MODELING AND MEASUREMENT OF METHYL BROMIDE EMISSIONS AT FOOD PROCESSING FACILITIES

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Methyl bromide is currently undergoing re-registration as required by the Food Quality Protection Act (FQPA) and FIFRA.[1] As part of this process, EPA performed a risk assessment, resulting in the identification of potential human health risks to workers (persons involved in the application of methyl bromide) and bystanders (persons who live or work in the vicinity of a fumigation site). To reduce these potential risks, EPA has proposed a number of mitigation measures, including site-specific fumigation management plans, respiratory protection, and buffer zones requiring posting and notification.

The focus of this study is the buffer zones that EPA developed using the PERFUM emission modeling program under a number of structure emission characteristics and fumigant application rate scenarios. The resulting buffer zones were in many cases quite large and would potentially restrain the ability of some facilities to continue their fumigation activities.

Under the sponsorship of the Methyl Bromide Industry Panel, a study to examine the emission patterns of methyl both during and after fumigation was developed. The objective was to determine if the buffer zones as developed by the PERFUM model were consistent with measured emission rates and downwind concentrations.

The technical approach was to collect time-dependent concentration data at the following points for both the treatment and aeration phases of the fumigation process:

- Building emission points (vents and stacks)—active and passive
- Interior of building at multiple points
- Downwind concentrations—both short-term (1, 2, 4 hours) and long-term (8, 16, 24 hour) samples
- Upwind concentrations (24-hour basis)
- Meteorological data using low threshold sonic anemometers (10 m and 2 m heights)
- Secondary meteorological data (3 m height) using standard sensors
- Laboratory analysis using high sensitivity GC/MS (detection limit down to 0.5 ppbv)

The Industrial Fumigant Company of Olathe, KS assisted in making contact with facility operators and arranged and conducted the fumigation activities that were tested. Three large

[1] US EPA. "Report of Food Quality Protection Act (FQPA) Tolerance Reassessment and Risk Management Decision (TRED) for Methyl Bromide, and Reregistration Eligibility Decision (RED) for Methyl Bromide's Commodity Uses," EPA 738-R-06-026, August, 2006

mills were selected for the initial studies—two flour mills and one rice mill. The volumes ranged from 1.2 to 1.8 million cubic feet. The age and construction of the buildings were considered in regards to the tightness and loss characteristics of the injected gas. Both passive and active aeration schemes were represented.

The treatment target was 16 oz/1000 ft^3, with a 24-hour exposure period followed by aeration (active—fans and/or vents, passive—windows, doors, vents, or a combination) for 16 to 24 hours.

During both parts of these phases, data were collected for various time periods to capture the time-dependence of the emissions and downwind concentrations. Shorter duration samples were collected during the initial periods followed by longer duration samples for the later samples.

The emission stacks and interior concentrations were measured using a multiple point manifold from which samples were analyzed using an on-line micro gas chromatograph. Sensitivity was on the order of 10 ppmv. Concentration data was collected at time intervals of 5 minutes to 1 hour over the entire treatment and aeration periods.

Based on information about building sizes, emission source characteristics and emission rate estimates, a preliminary model run was made using the general emission model Aermod. This model output was used to design the array of downwind sample collection points. The array was designed to capture concentrations at points ranging out from the building. The placement of samplers was affected by the suitability of collection points due to proximity to buildings, trees, roads, or other features that would impact correct sample collection.

Downwind ambient samples were collected using Bottle-Vac samplers with critical orifice flow controllers as well as Silonite-coated stainless steel canisters and variable-flow controllers. Analysis was performed by Ace Laboratory, Thousand Oaks, CA using EPA Compendium Method TO-15. Nominal detection limit was 1 ppbv for the Bottle-Vac samples and 0.5 ppbv for the canisters.

Meteorological data were collected on a 5-minute basis from both the 10 meter tower and the 3 meter tower.

The results of these tests were incorporated into the PERFUM2 model, which is a modified version of the EPA-approved PERFUM model used for soil fumigation emission dispersion calculations.

As of the date of this summary (August 31), the data were still being processed. The final results will be presented at the conference.