FARM WORKER PESTICIDE PROJECT

Proyecto de Campesinos y Pesticidas

7500 Greenwood Ave. N, Seattle, WA 98103; 206-729-0498

Barbara Morrissey Edited version sent Nov. 19, 2009
Washington State Department of Health
Sent via email to Barbara.Morrisssey@DOH.WA.GOV

Chlorpyrifos Drift Results
How DOH Should Interpret Them and What It Should Recommend.

Results of air monitoring conducted by the University of Washington for the State Department of Health as part of the state's pilot drift monitoring program have been posted on the DOH website. The Farm Worker Pesticide Project has the following comments for DOH regarding the results and their policy implications.

Before getting into our comments, we must note that we are concerned about how Dr. Fenske and other authors presented the data and about the potential for misinterpretation of the results prior to DOH's evaluation of them. At a DOH public meeting last summer, we asked Dr. Fenske if the UW presentation of the results would discuss the scientific evidence bearing on risks posed by chlorpyrifos and whether it would use other means of evaluating risk than comparison to inadequate California Department of Pesticide Regulation (CDPR) screening levels. Dr. Fenske replied that a review of the science on chlorpyrifos risks was beyond the scope of the UW contract and that evaluations and statements regarding safety were DOH's responsibility.

Individuals reading the report, however, will likely assume that UW scientists consider chlorpyrifos concentrations measured in 2008 to be safe. The report states that if CDPR screening levels are used, it appears that agricultural spraying in the sampled regions did not pose a health risk to residents or bystanders by the inhalation route. The report did not comment one way or the other on whether one *should* use those screening levels, but by omission it strongly implied that to do so is appropriate. It made no mention whatsoever of other options and of the vast body of evidence that throws into doubt the validity of the CDPR screening levels. Readers of the report could easily be misled, particularly if they were not present at the summer meeting where UW announced that it would engage in no health risk analyses.

The same sorts of concerns are raised by the fact that the report failed to mention other important topics (such as non-inhalation exposure routes and prenatal exposures) and that it implied that a single year of limited data is sufficient to make sweeping declarations regarding safety for children and adults in agricultural areas.

We ask both DOH and UW to make it clear to the public, policymakers, reporters and others who may review the UW report on-line that it does not evaluate health risks posed

by chlorpyrifos drift. It should be stated definitively that UW is not making any declarations regarding whether chlorpyrifos measured in the air in agricultural areas posed health risks or not. Both UW and DOH need to state that DOH is engaged in that health analysis and will reach conclusions which will be shared publicly shortly. These disclaimers should be posted on the DOH website, printed on the front page of the UW document, and stated in other forums to make sure that people are not confused by statements in the UW report.

As DOH proceeds to evaluate the risks posed by chlorpyrifos measured in the air in Washington State, it must engage in a comprehensive review of the scientific evidence on this pesticide. The agency must then act to ensure protection for children and others in agricultural areas. It is time for DOH leadership on a major public health issue in our state.

I. Overarching Violations of State and Federal Law, and Individuals Rights

State air testing confirmed what was already clear from farm worker community air monitoring in Washington State and from government monitoring in California. Chlorpyrifos regularly drifts beyond application sites, leading to contact with workers and others living in agricultural areas, including children. In fact, chlorpyrifos was detected in almost every single sample taken. It was found in off-site air, including residential air, on almost every day on which testing was done.

It is virtually impossible that people working and living in the areas tested were not exposed to chlorpyrifos. Vast numbers of people clearly inhaled and otherwise came in contact with this pesticide.

As discussed below the evidence is very strong that peoples' contacts with chlorpyrifos at levels measured pose serious health risks for them. But even if that were not the case, **the state monitoring reveals massive ongoing violations of state and federal law.** State and federal regulations and the labels for chlorpyrifos products prohibit application "in a way that will contact workers or other persons, either directly or through drift."[1] These regulatory statements embrace the rights of individuals to not be exposed to pesticides, without needing to prove injury as a prerequisite to those rights. **State and federal agencies charged with enforcing pesticide laws have clearly failed to enforce this no-contact standard and to defend people's rights to be free from contacts with chlorpyrifos.**

DOH must state these facts up front and center in its analysis. It must not perpetuate the habit that has been practiced by state and federal agencies for several decades now of turning a blind eye to this reality. The regulations that are violated with such impunity each year must instead be enforced. DOH must state this clearly in its report and it must become an advocate for strong enforcement on behalf of state residents.

---

[1] See p. 5 of label for Yuma 4E insecticide, for example. (The label is the law.) See also WAC 16-233-210(1); WAC 296-307-13010(1); and 40 CFR 170.210(a)

II. Unacceptable Risks to Health.

Although exposure victims should not be required to prove harm in order to end exposures, we can unfortunately make a very strong case that community members' exposures are indeed harmful. The weight of the evidence overwhelmingly indicates that ongoing use of chlorpyrifos in agriculture is putting people at risk of serious health effects.

A) There were exceedances of more protective screening levels. The state sampling yielded results that were comparable to the results of testing done in 2006 by farm worker community members affiliated with Farm Worker Pesticide Project. DOH should make reference to our study and note the consistency in findings.[2] See Appendix 2 below for a brief comparison.

DOH should also include in its analysis the reference dose for small children (170 ng/m^3) that we used which was developed employing standard EPA protocol and safety factors. (See Appendix 2 of our report *Poisons on the Wind* at www.fwpp.org for details on how the reference dose is derived. It incorporates 10-fold intraspecies, 10-fold interspecies and 10-fold FQPA uncertainty factors.)

Please note that on page 16 of the UW report, the authors state that the Technical Review Panel recommended that air concentrations be compared to the CDPR screening levels. Dr. Susan Kegley is listed as a member of the TRP. Given her publicly expressed concerns about the validity of the CDPR numbers in the past, I contacted Dr. Kegley and confirmed that she did not agree to use of that screening level.

There were numerous exceedances of the 170 ng/m3 screening level. See a listing of some exceedances below in Appendix 1. Note, however, that the list may not reflect all exceedances. Analyses such as averages over acute and subchronic periods were not done, for example.

In dismissing our findings in 2007 Dan Fazio of the state Farm Bureau was quoted in the Yakima Herald as saying, "Would you stand 15 yards from a field when they are spraying?" The UW report similarly says on page 1, "public exposure is not anticipated at the perimeter of an orchard for extended periods…." But the truth of the matter is that there are vast numbers of homes and daycares that are located even closer than 15 yards from orchards where chlorpyrifos is used. People, including children, born and unborn, are indeed present at the perimeter of orchards for extended periods of time. Community members working with FWPP would be more than glad to drive DOH representatives around in the Yakima Valley to show you numerous examples. Workers, of course, are also often present tending crops in locations close to chlorpyrifos application sites.

Pregnant farm workers are exposed all day while doing farm work and then also at home as they work in their yards. The impacts of exposures on their unborn children are of

---

[2] Dansereau, Perez, Kegley, Tupper and Wang, Poisons on the Wind: Community Air Monitoring for Chlorpyrifos in the Yakima Valley, http://www.fwpp.org; December 2006.

particular concern as discussed below. It is extraordinary that the UW report made no reference to the fact that children are exposed prenatally to chlorpyrifos and that the concentrations measured in the air should be evaluated with that reality in mind.

Even if people were able to leave homes and workplaces during and after applications, which is generally not the case, applicators are not required to provide notice to facilitate such protective measures. After a lengthy public review process several years ago, WSDA withdrew a proposed notification rule which would not have even covered chlorpyrifos and which was rife with other loopholes. People don't even have access to pesticide use reporting data to assess what has been applied nearby in past years. There is no requirement that applicators and growers tell people about their pesticide applications despite the chemical trespass that occurs.

Being inside does not necessarily prevent high exposures, particularly during peak application periods. Near-field 24 hour concentrations measured by UW topped 600 ng/m3 and peak exposures in shorter duration samples were much higher than that. It is not at all assured that these pesticides will remain outside rather than entering homes through windows and cracks. The warmer it is the more likely volatilization drift becomes and also the more likely that people will want their windows open. As discussed below, once inside chlorpyrifos can linger for years. Hence exposures from new applications can combine with exposures to resuspended chlorpyrifos trapped in house dust.

In any case, it is not enough to assume and hope that people will go inside and that they will "only" be exposed to "safe" concentrations of chlorpyrifos there. As studies outlined below make clear, too much is at stake.

It is also not appropriate to require people to vacate homes and daycares and/or to stay inside and close their windows, in order to reduce exposures. People have a right to enjoy their yards and homes without worry of toxic exposure. Suggesting that people go away or stay inside to limit exposures would not be tolerated in a wealthier community that does not face challenges associated with race, language and immigration status. It should be met with the same outrage with respect to farm worker communities.

B) Existing screening levels are not adequately protective.

It is not adequately protective to evaluate safety based on comparisons to existing reference doses (also called screening levels). Those levels are based on No Observable Adverse Effect Levels and Lowest Observable Adverse Effect Levels generated in a small number of studies, often only one study, testing for particular health effects that can be quite narrow in scope. One would assume that these incredibly important studies on which so much hinges would be published in peer-reviewed journals and that they would be readily publicly accessible. That is not the case. FWPP has spent hours attempting to obtain the studies that form the basis of the CDPR screening levels only to find that these unpublished studies generally conducted by the pesticide manufacturer are very difficult if not impossible to obtain.

A CDPR document explains that the acute and subchronic screening levels for chlorpyrifos (1200 and 850 ng/m3; the ones referred to by UW in its report) are based on the same subchronic rat inhalation study. No citation or title is given in the CDPR report. According to the very limited data available when we submitted these comments originally, rats were exposed to chlorpyrifos 6 hours per day, 5 days per week, and the highest dose was 297 ug/m3, with reportedly no effects seen at any dose level. We believe that the health endpoints tested were very narrow with an emphasis on cholinesterase inhibition. (Update: I have obtained and reviewed EPA documents about the studies. There appear to be a few studies involved rather than one as indicated by the DPR document, and the highest dose may have been 287 ug/m3 not 297 ug/m3, but I will contact you later about this.)

It is incredible that this study is the basis of the screening levels against which the chlorpyrifos levels in the air are being compared. There is substantial evidence that chlorpyrifos can cause harm through mechanisms other than cholinesterase inhibition, that harm can occur at much lower concentrations, that chlorpyrifos may be associated with a broader range of health effects than originally thought, and that some individuals are far more vulnerable to injury from exposures than others. DOH must consider the following studies and many others that compose a compelling body of evidence bearing on the risks posed by the constant presence of chlorpyrifos in people's air during the spray season.

i) Studies tracking children exposed prenatally to chlorpyrifos from household products in New York City. Researchers measured chlorpyrifos in umbilical cord plasma and found that highly exposed children scored lower on average at age three on a mental development index than children with lower exposures. The higher exposed children were significantly more likely to experience psychomotor and mental development delays, attention problems, attention-deficit/hyperactivity disorder problems, and pervasive developmental disorder problems.[3] At birth, chlorpyrifos was associated with decreased birth weight and birth length overall.[4]

The concentrations of chlorpyrifos in the mothers' air that led to these children's prenatal exposures were in the same range as those measured in the outdoor air of pregnant farm workers and other pregnant women in Washington State.[5] Peak chlorpyrifos levels measured here greatly exceeded the highest concentrations inhaled

[3] Rauh et al, Impact of Prenatal Chlorpyrifos Exposure on Neurodevelopment in the First 3 Years of Life Among Inner-City Children, Pediatrics 118(6), e1845-e1859 (2006)

[4] Perera et al, Effects of Transplacental Exposure to Environmental Pollutants on Birth Outcomes in a Multiethnic Population, Environ Health Perspect 111:201-205 (2003). When the level of maternal PON1 activity was taken into account, maternal levels of chlorpyrifos above the limit of detection coupled with low maternal PON1 activity were associated with a small but significant reduction in head circumference, Berkowitz et al, *In Utero* Exposure, Maternal Paraoxonase Activity, and Head Circumference, Environ Health Perspect 112:388-391 (2004)

[5] See Table 5 in Whyatt et al, Contemporary-Use Pesticides in Personal Air Samples during Pregnancy and Blood Samples at Delivery among Urban Minority Mothers and Newborns, Environ Health Perspect 111:749-756 (2003)

by the New York City mothers. Again we must stress that large numbers of people live very near to orchards where chlorpyrifos is used, literally often within arms length of the trees. Pregnant workers are outside much of the day and there is reason to expect that their exposures continue inside their homes.

Data on chlorpyrifos in indoor air in agricultural areas is limited, but some information is available. Concentrations measured in California in 2002 ranged from 4 to 36 ng/m3 (24 hour sampling). These concentrations are again too close for comfort to those inhaled by the New York City mothers, and it is not clear whether they were measured during the spray season or not.[6]

Table 1 below provides information from these studies. (*Includes minor edits from version sent to DOH on November 19th)*

Table 1. **Chlorpyrifos in the air (ng/m^3)**

New York City Study: CPF in mother's air (48 hr samples)

Range	0.7 to 345;
Median	7.1

Washington State Newly Posted Data

Peaks at near-field Receptor monitors (excluding QC samples) (24 hr samples)

Least downwind	56.2
Most downwind	606.8

Peaks at ambient samplers (>1000 meters from orchards) (24 hr. samples)

North Central WA	21.1
Yakima Valley	30.2

28-day average concentrations near-field (excluding QC samples)

Least downwind	10.5
Most downwind	59.1

28-day average ambient concentrations (>1000 feet from orchards)

North Central WA	7.2
Yakima Valley	9.3

Examples of peaks at perimeter sites

North Central:

1144.9 (6 hr sample, Location 3)

[6] Bradman et al, Pesticides and their Metabolites in the Homes and Urine of Farmworker Children Living in the Salinas Valley, CA, Journal of Exposure Science and Environmental Epidemiology 17:331-34 (2007). Unpublished data from then UW masters candidate Golan Kedan from 1999 found levels of chlorpyrifos in indoor air samples of 1.9 to 10.3 ng/m3 in the summer. We do not know the timing of chlorpyrifos applications in the area.

869.6 (6 hr. sample, Location 4)

Yakima Valley:
1001.7 (6 hr. sample, Location 3)
903.5 (6 hr. sample, Location 4)
Location 4 over the full spray and post-spray sampling period:
* 7 hr (includes spraying) – 903.5
* Next 6 hrs. (after spraying stopped) – 102.6
* Next 9 hrs. – 259.9
* Next 9 hrs - 333.5
* Next 10 hrs – 398.6
* Next 24 hrs – 297.5
* No samples collected after that.

Location 6 concentrations for these same samples (6 hr, 6 hr, 9 hr, 9 hr, 10 hr, 24 hr.): 470.6, 476.4, 147.1, 618.8, 229.7, 114.8.

Indoor Air California (24 hr samples)

Lowest	4
Highest	36

ii) Studies tracking farm worker community children in California exposed to agricultural chlorpyrifos and other organophosphates. Increasing levels of organophosphate metabolites measured in mother's urine during pregnancy were associated with increases in the number of abnormal reflexes and the proportion of children with more than three abnormal reflexes in infants assessed after three days of life.[7] Researchers also reported adverse associations between prenatal organophosphate metabolites and mental development and pervasive developmental problems at 24 months of age, though they said that these should be interpreted with caution.[8]

iii) Studies measuring neurobehavioral performance among workers and children in agricultural areas exposed to organophosphates. Agricultural children aged 2 to 6 performed more poorly on measures of response speed and latency as compared to similar non-agricultural children in research conducted in Oregon and North Carolina. Researchers noted that the modest differences they found "are consistent with functional effects seen in adults exposed to low concentrations of OP pesticides".[9] They also found that the neurobehavioral performance of the farm

[7] Young et al, Association Between In Utero Organophosphate Pesticide Exposure and Abnormal Reflexes in Neonates, Neurotoxicology 26, 199-209 (2005)
[8] Eskenazi et al, Organophosphate Pesticide Exposure and Neurodevelopment in Young Mexican-American Children, Environ Health Perspects 115:792-798 (2007)
[9] Rohlman et al, Neurobehavioral Performance in Preschool Children from Agricultural and Non-Agricultural Communities in Oregon and North Carolina, NeuroToxicology 26:589-598 (2005); See also Lizardi et al, The Effects of Organophosphate Pesticide Exposure on Hispanic Children's Cognitive and Behavioral Functioing , Journal of Pediatric Psychology 33(1):91-101 (2008) regarding research in Arizona.

workers was lower than that of the nonagricultural adults, and within the sample of farm workers there was a positive correlation between urinary organophosphate metabolite levels and poorer performance on some neurobehavioral tests. Deficits were seen with respect to sustained attention, information processing and motor speed and coordination. The scientists noted that "The correlation between the types of deficits seen, replication of specific deficits across studies, correlation with animal models, and the toxicologic effects of these chemicals is no doubt of extreme importance."[10]

iv) Agricultural Health Study findings of higher rates of self-reported neurologic symptoms among pesticide applicators associated with cumulative exposure to moderate levels of organophosphates, regardless of recent exposure or history of poisoning. [11]

v) Results of medical monitoring of pesticide applicators in Washington State. In the 6 years that the program has been in place chlorpyrifos has consistently been the lead likely culprit for workers with action-level depressions of "cholinesterase", an enzyme important to nervous system functioning.[12] The program's goal is to prevent poisoning, and Labor & Industries reports indicate that health effects were not reported for workers with depressed cholinesterase. That significant percentages of covered handlers each year have had cholinesterase declines of greater than 20% should raise concerns about potential long-term effects in light of the Agricultural Health Study mentioned above and other data, however. In the AHS study, neurologic symptoms were reported without workers having experienced acute poisoning episodes. What does it mean for workers to experience cholinesterase declines year after year albeit without experiencing acute poisoning symptoms? Keep in mind also that the monitoring program is an imperfect tool as we do not know how immediately follow-up blood tests follow the bulk of application hours. In some cases, workers could apply chlorpyrifos for close to 30 hours followed by a break, crossing the 30 hour threshold that triggers follow-up testing later after cholinesterase levels have rebounded, for example Monitoring is only available to handlers, and only those who exceed the 30 hour handling threshold.

vi) A major study linking chlorpyrifos to lung cancer. Individuals with the highest lifetime exposure-days had a relative risk of lung cancer 2.18 times that of those with no chlorpyrifos exposure.[13]

vii) New data on people's ability to detoxify chlorpyrifos. Detoxification of chlorpyrifos depends on an enzyme called paraoxonase-1 (PON1). Studies show that

---

[10] Rothlein et al, Organophosphate Pesticide Exposure and Neurobehavioral Performance in Agricultural and Nonagricultural Hispanic Workers, Environ Health Perspect 114:691-696 (2006)

[11] Kamel et al, Neurologic Symptoms in License Private Pesticide Applicators in the Agricultural Health Study, Environ Health Perspect 113:877-882 (2005)

[12] Cholinesterase Monitoring of Pesticide Handlers In Agriculture, annual reports of the Washington State Deaprtment of Labor & Industries.

[13] Lee et al, Cancer Incidence Among Pesticide Applicators Exposed to Chlorpyrifos in the Agricultural Health Study, J Natl Cancer Inst 96(23): 1781-9 (2004)

subpopulations exist that have lower PON1 levels, and therefore a decreased ability to remove chlorpyrifos from the body. It has also been demonstrated that infants have lower PON1 activity than adults.[14] New research shows that children's lower levels of the PON1 enzyme persist through at least age 7 rather than plateauing by age 2 as previously thought.[15] Researchers report a 164-fold variation in sensitivity to chlorpyrifos between the most sensitive newborn and the least sensitive mother, a 26-fold difference among newborns, and a 14-fold difference among adults.[16] It is reasonable to be concerned that some people may be especially vulnerable to effects associated with chlorpyrifos. In particular, some children may be especially susceptible to developmental impairment from chlorpyrifos exposures.

viii) Large numbers of laboratory studies have documented neurological impacts of chlorpyrifos, particularly in animals exposed prenatally or early in life.[17] These studies indicate that cholinesterase inhibition is likely only one mechanism by which chlorpyrifos does harm. They make it clear that unique mechanisms operating during formation and organization of the nervous system in young creatures make it inappropriate and misleading to rely on extrapolations from effects in adults.

The body of evidence indicating that existing reference doses are entirely inadequate and that children and adults are at risk of health problems from ongoing chlorpyrifos exposures is very large. Taken individually no one study proves definitively that chlorpyrifos causes health problems or that it can do so at concentrations in our environment. However, the scope and breadth of the studies taken together is very compelling with respect to both questions. Epidemiological studies are complemented by animal studies and there are plausible biological explanations for the sorts of health effects that are being documented among farm workers, their children, others in agricultural areas, and the New York City study children.

EPA's own scientists have expressed grave doubts about risk assumptions for chlorpyrifos and other organophosphates. DOH would be remiss if it failed to mention in its analysis the important protest lodged by the leaders of three unions representing 9000 scientists, risk managers and other specialists at EPA in May of 2006.[18] In an extraordinary letter to then EPA Administrator Stephen Johnson, the

---

[14] Berkowitz GS, Wetmur JG, Birman-Deych E, et al. In utero pesticide exposure, maternal paraoxonase activity, and head circumference. Environ Health Perspect 2004; 112**:** 388–91.

[15] Huen et al, Developmental Changes in PON1 Enzyme Activity in Young Children and Effects of PON1 Polymorphisms, Environ Health Perspect, doi:10.1289/ehp.0900870 (http://dx.doi.org/)

[16] Furlong et al, ON1 status of farmworker mothers and children as a predictor of organophosphate sensitivity. Pharmacogenet Genomics: 16 (3): 183-90

[17] For an overview see Slotkin, Developmental Neurotoxicity of Organophosphates: A Case Study of Chlorpyrifos, Chapter 21, Toxicology of Organophosphates and Carbamate Compounds, 2006. For one example of a new study published since that overview, see Tait et al, Long-Term Effects on Hypothalamic Neuropeptides after Developmental Exposure to Chlorpyrifos in Mice, Environ Health Perspect 117:112-116 (2009) FWPP would be glad to provide cites for scores of individual studies in our files, some of which may not be included in the bibliography of the overview study above.

[18] Letter to Stephen Johnson, EPA, May 24, 2006, from American Federation of Government Employees, National Treasury Employees Union, and Engineers and Scientists of California. Available on website of Public Employees for Environmental Responsibility.

scientists expressed their deep concern that in the soon-to-be-finalized tolerances and cumulative risk analyses for organophosphates the agency could "betray the public trust". The scientists referred to EPA's Scientific Advisory Panel's warnings that the agency's current approaches "may not be sufficiently conservative, may underestimate the risks to infants and children, and do not adequately identify individuals that may be inherently sensitive to neurotoxicants." They stated that "EPA's risk assessments cannot state with confidence the degree to which any exposure of a fetus, infant or child to a pesticide will or will not adversely affect their neurological development."

The letter notes that "As risk assessors, we continue to be troubled by the Agency's failure to adequately consider exposure to neurotoxic pesticides by infants and children who commonly enter the fields treated with these pesticides while accompanying their parents employed to perform post-application tasks. The children of farmworkers, living near treated fields, are also repeatedly exposed through pesticide drift onto outdoor play areas and through exposure to pesticide residues on their parents' hair, skin and clothing. Additionally, we are concerned that unborn fetuses may also be exposed to these neurotoxicants when pregnant women are employed to handle (mix, load and apply) these pesticides or are employed to enter treated areas to perform hand labor tasks following pesticide applications."

The scientists and others who sent the letter explicitly noted that EPA may be unduly influenced by pesticide manufacturers and users. For example, they note that many influential proponents of agriculture have repeatedly expressed concerns that EPA properly coordinate with agricultural stakeholders, USDA and producers. "It appears that the Agency has inadvertently taken this to mean that the concerns of agriculture and the pesticide industry come before our responsibility to protect the health of our Nation's citizens. We are concerned that the Agency has lost sight of its regulatory responsibilities in trying to reach consensus with those that it regulates, and the result is that the integrity of the science upon which Agency decisions are based has been compromised." They further note that "Our colleagues in the Pesticide Program feel besieged by political pressure exerted by Agency officials perceived to be too closely aligned with the pesticide industry and former EPA officials now representing the pesticide and agricultural community; and by the USDA through their Office of Pest Management Policy." The scientists specifically highlight chlorpyrifos in an Attachment to the letter noting that there is disagreement with the assumption that developmental effects from chlorpyrifos occur only at doses above those which cause cholinesterase inhibition, or even that they occur exclusively through inhibition.

With three more years of data in hand, it is unacceptable to fail to mention this letter and its implications regarding the legitimacy of screening levels which are based on EPA analyses.

C) <u>The drift data must be considered in the context of other exposures.</u>

Dr. Fenske's own prior research and that of many other scientists in Washington and elsewhere have documented exposures through other routes. The near constant

chlorpyrifos drift during spray season almost certainly contributes to these other exposures. Deposition from drift contaminates soil, toys, surfaces, soils, etc. It contributes to dermal and ingestion exposures associated with that contamination.

Documentation of widespread and ongoing exposures to chlorpyrifos for farm workers, their children and others in agricultural areas includes:

* Studies in which chlorpyrifos was measured in house and vehicle dust, on surfaces and toys, in children's clothing, and on children's hands. [19]
* Studies measuring metabolites associated with chlorpyrifos and other organophosphates in the urine of farm workers and their children.[20]
* While published data on chlorpyrifos in umbilical cord blood or other direct measures of prenatal chlorpyrifos exposures in agricultural communities are scant, it is clear that widespread exposures for pregnant women are leading to those prenatal exposures. Umbilical cord plasma measurements from infants of mothers exposed to chlorpyrifos in household products in the NewYork City studies discussed above indicate that it is readily transferred to the developing fetus during pregnancy.[21] Other data suggest that chlorpyrifos can also contaminate breastmilk. [22]

Multiple pathways of exposure to chlorpyrifos are undisputed for children and adults. Workers are exposed to chlorpyrifos through: i) contact during mixing, loading and applying it, ii) residues on plants and soils, iii) drift at work, iv) drift at home for vast numbers who live near the fields, and v) diet. Family members are exposed through i) pesticides that come home on workers' bodies, ii) drift from nearby fields, and iii) diet. Children are also exposed prenatally and potentially through breastmilk to the chlorpyrifos to which their mothers are exposed, as mentioned above.

---

[19] Bradman et al, Pesticides and their metabolites in the homes and urine of farmworker children living in the Salinas Valley, CA., J Expo Sci Environ Epidemiol. 2007 Jul: 17(4); 331-49; Thompson et al, Pesticide Take-Home Pathway among Children of Agricultural Workers: Study Design, Methods and Baseline Findings, J Occup Environ Med, 45:42-53, 2003; Curl et al, Evaluation of Take-home Organophosphorous Pesticide Exposure among Agricultural Workers and Their Children", Environ Health Perspect 110(12), A787-792, Dec. 2002; Fenske et al, Children's Exposures to Chlorpyrifos and Parathion in an Agricultural Community in Central Washington State, Environ Health Perspect 110(5), 549-553, May 2002; Koch et al, Temporal Association of Children's Pesticide Exposure and Agricultural Spraying: Report of a Longitudinal Biological Monitoring Study" Environ Health Perspect 110(8), 829-833, August 2002; Simcox et al, Pesticides in Household Dust and Soil: Exposure Pathways for Children of Agricultural Families, Environ Health Perspect 103(12), 1126-1134, Dec. 1995; Fenske et al, Strategies for assessing children's organophosphorus pesticide exposures in agricultural communities, Journal of Exposure Analysis and Environmental Epidemiology, 10, 662-671 (2000).

[20] Young et al, Association Between In Utero Organophosphate Pesticide Exposure and Abnormal Reflexes in Neonates, Neurotoxicology 26:199-209 (2005); Eskenazi et al, Organophosphate Pesticide Exposure and Neurodevelopment in Young Mexican-American Children, Environ Health Perspect 115:792-798 (2007); Curl 2002 Ibid, Fenske (2002) Ibid, Koch (2002) Ibid; Rothlein et al, Organophosphate Pesticide Exposure and Neurobehavioral Performance in Agricultural and Nonagricultural Hispanic Workers, Environ Health Perspect 114:691-696 (2006).

[21] Whyatt et al, Contemporary-Use Pesticides in Personal Air Samples during Pregnancy and Blood Samples at Delivery among Urban Minority Mothers and Newborns, Environ Health Perspect 111:749-756 (2003).

[22] Sanghi R, Pillar MK, Jayalekshmi TR, Nair A. 2003. Organochlorine and organophosphorous pesticide residues in breastmilk from Bhopal, Madhya Pradesh, India. Hum. Exp. Toxicol. 22:73–76.

Once chlorpyrifos enters a home it may remain there for years. Chlorpyrifos was found in house dust in 78% of 500 randomly selected homes across the United States in samples collected by the EPA and the US Department of Housing and Urban Development years after the ban on chlorpyrifos in most household products went into effect.[23] Researchers tracking urban children's exposures to chlorpyrifos also have found it in house dust years after the ban.[24] Children who crawl and play on the floor are exposed to lingering chlorpyrifos through ingestion, contact with the skin, and inhaling re-suspended particles.

A new study provides important information regarding the context in which the chlorpyrifos found in Washington State air must be considered. Scientists back-calculated OP pesticide exposures (chlorpyrifos plus other OPs) from urinary metabolite data and compared cumulative dose estimates with available toxicity information for a common mechanism of action (brain cholinesterase inhibition) using data from US EPA.[25] Their results "suggest that approximately 40% of children in the United States may have had insufficient margins of exposure (MOEs) for neurological impacts from cumulative exposures to OP pesticides (MOE less than 1000)." These scientists were using urinary metabolite data collected via the National Health and Nutrition Examination Survey (NHANES) program from1999 to 2002. They are not focusing on farm workers' children who have special additional exposures as compared to the general population such as inhaling chlorpyrifos drift. Even without their additional exposures, this study indicates that children in agricultural areas could face high organophosphate-related risks from other exposures in common with others across the country.

DOH must stand up for farm worker children, farm workers, and others in agricultural areas. It must discuss the new air results in the larger context of multiple exposures people face to chlorpyrifos, other organophosphates and other pesticides.

III) Air Concentrations May Be Higher in Different Years and Different Circumstances

Many factors could have decreased levels of chlorpyrifos measured in the air during the UW study. Even if concentrations measured in 2008 were not of concern, which is not the case, it would be inappropriate to assert safety based on very limited sampling in only one year.

a) The application area for the perimeter sites was small (four acres; five acres). The applications did not take very long (1 hour, 2 and 1/4 hours). Longer lasting applications on larger spray blocks may lead to higher air concentrations. (This concept was used by EPA in the new federal fumigant rule to generate charts for determining buffer zone size, but is not mentioned in the UW report.)

---

[23] Stout et al, American Healthy Homes Survey: A National Study of Residential Pesticides Measured from Floor Wipes, Environmental Science and Technology, accepted March 5, 2009.

[24] Whyatt et al, Within- and Between-Home Variability in Indoor-Air Insecticide Levels during Pregnancy among an Inner-City Cohort from New York City. Environ Health Perspect 115:383-389 (2007)

[25] Payne-Sturges et al, Evaluating Cumulative Organophosphorus Pesticide Body Burden of Children: A National Case Study, Environmental Science & Technology, 43 (20) (2009), accepted August 19, 2009.

b) The weather was “generally cold” limiting volatilization.

c) Stronger winds than those occurring during applications in 2008 can increase drift. Weather delayed application at the Yakima Valley site during the study, but is that care always taken, particularly when applicators are not making sure to be particularly cautious due to nearby air monitoring? Farm workers involved in our organization note that the pressure to get orchards sprayed can affect application decisions.

d) In the North Central perimeter study, the grower reported no chlorpyrifos use in surrounding areas during the study. In Yakima, one acre nearby was sprayed during the morning of April 2nd. In a different year or locations, multiple area fields could be sprayed concurrently.

e) The application rate at the North Central perimeter site was 0.75 pints of Govern 4E product per acre. The label allows up to 4 pints per acre (range of 1/2 to 4 pints; it says growers should use a higher rate in the range when there is increased pest pressure.) The total pounds of active ingredient per acre used was 1.5 pounds. At the full legal rate of 4 pints of Govern 4E per acre which the label says is equivalent to 2 pounds of active ingredient, the four acres could have received 8 pounds instead of 1.5 pounds of active ingredient. According to the National Agriculture Statistics Survey (NASS) database the average pounds per acre of chlorpyrifos used on apples in Washington State was 2.28, 2.20, 2.18,2.54, 2.26, 2.04, and 2.11 in 1991, 1993, 1005, 1997, 1999, 2001, and 2003 respectively. These are higher than the per acre poundage applied by applicators at the North Central perimeter site.

The application rate for Yakima site was 2 quarts of Yuma 4E product per acre, with a total of 10 pounds of active ingredient applied. The allowable application rate is again 1/2 pint to 4 pints per acre, with the label advising use at the higher rate when there is increased pest pressure. Five acres at the full 4 pint rate (2 lbs) would result in the use of 10 pounds of active ingredient, so it appears that this site did use the high end of the allowable range.

f) Growers/applicators were heavily involved in selection of perimeter sites. We request more information regarding their involvement in the receptor and ambient site selections. (Update: a recent email from Dr. Fenske on which DOH was cc:d notes that growers were not involved in selection of the non-perimeter sites, and locations were not revealed to them.)

g) We do not know whether use of chlorpyrifos in the regions around sampling locations occurred at typical rates or not. Information on whether spraying occurred on sampling days near monitors is limited. We do not know what the target pest population situation was in 2008, and how that affected chlorpyrifos applications.

There were some reports of seeing spraying on non-monitoring days; and only limited references to noticing it on sampling days. Lack of pesticide use reporting stymies analysis.

IV) Environmental Injustice: Unacceptable Risks for Farm Worker Children and Others in Agricultural Areas

Ten years ago EPA banned the residential applications of chlorpyrifos associated with the mental deficits and other health effects revealed in the New York City study discussed above. Data from that study show that children conceived after the ban were spared the chlorpyrifos exposures experienced by children conceived before it. Avoiding those exposures, they did not experience mental deficits, smaller birth size and other effects.

But as children and adults in urban areas were protected, chlorpyrifos use in agricultural areas continued. Exposures have been ongoing for people in farming areas, and in particular for farm workers and their children. This is a classic situation of environmental injustice. It is a double standard that continues in a community of color facing poverty, immigration challenges, and language barriers.

Many growers in our state and elsewhere have already eliminated the use of chlorpyrifos. There are safe alternatives for growing foods without using this pesticide.

Study after study after study in Washington State and elsewhere has documented the ongoing exposures to chlorpyrifos experienced by farm workers, their children and others in agricultural areas. At the end of each study, the researchers generally conclude that further study would be useful. While further study is indeed appropriate, it is well past the time to act to end the exposures.

Each person in our state has a right to not be exposed to chlorpyrifos. That right is being violated on a regular basis. This violation is all the more unacceptable because evidence is strong that exposures may lead to health effects. As with lead, the more time that passes, the more the evidence points to health impacts at lower and lower levels.

DOH now faces a test as to whether it will fulfill its mission to protect health in our state. The agency must stand up and clearly and unequivocally demand the real reforms outlined below. Scientists outside of DOH who have made careers out of detailing the exposures that are occurring in farm worker communities should also be in the forefront in calling for strong policy reforms to end exposures.

V) Mitigation is not enough.

It will not be enough for DOH and others to call for mitigation measures while endorsing ongoing use of chlorpyrifos. While urban children saw their residential product exposures and associated mental deficits end after a residential ban, farm worker families and others in agricultural areas continued to be exposed despite mitigation measures.

DOH staff are undoubtedly familiar with source reduction hierarchies and the reasons behind them. Engineering controls, personal protective equipment, buffer zones and other measures fall behind source reduction in terms of ensuring actual protection for people. Source reduction (eliminating the toxic substance at the source) is obviously the most effective means to ensure that exposures end.

Even with the greatest care during applications, chlorpyrifos can rise and drift after applications end. (See for example, the post-application drift data for the Yakima Valley perimeter site, where the 170 ng/m^3 reference dose was exceeded for at least 52 hours at two sampling locations and at least 43 hours at another.) EPA's own calculations for pesticide registrations find risks below target Margins of Exposure (MOEs) for workers even with the best protective equipment. The effectiveness of protective equipment is further reduced by the realities in the fields and by lack of inspections and enforcement. State budgetary cuts only worsen the situation with respect to inspections and enforcement.

The site visits conducted by Labor & Industries as part of the cholinesterase monitoring program are very telling. Numerous violations and other problems were found. One frequent problem was poor fitting of respirators and/or inadequate maintenance and changing of cartridges. It is likely that these sorts of problems spotlighted by the consultation visits are present at other state orchards as well. Poisoning cases attest to the risks workers face as a result. For example, in 2007 a 32 year old farm worker spraying apples and wearing Personal Protective Equipment (PPE) developed dermal and neurological symptoms.[26] He reported that his mask didn't fit properly. The worker went to the hospital the next day. His employer returned the full face mask to the supplier for repairs.

In another case involving a different pesticide, Columbia Legal Services attorneys recently represented a worker poisoned due to a defective respirator. That worker was ordered to keep working, and became very sick as a result. He felt that the order was made because the supervisor urgently needed to get the cherries sprayed. After the employer was fined, the worker was fired and evicted. Years later he received a settlement payment in his retaliation case against his employer.[27] I mention this non-chlorpyrifos case because it highlights the environmental injustice conditions that surround this issue. Workers may face retaliation when they act to protect themselves and others. DOH must protect farm workers and their families both because the health risks they face are serious ones and because their circumstances make it difficult for them to speak out.

Nor should "intervention" like encouraging families to wash floors daily, clean outside toys regularly, take off shoes, wash work clothes separately, etc. be substituted for ending contamination of workplaces and homes with chlorpyrifos. Requiring these extra daily tasks of the farm worker community violates basic principles of justice and equity.

---

[26] DOH Case 070034, 03/30/07, Appendix C, PIRT 2008 Annual Report, approved September 17, 2009
[27] Wheat, *Pesticide lawsuit dropped,* Wenatchee World, October 20, 2008.

Moreover research strongly suggests that this sort of "intervention" is of limited utility. In a major study published in 2008 [28], researchers reviewing the effectiveness of four years of certain intervention activities found that median organophosphate metabolite levels in people's urine were actually higher in Year 4 than in Year 1. There were no significant differences between intervention and control homes in terms of contamination levels. There were some declines in detections and concentrations of azinphos methyl, the only pesticide studied that is slated for imminent phase-out. This fact highlights the effectiveness of bans as compared to interventions and other mitigation.

Ending the use of chlorpyrifos is the only way to ensure that exposures end for farm workers, their children and others in agricultural areas. A ban would eliminate the ever present threat of acute poisoning episodes for children and adults, and it would prevent less immediately visible health effects associated with this pesticides. A ban would also result in other benefits including ending exposures to chlorpyrifos residues in food and protecting bees and wildlife.

VI. What DOH Must Do

In summary, here is the situation. We have:

* Constant off-site drift to near and distant locations, despite care taken because of knowledge about monitoring, and other factors reducing drift potential.
* Massive violations of laws prohibiting the handling of chlorpyrifos in a manner that results in contacts with people through drift.
* An egregious double standard between urban families and farm families that has existed for a decade.
* Vulnerable populations at risk including children and farm worker families dealing with classic environmental justice barriers.
* Comprehensive and compelling evidence of significant risk including at documented inhalation exposure levels. That evidence includes not only animal data and information from residentially exposed human populations, but also studies of farm workers and their families strongly suggesting that neurological impacts are occurring in children and adults.
* Documentation of significant exposures to chlorpyrifos above and beyond inhalation exposures, and also to other organophosphates and other pesticides as well.

It is hard to imagine a more compelling set of facts calling out for DOH leadership to protect health. We urge DOH to take the following actions:

1) Produce a strong analysis of the chlorpyrifos results, incorporating the studies and considerations raised in these comments.

2) Call upon the Governor to ensure full enforcement of legal requirements protecting people's right to not be exposed to chlorpyrifos, through appropriate state agencies. Urge EPA to use its authority to demand full enforcement by state

[28] Thompson et al, Para Niños Saludables: A Community Intervention Trial to Reduce Organophosphate Pesticide Exposure in Children of Farmworkers, Environ Health Perspect 116: 687-694 (2008)

agencies as well. DOH should explicitly recommend that inspectors be provided with air monitoring equipment to help in this work.

3) Call for a ban on the agricultural use of chlorpyrifos, and urge EPA to establish a short phase-out timeline through an expedited process. Call upon the Governor to direct WSDA to use its authority to establish a phase-out timeline in our state as well.

4) Recommend to the state legislature, the Governor and appropriate federal policymakers that they establish and fully fund comprehensive programs to facilitate grower transitions to alternatives and to ensure that alternatives are safe.

5) Call upon EPA to alter its pesticide evaluation procedures so that they embody the precautionary principle, using the chlorpyrifos experience as an illustration of why major reforms are needed.

6) Renew air monitoring as an essential part of DOH's work and aggressively seek adequate funding for it. Also seek funding to restore DOH's full pesticide program. Call upon the Governor to support air monitoring funding and restoration of the pesticide program's budget. Continuing air monitoring must not be used as an excuse for delaying reforms that end exposures, however.

7) Recommend immediate protective measures to reduce exposures during the short period before chlorpyrifos use is prohibited , such as no-spray buffer zones around homes, daycares, schools, and workers.

8) Establish DOH as an agency which takes seriously its mission to protect health, particularly vis a vis vulnerable populations such as children and environmental justice communities. Follow through on each of the recommendations above to make sure they are implemented fully and swiftly.

Please, let us know if you have any questions or need additional information. We look forward to reading DOH's report and to working with the agency to prevent further chlorpyrifos exposures and protect health.

Sincerely,

Carol Dansereau
Executive Director

APPENDIX 1

Exceedances of the 170 ng/m^3 Reference Dose

The more protective reference dose of 170 ng/m^3 was frequently exceeded in samples collected by UW. Examples include but are not necessarily limited to the following.

a) North Central Receptor Sites

At Receptor 1 on April 12 - 606.8 ng/m^3
(Spraying was noted across the road.)

Note: Receptor 3 on April 12 was close to the reference dose but not it at 163 ng.m^3) (No spraying was noticed.)

b) Yakima Valley Receptor Sites

Receptor 1: on April 3 208 ng/m^3 (No sighting of spraying.)

Receptor 2: on April 3 – 243 ng/m^3 (Spraying was observed on 4/2, the day before, so this was not necessarily the peak.)

c) Yakima Valley Perimeter Site

52 hours exceeding reference dose at Locations 4 and 5.
43 hours exceeding reference dose at Quality Control location.
Lots of exceedances of 170 ng/m3 for durations less than 24 hours, including as high as 1001.7.

There were numerous samples of less than 24 hour duration that had concentrations of chlorpyrifos above 170 ng/m^3. Some of these were quite high, such as 1144.9 ng/m3 (6 hour sample) at Location 3 next to North Central Washington's site.and 1001.7 ng/m3 (6 hour sample) at Location 3 next to the Yakima Valley sites. At Location 4 at the Yakima Valley site, near field concentrations were 903.5 for 7 hours during the application, followed by a period of 6 hours when concentrations were less than 170 ng/m3 (102.6 ng/m3). Concentrations then rose above 170 ng/m3 for 52 hours.

At Location 7 at the Yakima Valley site, concentrations exceeded 170 ng/m3 at 386.7 and 473.5 ng/m3 for a 6 hour sample and a 7 hour sample respectively. For the next 9 hour sample the concentration was 109.7 below the reference dose, but then for 9 hours and 10 hours the concentrations were 394.3 and 182.7 ng/m3 respectively. We have not calculated the average concentration over the full 41 hour period, but it is clearly higher than the reference dose. **This and other examples of periods of more than 24 hours at both perimeter sites for which the average concentration exceeds the reference dose are not included in the list of exceedances above, but they should be.** DOH needs to engage in a thorough analysis of the data.

Regardless of averages, however, peak exposures must be considered. Particularly with respect to prenatal exposures, a brief but significant fetal exposure to chlorpyrifos during a window of particular vulnerability could lead to major impacts.

Appendix 2

Comparison of Farm Worker Pesticide Project 2006 Results and the UW 2008 Results

FWPP did near-orchard sampling at residences without the knowledge of applicators and growers. We collected 24 hour samples for 21 days at each of two locations, with no gaps in sampling.

UW's Receptor and Perimeter sites were most comparable to this sampling because they occurred near orchards. The UW's 24 hour samples were collected every other day, however, for a total of 15 samples per location. (Three locations and a co-located Quality Control sampler in North Central and the same number in Yakima Valley). Growers were aware of air monitoring at the UW perimeter sites.

FWPP found concentrations above the reference dose of 170 ng/m3 at 6 to 8 days of the 21 sampling days at each location where we sampled. The highest concentrations were 475 and 572 ng/m3.

The UW measured concentrations exceeding 170 ng/m3 in North Central at 1 of 15 samples collected at Receptor Sites 1 and 3, and in the Yakima Valley at 1 of 11 samples collected at Receptor Site 1 and 1 of 12 samples at the Quality Control Receptor. The exceeding concentrations for these four Receptor sites were 606.8, 163.7, 208.2 and 218 ng/m3.

The 170 ng/m3 concentration was also exceeded for more than 24 hours at locations 4, 5, and the Quality Control sampler at the Yakima Valley Perimeter site. Numerous samples for durations less than 24 hours exceeded 170 ng/m3 at both the North Central and the Yakima Valley Perimeter sites, including at levels as high as 1144.9. Many peaks for periods less than 24 hours significantly exceeded the top concentrations FWPP found for 24 hour periods. At two locations at the Yakima Valley Perimeter site (Locations 4 and 5) concentrations exceeded 170 ng/m3 for 7 hours, followed by a gap of 6 hours below that level, followed by 52 hours above it. DOH should pay attention to high peak exposures as well as to 24 hour concentrations, especially when over the course of a few days, concentrations exceed 170 ng/m3 much of the time with intermittent periods of lower concentrations.

We have not yet compared other factors between the different studies such as temperature and wind.

UW did ambient sampling at locations more than 1000 meters from orchard. FWPP did not do comparable sampling.