FL #77

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Review of: Functional Equivalent Document: Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) list
Review by: Donald Weston, Adjunct Associate Professor, University of California, Berkeley.

I have limited my review to those topics in which I have the greatest expertise, namely bioaccumulation, toxicity, and benthic community assessment. I have not reviewed other portions of the document both because of time constraints and because much of it focuses on policy considerations on which I cannot comment (What alternatives would be most consistent with other regulatory programs? Which are most transparent? Which are feasible with agency resources?).

General comment: Greater clarity is needed in the distinction between Issue 4 (single line of evidence) and Issue 5 (multiple lines of evidence). Toxicity appears under Issue 5, yet it was my impression that toxicity could be used alone for listing (though not for TMDL implementation). It would be helpful to better explain what is meant by multiple lines of evidence. Some of that information appears towards the end of the document (pages 222 and thereafter), but it would be helpful to have a brief explanation up front when the single vs. multiple issue is first raised.

Issue 4E:

1. The text states: "Bioaccumulation is the uptake and retention of chemicals by living organisms. A pollutant bioaccumulates if the rate of intake in the living organism is greater than the rate of excretion or metabolism resulting in an increase in tissue concentration relative to the exposure concentration in the ambient environment." I believe this definition is in error. First, bioaccumulation is generally considered to be the uptake from all routes (i.e., food and water, as opposed to bioconcentration which is only from the dissolved phase). A pollutant that is taken up but rapidly metabolized (no retention) still bioaccumulates. Secondly, for all compounds the rate of uptake is initially greater than excretion/metabolism. As the tissue concentration rises, and for some compounds as elimination/metabolism becomes more effective, a steady state balance is reached between uptake and loss. So the definition provided is nonsensical since the balance between rate of intake and rate of excretion/metabolism depends entirely on when during the exposure it is measured. Given enough time and constant exposure conditions, a steady state will be achieved and uptake will equal excretion/elimination. By the definition provided then, everything would be bioaccumulative in the early stages of exposure, and nothing would be bioaccumulative at steady state!
2. A related issue is at the bottom of page 71 where PAH are claimed to be bioaccumulative substances that are taken up at a rate exceeding elimination and accumulated over the animal's lifetime. In fact, fish rapidly metabolize PAH and it is unusual to even find the parent compounds in tissue (typically the liver is examined for metabolites). They would not be bioaccumulative under the definition given in the text, at least for fish.

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3. There is an inconsistency between the middle of page 71 ('merely identifying the presence of a chemical substance in the tissues of an organism is not sufficient information to conclude the chemical will produce an adverse effect") and the bottom of page 71 ("pollutants detected in fish not only indicate pollution impacts on aquatic life and other wildlife..."). I think they mean potential exposure to piscivorous predators, not impacts, in the second case.
4. In all the tables of tissue guidelines provided, there is no indication of whether these values are on a wet or dry tissue basis.
5. I do not understand the criticism of the FDA action levels on page 75. It is claimed they were developed to protect human health from consumption of seafood involved in interstate commerce, so would not be appropriate to protect health if the seafood was consumed locally. The rationale for the distinction is unclear.
6. Alternative 4, the preferred alternative, is unclear. The text either reiterates basic information given previously on why one would want to look at contaminants in tissues (paragraphs 1 and 2), or says nothing at all (paragraphs 3 and 4). The text does not clearly state what Alternative 4 is, and what little description there is makes it sound no different than Alternative 2.
7. On page 77 bottom-feeding fish are said to accumulate contaminants from direct contact with contaminated sediment. I think this is unlikely as fish skin and scales are very effective barriers. Uptake is more likely through consumption of benthic invertebrates on which the fish feed. The distinction between "bottom-feeding fish' and "predator fish" which forms the basis for this paragraph is unclear. A bottom-feeding fish can be a predator fish.
8. The last sentence of paragraph 4 says "tissues from appropriate target species permit comparison of fish and shellfish contamination over a wide geographic area". I am not sure what is trying to be said here. If it is that one can compare data between sites, that is hardly a quality unique to tissue concentrations.

Issue 5C:

1. Page 109 lists 4 approaches that may be used to determine if pollutants are responsible for observed toxicity, and if so, which ones. Following this list, lengthy discussion is provided for the first 2 approaches (TIE and SQG), and brief discussion is provided for the third (correlations), but no text is provided explaining the fourth (measures of toxicological response). Explanatory text is needed for this as well since "measures of toxicological response" is particularly cryptic. Also, a toxicity unit analysis can be used to establish probable causality, but I am not sure this is among the list of 4 approaches provided.
2. Table 11 does not indicate the literature source for the "other sediment quality guidelines" given for lindane and total PAH.
3. Page 113 states "EqPs [Equilibrium Partitioning values] were developed for non-ionic chemicals and metals". This is simply wrong. The EqP approach is totally unsuitable for metals.

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Issue 5F: I have no specific comments on this section other than the title "Interpreting data related to adverse biological response" is awfully vague. The responses addressed range from reduced individual growth rates to carcinomas. It seems to be a "catch-all" section, making it understandably difficult to come up with a descriptive title. The text points out, and I would strongly agree, that with measurements of this type it is particularly important that there be strong evidence that the adverse effect is due to a pollutant before these data are used in 303(d) listing.

Issue 5G

1. Page 131 says "BMIs [Benthic Macroinvertebrate index] are ubiquitous, relatively stationary, and their large species diversity...". I think the text is referring to the macroinvertebrates and not the index.
2. Alternative 4 is given as the preferred alternative, but it is not clear what alternative 4 is. The title of the alternative implies there has to be some linkage of bioassessment data with simultaneously collected chemistry data, yet there is never any mention of this linkage throughout the discussion. Similarly, the title indicates some requirement to do "association assessment", whatever that is, but there is no further discussion of this assessment. Instead, the entire text is dedicated to how to choose a reference site and a listing of the type of biota that one might want to assess.
3. Alternative 4 is just one illustration of what I view as a chronic style problem throughout the document. There is an over-emphasis on giving a superficial primer on how to do environmental assessments (What species are used for toxicity testing? How do you compare test site toxicity to a control? How do you select a reference site when doing a bioassessment? What faunal groups might one want to do a bioassessment of?). I question whether this basic information is relevant to the question of what data can be used for 303(d) listing. Certainly one would want to use bioassessment data that included an appropriate reference site, but does this document need to spend pages describing how to pick that reference site? If so, then why not spend pages describing appropriate QA for laboratory sorting of the samples, or listing which taxonomic works are preferred for species identification. It is possible to go too far in describing how to do the assessment, and I believe this document has done so. Its length could be substantially reduced if it assumed the reader had a greater a priori understanding of environmental assessments or let the reader obtain such information from other sources.