External Scientific Peer Review of "Update to the Health-Based Recommendations to Mitigate Cancer Risk of Occupational Bystander Exposure to 1,3- Dichloropropene" and its associated documents

Scott M. Bartell, PhD
Joe C. Wen School of Population & Public Health
University of California, Irvine

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Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence:

Conclusion # 1: Estimation of an acceptable air concentration.

Conclusion # 2: Estimation of occupational bystanders' exposure from working in close proximity to treated fields without (i.e., at the edge of the field) and with (i.e., at 100 ft buffer zone) mitigation measures.

Conclusion # 3: Estimation of occupational bystanders' exposure from working in the general vicinity of treated fields (i.e., not in close proximity to treated fields).

As I indicated in my initial correspondence with the Scientific Peer Review Program, my expertise includes cancer risk assessment and general exposure assessment, but I don't have any specific expertise in fumigants, farmworker activity practices, or bystander exposure to pesticides.

General Comments

I have reviewed the documents provided, and personally verified the calculations on p. 8 of the Attachment to the June Memorandum that yielded an acceptable average air concentration of 0.21 ppb over the working lifespan of occupational bystanders. Although mostly reasonable assumptions were used to perform the calculations supporting all 3 of OEHHA's conclusions listed above, I am concerned that the breathing rate of 10 cubic meters used to calculate an acceptable air concentration (Conclusion #1) is too low for moderately intensive work such as farming, and appears to be inconsistent with default breathing rates indicated by OEHHA's own risk assessment guidance document. Conclusion #2 is well supported by detailed

spatiotemporal air dispersion modeling using thoughtful assumptions; the results comparing field edge concentration with and without a 100 ft buffer zone are particularly informative regarding the substantial exposure reductions that are expected with this simple mitigation strategy. Conclusion #3 mostly pertains to a call for continued monitoring/measurement of actual 1,3-D concentrations in the general vicinity of treated fields, as well as modeling efforts, as regulations shift away from township caps. This is sensible advice.

My specific comments and questions for each document follow.

Specific Comments on Attachment to June Memorandum

p. 3, "A breathing rate of 10 cubic meters over the workday was assumed, consistent with moderately intensive work and assumptions for occupational exposure used in OEHHA guidelines for other programs (OEHHA, 2015)." 10 cubic meters per 8-hr shift is a bit low for moderately intense work. It's unclear what part of the 2015 OEHHA document cited here is the source for this value, but in fact, p. 5-26 of that document indicates that "Exposed workers may be engaged in activities ranging from desk work, which would reflect breathing rates of sedentary/passive or light activities, to farm worker activities, which would reflect breathing rates of moderate intensity (See Table 5.9). OEHHA recommends default (Tier 1) point estimate 8-hour breathing rates in L/kg-8-hrs based on the mean and 95th percentile of moderate intensity activities, 170 and 230 L/kg-8-hrs, respectively, for adults 16-70 years old." Using the same 70 kg body weight used to derive the acceptable air concentration on p. 8 of the attachment to the June memorandum, these default values are equivalent to 11.9 and 16.1 cubic meters, respectively, over the workday. Notably, the 2015 OEHHA document has the breathing rates of 170 and 230 L/kg-8-hrs listed under "Moderate Intensity Activities (3.0 < METs < 6.0)" in Table 5.8, and Table 5.9 lists farming activities as having an average METs of 7.5, indicating that even higher breathing rates than these might be appropriate. A similar conclusion can be reached by reviewing the breathing rates by activity level in the US EPA Exposure Factors Handbook (e.g., Table 6-2). Replacing 10 cubic meters per 8-hr work shift with a more realistic breathing rate for moderately intensive work in the calculation on p. 8 would result in a slightly lower acceptable air concentration.

p. 5, "OEHHA is aware that some of its assumptions may overestimate exposure while others may underestimate it.... But OEHHA believes these parameters (i.e., edge of field, hours per day, not accounting for background, frequency of exposure) and other modeling assumptions overall balance each other out." Although risk assessment often requires that reasonable assumptions be made in the absence of ideal data, there is no

guarantee that this particular mix of overestimation and underestimation of parameters will actually balance each other out.

p. 9, "Using the above equation, an occupational bystander exposed during the workday to an average concentration of 0.21 ppb is estimated to experience a cancer risk of 10^{-5}." To be clear, this risk estimate applies to an occupational bystander exposed to an average concentration of 0.21 ppb over every workday for 40 years, not the risks to a worker exposed at that level for a single workday.

Specific Comments on August Estimation of Lifetime Exposure document
pp. 8-9, "For this analysis, OEHHA assumed: • The most exposed fieldworkers work for a single farm within a section-size area during a year. • Fieldworkers may move around within a township-size area due to changes in employment and/or croplands over a working lifetime." Although these may be reasonable assumptions, especially for the 2/3 of fieldworkers working mostly for single growers, I wonder whether they are reasonable assumptions for contract fieldworkers, who may be more likely to travel and work in multiple townships during a season as suggested in the attachment to the June memorandum. This isn't likely to result in higher exposure if the likelihood of 1,3-D application is independent of whether contract fieldworkers are present, but if 1,3-D is more likely to be applied when contract fieldworkers are present, they may be at risk of more frequent exposures than those who work mostly for a single farm.

p. 4, "Receptors were set up around the area source at different distances starting from the edge of the application...." The results presented in this document seem to all pertain to the receptors exactly on 80-acre field edge, rather than "at different distances starting from the edge." Focusing on the field edge exposures is a reasonable choice for characterizing the worst-case exposures for occupational bystanders, but if results are already available for farther distances, perhaps those could be used to help address OEHHA Conclusion #3 (Estimation of occupational bystanders' exposure from working in the general vicinity of treated fields). Based on my basic understanding of environmental advection-dispersion models, I'm guessing that 1,3-D concentrations drop off pretty quickly away from the field edge.

p. 9, "To protect fieldworkers who are exposed to large size applications, OEHHA used the 99th percentile of average application block sizes for inland estimates. To account for a similar number of data points, OEHHA used the 96.5th percentile for the coastal variables, which was determined using the following equation...." Although it's fairly typical to use upper percentiles in the range of 95-99th to compute reasonable maximum exposures, it seems a bit strange here to choose different percentiles for inland vs. coastal application block sizes. Why not use the 99th percentile for both? Or

are the actual percentiles moot, given that they are both larger than 80 acres, which appears to be the actual parameter selected for the models?