

# METHYL BROMIDE MODELLING STUDY – PORT OF TAURANGA



## APP203660 methyl bromide reassessment hearing

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# Project Summary

- There have been a number of dispersion modelling studies undertaken to assess the effects of methyl bromide fumigation events.
- Validation of the model predictions with monitoring data has been identified as a key data gap by WorkSafe and other stakeholders
- WorkSafe has commissioned a series of monitoring studies to measure methyl bromide downwind of individual fumigation events at the Port of Tauranga (10 out of a proposed monitoring events have been undertaken to date).
- PDP engaged to model the fumigation events.
- Modelling report can be found on the EPA's register of application documents webpage:
  - <https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203660/PDP-ModellingReport-WorkSafe-W02347800R002.pdf>





# Project Objectives

- To compare actual monitoring data with various modelling approaches and methodologies to identify most appropriate modelling for predicting dispersion.
- Improve understanding of dispersion from fumigation sources to help set buffer zones.



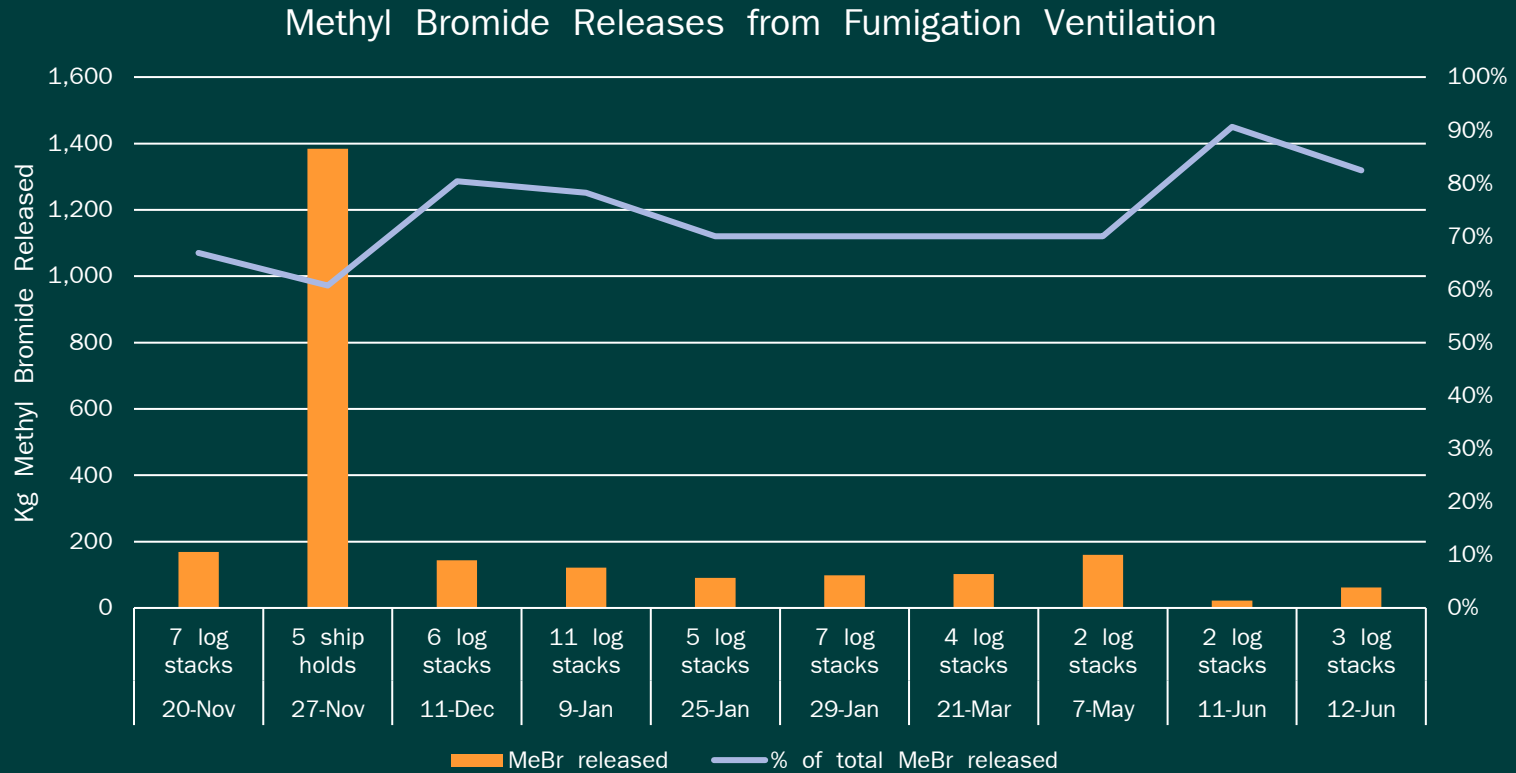


# Modelling Approach

- Model Selection - CALPUFF selected for its capability to model calm and variable winds, coastal effects, and sub-hourly time scales
- The modelling considered the ventilation phase of the fumigations over a 1-hour period
- Meteorological modelling datasets prepared using Port and BOPRC monitoring station data:
  - 1-hour time step – Current best practice modelling methodology, useful for predicting 1-hour averages for comparison with the 1-hour TEL.
  - 1-minute time step - investigational modelling to represent sub-hourly variations in emissions and meteorology.



# Summary of Fumigation Events





# Modelling inputs/outputs

## Inputs

- Meteorology (PoT, BOPRC, Air Matters)
- MeBr emissions (estimated by Genera for each log stack and ship hold)
- Source characteristics (locations, initial size of release, timing of release)

## Outputs

- Meteorological modelling datasets (1-hr and 1-minute time steps)
- Predicted ground level concentrations of methyl bromide throughout the modelling domain
- Model results comparison with monitoring data (SUMMA canisters, PIDs)



# Emissions estimation

For each fumigation release, Genera provided estimates of:

- Log volume
- Total enclosure volume
- Pre-ventilation concentration

Uncertainties in measurements likely due to irregularity of log stacks, homogeneity of concentrations throughout the log stack headspace.

Timing of ventilation provided by Air Matters spotters. Ventilation varies from 1 to several minutes per log stack.



Log Stack Fumigation (25 Jan)

# Meteorological Inputs



Met Stations with 1-minute data

PoT meteorological stations provide 1-minute average data. Used for developing sub-hourly met datasets for sub-hourly modelling by ASG.



Met Stations with 10-minute data

BOPRC meteorological stations provide 10-minute average data. Used for developing hourly met datasets.





# Source Parameterisation

- Log stacks modelled as series of volume sources.
- Volume source parameters informed by recommendations from previous modelling studies
- Orientation of log stacks, MeBr releases (kg), and timing of tarp removal provided by Air Matters reports.



Volume Sources for 9 January Modelling Event

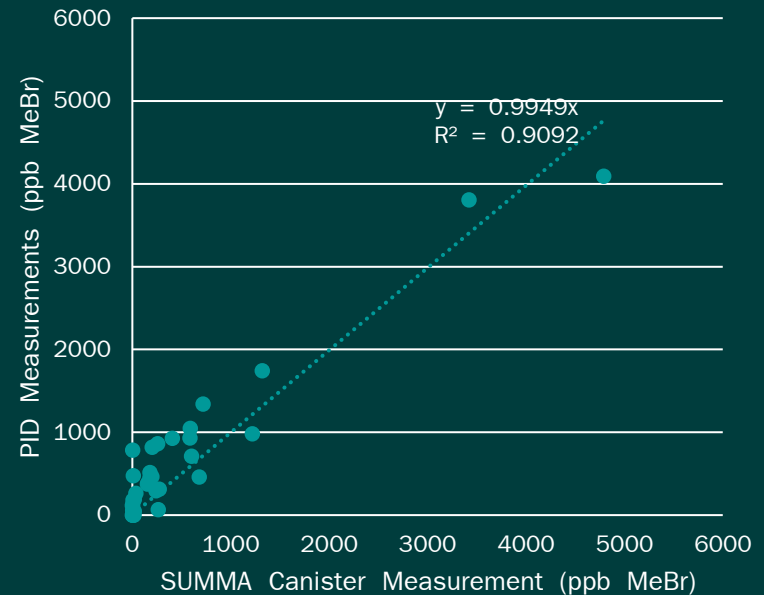


# Monitoring data

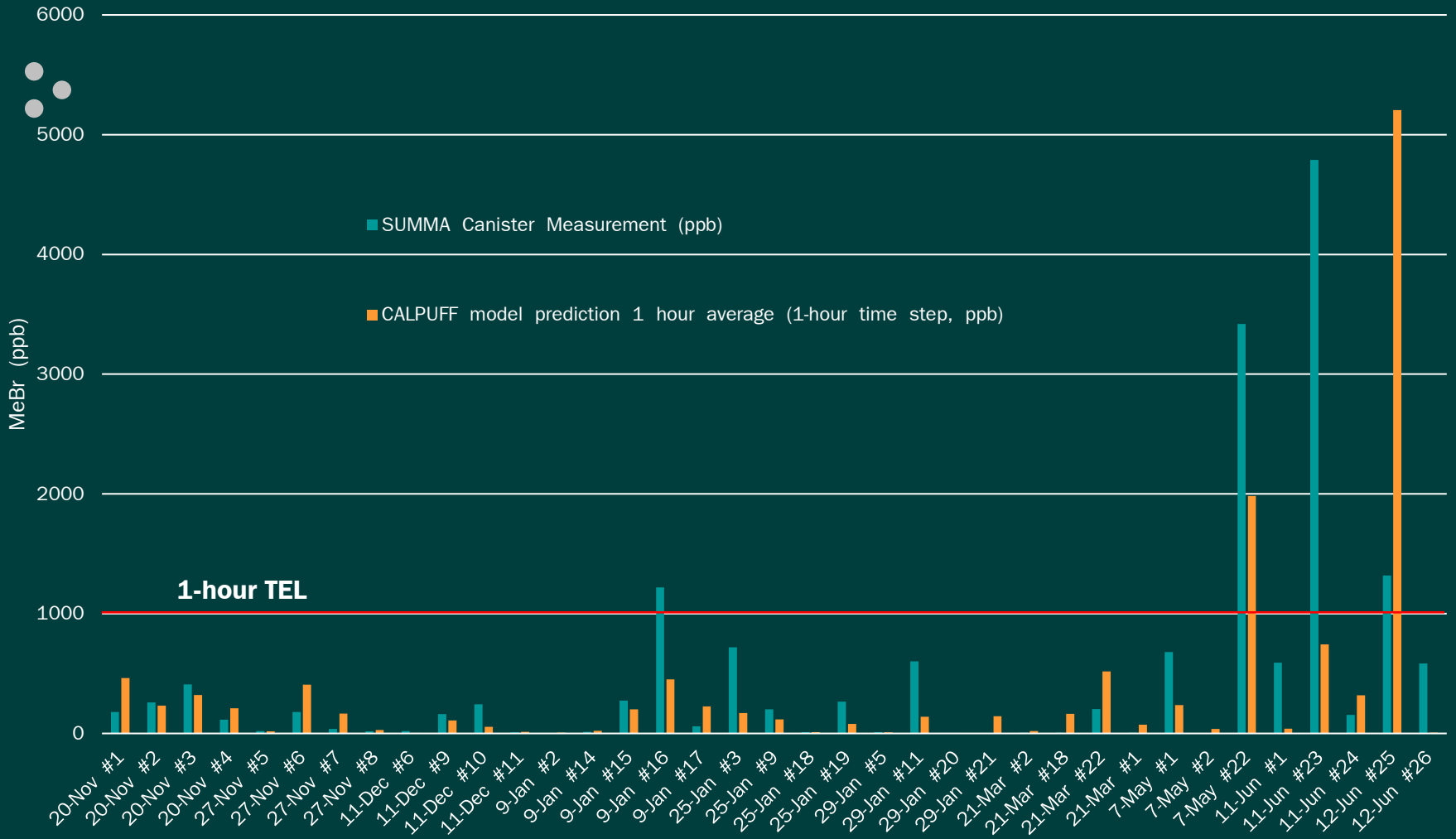
## Air Matters

- Two to four downwind monitoring sites per event.
- PIDs: instantaneous readings
- SUMMA Canisters – 1-hour and 24-hour integrated samples.
- PIDs influenced by other VOCs, notably pinenes and other terpenes from timber.

PID vs Canister-Sampled MeBr Concentrations

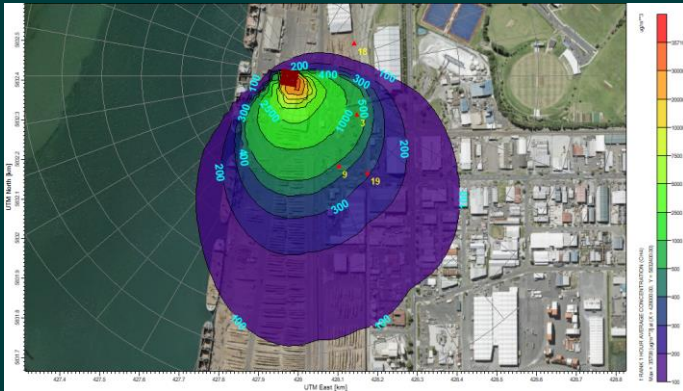


# Measured and Modelled MeBr (1-hour averages)

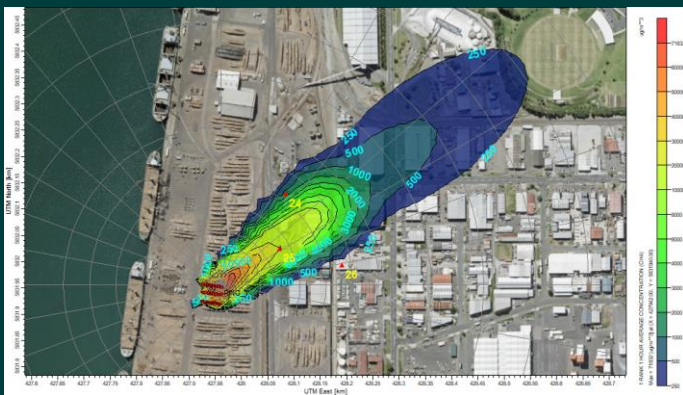


# Plume Dispersion

- Model predictions near the source of emission have steep concentration gradients, i.e. large changes in concentration over short distances
- Factors influencing dispersion of plume downwind of release:
  - Wind speed
  - Atmospheric stability
  - Orientation of volume sources relative to wind direction



Modelling Event for 25 Jan

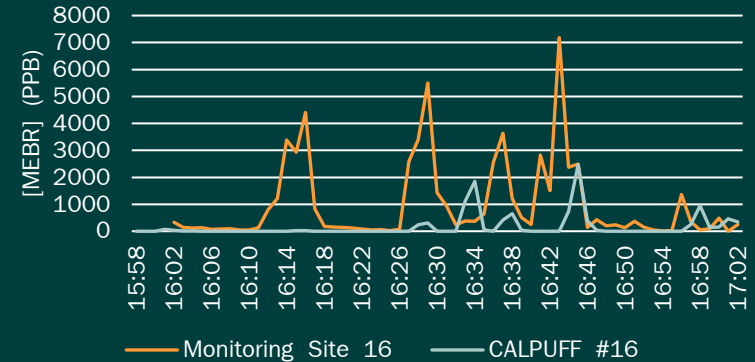


Modelling Event for 12 Jun

Date	WS (m/s)	Pasquill-Gifford Stability Class	Mixing Height (m)
25-Jan	2.1	A (Highly unstable)	1060
12-Jun	3.3	D (Neutral)	247

# Sub-hourly modelling (1-minute time step)

- Provides high resolution detail about transient events, but underpredicts concentrations
- Majority of methyl bromide disperses downwind within 1 minute of ventilation of log stacks.
- 1-hour average concentrations downwind of fumigation ventilation events consist of series of high concentration peaks.



Time Series for 9 January Modelling Event





# Conclusions and Next Steps

- PIDs good for indicative measurements of total VOCs but likely overestimate concentrations of methyl bromide.
- Modelling indicates that exceedances of the 1-hour TEL beyond Port boundary are likely to occur, though are limited to within close proximity of the Port boundary.
- Modelling of additional monitoring events will provide further case studies for assessment of model performance and be used to inform recommendations for separation distances.
- Drone monitoring will allow monitoring of normally inaccessible areas (e.g. offshore or on-port locations).
- Portable FTIR will provide methyl bromide-specific monitoring at higher time resolution (30s).

