commentletters - Comment Letter - Sediment Quality Objectives

9/16/08 Bd. Hrng. Item 9
Sediment Quality Objectives
Deadline: 9/5/08 by 12:00 p.m.

From: <Gfredlee@aol.com>
To: <commentletters@waterboards.ca.gov>
Date: Friday, September 05, 2008 9:28 AM
Subject: Comment Letter - Sediment Quality Objectives
CC: <tdoduc@waterboards.ca.gov>, <abaggett@waterboards.ca.gov>, <CHoppin@waterboards.ca.gov>, <drice@waterboards.ca.gov>, <gsecundy@waterboards.ca.gov>, <GWolff@waterboards.ca.gov>
Attachments: SWRCB SQO comm REV.pdf

Tam Doduc, Chair, and Members of the SWRCB:

Please find attached Dr. Anne Jones-Lee and my comments on the SWRCB staff's revised draft approach for developing sediment quality objectives. As with the initial draft we found that the staff's recommended approach is not technically valid for incorporating chemical information into the initial sediment quality classification or for trying to correct for the errors made in that classification using many of the so-called stressor identification approaches proposed. Based on my nearly 5 decades of research in evaluating the water quality impacts of sediment-associated contaminants, I found that this draft continues to fall far-short of providing adequate and reliable approaches for implementing the SQOs into technically valid, cost-effective sediment remediation and NPDES permit modifications. Further, the staff's proposed approach will fail in some, possibly many, situations to identify real adverse impacts on water quality of chemicals in sediments. The adoption of this approach as proposed will lead to massive waste of public and private funds for the inappropriate "management" of sediment quality/water quality in California.

Please contact me if you have questions on our comments.

Fred

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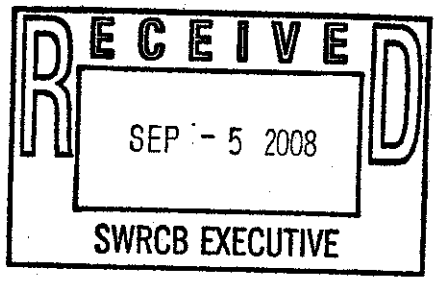

Comments on
"Draft Staff Report,
Water Quality Control Plan for Enclosed Bays and Estuaries
Part 1. Sediment Quality
Developed by State Water Resources Control Board
California Environmental Protection Agency
July 18, 2008"

Submitted by
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September 5, 2008

The California Water Resources Control Board (SWRCB or "Board") released its staff's draft sediment quality objective (SQO) development approach for public comment on September 27, 2007; staff responses to those comments were released in the winter of 2008. The SWRCB staff subsequently edited its draft SQO development approach, and the revised approach was considered and approved by the SWRCB at a workshop on February 19, 2008. Owing to an administrative problem, the revised, approved draft, "Draft Staff Report, Water Quality Control Plan for Enclosed Bays and Estuaries Part 1. Sediment Quality," was re-released on July 18, 2008. The following comments refer to the draft proposed SQO development approach, and the attached table addresses the "responses" made to prior comments of Lee and Jones-Lee.

The authors have commented at numerous junctures in the SWRCB's attempt to develop SQOs, the most recent being those submitted by Lee and Jones-Lee (2007). A primary concern discussed in those comments, that went substantively unaddressed in subsequent drafting, was that the initial component of the sediment quality evaluation is based in significant part on the total concentrations of selected chemicals in a sediment and the "co-occurrence"-based interpretation of total concentration information. This fundamental component of the evaluation ignores what has been known about the aqueous environmental chemistry and toxicology of sediment-associated contaminants for nearly four decades, namely that chemicals exist in sediments in a variety of chemical forms, only some of which are toxic/available to impact aquatic life, and that the release/impact of most sediment-associated contaminants is unrelated to their total concentrations in the sediment.

For its proposed SQO development approach the staff relied on the California Logistic Regression Model Calculation, a modified "co-occurrence" approach. As would be expected from the aqueous environmental chemistry of sediment-associated contaminants, and as has been well-documented in the technical literature, the total concentration of a chemical in a sediment, or a comparative index based on total concentration (such as "co-occurrence"), does not reveal substantive, reliable information concerning the potential impact of that contaminant on aquatic life or beneficial uses of

the water/sediment in question. As discussed in the Lee and Jones-Lee (2007) comments, because basic principles of aquatic chemistry were ignored or unreliably incorporated, the SQO development approach as drafted cannot be relied upon to provide technically valid screening or assessment of potential hazards associated with sediment-associated contaminants.

The SWRCB staff attempted to correct for the unreliability of its SQO development approach by recommending that any sediment that is classified as "impaired" based on those technically flawed SQOs must be evaluated through a "stressor identification" process to determine the chemical(s) responsible for sediment toxicity. As discussed by Lee and Jones-Lee (2007) however, initial classification or screening of the type prescribed would not be "conservative" to at least rule out sediments that clearly do not need further investigation; it would simply be unreliable. Sediments that do not pose significant hazard would not necessarily be screened out; some sediments worthy of further investigation would not necessarily be identified as such. Technically valid, reliable, responsible evaluation and management of sediment-associated contaminants cannot be based on unreliable screening or initial classification.

The staff's recommended approach for "stressor identification" also did not reliably incorporate or consider basic principles of aquatic chemistry. Thus, even if the "stressor identification" step could make up for the unreliability of the screening, it could not be relied upon to provide correct identification of the "cause" of sediment-toxicity. This error in sediment quality classification and stressor identification could readily lead to massive waste of public and private funds in implementing misdirected sediment remediation approaches and inappropriate NPDES permit modifications. It could also result in the ignoring of situations that truly merit further investigation or remediation. This fundamental defect in the evaluation renders the subsequent assessments of sediment character and hazard, suspect at best.

As discussed by Lee and Jones-Lee (2007), rather than postponing the proper evaluation of impacts of sediment-associated chemicals until after unreliable processes have been undertaken, the technically valid and common-sense approach would be to properly incorporate aquatic chemistry/aquatic toxicology/biology into the initial sediment quality evaluation, i.e., TIEs, should be conducted as part of sediment classification for those sediments that have potentially significant aquatic life toxicity. Use of technically reliable TIEs should not be delayed until after sediments have already been dubiously "classified" as impaired. Another significant problem with implementation of the staff's "stressor identification" approach to adjust for unreliable screening is the fact that once a sediment is "classified," even erroneously, as "impaired," it will be very difficult to change that classification, despite results of further study. Environmental groups and others will look on such "reclassification" as the Regional Board's capitulating (back sliding) to political pressure from entities perceived to be responsible for the presence of chemicals that caused the initial "classification" of the sediments.

Lee and Jones-Lee (2007) also expressed concern that the staff's review of the literature associated with developing the SQO development approach only listed papers/reports that

promote, or do not critically evaluate, the use of co-occurrence-based indices and total contaminant concentrations for sediment quality assessment and management. Absent from the SQO development approach discussion and documentation was citation, much less incorporation, of the vast technical literature discussing the aqueous environmental chemistry and behavior of sediment-associated contaminants. It is not surprising, therefore, that the SQO development approach drafted is so deficient in handling contaminant behavior and impact assessment.

Lee and Jones-Lee (2007) discussed the fact that the proposed SQO development approach did not give adequate attention to how the SWRCB staff envisioned the SQOs' being implemented by the Regional Water Boards. In addition to highlighting the significance of that omission, Lee and Jones-Lee suggested that proper consideration of SQO implementation during the drafting of the SQOs, and discussion of the implementation approach as part of the SQOs, may have brought to light many of the technical deficiencies in the SQO development and their ramification for reliable management of sediment-associated contaminants.

The SWRCB posted a copy of comments it received on the September 2007 SQO development approach on its website at http://www.swrcb.ca.gov/water_issues/programs/bptcp/sediment.shtml. Several of those who submitted comments on the draft discussed technical deficiencies in the SQO development and implementation approaches related to their not properly incorporating aquatic chemistry (chemical character, reaction, interaction, fate, and availability) into the SQOs, and the inability to correct for those deficiencies through "stressor identification" processes recommended. Almost without exception, those reviewers who had creditable background in aquatic chemistry found, as Lee and Jones-Lee (2007) had, that the draft SQO development approach did not reflect an understanding, much less incorporation, of basic principles of aquatic chemistry. Many noted, for example, that neither the total concentration of a chemical or group of chemicals, nor "co-occurrence"-based indices or values, is reliable for assessing the impact of sediment-associated contaminants on aquatic life toxicity.

Posted along with the comments submitted on the September 2007 draft SQO development approach were the staff's "responses" to those comments. Unfortunately, the responses to at least the Lee and Jones-Lee (2007) comments were largely superficial, evasive, and/or dismissive; some responses distorted or misrepresented the comments. The responses neither adequately nor properly addressed the issues raised in the comments. The staff has clearly chosen to not acknowledge or rectify the technical unreliability of the aquatic chemistry components of its SQO development approach. "Answers" to those responses are attached.

Several of those who supported the September 2007 SQO development approach did so because it was seen as an improvement over that being used by several Regional Water Boards for sediment classification. Several of the Regional Boards have classified "sediment quality" using only co-occurrence-based approaches, employing the total concentrations of chemicals or groups of chemicals in sediments. As noted above, while

the technical literature on this issue was not cited by the SWRCB staff in its September 2007 report, it is well-documented in the literature that such approaches are not reliable since the impact of a sediment-associated contaminant or groups of contaminants is not controlled by the total concentration of a chemical or group of chemicals. Several of those who supported the staff's proposed SQO development approach concluded that incorporating, to some extent, aquatic life toxicity and benthic organism assemblage information into sediment classification would improve the reliability of the initial sediment classification beyond that which would be attained based solely on total concentrations of a chemical(s) and the exceedance of the co-occurrence-based sediment quality guidelines. However, as discussed by Lee and Jones-Lee (2007), that position is misguided because the total concentration/"co-occurrence" aspect of the approach is essentially a "wild-card" that distorts in rather random fashion any technically valid components of the evaluation, rendering that otherwise useful information, unreliable as well.

From the discussion at the SWRCB workshop to review the staff's proposed SQO development approach on February 19, 2008, it appeared clear that several members of the Board felt trapped into supporting the staff's approach at that time, rather than postponing the matter until the technical deficiencies were properly addressed, in order to meet a court order to have an SQO development approach adopted by a certain date. This was most unfortunate.

Subsequent to release of the proposed SQO development approach in September 2007, the SWRCB staff released several modifications. However, those adjustments did not address the fundamental flaws in the staff's approach of incorporating total concentration of a chemical(s) into the initial sediment quality evaluation. Further, the July 18, 2008 updated SQO development approach, which is the subject of these comments, also did not address that fundamental deficiency, or the technical deficiencies in the stressor identification approach. They also did not sufficiently/reliably address the issues of implementation of the SQOs at the Regional Board level to enable the Regional Boards to establish the need for sediment remediation or NPDES permit modification for potential dischargers of chemicals identified, albeit unreliably, as being responsible for causing the sediment to be classified as "impaired." Since these issues have not been adequately addressed in the July 18, 2008 currently proposed SQO development and implementation approach, the Lee and Jones-Lee (2007) comments are applicable to this updated proposed approach as well.

It is strongly recommended that the SWRCB return the staff's July 18, 2008 version of the SQO development approach to the staff and direct the staff to properly correct the significant technical deficiencies. Most significantly, the disregard for and misrepresentations of the aqueous environmental chemistry of sediment-associated contaminants incorporated into the approach (as discussed by Lee and Jones-Lee (2007) and herein) need to be corrected in such a manner that the resultant SQOs are technically valid. The SWRCB should also direct the staff to develop detailed guidance on how to properly identify a chemical(s) responsible for sediment toxicity and/or altered benthic organism assemblage.

Staff should also be directed to develop detailed guidance that the Regional Boards can use to implement the SQO development approach into technical valid, cost-effective sediment evaluation and remediation tools and for NPDES permit modification.

As discussed in the Lee and Jones-Lee (2007) comments, particular attention needs to be given to the implementation of the SQO development/implementation approach to urban stormwater runoff situations. As it stands now, the public could readily be trapped into supporting massive expenditures for remediation of sediments that are unreliably classified as "contaminated" or "impaired" owing to urban stormwater runoff-associated contaminants that accumulate in aquatic sediments but that do not, in fact, adversely affect aquatic life/beneficial uses of the water or sediment. As Lee and Jones-Lee (2007) discussed, aquatic sediments that are under the influence of urban stormwater runoff could readily contain elevated total concentrations of several chemicals such as heavy metals, and could also exhibit aquatic life toxicity. While the staff's SQO development approach would presume the toxicity to be caused by the "co-occurrence" of the toxicity with heavy metal concentrations, that toxicity could, in fact, readily be caused by chemicals that are not on the SWRCB staff's limited list of chemicals that are to be considered in sediment quality evaluation, such as a pyrethroid-based pesticide. Examples of situations in which this has occurred were provided by Lee and Jones-Lee (2007). A proper review of the literature and incorporation of aquatic chemistry into the SQO development approach would have shown the fallacy of the proposed approach and led to the elimination of the total concentration/co-occurrence aspects of the evaluation approach.

The SWRCB needs to ensure that the staff responsible for the third attempt to develop an SQO development approach properly incorporate aquatic chemistry into the development and implementation approach.

These comments on the deficiencies in the staff's SQO development approach are based on Lee's nearly five decades of graduate-level teaching of, research into, and practical application of, aquatic chemistry/toxicology and the water quality impacts of chemical contaminants in aquatic/sediment systems. During his professional career Dr. Lee has developed more than 1100 professional papers and reports on his and his associates' aquatic chemistry/water quality research. Those publications have included several reviews on sediment quality evaluation, including the compressive review, "Appropriate Incorporation of Chemical Information in a Best Professional Judgment "Triad" Weight-of-Evidence Evaluation of Sediment Quality," (Lee and Jones-Lee, 2002; 2004). The Lee and Jones-Lee (2007) comments included additional information on their qualifications to comment on technical deficiencies in the staff's proposed SQO development approach.

Support for Comments

The development of these comments, as well as previous comments on the SWRCB SQO development approaches submitted by Lee and Jones-Lee that are on their website, www.gfredlee.com in the Sediment Quality section

[http://www.gfredlee.com/psedqual2.htm#criteria] was funded solely by personal resources of G. Fred Lee & Associates.

References

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Overview: Answers to SWRCB Staff Responses to Comments on September 2007 Proposed SQO Development Approach

Overall, the SWRCB staff 's "responses" to comments submitted to the SWRCB by us on the September 2007 proposed SQO development approach neither adequately nor reliability addressed many of the legitimate technical issues raised regarding the proposed SQO development approach. Some of most significant technical issues raised were either ignored or dismissed with "disagree with." Of particular concern in this regard were the responses to comments noting the disregard in the draft plan for the aquatic chemistry – the characteristics, behavior, interactions, and availability – of sediment-associated contaminants that controls the impact of those contaminants on aquatic life and other beneficial uses of aquatic systems. As noted in those comments, the proposed SQO development approach failed to incorporate a technically valid approach for integrating information on chemicals into the initial sediment classification. Rather than correct that serious shortcoming, the plan added on to the initial unreliable sediment classification what was termed a "stressor identification" to try to make up for the unreliable co-occurrence-based classification to determine the chemical(s) responsible for real (or presumed as a result of unreliable assessment) sediment toxicity and altered benthic organisms assemblages. As discussed in the Lee and Jones-Lee (2007) comments, total concentrations of a chemical or group of chemicals, either directly or through a co-occurrence-based manipulation, are not a reliable, technically valid basis for screening or initial sediment classification. As discussed by Jones-Lee and Lee (1978, 2005a,b), Lee et al. (1978), and Lee and Jones-Lee, 2000), as well as by others cited in those papers, with the exception of ammonia, there is no relationship between the total concentration of potential pollutants in sediments and sediment toxicity. Thus, all of the co-occurrence-based "sediment quality guidelines" are fundamentally flawed.

It is of great concern, as pointed out in our comments, that the literature cited in the proposed plan was restricted to writings that either promoted its selected, though technically unreliable, approach, or did not provide a critical assessment of its approaches for sediment quality evaluation, regulation, and management. Absent from the staff writings were citations to the vast scientific literature that discusses fundamentals of aquatic chemistry and the application of aquatic chemistry to sediment quality evaluation and management, or discusses technical deficiencies in approaches that are commonly used, albeit unreliably, for that purpose. While not referenced in the SWRCB staff proposed SQO development approach, these issues are well-documented in the literature. Lee and Jones-Lee (2002, 2004) and Jones-Lee and Lee (2005b) discussed much of that literature.

Lee and Jones-Lee (2007) also discussed the grossly deficient list of chemicals/parameters considered in the initial sediment evaluation. Not included were prevalent sediment contaminants and conditions well-known to be responsible for sediment toxicity, including low-DO, ammonia, hydrogen sulfide, and a variety of pesticides. Failure to include those parameters up-front in the initial sediment classifications greatly decreases the reliability of even a credible evaluation scheme and can mislead sediment assessment and "remediation" efforts.

As discussed by Lee and Jones-Lee (2007), the staff's attempt to correct for significant errors that can be expected to occur in initial sediment quality evaluation/classification from the technical unreliable SQO development approach, with the so-called "stressor identification," serves to compound the problem. As documented by Lee and Jones-Lee (2007) the foundation of the suggested approaches for sediment quality objectives development is fundamentally flawed. Following the proposed approach will not result in reliable identification of the chemicals responsible for causing sediment toxicity or altered benthic organism assemblages. Following the staff's recommended approaches will result in unreliable stressor identification. Such results can readily cause large expenditures for misdirected sediment "remediation" and NPDES permit changes, and other source control efforts.

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http://www.members.aol.com/annejlee/SQGSuperfund2.pdf

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Specific Answers to "Staff Responses" to Comments

No.	Subj.	Original Comment	Staff Response	Author
178	5.5.3	What should be done to evaluate the reliability of the proposed SQO development approach is compare the outcome of a total concentration co-occurrence-based approach with that of a properly developed sediment quality evaluation using the biological effects-based components of toxicity and benthic organism assemblage information that include a properly evaluated chemical component based on TIEs that show the chemical(s) responsible for toxicity and altered benthic organism assemblages	Staff disagree. A TIE should not be required at every station.	GFL
Answer:		The staff response has not addressed the issue raised in this comment. This comment did not advocate running TIEs at every station. Rather, it was offered as a mechanism by which the unreliability of the SQO approach incorporating total concentration/co-occurrence would be clearly revealed to those who do not understand, through knowledge of aquatic chemistry, the invalidity of the staff's approach. The comment was part of the overall technical discussion of the lack of technical validity of the approach that the staff had adopted for incorporating "chemical information" into the triad evaluation. As indicated in our comments, if the staff had actually evaluated the reliability of their SQO development approach on several sediment samples, they could have convinced themselves that the co-occurrence approach they were promoting was technically invalid. Aside from the solid aquatic chemistry basis for our concern and the comment, this comment was based on empirical field work that we did in the 1970s, in which we measured the chemical concentrations of about 30 conventional pollutants on about 100 sediment samples from waterways from across the US, the release of those pollutants, and the laboratory toxicity of the sediments. We found that the neither the total concentration of the chemicals, nor exceedance of what have since become "co-occurrence"-based "sediment quality guidelines" for the individual chemicals or groups of chemicals that we measured in the sediments predicted sediment toxicity. In fact, despite our including some of the most heavily contaminated sediments in ports and harbors, we found the most common cause of sediment toxicity was ammonia, a chemical that the SWRCB staff has chosen to ignore in developing SQOs. As we discussed in our comments, the staff's failure to include a number of truly significant sediment-associated contaminants, including low-DO, ammonia, and hydrogen sulfide, in the SQO development approach represents		

		another fundamental and significant flaw in its approach. That omission alone makes the staff's approach unreliable for initial screening/classification, evaluating the potential hazards of sediments, or for directing the expenditure of public and private funds for sediment "remediation" and "source control." Imposition of the proposed SQO development approach could readily cost large amounts of money and yet fail to control sediment toxicity. Further, the staff's approach could readily identify a sediment as being non-toxic based on the laboratory test used while the sediment could, in fact, be responsible for large amounts of unmeasured sediment toxicity.		
205	5.5.3	The major technical deficiency is that the role of aquatic chemistry in affecting how chemical contaminants in aquatic sediments impact beneficial uses of waterbodies has not been inadequately considered or incorporated	The important influence of aquatic chemistry is acknowledged by the requirement that measures of toxicity and benthic community effects (measures that incorporate chemical bioavailability) be included in the site assessment.	GFL
Answer:		While it may have been the staff's intention to "acknowledge" the importance of aquatic chemistry by requiring toxicity and benthic community effects assessments, the inclusion of the total concentration/co-occurrence-based component in the overall assessment, as was done, renders the findings of otherwise reliable assessments of toxicity and benthic community effects, distorted and unreliable, undermining, at best, the attempt at technical reliability. As discussed in the comments, the total concentration/co-occurrence-based component provides technically unreliable, not realistic or conservative, information concerning the potential impact of sediment-associated contaminants on sediment/water quality. Furthermore, as indicated in our comments, trying to incorporate basic aquatic chemistry into the sediment classification approach after the sediments have already been classified, albeit unreliably, does not reflect how the current regulatory system works. Those familiar with this system know that once a sediment is classified as "impaired" it is very difficult, if not impossible, to correct this error.		
206	5.5.3	While the sediment toxicity and benthic organism assemblage information are technically valid components of a biological effects-based sediment quality evaluation, the total concentration of a chemical or chemicals in a sediment, either directly, or through a co-occurrence assessment or index, is not. It has been known for more than 30 years that the total concentrations of sediment-associated chemicals, individually or collectively, do not have a cause-and effect relationship to the impact that that sediment has on benthic organisms, aquatic life, or sediment/water quality	The approach does not assume that a cause and effect relationship with specific chemicals is present.	GFL
Answer:		The staff response has not addressed the issue raised in our comment. First, the use of total concentration/co-occurrence as was done does, in fact, carry a presumption that the exceedance of the co-occurrence trigger is reason to believe that the sediment may cause an adverse impact. If there were not a fundamental presumption that the reason for concern for the sediment (i.e., cause of concern) was the parameter(s) that triggered the exceedance of the co-occurrence index, there could be no rationale for incorporating the index value or trigger. (For example, if the total copper concentration in a sediment exceeded the co-occurrence-based trigger, would not the regulator suspect copper of causing a problem, rather than a parameter that did not exceed the trigger?) In fact, the entire co-occurrence approach was founded based on the "co-occurrence" of elevated total concentrations of individual parameters and some "impact" of the sediment. That the presumption that "co-occurrence" implies "cause" has been recognized (even by its developers) as a fundamental defect in use of the approach for this purpose – and a reflection of the disregard for aquatic chemistry. The staff's approach for sediment		

		classification does, in fact, presume that elevated concentrations of a chemical or group of chemicals is a likely cause of sediment toxicity.		
207	5.5.3	The failure of the SQO staff report to even discuss the significance of not including the potential toxicity associated with low-DO, ammonia, and hydrogen sulfide derived from aquatic sediments as part of the cause of sediment toxicity is a major, fundamental flaw with the proposed approach	Staff are cognizant of the presence of other "non" toxic pollutants that could affect benthic invertebrates, and have made stressor identification an important component of the plan.	GFL, RB5
Answer:		The staff response does not address the issue raised by the comment. The stressor identification approach provided by the staff does not address the issue of the impact on benthic organism assemblages of low-DO conditions that occur with the suspension of bedded sediments into the water column associated with wind or other causes and the exertion of rapid-acting inorganic oxygen demand that kills aquatic life. This issue was completely ignored by the staff. Further, in its response the staff has apparently categorized "low-DO, ammonia, and hydrogen sulfide" as "other 'non'toxic pollutants;" these chemicals/conditions clearly are some of the most significant causes of toxicity in sediments. It is regrettable and counterproductive that, as discussed in our comments, the staff has apparently chosen not to consider those demonstrable causes of toxicity in favor of a more contrived approach that fingers a narrow, select group of chemical "pollutants."		
208	5.5.3	Another significant deficiency with the SWRCB staff's recommended approach is the imprudently narrow focus of the list of chemicals considered in the SQO development. Low DO, ammonia, and hydrogen sulfide can be responsible for sediment toxicity but are not given consideration. They can, in fact, be largely responsible for toxicity erroneously attributed, through "co-occurrence" evaluation, to other chemicals that also occur in the sediment. Further, there is a vast array of potentially toxic chemicals, such as some of the widely-used pesticides, that are not being adequately considered in the staff's proposed list of chemicals that serves as the basis for SQO development	The toxicity and benthic community LOEs incorporate the effects of unmeasured toxic chemicals such as pesticides.	GFL, RB5
Answer:		The staff did not address the substance of our comment. Contrary to the staff's response, the toxicity and benthic organism community LOEs do not correct for the fact that the sediment classification approach does not consider, in its initial stages, the vast array of chemicals that can be responsible for sediment toxicity. As discussed in our comments, the technically unreliable and inadequate initial screening/classification could readily dismiss from further consideration/evaluation sediments that could, in fact, have adverse impacts owing to contaminants/conditions that are not considered, including ammonia, low-DO, and hydrogen sulfide.		
209	5.5.3	The statement about including "other chemicals of concern" in the CA LRM Pmax co-occurrence-based approach for the "chemistry" (more properly, chemical concentration) is a superficial attempt to try to make this technically invalid approach appear more reliable. Repeatedly at staff-organized meetings to discuss SQO development, and in his writings Lee has pointed out that there is a vast array of chemicals that could be causing toxicity in a sediment but that are not considered in the Long and Morgan, MacDonald, or Field et al., co-occurrence-based approaches. Misguided focus on a chemical based on its total concentration can result in failure to address the primary cause of the sediment toxicity	The approach does not assume that a cause and effect relationship with specific chemicals is present. The toxicity and benthic community LOEs incorporate the effects of unmeasured toxic chemicals such as pesticides.	GFL
Answer:		The staff did not address the substance of the comment. As discussed in answers above, the fundamentals of the "co-occurrence"-based approaches do, in fact, presume a cause-and-effect relationship between the concentrations of contaminants and "impact." Further, contrary to the staff's response, the toxicity and benthic organism community LOEs do not correct for the fact that the approach does not consider, from the beginning of sediment classification, the vast array of chemicals that can be responsible for sediment toxicity.		

210	5.5.3	The inclusion of chemical concentrations in the proposed SQO methodology in the manner advocated by the staff, is a contrivance to incorporate what the staff mistakenly calls "chemistry" into a triad approach for sediment quality evaluation. Aquatic sediment chemistry involves the evaluation of the chemical reactions – their kinetics and thermodynamics – that control whether a chemical exists in forms that affect aquatic life in a sediment	The approach proposed in the Plan is consistent with current scientific practice for sediment quality assessment.	GFL
Answer:		The fact that the staff may consider its approach to be "consistent with scientific practice for sediment quality assessment" is irrelevant and does not make up for the fundamental and demonstrable technical deficiencies of the approach. This is especially true since as discussed in our comments, the "scientific practice" it apparently considered – at least based on the literature cited in its draft development approach – was restricted to writings that either promoted its selected, though technically unreliable, approach, or did not provide a critical assessment of its approaches for sediment quality evaluation, regulation, and management. Glaringly absent from the staff writings were citations to the vast scientific literature that discusses fundamentals of aquatic chemistry and its application to sediment quality evaluation and management, or technical deficiencies in approaches that are commonly used, albeit unreliably, for that purpose. To dismiss the technical deficiencies in its approach on the basis that others who do not understand fundamentals of aquatic chemistry also dismiss them, as the staff did in its response, is irresponsible at best. Even the staff acknowledges that the commonly used co-occurrence-based approach for sediment classification is unreliable. Yet the staff continues to use this unreliable approach with the mistaken notion that the errors made in using this approach can later be corrected.		
211	5.5.3	Staff has relied exclusively upon authors who advocate for co- occurrence-based approaches, to the exclusion of the vast technical literature that substantiates the technical unreliability of the approach. Notably absent is reference to the presentations at the 2002 Fifth International Conference on Sediment Quality Assessment, as well as countless papers in the literature that address why co-occurrence based approaches should not be used in sediment quality evaluation. Such unbalance in a review, especially in advocacy of a technically unreliable position, is not serving the SWRCB or the public interest well	Staff are using empirically derived guidelines to assist only in the interpretation of the MLOE.	GFL
Answer:		The staff's response did not address the substance of the comment. The staff's response, "Staff are using empirically derived guidelines to assist only in the interpretation of the MLOE" says nothing to justify, from a technical perspective, its approach or to correct for the deficiencies pointed out in the comment. The value of "empirically derived guidelines" is only as good as the technical foundation and reliability of those guidelines. They are of no value, and indeed can be counterproductive, when the "empirically derived guidelines" do not reliably incorporate fundamental knowledge of aquatic chemistry. The dismissive response provided suggests that staff may at least know that the approach is unreliable but is unwilling or unable to make the necessary corrections, a condition that should be acknowledged forthrightly.		
212	5.5.3	It is disturbing and disheartening to find that the SWRCB staff used co-occurrence-based ERL and ERM values in 2006 to evaluate the quality of California's water and sediments. It was obvious even then that what should have been done was to base the sediment quality evaluation on toxicity information and not incorporate what were recognized to be technically invalid co-occurrence-based ERM and ERL values into the evaluation. In order for the State Board and Regional Board staffs to rectify this error, additional staff resources and expertise would be required to properly conduct the TIEs to determine the chemical(s) responsible for the sediment toxicity that should have been conducted long ago. Since this back tracking and reworking is unlikely, it is unlikely that the SWRCB and Regional Board staffs will stop using cooccurrence-based approaches to evaluate sediment quality. Thus, inappropriate and unreliable evaluations of sediment quality will continue in California, and remediation and source control programs misdirected toward perceived (but not confirmed) sediment quality problems	The author is referring to the Listing Policy in this comment. The proposed approach requires stressor identification.	GFL
Answer:		Trying to conduct stressor identification after a sediment has already been classified as impaired is not a workable approach in today's regulatory climate. Further, several of the stressor identification approaches are not technically valid.		

213	5.5.3	Overall the staff's proposed approach for SQO development can trap the public and private entities into spending large amounts of money only to find they are chasing phantom sediment quality "problems." Members of the Scientific Advisory Panel repeatedly stated that the total chemical concentration co-occurrence-based SQOs should not be used in a regulatory program. Yet clearly the co-occurrence-based SQO is a key component of the proposed sediment quality evaluation approach and, therefore, likely a component of the regulatory program that will evolve from the staff's proposed approach for sediment quality evaluation	The MLOE approach results is a classification of sediment quality into multiple categories that can be used to prioritize management actions and thus make more effective use of limited resources. The Scientific Steering Committee has endorsed the use of chemistry data in the MLOE approach described in the Staff Report.	GFL
Answer:		When one of the multiple lines is technically invalid, the combination of the lines cannot be relied upon to produce a technically valid result. As discussed in our comments, it is not effective use of limited resources to base decisions regarding the continuation of sediment evaluation and requirements for remediation on an unreliable initial categorization. The staff stated in its response, "The Scientific Steering Committee has endorsed the use of chemistry data in the MLOE approach described in the Staff Report." That statement is misleading. That Committee was explicit in stating that it is not endorsing an approach for implementation of the SQO development approach into a regulatory program. As discussed by Lee and Jones-Lee (2007) the SQO development approach proposed by the staff is technically flawed when there is an attempt to implement the sediment classification into regulatory programs that lead to sediment remediation and/or source control for chemicals accumulated in sediments.		
563		The SQOs should examine what implementation will likely be required to achieve the SQOs, what alternative approaches to achieving the SQOs' goals exist, how much sediment will fail For example, the Staff Report is not clear on when and how a non attainment of the SQOs will be determined, or how remediation of the site will be accomplished, and lacks a defined implementation plan.	Staff disagree. Section VII has been amended to clarify the implementation requirements and figures 1 and 2 illustrating the overall process for permitees and regional monitoring programs have been added. See also response to comment #587.	CCOC, LW
Answer:		Contrary to the staff's response, neither the initial nor the revised draft SQO development approach provides adequate guidance for implementing the SQO development approach into regulatory programs that can be reliably implemented at the Regional Board level. The proposed SQO development approach, and following what the staff terms an implementation approach, will clearly lead to justifiable litigation to obtain court relief from technically invalid components of the SQO development and implementation approaches.		
23	5.7	One of the most significant deficiencies in the proposed approach for developing the SQOs is its lack of detailed information on how the results of the SQO triad, even if reliable, would be implemented to reliably direct and regulate the identification and cleanup of contaminated sediment, and institute appropriate source identification and control to prevent future sediment contamination	Staff disagree.	GLF
Answer:		Contrary to the staff's response, neither the initial nor the revised draft SQO development approach provides adequate guidance for implementing the SQO development approach into regulatory programs that can be reliably implemented at the Regional Board level. The proposed SQO development approach and following what the staff terms an implementation approach will clearly lead to justifiable litigation to obtain court relief from technically invalid components of the SQO development and implementation approaches.		
24	5.7.4	One of the most vulnerable groups subject to inappropriate application of the SWRCB staff's proposed sediment quality evaluation is the urban stormwater runoff water quality managers and the public they represent. While it has been well-established that such metals are largely non-toxic, the total concentrations of the metals will likely continue to exceed co-occurrence-based sediment quality guidelines, including those proposed for the SQO development approach	Staff disagree. The commenter does not understand the relationship between assessment and stressor identification.	GLF

Answer:		Contrary to the staff's glib dismissal in response to this comment, Lee and Jones-Lee do, indeed, understand the "relationship between assessment and stressor identification." It was, in fact, their understanding of that "relationship" – in concert with their understanding of aquatic chemistry – that prompted their comment on the fundamentally flawed nature of the approach of trying to correct for errors (introduced through the unreliable incorporation of chemical concentration information in the assessment) through stressor identification. Aside from staff's unrelenting disregard of fundamentals of aquatic chemistry in their approach, the staff has not addressed the consequences of "backsliding" in its trying correct errors in the initial assessment by follow-on studies, even if those errors could be reliably corrected through stressor identification.		
25	5.7.4	Inappropriate regulatory approaches can ultimately result in the regulated community's having to take the issues to the court to find remedy from implementation of their unreliable results. Using the SWRCB database used to develop the SQOs, it can be demonstrated that the chemical concentration component of the SQO can be in error and mislead the identification of chemicals as causing impaired sediment quality	Commenter is referred to Section VII.F of the draft Part 1	GLF
Answer:		The staff did not credibly address the significant potential for dischargers of a chemical to be forced to seek remedy through the courts to get the technical errors made in SQO development and implementation corrected.		
71	5.7.5	The staff provided a section devoted to stressor identification in its report. That section is evidently part of the staff's guidance on SQO implementation; the stressor identification results are to be used to correct the errors associated with use of total concentration co-occurrence-based chemical information	Staff disagree. Once sediment quality is assessed, the logical next step is to determine what is causing the problem.	GFL
Answer:		The staff has not addressed the issue raised; rather, the "response" given clearly shows the disregard for aquatic chemistry in the assessment of sediment-associated contaminants and highlights the essence of the technical issue. The staff's approach incorporates an unreliable, not simply "conservative," initial identification of a sediment as "impaired" as a result of its containing an elevated concentration of a chemical or group of chemicals – an approach which it does not consider (see its response and answer to comment no. 206 above) to rely on a "cause and effect" relationship. Yet, according to this response, it advocates proceeding from that point to determine the "cause" of the "problem." Ignored is the fact, as discussed by Lee and Jones-Lee (2007) and elsewhere, that by skirting the foundations of aquatic chemistry in its proposed evaluation approach, it does not provide a technically reliable basis for identifying a problem or a technically valid foundation for investigating the cause of a problem. Thus, while regulators and dischargers expend time and resources pursuing the "cause" of a "problem" identified by the SQO approach, there may well be no "problem" at all. A serious consequence of the subsequent finding – through investigations and/or the courts – that there is no "problem" is the diversion of resources from identifying and dealing with real problems, and the very real potential of having to continue on with "remediation" of the non-problem to avoid the appearance of absolving polluters of responsibility for "cleanup" (albeit of a non-problem). Exposure of the unfolding of such scenarios does little but erode public confidence in its State and Regional Boards.		
72	5.7.5	TIEs that can be reliably used by those with limited understanding and experience in the aquatic chemistry of sediments as it relates to sediment toxicity, it is possible for those with this knowledge to conduct TIEs to potentially identify causes of sediment toxicity. This situation points to the need to focus the initial sediment quality evaluation on biological effects (toxicity and benthic organism assemblages) without trying to force-fit total chemical concentration information into the evaluation	The draft plan does incorporate stressor identification into the process	GFL
Answer:		As discussed by Lee and Jones-Lee (2007) if the TIE process is conducted properly it can provide reliable results. However, essentially all the other proposed ID approaches are		

		technically invalid; their incorporation will result in inadequate or incorrect identification of stressors for sediment toxicity and/or benthic organism alternation.		
90	6	The California Environmental Quality Act (CEQA) requires that full disclosure be provided as to the environmental consequences of a proposed action. The staff report does not meet the CEQA-equivalent requirement in that regard. It does not provide, for example, a reliable discussion of the consequences of ignoring low-DO, ammonia, hydrogen sulfide, and other toxicants, in sediment quality evaluation. Sediment remediation could be similarly misdirected by not considering many other constituents such as pyrethroid-based and other pesticides. This issue should have been discussed in any credible CEQA-equivalent discussion of the SQO development approach	Staff disagree. The draft Part 1 supports stressor identification and that task is aimed at identifying the stressor that is toxic to benthic communities, regardless of the type of pollutant. Once the stressor is identified, Regional Boards can respond in accordance with Basin Plans.	GFL, RB5
Answer:		The response to this comment does not reflect an understanding of the issues and technical aspects of aquatic chemistry that preclude the recommended stressor ID approach from identifying low-DO, H_2S, and many other chemicals as causes of the problems for which they are, in fact, responsible. For example, as discussed in the comments on the original comments by Lee and Jones-Lee (2007) and in references provided, suspension of sediments containing accumulations of inorganics into a watercolumn can cause transitory DO depletion and death of benthic organisms, an impact that cannot be revealed by after-the-fact stressor ID.		
407	VII.F	This statistical approach is not valid for identification of the pollutant responsible for a biological effect such as sediment toxicity and/or altered benthic organism assemblages compared to the assemblages that should be present based on habitat characteristics. It is another manifestation of the invalid co-occurrence-based approaches in that it contrives to relate total concentrations of a chemical(s) to a biological response	Well-designed statistical analyses can be informative in guiding and confirming the results of stressor identification.	GFL
Answer:		The response to this comment revealed a limited understanding of fundamentals of aquatic chemistry and statistics in its defense of using statistical approaches, however "well-designed," for "guiding" and "confirming" results of stressor ID. Next to disregard for aquatic chemistry, one of the most notorious culprits in misdirecting water/sediment quality evaluation and management is the application of statistics beyond their limitations. This is an insidious problem since such approaches provide seemingly simple uses for numbers by anyone, and under seemingly respectable and authoritative cover of "statistics." A case in point is the gross misuse of "co-occurrence" statistics, which continue to "mis-guide" sediment quality assessment and management. Those who understand these issues know that this approach is not reliable for "verifying," much less "identifying" the chemical(s) responsible for sediment toxicity or altered benthic organism assemblages.		
408	VII.F	Reliable identification of the chemical(s) and/or conditions responsible for toxicity to aquatic life in sediments is done through a properly conducted TIE. This is, therefore, the appropriate mechanism for incorporation of chemical information into a triad sediment quality evaluation approach.	Staff disagree. A TIE should only be conducted if there is a reason to believe the sediments are degraded. Adding a requirement for TIEs to be conducted in conjunction with toxicity and benthic community analysis lines of evidence is not a reasonable nor practical approach.	GFL
Answer:		The response given distorts the comment made by starting with the premise that the comment advocated conducting TIEs on all sediments. Obviously TIEs are needed when there is sediment toxicity and/or altered benthic organism assemblages. As reflected in the "response," a fundamental problem with the staff's proposed approach and position is that the basis upon which the "reason to believe that sediments are degraded" is technically unsound, and can be expected to render unreliable assessments of whether or not a sediment is "degraded." This is discussed in Lee and Jones-Lee (2002, 2004, 2005b).		

409	VII.F	This approach reflects a lack of understanding of aquatic chemistry/toxicity; those familiar with this topic know that spiking sediments cannot be relied upon for determining if a chemical in the sediments is the cause of observed sediment toxicity	Staff disagree. This approach represents just one of the many studies that can be conducted to gather more information about the bioavailability and exposure/response relationship in a particular sediment.	GFL
Answer:		The comment made was not one with which one can simply choose to "disagree" as provided in the response. It is a matter of the realities of aquatic chemistry. The response continues by claiming that the results of the spiking studies advocated provide another piece of "information," presuming that that "information" is meaningful and useful. While clearly the results of that spiking exercise would in fact produce "information" and "data" (data that could even be entered into a statistical manipulation), such results would not be meaningful owing to the fundamental flaws with respect to the aquatic chemistry of sediment-associated contaminants discussed in the comment; that "data" would serve only to distort other, reliable information that may have been generated. Having pioneered in developing the aquatic chemistry field, taught this topic to graduate students for 30 years, and published more than 1100 papers/reports on this issue, I can state, without reservation, that spiking of sediments can readily lead to incorrect conclusions regarding chemicals responsible for sediment toxicity and bioaccumulation.		
410	VII.F	Also, transplanting organisms to measure bioavailability is not necessarily reliable to identify a toxic species in sediments. Non-toxic forms of some chemicals such as organic complexes can be taken up by organisms in sediments without causing toxicity to them, or to other organisms, in the sediment. Further, the partitioning between a sediment bound chemical and organism tissue is significantly different from the partitioning	All methods to measure bioavailability have limitations and site-specific considerations. This method is one of an array of options that may be useful, depending upon the details of the site.	GFL
Answer:		The staff response did not address the issues raised in the comment. It summarily dismissed the technical concerns raised in the comment by stating, "All methods to measure bioavailability have limitations and site-specific considerations." However, it did not address the "limitations and site-specific considerations" for its recommended bioavailability assessment approach in its proposed stressor ID approach. That should have been done. Further, while the response went on to state, "This method is one of an array of options that may be useful, depending upon the details of the site." the results of an unreliable or technically invalid approach would not be useful no matter what the "details of the site." As discussed by Lee and Jones-Lee (2007), measurement of bioavailability is not reliable for determining if a chemical is causing toxicity.		
412	VII.F	Overall, except for the appropriate use of TIEs, the recommended stressor identification presented in the staff report is flawed and can readily lead to incorrect assessments of the chemical(s) responsible for sediment quality impairment. Unreliable stressor identification can lead to large expenditures for misdirected and hence ineffective sediment "remediation" and source control	Staff disagree. TIEs are iterative studies.	GFL
Answer:		Again, being a matter of the fundamentals of aquatic chemistry, the comment made was not one with which one can simply choose to "disagree" as provided in the response. Dr. Lee has been developing TIEs for identification of the causes of sediment toxicity since the mid-1960s. The staff response does not address the issue raised in our comment.		
413	VII.F	Any identification of a water quality or sediment quality "problem," especially one based in any way on co-occurrence- based concentrations, should be followed by properly conducted, true chemistry and toxicity studies to reliably determine if a real water quality impairment such as toxicity exists, the cause of the impairment (not simply what "cooccurs" with measured concentrations) as well as the role of aquatic nutrient-caused sediment toxicity (such as episodic low-DO) in affecting the aquatic life resources of the waterbody	As stated previously, the draft plan as proposed requires stressor identification.	GFL

Answer:		As discussed in our comments, the stressor identification approach proposed by the staff fails to incorporate basic principles of aquatic chemistry into determining the cause of sediment toxicity.		
	GFL	G. Fred Lee and Associates	G. Fred Lee	
	LW	Lathum Watkins on behalf of General Dynamics NASSCO	Kelly Richardson	
	RB5	Central Valley Regional Water Quality Control Board	Kenneth D. Landau	