Department of Pesticide Regulation

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MEMORANDUM

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HSM-04034
(No. assigned after issuance of memo)

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SUBJECT: BACKGROUND FOR EXPOSURE MONITORING OF DUST HANDLERS

Few data are available for handlers of dust formulations or for reentry workers in crops treated by dust formulations. The limited data available suggest that dust formulations can potentially result in high exposures, at least for handlers. Dusts have been shown to be suspended in air longer than spray droplets, to drift farther and to have less on-target deposition (Ware, 1971). Also, when M/L/A exposure was monitored during dusting and spraying in greenhouses (Brouwer *et al*., 1992), exposures were much higher during dusting.

The exposure monitoring data most needed are of handlers mixing, loading, and applying dust formulations using either hand-held or ground equipment. No M/L exposure data are available for handlers. Data also are needed for dusting with power blowers, both backpack and tractor-driven (Bernie photographed several of these last year), and for row crop dusters. Exposure monitoring data with full dosimetry in any of these scenarios would be extremely valuable.

If cooperators doing aerial applications of dust formulations are found, exposure monitoring of aerial applicators would be valuable, too. However, recent PUR data suggests that, at least with carbaryl (the only AI for which I have queried dust uses), aerial applications are uncommon. No aerial applications of carbaryl dust products were reported in 2002, although a total of 1,700 acres were treated with ground applications of carbaryl dusts [mostly grapes (960 acres) and corn (733 acres)]. In 2001, aerial applications of carbaryl dust products were made six times, all to grapes (59 acres total) and cotton (36 acres total). The most recent year in which more than a handful of applications were made was 1997, in which 40 aerial applications were made to grapes, apricots, peaches, nectarines, and plums (total 512 acres treated aerially; in contrast, 2,818 acres were treated with carbaryl dusts by ground methods). If other AIs follow this trend, then there may be no aerial applications to monitor. Ground applications of dust products should be relatively common, though, as sulfur is still the most highly-used AI (DPR, 2003).

A query of the DPR Product Label Database shows that more than a dozen active ingredients have dust formulations registered in California for use on grapes (the query focused on grapes to eliminate products registered solely for home and garden use, like most carbaryl dust products). The AIs are listed in Table 1, which is provided to assist in target analyte selection.

Table 1. Active Ingredients with Dust Formulations Registered in California for Use on Grapes [a]

Active Ingredient	DPR Chemical Code	Active Ingredient	DPR Chemical Code
Carbaryl	105	Dicloran	81
Copper	714	Dicofol	346
Copper Hydroxide	151	Gibberellins	310
Copper Oxychloride	156	Myclobutanil	2245
Copper Oxychloride Sulfate	168	Piperonyl Butoxide	486
Copper Sulfate, Basic	162	Pyrethrins	510
Cryolite	173	Sodium Bisulfite	547
Diatomaceous Earth	195	Sulfur	560

[a] Active ingredients with dust/powder products actively registered (i.e., products are categorized as "active") for use on grapes according to DPR product label database, queried 12/31/04.

Available exposure monitoring studies are summarized below. The greatest data needs are for handlers; although reentry exposure monitoring data are incomplete, the limited data available suggest that working in crops treated by dusts may not be worse than working in crops treated by other formulations, and that existing data can be used to estimate reentry exposures.

Handlers:

Only two exposure monitoring studies are available, and neither study provides sufficient information to allow estimation of handler exposures:

1) Exposure was monitored in two M/L/As dusting grapes with captan (O'Connell *et al.*, 1990). Biomonitoring was done for three days (urine collected and analyzed for a common metabolite of captan; creatinine analyses suggested that collections were incomplete), and dermal and inhalation monitoring was done on a fourth day. Dermal dosimetry included cotton t-shirts, cotton socks, and front and back thigh patches. Hand exposure was monitored with hand wipes. These wipes might underestimate exposure (Brouwer *et al.*, 2000). Additionally, thigh exposure was extrapolated from the thigh patches using EPA's value of 3,820 cm^2 for thigh surface area (O'Connell *et al.*, 1990). This could result in an underestimate of exposure if sides of legs had substantially more residue than back patches, but not substantially less residue than front patches; i.e., if the average residues per cm^2 on front and back patches were less than the amounts on the rest of the upper legs (residues found on individual patches were not reported, but I assume that front patches had higher residues than back patches). Furthermore, tube socks had the highest residue on both workers. If tube socks did not cover knees, then exposure could be underestimated. The most critical concern with this study, however, is the small sample size (n = 2).

2) Brouwer *et al.* (1992) monitored workers spraying (handwand) and dusting pesticides in greenhouses. Dusting was done with a backpack blower, with zineb, thiram, and chlorothalonil products. Dermal exposure on hands and forearms was monitored with cotton gloves; no other dermal dosimetry was done, though personal air samplers were used to monitor inhalation exposure. Ten workers were monitored while dusting, and thirteen while spraying. The geometric mean dermal exposure for dusters was 39.4 mg/hr, while the sprayers had a geometric mean exposure of 17.8 mg/hr. Respiratory exposures were more than ten times higher during dusting than during spraying (Brouwer *et al.*, 1992). Because only hands were monitored, and because amounts of pesticide handled by each worker were not reported, these results cannot be used in exposure assessment.

Another study monitored exposure of workers during seed treatment with lindane dust (Fenske *et al.*, 1990). This study was not evaluated in depth, but will be considered if seed treatment is a scenario needed in any future exposure assessments. Furthermore, workers doing on-farm seed treatment with a dust formulation were monitored in a recent study by the Agricultural Handlers Exposure Task Force. Thus, seed treatment is an area that does not seem to need additional study by WHS. Unfortunately, exposure monitoring data from these studies cannot be extrapolated to other dust handler scenarios.

<u>Reentry Workers:</u>

Again, two pertinent studies are available; both are companion studies to the handler exposure monitoring summarized above:

1) WHS monitored exposure of workers performing cultivation activities in grapes that had been dusted with a captan/sulfur formulation (O'Connell *et al.*, 1993). Passive dosimetry was done in the same way as in the M/L/A study (O'Connell *et al.*, 1990), and therefore, hand exposures and thigh exposures may be underestimated as mentioned above. Dermal exposure monitoring data were presented for cane turning, leaf pulling, and grape harvesting. DFR data were also given, allowing transfer coefficients to be estimated, though DFR data for cane cutting and leaf pulling are not completely matched to exposure monitoring (DFR data are presented for the first two days, and complete dermal exposure monitoring data are given for the last two days, giving an overlap of one day). If DFR data are assumed to change little between days (monitoring was done 2 months post-application, so this is a reasonable assumption), it may be possible to compare data in this study with existing studies in which liquid formulations were applied to grapes, and determine whether formulation substantially affects reentry exposure. Preliminary examination of the WHS data suggests that transfer coefficients are not higher in this study than in studies involving reentry into grapes treated with liquids.

2) Brouwer *et al.* (1992) monitored hand and forearm exposure to reentry workers who cut, sorted and bundled carnations treated with sprays or dusts. The limited dosimetry precludes

using these data in exposure assessments. However, Brouwer *et al.* (1992) presented dermal exposure data for workers harvesting carnations treated by both dusts and sprays, and the dust formulations did not correlate with greater rates of exposure.

Both of the above studies suggest that existing exposure monitoring data are likely to be health-protective for workers reentering crops treated by dust formulations. Therefore, exposure monitoring for these reentry workers does not seem to be a high priority.

References:

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