

## M e m o r a n d u m

To John M. Donahue, Chief  
Worker Health and Safety Branch

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Place Sacramento

Phone: 445-4222

From Department of Pesticide Regulation

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Subject HOT GAS INJECTION FUMIGATION STUDY RESULTS

Starting on January 28, 1997, a hot gas injection was conducted in Imperial County at Ben Abatti Farms. Worker Health and Safety Branch was present to collect worker exposure samples during all three days of the application. SKC low flow pumps were used to draw air through charcoal tubes. The pumps were set to draw approximately 10 liters over two hours. Each day's actual application period lasted approximately four hours, so two sets of samples were taken per day. There were five workers involved with the application. One was a supervisor, the remaining four were more closely involved with injection procedure. Of these, three worked attaching, decoupling and moving the application manifolds. The fourth worker was stationed at the end of the rows and inspected the application tube end to ensure complete delivery of the gas, indicated by an expansion of the tube end.

Methyl bromide was supplied by a large cylinder ("pig") mounted on the rear of the application rig platform. Via steel-braided hoses, the methyl bromide flowed into a heat exchanger (propane-fired), then through a control valving system and, finally, to the manifold where it was distributed into the field. Each manifold had 10 outputs, so up to 10 rows could be treated at a time. The gas was distributed into the field by using previously buried irrigation tubes ("T-tape"). Almost all the piping and valving were steel, iron, or brass. Only the compression fittings at each manifold nipple were plastic, as were the irrigation tubes. The application beds were covered with plastic tarpaulin to retard the off-gassing of methyl bromide. There was bare soil in between the application beds. After application, the methyl bromide supply was shut off and the lines were purged with nitrogen gas. The N<sub>2</sub> gas purging lasted approximately 10 seconds.

The four application workers were fitted with personal air samplers. The sampling media was changed after about two hours. The supervisor on the application rig was not fitted with a sampling pump, but instead, the pump was located on the rig itself, at the general breathing zone height of the operator. This sampling scheme was followed on all three sampling days. Over the course of the applications, a total of 1.25 tons of methyl bromide were injected. The first day of application ran longer than subsequent ones, since they had to assemble both of the manifolds. Leakage was checked for using a soapy solution. No hazardous events (hose rupture, coupling failure, etc.) that could cause gross exposure were noted. However, Environmental Monitoring and Pest Management Branch reported that on the first evening after the application, they were finding "high-levels" of methyl bromide (2-3 ppm) at their field stations. To sample for potentially high off-gassing from the field (which could have an effect on worker exposure) three sampling trains were placed directly atop three tarped rows, near the end of

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the row. This was done the first evening of the application series, the following morning, and again on the morning after that (Wednesday). There was little, if any, air motion during those sampling times.

After three days of sampling, 42 samples had been collected: 24 personal samples from the field workers, six area samples from the rig, nine area samples directly from the field, and three daily blanks. All samples were stored on dry ice. Samples were personally transported to Chemistry Laboratory Services in Sacramento.

The following is a summary of the worker exposure results:

**Eight Hour Time Weighted Average Air Levels of Methyl Bromide  
(In PPM)**

<u>Worker ID Code</u>	<u>Day One</u>	<u>Day Two</u>	<u>Day Three</u>
TRN	0.37	0.25	0.34
ATO	0.07	0.01	NA
RBT	0.16	0.11	0.02
HEC	0.50	0.12	0.17
RIG	0.01	0.08	0.13
RIC	NA	NA	0.77

**NA - Not applicable (Worker Not Present)**

All worker ID codes except RIG refer to an individual employee outfitted with their own sampling train. RIG is the area sample collected from the application rig.

Possible sources for the methyl bromide detected could be:

1. Connecting the main methyl bromide cylinder to the rig.
2. Pulling on the irrigation tubing to straighten any kinks which interfere with gas flow (worker TRN was observed doing this repeatedly).
3. Minor leakage at the compression fitting during removal (after N<sub>2</sub> purge).
4. Minor leakage at the tube end (this would be for worker HEC on day one and two, for worker RBT on day three).
5. Leakage from a improperly taped/buried irrigation line emitter.
6. Non-familiarity with procedure (worker RIC joined the crew on the third day since worker ATO was not available that day).

The area samples collected on the surface of the tarped rows gave the following results:

<b>Airborne Methyl Bromide Levels at 30 cm Above Tarpaulin Surface</b>		
<b>Collection Time</b>	<b>Mean PPM</b>	<b>S.D.</b>
<b>Day One Evening (40 min)</b>	0.027 (n=3)	$\pm 0.0004$
<b>Day Two Morning (45 min)</b>	0.017 (n=3)	$\pm 0.0009$
<b>Day Three Morning (30 min)</b>	0.027 (n=3)	$\pm 0.0012$

Collected air volume ranged from 5 to 8 liters. These are uniformly low levels, detected directly atop the tarpaulin covered field row. The only known sources present during this sampling were leakage directly through the tarpaulin and off-gassing from the uncovered soil between elevated beds.

These results indicate a uniformly low level of potential exposure to workers following the procedures used in this application.

Suggested additions to the permit conditions for hot gas fumigation (underlined sections are new):

4. Approximately 2 days before the start of the fumigation, all drip tubing shall be checked for blockage and the irrigation system connections and fittings shall be checked for blockage and leaks using pressurized air and/or water. The end of each line of drip tubing shall be placed under the tarpaulin prior to introduction of fumigant.
6. Before starting the fumigation, all fittings above ground and outside of the tarpaulin shall be pressure tested with compressed air, water, or nitrogen gas to a maximum pressure of 100 pounds per square inch. A sudsing solution shall be used to check the fittings for leaks if using air or nitrogen. All apparent leaks shall be eliminated prior to the fumigation. All drip tubing connected to the distribution manifold not covered by the tarpaulin shall be sealed to prevent methyl bromide loss.
10. Prior to disconnecting any line containing methyl bromide, the system shall be purged of methyl bromide with water, or by means of a pressurized gas, such as CO<sub>2</sub> or nitrogen.
11. After purging of lines, drip lines shall be pinched off and then disconnected from the distribution manifold. All disconnected lines leading into the treated field shall be secured to prevent gas from escaping.
12. All workers shall wear safety goggles when handling or near manifold system lines or other lines containing methyl bromide under pressure.