Review of:

Total maximum daily loads for toxicity and pesticides in the Santa Maria Watershed in Santa Barbara, San Luis Obispo, and Ventura Counties, California

Authored by:

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Central Coast Regional Water Quality Control Board

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Objective: Follow guidelines within Attachment Two for addressing scientific assumptions, findings, and conclusions within the TMDL document. Specifically, "determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.".

Comments:

Numeric Targets:

1. It would be very helpful to report information or data on the quantities of suspended solids in the various reaches of the system. Background information could be presented in the Watershed Description under the Problem Identification.

   Suspended sediments and organic matter, as well as dissolved organic matter and organic carbon, would be among the most important water quality parameters in these systems that would influence bioavailability of the more hydrophobic pesticides included within the TMDL, particularly organochlorines and pyrethroids, and to some extent chlorpyrifos.

2. For the water column numeric targets for pyrethroids and organochlorines it should be described how the sampling will occur to compare to the numeric target. Perhaps this is

discussed in the monitoring section and I missed it (See comment in Monitoring Section). The point is if the water sample is filtered so that suspended particles are removed, this may not be consistent with the conditions under which the toxicity data was generated that are used for the numeric target. Suspended particles can have a significant effect on bioavailability. In terms of chemical analysis, filtering suspended particles can reduce the amount of chemical detected in samples. Alternatively, extracting water samples that are unfiltered could result in a measured aqueous concentration that is actually above the concentration that is readily bioavailable and will contribute to toxicity.

3. Pyrethroid sorption to suspended OM: Is this fraction accounted for in the numeric water column targets? For members of this chemical class bioavailability could be strikingly different with suspended OM present versus a system in which most of the chemical is in the form of the freely dissolved fraction?

4. Table 3-9: It would be useful to identify the species (i.e., *Hyalella azteca*) in the endpoint column following the text "average 10-d median lethal concentration (LC50)". This is identified as a footnote for Table 3-4, but it is somewhat obscure by only being mentioned there.

5. Synthetic Pyrethroid Sediment Numeric Targets:

    a. It is stated that a specific methodology is described in the implementation section related to identifying a more protective target than the *H. azteca* 10-d sediment LC50s reported by Amweg et al. (2005) and Maund et al. (2002). I have had difficulty locating this methodology within the implementation section. Is it planned to be included in later drafts of this document? This needs to be explicitly described and would be better placed in the Numeric Targets section of the document. There could potentially be a significant difference between the interim LC50 targets and a more protective target, such as one using an ECXX for invertebrate growth or development.

    b. It should be described in this section the rationale on why *H. azteca* 10-d sediment LC50s were selected as pyrethroid sediment numeric targets. Are *H. azteca* the most sensitive species to pyrethroids that has been examined? Similar to that mentioned above, I think a sediment concentration resulting in sublethal concentrations might be more appropriate for protecting aquatic resources.

    c. It should be noted at what temperature the pyrethroid toxicity data used for the numeric targets was conducted. Pyrethroid toxicity is temperature-dependent and there could be a discrepancy in the temperature under which the toxicity data was

generated and the average daily temperature for various waterbodies addressed in the TMDL.

6. Numeric targets for OCs are based on human health risk (i.e., carcinogenicity) and are several orders of magnitude below aqueous concentrations (at least for DDT and Toxaphene) that result in sublethal ecological effects on benthic invertebrates and fish. Alternatively, OPs and pyrethroid numeric targets are based on ecological effects of aquatic receptor species. It seems there should be an explanation for why some pesticides within the TMDL human-health based benchmarks are used while for other pesticide benchmarks aquatic receptor species responses are used. This could be as simple as indicating that the human health data just have not been generated yet. However, without some explanation it appears the drivers for numerical targets are very different among pesticides: some driven by human health concern versus others driven by damage to ecosystem services.

Source Analysis

1. Within the Problem Identification, under section 2.4. Pollutants Addressed: This reviewer believes that it would be helpful to provide, as an appendix, the initial list of analytes that were tested for in surface water to develop the list of pesticides of concern (i.e., that may impair beneficial uses) in the TMDL. Was the list of pollutants derived from pesticide use survey data? Were any carbamates, such as carbaryl, tested for? It seems that carbaryl may have been used as late as 2010 on some California agricultural crops, but was not included. This question arises because pyrethroids and malathion were not evaluated for the 2008-2010 303(d) list, yet they were included here within the TMDL.

2. Also under Pollutants addressed and their sources: it seems possible that fungicide use may occur within the Santa Maria watershed. I am not familiar with the definition of pesticide that is used for the TMDL and the coverage of chemicals intended within that definition; however, fungicides could very well be considered “pesticides”. Furthermore, their intended targets and mechanism of action as a fungicide could impair some of the assigned specific beneficial uses. In addition, unintended targets via different mechanisms of toxic action may occur for invertebrate or vertebrate taxa within the watershed. These compounds could potentially be classified under the General Objective for Toxicity described on page 20 of the TMDL document, based on the examples outlined (e.g., “detrimental physiological responses”).

TMDLs and Allocations

1. Any potential anthropogenic activities that may likely influence future flow duration curves should be investigated. Some activities that come to mind include: planned dredging, erosion control measures, changes in irrigation runoff patterns, bridge alterations, weir implementation, dykes, etc.). If these planned activities may or will occur in any of the water bodies within the Santa Maria Watershed, there should be a mechanism in place to recalculate flow duration and load duration curves described in appendix B as the supplement to the concentration-based TMDL.

2. 5.7. Seasonal Variation: There could be a problem with the rationale that "since the TMDL is expressed in terms of concentration, seasonal variation is not appropriate". Many of the compounds (i.e., pesticides) listed in the TMDL have been shown to have temperature-dependent toxicity. Pyrethroid toxicity is generally inversely related to temperature, while OP toxicity is generally positively related to temperature. Many of the pesticides listed in the TMDL document (or representatives from the same chemicals classes) have been shown to exhibit temperature-dependent toxicity. If numeric targets are set based on toxicity data that was generated at a continuous 24 °C (i.e., a common standardized temperature for toxicity testing), these numeric targets may not be appropriate for the extremes of seasonal variation. Furthermore, the targets may only be appropriate for a short period of the 24-h daily temperature cycle in some ecosystems. This reviewer recommends that this source of variation on pyrethroid and OP toxicity be mentioned and potentially discussed within the TMDL document. This would also have implications for monitoring (see below) and how the toxicity data used for numeric targets can be highly dependent on water quality conditions (e.g., suspended sediments, dissolved sediments, and temperature). These modifying factors are somewhat accounted for in the sediment numeric targets by using a concentration based on organic carbon mass. This reviewer wonders why this source of variation on bioavailaibity is not accounted for in the aqueous numeric targets.

Implementation and Monitoring

1. Will aqueous samples that are collected as part of monitoring component be filtered? If the water sample is filtered and suspended particles are removed, the conditions may not be consistent with the conditions that the numeric targets were generated under (i.e., the toxicity data). As mentioned above, suspended particles can have a significant effect on bioavailability.

2. Aquatic Habitat Descriptions: Several of the water bodies listed in the section are designated as both a Cold water system and Warm water system. I have similar comments to those mentioned above about the effect of temperature on pesticide risk to

aquatic life. It is apparent on pg. 97 that some of the water bodies are designated both cold water and warm water. I assume this represents lower order streams (perhaps in higher elevations) being cold water and flowing into higher order reaches that are designated warm water. If the same numeric targets hold for areas designated either cold or warm, then an argument could be made that a large source of variation exists within the TMDL for protection of those designations. For example, considering bioavailability being equal, pyrethroids would be more toxic to benthic organisms (i.e., the metric that the numeric target is based on) in Cold water systems than Warm water systems.

3. The Implementation and Monitoring Plan seems to have sections that may be out of place and it is difficult to follow. For example, on pg. 104 it is indicated that a section begins labeled Monitoring Plan. Later, on pg. 106 focus reverts back to an implementation plan for municipal storm water. Is the OC pesticide implementation plan the only one that contains monitoring? Even a review of the table of contents (pg. 5) the section 6 sub-sections do not seem to follow a pattern or flow well. I think some simple restructuring of the section could resolve this.

<u>Additional Comments</u>:

1. Within the Public Participation Section: Perhaps outside of the formal annual meetings input from the public or stakeholder groups could be requested or submitted online at designated times between the annual meetings.

2. There are typos throughout the document, particularly in the problem identification section. I am assuming California Water Boards were most interested in technical comments, so I have not included grammatical edits in this review. However, I can collect, summarize, and provide those if needed.