Proposal Reviews

#188: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

University of California, Berkeley

Final Selection Panel Review	
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Final Selection Panel Review:

CALFED Bay-Delta 2002 ERP PSP
Final Selection Panel Review

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

Please provide an overall evaluation rating.

Fund	
As Is	**-**
In Part	**-**
With Conditions	**-**
Consider as Directed Action	**-**
Not Recommended	**X**

Amount: **$0**

Conditions, if any, of approval (if there are no conditions, please put "None"):

None

Provide a brief explanation of your rating:

This proposed project would examine the distribution, persistence, bioaccumulation, and effects of pyrethroid insecticides, an extremely toxic, hydrophobic group of insecticides whose usage in the Sacramento and San Joaquin river basins is increasing. Several scientists commented on the technical panel's recommendation against funding this proposal, stating that its topic is important and its analytical methods are sound.

The Selection Panel concurs with the technical reviewers and proponents of this proposal that ecotoxicological work on pyrethroid insecticides is needed. However, the Selection Panel believes that the assessment of exposure to pyrethroid insecticides in the Bay-Delta ecosystem should be deferred until development and testing of analytical methods for quantifying their levels in nature (versus toxicological concentrations). The Selection Panel is recommending that methods development for pyrethroid insecticides be funded as a first step in investigating pyrethroids (see proposal 242, titled "Pyrethroid Insecticides: Analysis, Occurrence, and Fate in the Sacramento and San Joaquin Rivers and Delta").

Moreover, CALFED intends to sponsor a technical workshop to identify critical information gaps concerning the fate, biological exposure, and toxic effects of pesticides in the Bay-Delta system as a means of developing an integrated, coordinated science strategy for ecotoxicological research on pyrethroids and other insecticides of concern. The principal investigators on this proposal will

be encouraged to participate in the development of this forthcoming comprehensive science strategy.

Research and Restoration Technical Panel Review:

CALFED Bay-Delta 2002 ERP PSP
Research and Restoration Technical Panel Review Form

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

Review:

Please provide an overall evaluation summary rating:

Superior: outstanding in all respects;
Above Average: Quality proposal, medium or high regional value, and no significant administrative concerns;
Adequate: No serious deficiencies, no significant regional impediments, and no significant administrative concerns;
Not Recommended: Serious deficiencies, significant regional impediments or significant administrative concerns.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
-Superior	**This is a well thought out proposal that addresses a significant data gap in understanding potential threats posed by the increasing rates of usage of pyrethroid pesticides to aquatic species. It is generally considered that these investigators would provide very useful and relevant results if funded, but limitations imposed by inadequate analytical chemistry methods will likely preclude much of the work from being successfully completed. While this is an important area for research, it likely requires better methods development in order to be successful. One of the external reviewers provided very good suggestions for the proponents to consider regarding methodologies.**
-Above average	
-Adequate	
XNot recommended	

1. **Goals and Justification.** Does the proposal present a clear statement of goals, objectives and hypotheses? Does the proposal present a clear justification and conceptual model for the project?

   The proposed work includes wide ranging field studies on the occurrence and persistence of pyrethroids in agricultural soil, pesticide runoff due to rainfall, regional/near-farm/near-urban aquatic bedded sediment, and aquatic suspended sediment. Results of these analyses will be evaluated in conjunction with field and laboratory studies on bioaccumulation and sediment-associated or dietary toxicity of pyrethroids to a threatened native fish species or relevant invertebrate prey species, as well as laboratory development of biochemical indicators of pyrethroid exposure of fish in the field.

Due to their highly hydrophobic nature, pyrethroids are expected to preferentially partition into sediment. Dr. Weston proposes to measure pyrethroid levels in various types of sediment in this watershed, which is an important first step in assessing the environmental scope of the problem and in helping to fill in a major data gap. However, analytical issues are not addressed which will likely preclude the ability of the investigators to successfully complete this work.

2. **Likelihood of Success (Approach, Feasibility, Capabilities and Performance Measures).** Is the project likely to succeed based on the approach, feasibility and project team capabilities? Are the proposed performance measures adequate for measuring the project's success?

   Although water-born exposure tends to dominate in the scientific literature on laboratory toxicity studies, the proposed work focuses more on environmentally relevant, sediment-based laboratory exposure studies of aquatic invertebrates. These studies would provide results that will be necessary for assessing the toxicological importance of the pyrethroid sediment concentrations in the Sacramento-San Joaquin watershed -- with respect to the invertebrates themselves, and to trophic transfer to at-risk fish species. Also, results from the field surveys of sediment concentrations, together with the invertebrate toxicity and bioaccumulation studies, would serve as a good foundation for the proposed dietary exposure studies planned with fish. Therefore, various components of the proposal complement each other well in the overall study design. However, there are serious concerns about whether current analytical techniques will allow measurement of ambient levels of these compounds. This is a major flaw, which the proponents recognize, but which the panel felt was substantive enough to preclude recommending the study for funding.

   Nonetheless, the panel wanted to make it clear that there are additional elements that are particularly environmentally relevant that also lend strength to this proposal. These include in situ toxicity testing of pesticide runoff from agricultural fields, which ensures that test organisms will be exposed not only to dissolved pesticide in the water column, but, more importantly, to the suspended particle-adsorbed pyrethroids. The choice to study the threatened native fish species, Sacramento splittail, meshes well with the choice to use the splittails natural invertebrate prey in dietary exposure studies on this fish in which the food organisms are first raised on pyrethroid contaminated sediments (allowing time for bioaccumulation). Invertebrate species that are important as prey to other at-risk fish, such as salmon and sturgeon, also are included in the toxicity and bioaccumulation studies. The extensive tracking of pyrethroid residues, from orchard soil to soil present in orchard runoff to aquatic sediments, provides good continuity in the study of environmental fate.

   Aspects of the proposal that incorporate less environmental relevance include the selection of some of the toxicity endpoints. Invertebrate sediment exposure studies include only acute toxicity testing. The addition of sublethal endpoints such as growth and reproduction would be valuable, especially since pyrethroids have been implicated in effects on growth in shrimp and aquatic insects. Also, although the fish toxicity studies do include measurement of a variety of sublethal endpoints, the addition of an evaluation of behavioral effects would be especially appropriate based on the neurotoxic properties of pyrethroids. For toxicological studies of pesticide interactions, pyrethroids and organochlorines have been proposed for use in binary mixtures. However, the fact that organophosphates such as diazinon and chlorpyrifos are widespread in the Sacramento-San Joaquin watershed suggests that these OPs also would be a good choice for combining with pyrethroids in such studies. Like pyrethroids and organochlorines, organophosphates have neurotoxic effects, and their use is expected to continue in this watershed.

It is clear that the use of radiolabeled pyrethroids in the invertebrate toxicity and bioaccumulation studies has several advantages over non-radioactive compounds. However, it seems possible that environmental breakdown of radiolabeled pyrethroids in spiked sediment may generate less toxic (or non-toxic) radioactive pyrethroid isomers. If measurement of the parent compound (and other toxic isomers) in the sediment is based solely on radioactivity levels, their concentrations could be overestimated, thereby leading to the determination of inflated LC50 values as well. This possibility is not addressed in the proposal. For similar reasons, there may be a potential to overestimate the bioaccumulation of active (toxic) substances in invertebrates. However, this might be avoided if prior information on parent and metabolite occurrence in tissue was available from the TLC or HPLC analyses that are part of the radioactive toxicokinetic studies. Also, it is not clear why the bioaccumulation study will be done with the oligochaete L. variegatus, but the comparative natural digestive fluid experiment will be done with the polychaete A. brasiliensis. A more direct comparison could be made if the same organism could be used for both experiments.

In addition, given the exceedingly high toxicity of these compounds to arthropod species, some of the focus on examining direct effects on fish may be more appropriately redirected towards invertebrates.

3. **Outcomes and Products.** Will the project advance the state of scientific knowledge in general and/or make an important contribution to the state of knowledge of the Bay-Delta Watershed? For restoration proposals, is the project likely to contribute to ecosystem restoration or species recoveries in a significant way? Will the project produce products useful to decision-makers and scientists?

   If the project could be conducted as described, despite possible analytical limitations, it should deliver very useful and timely information concerning the status of pyrethroid contamination and risks posed.

4. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   Overall, an expensive proposal, yet the costs for the specific tasks seem reasonable.

5. **Regional Review.** How did the regional panel(s) rank the proposal (High, Medium, Low)? Did the regional panel(s) identify significant benefits (regional priorities, linkages with other activities, local involvement) or impediments (local constraints, conflicts with other activities, lack of local involvement) to this proposal? What were they?

   Generally ranked medium by regional panels.

6. **Administrative Review.** Were there significant concerns about the proposal with regard to the prior performance, environmental compliance and budget administrative reviews? What were they?

   No prior performance issues raised, budget review was ok, some permitting issues were raised in the environmental compliance review.

Miscellaneous comments:

None

Delta Regional Review:

Proposal Number: 188

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

Overall Ranking: **-**Low **X**Medium **-**High

Provide a brief summary explanation of the committee's ranking:

This is one of many proposed studies of pyrethroids in the Delta. The committee did not see this study's immediate benefits to the Delta Some concern about this project overlapping with already funded work.

1. Is the project feasible based on local constraints?

   XYes **-**No

   How?

   PIs have experience with local farmers and can gain necessary access. Climate and hydrology have been well considered.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

   XYes **-**No

   How?

   The project proposes to study a toxic pesticide, pyrethroid, being used extensively in the watershed. Sediment and water quality issues are addressed. It also will contribute information to help protect at-risk and harvestable species of fish.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

   XYes **-**No

   How?

   Through another CLAFED grant, the PIs are currently studying effects of pesticides on invertebrates in the watershed. This project extends that research to a pesticide that was not previously targeted. Project will collaborate with three other CALFED proposals looking at toxicity of sediments and toxicity analytic methods.

4. Does the project adequately involve local people and institutions?

   XYes **-**No

How?

Local growers will collaborate. Letters of support from the local CA Prune Board, Dept. of Water resources, and the Army Corps of Engin. Presentations of results planned Ag groups and Sacramento River Watershed Program.

Other Comments:

None.

San Joaquin Regional Review:

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

Overall Ranking: **X**Low **-**Medium **-**High

Provide a brief summary explanation of the committee's ranking:

The reviewers agreed that proposal to use several experimental methods in one study was not prudent, considering that the analytical methods for pyrethroids has yet to be developed. The proposal should be resubmitted after the method has been developed and accepted, which would reduce uncertainty associated with the chemical analysis.

1. Is the project feasible based on local constraints?

   XYes **-**No

   How?

   The study, while ambitious, is well-organized, well-sited to evaluate specific hypotheses, and has a research team with the appropriate breadth of experience and expertise.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

   XYes **-**No

   How?

   The priority addressed is the reduction of degradation of water quality by understanding the fate and effect of the use of pyrethroid insecticides on agricultural fields in the Sacramento-San Joaquin watershed.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

   XYes **-**No

   How?

   The proposal states that interaction with another group of investigators will be an integral part of the study.

4. Does the project adequately involve local people and institutions?

XYes **-**No

How?

Background information indicates that the researchers have worked with local farmers; presumably they will continue to do so. It is not clear, however, what audience they mean to target when they propose to disseminate the results to "stakeholders".

Other Comments:

Some aspects of the study are in the initial stages of experimentation, such as the use of "digestive fluid extract" to measure actual incorporation of the chemical of concern into organisms that may be secondarily affected. The use of radio-labled compounds adds a level of complexity that may not be able to be sorted out given the timeframe of the study.

Sacramento Regional Review:

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

Overall Ranking: **-**Low **X**Medium **-**High

Provide a brief summary explanation of the committee's ranking:

Pyrethroids are of increasing importance and we need to understand the fate of these pesticides better before the use of them spreads.

1. Is the project feasible based on local constraints?

   -Yes **X**No

   How?

   There are currently no analytical methods for testing for these compounds at the trace levels that exist in the environment. The researcher proposes ways around this problem but we have concerns about how effective they would be.

2. Does the project pursue the restoration priorities applicable to the region as outlined in the PSP?

   XYes **-**No

   How?

   The proposal addresses Restoration priorities 7 for Sacramento and 5 for multi region refer to pesticide testing.

3. Is the project adequately linked with other restoration activities in the region, such as ongoing implementation projects and regional planning efforts?

   XYes **-**No

   How?

   It is coordinated with some ongoing work by the Cal. Prune Board and the Cal. Almond Board under 319 and prop 13 grants.

4. Does the project adequately involve local people and institutions?

   XYes **-**No

How?

Not entirely clear but they do indicate that they have contacted some local growers that would give them access to their orchards.

Other Comments:

This proposal seems very much like the USGS proposal On Pyrethroid Insecticides and we would request that the technical committee review both of these to determine which one has the most merit. It also seems that they would need a take permit for the splittail and that is not mentioned anywhere in the proposal.

External Scientific: #1

Research and Restoration External Scientific Review Form

Proposal Number: **188**

Applicant Organization: **University of California, Berkeley**

Proposal Title: **Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids**

Conflict of Interest Statements:
I have no financial interest in this proposal.
XCorrect
-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

none

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;
Good: quality but some deficiencies;
Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
-Excellent	**I've detailed my rationale for trying to find a mechanism to fund part of the proposed work. If money is available, all of the proposed work has fundamental value as long (although for some tasks, the analytical methods present great risk, see above).**
XGood	
-Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   The goals are clear; the hypotheses are too broad (almost statements of fact - it is only the magnitude of the processes that are in question) and almost impossible to disprove and thus not particularly useful in my view; however, that in no way will hinder the success of the project as it is really exploratory research with clearly outlined tasks - successful completion of which would greatly increase our ability to understand whether there are risks to aquatic ecosystems assoicated with pyrethorid useage in the region.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project

justified?

The general topic is extremely well justified (see more complete review below) - I do have concerns regarding whether all of the research components should be of equal priority.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

   See below for a detailed response to these questions.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

   Feasibility will depend on development of sensitive and reliable ultratrace analysis methods (see below); I also comment on the scale of the propsed work below.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   The success of the project will be easy to measure, and the authors have identified the major risks inherent in the work.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   The knowledge that would come out of successful completion of the proposed work would be invaluable - although I have suggested below that they start with the bigger first order questions.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

   A great research team that bring together unique and complementary talents - I have suggested below that they consider adding a top trace analytical chemist to the team.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   The budget is reasonable for the proposed work - the question should be whether all the proposed work is of high enough priority given that there is not enough information to suggest that this is a real problem yet.

Miscellaneous comments:

I have very mixed feelings about this proposal. Weston has done an excellent job in arguing for the need for better aquatic risk assessments for pyrethroid pesticides that are being used in large and increasing quantities. As a class of chemicals, the pyrethroids are perhaps the most toxic (LC50's of very low ppt for many crustacea and insects) of any anthropogenic chemicals, and yet we know almost nothing about their distributions, fate, and potential effects in the environment -

I take my hat off to the PI's for trying to take on such a difficult project. However, I have major concerns about the project: first, that the trace analysis proposed is very risky, has not been successfully demonstrated, and in my view will likely be inadequate (see below) - I view the work on measuring sediment and perhaps water concentrations of pyrethroids to be most important part of the proposed study - without it, there is no way of knowing whether this issue is a potential problem of concern; and secondly, the proposal is ambitious in scope and it can be argued that in several cases the proposed studies are either premature or are not likely to lead to the most sensitive indicators of environmental exposure. I have great respect for the research team and am somewhat familiar with work of the four most important investigators. If I had more confidence in the trace analyses - not a strength of the research team, I would argue strongly that Calfed place a priority on funding at least part of the proposed research. Given the concerns that I summarize below, I would rate this as an important but very high risk project to fund.

Specific concerns:

- Trace Analysis: Permethrin is a type I pyrethroid that contains 2 chlorines and ensfenvalerate is a type II pyrethroid that contains 1 chlorine and acts via different mechanisms. The authors propose to utilize GC-ECD as their primary analytical tool; ECD is not particularly sensitive nor selective for compounds with only one or two chlorines - are their analytical targets of low ppt concentrations achievable in clean matrix (blanks) - perhaps; but I doubt strongly that ECD will be selective enough to analyze for these compounds in the low part per trillion range in either water or sediment extracts. I'm skeptical of any analytical approach that does not employ a sensitive/selective mass spectrometer (GC or perhaps LC) for this application - even then it is a very tough road; in addition to detector problems, there are very difficult problems to handle with respect to sample preparation; Mike Thurman tells me that SPE extraction may lead first to poor recoveries for these compounds when trying to go down to low ppt levels (concentration dependent "irreversible binding") and will result in more matrix intereferences than are optimal for this application; the sediment clean-up referred to in the text appears to be for SPMD applications that are easier in some ways, with respect to removing complex matrix intereferences - the bottom line is that the analytical chemistry is critically important to the success of this project in answering the "is this an issue"?, and that the PI's have not indicated enough experience, intitial success, or appreciation of the difficulties involved to give me any real confidence that they will succeed (even the methods in the Appendix had enough little errors to indicated unfamiliarity with the analyses (GC temperatures, probably too thick of a film thickness, the use of Cu+2 instead of elemental Cu to remove S) - for the money that is involved here, I would argue that the research team would benefit greatly from the addition of a top notch analytical chemist/mass spectrometrist.

- "Putting the cart before the horse": The outline of tasks and approaches would make great sense and be very appropriate if: there were any evidence that pyrethroids exposures were known to be potentially toxicologically significant; and if upper trophic level fish were known to be either signicantly exposed or affected (more on this below). This is a matter of judgement/philosophy, but in my view it is difficult to justify looking at details of contaminant toxicokinetics and the ability of digestive fluid to mimic bioavailability of sediment sorbed contaminants, before demonstrating that the organisms are appreciably exposed or at risk in the field - the science proposed is first rate, and the team of investigators is extremely well (if not uniquely) equipped to conduct the proposed studies - I just have a hard time arguing that they should receive priority for funding. The areas that I see as being most critical are the field studies (both ambient concentrations and the in-situ toxicity tests (I really like this part and I could see funding it if linked to known spraying on individual properties even without a good sense that the

analytical chemistry will work) and work on developing sensitive biomarkers for exposure (however, I would not have picked fish carboxylesterases for reasons given below). I could also see funding the work on sediment bioaccumulation by benthic invertebrates, if the authors had recognized and discussed how they would incorporate into their conceptual/experimental plan the problems with and how to separate 14-C metabolites from parent pyrethroids in that part of the work

- Focus on fish endpoints: Two of the PI's have done initial work on examining the effects of pyrethroids on fish models. However, as the authors point out, the conventional wisdom is that pyrethroids do not accumulate up the food chain because of a combination of poor delivery to surface waters from the watershed (not mentioned) and because of extensive transformation/metabolism, in part by carboxylesterases and also by mixed function oxidases (which is why MFO inhibitor PBO is generally used in pesticide formulations). The highest BAF value that the authors have found in the literature for pyrethroids was 3600 in a bivalve (much lower than expected if there were no metabolism - ie compare to PCBs/DDT residue BAFs over 100,000- generally the bioaccumulation is much lower in most species because of metabolism and perhaps low bioavailibility or uncertain exposure concentrations on lab tests. I would argue that there are two reasons that I would not focus on fish as indicator organisms of exposure or toxicity - first for high log Kow compounds (> 6??)), it very unlikely that exposure in large upper trophic level predators will be anywhere near that at low lower levels (less cumulative metabolism up the food-web and more importance of water/sediment exposure relative to prey dietary exposure for smaller organisms) and because fishes are known to be approximately 1000 times less sensitive to pyrethroids than are many arthropods - the place to look for effects or biomarkers of exposure is in lower trophic level arthropods in my opinion.

I do think that toxicology aspects of the work represent good research, but I think that that there are alternative approaches that should be tried first because it is not clear at all whether there will be observable effects even in the most sensitive species.

In conclusion, it is my opinion that these investigators would do some very good work on this very important topic. The proposal suffers in my view from a lack of experience on the topic, but then no one that I know of has a lot more experience - if there is a mechanism within Calfed for altering the scope of work, I might suggest that a chemist with ultra-trace analysis be added to the team (Mike Thurman might be a good choice, but he has little experience dealing with sediment matrices and has not yet published his pyrethroid work outside a USGS report). This is a well written and argued proposal on a topic that demands research funding - my suggestion is to find a way to fund a one year project that could help the PI's develop a more mature and defensible plan for the next round of funding.

External Scientific: #2

Research and Restoration External Scientific Review Form

Proposal Number: **188**

Applicant Organization: **University of California, Berkeley**

Proposal Title: **Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids**

Conflict of Interest Statements:
I have no financial interest in this proposal.
XCorrect
-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

None

Review:

Please provide an overall evaluation summary rating:

<u>Excellent:</u> outstanding in all respects;
<u>Good:</u> quality but some deficiencies;
<u>Poor:</u> serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
XExcellent	**This is a well thought out proposal that addresses a significant data gap in understanding potential threats posed by pyrethroid pesticides to aquatic species.**
-Good	
-Poor	

1. **<u>Goals.</u>** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   Rating: Excellent

   The proposed work includes wide ranging field studies on the occurrence and persistence of pyrethroids in agricultural soil, pesticide runoff due to rainfall, regional/near-farm/near-urban aquatic bedded sediment, and aquatic suspended sediment. Results of these analyses will be evaluated in conjunction with field and laboratory studies on bioaccumulation and sediment-associated or dietary toxicity of pyrethroids to a threatened native fish species or relevant invertebrate prey species, as well as laboratory development of biochemical indicators of pyrethroid exposure of fish in the field.

The fact that the body of knowledge on the occurrence, persistence, and toxic effects of pyrethroids lags behind the increasing use of these pesticides in the Sacramento-San Joaquin watershed illustrates a need for further research on the environmental impact of such compounds.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

   Rating: Very Good Excellent

   Due to their highly hydrophobic nature, pyrethroids are expected to preferentially partition into sediment. Dr. Weston proposes to measure pyrethroid levels in various types of sediment in this watershed, which is an important first step in assessing the environmental scope of the problem and in helping to fill in a major data gap.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

   Rating: Very Good

   Although water-born exposure tends to dominate in the scientific literature on laboratory toxicity studies, the proposed work will focus on more environmentally relevant, sediment-based laboratory exposure studies of aquatic invertebrates. These studies will provide results that will be necessary for assessing the toxicological importance of the pyrethroid sediment concentrations in the Sacramento-San Joaquin watershed -- with respect to the invertebrates themselves, and to trophic transfer to at-risk fish species. Also, results from the field surveys of sediment concentrations, together with the invertebrate toxicity and bioaccumulation studies, will serve as a good foundation for the proposed dietary exposure studies planned with fish. Therefore, various components of the proposal complement each other well in the overall study design.

   There are additional elements that are particularly environmentally relevant that also lend strength to this proposal. These include in situ toxicity testing of pesticide runoff from agricultural fields, which ensures that test organisms will be exposed not only to dissolved pesticide in the water column, but, more importantly, to the suspended particle-adsorbed pyrethroids. The choice to study the threatened native fish species, Sacramento splittail, meshes well with the choice to use the splittails natural invertebrate prey in dietary exposure studies on this fish in which the food organisms are first raised on pyrethroid contaminated sediments (allowing time for bioaccumulation). Invertebrate species that are important as prey to other at-risk fish, such as salmon and sturgeon, also are included in the toxicity and bioaccumulation studies. The extensive tracking of pyrethroid residues, from orchard soil to soil present in orchard runoff to aquatic sediments, provides good continuity in the study of environmental fate.

   Aspects of the proposal that incorporate less environmental relevance include the selection of some of the toxicity endpoints. Invertebrate sediment exposure studies include only acute toxicity testing. The addition of sublethal endpoints such as growth and reproduction would be valuable, especially since pyrethroids have been implicated in effects on growth in shrimp and aquatic insects. Also, although the fish toxicity studies do include measurement of a variety of sublethal endpoints, the addition of an evaluation of behavioral effects would be especially appropriate based on the neurotoxic properties of pyrethroids. For toxicological studies of

pesticide interactions, pyrethroids and organochlorines have been proposed for use in binary mixtures. However, the fact that organophosphates such as diazinon and chlorpyrifos are widespread in the Sacramento-San Joaquin watershed suggests that these OPs also would be a good choice for combining with pyrethroids in such studies. Like pyrethroids and organochlorines, organophosphates have neurotoxic effects, and their use is expected to continue in this watershed.

It is clear that the use of radiolabeled pyrethroids in the invertebrate toxicity and bioaccumulation studies has several advantages over non-radioactive compounds. However, it seems possible that environmental breakdown of radiolabeled pyrethroids in spiked sediment may generate less toxic (or non-toxic) radioactive pyrethroid isomers. If measurement of the parent compound (and other toxic isomers) in the sediment is based solely on radioactivity levels, their concentrations could be overestimated, thereby leading to the determination of inflated LC50 values as well. This possibility is not addressed in the proposal. For similar reasons, there may be a potential to overestimate the bioaccumulation of active (toxic) substances in invertebrates. However, this might be avoided if prior information on parent and metabolite occurrence in tissue was available from the TLC or HPLC analyses that are part of the radioactive toxicokinetic studies. Also, it is not clear why the bioaccumulation study will be done with the oligochaete L. variegatus, but the comparative natural digestive fluid experiment will be done with the polychaete A. brasiliensis. A more direct comparison could be made if the same organism could be used for both experiments.

Lastly, the proposal includes the development of stress protein expression patterns as a possible biomarker that would be specific for pyrethroid exposure in fish. Stress proteins can be induced by a broad range of environmental stressors, and their expression pattern is affected not only by the type of stressor, but also its concentration and the duration of exposure. The proposal could have been strengthened by a discussion of how these potentially complicating variables would be addressed.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

   Rating: Excellent

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   Rating: Excellent

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   Rating: Excellent

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Rating: Very Good

The strong connections that the author and collaborators have with the agricultural community (growers, pest control advisers, agricultural industry groups, county Cooperative Extension offices) will be essential for farm selection, sampling access, and regional dissemination of project results.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   Rating: Very Good

Miscellaneous comments:

External Scientific: #3

Research and Restoration External Scientific Review Form

Proposal Number: **188**

Applicant Organization: **University of California, Berkeley**

Proposal Title: **Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids**

Conflict of Interest Statements:
I have no financial interest in this proposal.
XCorrect
-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

none

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;
Good: quality but some deficiencies;
Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
-Excellent	**This is an expensive project that assesses fate and transport of pyrethroid pesticides in the environment. The proposal is quite ambitious, given the lack of knowledge about potential routes of cycling and the lack of capabilities to measure the compounds at ambient levels.**
XGood	
-Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   The PIs present an ambitious plan to better understand both the fate and effects of pyrethroid pesticides on water quality and toxicology in the Central Valley of California. They clearly state a number of goals and present a hypothesis-guided research program. They identify pyrethroid pesticides as an emerging contaminant of concern and justify their study based on the unknowns about these contaminants. If indeed these compounds elicit adverse effects on biota, the concept is both timely and important.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project

justified?

It is truly difficult to assess if in fact this research is justified relative to existing knowledge because very little is known about fate and transport of the pesticides. Normally, this type of research is funded (USEPA) at much lower levels that the PIs request. This would basically be done to provide seed money for investment in research on emerging compounds. If the PIs show progress in identifying that there is, in fact a concern, more funding could follow. Perhaps this is the type of approach that could be undertaken by CALFED.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

   The above comments are made because the PIs have assembled a huge effort of both time and funding, to study a number of different aspects of pyrethroid fate and bioaccumulation. At this point, the assembled team has not even shown that they can measure these compounds at levels that they feel are potentially toxic. This is a major concern and could be the weak link in the proposal. Perhaps a good portion of this study should be spent working with these methodologies. The PIs acknowledge that they can conduct this project even without the lower detection limits because they use radioisotopes for uptake studies. I caution against assuming that these results are directly transferable for these studies. Even with isotopic studies using high specific activity tracers, concentrations spike may be much higher than ambient.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

   The approach is fully documented but the technical feasibility again rests on the ability to measure these compounds at low levels. There must be someone at UCB with the laboratory equipment necessary to analyze these compounds. Obviously, there are not many people with direct experience with these compounds, but it is essential to pool the talent with a competent analytical chemist who can lead the team to the lower level of analyses.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   As in most academic research projects, performance measures are built around scientific presentations and publications. It almost is presented as a given that these PIs will get the results they propose. That is where the greatest risk is presented. Better performance measures would be successful completion of individual tasks prior to moving on to the latter stages of the proposed work. The should be a discussion of QA-related success measures.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   Obviously, if fully successful, this project would yield significant data on pyrethroid contamination and transport in this sensitive ecosystem. Toxicological studies would be an added benefit for fate assessment. Interpretative outcomes are only likely with the ability to detect low levels.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

   The PIs have proven track records in their respective fields. Their ambitious plan is targeted to the production of peer-reviewed journal articles. They have most of the infrastructure to conduct the project. The wild card is the analytical capability.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   This is an expensive program with high risk. Perhaps CALFED should fund at a much lower rate as exploratory research.

Miscellaneous comments:

External Scientific: #4

Research and Restoration External Scientific Review Form

Proposal Number: **188**

Applicant Organization: **University of California, Berkeley**

Proposal Title: **Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids**

Conflict of Interest Statements:
I have no financial interest in this proposal.
XCorrect
-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

none

Review:

Please provide an overall evaluation summary rating:

Excellent: outstanding in all respects;
Good: quality but some deficiencies;
Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
XExcellent	**This is a strong proposal. The goals and objectives are clearly stated and are consistent with the procedures described in the proposal. Research and outreach products should contribute significantly to meeting the objectives of the project. There appears to be an appropriate infrastructure to leverage the diverse expertise of the applicants to meet the objectives of the proposal.**
-Good	
-Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   The goals and objectives are clearly stated and are consistent with the procedures described in the proposal.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

Concern for OPs in Californias Central Valley surface water has been an issue for a number of years. There is specific concern for pesticide use during the delay dormant season for orchard crops because it is during this period that there is significant rainfall in the valley. In addition, during this period trees are either bare or without significant foliage, increasing the potential for off-target drift.

OP use in agriculture is generally on the decline. Concern now shifts to OP replacements and alternative pest management strategies. The synthetic pyrethroids are known replacements for OPs for insect pest management during the delayed dormant period. These compounds can be highly toxic to aquatic life. With reduced OP use, synthetic pyrethroid use may increase significantly. Consequently, it is important to evaluate Central Valley pest management strategies that employ the synthetic pyrethroids to determine the potential for adverse impact on aquatic systems.

The proposed work will expand upon, and complement, the research proposed in Part 1. The hypotheses to be tested are clearly stated. They include investigation of the relationship between pyrethroid sediment residues, benthic organism body burden, and transfer up the food chain to at-risk fish species. In situ bioassays will be developed for several species. Biomarkers will be explored for their usefulness in relating exposure to risk. In addition, a suite of physiological, histopathological, and biochemical assays will investigated as early indicators of sub-lethal effects that may impact fitness and survival. As in Part 1, this is a very broad approach to studying the problem, requiring expertise across a number of disciplines. Success will require a concerted effort on the part of the collaborators to periodically evaluate research progress and convey these findings to other participants.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

In many respects this proposal complements Part 1 in that it investigates the problem beyond the edge-of-field introduction of pyrethrioids into the aquatic ecosystem. There is some overlap in field studies as some sites will be employed by both Part 1 and Part 2 applicants. In the Part 2 proposal, these sites will be used for in situ bioassays. Bioassay results will be compared to soil, sediment, and water pyrethroid residues. Detection limits are expected to be 0.01-0.05 ug/l. In addition, biomarkers, including P450, carboxyesterase and heat shock protein, as well as physiological and histopathological indicies, will be investigated as more sensitive indicators of exposure in splittail. The long-term relationship between pyrethroid sediment residues and uptake by biota that ingest sediment will be explored using some novel methods. The applicants hypothesize that these biota are tropically significant to at-risk fish species. For pyrethroids to move up the food chain requires a reasonably long residence time within the organism. Pyrethroid uptake, distribution, metabolism, and elimination will be evaluated using empirical data fit to a toxicokinetic model to assess the potential for transfer to higher tropic orders. Finally, a limited number of mixtures will be tested in laboratory bioassays using a benchmark dose approach. This is a very ambitious research strategy that emphasizes a broadly-based multifaceted approach.

As with Part1, those components that involve field work are subject to the usual concerns regarding environmental research. Are the field sites representative of production practices in the Central Valley? Will the weather conditions (temperature, rainfall) that prevail during this research be representative, i.e., can the results be extrapolated to a variety of conditions that may lead to off-site pesticide movement in runoff? To what degree will the results of the in situ

bioassay studies be specific to the conditions at these sites only? Are upstream sites a negative control for all stressors? For assays that measure survival, results will give information on the toxicity of the sum of all stressors, including measured levels of pyrethroids. For splittail only, physiological, histopathological, and biochemical biomarkers will also be examined. However, these are markers of exposure to a wide variety of contaminants, naturally occurring compounds, and other stressors. Without some evidence of pyrethroid target site and toxic effect that is mechanistically related to these indicators, changes can only be related generally to the sum of the stressors at each of the in situ sites. One might suggest that the larger the battery of biomakers, the greater the weight of evidence. However, for the proposed research design I believe that even a strong finding will be suggestive at best. To improve the applicability of the findings to other sites, the applicants might consider additional water quality measurements such as turbidity, water temperature, D.O., pH, and redox potential, which can be continuously monitored during the field study. Companion laboratory studies with splittail will look at pyrethroid dietary exposure only. Endpoints measured will be mortality, growth, and biomarker responses. Results of laboratory studies may be most useful in interpretation of in situ studies at comparable pyrethroid exposure levels.

Invertebrate toxicity and bioaccumulation studies are well designed and should provide valuable information on the distribution and persistence of pyrethriod sediment loads and their bioavailability to benthic biota. The in vitro digestive fluid extraction is a novel approach that should further resolve understanding of bioavailability to deposit-feeding invertebrates. Usefulness of the proposed toxicokinetic modeling study is highly dependent on deriving toxicokinetic parameters for transfer coefficients and rate constants from empirical data. There is much uncertainty associated with model parameterization and validation that is not adequately described; however, this mechanistic approach offers an opportunity to better understand the potential for bioaccumulation and tropic transfer.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

   This is a very ambitious project. Some preliminary findings regarding the likelihood of success in applying a suite of physiological, histopathological, and biochemical assays, as early indicators of sub-lethal effects, is desired. Other aspects of the study are technically feasible.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   This proposal has both a research and outreach component. Measures of success of the research component will be significant new knowledge, i.e., the relationship between pesticide use practices and impacts on the aquatic ecosystem. Measure of success in the outreach component will be harder to evaluate. One measure is a broader understanding, by both researchers and stakeholders, of potential impacts of increased pyrethroid use on water resources in the Central Valley and delta regions of California. If study findings suggest the likelihood of unreasonable adverse impacts to aquatic ecosystems, the adoption of new pesticide use practices that have been determined to reduce pesticide runoff, i.e., reduced pesticide use, use of less risky pesticides, or use of pesticides in less risky ways, would be a measure of success. The proposal discusses in sufficient detail how these measures of performance will be evaluated. However, only with continued monitoring can the actual impact of outreach efforts be evaluated.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   Research and outreach products will consist of presentations, newsletters, publications, and reports. These products are important to the outcome and should contribute significantly to meeting the objectives of the project and also the performance measures described above.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

   The applicants have a strong track record based on past performance in their given area of expertise. The critical feature of this effort is that the research team has a broad scope of expertise, from pest management and environmental toxicology to invertebrate toxicology, ecotoxicology, biochemistry and veterinary pathology. In addition, there appears to be an appropriate infrastructure to leverage this diverse expertise to meet the objectives of the proposal.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   Given the nature of this proposal, cost/benefit is difficult to evaluate. However, if the research and outreach objectives are achieved, as determined by performance standards, the funding sought is appropriate. It is safe to say that no other state has allocated funds for activities at this scale to address ecosystem restoration, so comparisons of cost/benefit expectations with other states are not possible.

Miscellaneous comments:

External Scientific: #5

Research and Restoration External Scientific Review Form

Proposal Number: **188**

Applicant Organization: **University of California, Berkeley**

Proposal Title: **Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids**

Conflict of Interest Statements:
I have no financial interest in this proposal.
XCorrect
-Incorrect

In the blank below please explain any connection to proposal, to applicant, co-applicant or subcontractor or to submitting institution (write "none" if no connection):

I am acquainted with one sub-contractor, Michael Lydy of So. Illinois University. Several years ago, Mike used to work for the same federal agency I work for. We worked on the same national program, but Mike was located in a different district/state.

I have no connection to the submitting institution (University of California at Berkeley). However, several sub-contractors are affiliated with the University of California at Davis, which is where I did my graduate work. I do not know the UCD sub-contractors personally.

Review:

Please provide an overall evaluation summary rating:

<u>Excellent:</u> outstanding in all respects;
<u>Good:</u> quality but some deficiencies;
<u>Poor:</u> serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
XExcellent	**The work is justified because pyrethroids are of growing importance in the Delta and more info. is needed on the environmental fate and effects of particulate-associated contaminants, such as pyrethroids, for consideration in risk assessment and ecosystem restoration efforts in the Delta. The conceptual model is appropriate for the pesticides of interest (pyrethroids) and the study area (Delta). The hypotheses are clearly stated and well addressed by the proposed study. The products of the proposed work will be valuable, both to the environmental managament commnity in California/the Delta, and to the scientific community as a whole.**
-Good	
-Poor	

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   Yes and yes. The Problem and Justification sections clearly describe the importance of pyrethroid insecticides in the Bay/Delta, and make a good case that proper management of these pesticides requires an approach that includes minimizing off-site transport and understanding fate and effects. Hypotheses are relevant, timely, clearly stated, and testable.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

   Yes, the conceptual model is clearly framed by the hypotheses being tested (and it's also shown in Figure 1). The study is justified because it addresses several areas of current importance, both in the Delta and to the scientific community as a whole. The authors propose to use state-of-the art methods to investigate several important areas of current scientific interest (bioavailability of sediment-associated contaminants, toxicokinetics, toxicity of mixtures, sublethal toxicity, biomarkers of exposure) as applied to pyrethroids, an important class of pesticides in the Delta. Pyrethroids are a very appropriate class of compounds for such a study because of their p/c properties, and their growing use in the Delta.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers?

   The approach is suitable for the class of pesticides being investigated (pyrethroids), the study area (Delta), and the specific objectives of the proposal. The results of the regional and land use-related surveys will contribute substantively to our knowledge of pyrethroid distribution, persistence, and environmental fate in the Delta, in relation to pyrethroid use in the Delta. The in situ toxicity testing will establish whether toxicity occurs in the field and under what conditions. Laboratory tests on toxicity, bioaccumulation, and toxicokinetics will expand the knowledge base on pyrethroid uptake by, and effects on, aquatic biota. This includes some areas about which little is currently known (such as sublethal toxicity and toxicity of mixtures). The study proposes to develop new tools (rapid monitoring assays) that, if feasible, would be valuable in assessing pyrethroid exposure and effects in the field. The study also applies some relatively new tools (in situ toxicity testing, digestive fluid extraction) to meet the proposed objectives. The proposed work will provide and/or validate new tools for assessment of pyrethroid exposure and effects. I think the info. from this study will be useful for decision-makers, given the growing importance of pyrethroids in the Delta and the fact that current risk assessment methods generally are aimed at pesticides in the water colunmn. This work addresses approaches to conducting risk assessment for particulate-associated contaminants such as pyrethroids.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

The proposal is well documented and the tasks address the objectives and the hypotheses being tested. The proposed work is technically feasible, and I would expect it to be achievable. The only question-mark would be whether the rapid monitoring assays proposed for development will end up being successful/feasible, but there is no way to know that in advance, They seem to have a reasonable probability of success, and in my view, the potential usefulness of such tools warrant the attempt.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   The final research product metrics are appropriate and adequate. The intermediate performance measures (no. of presentation and publications) are less satisfying but probably are reasonable, if they include presentations and publications aimed at both scientific and regulatory audiences.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   The final research product metrics are appropriate and valuable. Additional products described under "Expected products/outcomes" should be very useful to environmental management of the Delta. The results should provide valuable info. on at-risk species in the Delta (splittail).

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

   The authors of the proposal have impressive research histories and publication records. I believe they are qualified and have the infrastructure to complete the project successully.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   I am not really qualified to assess whether the budget is reasonable and adequate. I note that the scope of the proposed work is large and that there are opportunities for matching funds from USACOE and So. Illinois University.

Miscellaneous comments:

I have a few questions for the authors on their proposal, but these are details and they in no way affect my opinion of the proposed work, which I think is commendable and worth funding. (1) Under task 1, in situ toxicity testing, do you plan to measure pyrethroid levels in sediment (as well as water)? (2) Also under in situ toxicity testing, do you plan to use other endpoints in addition to lethality for some test species (such as immobilization for Ceriodaphnia)? (3) Under task 2, invertebrate bioaccumulation, how will you determine he effects of "aging" on bioavailability?

Prior Performance/Next Phase Funding: #1

New Proposal Number: 188

New Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

1. Prior CALFED project numbers, titles, and programs: (*list only projects for which you are the contract manager*)

   ERP 99-N07 Chronic Toxicity of Environmental Contaminants in Sacramento Splittail - A Biomarker Approach

2. Prior CVPIA project numbers, titles, and programs: (*list only projects for which you are the contract manager*)

   N/A

3. Have negotiations about contracts or contact amendments with this applicant proceeded smoothly, without persistent difficulties related to standard contract terms and conditions?

   XYes -No -N/A

   If no, please explain any difficulties:

4. Are the status, progress, and accomplishments of the applicant's current CALFED or CVPIA project(s) accurately stated?

   XYes -No -N/A

   If no, please explain any inaccuracies:

5. Is the applicant's progress towards these project(s)' milestones and outcomes to date satisfactory?

   XYes -No -N/A

   If no, please explain deficiencies:

6. Is the applicant's reporting, records keeping, and financial management of these projects satisfactory?

   XYes -No -N/A

   If no, please explain deficiencies:

7. Will the project(s) be ready for next phase funding in 2002, based on its current progress and expenditure rates?

   -Yes -No -N/A

If no, please explain:

N/A

Other Comments:

Prior Performance/Next Phase Funding: #2

New Proposal Number: 188

New Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

1. Prior CALFED project numbers, titles, and programs: (*list only projects for which you are the contract manager*)

   97-C12 Alternative Practicies for Reducing Pesticide Impacts on Water Quality

2. Prior CVPIA project numbers, titles, and programs: (*list only projects for which you are the contract manager*)

3. Have negotiations about contracts or contact amendments with this applicant proceeded smoothly, without persistent difficulties related to standard contract terms and conditions?

   XYes -No -N/A

   If no, please explain any difficulties:

4. Are the status, progress, and accomplishments of the applicant's current CALFED or CVPIA project(s) accurately stated?

   XYes -No -N/A

   If no, please explain any inaccuracies:

5. Is the applicant's progress towards these project(s)' milestones and outcomes to date satisfactory?

   XYes -No -N/A

   If no, please explain deficiencies:

6. Is the applicant's reporting, records keeping, and financial management of these projects satisfactory?

   XYes -No -N/A

   If no, please explain deficiencies:

7. Will the project(s) be ready for next phase funding in 2002, based on its current progress and expenditure rates?

   -Yes -No **X**N/A

   If no, please explain:

Other Comments:

Environmental Compliance:

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

1. Are the legal or regulatory issues that affect the proposal identified adequately in the proposal?

   -Yes **X**No

   If no, please explain:

   Project would need to comply with FESA and corresponding NEPA documentation for take of Sacramento splittail.

2. Does the project's timeline and budget reflect adequate planning to address legal and regulatory issues that affect the proposal?

   -Yes **X**No

   If no, please explain:

   The proposal doesnt plan for a FWS take permit and corresponding NEPA documentation; however, time and funding could be budgeted under Project Management.

3. Do the legal and regulatory issues that affect the proposal significantly impair the project's feasibility?

   -Yes **X**No

   If yes, please explain:

Other Comments:

Budget:

Proposal Number: 188

Applicant Organization: University of California, Berkeley

Proposal Title: Water quality effects of pesticides used in orchard agriculture - Part 2: Aquatic fate and effects of particle-sorbed pyrethroids

1. Does the proposal include a detailed budget for each year of requested support?

   XYes **-**No

   If no, please explain:

2. Does the proposal include a detailed budget for each task identified?

   XYes **-**No

   If no, please explain:

3. Does the proposal clearly state the type of expenses encompassed in indirect rates or overhead costs?

   XYes **-**No

   If no, please explain:

4. Are appropriate project management costs clearly identified?

   XYes **-**No

   If no, please explain:

5. Do the total funds requested (Form I, Question 17A) equal the combined total annual costs in the budget summary?

   -Yes **X**No

   If no, please explain (for example, are costs to be reimbursed by cost share funds included in the budget summary).

   Requesting $1,925,430 State Funds OR $2,452,462 Federal Funds (17a); Grand Total of Budget Summary for 3-Years is $1,925,409.

6. Does the budget justification adequately explain major expenses?

   XYes **-**No

If no, please explain:

7. Are there other budget issues that warrant consideration?

   -Yes **X**No

   If yes, please explain:

Other Comments: