Department of Pesticide Regulation

Mary-Ann Warmerdam
*Director*

Arnold Schwarzenegger
*Governor*

# MEMORANDUM

TO: Susan Edmiston, Chief
Worker Health and Safety Branch

**HSM-07008**

FROM: Harvard R. Fong, CIH, Senior Industrial Hygienist
Worker Health and Safety Branch *(original signed by H. Fong)*
(916) 445-4211

DATE: September 27, 2007

SUBJECT: RESULTS FROM SAMPLE COLLECTION IN TULARE COUNTY FOR A SUSPECTED ORGANOPHOSPHATE EXPOSURE EVENT

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On July 30th, 2007, Bernardo Hernandez, Zahangir Kabir and I met with David Case of the Tulare County Agricultural Commissioner's (CAC) office to discuss an alleged organophosphate-poisoning event in that county. The event involved an applicator who had a plasma cholinesterase (ChE) level that was 28% of his baseline. Four other workers from the same ranch also had ChE reduction (as low as 65% of baseline), but none as severe as this worker. This worker reported symptoms of potential pesticide exposure on June 9, 2007, and was examined by a physician on June 11, 2007. The CAC investigation had so far reported that the worker had been spraying in what was reported to be an "enclosed cab". Also reported was the worker's clothing/personal protective equipment (PPE) ensemble consisted of baseball cap and work clothing; no gloves or respiratory protection were mentioned as used in the CAC report.

Under Title 3 California Code of Regulations (CCR) Section 6746: Medical Supervision, a reduction to 80% or less of baseline triggers an investigation of work practices and equipment (Title 3 CCR Section 6746 [d]). A reduction to greater than 60% of baseline plasma ChE requires the worker to be removed from activities that could result in exposure to ChE inhibitors such as organophosphate or carbamate pesticides (3 CCR Section 6746 [e]).

After meeting with Mr. Case, we proceeded to the equipment storage facility of the ranch and met with the worker who was the trigger for this investigation. Mr. Hernandez spoke to the worker (who was Spanish speaking) and filed this following report with me:

> The following is a general translation of what was uncovered between the applicators and myself. The statements provided were not to any scripted questions. The five applicators load from a "nurse rig". Every once in a while they load their own air blast sprayers. The five applicators are provided with rubber gloves (dishwasher type), cloth coveralls, eye protection (goggles), and a half-face respirator. They all wear ball caps and leather boots. The employee with the 28% depression relative to his baseline was the most ill. He related his symptoms to be headache, nausea, vomiting and searing-stabbing like abdominal pain. The other four were asymptomatic. The most ill employee conveyed that on the day he

> got ill his tractor was missing one side tractor window (a cardboard piece was substituted) and he had eaten a burrito at morning break in the field (the aluminum foil wrapper around the burrito was between his hands and the burrito). The other four applicators noticed that the ill applicator did not wash his hands after removing his gloves. The ill applicator states that he is highly sensitive to pesticides and that the odor of the chlorpyrifos makes him ill causing him to experience symptoms of headaches, the searing-stabbing like abdominal pain and nausea. He has not been medically released to return to work as a mixer/loader/applicator as yet.

During Mr. Hernandez's interview, Mr. Kabir and I took samples of suspected sources of contamination. These included cloth samples from a coverall (though not the actual coverall the worker wore, it was from the pool of coveralls available for worker use), interior gauze swabs of the worker's gloves and respirator, swab samples from the suspect tractor ("JD1"), swabs from two other application tractors ("L5" and "NH"), swab sample from a nurse rig ("NR") used by all employees and samples from the worker's boots (interior swab of right boot, excised leather piece from the instep of the left boot). The tractor swab samples were taken from the steering wheel, the vehicle seat, the control levers, the door windshield, and the hood of the engine (likely positive). Where possible, a 100 $cm^2$ stainless steel cutout template was used to standardize and replicate the sampled area. Between 3 and 4 ml of isopropyl alcohol (home use grade, RITE AID store brand) was used to moisten the gauze samplers. The nurse rig also had its steering wheel swabbed. Mr. Hernandez also obtained a handwash sample from the worker.

A sample of the pesticide shipment used during this application season (LORSBAN 4E, 44.9 % active ingredient chlorpyrifos) was obtained. All samples (except the product sample) were stored on wet ice in an ice chest for transport. Chilled samples were either on wet ice or stored in a refrigeration unit delivered to the Center for Analytical Chemistry in Sacramento.

The following table shows the results of the sampling and analysis. For some of the collected samples, it was not possible to calculate the micrograms per square centimeter ($\mu g/cm^2$) value because of the topology of the sampled item (interior of glove, respirator, boot). The product sample was analyzed and found to be 44.8 % chlorpyrifos (label reported value is 44.9% active ingredient) with a trace of sulfotepp. The sulfotepp trace is a recognized impurity to chlorpyrifos formulations, according to the Food and Agriculture Organization (FAO) of the United Nations (see FAO SPECIFICATIONS AND EVALUATIONSFOR CHLORPYRIFOS: http://www.fao.org/ag/AGP/AGPP/Pesticid/Specs/docs/Pdf/new/chlorpyr.pdf).

| **Sample Location** | **Media Type** | **Chlorpyrifos, µg/sample** | **Surface Area, $cm^2$** | **Chlorpyrifos, $\mu g/cm^2$** |
|---|---|---|---|---|
| Coverall sleeve, left | Cloth | 91.4 | 105 | 0.870 |
| Coverall sleeve, right | Cloth | 73.5 | 170 | 0.432 |
| Glove interior, left | Gauze swab | 1.23 | N/A[A] | |
| Glove interior, right | Gauze swab | 3.65 | N/A[A] | |
| Coverall, seat | Cloth | 19.8 | 115 | 0.172 |
| Respirator, interior | Gauze swab | 0.54 | N/A[A] | |
| Boot interior, right | Gauze swab | 1823 | N/A[A] | |
| Boot leather, left | Leather | 12085 | 30 | 402.83 |
| Control lever, tractor JD1 | Gauze swab | 3.66 | N/A[A] | |
| Control lever, tractor L5 | Gauze swab | 0.34 | N/A[A] | |
| Control lever, tractor NH | Gauze swab | 22.5 | N/A[A] | |
| Door window, tractor JD1 | Gauze swab | ND[B] | 100[C] | <0.01 |
| Door window, tractor L5 | Gauze swab | ND[B] | 100[C] | <0.01 |
| Door window, tractor NH | Gauze swab | 0.30 | 100[C] | 0.003 |
| Seat, tractor JD1 | Gauze swab | ND[B] | 100[C] | <0.01 |
| Seat, tractor L5 | Gauze swab | ND[B] | 100[C] | <0.01 |
| Seat, tractor NH | Gauze swab | ND[B] | 100[C] | <0.01 |
| Steering wheel, tractor JD1 | Gauze swab | 41.7 | 1000[D] | 0.042 |
| Steering wheel, tractor L5 | Gauze swab | 9.09 | 1000[D] | 0.009 |
| Steering wheel, tractor NH | Gauze swab | 15.5 | 1000[D] | 0.016 |
| Steering wheel, tractor NR | Gauze swab | 47.5 | 1000[D] | 0.048 |
| Engine hood, tractor JD1 | Gauze swab | 81.5 | 100[C] | 0.815 |
| Engine hood, tractor L5 | Gauze swab | 0.45 | 100[C] | 0.005 |
| Blank | Gauze swab | ND[B] | N/A[A] | |
| Handwash | Water | 4.92 | 840[E] | 0.006 |

[A]Because of the topology of the sampled object(s), an accurate measurement of the sampled surface is not possible.
[B]ND = None Detected [Limit of Detection = 0.30µg/sample]
[C]Sampled using 100 $cm^2$ stainless steel cutout template
[D]Estimate of surface area of 35 cm diameter steering wheel with interior diameter of 3 cm.
[E]EPA**.** (1997) Exposure factors handbook, Volume 1: General factors**.** EPA/600/P-95/002Fa. Washington, DC: Office of Research and Development, National Center for Environmental Assessment, U.S. Environmental Protection Agency.

Several of these results raise questions of worker exposure potential. The value on the left coverall sleeve is essentially the same as found on the hood of the application tractor. The right sleeve is only 50% less than those two values. If the residue in the clothing is essentially equivalent to that found on the exterior of the tractor, this might indicate a need for more vigorous laundering.

The residues in the cab interior (levers and steering wheel) suggest that these are deposited by hand-to-surface contact and not necessarily by airborne-to-surface, since the door window samples were, in some cases, orders-of-magnitude lower than the other surfaces interior surfaces. Wiping down of these contact surfaces at the end of the workday, using a dilute bleach solution, may help reduce this source of pesticide exposure.

The results from analysis of the boots point to a source of constant worker exposure to chlorpyrifos. The swab from the interior, though not calculated on a $\mu g/cm^2$ basis, indicates that at least 1.8 mg of chlorpyrifos were available for absorption, with a higher value very likely. The sample of the leather shows that the leather of the boots is acting as a reservoir for chlorpyrifos, likely causing low level but sustained exposure. Given that the microclimate in the boot is probably warm and moist, the dermal absorption of chlorpyrifos may very well approach the 9% rate found in Nolan *et al.* (1982; see HS-Report 1661). The wearing of these contaminated boots may have been a contributor to the depression of the worker's ChE. Exactly how these boots became contaminated with chlorpyrifos was reported by the CAC investigating agent:

> During the interview [the affected worker] stated that while loading Lorsban-4E and Britz 415 Supreme Spray Oil into the airblast sprayer's pesticide holding tank, the concentrate pesticides would spill and splash onto his personal leather work boots. In addition, [the worker's body] and most likely his leather work-boots also, were…exposed to diluted pesticide spray solution mist during mixing/loading and application activities.

A direct splash or spill of concentrate would likely result in a high level of contamination to a leather boot. Repeated splashes of finished tank mix may also lead to leather saturated with chlorpyrifos. This level of contamination suggests that leather boots or boots not made of chemical resistant rubber, are ill advised, regardless of the pesticide signal word category. In addition, the LORSBAN 4E label states that mixer/loaders supporting a ground application must wear "Chemical resistant footwear plus socks". Since the worker did report engaging in some loading activity ("Every once in a while they load their own air blast sprayers"), this non-compliance with the label directions may be instrumental in the worker's exposure to organophosphates.

cc: Mr. David Case, Agricultural Standards/Inspector IV, Tulare County
Mr. Al Lomeli, DPR Enforcement/Central Regional Office, Fresno