

Comments on
Draft
**Methodology for Derivation of Pesticide Sediment Quality Criteria
for the Protection of Aquatic Life**

May 2011 Phase I: Review of Existing Methodologies

Prepared by

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Under contract with the California Central Valley Regional Water Quality Control Board (CVRWQCB), Tessa L. Fojut, Ph.D., Martice Vasquez, Ph.D., and Ronald S. Tjeerdema, Ph.D. of the University of California, Davis undertook a study with the goal, according to their draft project report, “to develop a methodology for derivation of pesticide sediment quality criteria for the protection of aquatic life in the Sacramento and San Joaquin River basins. There are three phases to this project. This is a report of the results of Phase I, which is a comparison and evaluation of existing criteria derivation methodologies from around the world. Phase II will be development of the sediment criteria derivation methodology.” Drs. Lee and Jones-Lee were contracted to conduct a peer review of that draft Phase I report.

According to the draft report’s Executive Summary, “*The approach for Phase I was to conduct an extensive literature search to find 1) criteria derivation methodologies currently in use, or proposed for use, throughout the world; 2) original studies supporting the methodologies; 3) proposed modifications of existing methodologies; and 4) relevant and recent research in ecotoxicology and risk assessment. In this report, important elements of sediment quality criteria derivation methodologies are discussed with respect to how they are, or are not, addressed by existing methodologies.*”

“*The goal of this review is to determine if there is an appropriate existing methodology that can be used to calculate sediment quality criteria for pesticides, particularly for a group of or individual pyrethroids. There are three main approaches that are currently used for development of sediment quality guidelines: empirical, mechanistic and spiked-sediment toxicity testing. In general, the empirical approaches generate concentration ranges that are very likely, likely, or not likely to cause adverse effects, while the mechanistic approaches generate single concentrations not to be exceeded that are based on the existence of a water quality criterion for the compound of interest. The third approach uses spiked-sediment toxicity data to derive criteria with statistical distributions or by applying an assessment factor (sometimes called safety factors). Several of the methodologies incorporate multiple approaches and recommend deriving criteria from spiked-sediment toxicity test data if it is available, or comparing the derived criteria to this data if it is limited.*”

Reviewers' Background to Comments

Dr. Lee's academic and professional expertise and experience is focused on aquatic chemistry; Dr. Jones-Lee's academic and professional expertise and experience is in aquatic biology and toxicology. Together they have pioneered in the integration of the disciplines of aquatic chemistry, aquatic biology, and aquatic toxicology for evaluating the water quality impacts of chemicals in aquatic sediments with particular emphasis on developing sediment quality criteria.

Dr. G. Fred Lee began his work on the evaluation of the water quality significance of sediment-associated chemicals, including pesticides, in the mid-1960s while serving as Professor of Water Chemistry and Director of the Water Chemistry Program at the University of Wisconsin, Madison. He and his graduate students conducted some of the first investigations of chemicals in aquatic sediments as a factor affecting beneficial uses (water quality) of waterbodies, and published extensively on their findings. Over the years, he has worked with about 50 graduate students in their MS and PhD thesis and dissertation work on sediment quality issues; Dr. Anne Jones-Lee has worked with Dr. Lee on sediment quality issues since the mid-1970s.

Dr. Lee has conducted more than \$1.5-million in research on sediment quality evaluation, including an approximately \$1-million study devoted to assessing water quality impacts of dredged sediment disposal and developing dredged sediment quality criteria for the US Army Corps of Engineers Dredged Material Research Program (DMRP).

He and his associates have published more than 90 professional papers and reports on their work, many of which are available on Dr. Lee and Jones-Lee's website [www.gfredlee.com] in the "Contaminated Sediment" section [<http://www.gfredlee.com/psedqual2.htm>].

The DMRP project involved intensive laboratory and field investigations of the release and potential water quality impacts of about 30 potential pollutants, including heavy metals, a suite of organochlorine pesticides, PCBs, and nutrients, in about 100 sediments from waterways throughout the US. Particular attention was given to potential toxicity to aquatic life of sediment-associated chemicals released in available forms to the water column upon sediment suspension into the water column. The results of that study were published by the Corps of Engineers in a 2-part, 1,500-page report:

Lee, G. F., Jones, R., Saleh, F., Mariani, G., Homer, D., Butler, J., and Bandyopadhyay, P., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Materials Disposal, Vol. II: Data Report," Technical Report D-78-45, US Army Engineer Waterway Experiment Station, Vicksburg, MS, 1186 pp., August (1978).

Jones, R. A., and Lee, G. F., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Material Disposal, Vol. I: Discussion," Tech Report D-78-45, US Army Engineer Waterway Experiment Station, Vicksburg, MS, August (1978).

With his colleagues, Lee also developed numerous papers and reports addressing their findings in that and subsequent, related studies, many of which are available on Lee's website in the Contaminated Sediments section [<http://www.gfredlee.com/psedqual2.htm#dredge>], including:

Lee, G. F., and Mariani, G., "Evaluation of the Significance of Waterway Sediment-Associated Contaminants on Water Quality at the Dredged Material Disposal Site," IN: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, American Society for Testing and Materials, pp. 196-213 (1977). [<http://www.gfredlee.com/Sediment/Lee-Mariani-ASTM.pdf>]

Lee, G. F., Lopez, J., and Mariani, G., "Leaching and Bioassay Studies on the Significance of Heavy Metals in Dredged Sediments," Proc. Internat. Conf. on Heavy Metals in the Environment, Toronto, Ontario, Canada, Oct 27-31, pp. 731-764 (1975). [<http://www.gfredlee.com/Sediment/Lee-Lopez-Mariani-HMDredge.pdf>]

Those Corps of Engineers' studies served as the technical basis for the past and current regulatory approach used by the US EPA and the Corps of Engineers for regulating dredged sediment disposal with emphasis on open water disposal of contaminated dredged sediments. Those studies unequivocally documented that the concentrations of heavy metals, organochlorine pesticides, PCBs, and nutrients chemicals in sediments are unrelated to the release of those potential pollutants to the water column or their impact on water quality. While the studies showed that many of the US waterway sediments studied contained high concentrations of many potential pollutants such as heavy metals, pesticides, and PCBs, those chemicals were not in toxic/available forms. The toxicity caused in the laboratory toxicity tests of those sediments was found to be due to ammonia derived from the accumulation of particulate organic nitrogen that decomposed to ammonia.

Long and Morgan (1989) used part the Lee et al. database in developing their so-called sediment quality guidelines (ERLs and ERMs) to try to statistically "correlate" total concentrations of chemicals in sediments with some form of "impact." Critically missing, however, was determination of cause-and-effect for the "relationship;" the chemical was considered to be "related" to the "effect" whether or not it was in any way contributing to that effect. Furthermore, Long and Morgan failed to include information on the presence of ammonia in the sediments that was, in fact, found to be the most likely cause of the sediment toxicity found in those studies, irrespective of the concentrations of other "pollutants" covered by the "guidelines." Furthermore, Long and Morgan have warned against applying their ERL and ERM values for sediment regulation. Jones-Lee and Lee discussed the unreliability of co-occurrence-based values for assessing and regulating sediment-associated contaminants in a number of professional papers and reports, including:

Jones-Lee, A. and Lee, G. F., "Unreliability of Co-Occurrence-Based Sediment Quality Guidelines for Contaminated Sediment Quality Evaluation at Superfund/Hazardous Chemical Sites," Journ. Remediation 15(2):19-34 (2005).
<http://www.gfredlee.com/Sediment/SQGSuperfund2.pdf>

While Long and Morgan are not alone in trying to relate, through statistical correlations, the total concentration of a chemical in sediments and sediment toxicity, all "co-occurrence"-based approaches, and approaches with a "co-occurrence"-based component, suffer from similar

technical deficiencies and lack of cause-and-effect couplings. As discussed by Lee and Jones-Lee, as well as by others, co-occurrence-based approaches as a foundation of ERMs, ERLs, PEL, among other such surrogates, are technically invalid and should not be used for any sediment evaluation, screening, or management purpose. The studies conducted by California State Water Resources Control Board (SWRCB) contractors for the development of Part 1 SQOs Plan clearly demonstrated what had been demonstrated in the 1970 by Lee and his associates: there is no relationship between the total concentration of a chemical in sediments and the toxicity of the sediment to aquatic life, or the bioaccumulation of the chemical within aquatic life. These issues are discussed further below.

The development and implementation of technically valid water quality criteria, standards, and objectives have been a focal point of Dr. Lee's more than five-decade-long professional career. His experience includes serving as an invited reviewer of the National Academy of Science/National Academy of Engineering (NAS/NAE) "Blue Book" of national water quality criteria developed in 1972, serving as an invited contributor to the American Fisheries Society's review of the US EPA "Red Book" of water quality criteria of 1976, and serving as a US EPA invited peer reviewer of the US EPA "Yellow Book" of water quality criteria and the then proposed criteria development approach of 1986. A descriptive summary of that experience is presented at:

G. Fred Lee and Anne Jones-Lee Expertise and Experience in Water Quality Standards and NPDES Permits Development and Implementation into NPDES Permitted Discharges. <http://www.gfredlee.com/exp/wqexp.htm>

Dr. Lee has been a member of several professional organizations such as Water Environment Federation, participated in and addressed professional conferences and other groups specifically on issues of the development of sediment quality criteria.

Throughout Dr. Lee's professional career he has been active in developing regulatory approaches for identifying and managing chemicals in aquatic sediments that have the potential to be adverse to water quality. He and Dr. Jones-Lee have developed several papers and reports that specifically discuss potential problems with proposed approaches for identifying and regulating contaminated sediment, and that present specific recommendations for more reliable evaluation and regulation of contaminated sediments to protect water quality without significant unnecessary expense for sediment "management" (remediation) and "source control." They summarized their many years of experience on this area in:

Lee, G. F. and Jones-Lee, A., "Appropriate Incorporation of Chemical Information in a Best Professional Judgment 'Triad' Weight of Evidence Evaluation of Sediment Quality," Presented at the 2002 Fifth International Symposium on Sediment Quality Assessment (SQA5), IN: Munawar, M. (ed.), Aquatic Ecosystem Health and Management 7(3):351-356 (2004).
<http://www.gfredlee.com/Sediment/BPJWOEpaper.pdf>

It is with this background we offer the following comments on the UCD draft report for developing sediment quality criteria.

Specific Comments

Near the bottom of page 1 of the draft report is a listing of CVRWQCB requirements for controlling toxicity which includes the Basin Plan requirement:

"...waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life."

That requirement does not reflect an understanding that with few exceptions, aquatic sediments exhibit toxicity to some forms of aquatic life. As discussed by Lee and Jones-Lee in their writings on sediment quality evaluation (see reference listed above and on their web site www.gfredlee.com in the Contaminated Sediment section), accumulations in the sediment of decaying algae that developed in the water column, died, and settled to the sediments, exert an oxygen demand that causes the sediments just below sediment surface to become anoxic (without dissolved oxygen). That anoxia leads anaerobic and chemically reducing conditions under which ferric iron is reduced to ferrous iron, and sulfate is reduced to sulfide; ammonia arising from the decomposition of organic nitrogen in algae accumulates in the sediments. Sulfide and ammonia, in addition to the absence of dissolved oxygen, are highly toxic to many forms of aquatic life. Information on the potential impacts of nutrients leading to toxicity to aquatic life due to low DO is presented in:

Lee, G. F. and Jones-Lee, A., "Role of Aquatic Plant Nutrients in Causing Sediment Oxygen Demand Part I – Origin of Rapid Sediment Oxygen Demand," Report of G. Fred Lee & Associates, El Macero, CA, May (2007).
<http://www.gfredlee.com/Sediment/NutrientSOD1RapidOD.pdf>

Lee, G. F., and Jones-Lee, A., "Role of Aquatic Plant Nutrients in Causing Sediment Oxygen Demand Part II – Sediment Oxygen Demand," Report of G. Fred Lee & Associates, El Macero, CA, June (2007).
<http://www.gfredlee.com/Sediment/NutrientSOD2SOD.pdf>

Lee, G. F., and Jones-Lee, A., "Role of Aquatic Plant Nutrients in Causing Sediment Oxygen Demand Part III – Sediment Toxicity," Report of G. Fred Lee & Associates, El Macero, CA, June (2007). <http://www.gfredlee.com/Sediment/NutrientSOD3Tox.pdf>

Those reports were developed in connections with the Lee and Jones-Lee review of the SWRCB draft sediment quality criteria (SQO) Plan 1:

Lee, G. F., and Jones-Lee, A., "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'" and Answers to SWRCB Staff Responses to Comments on September 2007 Proposed SQO Development Approach. Submitted to State Water Resources Control Board, Sacramento, CA. Report of G. Fred Lee & Associates, El Macero, CA, September 5 (2008). <http://www.gfredlee.com/Sediment/SQOCommentsAnswers.pdf>

Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Staff Report Substitute Environmental Document Proposed Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality for the Protection of Fish and Wildlife' Report of State Water Resources Control Board Division of Water Quality, January 28, 2011," Submitted to State Water Resources Control Board, Report of G. Fred Lee & Associates, El Macero, CA, March 14 (2011).

<http://www.gfredlee.com/Sediment/SedQualDraftSubCom.pdf>

Lee, G. F., and Jones-Lee, A., "Conclusions & Recommendations – Developing Updated Sediment Quality Objectives," PowerPoint Slides Summary of Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Staff Report Substitute Environmental Document Proposed Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality for the Protection of Fish and Wildlife' Report of State Water Resources Control Board Division of Water Quality, January 28, 2011," Submitted to State Water Resources Control Board, Report of G. Fred Lee & Associates, El Macero, CA, March 14 (2011). <http://www.gfredlee.com/Sediment/SedQualDraftSubPpt.pdf>

As discussed above, in general the real, ultimate cause of the inherent toxicity of sediment is the aquatic plant nutrients, nitrogen and phosphorus, added to the waterbody that stimulate the development of algae; the algae grow in the water column, die, and settle to the sediment where their bacterial decomposition exerts an oxygen demand. If the CVRWQCB truly enforced its Basin Plan requirement, quoted above, to control all causes of aquatic sediment toxicity the Board would need to regulate discharges of nutrients that lead to the development of algae that lead to conditions in aquatic sediments that are toxic to some forms of aquatic life. However, in developing its SQO Plan 1, the SWWRCB specifically choose to exclude the toxicity caused by low-DO, sulfide, and ammonia in regulating "toxicity" of aquatic sediments.

The typical approach followed for evaluating sediment toxicity is to conduct toxicity tests under laboratory conditions that specifically remove toxicity due to low-DO, sulfide, and ammonia in order to measure the toxicity apparently "due to" a pesticide or some other target chemical, irrespective of whether or not that target component is in fact responsible for manifested toxicity. That approach also can result in the overlooking of sediments that actually cause aquatic life toxicity. For regulatory agencies to selectively focus investigation of sediment toxicity on a group of potential pollutants selected *a priori*, and disregard chemicals known to cause the bulk of ubiquitous sediment toxicity is misguided, technically invalid, wasteful of resources, and shortsighted in addressing the role of sediment toxicity in affecting the beneficial uses of a waterbody.

The basic issue that must be addressed is: what is the significance of aquatic sediment toxicity in impacting the beneficial uses of a waterbody? Questions such as the following need to be carefully considered and reliably answered in establishing a sediment testing regimen and regulatory requirements. Is the toxicity caused by a pesticide in the sediment of greater significance to the particular test organism under the test conditions than the toxicity caused by a pyrethroid pesticide also in that sediment, or to the toxicity caused by low-DO or ammonia, etc. in that sediment? Is the toxicity manifested by the particular test organism(s) under the testing conditions demonstrably indicative of the impacts of the sediments to the beneficial uses of the waterbody in question? If pyrethroid pesticides that cause toxicity to *Hyalella* under test conditions were removed or controlled in situ, will the designated beneficial uses of the waterbody be improved, and if so, by how much? If low-DO conditions cannot be reliably and economically controlled, should funds be spent for the "remediation" of other potentially toxic components of the sediment, when the sediments would remain toxic after "remediation?" These are issues that need to be addressed as part of developing the regulatory program for pyrethroid based pesticides as well as for some other chemicals present in aquatic sediments. It could be that by focusing on eliminating aquatic life "toxicity" caused by pyrethroid-based pesticides the public and commercial/agricultural interests would be deprived of a highly beneficial product while effecting little or no improvement to the overall beneficial uses of

waterbodies. Since some forms of aquatic life are very similar to the insects that the pesticides are designed to control, it will be very difficult to develop a pesticide that is effective in controlling the target insect pests without causing toxicity to some forms of aquatic life.

Near the bottom of the first paragraph on page 2 of the draft report is the statement, *“Many studies have demonstrated that total measured contaminant concentrations in sediments are poorly correlated to observed effects, which is most likely due to limited bioavailability of the contaminants (Conrad et al. 1999, DiToro et al. 2002, Xu et al. 2007)”*

The first, and thus far the most comprehensive, study of this issue was the Lee et al. DMRP studies of the 1970s discussed above. In those studies it was demonstrated that there is no relationship between the concentration of a potential pollutant in an aquatic sediment and its toxicity. As discussed above the results of those studies have been published in the refereed literature and are readily found through the Internet and should be included in the listing of source of information on this issue.

Much of the draft report is devoted to summarizing approaches that have been used to attempt to develop sediment quality criteria in the US and several other countries; however, the summary does not provide a technical review. The “use” of an approach does not impart a technical reliability to the approach. Over the past 30 years or so Lee and Jones-Lee have been active in reviewing the various approaches for developing sediment quality criteria particularly in the US. The discussion of the US approaches presented in this draft report is deficient in its failing to present sufficient discussion of the detailed technical comments and critiques made by reviewers of the various methods used for SQC/SQG guideline development and implementation. A reviewer of this draft report would thus not be made aware of the substantial technical literature that identifies and discusses the technical problems and deficiencies inherent in approaches that have been used. Such a review should be an integral part of a discussion of the approaches for this draft report. Lee and Jones-Lee are not in a position to provide similar comments on the foreign-based sediment quality criteria; professionals in the other respective countries may have discussed the problems with the discussed sediment quality criteria covered in this draft report. As with the US literature a critical review such as review of the home country criteria would provide a better understanding of the potential problems with those sediment quality criteria. The net result of a more detailed review of the foreign literature could, as it does in reviewing the US literature as discussed herein, change the impression of the reliability of the foreign literature.

Page 3 and page 4 of the draft report present references to sources of literature used in developing the draft report. Review of Table 1 and the list references used shows that this report is highly deficient in providing the reader with references to the vast literature that discusses technical shortcomings of and unreliable information presented in references cited in the report. For example, Dr. T. O’Connor of NOAA has commented.

O’Connor, T. P., “The Sediment Quality Guideline, ERL, Is Not a Chemical Concentration at the Threshold of Sediment Toxicity,” Mar. Poll. Bull. 49:383-385 (2004). <http://www.gfredlee.com/Sediment/oconnor.pdf>

More than fifteen years ago, Lee and Jones-Lee critiqued approaches being proposed and used for sediment quality criteria, with supporting literature available at that time in:

Lee, G. F. and Jones-Lee, A., “Can Chemically-Based Sediment Quality Criteria Be Used as Reliable Screening Tools for Water Quality Impacts?” Invited Presentation for Society

of Environmental Toxicology and Chemistry News, April (1996).
<http://www.gfredlee.com/Sediment/sedseta2.pdf>

As noted above, a credible comprehensive literature review of approaches for developing sediment quality criteria should include relevant technical literature, including, and especially in this case, that which may be critical of approaches being advocated. See ensuing discussion.

Page 5 second paragraph states,

“Large amounts of literature are available on contaminated sediment risk assessment, but the objective of this review is to only focus on one aspect of risk assessment, which is developing numeric SQC for which compliance can be based solely on chemistry measurements.”

The restriction of the review to that literature which advocates for or has adopted sediment quality criteria development approaches based solely on “chemistry measurements” – especially to the exclusion of technical literature critical of such approaches – renders the literature review, and indeed the foundation of the draft report, biased and invalid for providing a usable technical review. While a number of attempts have been made to develop sediment quality criteria based only on chemical measurements, it has long been well-recognized that while administratively expedient, that approach is fundamentally flawed. As discussed in the literature cited above as well as elsewhere, there is no reliable information that shows that the measurement of the concentrations of potential pollutants in an aquatic sediment provides a reliable indicator of sediment toxicity.

Page 9 first full paragraph states,

“While SQC can refer to chemical-specific concentrations in sediment expected to cause adverse biological effects, or levels of biological effects that are considered unacceptable, we will focus on SQC methods that yield chemical-specific numerical concentrations. According to Chapman (1989), the advantages to these types of criteria are that they are widely applicable and their application is straightforward, requiring no specialized biological, chemical, or other expertise. The disadvantages of individual numerical criteria are that they may overlook toxicity due to other chemicals and the values are not flexible to account for site-specific variations.”

The primary reason that chemical concentration approaches are not reliable is that many potential pollutants in the water column and especially in sediments exist in a variety of chemical forms, only some of which are toxic. This section should be expanded to discuss this issue.

Page 10 first full paragraph states,

“3.1 Numeric criteria vs. advisory concentrations

“Numeric SQC have been derived for a few compounds by the USEPA (dieldrin, endrin, PAHs), but none of these numeric criteria have been adopted as sediment quality standards.”

A discussion needs to be added to address the fact that after spending many tens of millions of dollars trying to fashion numeric SQCs into a reliable approach, the US EPA finally concluded that that approach is not reliable for developing SQCs.

Page 11 third paragraph states,

“When data are limited, numeric criteria of low site-specificity and high uncertainty can be derived, then as more data become available, criteria can be refined for better site-specificity and greater

certainty”

That quoted sentence implies that it is possible, through repeated chemical measurement, to refine the chemical approach to make it a more reliable predictor of sediment toxicity. That implication is not technically valid. The only way to reliably determine if a sediment is toxic is to measure toxicity. For many reasons related to the kinetics and thermodynamics of chemicals in aquatic systems, and their impacts on aquatic organisms, there is no simple relationship between sediment chemical concentration and sediment toxicity. This was described at length in the technical literature more than four decades ago.

Page 37 Bottom. See the discussion above concerning why the US EPA discontinued trying to develop the EqP approach for developing SQG. The Lee and Jones-Lee (1996) paper referenced above also summarized fundamental technical deficiencies in that approach.

Page 46 second paragraph states,

“The primary advantages of the SSTT approach are that it is technically acceptable, shows a direct cause-effect relationship, and it addresses the issue of bioavailability, while the primary disadvantage of using the SSTT approach is the dearth of data currently available.”

The primary disadvantage of the SSTT approach is that the chemical spike will rarely come to the same equilibrium position with respect to chemical forms under the test conditions as the pollutant that is present in the sediments. As Lee and Jones-Lee have discussed in their writings on the development of sediment quality criteria, all spiked-sediment studies need to be conducted repeatedly over time to allow for potentially better equilibration of the spike with the originally present pollutant in the sediment. The disregard for this fundamental principle is a deficiency of the draft report.

Page 46 section 6.2.3 begins a discussion of empirical approaches. As was found with the lack of critical review of the Long and Morgan and other co-occurrence-based approaches, the draft report also falls far-short of adequately discussing the literature on the problems with the empirical approaches. The authors of the draft report have relied too much on a summary report of Wenning et al. As discussed in Lee’s writings that are not cited in the draft report, the data base developed by Lee and his graduate students served as the primary original data set used by Long and Morgan. While the SQG developed by Long and Morgan are called “NOAA” guidelines as quoted above, O’Connor (who headed the NOAA Status and Trends study) discussed the fact that those “guidelines” are not NOAA-adopted guideline and are in fact unreliable for predicting sediment toxicity. The Corps of Engineers and the US EPA have both rejected this approach for developing sediment quality guidelines. The overlooking, or disregard, for such information is a serious deficiency in the UCD draft report discussion of this approach.

These comments on the deficiencies in the discussion of the Long and Morgan, MacDonald, and related approaches are equally applicable to the discussion in the draft report sections 6.2.3.2 *Effects level approach (Florida)*, and 6.2.3.3 *Apparent effects thresholds approach (Washington/Oregon/Puget Sound)*. There is a substantial literature on the unreliability of these approaches that is not mentioned in the UCD draft review.

Page 48 6.2.3.5 *Logistic regression model approach (California)* The discussion of this approach and its potential technical problems is somewhat more reliable than those of other approaches in this draft report. However, there are several detailed discussions of the problems with this approach, including those of Drs. Lee and Jones-Lee, that are readily available on the Internet and in the SWRCB

proceedings concerning SQOs based on this approach, that should have been incorporated into this discussion.

The discussion on page 49 6.2.3.7 *Evaluation of empirical approaches* fails to adequately discuss why the Logistic regression model approach is not reliable for developing SQOs for any chemical including pesticides. The primary reason that that approach is not reliable is that it is based on the total concentration of a chemical rather than on the toxic/available forms in the sediments. Contrary to the statements made in the draft report, the problem is not a lack of a sufficiently large data base; rather the problem is that the approach itself is fundamentally flawed. As discussed above, there is no relationship between the total concentration of a chemical in a sediment and its potential toxicity.

Page 55 last paragraph states,

“Of the three main approaches discussed in this review, only the empirical approach utilizes all available data to derive SQGs.”

That statement is not necessarily true; for example, the SQG developed by Long and Morgan, which was based on a large part on the database developed by Lee et al., did not include the ammonia data that were included in the Lee et al. database. As it turns out, ammonia has been found to be the primary toxicant in many of the sediments studied.

Page 56 states in the Conclusions section,

“Empirical approaches make use of large datasets that include both field bioassay and laboratory toxicity data, with matching chemistry data, to determine ranges of sediment concentrations that are likely or not likely to cause toxicity. The empirical approaches would not be useful for determining sediment quality criteria (SQC) for pesticides in the Sacramento-San Joaquin River basins, because little if any matching chemistry and toxicity data are available for many of the compounds of interest (e.g., pyrethroids), and a direct cause-effect relationship between a single sediment contaminant and toxicity cannot be discerned, leading to high uncertainty in any SQC derived for individual compounds.”

Empirical approaches CAN, but do not necessarily, make use of large datasets in those areas. The statement that empirical approaches would not be useful for SQCs for pesticides in the Sacramento-San Joaquin River basins is accurate, but the basis given for that conclusion is not. As discussed herein, it is unreliable to use empirically derived data to establish SQOs for any type of chemical because of the myriad factors that impact the toxicity of a sediment-associated chemical but that cannot be properly quantified and incorporated; only the total concentration of the chemical is known.

The statement, *“The EqP approach uses aquatic toxicity data with the equilibrium partitioning model to derive SQC. This approach could be used in the Sacramento-San Joaquin River basins for any pesticides for which there are existing water quality criteria, but this approach neglects any available sediment toxicity data.”*

The EqP approach suffers from the same problems discussed above; all the factors that can impact participation in equilibrium reactions are large unknowns.

The Conclusions section also states, *“The SSTT approaches utilize sediment toxicity data, creating a scientifically defensible foundation for SQC.”*

While that approach is potentially more reliable for establishing SQCs on a site-specific basis for a particular compound, it is not practical owing to the large-scale studies needed to establish reliable data to establish proper equilibration of the chemical of concern in the sediment.

Page 57 states, “*There are two possible outcomes of this project: 1) recommend an existing methodology for adoption, or 2) develop an entirely new methodology.*”

Based on Lee’s four decades of studies on the role of sediment-associated chemicals in causing aquatic life toxicity, it will not be possible to develop reliable SQCs based on the chemical concentration of a particular chemical, such as a pyrethroid-based pesticide, and its potential to cause aquatic life toxicity in a variety of sediments without very large, well-planned and executed, site-specific studies.

As discussed in Lee and Jones-Lee’s writings cited above, the proper regulation of pyrethroid-based pesticides will require first, a determination of whether or not the pesticide-containing sediment is toxic. If it is toxicity, it must be determined whether or not the toxicity is likely due to a particular pesticide. A properly designed and executed chemical additions method can be useful for making that evaluation. Contrary to statements made in the draft report, having more co-occurrence-based sediment concentration and toxicity data does not improve the reliability of the approach. It will likely simply show the extreme scatter typical of data of this type.