Department of Pesticide Regulation

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MEMORANDUM

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TO: Shelley DuTeaux, Ph.D., MPH
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FROM: Terrell Barry, Ph.D., Research Scientist IV *[original signed by T. Barry]*
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Exposure Assessment Section, Human Health Assessment Branch

DATE: August 15, 2017

SUBJECT: Response to Dow AgroSciences' Comments on the Exposure Assessment Sections of the DPR Draft Chlorpyrifos Risk Characterization Document (dated December 31, 2015)

I. Background

The California Department of Pesticide Regulation (DPR) received comments from Dow AgroSciences (DAS) dated March 28, 2016 pertaining to the December 31, 2015 draft chlorpyrifos (CPF) Risk Characterization Document (RCD). This memorandum contains the Human Health Assessment (HHA) Branch responses to the DAS comments on the exposure assessment sections of the RCD.

II. Response to Comments

1) **Page 3. I. Executive Summary. DAS Comments: "DAS strongly disagrees with the proposal that exposures in any of the scenarios should exceed regulatory levels of concern or that they may present a risk to human health for any population group under real-world use conditions**. The use of valid, verified toxicological endpoints and realistic real-world use conditions and exposures would result in scenarios that do not exceed regulatory levels of concern or that would present a risk to human health for any population group."

HHA Response: As detailed in the draft RCD, this exposure assessment adopted the point-of-departures, spray-drift models, and post-application dermal and inhalation assessment methods developed by US EPA. In addition, this exposure assessment tailored the exposure duration and spray drift modeling to be consistent with the actual use patterns, allowable application rates, and available aerial and ground based application methods of chlorpyrifos in California. Hence, exceedance of the level of concern (e.g., below the inhalation target margin-of-exposure [MOE]) or *vice versa* identified in this exposure assessment should be considered as realistic and California specific.

2) **Page 5-6. I. Executive Summary. DAS Comments: "The application/exposure/risk scenarios used in DPR assessments are overly conservative in general and several key aspects are not valid. The resulting cumulative effect significantly over-estimates exposures from spray drift**. Not all product use rates evaluated are supported by current labels and should be excluded. A critical limitation of the assessment approach is the use of AGDISP to estimate air concentrations for human inhalation exposure assessment. This is without precedent and has never been validated with field data and thus is an improper use of the model. In addition, the result of greater drift at the 15 gallons per acre application for aerial applications versus 2 gallons per acre is based upon incorrect parameterization of the model; in reality, higher application volumes result in lower drift potential. The fixed-winged aircraft used in the assessment is worst-case and not representative of typical, real-world practices. Using a more common aircraft, incorporating the correct application rate, calibrating the model correctly, and the incorporation of drift reduction technology, the estimated exposure would be reduced by 75% for deposition and 50% for air concentrations."

   HHA Response: Comment 2 is noted and will be addressed in the responses to comments below.

3) **Page 6. I. Executive Summary. DAS Comments: "…the use of a default assumption of 100% dermal absorption dramatically over-estimates resulting risk.** CA DPR had advised in 1991 that a dermal absorption value of only 9.6% be used, and if used, this would decrease the estimated risk 10-fold from what is proposed in the current assessment.

   HHA Response: This exposure assessment adopted the chlorpyrifos route-specific PBPK modeled point-of-departures (PoD) that were developed by US EPA. For the dermal route, the PBPK-derived dermal PoD is based on the concept of permeability for evaluating the rate of CPF absorption into the skin (instead of dermal absorption factor). In other words, the PoD already factors the dermal absorption of CPF in humans into its derivation. Hence, in the draft RCD, dermal absorption factor was not used**.**

4) **Page 6. I. Executive Summary. DAS Comments: "The injury and illness incident data actually show an extremely low frequency of definitive or even alleged incident involving chlorpyrifos and do not support a conclusion of risk to bystanders from spray drift**. In the cited time period, the real world incident data do not support the RCD risk conclusion since there was only one definite incident attributed to spray drift and that involved an applicator and not a bystander. Furthermore, the incidents cited do not reflect applications made using the newer buffer restrictions which EPA has recently concluded are more than protective for all population groups including infants, children and women who may be pregnant."

HHA Response: As detailed in the report by Mehler *et al.* (2006), illnesses attributable to non-occupational exposures are not comprehensively reported. Also, because not all affected individuals relate their symptoms to pesticide exposure and treating physicians may not recognize effects related to pesticide exposure, the true rate of reporting may not be known. Updated pesticide illness data will be included in the revised chlorpyrifos risk assessment per the DPR Pesticide Illness Surveillance Program.

5) Page 38. II. TOXICOLOGY PROFILE. RCD Page 74: *"The study of greatest interest for risk assessment is the one performed with aerosol, since that is the most likely media form for human inhalation exposure in California (Kwok, 2015; APPENDIX 3)."* ***DAS Response:*** "Based on the report by Kwok (2015) the CA DPR assumes that aerosol exposure from spray drift is the most likely human exposure scenario in California. DAS commissioned a 6 hour nose only chlorpyrifos aerosol exposure study (Hotchkiss et al, 2010) to provide toxicokinetic data to extend CPF PBPK/PD modeling efforts (Timchalk, 2002; Poet et al., 2014) to include inhalation as a route of exposure. It has been determined that acute 6 hour (Hotchkiss et al, 2013) and repeated subchronic (Newton, 1988) exposure of rats to saturated vapor atmospheres of chlorpyrifos have no measurable effect on ChE activity in any tissue. The use of a solid aerosol of chlorpyrifos was necessary to achieve an absorbed dose sufficient to induce detectable ChE inhibition following a single 6 hour exposure (Hotchkiss et al, 2010). The particulate nature of the chlorpyrifos aerosol used in the Hotchkiss et al (2010) study was unique and is not representative of the composition of spray drift aerosols that might be encountered in the ambient environment. Chlorpyrifos is never applied in its pure state, rather it is formulated with inert ingredients for spray/fog applications, reducing the actual chlorpyrifos concentration in spray drift aerosols relative to the solid aerosols used by Hotchkiss et al (2010).

The US EPA has published PoDs for steady-state inhalation exposure for two critical subpopulations (children 1-2 years old: 2.37 mg/m3; and females 13-49 years old: 6.15 mg/m3;US EPA 2014a) that are used for both acute and subchronic CPF spray-drift exposures in California. The PoDs were derived based on the assumption that the regulated aerosol is pure CPF, as used in the Hotchkiss et al (2010) study, when in reality any spray drift aerosol will contain a much lower concentration of CPF, based on the % CPF composition of the sprayed formulation. As such the PoD aerosol concentrations are likely to overly conservative, not reflective of the actual exposure scenario, and should be adjusted for the % CPF in the formulation associated with a spray drift event to yield a comparable inhaled dose of CPF. This would effectively increase, and more accurately reflect, the PoD aerosol concentration in proportion to the % CPF in the spray drift aerosol."

HHA Response: The deposition mechanism of CPF onto the respiratory tract is determined by the aerodynamic diameter of aerosol (Jarabek *et al.*, 1989). Aerosol with aerodynamic diameter < 10 μm has potential of reaching into deep regions of the lung for systemic absorption. Because the scrubbing mechanism of the respiratory tract would enhance the local absorption of vapor (USEPA, 1994), the observation that the aerosol form of CPF is more potent than its vapor form for inducing RBC cholinesterase inhibition is likely due to the difference in deposition mechanism between these physical forms. The air concentrations estimated by the AGDISP model are for the active ingredient only, i.e., CPF only, with the percent of CPF taken into consideration by the AGDISP model in the tank mix specification. Hence, no additional adjustment needs to be made for evaluating the exposure to spray drift.

6) **Page 38. II. TOXICOLOGY PROFILE.** RCD Page 74: *"The U.S.EPA did not anticipate acute inhalation exposure for their residential scenarios. They instead generated PoDs for steady-state inhalation exposure for two critical subpopulations (children 1-2 years-old: 0.00237 mg/m3; females 13-49 years-old: 0.00615 mg/m3) (U.S. EPA 2014a)."* **DAS Response:** "CA DPR has incorrectly stated the PoDs for the two populations (children 1-2 years old and females 13-49 years old). An examination of Table 4.8.4 on page 65 of the USEPA's Chlorpyrifos: Revised Human Health Risk Assessment for Registration Review clearly shows that the PoDs corresponding to 10% RBC inhibition in these two populations are 2.37 and 6.15 mg/m3, respectively, not 0.00237 mg/m3 or 0.00615 mg/m3 as CA DPR states. There is a 1000X difference in the CA DPR-values from what was published by the USEPA."

   HHA Response: The typographical errors identified will be corrected in the revised RCD.

7) **Page 66. V. BYSTANDER EXPOSURE. Application Rate Assumptions for Modeling:** "While the labels for insecticides can be complex due to the large numbers of crops and pests, it must be noted that some of the modeled scenarios are not allowed on labels. The maximum application rate that can be delivered by air is 2.3 lb ai/acre, for treatment of Asian citrus psylla; 4 lb/acre and 6 lb/acre rates are off-label."

   HHA Response: Please see the RCD Page 109. Table 47 Footnote b: "Although 4 and 6 lb/ac are not allowed for aerial application by the current product labels of CPF, these application rates were included in the U.S. EPA analyses (Dawson et al., 2012)." The 4 lb/acre and 6 lb/acre rates were included by HHA for comparison to the analysis by US EPA. In addition to Dow AgroSciences, other manufacturers of CPF products exist. The HHA analysis also used the currently registered Cheminova NUFOS 4E label for an insecticide chlorpyrifos formulation that has a minimum finished spray volume of 15 gal/ac for aerial applications made to grapefruit, lemons, oranges, and other citrus fruit.

8) **Page 67. V. BYSTANDER EXPOSURE. Choice of Aircraft: "…**If a more appropriate aircraft such as the AT401 or AT502 were chosen there would be more operational options for larger application volumes and/or for increasing droplet size as methods of mitigating potential exposure."

HHA Response: Barry (2015) states that the Enforcement Branch of DPR obtained a count of each aircraft model from Agricultural Commissioners in high CPF use counties. The AT802 is used in California. HHB uses the reasonable worst case scenario to estimate exposure risk. The AT802 aircraft is the reasonable worst case scenario aircraft for the chlorpyrifos exposure assessment.

9) **Page 67. V. BYSTANDER EXPOSURE. Parameterization of the Model in the Aerial Exposure Scenarios: "**The report goes into some detail in Appendix 3 on the effects of application volumes upon spray drift. Unfortunately, this analysis is based upon incorrect assumptions in model parameterization. 15 GPA was selected as an upper-end application volume, however, the AT802A cannot apply 15 GPA because there is no equipment that can deliver this rate."

   HHA RESPONSE: HHA will make appropriate changes to the parametrization of the 15 gal/ac finished spray aerial application scenario in the revision of Barry (2015). However, 2 gal/ac finish spray is the default for the exposure assessment for both US EPA (Dawson et al., 2012) and HHA. The 15 gal/ac scenario was simulated only for comparison to the 2 gal/ac default finished spray scenario.

10) **Page71. V. BYSTANDER EXPOSURE. Using AGDISP to Estimate Air Concentrations: "…**AGDISP was not designed for estimating air concentrations for inhalation exposure and the air concentration estimates have never been directly validated. Indeed, since there were no airborne concentration estimates available for ground or airblast applications, aerial applications were actually unduly penalized by virtue of having another modeled exposure route available for assessment. Because of all these factors, DAS concludes that it is inappropriate to rely on this methodology to generate inhalation exposure values for risk assessment of the aerial use patterns."

    HHA RESPONSE: HHA maintains that the AGDISP model is appropriate to be used for estimating inhalation exposure. For example, air concentrations were estimated using the AGDISP model in US EPA's most recent human health risk assessment for the aerial ultra-low volume (ULV) mosquito application scenarios (see page 77 of US EPA, 2014). Details of the AGDISP simulations are given in the most recent occupational and residential exposure assessment (see page 22 in (USEPA, 2014)). Therefore, both US EPA and HHA are using the same modeling tool to estimate 1-hr off-site air concentrations associated with aerial applications of CPF. In addition, US EPA used the initial 1-hr air concentrations directly from the AGDISP model in the same manner the DPR RCD used the initial 1-hr AGDISP air concentrations (USEPA, 2012), spreadsheet EPA-HQ-OPP-2008-0850-0107).

11) **Page 73-74. VI. BYSTANDER RISK. RCD Page 116. Table 53. DAS Comments: "…**The RCD has used an overly conservative Dermal Absorption Value. Calculations

involving dermal absorption percentages in the current DPR assessment utilized a dermal absorption factor of 100%."

HHA Response: Please see response to Comment 3.

12) **Page 76. VI. BYSTANDER RISK. RCD Page 81. "**For estimating the dermal exposure from contaminated lawn…**" DAS Comments: "**Following the direction of USEPA's 2012 Residential SOP the dermal absorption value of 9.6% should be used to calculate dermal exposure rather than the current default of 100%. Employing this correct approach, the dermal exposure component of the combined deposition, would decrease by a factor of 10."

HHA Response: Please see response to Comment 3.

13) **Page 76-78. VI. BYSTANDER RISK. RCD Page 81. "***Accordingly, the bystander exposures could occur indirectly via contact (e.g., dermal exposure) with the areas contaminated with the drift deposit and (or) directly via inhalation of the airborne material (e.g., aerosol).***"** **DAS Comments:** "Dow AgroSciences believes the RCD has used an inappropriate approach with regard to Inhalation Exposure…DPR's assessment, the approach used the AGDISP model to estimate exposure through calculation of breathing zone air concentrations via aerosol. As more fully explained in Section 5 above, the air concentration output of the AGDISP model was not designed for human exposure purposes, but rather for optimizing the operation of forest canopy sprayers. Therefore there should not be an inhalation component in the calculation of bystander risk, and thus the resultant aggregate MOEs as presented in Table 53, (and Tables 57 and 58) should not include a contribution from inhalation. CA DPR indicates *Inhalation appears to drive the MOEs below the target value for children (1-2 years old)* (p. 116, CA DPR, 2015*).* If inhalation exposure is discounted due to the DAS position that the model used is inappropriate, then the aggregate exposures as presented in Table 53 approach acceptable MOEs."

HHA Response: Please see the response to Comment 10 above.

14) **Page 78. VI. BYSTANDER RISK. RCD Page 85**. "Table 25: The units for dose are presented as mg/kg/d." **DAS Comments:** "The units should be expressed in µg/kg/day."

HHA Response: The typographical errors identified will be corrected in the revised RCD.

15) **Page 78. VI. BYSTANDER RISK. RCD Page 103**. Table 41: "In **Table 41**, a number of Hand-to-Mouth MOEs are below the target value of 100." **DAS Comments:** "If the FQPA 10X SF was reduced to 1X, and applied to all MOE calculations, the MOEs would increase by a factor of 10. As such, in Table 41, all MOEs would be above 100 and therefore pass.

HHA Response: The rationale of using 10X FQPA factor was detailed in the draft RCD. Accordingly, the comment that "*If the FQPA 10X SF was reduced to 1X, and applied to all MOE calculations, the MOEs would increase by a factor of 10. As such, in Table 41, all MOEs would be above 100 and therefore pass***"** is noted.

16) **Page 78-79. VI. BYSTANDER RISK. RCD Page 103. Table 41.** ""In **Table 41**, a number of Hand-to-Mouth MOEs are below the target value of 100." **DAS Comments:** "… Additionally minor adjustment to application parameters would allow for a reduction in deposition with resultant MOEs above 100. For example, increasing application volume to 3 lb/acre with coarse droplet size decreases deposition of spray by a factor of 1.6 at a 25 ft. setback distance with a corresponding increase in MOE values."

HHA Response: Given the context of this comment and the previous application rate comments, it is assumed that "3 lb/acre" should be 3 gal/acre finished spray. The label allows a minimum of 2 gal/acre finished spray and medium droplet size spray quality as the finest spray quality. DAS noted in their comments (page 66) that "… higher application volumes will result in lower drift potential." The 2 gal/acre finished spray volume as the minimum allowed by the label is reasonable worst case. HHA uses 2 gal/acre finished spray volume and medium droplet size as the default reasonable worst case consistent with the Tier II simulations performed by U.S. EPA (Dawson et al., 2012). Therefore, HHA will maintain the 2 gal/acre finished spray volume and medium droplet size for this exposure scenario.

17) **Page 79. VI. BYSTANDER RISK. RCD Page 105, Table 43.** "See rows 1-6 for Dermal Exposure Route." **DAS Comments:** "Rows 5 and 6 are duplicative of rows 1 and 2 and should be deleted. Furthermore, rows 1-4 should be annotated with the application rates 1, 2, 4 and 6 lb/acre, respectively.

HHA Response: The typographical errors identified will be corrected in the revised RCD.

18) **Page 79. VI. BYSTANDER RISK. RCD Page 117-199**: "See Tables 54 and 55." **DAS Comments:** "These tables include an inhalation exposure route for both ground boom and airblast applications. However, DPR states that inhalation exposure calculations were performed only for the aerial application of CPF [p. 82 (CA DPR, 2015)]. Therefore, inhalation should not be included in these tables."

HHA Response: The typographical errors identified will be corrected in the revised RCD.

19) **Page 90. VIII. RISK APPRAISAL. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. DAS Comments: "**DAS provided a detailed response to DPR's spray drift assessment methodology in Section V above. DPR claims the models used are "state-of-

the-art" and they are indeed used by USEPA for regulatory decision making. However if the models are incorrectly parameterized, the resulting drift predictions can be overestimates."

HHA Response: The default spray drift assessment scenario of 2 GPA finished spray was correctly parameterized. The 15 GPA finished spray scenario (used only for comparison to the default spray drift scenario) will be examined and re-parametrized as required. All changes to the 15 GPA scenarios will be included in the revision of Barry (2015).

20) **Page 91. VIII. RISK APPRAISAL. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. "**DPR states that the conditions modeled for the assessment of spray drift from aerial applications were tailored to match operational conditions in California. However, several of the aircraft settings employed are physically impossible and do not reflect the best practices routinely applied by the aerial application industry in California. Because of these issues, DPR's assertion that the exposure estimates in the assessment are "realistic upper bound values" is a misstatement – the calculated values are unlikely be encountered in the field. Comments provided above in Section V, Bystander Exposure, demonstrate how the inclusion of correct operating parameters greatly mitigates the magnitude of potential spray drift."

HHA Response: The aerial application scenarios were tailored to match reasonable worst case California applications. The aerial application scenarios using 2 gal/acre finished spray for both the fixed wing and the rotary aircraft were correctly parameterized. HHBA exposure modeling quantifies the reasonable worst case application practices as allowed by current product labels. This is because HHA analysis must capture the range of exposures possible given the application rates allowed by the product labels.

21) **Page 91. VIII. RISK APPRAISAL. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. DAS Comments: "**In their assessment, DPR modeled an inhalation exposure from aerial applications with the AGDISP model. As noted above in Section V, this is an unvalidated and inappropriate use of the model. DPR justifies this use by citing a Tulare County air monitoring study that, following an airblast application of chlorpyrifos to citrus, yielded air peak air concentrations of the same order of magnitude as the AGDISP estimates. Upon closer examination of the Tulare study, the sampling technique could not distinguish between aerosol (i.e., spray drift) and vapor residues of chlorpyrifos; in fact, the peak concentrations did not occur immediately after application, suggesting that much of the residue was the result of volatilization after application. As noted in the toxicology sections above, inhalation exposure at saturated vapor conditions (c. 0.250 mg/m3) results in no adverse effects (a value an order of magnitude higher than the peak concentration in the Tulare study), so it is unlikely that the monitored concentrations would results in an adverse effects."

HHA Response: Based on the available toxicity data in experimental animals, the aerosol form of CPF is more potent than its vapor form for inducing RBC cholinesterase inhibition (please also see response to Comment 5). However, the employment of Tulare County air monitoring study in the RCD is to access whether a similar air concentration could be observed using a ground based application method. As DAS pointed out, the sampling technique employed in the CARB study could not distinguish between aerosol (i.e., spray drift) and vapor residues of chlorpyrifos. Although the CARB sampling method was not optimal for aerosol collection, the majority of pesticide applications result in some amount of spray drift (http://www.cdpr.ca.gov/docs/dept/factshts/epadoc.htm). Therefore, it is reasonable to assume that residues collected in samples taken during the application period consist of vapor immediately re-volatilizing off the application and the smallest aerosols being lost as spray drift. Hence, it is plausible that the ground based application could be effective as its aerial counterpart in generating spray-drift aerosol.

22) **Page 91. VIII. RISK APPRAISAL. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. DAS Comments: "**Also citing the Tulare study, DPR states that their modeled exposure is underestimated because the AgDRIFT modeling does not include an estimate of inhalation exposure. The route of exposure is indeed not accounted for, but based upon the low potential hazard from inhalation, this uncertainty is likely of little consequence."

HHA Response: The comment that *"The route of exposure is indeed not accounted for, but based upon the low potential hazard from inhalation, this uncertainty is likely of little consequence"* is noted.

23) **Page 91. VIII. RISK APPRAISAL. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. DAS Comments: "**Tables 57 and 58 include inhalation as one of the routes of exposure. As explained in Sections V and VI of this document, the AGDISP model has not been validated for estimating breathing zone air concentrations and therefore should not be included as a relevant route of exposure. These tables also indicate an exceedance of the target MOE of 100 for hand-to-mouth exposure. Minor adjustments of the application parameters would allow for decreased deposition and thus higher MOEs as explained in Section 6. Lastly the dermal MOE in these tables were calculated on the basis of 100% absorption as outlined in Section 6. The available specific dermal absorption values should be used.

HHA Response: Please see responses to Comments 10 and 3 above.

24) **Page 92. VIII. RISK APPRAISAL. In Summary. RCD Page 132-134. V.I. Acute CPF Spray Drift Exposure Appraisal. Spray. DAS Comments: Drift Exposure: "**Children 1-

2 yrs: Where hand-to-mouth MOEs are lower than the target of 100, minor adjustments to the aerial application parameters would allow for acceptable MOEs as explained in Section 6. Additionally, as DPR has emphasized, inhalation exposure is driving the risk assessment, and consequent consideration of mitigation, but this assentation is based on the inappropriate use of the AGDISP model which is not validated to calculate breathing zone air concentrations."

HHA Response: Please see responses to Comments 10 and 20 above.

25) **Page 94. VII. CONCLUSIONS. Second Complete Paragraph. DAS Comments:** "**The application/exposure/risk scenarios used in DPR assessments are overly conservative in general and several key aspects are not valid. The resulting cumulative effect significantly over-estimates exposures from spray drift**. Not all product use rates evaluated are supported by current labels and should be excluded from the analysis. A critical limitation of the assessment approach is the use of AGDISP to estimate air concentrations for human inhalation exposure assessment. This is without precedent and has never been validated with field data and thus is an improper use of the model. In addition, the result of greater drift at the 15 gallon per acre application for aerial applications versus 2 gallons per acre is based upon incorrect parameterization of the model; in reality, higher application volumes result in lower drift potential. The fixed-winged aircraft used in the assessment is worst-case and not representative of typical, real-world practices. Inclusion of practical and commonly-used mitigation measures, such as increases in application volume, appropriate nozzle selection and optimization of aircraft operating conditions, can reduce drift potential by several-fold. Applicators routinely make these sorts of decisions, especially when sensitive crops or other areas potentially at risk are close to the application area."

HHA Response: Please see the responses to Comments 7, 9, 10 and 20 above.

26) **Page 94. VII. CONCLUSIONS. Third Complete Paragraph. DAS Comments: "**While the application scenario over-estimates the level of exposure, **the use of a default assumption of 100% dermal absorption dramatically over-estimates the resulting risk.** CA DPR had advised in 1991 that a dermal absorption value of only 9.6% be used, and if used, this would decrease the estimated risk 10-fold from what is proposed in the current assessment."

HHA Response: Please see response to Comment 3.

27) **Page 94. VII. CONCLUSIONS. Last Complete Paragraph. DAS Comments: "**Dietary and drinking water exposures are not a significant contributor to the aggregate risk calculated in the assessment. As DPR notes, exposure to drift in the air was the primary cause, accounting for as much as 95% of the combined or aggregate exposures. With the corrections

discussed here, spray drift and therefore inhalation exposure would be significantly reduced and when combined with the appropriate reduction in dermal adsorption, aggregate exposure and resulting risk are significantly lowered."

HHA Response: Please see the responses to Comment 20 and Comment 1 above.

28) **Page 95. VII. CONCLUSIONS. First Complete Paragraph. DAS Comments: "The injury and illness incident data show an extremely low frequency of definitive or even alleged incident involving chlorpyrifos and do not support a conclusion of risk to bystanders from spray drift**. In the cited time period, the real world incident data do not support this risk conclusion since there was only one definite incident attributed to spray drift and that involved an applicator and not a bystander. Furthermore, the incidents cited do not reflect applications made using the newer buffer restrictions which EPA has recently concluded are more than protective for all population groups including infants, children and women who may be pregnant."

HHA Response: Please see the response to Comment 4 above.

References

Barry, T. 2015. Estimation of chlorpyrifos horizontal deposition and air concentrations for California use scenarios. Sacramento, CA: Human Health Assessment Branch, Department of Pesticide Regulation, California Environmental Protection Agency. December 16, 2015. http://www.cdpr.ca.gov/docs/hha/memos/chlorpyrifos_%20modeling.pdf.

Dawson, J. L., Bohaty, R., Mallampalli, N., Wolf, J., Metzger, M., Evans, J., Spatz, D., and Jones, A. 2012. Chlorpyrifos, PC Code 059101, DP Barcode 399483 and 399485; Evaluation of the Potential Risks from Spray Drift and the Impact of Potential Risk Reduction Measures. https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0850-0105.

Jarabek, A. M., Menache, M. G., Overton, J. H., Jr., Dourson, M. L., and Miller, F. J. 1989. Inhalation reference dose (RfDi): an application of interspecies dosimetry modeling for risk assessment of insoluble particles. *Health Phys* 57 Suppl 1:177-183.

Mehler, L. N., Schenker, M. B., Romano, P. S., and Samuels, S. J. 2006. California surveillance for pesticide-related illness and injury: coverage, bias, and limitations. *J Agromedicine* 11:67-79.

US EPA 1994. Methods for Derivation of Inhalation Reference Concentrations (RfCs) and Application of Inhalation Dosimetry. U.S. Environmental Protection Agency, Office of Research and Development, Office of Health and Environmental Assessment, Washington, DC, EPA/600/8-90/066F. In *EPA-HQ-OPP-2009-0687*. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

US EPA 2012. Appendix F – Chlorpyrifos – Evaluation of the potential risks from spray drift and the Impact of potential risk reduction measures. . https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0850-0107.

US EPA 2014. Chlorpyrifos: Revised human health risk assessment for registration review. Chlorpyrifos, PC Code 059101, DP Bar code 424485. Memorandum dated December 29, 2014. https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0850-0195.