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MEMORANDUM

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TO: Randy Segawa, Agriculture Program Supervisor IV
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SUBJECT: ALTERNATE METHIDATHION APPLICATION AIR CONCENTRATION ESTIMATES

This memorandum provides a potential alternative to estimation of methidathion air concentrations associated with the orchard airblast sprayer application process. An alternative estimate is necessary because the Air Resources Board study (Royce et al., 1993) is the only case where methidathion air concentrations were measured during an airblast sprayer application. In that study the air samplers were not downwind during the application so an acceptable alternative source must be found to provide an estimate of the methidathion air concentrations associated with the application period. The Spray Drift Task Force (SDTF) (1997) collected data indicating that primary drift is "generic" with respect to the active ingredient. This very large data set encompassing aerial, ground, orchard blast, and chemigation application methods was reviewed by the a U.S. Environmental Protection Agency (U.S. EPA) Peer Review Panel (U.S. EPA, 1997a) and the Federal Insecticide, Fungicide, Rodenticide Act Scientific Advisory Panel (U.S. EPA, 1997b) and found to adequately support the generic drift assumption. The generic assumption means that similar application technologies (application method) exhibit similar deposition functions with downwind distance regardless of the active ingredient actually applied. Tank mix physical properties (dynamic surface tension, shear and extensional viscosity) also influence spray drift but that influence is minor when compared to application technology (U.S. EPA, 1997a). Thus if appropriate orchard blast sprayer data exists for a different active ingredient, it can potentially be used as a proxy to fill in the data void for methidathion. The Royce (1993) application was made at night using a typical airblast sprayer. In this case a possible proxy choice is data collected on methyl parathion. Wofford and Ando (2003) conducted a study monitoring methyl parathion concentrations during two orchard airblast applications to walnuts. One of the applications used specially engineered airblast sprayers elevated to directly deliver the spray into the canopies and was made during the day so this data is not appropriate to use as a proxy. However, the second application was made using typical airblast sprayers and was made at night. Thus, this application is reasonably similar to the methidathion application.

Methyl parathion air concentrations collected by Wofford and Ando (2003) are shown below:

Distance (ft)	11hr Time Weighted Average Concentration (ug/m^3)
36	6.15
39	5.82
22	5.34
29	1.48
30	2.78
28	2.52
33	2.47
29	7.25
71	4.65
171	1.90
54	4.56

Although it is true that the generic drift paradigm suggests this data can be used as a proxy, there are a number of uncertainties associated with using the air concentrations above to characterize methidathion air concentrations expected during an orchard blast application to oranges. Those uncertainties are discussed below:

1. Orchard Type. While both applications were made by typical airblast sprayer, the orchard types themselves are quite different. The orchard type was found to be a significant factor in the SDTF (1997) results because of differing tree shapes and orchard spacing. The Wofford and Ando (2003) data is for an airblast application made to walnuts. The methidathion application was made to an orange orchard. Oranges present a dense canopy that extends from approximately 5m to ground level. The SDTF found that airblast sprayer applications to oranges resulted in about three times the amount of spray deflected over the tops of the trees relative to other orchard types (SDTF, 1997). As a result, both the airborne spray and the horizontal deposition associated with oranges tended to be higher relative to other orchard types.

2. Orchard Size (acres). Theoretically, orchard size would be expected to have a relatively minor effect on air concentrations associated directly with the application (primary spray drift) since the SDTF (1997) found for orchard airblast that the first six rows at most contribute to measurable primary spray drift. However, the sampling period in Wofford and Ando (2003) was 11 hours. Therefore, the sample results include both primary spray drift and volatilization (secondary transport). The contribution due to volatilization would be affected by the orchard

size. The larger the orchard the greater the mass expected. It is impossible to separate these two sources with the information available. The Wofford and Ando (2003) orchard was a 100 acre rectangle. The highest air concentrations were measured at the southern narrow end of the orchard. The Royce (1993) orange orchard was an 18-acre rectangle.

3. Vapor Pressure of the Active Ingredient. This relates to the fraction of the air concentrations attributable to volatilization of the active ingredient following application. The vapor pressures are relatively similar so this difference is not expected to be a source of a significant difference between the two studies. Methidathion has a vapor pressure of $3.4x10^{-6}$ mmHg and methyl parathion has a vapor pressure of $9.6x10^{-6}$mmHg.

4. Application Rate. Wofford and Ando (2003) used 2lb methyl parathion/ac while Royce (1993) used 3lb methidathion/ac. This would cause a difference between measurements. A proportional adjustment of air concentrations is reasonable.

5. Sampler Placement. The samplers were located at different distances in the 2 studies. Wofford and Ando (2003) placed samplers at varying distances between 30ft and 150ft. Royce (1993) places samplers at 49ft and 82 ft. There is insufficient information to reliably adjust for those differences.

6. Time of Application. Both applications were made at night in July. This is a similarity rather than a difference and is an important similarity. Relative to the same application made during the day, night conditions can be expected to produce higher off-site air concentrations due to low wind and lack of vertical mixing typically present during those hours.

7. Duration of Sample. The application interval sample duration in Wofford and Ando (2003) was 11 hours while in Royce (1993) the duration was 8 hours. These two sampling intervals are probably similar enough to use directly. However, and adjustment for sampling interval duration could be made.

References

Royce, B.R., K.E. Longley, and B.H. Gump. 1993. Airborne concentrations of methidathion and methidaoxon in central Tulare County from sampling conducted in June and July 1991. Engineering Research Institute, California State University, Fresno. Prepared for California Air Resources Board Contract No: A032-094. June 24, 1993.

SDFT. 1997. A summary of airblast application studies. Spray Drift Task Force. Stewart Agricultural Research Services, Inc. P.O. Box 509, Macon, Missouri 63552. <http://www.agdrift.com/PDF_FILES/airblast.pdf>.

U.S. EPA. 1997a. Annual Spray Drift Review. Report of Peer Review Panel findings. Office of Pesticide Programs, Environmental Fate and Effects Division. <http://www.epa.gov/scipoly/sap/meetings/1997/december/spraydrift.htm>.

U.S. EPA. 1997b. A set of scientific issues being considered by the Agency in connection with the Spray-Drift Program. Report of the Scientific Advisory Panel meeting held December 11, 1997. Arlington, Virginia. <http://www.epa.gov/scipoly/sap/meetings/1997/december/finaldec.pdf>.

Wofford, P. and C. Ando. 2003. Preliminary methyl parathion air concentrations measured adjacent to two walnut orchard applications. Memorandum dated September 25, 2003 to Randy Segawa, Senior Environmental Research Scientist. California Environmental Protection Agency. Department of Pesticide Regulation, Environmental Monitoring Branch. Sacramento, California 95812-4015.