

ANALYSIS OF UNDER-CANOPY AIR IN GRAPE VINEYARDS  
TREATED WITH METHOMYL TO INVESTIGATE THE  
POTENTIAL FOR INHALATION EXPOSURE

by

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INTRODUCTION

Illness investigations in field workers have usually focused on dermal exposure as the route responsible for intoxication. The majority of illnesses classified by the California Department of Food and Agriculture have shown this to be the most likely route of exposure. Illnesses/injuries usually occur after extensive contact with excess residues on foliage, after spilling concentrate on the body or from coming in contact with spray drift during application. Speculation as to the contribution from other exposure routes has led to an investigation of the second most likely route, inhalation. The specific situation of field-worker inhalation exposure to airborne methomyl foliar residue was investigated. The dermal LD<sub>50</sub><rabbit> has been reported as >1,500 mg/kg, the oral LD<sub>50</sub><rat> as 17 mg/kg and the inhalation LC<sub>50</sub><rat> as 0.3 mg/l. The inhalation value LC<sub>50</sub> for a 70 kg male fieldworker, based on the rat value, is estimated as 60 mg/kg (assuming inhalation rate of 29 LPM in an 8 hour day).

## METHODS AND MATERIALS

Two separate blocks of grapes were selected for sampling; one of French Columbard grapes (sprayed 18 days earlier) and one of a seedless cultivar (sprayed 7 days earlier). Application rates on both were 0.675 pound of methomyl diluted in 100 gallons of water per acre. Both blocks also received a spreader-sticker, and a systemic fungicide; the Columbards were additionally treated with sulfur.

Airborne methomyl was collected using a sampling train consisting of a primary glass fiber filter with support pad housed in a plastic cassette (for particulate [1.0  $\mu\text{m}$  pore size]) and a secondary XAD-2 sorbent tube (for gas phase [vapor pressure  $5 \times 10^{-5}$  torr at  $25^\circ\text{C}$ ]). Average air flow was ~1.9 LPM.

Four rows in the seedless block and one row in the Columbard block were selected for sampling. Two pumps were located in each row. Both were located up inside the foliar canopy. Samples were taken in the morning for ~230 minutes and in the afternoon for ~180 minutes. During both sampling periods, one of the pump locations was subject to impact dislodgement. An aluminum bat was used to strike the vine and foliage close to the pump. The area was struck once per minute, with enough force to dislodge leaves from the plant. It was assumed that this force was also sufficient to free dislodgeable pesticide residues. Particulate material was seen to be generated during impact sampling, though the composition was unknown. Impact sampling lasted for approximately one hour. After sampling, all sampling media were capped and stored on dry ice.

In addition to air sampling, leaf punch samples were also taken on the same day as air sampling to characterize the potential dislodgeable residues. Punches were taken from the row where the air pumps were located. After collection, the sampling media were sealed with aluminum foil, capped with plastic caps and placed on wet ice. All samples were taken to Chemistry Laboratory Services in Sacramento for analysis.

## RESULTS

The leaf punch samples established the presence of methomyl in the vineyards (Table One). This was critical since none of the air samples (20 XAD-2 and 20 glass fiber filter) had any detectable levels of methomyl. Both the glass fiber filter and the XAD-2 media had values below the minimum level of detection: 0.25  $\mu\text{g}/\text{sample}$ . Using this MDL and the amount of air drawn by the pumps, it was possible to calculate the MDL in nanograms per liter. The highest average MDL was 0.77  $\text{ng}/\text{L}$ , the lowest was 0.57  $\text{ng}/\text{L}$ . The variation in MDL is reflective of the varied sampling volumes.

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TABLE ONE

**Dislodgeable Foliar Residue Levels of Methomyl On Grapes**

Sample A	0.031 ug/cm <sup>2</sup>
Sample B	0.031 ug/cm <sup>2</sup>
Sample C	0.021 ug/cm <sup>2</sup>
Sample D	0.022 ug/cm <sup>2</sup>
Sample E	0.025 ug/cm <sup>2</sup>

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Samples A-D correspond to the seedless, Sample E was from the Columbarids.

These values can be used in calculating potential dermal and inhalation exposure. The average dislodgeable foliar residue (DFR) on the seedless was 0.026 ug/cm<sup>2</sup>, which is very close to the Columbarids value and will be used in all ensuing calculations. Taking the DFR and multiplying it by both 6 hours (potential foliar contact time) and 36,000 cm<sup>2</sup>/hour (estimated mean transfer factor, D. Haskell, HS-Report 1525) gives a value for potential dermal exposure: 5.62 mg. The potential inhalation exposure can be estimated from the MDL values. Using the highest MDL of 0.77 ng/L, an exposure period of 6 hours and a respiration rate of 29 LPM, the potential inhalation exposure is 8 ug. If 100 percent dermal absorption and 50 percent inhalation absorption (Raabe, 1988) is assumed, total dosage for a 54.8 kg female fieldworker is 102.6 ug/kg and for a 70 kg male 80.3 ug/kg.