

**Response to 2002 Peer Review of CALFED
San Joaquin River DO TMDL Projects**

**Carl W. Chen
Systech Engineering, Inc.
3180 Crow Canyon Place, Suit 260
San Ramon, CA 94583**

INTRODUCTION

A peer review meeting was conducted on June 11- 12, 2002 to evaluate studies conducted in support of developing a Total Maximum Daily Load (TMDL) for dissolved oxygen (DO) in the San Joaquin River (SJR) Deep Water Ship Channel (DWSC). The peer review panel includes Dr. Jim Cloern, United States Geological Survey, Dr. Steve Chapra, Tufts University, Dr. Bill Ritter, University of Delaware, Dr. David Beasley, North Carolina State University, Dr. Alex Horne, University of California, Berkeley and Dr. Alan Jassby, University of California, Davis.

In general, the peer reviewers were satisfied with the scientific rigor of individual studies. They concurred with the major findings that low dissolved oxygen in the DWSC was caused by low river flow, deepen ship channel, high algae concentration from upstream, and ammonia discharge from Stockton treatment plant. Peer reviewers endorsed the mass balance approach used by all members of study team.

They have noticed some discrepancies between analyses performed by various investigators. The discrepancies can probably be resolved with the help of a model. Because the modeling component was not funded last year, the discrepancies remain unresolved. Despite the fact that the modeling component was not funded last year, we participated in the peer review on our own account.

The peer reviewers found our DO model to be fundamentally sound. They recommended that the DO model be used to resolve the mentioned differences, to fill some data gaps, and to test some hypotheses about management questions (i.e. TMDL calculations) that do not require the 3D resolution. They also recommend that the funding for existing investigators be extended so that they can analyze the data more fully, rather than funding new data collection projects.

GENERAL RESPONSE

We are gratified that the DO model was found to be fundamentally sound and useful to serve as a vehicle for integration for problems that do not require 3D resolution. Dr. Sam Luoma of CALFED has said that the use of multiple models in the environmental study is consistent with CALFED philosophy. We hope that the DO model will be used in that capacity. We stand ready to participate in the team effort.

SPECIFIC RESPONSES

1. During the peer review, there was a question raised about the degree of load reduction between Mossdale and Channel Point. We have stated that the apparent reduction of pollutant concentrations from Mossdale and Channel Point is not caused completely by the processes occurring between these two points. The Channel Point is tidally influenced. During the model simulation, we have seen that the pollutant concentrations at Channel Point were lower during the flood tides. Thus, we believe that the DO model can be used to evaluate the true reduction attributable to the river flow from Mossdale and Channel Point.
2. Dr. Alan Jassby was pleased to see that the DO model predicted the 2001 condition without any adjustment for two parameters (temperature and dissolved oxygen) as described in our report. He wondered how does the model perform for other parameters. We did not perform the analyses due to budget limitations. We will do those comparisons if funding becomes available.
3. Mr. Mark Gowdy of Central Valley Regional Water Quality Control Board expressed a desire to learn more about the model and also the need for the Regional Water Quality Control Board to wrap their arm around it. In response, we offer to conduct workshops to explain the details of the model with the new funding.
4. Dr. Peggy Lehman concluded that ammonia discharge by Stockton was major cause of DO deficit in DWSC. This conclusion was not shared by some investigators, who believed that the ammonia decay was lower due to colder temperature in the fall, when ammonia discharge became higher. In the new study, we propose to use the DO model to resolve the differences. We will evaluate Lehman's laboratory data to determine how she translated the data obtained under laboratory condition and projected it to the field condition and how she arrived at her conclusion. We will compare her rate to the rate used in the model. We will run the model with varying discharge of Stockton ammonia and track their effects on ammonia and DO concentrations in

DWSC under field condition. The flux of ammonia generated by the decay of algae, phaeophytin and VSS will be teased out for analyses.

5. There is an apparent reduction of pollutant concentrations between Mossdale and Channel Point. There is a need to determine whether the upstream discharge can take a credit for that load reduction. In the new study, we propose to use the DO model to determine the load reduction attained between these two points. At the present time, the model does not consider the sink associated with agriculture diversion between Mossdale and Channel Point. With the diversion data estimated by Nigal Quinn and Alice Tulloch, we will update the diversion data. The updated model will be used to simulate the load reduction between Mossdale and Channel Point. This load reduction, however, cannot be attributed totally to the water quality behavior of SJR between Mossdale and Channel Point. Because, Channel Point is tidal so that half of the time its water is from Mossdale and half of the time its water is from DWSC (decay and mixed with Sacramento Water). We will use the model to tease out the reduction attributable to SJR and the reduction attributable to DWSC.
6. During the peer review, Mr. Mark Gowdy presented his observations that the initial concentration for Streeter-Phelp equation at Channel Point was a function of river flow and that the location of minimum DO in DWSC also shift with river flow. In the new study, the DO model will be used to generate output that shows Channel Point as the upstream station for only half of the time. In the other half, Channel Point is a downstream station for Streeter-Phelp equation. Thus, low concentration at high flow may occur as a result of dilution provided by the Sacramento River Water.
7. In the new study, we propose to use the model to resolve any differences between Gary Litton's sediment settling velocity and the value used in the model. We have previously worked together on the issue. Because Litton measured settling velocity inside the collection tube, its value is expected to be higher than the settling velocity under turbulent field condition. We told Gary Litton that the use of his measured settling velocity would lead to a complete fall out of total suspended sediment. This would require a scour and resuspension term, which could not be measured by his apparatus. We will work with him to try various combinations of settling and scouring velocities with the model. We will show him the predicted sediment concentrations, sediment flux, and scouring flux. We hope to reach a consensus on the parameter values that can produce outputs consistent with his observations.
8. During the peer review, a reviewer raised two important questions. How does the number presents in Fred Lee's conceptual model compare to the flux calculated by the model. Also, why the missing information in Fred Lee's conceptual model was not filled by the model calculations. Both questions

were not resolved due to the lack of a modeling component in last year's study. We will do that in this contract extension. It must be recognized at this time that the water volume in Fred Lee's box model has a constant value. The DO model calculates the instantaneous water volumes that vary with tides as in the real situation. His fluxes are calculated by an average flow to an average pollutant concentration over time. The DO model multiplies the instantaneous flow to instantaneous pollutant concentration to calculate instantaneous fluxes. The instantaneous fluxes are then averaged over a tidal period for the average tidal flux. The numbers calculated by the box model are going to be different from those calculated by the dynamic DO model. How big is the difference? Does it change the conclusions? These questions will be answered in the proposed study.

9. In the original plan, the model was to make predictions and the Principal Investigators (PIs) would performed measurements to confirm the predictions. If the results were not good, the modeler and PIs would work together to find out why and find ways to improve both modeling and field measurement. This was not done last year because the modeling component was not funded. In the new study, we propose to conduct a post modern analysis. We will use the DO model in predictive mode by presuming the data was not collected. We will then see how the predictions fair with real data. We cannot improve field measurement as originally planned. But, we can improve the model with this post modern analysis.
10. During the modeling study, we have used the DO model to calculate TMDLs for Stockton and river loads under various combinations of river flow. We found the feasible solution to be around 10 to 20% of load reductions for all upstream load and Stockton load under a river flow of 600 to 1000 cfs. In the new study, we propose to use the DO model to calculate various alternatives of TMDLs that may be politically acceptable to most stakeholders.
11. Based on the results of analyses described above, we will prepare a report that summarizes our collective thinking. The report will describe the agreements and disagreement among all of us. It will also compile data gaps, which hopefully will be shorter than the one presented in this year's peer review meeting.