MODELING EXPOSURES FROM AGRICULTURAL PESTICIDES

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Introduction

Modeling airborne exposures to fumigants and other pesticides involves two key steps: (1) characterizing flux rates, and (2) modeling the flux to estimate airborne concentrations around the field. Both steps are important. This paper summarizes the state-of-the-art in both areas with the objective of seeking realistic assessment of actual exposures. The focus is not on regulatory applications, but with a broader review.

Expanding the utility of the integrated horizontal flux (IHF) method is an achievable goal. A summary is provided of the current use of the IHF method for small and large field examples. Looking forward, however, the application of the IHF method can readily be adapted to meet less restrictive conditions for multiple concurrent plots, and also for applications well beyond agricultural uses. A methodology is summarized that would allow the use of the IHF method with shorter separation between fields, which would substantially improve the efficiency of conducting concurrent trials.

In terms of the modeling component, the benefits of a two-tiered modeling system for agricultural applications is described. Such an approach has been in practice for many years in other air quality modeling applications. A screening procedure can be followed by more refined modeling when necessary. Otherwise more simplistic methods can be used. Especially in non-regulatory settings where modeling also can be used to estimate exposures, there are substantial risks in only relying on screening-level modeling analysis. Some options and means of refinement are described.

Methods

The IHF method is widely in use because it is, in the author's judgment, the most efficient and defensible means of computing flux rates for agricultural applications. Examples are provided for small and large field sizes, with the height of the profiles modified to accommodate larger fields. Important limitations of the aerodynamic method are described. In addition, a methodology is presented that in the extreme would allow the use of the IHF method to assess different applications in four quadrants on one contiguous field. The same approach also could be used to subtract upwind contributions from concurrent plots with closer separation than the typical ~ 600-800 m separation typically sought.

In terms of modeling the flux to estimate exposures, the focus in on non-regulatory applications, i.e. challenges to registrants and applicators regarding airborne exposures. The limitation of having a screening-level method as the standard of care for evaluating fumigants is described. Methods to

provide more refined modeling methodology that would meet the legal requirement of an authoritative source are summarized.