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M E M O R A N D U M

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SUBJECT: RESULTS FROM AREA MONITORING FOR AIRBORNE METHYL BROMIDE DURING TARPAULIN CUTTING AND REMOVAL FROM SITES USING DIFFERENT TARPAULIN FILM FORMULATIONS AND APPLICATION METHODS

On June 8, 2009, staff members Frank Schneider and Kevin Solari, of the Department of Pesticide Regulation's (DPR) Worker Health and Safety (WHS) Branch, were in Kern County to conduct area monitoring of airborne methyl bromide during experimental soil fumigations investigating various containment strategies. These applications were sponsored by the University of California Cooperative Extension and were conducted as a range-finding study to monitor methyl bromide off gassing from fields with the following emission control test systems:

- Field One: Low permeability polyethylene film (LPPF) tarpaulin, 12" shank depth.
- Field Two: Totally impermeable film (TIF) tarpaulin, 12" shank depth.
- Field Three: Totally impermeable film (TIF) tarpaulin, surface spray of potassium thiosulfate (KTS), 12" shank depth.
- Field Four: Totally impermeable film (TIF) tarpaulin, alternate strip application, 18" shank depth.
- Field Five: Totally impermeable film (TIF) tarpaulin, 18" shank depth.

The actual applications had occurred several days earlier and WHS staff was present to monitor potential worker exposure of airborne methyl bromide during tarpaulin cutting and removal processes.

On June 8th, air samples were collected by air pumps affixed to the cutter rig. At each field site, air monitoring was done as the cutter rig was driven over the plastic films. The cutter rig was a four-wheeled all terrain vehicle (quad-ATV) with a spring-loaded steel cultivator disc attached on the rear. The disc was designed to press through the plastic film, slicing it as the quad-ATV

drove along the length of the film panel. To collect the air samples, a SKC Low-Flow Pump ("clicker pump") was used to pull air through two-part, petroleum-based charcoal tubes (SKC Cat. # 226-38-02). Unlike most air sampling tubes, these tubes are constructed in two separate parts, one tube for the primary adsorbent, and a second tube for the secondary absorbent (backup). This prevents post-sampling migration from the primary to the secondary. Flow was adjusted to maintain sample volume below the rated maximum volume of approximately 12 liters. The sampling train (sampling pump, plastic tubing and charcoal tubes) was placed on the rear of the quad-ATV, such that the sampled air parcel was approximately 1.5 meters from the soil surface (see Photo One). A duplicate sampling train was co-located on the quad-ATV to provide both a duplicate.

Photo One: Sampler Placement on quad-ATV

sample and a cross-check of the sample accuracy. All five site locations were sampled. After sampling, which lasted between six and fourteen minutes, depending on how long it took the cutter to complete his task, the sample trains were retrieved and the tubes disconnected from the pumps, separated, capped and placed on dry ice.

Tarpaulin removal was scheduled for the following day, June 9th, as required by regulation (24 hours must pass between tarpaulin cutting and subsequent removal: (Title 3 California Code of Regulations Section 6447.3), I had arrived that morning to assist in the sampling. A crew of three workers was used to remove the tarpaulin. The crew consisted of one driver/gatherer and two receiver/loaders. The driver/gatherer (Photo Two) spent time either on ground, gathering a section of the tarpaulin to be handed up to the receiver/loaders; or in truck cab, driving the vehicle. The receiver/loaders spent time either on the ground assisting the driver/gatherer or on the flatbed of the truck, loading gathered tarpaulin film into the truck bed (Photo Three). Additionally, at some of the sites, the tarpaulin had not been completely slit by the cutter. In such

Photo Two: Driver/Gatherer

cases, one of the receiver/loaders initially would tear the film panels by hand, but later obtained a shovel for cutting the tarpaulin (See Photo Four).

Photo Three: Receiver/Loaders

Photo Four: Manual Tarp Cutting

In order to characterize potential worker exposure, three area sampling locations were identified as being the best sites for measuring air parcels that workers would be spending considerable time within. Since this was an experimental use of these film materials, any direct sampling (i.e.

attaching air monitoring pumps directly to the worker's body) would have required a human subject's committee review of the protocol/procedure, no personal air sampling was conducted. Instead of personal monitoring, area monitoring was conducted. Three sampling locations were chosen to best simulate worker's breathing zone monitoring.

Air samples were collected in the cab of the truck (corresponding to the driver's location), attached to the access ladder, approximately 3 meters from the ground (corresponding to the receiver/loaders normal work area) and on the exterior of the truck bed approximately 1.25 meters from the ground (general air exposure when workers are not in the other two work areas). These can be seen in Photo Five.

Photo Five: Sampling Pump Locations (Cab/Bed Exterior/Ladder)

Sampling procedures were the same as for the previous day of cutter monitoring: clicker pumps drawing air through two-part charcoal tubes, limited to a maximum of 12 liters sample volume. Sampling commenced when the workers entered the test plots and ceased when they had drawn up the last panel of film in that plot. Sampling times ranged from 30 minutes (Field 1) to 53 minutes (Field 2, a field that the cutter had not done a sufficient slicing, requiring manual panel separation to complete). At the end of sampling, tubes were removed from the pumps, separated, capped and placed on dry ice.

At the end of the workday for the tarpaulin removal crew, WHS staff retrieved the sampling equipment and transported the frozen samples to Sacramento. On the following day, June 10th, the samples were relinquished for analysis to the California Department of Food and Agriculture's Center for Analytical Chemistry. The results of the laboratory analysis are given in Table One. None of the values in Table One exceed the DPR Methyl Bromide Guideline value of 0.630 parts per million (ppm). In Table Two, the Time Weighted Average (TWA) has been calculated per monitored area, showing that there is also no exceedence of the Cal/OSHA Permissible Exposure Limit of 1 ppm.

Table One: Monitoring Results (in ppm methyl bromide)

Location	Field 01	Field 02	Field 03	Field 04	Field 05
Cutter I	0.047	0.048	0.242	0.014	0.123
Cutter II	0.053	0.046	0.220	0.016	0.135
Cab	0.003	0.012	0.007	0.003	0.045
Ladder	0.003	0.005	0.005	0.003	0.042
Bed Exterior	0.003	0.008	0.015	0.004	0.092

Table Two: Results Calculated as Time Weighted Average

Location	Time Weighted Average (8 hour) Parts Per Billion Methyl Bromide
Cutter I	8.1
Cutter II	8.0
Cab	5.6
Ladder	4.4
Bed Exterior	9.2

Both Tables indicate that potential worker exposure to methyl bromide is very low. For the cutter, the highest air concentration was from Field 3 (shallow shank, broadcast/potassium thiosulfate treatment). Second highest was Field 5 (deep shank/broadcast). Lowest was Field 4 (shallow shank/strip application). Potential exposures for the puller crews were mostly low and consistent (i.e. no specific location showed higher air concentration). However, Field 5 (deep shank/broadcast) was both the highest for all locations (cab/bed exterior/ladder), but also had 2X exposure at “bed exterior” compared to “cab” and “ladder”. When the potential exposure concentrations are calculated as TWAs, the resulting air concentration values are extremely low, compared to the PEL of 1 ppm.

Caution should be exercised when applying these results to estimate future applications under customary agricultural conditions. These results should not be considered as necessarily representative of potential worker exposure. The incomplete cutting of some of the tarps may have had an effect on not only the cutter (lower exposure because incomplete liberation of trapped gas) but also on the tarpaulin removal (conversely higher exposure because of incomplete liberation of gas). The test plot’s field size (1 acre blocks) does not necessarily reproduce normal field conditions (20+ acre blocks) and the working conditions will likely be different (more time spent within the larger field boundaries and thus working above off-gassing soil) and the results presented here may not scale up in a linear fashion. Likewise, since these were area samples, they do not fully characterize the exposure of these types of workers to off-gassing fumigants. This study is primarily for range-finding purposes, to establish what air concentrations of fumigants may be found under the differing treatment/film conditions. Once an optimal film/treatment is developed, further air monitoring to establish “real world” air concentrations would be necessary.