

OEHHA comments: Four health risks of chlorpyrifos

As a retired school nurse who has lived over 25 years in agricultural communities, I have particular interest in the health of farmworker families. These comments are derived from an informal risk characterization of the health risks of chlorpyrifos, using a framework of human and environmental concerns, and from my comments on Department of Pesticide Regulation's Draft Risk Assessment. I want to thank OEHHA for revisiting the risks of chlorpyrifos, especially since DPR's assessment, and the mitigations subsequently proposed, were extremely disappointing. My intention is to increase mutual understanding between regulators and stakeholders, and to find areas of agreement that support collective actions to prevent harm.

Developmental harm from perinatal and childhood exposures:

In vitro, animal, and human exposure studies all support the neurotoxicity of chlorpyrifos, with resulting harm to development, learning, and behavior. Influences of exact doses, mechanisms, timing, and genetic variability on adverse effects are still unknown. In their respective reports, both EPA and DPR acknowledged repeatedly that the neurotoxic dose of chlorpyrifos may be less than the 10% RBC AChE inhibition used in DPR's risk assessment. Per DPR, there is "compelling evidence that developmental neurotoxicity may occur in humans... at exposures below those that cause overt toxicity or inhibit AChE". However, DPR's refusal to use the results of EPA's most recent report on CPF dramatically altered both what exposures were evaluated and conclusions reached to as safe levels.

EPA's website states that "EPA believes that evidence from epidemiological studies indicate effects may occur at lower levels than indicated by the toxicology data base." Because of the significance of harms and multiple unknowns, EPA lowered the Point of Departure (PoD) for calculating risks and exposures considerably in the November 2016 report. In that report, EPA stated that they were "...unable to conclude that risk from aggregate exposure from use of chlorpyrifos meets the safety standard." The Scientific Advisory Panel (SAP) endorsed the final methodology used. Yet DPR chose to call EPA's report a "draft", and declined to use its conclusions.

DPR's focus on short-term, acute exposures also resulted in mischaracterization of risks. For example, "steady state" effects of 21-30 days do not equate with chronic and recurrent exposures experienced by residents of agricultural communities. Nor was there any acknowledgement of combined and cumulative impacts of exposures to multiple agricultural chemicals, including other organophosphates with similar mechanisms of action. A recent large retrospective study in the Central Valley found correlation between high pesticide use in nearby fields and birth defects. Similar correspondences occurred with respect to adverse neurodevelopmental effects in both the CHAMACOS and CHARGE epidemiological studies, some of which were specific to chlorpyrifos.

As a neurotoxin, CPF has been clearly shown to be most harmful to developing cells. Obviously, pregnant women, infants, and young children are the groups most vulnerable. Since dose, mechanism, timing, and genetic variations are still unknown, protection must be broad, with the safest exposure approaching zero. Therefore, recurrent, chronic, and aggregate exposures must all be addressed, not just acute and short-term exposures. Designating CPF as both a developmental and reproductive toxin AND as a Toxic Air Contaminant (TAC) are steps in that direction.

Poisonings of farmworkers and agricultural communities:

DPR focused on "bystanders" and ignored risks to farmworkers. This is in spite of recent and recurrent poisonings of field workers that involved chlorpyrifos. In their most recent report, EPA concluded that, even with maximum PPE and appropriate engineering controls, applicators and handlers could not be adequately protected. Many poisoning episodes are caused by drift, affecting workers in nearby fields, as well as occupants of schools and residents in the drift zone.

Pesticide drift results in much more than bad air quality. Besides respiratory effects, drift creates conditions for exposure via multiple routes: indoor as well as outdoor air; skin exposure; oral exposure from residues deposited on food, surfaces, and in soil and water. These multiple routes support the need to more carefully consider aggregate exposure.

DPR's use of pesticide incidents as surrogates for who was exposed and how was flawed, since under-reporting is common. Even workers who become ill often do not seek medical evaluations due to fear of job loss, costs, deportation, etc. Nor are poisoning incidents surrogates for recurrent moderate to high exposures, which have been noted to have neuro-behavioral impacts similar to those found in animals and children: memory and concentration problems, mood changes, etc.

Pesticide exposure assessments are often derived from modeling based on small studies, in lieu of actual monitoring. Assumptions, even when labeled "worst case," are based on correct use of pesticides, which does not always happen in real world situations. Farmworkers are directly impacted by both accidents and improper use. In addition, while DPR acknowledge that CPF residues "persist for weeks or months in indoor environments", household exposures were characterized as short-term exposures in the assessment. Workers are "vectors" for take-home exposures, and both they and their families may be subject to both acute and chronic excess exposures after work ends.

DPR's assessment also ignores the reality that some farmworkers overlap with one of the two categories of "bystanders" considered at highest risk: women of childbearing age. Often these women continue to work in the fields during their pregnancies, thus compounding the risk of harmful exposures. Breast milk can also be a source of CPF exposure to infants.

Families in agricultural communities consider themselves to be stakeholders, not bystanders. While they may not use that term, some have eloquently articulated concerns about exposures as members of unjustly impacted communities. I hope OEHHA plans to arrange for translation for the November hearing. Farmworker families live, work, and attend school in close proximity to fields where chlorpyrifos is sprayed. They are subject to spray drift, occupational, and take-home exposures. Many lack resources to apply optimal "engineering controls" at home. Environmental justice principles demand that the concerns and elevate risks of farmworker families be included when assessing risks of chlorpyrifos.

Contamination of food and water:

Because a different Point of Departure is used in DPR's report, the resulting assessment ignores EPA's conclusions on food and water contamination almost completely. Oral exposures were minimally addressed, primarily as they contribute to aggregate exposures. While California, as a major producer of fruits and vegetables, may not want to officially acknowledge that foods eaten by toddlers can bear residues of chlorpyrifos up to 140 times safe levels, consumers may take note of EPA's findings in light of increasing attention to chemicals on and in food. Potential economic

costs of reported food contamination must be considered in addition to the social and economic burdens of IQ loss, behavior problems, increased need for Special Education, etc.

Environmental damage to endangered species and rural areas:

While reported separately, EPA scientists also concluded that chlorpyrifos presents significant risk to many endangered species, both directly and via harm to habitats. This report may be outside of both DPR's and OEHHA's purview. However, although chlorpyrifos is touted for its short half-life and biodegradability, it has spread all over the planet, leaving detectable levels in soil, water, and arctic ice. Rural communities are subject to pesticide contamination of air, soil, and water from multiple sources. Cumulative impacts of agricultural chemicals present hazards to humans, wildlife, habitats, and to our climate.

Assumptions: Risk Assessment and Management, or Precautionary Principle?

Discounting the validity of EPA's conclusions and using a much different PoD allowed DPR to reach much different Margins of Exposure (MOEs) in the draft Risk Assessment. While DPR concluded that some mitigations might be in order, nothing specific was disclosed until later, and those offered were woefully inadequate. The focus on air quality, the TAC designation, bystanders, and short-term acute exposures certainly narrowed their scope.

Using different assumptions inevitably makes agreement on conclusions difficult. A 2008 article from sciencedirect.com on the use of MOEs to estimate risks states "Depending on the approaches taken in determining the PoD and estimate of exposure, it is possible to derive very different values for the MOE." This is an obvious reason why DPR's draft report differs so dramatically from EPA's Nov. 2016 report, and why I hope OEHHA will take a different approach. The choice to exclude both chronic/recurrent bystander exposures and occupational exposures is based on assumptions also open to question. Yet underlying all these decisions is a more troubling difference in assumptions. DPR's actions and decisions do not appear to be guided by the Precautionary Principle.

Using 10% RBCs AChE inhibition as the standard fails to adequately address the neurotoxicity of chlorpyrifos. As previously stated, and admitted by DPR, there are multiple uncertainties. A safety factor of 100x may not account for all of them, especially since the harmful dose may not be measurable in RBC samples. DPR admitted to other deficiencies in the use of this standard, as quantifiable samples are difficult to both collect and to detect.

A review of DPR's many tables on drift exposures throughout the report (the pink, mauve, and purple pages) revealed that current buffers are inadequate to protect vulnerable groups. Severe restrictions of distance and rates for aerial, air blast, and ground boom application should have been the minimum mitigations proposed. Designation of CPF as a developmental and reproductive neurotoxin could be the basis for its also being designated as a Toxic Air Contaminant. For those of us highly concerned about pesticide drift, these steps offer some hope of reduction of use and exposure, at least for this one chemical.

At the September hearing, a member of DPR's panel stated that rationale for not using EPA's most recent conclusions was that it is based on "new science...a novel approach." Yet that is at least one compelling reason why relying on DPR's Risk Assessment to determine Risk Management is inadequate. The multiple unknowns and uncertainties in both EPA and DPR's reports are elements

that make the Precautionary Principle a better strategy for addressing risks of chlorpyrifos than relying on Risk Assessment. There is uncertainty regarding the causes, nature, and magnitude of harm. Harms identified are possible, scientifically plausible, and unacceptable. There exist complex relationships among environmental and individual factors. Interventions are required to constrain and contain the harm. More evidence and information are needed. (See COMEST/UNESCO 2005).

The essential question is not what mitigations will lower risk and improve the numbers on pink and purple pages. Rather, what actions will reduce harms to the lowest possible level? With so many unknowns, the safest option is to reduce exposure to zero, and that means a ban, or at the very least severe restrictions with the goal of a phase out. As stated, OEHHA's designation of CPF as a developmental and reproductive toxin is a step in that direction. Using the Precautionary Principle promotes innovation, according to COMEST/UNESCO. We need measures that will promote research and development to take California further in the direction of truly sustainable agriculture.

In order to truly explore impacts of and alternatives to use of chlorpyrifos, "bystanders" must be considered stakeholders. So must farmworkers. The concerns of residents and workers in agricultural communities cannot be measured using a model rooted in cost/benefit. Neither their neurological systems, nor those of their children are a commodity. Social and environmental justice and state and federal law require that those most impacted be protected. Where there is uncertainty, it is best to err on the side of caution. My hope is that OEHHA's assessment and action will be informed and guided by the Precautionary Principle.

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My background: In my graduate NP education at UW, I received a NIOSH grant, which allowed additional formal training in toxicology, exposure assessment, industrial hygiene, and occupational and environmental medicine. I also attended workshops in Risk Assessment, Management, and Communication, and worked pro bono on farmworker safety education, including applicator training. I worked as a nurse collecting samples on two exposure assessments of children living in orchard areas of Eastern Washington. That was 20 years ago, and I did not pursue a career in occupational health, instead working most of the intervening years as a school nurse in an ag-based community with a large farmworker population. I don't claim to be an environmental scientist; rather I consider myself an advocate and activist for social and environmental justice with a scientist's mindset.