Comments on the CVRWQCB Sacramento and San Joaquin River Proposed Pesticide Basin Plan Amendment Development Approach

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The Central Valley Regional Water Quality Control Board (CVRWQCB) staff have proposed to amend the pesticide regulatory requirements currently in the Basin Plan for the Sacramento and San Joaquin River watersheds. According to the Fact Sheet (CVRWQCB, 2006),

> *"The Amendment would be designed to establish water quality objectives and a program of implementation for pesticides that are impacting or could potentially impact aquatic life uses in surface waters."*

Based on discussions held at a recent staff meeting devoted to reviewing the proposed approach, the overall objective of this Basin Plan Amendment is to simplify regulating pesticide-caused aquatic life toxicity. As presented in the Fact Sheet, the proposed Basin Plan Amendment has several components. In response to a request for comments on this approach, comments on some of the unreliable aspects of the staff's approach related to developing several of these components are presented below.

One of the major problems with the staff's proposed approach is that the pesticide Basin Plan Amendment is to be developed on a "crash" basis within a two-year period. A number of the topic areas that are proposed by the staff to be included in this pesticide Basin Plan Amendment are devoted to topics that have been worked on for many years by the US EPA and others, with much greater financial and technical assistance resources than are available to the CVRWQCB staff. Many of the issues that the staff propose to address on a "crash" basis will not be successfully addressed with the resources available in the timeframe allowed.

Water Quality Criteria

Based on having been involved in investigating the impact of pesticides on aquatic life related beneficial uses of waterbodies since the 1960s, I (G. Fred Lee) find that several aspects of the staff's proposed approach for regulating pesticides are potentially technically invalid and can readily lead to inappropriate regulations. As discussed below, the basic problem is that the staff, in developing this approach, potentially could fail to adequately consider the aquatic chemistry and aquatic toxicology/biology of pesticides as they impact aquatic life.

One of the objectives of the proposed pesticide Basin Plan Amendment is to establish numeric water quality objectives for pesticides. It is important that the staff fully understand and address the difficulties of developing reliable water quality criteria/objectives. This is a topic that I have been involved in since the late 1960s, including serving as an invited peer reviewer for the National Academies of Science and Engineering's Blue Book of Water Quality Criteria, 1972. Further, I was a member of the American Fisheries Society's review panel for the US EPA's Red

Book of Water Quality Criteria that was published in 1976. In addition, I was an invited peer reviewer of the US EPA's Gold Book of Water Quality Criteria of 1986. This peer review panel reviewed the approach that the US EPA used then and continues to use to develop water quality criteria. Further, I have participated in a number of US EPA workshops on updating water quality criteria and standards. I am familiar with the approaches that can and should be used to develop appropriate water quality criteria and standards that will adequately regulate potentially significant water quality impacts without significant overregulation which would unnecessarily curtail the use of pesticides.

While it is relatively simple to develop numeric values that can be called "water quality objectives" for pesticides, without an adequate and reliable database of the impact of pesticides on aquatic life-related beneficial uses, such simplified approaches for developing water quality criteria/standards/objectives can readily lead to inappropriate regulation of pesticides.

At the staff meeting, I asked about the overall approach in developing water quality objectives relative to the Clean Water Act requirements of developing criteria that are protective in all waters. This approach was mandated by the US Congress as part of the 1972 amendment to the federal Water Pollution Control Act. However, as is well established, developing water quality criteria that will be protective against aquatic life toxicity in all waters will result in criteria that are highly overprotective in many waters. The US EPA understood this situation and has developed a Water Quality Standards Handbook (US EPA, 1994) that enables site-specific adjustment of a water quality criterion for waterbody characteristics that tend to cause a potentially toxic chemical, such as a pesticide, to exist in nontoxic forms. As I indicated at the staff meeting on the proposed Basin Plan Amendment development approach, the staff should also develop at the same time guidance on how to develop a site-specific water quality objective modification approach for pesticides that can be applied to make the objectives more appropriately applicable to a particular waterbody in which there is interest in regulating pesticide concentrations.

The current Basin Plan approach for regulating pesticides and other chemicals is based on controlling aquatic life toxicity due to these chemicals. This narrative approach has considerable technical merit, in that it incorporates, through toxicity testing, an assessment of the waterbody site-specific characteristics that affect the primary impact of the pesticide on aquatic life – i.e., toxicity.

A recent example of the importance of assessing aquatic life toxicity in evaluating the potential impacts of pesticides occurs in the report that Larry Walker Associates (LWA 2006) submitted to the Sacramento/Yolo Mosquito and Vector Control District. There was concern about the use of a pesticide (natural pyrethrin) that was used in aerial spraying in an attempt to control mosquito populations that could carry the West Nile Virus. LWA focused the assessment of whether the pyrethrin that settled into the waterbodies in the Sacramento/Yolo County area could be causing aquatic life toxicity based on measurements of the concentrations of pyrethrin in the waterbody. They compared these concentrations to LC50 concentrations for toxicity to aquatic life that had been reported in a US EPA database. They concluded that there was little likelihood that the concentrations found, which in some waterbodies exceeded the LC50 for certain forms of aquatic

life, were not causing toxicity. However, there are a number of significant technical difficulties that can readily make this chemically based approach unreliable.

One of the difficulties with this approach is that the aquatic chemistry of pyrethrin is such is that it tends to sorb (attach) to particulate matter, which can detoxify the pesticide. Since the analytical methods used measure total concentrations of the pesticide, they include nontoxic forms. In addition, it has been found that pyrethroid-type pesticides interact with dissolved organic carbon (DOC), which also detoxifies that portion of the pesticide that has interacted with DOC. These issues were reviewed by Gan et al. (2006). Both of these components of the aquatic chemistry of pyrethrin make the estimates of aquatic life toxicity based on chemical measurements of concentrations unreliable.

Another component of the aquatic chemistry of pyrethrin pesticide is that the pesticide, in attaching to particulate matter, settles to the waterbody sediments, and thereby causes aquatic life toxicity to sediment-associated organisms. The work of D. Weston and his associates at UC Berkeley (Amweg et al. 2006) have demonstrated the importance of this component of pyrethroid-based pesticide toxicity. The toxicity in the sediments is a function of the total organic carbon (TOC) of the sediments. The recent article by Raloff (2006) provides additional discussion of these issues.

The aerial spraying of pyrethrin to control West Nile Virus mosquito vectors included spraying piperonyl butoxide (PBO). PBO is a chemical that enhances the toxicity of pyrethrin and other pyrethroid pesticides. LWA made a significant error in their approach for assessing the significance of PBO in affecting aquatic life toxicity, where it focused on whether the PBO caused toxicity. Those knowledgeable about the toxicity of pyrethroids know that the issue is not the toxicity of PBO, but the impact of PBO in enhancing the toxicity of pyrethroid-based pesticides. This enhancement occurs at much lower concentrations than those that are toxic to aquatic life. Again, there is no method to chemically assess the impact of PBO on pyrethrin-based toxicity. It has to be done through measurement of aquatic life toxicity.

Overall, the chemically based approach, which evidently is what the CVRWQCB staff is attempting to develop for regulating pesticides, can readily lead to inappropriate regulation, since, as was done by LWA, it can lead to an incorrect assessment of aquatic life toxicity. The approach that needs to be followed in regulating pesticides is to base the regulations on aquatic life toxicity assessment in the water column and sediments.

Aquatic Life Beneficial Use Assessment

A second objective of the proposed Basin Plan Amendment is to establish aquatic life beneficial uses in Central Valley streams that do not have a designated beneficial use. As discussed at the meeting, this approach involves conducting bioassessments in various streams in the Central Valley to establish that there is, at least at times, aquatic life in the streams. As I pointed out at the staff meeting, this approach is a waste of time and money. There is no issue as to whether there are some forms of aquatic life in streams when there is water present. There is no need to spend taxpayers' money proving what is obvious.

Pesticide Risk Assessment

I have been following the approach that the CVRWQCB staff have been using to develop a "pesticide risk assessment." This approach is similar to the approach that I developed and used in my work for the Santa Ana Regional Water Quality Control Board in the late 1990s (see Lee and Taylor 2001), in which I was concerned about identifying the cause of unknown-caused toxicity found in stormwater runoff in the Upper Newport Bay watershed. One of the issues that apparently is not being adequately considered by the CVRWQCB staff is that very small county-wide annual use amounts (a few thousand pounds) of some pesticides can cause significant aquatic life toxicity in waterbodies. Apparently, the screening process used by the CVRWQCB does not adequately consider this situation, where some of the more highly toxic but limited-use pesticides are not being considered to be a significant cause of aquatic life toxicity in the Central Valley.

Another problem with the approach used by the CVRWQCB staff in the development of a risk assessment for pesticides is the lumping together into one database/evaluation, toxicity to aquatic animal life and toxicity to plants (algae). Although toxicity to zooplankton, fish and benthic invertebrates is potentially significant in adversely affecting the beneficial uses of a waterbody, toxicity to algae in many of the waterbodies in the Central Valley of California is not adverse to the beneficial uses of the waterbody, since many of these waterbodies have excessive growths of algae that, in themselves, are significantly impairing water quality/beneficial uses. While toxicity to algae is a technical violation of the Basin Plan, it is questionable that the Board will require the control of pesticides (herbicides) that are found in waterbodies with excessive growths of algae. On several occasions I have suggested to the CVRWQCB staff that they need to separate the databases for aquatic life toxicity to animals from those to plants. Thus far they have not acted on my suggestions.

Sediment Quality Criteria

The Fact Sheet mentions that, "*Both potential narrative and numeric sediment quality criteria will be considered,*" as part of developing a Basin Plan Amendment for pesticides. Specific mention was made of considering approaches that other states are using – specifically, the state of Florida – in developing sediment quality standards. I am familiar with the state of Florida's technically invalid approach for developing sediment quality standards. It is based on total concentrations of a chemical and co-occurrence with toxicity. Such an approach is well known to be technically invalid. This is another example of the CVRWQCB staff's not being familiar with the literature, and especially the work that is being done at the State Water Board level, in developing sediment quality criteria for the state of California. Spending taxpayer funds to review the literature on developing sediment quality criteria for pesticides is another waste of time and money. It could readily result in technically invalid approaches being adopted by the CVRWQCB, such as the so-called "co-occurrence-based" approaches that are in the literature.

As discussed by Jones-Lee and Lee (2005) and in literature by others cited therein, chemically based sediment quality criteria are unreliable for assessing the potential for chemicals in the sediments, including pesticides, to cause aquatic life toxicity. Again, as with water column toxicity, a reliable approach must be based on assessing aquatic life toxicity through toxicity measurements. In addition, an assessment of the benthic organism assemblages present in a waterbody's sediments relative to the habitat characteristics should be included in assessing the

potential impacts of a chemical or group of chemicals associated with sediments on water-quality-related beneficial uses of a waterbody.

Chris Beegan of the State Water Board staff has been working on developing sediment quality objectives for California marine waters over the past two years. This work is being conducted under the guidance of a national expert panel that has helped shape the State Board's sediment quality objective development approach. The State Board staff team and the expert panel have held periodic meetings, which are open to anyone interested, to discuss current progress toward sediment quality objective development. I have been a participant in these meetings. While, initially, considerable emphasis was being placed on the use of chemically based assessment approaches, currently, the emphasis has shifted to biologically based assessment approaches, with chemically based assessments only being used as an indicator of the potential significance of a chemical. Even this use is recognized as frequently being unreliable. The problem is one that has been understood for over 30 years – namely, that chemicals exist in aquatic sediments in a variety of forms, only some of which are toxic/available. Biologically based approaches must be used to reliably assess toxicity/availability.

Bill Jennings has been instrumental in having the State Water Resources Control Board (SWRCB) make available $2.5 million to expand the development of sediment quality objectives to the Delta. This work is to be initiated this year, with the first meeting to discuss approaches to take place in March. Rather than the CVRWQCB staff trying to develop sediment quality objectives for pesticides on a "crash" basis to fit within the limited timeframe that has been proposed for developing the pesticide Basin Plan Amendment, it would be far more appropriate to stop any work along this line as part of the Basin Plan Amendment, and become active in the SWRCB's efforts to develop sediment quality objectives for Delta waters. Such objectives could be applicable to other waterbodies in the Central Valley.

Source Assessment and Loading Capacity Analysis

The CVRWQCB staff responsible for developing the pesticide Basin Plan Amendment approach propose to use "models" to assess the allowable loading capacity for pesticides discharged to Central Valley waterbodies. As the individual responsible for developing and then chairing for a number of years the ASTM Pesticide Fate and Transport Modeling subcommittee, I (G. F. Lee) am familiar with the problems with trying to develop reliable modeling approaches for pesticides. Basically, there is no model available, nor will one likely be developed, that can develop reliable predictions of the allowed loading of a pesticide to a waterbody without a massive waterbody-specific study. While it is possible to develop so-called models that are alleged to be useful for this purpose, these are nothing more than computer game-playing, which have little or no reliable predictive capability. This is another component of the staff's proposed approach for developing a Basin Plan Amendment that will not provide reliable information upon which to regulate pesticides in the Central Valley.

Management Practice Alternatives

Another component of the pesticide Basin Plan Amendment development approach is an assessment of the management practice alternatives. In 2002, under contract with the SWRCB on behalf of the CVRWQCB, we (Lee and Jones-Lee 2002) conducted a detailed review of the literature pertinent to evaluating management practices for nonpoint source pollutants in the

Central Valley. Since developing this report I have been following closely the work that is being done by the Ag Waiver Program that is pertinent to the issue of evaluating management practices for controlling pesticides and other potential pollutants in stormwater runoff to Central Valley waterbodies. Little progress has been made and, for that matter, will be made for a number of years, in reliably evaluating potentially effective management practices for controlling pesticides in stormwater runoff and irrigation tailwater discharges in the Central Valley. This situation will not change significantly within the timeframe that is being allowed for development and implementation of the pesticide Basin Plan Amendment.

Overall Assessment

The current CVRWQCB staff's proposed approach for developing a Basin Plan Amendment that can be used for regulating pesticides in the Central Valley has highly significant technical problems that will cause it to fail to develop reliable approaches for controlling aquatic life toxicity in Central Valley waterbodies associated with the use of pesticides in this area. As discussed above, a number of the components of this proposed approach fail to adequately and reliably consider the complexity of the issues that are well known to affect pesticide-caused aquatic life toxicity. If the Board staff proceed with this approach, it will almost certainly lead to justifiable litigation against the Board for attempting to use technically invalid approaches for regulating pesticides.

Need for Pesticide TMDL Compliance Monitoring Programs

When the CVRWQCB adopted the OP pesticide TMDL for the San Joaquin River, Bill Jennings and I independently indicated to the Board that the CVRWQCB staff's approach of tying the compliance monitoring for the San Joaquin River OP pesticide TMDL to the Ag Waiver monitoring was inappropriate. Subsequently, I developed a discussion (Lee 2005a) of the inappropriateness of the Board's adopting this TMDL without requiring that the staff develop an approach for compliance monitoring of the TMDL requirements which was not tied to the Ag Waiver monitoring program that was yet to be developed. I have been closely following the development of the Ag Waiver water quality monitoring program. It is clear that it will be years before that program will likely become effective in adequately monitoring the San Joaquin and Sacramento River systems in order to evaluate compliance with the TMDLs that have been adopted by the Board for regulating OP-pesticide-caused aquatic life toxicity. As I have suggested, the staff responsible for developing pesticide regulatory approaches should immediately develop a stand-alone compliance monitoring program for TMDL implementation. If and when the Ag Waiver monitoring program develops a credible aquatic life toxicity monitoring program, then the two monitoring programs could be integrated. As it stands now, there will be a lack of adequate implementation of compliance monitoring for the TMDLs. Work along this line would be a far more important and effective approach for regulating pesticide-caused aquatic life toxicity than the approaches proposed by the staff in developing a Basin Plan Amendment for pesticides. This should be a high priority for the CVRWQCB "pesticide" staff.

Proactive Approach for Controlling Pesticide-Caused Aquatic Life Toxicity

Several years ago, as part of participation in the Sacramento River Watershed Program OP pesticide toxicity subcommittee, where there was considerable discussion about how to regulate aquatic life toxicity due to the use of new or expanded-use pesticides, we developed (Jones-Lee

and Lee 2000, Lee 2001) a proactive approach for screening new or expanded-use pesticides for their potential to cause aquatic life toxicity. Basically we recommended that the CVRWQCB, with the cooperation of the Department of Pesticide Regulation, establish a proactive approach for screening the initial uses of new or expanded-use pesticides in the Central Valley. This approach involves conducting field studies associated with the initial uses of new or expanded-use pesticides, where stormwater runoff and fugitive and tailwater discharges would be monitored to determine if the receiving waters for this runoff/discharge are toxic to aquatic life. This approach would specifically address the deficiencies in the US EPA Office of Pesticide Programs' failure to incorporate fate and transport information as part of registering/labeling pesticides for use under conditions where stormwater runoff or water discharges from the use area could transport pesticides into receiving waters and thereby cause aquatic life toxicity in these waters. This proactive approach could be funded by the pesticide manufacturers/ formulators and those who wish to use these pesticides in the Central Valley. Initial-use and periodic studies of this type would detect problematic pesticides before widespread use occurs. If the CVRWQCB staff focused their efforts on developing this approach, it would be far more effective than the proposed Basin Plan Amendment approach for controlling aquatic life toxicity associated with new or expanded-use pesticides. Additional information on issues pertinent to regulating new or expanded-use pesticides has been presented in the *Stormwater Runoff Water Quality Newsletter* (Lee 2005b).

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