Department of Pesticide Regulation

Mary-Ann Warmerdam
Director

M E M O R A N D U M

Arnold Schwarzenegger
Governor

TO: Susan Edmiston
Agriculture Program Supervisor III
Worker Health and Safety Branch

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(No. assigned after issuance of memo)

FROM: Sheryl Beauvais *(original signed by S. Beauvais)*
Staff Toxicologist (Specialist)
445-4268

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SUBJECT: BACKGROUND FOR EXPOSURE MONITORING OF WORKERS DIPPING NURSERY STOCK

No exposure monitoring data are available for workers dipping nursery stock. Surrogate data from the Pesticide Handlers Exposure Database can be used for mixer/loader exposure estimates, and reentry exposure is represented by harvesting of ornamentals or other activities. However, no exposure monitoring data are available for applicators dipping plant roots into pesticide solutions. This scenario differs from most pesticide handler scenarios in that it is anticipated that workers may immerse hands into solution. It is important to distinguish between other types of pesticide applications to roots (e.g., sprays) and immersion of plants by hand into a pesticide solution. Only activities where workers immerse plants by hand are of interest.

Two types of information are requested from the WHS Exposure Monitoring Program (Bernie is trying to find a cooperator for the first one, and I hope to get this information early in 2005):

1) Little information is available about how this type of root dipping is actually done. Documentation (via a memo and/or photographs) of workers doing root dips are needed, specifically, answers to the following questions:

- How much AI is handled per worker in a typical workday?
- How many plants are handled per worker? Are plants dipped individually or in bundles?
- What clothing and PPE do workers wear?
- Are hands immersed? If so, are they partially or completely submerged in solution?
- Are clothes splashed or dripped on? If so, what body parts are affected?

Figure 1 shows a worker dipping seedlings in a clay slurry. This is done to protect roots from drying until the seedlings are transplanted. While most of the exposure of a worker doing this activity is anticipated to be to the hands, inspection of Figure 1 suggests that workers may also be exposed by splashes or drips on the forearms, torso, and legs. It would be valuable to know whether workers dipping nursery stock into a pesticide solution would splash and drip as much (for that matter, this worker's coverall may have residue from multiple days, and little splashing and dripping may occur each day).

Figure 1. Seedling roots are dipped in kaolin clay at a state nursery in Maryland [a], to protect roots against drying out (no pesticide use was mentioned). Note clay residue on forearms, torso, and legs.

[a] From MDNR (2003).

2) Exposure monitoring data with full dosimetry or appropriate biomonitoring (of an AI where the pharmacokinetics are well-described) would be valuable. If workers immerse hands into solution, biomonitoring may be the best way to monitor exposure.

It's possible that nursery stock dipping may be similar to pet and livestock dips, though a comparison of these activities has not been done, and is not requested here. Exposure monitoring data are also lacking for persons doing pet and livestock dips, other than limited biomonitoring (Buchanan *et al.*, 2001), in which individual worker activities were too poorly described to allow an estimate of exposure from amount of pesticide handled.

Several active ingredients (AIs) are registered in California for use in dipping nursery stock; examples are given in Table 1. These products were identified by a Google search for product labels with variations of the words, "root dip." I then confirmed that these products were registered in California. Table 1 is provided to assist in target analyte selection.

Table 1. Examples of Active Ingredients with Root Dipping Uses Registered in California [a]

Active Ingredient	Example Product Name	EPA Reg. No.	Crops
Carbaryl	Sevin® 4F	264-349-ZB	Vegetable transplants, foliage plants and bedding plants
Carbofuran	Furadan® 4F	279-2876-ZC	Pine seedlings
Chlorpyrifos	Dursban® 4E-N	62719- 254-AA	Containerized or balled and burlapped nursery stock
Endosulfan	Thiodan® 3EC	279-2924-ZA	Cherry, peach and plum nursery stock
Fosetyl-Al	Aliette® WDG Fungicide	264- 516-AA	Citrus (non-bearing)
Malathion	Malathion 5EC	51036- 104-AA	Grape Vines (Over- wintering on nursery stock only)

[a] List is not comprehensive; includes products currently registered in California. Some active ingredients that were formerly registered in California for root dipping are no longer registered (e.g., benomyl).

References:

Buchanan, D., Pilkington, A., Sewell, C., Tannahill, S.N., Kidd, M.W., Cherrie, B. and Hurley, J.F. 2001. Estimation of cumulative exposure to organophosphate sheep dips in a study of chronic neurological health effects among United Kingdom sheep dippers. Occupational and Environmental Medicine 58:694-701.

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