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**A Review of the Draft Diazinon Criteria Derivation Document Prepared by Amanda Palumbo, Patti TenBrook, Tessa Fojut and Ronald Tjeerdema**

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The goal of this document was to develop freshwater water quality criteria for the OP insecticide diazinon using a new methodology described in detail in TenBrook et al. 2009. The need for a new methodology was identified by California's Central Valley Regional Water Quality Control Board (CVRWQCB, 2006). My review comments on this document are presented below by page along with a few general comments.

**Page by Page Comments**

Page 5, Ecotoxicity Data, parag 1 - The number of studies evaluated is mentioned (~250). How many different test species were included in these 250 studies? Only studies rated relevant and reliable (RR) were included Appendix C. Data from studies that were evaluated but have lower ratings should also be included in an appendix so the reader can see the reasons (failed parameters) that lead to study rejection. This will make the process much more transparent.

Page 5 bottom of page and top of page 6 – It is not clear from this section how studies rated RL, LL, or RL can be used as reliable supplemental information if they are flawed (see Table 8). How will these studies actually be used? Can studies with unacceptable ratings be used to influence the final criteria?

Page 6, parag 2 – It is not clear from this section how the microcosm/mesocosm data will actually be used as supplemental information. For example, if the microcosm/mesocosm data were rated RR can the toxicity values be used to change (i.e., raise or lower) a final criterion?

Page 6, last parag – There needs to be a consistent process for rounding off the significant digits in the criteria development process. Will the final criterion always be reported with one significant digit for all pesticides? Was this issue addressed in the TenBrook et al. 2009 document?

Page 7, Alternative Approach – After splitting the species into 2 groups, the SSD was then developed with the lower subset (invertebrates) using the log-logistic distribution. This produced an acute value of 0.208 ug/L/2 or 0.104 ug/L. This is confusing as it suggests that 0.1 ug/L and not 0.2 ug/L will be the final acute criterion. Please add text to clarify this issue.

Page 10, Chronic criterion calculation – ACRs were developed for 3 species with the corresponding acute LC50 values and the MATCs (chronic values). The MATC (maximum

acceptable toxic concentration) is the geometric mean of the NOEC and the LOEC. These NOEC, LOEC and MATC values have a high degree of uncertainty as they are determined by the range of test concentrations (dilution series) and the sample size used in the toxicity test. The peer reviewed literature has a number papers that discuss the uncertainty associated with using NOEC, LOEC and MATC values in the regulatory process because these values have no statistical confidence (Newman, 2010; Risk Sciences, 2001 among others). In cases where a suboptimal design is used higher NOEC and LOEC values may be reported due to low statistical power and high error variance. In contrast, when a superior study design is used lower NOEC and LOEC values could be reported. Values such as EC50s, EC25s or EC20s should be used to represent chronic values.

A chronic criterion of 0.2 ug/L is calculated using the 5<sup>th</sup> centile/50 % confidence limit (0.358949). This value is then divided by the ACR of 2.3 to obtain a chronic criterion of 0.2 ug/L. This would seem to be the end of the chronic calculation. However, the authors continue with additional calculations using acute values from the entire data set and the lower 95<sup>th</sup> confidence interval. The 5<sup>th</sup> centile, 95% confidence limit of 0.167165 ug/L is divided by the ACR of 2.3 to obtain a value of 0.0836 or a final chronic criterion on 0.1 ug/L. Additional calculations are also conducted using the more sensitive subset of species and a log-logistic distribution (5<sup>th</sup> centile, 50% confidence limit of 0.208136 ug/L divided by the ACR of 2.3) to obtain a chronic value of 0.1 ug/L. These last two calculations used to drive the original chronic criterion of 0.2 ug/L to a lower chronic value of 0.1 ug/L add yet another level of overprotection and need to be justified.

Page 10, mixtures – Joint toxicity definitions of antagonism, additivity and synerism should be provided to the reader upfront in this section. Antagonism is phenomenon is which the toxicity of a mixture of chemicals is less than would be expected from a simple summation of the toxicities of the individual chemicals present in a mixture (i.e., algebraic subtraction of effects). Additivity is when the toxicity of a mixture of chemicals is approximately equivalent to that expected from simple summation of the known toxicities of the individual chemicals present in the mixture (i.e., algebraic summation of effects). Synergism is a phenomenon in which the toxicity of a mixture of chemicals is greater than would be expected from a simple summation of the toxicities of individual chemicals in a mixture. The assumption that OP insecticides are often detected in the environment concurrently is often misstated. For example, it is unlikely to have diazinon and chlorpyrifos measured in the same water sample because these two OPs are not generally used at the same time to control pest pressure.

Page 13, Sensitive Species, last parag – The lack of logic in the last paragraph of this section is troubling. In summary, the authors used chronic cladoceran toxicity data from studies they judged to be unacceptable to lower the chronic criterion from 0.2 ug/L to 0.1 ug/L. Scientific rationale is needed to support this action.

Page 15, Ecosystem and other studies – Why can't the acceptable Giddings et al. 1996 microcosm study (LOEC = 9.2 ug/L and NOEC = 4.3 ug/L) be used as justification for keeping the original chronic criterion at 0.2 ug/l rather than lowering it to 0.1 ug/L based on unacceptable toxicity data. This would seem to be excellent rationale to support the original 0.2 ug/L chronic criterion.

Page 17/18 – Limitations, assumptions and uncertainties – Chronic data were lacking for two of the five required taxa (benthic crustaceans and insects) and this was stated as a source of uncertainty. It would therefore seem prudent to allow the registrant to fund the necessary high quality toxicity studies that would allow these data gaps to be filled. I would suggest starting this type of dialogue with the registrant. This would promote a data driven process and reduce the uncertainty associated with use of an ACR approach (see previous comments on the uncertainty associated with the use of NOEC, LOEC and MATC values).

Page 18, parag 1 – As stated previously, the authors are using unacceptable toxicity data from cladocerans to drive their original chronic criterion from 0.2 to 0.1 ug/L to ensure protection of cladocerans. The authors also use the bimodality argument to drive a lower chronic value as well. These actions need to be justified.

### General Comments

It is noteworthy that the acute diazinon toxicity data screening process resulted in only 13 species values that were judged to be acceptable for use in the SSD. This seems like a rather minimal data set given the large toxicity data set for diazinon. I suspect this is the result of the data screening process that I have previously addressed in my review of the diuron water quality criteria document (see Hall, 2009). These previous comments also apply to this draft water quality criteria document for diazinon and are included below.

In my view, the step by step process for reviewing the toxicity data is cumbersome, somewhat flawed and needs to be revised. In the current format, a total of 4 forms need to be completed if the relevance score in Table 3.6 is  $\geq 70$  (see TenBrook et al., 2009). It would be more logical to first establish criteria that **must** be acceptable before conducting any other evaluation of documents containing the toxicity data. These “Kill Switch Criteria” that must be met for an acceptable study are as follows: (1) Is the control endpoint (survival or growth) acceptable?; (2) Is the document under review the (primary) original source of the data?; (3) Were adverse effects evaluated using exposures of a single pesticide?; (4) Was the duration of exposure reported?; (5) Were the effects reported for relevant endpoints (e.g., survival, growth, or reproduction)?; (6) Was more than one dose/concentration used in the toxicity test?; (7) Was the test species reported?; (8) Was the chemical form (% active ingredient) of the test material reported?; and (9) Was a dose response relationship evident? For example, in the current data review process a study with unacceptable control survival receives a 7.5 point reduction (see Table 3.6 in TenBrook et al. 2009) and can still be rated acceptable for criteria development. In contrast, studies published in the peer reviewed literature with page space limitations, which often lack details for various water quality parameters (i.e., hardness, alkalinity, dissolved oxygen, conductivity and pH) resulting in point deductions in the scoring system, may be rated non-acceptable. Page space limitations in published papers may also result in lack of details on tolerance values for test species to various water quality parameters, dilution water information, and information on prior contaminant exposure which can cause scoring reductions that may lead to data rejection (see Table 3.8 in TenBrook et al. 2009). The exclusion of data that may be valid in the above scenarios is problematic and could result in the use of safety factors that have a high degree of uncertainty.

## References

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