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SUBJECT: SUMMARY OF "ANALYSIS OF THE RELATIONSHIP BETWEEN PERCENTILES OF THE WHOLE FIELD BUFFER ZONE DISTRIBUTION AND THE MAXIMUM DIRECTION BUFFER ZONE DISTRIBUTION"

Environmental Monitoring Branch scientists evaluated two modeling methods used to compute fumigant buffer zone distances and their associated protection probabilities for specific pesticide applications: the *whole field* and *maximum direction* methods. Their findings are presented in the Department of Pesticide Regulation memorandum to Randy Segawa (Barry and Johnson 2007). The scientists undertook this evaluation to clarify for risk managers critical differences between the two methods. This clarification is essential because the two modeling methods are based upon fundamentally different philosophies of risk mitigation–and the resultant buffer zones generated by each method are very different. However, the language used to describe the level of protection achieved by each is the same. This causes confusion over the meaning of "protection probability" and the expected degree of public protection provided by the buffer zones generated by the two methods.

This is a very important issue for risk managers to carefully evaluate for themselves. At your request, I summarized the memorandum and conclusions for those individuals not conversant in modeling terminology.

Background

Buffer zones are computed by evaluating pesticide fumigant emissions (flux) under different meteorological conditions, and using this data to calculate air concentrations at different distances and directions around the field. From these calculations, buffer zone distances from the field are determined that provide a given probability that health threshold limits will not be exceeded. If, for example, that probability is 95%, the buffer zone is described as being 95% protective. However, this is where the methods sharply differ: "protection probability" means two completely different things for the two methods.

In the *maximum direction* method, a buffer zone that is 95% protective is derived such that air concentrations will not exceed health threshold limits anywhere around the buffer zone perimeter in 95 out of every 100 applications. Consequently the buffer zone will "fail" (i.e. air concentrations will exceed health threshold limits somewhere around the perimeter) in 5 of every 100 applications.

In contrast, *whole field* buffer zones define protection probabilities and failure rates much differently. Again consider 100 fumigant applications for the *whole field* method; in that method a 95% protective buffer zone is derived such that air concentrations will not exceed health threshold limits along 95% of the <u>total combined buffer zone perimeters of all 100 applications.</u> This does <u>not</u> mean that the *whole field* buffer zone is protective along the buffer zone perimeter in 95% of applications. The critical point is that *whole field* buffer zones (e.g. 95%, 99%, etc.) do not provide any defined level of protection for individual applications. Therefore, for any individual application it is not possible to directly determine the *whole field* buffer zone failure rate.

The Department of Pesticide Regulation uses the *maximum direction* method of setting buffer zones. Fumigant buffer zones constructed using this method provide a defined probability of protection for every single application. This protection probability is the "application level protection probability." Because there is no straightforward way to determine application level protection probabilities from "*whole field*" buffer zones, the relative protection of the two methods cannot be directly compared. Environmental Monitoring Branch scientists conducted this study to answer the following question:

"For any individual application, how do protection probabilities and failure rates for *maximum direction* buffer zones and *whole field* buffer zones compare?"

Methods

Modeling simulations were conducted using both the *whole field* and *maximum direction* methods. Using those data they compared the estimated protective level for the *maximum direction* modeling method with the *whole field* method at the 99% protective buffer zone length calculated by the *whole field* method.

Results And Discussion

In all instances, the calculated 99% protective *whole field* buffer zone lengths would not have yielded 99% protective percentages for individual applications as they would have if a 99% protective *maximum direction* buffer zone had been used. In fact, median protective percentages for individual applications ranged from 71 to 92.5% using a w*hole field* 99% buffer zone length. These simulations included methyl bromide, metam sodium, and chloropicrin applications. This means that the 99% *whole field* buffer zone distances actually failed to provide protection along the buffer zone perimeter in 7.5% to 29% of applications (median failure rates, dependent on type of application). Moreover, the study found that when there is a *whole field* buffer zone failure, for half of the applications the perimeter distance over which concentrations exceeded the health reference level was greater than the length of a football field for a 20 acre methyl bromide application.

CONCLUSIONS

The complementary concepts of buffer zone protection probability and buffer zone failure rate can be expressed in at least two different ways. Because *whole field* and *maximum direction* protective probabilities clearly differ at the same buffer zone length, it is important for risk managers to understand these differences before they determine which tool to use to achieve their mitigation goals.