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M E M O R A N D U M

TO: Shelley DuTeaux, PhD, MPH
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FROM: Terrell Barry, PhD, Research Scientist IV *[original signed by T. Barry]*
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DATE: August 15, 2017

SUBJECT: Response to the California Air Resources Board Comment on the Draft Chlorpyrifos Risk Characterization Document (Dated December 31, 2015)

This memorandum provides responses to comments submitted by the California Air Resources Board (CARB) on the 2015 draft chlorpyrifos Risk Characterization Document (RCD). We thank the CARB for providing these comments. Our responses are shown below.

ARB Comment #1:

Basis for exposure assessment - The Risk Characterization Document (RCD) describes three primary application methods that lead to offsite drift following applications of chlorpyrifos: ground-based boom applications, ground-based air-blast spray applications, and aerial applications (fixed wing and helicopter). There have only been a limited number of air monitoring studies conducted near applications of chlorpyrifos. Because of this, DPR relied on modeling to estimate air concentrations for the RCD. DPR staff used two drift models developed by U.S. EPA, AgDRIFT and AgDISP, to estimate deposition and offsite air concentrations associated with applications of chlorpyrifos. On page 21 of the RCD, the Technical Summary states that one of the main uncertainties of the exposure assessment was the lack of air concentration estimates for ground-based boom and air-blast applications of chlorpyrifos. However, on page 132, the RCD references air monitoring conducted in 1996 by staff of the California Air Resources Board (CARB) at DPR's request adjacent to an air-blast application of chlorpyrifos. We suggest revising the Technical Summary to indicate there is uncertainty due to minimal data, not a lack of data.

HHA Response: *The language of the RCD will be changed to reflect this comment.*

ARB Comment #1, continued:

In 2014 and 2015, CARB staff conducted air monitoring at DPR's request adjacent to two additional chlorpyrifos applications. Data from those two studies were not available when the RCD was completed, but have now have been provided to DPR staff. We recommend including

data from all available air monitoring studies in a revised RCD, along with an analysis of how the monitoring data compare with the model estimates.

> ***HHA Response:*** *New studies which are available in the public domain will be reviewed, and as appropriate be incorporated into the revised RCD. It is our understanding that the measured values from the 2014 ARB study may not be directly comparable to the model estimated air concentrations for the following reasons: 1) there were potential inconsistencies between the duration of the sampling period and the duration of the application period; 2) a different sampling method may have been more appropriate for aerosols; and, 3) it appears that the highest application period-measured air concentration was not collected in the predominate wind direction according to the wind rose. Even given these potential complications in comparing the measured air concentration to modeled air concentration, we will review and itemize the data and revise the RCD as appropriate.*

ARB Comment #1, continued:

In addition, while the focus of DPR's exposure assessment is offsite drift, we understand that the two models used by DPR are also capable of estimating the portion of a chlorpyrifos droplet that evaporates during deposition. We suggest including an estimate of the contribution of droplet evaporation to offsite exposure.

> ***HHA Response:*** *The revised exposure assessment in the chlorpyrifos RCD includes both deposition and inhalation as sources of exposure for all scenarios. Exposure estimates are provided at multiple distances downwind for every scenario in the RCD. These exposures estimate intrinsically account for and estimate the contribution of droplet evaporation through the change of deposition and air concentrations with distance.*

ARB Comment #2:

<u>Post-application volatilization</u> - While we know that chlorpyrifos has low volatility and that primary offsite movement will likely be due to drift immediately following an application, CARB's monitoring indicated that low air concentrations persisted offsite well after the completion of applications. This indicates that some post-application volatilization and offsite movement is occurring, meaning that the duration of offsite exposure is longer than the period associated with drift during an application. Some of this offsite movement will occur in the

gaseous phase and some adsorbed onto particles. We suggest attempting to characterize this offsite exposure through the use of emission estimates and air dispersion modeling using AERMOD, U.S. EPA's preferred air dispersion model.

> ***HHA Response:*** *HHA agrees that CPF is lost through volatilization after the application is completed. However, volatilization was not evaluated for two reasons:*
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> *1) A review of the air dispersion modeling presented in U.S. EPA (2013) found that the agency's estimates of the air concentrations of CPF were higher than the theoretical saturated air concentration (Reiss et al., 2013). Air concentrations higher than the saturated air concentration of CPF cannot occur in the environment.*
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> *2) US EPA reviewed a new toxicology study (Hotchkiss et al., 2013) submitted together with the revised analysis of the volatilization data based on public comments (Reiss et al., 2013). Specifically, in the US EPA (2014) memorandum entitled "Chlorpyrifos: Reevaluation of the potential risks from volatilization in consideration of chlorpyrifos parent and oxon inhalation toxicity studies" US EPA reevaluated risks due to volatilization exposure to CPF or CPF-oxon and concluded on page 2: "Based on the new data, there are no human health risks of concern anticipated for volatilization exposure to either chlorpyrifos or chlorpyrifos-oxon."*
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> *However, HHAB will further examine this issue if new information becomes available in the future.*

ARB Comment #3:

Exposure scenarios - Appendix 3 of the RCD contains a description of the modeling that was conducted by DPR staff to estimate offsite air concentrations using AgDRIFT and AgDISP. Based on information from U.S. EPA and California pesticide use, a range of field sizes were used in the modeling. The largest field size for an orchard air-blast application was 40 acres, the largest ground-based boom application was 300 acres, and the largest aerial application was 350 acres. We are concerned that the largest field size used for modeling an orchard air-blast application was considerably smaller than the field sizes selected for modeling the other two application methods. We recommend including a similar size orchard air-blast application in the exposure assessment.

> ***HHA Response:*** *As noted in this comment, the maximum application size is considerably smaller for orchard airblast than for ground boom or aerial applications. This is due to*

the nature of the application method and the crop type. For the exposure analysis, the maximum size of each application method was based both on the pesticide use information and on the size where no spray drift from additional application swaths contributed to horizontal deposition downwind of the application. Basically, once an application of any method gets large enough there is no deposition beyond the downwind edge of the application from additional swaths. The AgDRIFT model has a limit of 20 swaths for orchard airblast and ground boom applications. Barry (2015) described a method to extend the maximum number of swaths by overlaying blocks of 20 swath deposition results. Scenarios for 40 and 60 swaths for both orchard airblast and ground boom are shown in Barry (2015). Blocks of swaths were added until the deposition curve from the farthest upwind block did not contribute any deposition beyond the downwind edge of the first block of swaths. For orchard airblast that occurred after 3 blocks of 20 swaths (a total of 60 swaths), which is the scenario used for the exposure estimates presented in the RCD.

ARB Comment #3, continued:

In addition, DPR assumed that the amount of offsite movement due to drift during an application of chlorpyrifos was only 0.35 percent of the amount applied. The reference for this drift percentage was a personal communication. Using such a low drift percentage does not seem health protective. We suggest using data from published studies as the basis for this drift percentage. For example, Majewski and Capel cite a range of studies that indicate that offsite drift ranges from 1-75 percent of the application rate, varying due to numerous factors (M. Majewski and P. Capel, Pesticides in the Atmosphere, Ann Arbor Press, 1995).

HHA Response: *The modeling methods memorandum will be edited to more fully explain the use of the 0.35 percent deposition. We do not assume that only 0.35 percent of the application rate was the total mass lost through drift. The total mass lost by spray drift from an application varies with each application scenario and is not used directly in the exposure calculations. For clarity, a table summarizing for each scenario Application Efficiency (on-target and off-target mass accounting) will be added to the spray drift modeling memorandum.*

The 0.35 percent is only a screening value used to rank aircraft according to far field deposition. The final aircraft selected were those that showed the furthest distance downwind to that screening level (one fixed-wing and one rotary aircraft). That

screening level was chosen by the original exposure assessor, Sheryl Beauvais, the person cited in the personal communication. The 0.35 percent deposition is not the deposition value used in the exposure calculations. There is no single deposition value used to estimate exposures. Exposures are calculated at each distance, as shown in the RCD, using specific outputs of deposition and air concentration at each distance.

Literature Cited

Barry, T. A. 2015. Estimation of Chlorpyrifos Horizontal Deposition and Air Concentrations for California Use Scenarios. Memorandum to Kwok, Eric S. C., Human Health Assessment Branch, from Barry, Terri A., Research Scientist IV, dated December 16, 2015. Department of Pesticide Regulation. California Environmental Protection Agency. Sacramento, CA 95812.

Hotchkiss, J. A., Krieger, S. M., Brzak, K. A., and Rick, D. L. 2013. Nose-Only Inhalation of Chlorpyrifos Vapor: Limited Toxicokinetics and Determination of Time-Dependent Effects on Plasma, Red Blood Cell, Brain and Lung Cholinesterase Activity in Female CD(SD): Crl Rats. *Dow Chemical Company, Midland MI., Study # 131040* DPR Vol. 342-0937 #271252.

Reiss, R., Freeman, E., and Johnston, J. 2013. A review of EPA's "Chlorpyrifos: Preliminary evaluation of the potential risks from volatilization." Submitted by Exponent. 1800 Diagonal Road, Suite 500, Alexandria, VA 22314. Prepared for Dow AgroSciences LLC. 9330 Zionsville Rd. Indianapolis, IN 46268. https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0850-0171

U.S. EPA 2013a. Chlorpyrifos; Preliminary Evaluation of the Potential Risks from Volatilization. *Office of Chemical Safety and Pollution Prevention, U.S. Environmental Protection Agency, Washington, DC.* 31 Jan 2013. https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0850-0114

U.S. EPA 2014. Chlorpyrifos: Reevaluation of the potential risks from volatilization in consideration of chlorpyrifos parent and oxon inhalation toxicity studies. EPA-HQ-OPP-2008-0850-0192.