0.073	<0.10	<0.097	0.1	<0.085	<0.080	0.3	<0.084	<0.083	<0.086	<0.13	<0.097	<0.085	<0.11	<0.22	<0.12
ME390496.003	S04	8/06/2026		0.009	<0.0028	0.006	<0.0038	0.019	0.008	0.005	0.027	<0.0033	<0.0032	<0.0034	0.006	0.008	0.011	<0.0041	<0.0088	<0.0046
ME391219.003	S04	6/07/2026	0.063	0.079	<0.035	0.052	<0.046	0.14	<0.041	<0.038	0.22	<0.040	<0.039	<0.041	<0.062	0.17	0.1	<0.051	<0.11	<0.056
ME386974.004	S05	4/12/2025	<0.066	<0.075	<0.066	<0.093	<0.088	0.2	0.1	<0.073	0.2	<0.076	<0.075	<0.079	0.3	<0.088	<0.077	<0.097	<0.20	<0.11
ME387251.004	S05	18/12/2025	<0.066	<0.076	<0.067	<0.093	<0.089	0.1	<0.078	<0.073	0.1	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME387497.004	S05	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.004	S05	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.2	<0.075	<0.074	<0.078	<0.12	<0.087	<0.077	<0.095	<0.20	<0.11
ME388421.004	S05	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	<0.068	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.004	S05	17/02/2026	<0.065	<0.075	<0.066	<0.092	<0.088	<0.073	<0.077	<0.073	0.1	<0.076	<0.075	<0.078	<0.12	<0.088	0.1	<0.096	<0.20	<0.11
ME388735.003	S05	4/03/2026	<0.062	<0.071	<0.063	<0.088	<0.083	<0.069	<0.073	<0.069	0.1	<0.072	<0.071	<0.074	<0.11	<0.083	0.1	<0.091	<0.19	<0.10
ME388800.003	S05	18/03/2026	<0.066	<0.076	<0.067	<0.094	<0.089	0.1	<0.079	<0.074	<0.085	<0.077	<0.076	<0.080	<0.12	<0.089	<0.079	<0.098	<0.21	<0.11
ME389153.004	S05	30/03/2026	<0.076	<0.088	<0.077	<0.11	<0.10	0.1	<0.090	<0.085	<0.098	<0.089	<0.088	<0.092	<0.14	<0.10	<0.090	<0.11	<0.24	<0.12
ME389565.004	S05	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	<0.074	<0.078	<0.074	0.1	<0.077	<0.076	<0.080	<0.12	<0.089	<0.078	<0.098	<0.21	<0.11
ME389734.004	S05	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.085	<0.070	<0.074	<0.070	<0.062	<0.073	<0.072	<0.075	<0.11	<0.085	<0.074	<0.093	<0.20	<0.10
ME390109.004	S05	11/05/2026	<0.072	<0.083	<0.073	<0.10	<0.097	0.1	<0.085	<0.080	0.2	<0.084	<0.083	<0.087	<0.13	<0.097	<0.085	<0.11	<0.23	<0.12
ME390496.004	S05	8/06/2026		0.010	<0.0028	0.007	<0.0038	0.020	0.006	0.003	0.018	<0.0033	<0.0032	<0.0034	<0.0051	0.008	0.011	<0.0041	<0.0088	<0.0046
ME391219.004	S05	6/07/2026	0.059	0.060	<0.035	0.052	<0.046	0.14	<0.041	<0.038	0.14	<0.040	<0.039	<0.041	<0.062	0.048	0.078	<0.050	<0.11	<0.056

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isooctane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME386974.005	S06	4/12/2025	0.1	0.1	<0.066	<0.093	<0.088	0.2	0.1	<0.073	0.2	<0.076	<0.075	<0.079	0.3	0.2	<0.077	<0.096	<0.20	<0.11
ME387251.005	S06	18/12/2025	0.2	0.1	<0.067	<0.093	<0.089	0.2	<0.078	<0.073	0.3	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME387497.005	S06	5/01/2026	0.1	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.3	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.005	S06	19/01/2026	0.2	0.1	<0.066	<0.092	<0.087	0.3	0.1	0.1	0.4	<0.075	<0.074	<0.078	0.2	0.2	<0.077	<0.095	<0.20	0.1
ME388421.005	S06	3/02/2026	0.1	0.1	<0.062	<0.087	<0.082	0.2	<0.072	<0.068	0.4	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.005	S06	17/02/2026	0.3	0.3	<0.066	<0.092	<0.087	0.8	0.1	0.1	0.6	0.2	<0.075	<0.078	0.2	0.2	0.2	<0.096	<0.20	0.2
ME388735.004	S06	4/03/2026	0.2	0.1	<0.063	<0.088	<0.083	0.3	0.1	<0.069	0.4	<0.072	<0.071	<0.074	0.1	0.1	0.1	<0.091	<0.19	<0.10
ME388800.004	S06	18/03/2026	0.2	0.3	<0.067	<0.094	<0.089	0.5	0.1	<0.074	<0.085	0.1	<0.076	<0.080	0.2	0.1	0.1	<0.098	<0.21	<0.11
ME389153.005	S06	30/03/2026	0.3	0.2	<0.077	<0.11	<0.10	0.5	0.1	<0.085	<0.097	0.1	<0.087	<0.091	0.2	0.1	0.1	<0.11	<0.24	<0.12
ME389565.005	S06	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	0.2	<0.078	<0.074	0.2	<0.077	<0.076	<0.080	<0.12	<0.089	<0.078	<0.098	<0.21	<0.11
ME389734.005	S06	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.085	<0.070	<0.074	<0.070	<0.062	<0.073	<0.072	<0.076	<0.11	<0.085	<0.074	<0.093	<0.20	<0.10
ME390109.005	S06	11/05/2026	<0.072	0.1	<0.073	<0.10	<0.097	0.3	<0.085	<0.080	0.2	<0.084	<0.083	<0.086	0.1	<0.097	0.1	<0.11	<0.22	<0.12
ME390496.005	S06	8/06/2026		0.012	<0.0028	0.006	<0.0038	0.028	0.008	0.005	0.017	<0.0033	<0.0032	<0.0034	0.007	0.011	0.011	<0.0041	<0.0088	0.005
ME391219.005	S06	6/07/2026	0.077	0.1	<0.035	0.060	<0.046	0.19	0.046	<0.038	0.13	<0.040	<0.039	<0.041	<0.062	0.16	0.090	<0.051	<0.11	<0.056
ME386974.006	S07	4/12/2025	0.1	0.1	<0.066	<0.093	<0.088	0.3	0.1	<0.073	0.3	<0.076	<0.075	<0.079	0.4	0.2	0.1	<0.096	<0.20	<0.11
ME387251.006	S07	18/12/2025	0.1	<0.076	<0.067	<0.093	<0.089	0.2	<0.078	<0.073	0.2	<0.077	<0.076	<0.079	0.1	0.1	<0.078	<0.097	<0.21	<0.11
ME387497.006	S07	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.006	S07	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.2	<0.075	<0.074	<0.078	0.1	0.1	<0.077	<0.095	<0.20	<0.11
ME388421.006	S07	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	0.1	<0.072	<0.068	0.2	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.006	S07	17/02/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.3	0.1	<0.072	0.3	<0.076	<0.075	<0.078	0.1	0.1	0.2	<0.096	<0.20	<0.11
ME388735.005	S07	4/03/2026	<0.062	<0.071	<0.063	<0.088	<0.083	0.2	<0.073	<0.069	0.1	<0.072	<0.071	<0.074	0.1	<0.083	0.1	<0.091	<0.19	<0.10
ME389153.006	S07	30/03/2026	<0.076	<0.087	<0.077	<0.11	<0.10	0.2	<0.090	<0.085	<0.098	<0.089	<0.087	<0.092	<0.14	<0.10	<0.090	<0.11	<0.24	<0.12
ME389565.006	S07	13/04/2026	<0.067	<0.076	<0.067	<0.094	<0.090	0.1	<0.079	<0.074	0.1	<0.077	<0.076	<0.080	<0.12	<0.090	<0.079	<0.098	<0.21	<0.11
ME389734.006	S07	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.085	<0.070	<0.074	<0.070	<0.062	<0.073	<0.072	<0.075	<0.11	<0.085	<0.074	<0.093	<0.20	<0.10
ME390109.006	S07	11/05/2026	<0.072	<0.083	<0.073	<0.10	<0.097	0.2	<0.085	<0.080	0.1	<0.084	<0.083	<0.086	<0.13	<0.097	<0.085	<0.11	<0.22	<0.12
ME390496.006	S07	8/06/2026		0.008	<0.0028	0.006	<0.0038	0.021	0.006	0.004	0.013	<0.0033	<0.0032	<0.0034	<0.0051	0.007	0.010	<0.0041	<0.0088	<0.0046
ME391219.006	S07	6/07/2026	0.048	0.059	<0.035	0.053	<0.046	0.16	<0.041	<0.038	0.12	<0.040	<0.039	<0.041	<0.062	0.059	0.072	<0.051	<0.11	<0.056
ME386974.007	S08	4/12/2025	0.1	0.1	<0.066	<0.093	<0.088	0.3	0.1	<0.073	0.4	<0.076	<0.075	<0.079	0.3	0.2	0.1	<0.096	<0.20	<0.11
ME387251.007	S08	18/12/2025	0.2	0.2	<0.067	<0.094	<0.089	0.5	0.2	0.1	0.4	<0.077	<0.076	<0.079	0.1	0.2	0.2	<0.097	<0.21	0.1
ME387497.007	S08	5/01/2026	<0.051	0.1	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	<0.068	0.2	<0.075	<0.16	<0.083
ME387835.007	S08	19/01/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.2	0.1	<0.072	0.2	<0.075	<0.074	<0.078	0.1	<0.087	<0.076	<0.095	<0.20	<0.11
ME388421.007	S08	3/02/2026	<0.061	0.1	<0.062	<0.087	<0.082	0.2	0.1	0.1	0.2	<0.071	<0.070	<0.073	<0.11	0.1	<0.072	<0.090	<0.19	<0.099

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isooctane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME388476.007	S08	17/02/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.2	<0.077	<0.072	0.2	<0.076	<0.075	<0.078	<0.12	0.1	0.2	<0.096	<0.20	<0.11
ME388735.006	S08	4/03/2026	<0.062	0.2	<0.063	0.1	<0.083	0.4	0.2	0.1	0.3	<0.072	<0.071	<0.074	0.1	0.2	0.3	<0.091	<0.19	<0.10
ME388800.005	S08	18/03/2026	0.1	0.3	<0.067	0.3	<0.089	0.6	0.3	0.3	<0.085	<0.077	<0.076	<0.080	0.2	0.3	0.5	<0.098	<0.21	0.1
ME389153.007	S08	30/03/2026	<0.077	0.1	<0.078	<0.11	<0.10	0.2	0.1	<0.085	<0.098	<0.089	<0.088	<0.092	<0.14	<0.10	0.1	<0.11	<0.24	<0.12
ME389565.007	S08	13/04/2026	<0.066	0.1	<0.067	<0.094	<0.089	0.2	<0.078	0.1	0.3	<0.077	<0.076	<0.079	<0.12	<0.089	0.1	<0.097	<0.21	<0.11
ME389734.007	S08	28/04/2026	0.2	0.2	<0.064	<0.089	<0.084	0.4	0.1	0.1	0.9	<0.073	<0.072	<0.075	<0.11	0.2	0.2	<0.092	<0.20	<0.10
ME390109.007	S08	11/05/2026	0.1	0.1	<0.073	<0.10	<0.097	0.2	0.1	<0.081	0.4	<0.084	<0.083	<0.087	<0.13	0.1	0.1	<0.11	<0.23	<0.12
ME390496.007	S08	8/06/2026		0.021	<0.0028	0.011	<0.0038	0.044	0.016	0.012	0.063	0.004	<0.0032	<0.0034	0.012	0.022	0.025	0.004	<0.0088	0.010
ME391219.007	S08	6/07/2026	0.6	0.44	<0.035	0.15	<0.046	1.2	0.31	0.17	0.87	0.1	<0.039	<0.041	0.2	0.39	0.29	0.1	<0.11	0.1
ME386974.008	S08.1	4/12/2025	0.1	0.1	<0.066	<0.093	<0.088	0.3	0.1	<0.073	0.4	<0.076	<0.075	<0.079	0.3	0.2	0.1	<0.096	<0.20	0.1
ME387251.008	S08.1	18/12/2025	0.2	0.2	<0.067	0.1	<0.089	0.5	0.2	0.1	0.5	0.1	<0.076	<0.079	0.2	0.2	0.2	<0.097	<0.21	0.1
ME387497.008	S08.1	5/01/2026	<0.051	0.1	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	0.1	0.2	<0.075	<0.16	<0.083
ME387835.008	S08.1	19/01/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.2	0.1	0.1	0.2	<0.075	<0.074	<0.078	0.1	<0.087	<0.076	<0.095	<0.20	<0.11
ME388421.008	S08.1	3/02/2026	<0.061	0.1	<0.062	<0.087	<0.082	0.2	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	0.1	<0.072	<0.090	<0.19	<0.099
ME388476.008	S08.1	17/02/2026	<0.065	0.1	<0.066	<0.092	<0.087	0.1	0.1	<0.072	0.2	<0.076	<0.075	<0.078	<0.12	0.1	0.2	<0.096	<0.20	<0.11
ME388735.007	S08.1	4/03/2026	<0.062	0.2	<0.063	0.1	<0.083	0.4	0.2	0.2	0.3	<0.072	<0.071	<0.074	0.1	0.2	0.3	<0.091	<0.19	0.1
ME388800.006	S08.1	18/03/2026	0.1	0.4	<0.067	0.3	<0.089	0.6	0.3	0.3	<0.085	<0.077	<0.076	<0.080	0.2	0.4	0.5	<0.098	<0.21	0.1
ME389153.008	S08.1	30/03/2026	<0.077	0.1	<0.078	<0.11	<0.10	0.2	<0.091	0.1	<0.098	<0.089	<0.088	<0.092	<0.14	0.1	0.1	<0.11	<0.24	<0.12
ME389565.008	S08.1	13/04/2026	<0.066	0.1	<0.067	<0.094	<0.089	0.3	<0.078	0.1	0.3	<0.077	<0.076	<0.079	<0.12	0.1	0.2	<0.097	<0.21	<0.11
ME389734.008	S08.1	28/04/2026	0.2	0.2	<0.064	<0.089	<0.084	0.4	0.1	0.1	1	<0.073	<0.072	<0.075	<0.11	0.2	0.2	<0.092	<0.20	<0.10
ME390109.008	S08.1	11/05/2026	0.1	0.1	<0.073	<0.10	<0.097	0.2	0.1	<0.081	0.4	<0.084	<0.083	<0.087	<0.13	0.1	0.1	<0.11	<0.23	<0.12
ME390496.008	S08.1	8/06/2026		0.023	<0.0028	0.010	<0.0038	0.048	0.016	0.013	0.057	0.004	<0.0032	<0.0034	0.011	0.020	0.024	0.004	<0.0088	0.008
ME391219.008	S08.1	6/07/2026	0.59	0.44	<0.035	0.16	<0.046	1.2	0.32	0.13	0.86	0.1	<0.039	<0.041	0.2	0.47	0.29	0.1	<0.11	0.2
ME386974.009	S09	4/12/2025	0.1	<0.075	<0.066	<0.093	<0.088	0.2	0.1	<0.073	0.3	<0.076	<0.075	<0.079	0.3	0.1	0.2	<0.096	<0.20	<0.11
ME387251.009	S09	18/12/2025	0.1	0.1	<0.067	<0.094	<0.089	0.3	0.1	<0.074	0.3	<0.077	<0.076	<0.079	<0.12	0.1	0.1	<0.097	<0.21	<0.11
ME387497.009	S09	5/01/2026	<0.051	<0.058	<0.052	<0.072	<0.068	0.1	<0.060	<0.057	0.1	<0.059	<0.058	<0.061	<0.092	<0.068	<0.060	<0.075	<0.16	<0.083
ME387835.009	S09	19/01/2026	<0.065	<0.074	<0.066	<0.092	<0.087	0.1	<0.076	<0.072	0.1	<0.075	<0.074	<0.078	<0.12	<0.087	<0.076	<0.095	<0.20	<0.11
ME388421.009	S09	3/02/2026	<0.061	<0.070	<0.062	<0.087	<0.082	0.1	<0.072	<0.068	0.1	<0.071	<0.070	<0.073	<0.11	<0.082	<0.072	<0.090	<0.19	<0.099
ME388476.009	S09	17/02/2026	<0.065	<0.075	<0.066	<0.092	<0.087	0.1	<0.077	<0.072	0.1	<0.076	<0.075	<0.078	<0.12	<0.087	0.2	<0.096	<0.20	<0.11
ME388735.008	S09	4/03/2026	<0.062	0.1	<0.063	<0.088	<0.083	0.2	0.1	0.1	0.2	<0.072	<0.071	<0.074	<0.11	<0.083	0.2	<0.091	<0.19	<0.10
ME388800.007	S09	18/03/2026	<0.067	0.1	<0.067	<0.094	<0.089	0.2	0.1	0.1	<0.085	<0.077	<0.076	<0.080	<0.12	0.1	0.2	<0.098	<0.21	<0.11
ME389153.009	S09	30/03/2026	<0.077	<0.088	<0.078	<0.11	<0.10	0.1	<0.091	<0.085	<0.098	<0.089	<0.088	<0.092	<0.14	<0.10	<0.091	<0.11	<0.24	<0.12

Sample Name	Sample Location	Sample End Date	Ethyl acetate	Ethylbenzene	Isobutanol	Isooctane	Isopropylbenzene	m&p-Xylenes	Methylcyclohexane	Methylcyclopentane	Methylethylketone	Methylisobutylketone	Methyl methacrylate	Methyl-ter-butyl ether	n-decane	n-Heptane	n-Hexane	N-Octane	Naphthalene	N-Nonane
ME389565.009	S09	13/04/2026	<0.066	<0.076	<0.067	<0.094	<0.089	0.1	<0.078	<0.074	0.1	<0.077	<0.076	<0.079	<0.12	<0.089	<0.078	<0.097	<0.21	<0.11
ME389734.009	S09	28/04/2026	<0.063	<0.072	<0.064	<0.089	<0.084	0.2	<0.074	<0.070	0.3	<0.073	<0.072	<0.075	<0.11	<0.084	0.1	<0.092	<0.20	<0.10
ME390109.009	S09	11/05/2026	<0.072	<0.083	<0.073	<0.10	<0.097	0.1	<0.085	<0.081	0.2	<0.084	<0.083	<0.087	<0.13	<0.097	<0.085	<0.11	<0.23	<0.12
ME390496.009	S09	8/06/2026		0.009	<0.0028	0.007	<0.0038	0.022	0.007	0.004	0.025	<0.0033	<0.0032	<0.0034	0.005	0.008	0.012	<0.0041	<0.0088	<0.0046
ME391219.009	S09	6/07/2026	0.19	0.18	<0.035	0.072	<0.046	0.47	0.12	0.054	0.33	0.041	<0.039	<0.041	0.1	0.17	0.15	<0.050	<0.11	<0.056

Sample Name	Sample Location	Sample End Date	n-Propylbenzene	N-Undecane	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trichloroethylene	Trichloromethane	Xylenes	Total BTEX
ME386975.001	S01	5/12/2025	<0.090	0.2	<0.079	<0.084	<0.087	0.4	<0.075	<0.069	0.1	0.6
ME387360.001	S01	22/12/2025	<0.075	<0.18	<0.065	<0.070	<0.072	0.2	<0.062	<0.057	<0.065	0.2
ME387498.001	S01	5/01/2026	<0.089	<0.21	<0.078	<0.084	<0.086	0.2	<0.074	<0.068	0.1	0.3
ME387836.001	S01	19/01/2026	<0.089	<0.21	0.1	<0.083	<0.086	0.3	<0.073	<0.067	0.3	0.7
ME388420.001	S01	3/02/2026	<0.083	<0.20	<0.073	<0.078	<0.080	0.2	<0.069	<0.063	<0.15	0.2
ME388477.001	S01	17/02/2026	<0.090	<0.21	<0.079	<0.084	<0.087	0.3	<0.074	<0.068	<0.079	0.3
ME388734.001	S01	4/03/2026	<0.084	<0.20	<0.074	<0.079	<0.082	0.3	<0.070	<0.064	<0.074	0.3
ME389000.001	S01	18/03/2026	<0.091	<0.22	<0.080	<0.085	<0.088	1.1	<0.075	<0.069	0.1	1.3
ME389152.001	S01	30/03/2026	<0.11	<0.25	<0.093	<0.099	<0.10	0.4	<0.087	<0.080	<0.093	0.4
ME389566.001	S01	13/04/2026	<0.091	<0.22	<0.079	<0.085	<0.088	0.3	<0.075	<0.069	<0.079	0.3
ME389735.001	S01	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.3	<0.071	<0.065	0.1	0.4
ME390110.001	S01	11/05/2026	<0.099	<0.24	<0.087	<0.093	<0.096	0.4	<0.082	<0.075	<0.087	0.4
ME390497.001	S01	8/06/2026	<0.0038	<0.0091	0.008	<0.0036	<0.0037	1.4	<0.0032	0.005	0.030	1.4
ME391220.001	S01	6/07/2026	<0.047	0.2	0.2	<0.044	<0.045	3.1	<0.039	<0.036	0.8	4.6
ME386974.001	S02	4/12/2025	<0.090	0.2	<0.079	<0.084	<0.087	0.5	<0.074	<0.068	0.2	0.7
ME387251.001	S02	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.2	<0.074	<0.069	<0.079	0.2
ME387497.001	S02	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	<0.061	0.2
ME387835.001	S02	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.2	<0.073	<0.067	<0.078	0.2
ME388421.001	S02	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	<0.15	0.2

Sample Name	Sample Location	Sample End Date	n-Propylbenzene	N-Undecane	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trichloroethylene	Trichloromethane	Xylenes	Total BTEX
ME388476.001	S02	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.074	<0.068	<0.15	0.3
ME389153.001	S02	30/03/2026	<0.11	<0.25	<0.093	<0.099	<0.10	0.3	<0.087	<0.080	0.1	0.4
ME389565.001	S02	13/04/2026	<0.091	<0.22	<0.079	<0.085	<0.087	0.2	<0.075	<0.069	<0.079	0.2
ME389734.001	S02	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.3	<0.071	<0.065	0.1	0.4
ME390109.001	S02	11/05/2026	<0.099	<0.23	<0.087	<0.092	<0.095	0.4	<0.082	<0.075	0.1	0.5
ME390496.001	S02	8/06/2026	<0.0038	<0.0091	0.005	<0.0036	<0.0037	0.6	<0.0032	0.004	0.020	0.6
ME391219.001	S02	6/07/2026	<0.047	<0.11	0.064	<0.044	<0.045	1.6	<0.039	<0.036	0.27	2.2
ME386974.002	S03	4/12/2025	<0.090	0.3	<0.079	<0.084	<0.087	0.4	<0.074	<0.068	0.2	0.5
ME387251.002	S03	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.3	<0.074	<0.069	0.1	0.3
ME387497.002	S03	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	0.1	0.2
ME387835.002	S03	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.2	<0.073	<0.067	0.1	0.3
ME388421.002	S03	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	<0.15	0.2
ME388476.002	S03	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.074	<0.068	0.1	0.4
ME388735.001	S03	4/03/2026	<0.085	<0.20	<0.074	<0.079	<0.082	0.2	<0.070	<0.064	0.1	0.3
ME388800.001	S03	18/03/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.4	<0.075	<0.069	<0.080	0.4
ME389153.002	S03	30/03/2026	<0.11	<0.25	<0.092	<0.098	<0.10	0.3	<0.087	<0.080	<0.092	0.3
ME389565.002	S03	13/04/2026	<0.091	<0.22	<0.079	<0.085	<0.087	0.2	<0.075	<0.069	<0.079	0.2
ME389734.002	S03	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.4	<0.071	<0.065	0.1	0.5
ME390109.002	S03	11/05/2026	<0.098	<0.23	<0.086	<0.092	<0.095	0.5	<0.081	<0.075	0.1	0.5
ME390496.002	S03	8/06/2026	<0.0038	<0.0091	0.004	<0.0036	<0.0037	0.3	<0.0032	0.004	0.018	0.3
ME391219.002	S03	6/07/2026	<0.047	<0.11	0.060	<0.044	<0.045	0.92	<0.039	0.037	0.22	1.4
ME386974.003	S04	4/12/2025	<0.090	0.2	<0.079	<0.084	<0.087	0.3	<0.074	<0.068	0.2	0.5
ME387251.003	S04	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.3	<0.074	<0.069	0.1	0.3
ME387497.003	S04	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	0.1	0.2
ME387835.003	S04	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.073	<0.067	0.1	0.4
ME388421.003	S04	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	<0.15	0.2
ME388476.003	S04	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.2	<0.073	<0.068	0.1	0.3
ME388735.002	S04	4/03/2026	<0.085	<0.20	<0.074	<0.079	<0.082	0.2	<0.070	<0.065	<0.074	0.2
ME388800.002	S04	18/03/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.2	<0.075	<0.069	0.1	0.3
ME389153.003	S04	30/03/2026	<0.10	<0.25	<0.092	<0.098	<0.10	0.2	<0.087	<0.080	0.1	0.3
ME389565.003	S04	13/04/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.2	<0.075	<0.069	<0.080	0.2
ME389734.003	S04	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.2	<0.071	<0.065	0.1	0.3

Sample Name	Sample Location	Sample End Date	n-Propylbenzene	N-Undecane	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trichloroethylene	Trichloromethane	Xylenes	Total BTEX
ME390109.003	S04	11/05/2026	<0.099	<0.23	<0.086	<0.092	<0.095	0.4	<0.081	<0.075	0.1	0.6
ME390496.003	S04	8/06/2026	<0.0038	<0.0091	0.007	<0.0036	<0.0037	0.1	<0.0032	0.004	0.027	0.1
ME391219.003	S04	6/07/2026	<0.047	<0.11	0.070	<0.044	<0.045	0.51	<0.039	<0.036	0.21	0.92
ME386974.004	S05	4/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.4	<0.074	<0.068	0.2	0.5
ME387251.004	S05	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.3	<0.074	<0.069	0.1	0.4
ME387497.004	S05	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	0.1	0.2
ME387835.004	S05	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.073	<0.067	0.1	0.4
ME388421.004	S05	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	<0.15	0.2
ME388476.004	S05	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.2	<0.074	<0.068	<0.078	0.2
ME388735.003	S05	4/03/2026	<0.085	<0.20	<0.074	<0.079	<0.082	0.2	<0.070	<0.064	<0.074	0.2
ME388800.003	S05	18/03/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.2	<0.075	<0.069	0.1	0.3
ME389153.004	S05	30/03/2026	<0.10	<0.25	<0.092	<0.098	<0.10	0.2	<0.086	<0.080	0.1	0.3
ME389565.004	S05	13/04/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.3	<0.075	<0.069	<0.080	0.3
ME389734.004	S05	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.2	<0.071	<0.065	<0.075	0.2
ME390109.004	S05	11/05/2026	<0.099	<0.23	<0.087	<0.092	<0.096	0.5	<0.082	<0.075	0.1	0.6
ME390496.004	S05	8/06/2026	<0.0038	<0.0091	0.007	<0.0036	<0.0037	0.1	<0.0032	<0.0029	0.027	0.1
ME391219.004	S05	6/07/2026	<0.047	<0.11	0.064	<0.044	<0.045	0.46	<0.039	<0.036	0.21	0.83
ME386974.005	S06	4/12/2025	<0.090	<0.21	0.1	<0.084	<0.087	0.5	<0.074	<0.068	0.3	0.9
ME387251.005	S06	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.4	<0.075	<0.069	0.2	0.7
ME387497.005	S06	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	0.1	0.3
ME387835.005	S06	19/01/2026	<0.089	<0.21	0.1	<0.083	<0.086	0.5	0.1	<0.067	0.4	1
ME388421.005	S06	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.3	<0.069	<0.064	0.2	0.6
ME388476.005	S06	17/02/2026	<0.089	0.2	0.3	<0.083	<0.086	0.7	<0.073	<0.068	1.1	2.1
ME388735.004	S06	4/03/2026	<0.085	<0.20	0.1	<0.079	<0.082	1.3	<0.070	<0.064	0.4	1.9
ME388800.004	S06	18/03/2026	<0.091	<0.22	0.2	<0.085	<0.088	0.7	<0.075	<0.069	0.7	1.7
ME389153.005	S06	30/03/2026	<0.10	<0.25	0.2	<0.097	<0.10	0.9	<0.086	<0.079	0.6	1.7
ME389565.005	S06	13/04/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.4	<0.075	<0.069	0.2	0.5
ME389734.005	S06	28/04/2026	<0.086	<0.20	<0.076	<0.081	<0.083	0.2	<0.071	<0.065	<0.076	0.2
ME390109.005	S06	11/05/2026	<0.099	<0.23	0.1	<0.092	<0.095	0.5	<0.081	<0.075	0.4	1.1
ME390496.005	S06	8/06/2026	<0.0038	<0.0091	0.010	<0.0036	<0.0037	0.1	<0.0032	<0.0029	0.038	0.1
ME391219.005	S06	6/07/2026	<0.047	<0.11	0.087	<0.044	<0.045	0.55	<0.039	<0.036	0.28	1
ME386974.006	S07	4/12/2025	<0.090	0.3	0.1	<0.084	<0.087	0.5	<0.074	<0.068	0.4	1

Sample Name	Sample Location	Sample End Date	n-Propylbenzene	N-Undecane	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trichloroethylene	Trichloromethane	Xylenes	Total BTEX
ME387251.006	S07	18/12/2025	<0.090	<0.21	<0.079	<0.084	<0.087	0.4	<0.075	<0.069	0.2	0.5
ME387497.006	S07	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.1	<0.058	<0.053	0.1	0.2
ME387835.006	S07	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.073	<0.067	0.1	0.4
ME388421.006	S07	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	0.1	0.3
ME388476.006	S07	17/02/2026	<0.089	<0.21	0.1	<0.083	<0.086	0.4	<0.073	<0.068	0.4	1
ME388735.005	S07	4/03/2026	<0.085	<0.20	<0.074	<0.079	<0.082	0.6	<0.070	<0.064	0.2	0.8
ME389153.006	S07	30/03/2026	<0.10	<0.25	<0.092	<0.098	<0.10	0.4	<0.086	<0.079	0.2	0.5
ME389565.006	S07	13/04/2026	<0.091	<0.22	<0.080	<0.085	<0.088	0.3	<0.075	<0.069	0.1	0.4
ME389734.006	S07	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.2	<0.071	<0.065	<0.075	0.2
ME390109.006	S07	11/05/2026	<0.099	<0.23	<0.086	<0.092	<0.095	0.4	<0.081	<0.075	0.2	0.6
ME390496.006	S07	8/06/2026	<0.0038	<0.0091	0.007	<0.0036	<0.0037	0.1	<0.0032	<0.0029	0.028	0.1
ME391219.006	S07	6/07/2026	<0.047	<0.11	0.060	<0.044	<0.045	0.41	<0.039	<0.036	0.23	0.79
ME386974.007	S08	4/12/2025	<0.090	0.3	0.1	<0.084	<0.087	0.6	<0.074	<0.068	0.4	1.2
ME387251.007	S08	18/12/2025	<0.090	<0.21	0.2	<0.084	<0.087	1.9	<0.075	<0.069	0.6	2.7
ME387497.007	S08	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.3	<0.058	<0.053	0.1	0.5
ME387835.007	S08	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.073	<0.067	0.2	0.6
ME388421.007	S08	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.4	<0.069	<0.064	0.2	0.6
ME388476.007	S08	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.4	<0.073	<0.068	0.2	0.6
ME388735.006	S08	4/03/2026	<0.085	<0.20	0.2	<0.079	<0.082	1.1	<0.070	<0.064	0.6	1.9
ME388800.005	S08	18/03/2026	<0.091	<0.22	0.3	<0.085	<0.088	1.5	<0.075	<0.069	0.9	2.8
ME389153.007	S08	30/03/2026	<0.10	<0.25	0.1	<0.098	<0.10	0.5	<0.087	<0.080	0.3	0.9
ME389565.007	S08	13/04/2026	<0.090	<0.21	0.1	<0.084	<0.087	1	<0.075	<0.069	0.3	1.4
ME389734.007	S08	28/04/2026	<0.086	<0.20	0.2	<0.080	<0.083	0.6	<0.071	<0.065	0.5	1.3
ME390109.007	S08	11/05/2026	<0.099	<0.23	0.1	<0.092	<0.096	0.5	<0.082	<0.075	0.3	0.9
ME390496.007	S08	8/06/2026	<0.0038	0.015	0.017	<0.0036	<0.0037	0.2	<0.0032	<0.0029	0.061	0.3
ME391219.007	S08	6/07/2026	0.1	0.3	0.47	<0.044	<0.045	1.7	<0.039	<0.036	1.7	3.9
ME386974.008	S08.1	4/12/2025	<0.090	0.2	0.1	<0.084	<0.087	0.6	<0.074	<0.068	0.4	1.1
ME387251.008	S08.1	18/12/2025	<0.090	0.2	0.2	<0.084	<0.087	2.1	<0.075	<0.069	0.7	3.1
ME387497.008	S08.1	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.3	<0.058	<0.053	0.1	0.5
ME387835.008	S08.1	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.4	<0.073	<0.067	0.2	0.7
ME388421.008	S08.1	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.4	<0.069	<0.064	0.2	0.6
ME388476.008	S08.1	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.4	<0.073	<0.068	0.1	0.6

Sample Name	Sample Location	Sample End Date	n-Propylbenzene	N-Undecane	o-Xylene	Styrene	Tetrachloroethylene	Toluene	Trichloroethylene	Trichloromethane	Xylenes	Total BTEX
ME388735.007	S08.1	4/03/2026	<0.085	<0.20	0.2	<0.079	<0.082	1.1	<0.070	<0.064	0.6	1.9
ME388800.006	S08.1	18/03/2026	<0.091	<0.22	0.3	<0.085	<0.088	1.6	<0.075	<0.069	0.9	2.9
ME389153.008	S08.1	30/03/2026	<0.10	<0.25	0.1	<0.098	<0.10	0.6	<0.087	<0.080	0.4	1
ME389565.008	S08.1	13/04/2026	<0.090	<0.21	0.1	<0.084	<0.087	1	<0.075	<0.069	0.3	1.5
ME389734.008	S08.1	28/04/2026	<0.086	<0.20	0.2	<0.080	<0.083	0.6	<0.071	<0.065	0.6	1.3
ME390109.008	S08.1	11/05/2026	<0.099	<0.23	0.1	<0.092	<0.096	0.6	<0.082	<0.075	0.3	1
ME390496.008	S08.1	8/06/2026	<0.0038	0.012	0.016	<0.0036	<0.0037	0.2	<0.0032	0.003	0.064	0.3
ME391219.008	S08.1	6/07/2026	0.1	0.2	0.49	<0.044	<0.045	1.7	<0.039	<0.036	1.7	3.9
ME386974.009	S09	4/12/2025	<0.090	0.3	<0.079	<0.084	<0.086	0.4	<0.074	<0.068	0.2	0.6
ME387251.009	S09	18/12/2025	<0.090	<0.21	0.1	<0.084	<0.087	0.8	<0.075	<0.069	0.3	1.2
ME387497.009	S09	5/01/2026	<0.070	<0.17	<0.061	<0.065	<0.067	0.2	<0.058	<0.053	0.1	0.2
ME387835.009	S09	19/01/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.2	<0.073	<0.067	0.1	0.3
ME388421.009	S09	3/02/2026	<0.084	<0.20	<0.073	<0.078	<0.081	0.2	<0.069	<0.064	0.1	0.3
ME388476.009	S09	17/02/2026	<0.089	<0.21	<0.078	<0.083	<0.086	0.3	<0.073	<0.068	0.1	0.4
ME388735.008	S09	4/03/2026	<0.085	<0.20	0.1	<0.079	<0.082	0.5	<0.070	<0.064	0.3	0.8
ME388800.007	S09	18/03/2026	<0.091	<0.22	0.1	<0.085	<0.088	0.8	<0.075	<0.069	0.3	1.2
ME389153.009	S09	30/03/2026	<0.10	<0.25	<0.092	<0.098	<0.10	0.4	<0.087	<0.080	0.1	0.5
ME389565.009	S09	13/04/2026	<0.091	<0.22	<0.079	<0.085	<0.088	0.3	<0.075	<0.069	0.1	0.4
ME389734.009	S09	28/04/2026	<0.086	<0.20	<0.075	<0.080	<0.083	0.3	<0.071	<0.065	0.2	0.5
ME390109.009	S09	11/05/2026	<0.099	<0.23	<0.087	<0.092	<0.096	0.4	<0.082	<0.075	0.1	0.5
ME390496.009	S09	8/06/2026	<0.0038	<0.0091	0.008	<0.0036	<0.0037	0.1	<0.0032	<0.0029	0.030	0.2
ME391219.009	S09	6/07/2026	<0.047	<0.11	0.22	<0.044	<0.045	0.84	<0.039	<0.036	0.69	1.8

[illegible]

Appendix B RPD calculations



Together we create + sustain a better world