

Information on Dissolved Oxygen Water Quality Criterion

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At the recent SJR DO TMDL Steering Committee meeting, questions again arose about the TMDL DO goal with particular reference to averaging of the DO concentration in evaluating compliance with the water quality objective. Several months ago I scanned the US EPA DO water quality criteria document sections for inclusion in the Issues report as an Appendix F. Since a key document, US EPA Ambient Water Quality Criteria for Dissolved Oxygen (1986) presenting information on the basis for the US EPA 5 mg/L DO national criterion is no longer available, recently I have also scanned this document to convert it to an electronic file that could be distributed to others who are interested. This is a 47 page DO criterion document that presents the background information on the basis for the US EPA to establish the 5 mg/L national DO criterion. This document has been added to Appendix F with the other DO criterion documents. This appendix contains a complete set of the information that has been developed over the past 30 years on the impact of dissolved oxygen concentrations on fish and aquatic life that has been used to establish DO criteria. This information is pertinent to understanding the origin of the 5 mg/L DO national criterion. This appendix also contains information relative to averaging DO concentrations in assessing compliance with the water quality objective.

The primary basis for establishing the 5 mg/L DO criterion was that fish growth rates are reduced when the DO is below 5 mg/L. Some fish are killed by short exposure to DO concentrations of about 3 mg/L. There is an extensive discussion of these issues in the criterion documents. From my assessment of the information available, it appears that DO concentrations below 5 mg/L will be adverse to DWSC fish growth rates.

Since DO concentrations below about 3 mg/L can be lethal to some fish with short exposures, it will be important to control the DO "crashes" to values below about 3.5 mg/L. This means that there will be a need to better understand the causes of the DO crashes like the one that occurred in late September early October 1999 when the SJR flow into the DWSC was decreased to about 150 cfs. This is an issue that is not being given adequate attention in the current CALFED studies.

It is my assessment that there is considerable justification to question the reliability of the 6 mg/L DO water quality objective. Dissolved oxygen concentrations less than 6 mg/L are supposed to inhibit chinook salmon migration to home waters. DO may play a role in inhibiting chinook salmon homing migration, but of equal if not greater importance is elevated temperatures, and low SJR DWSC flow from tributary streams that leads to loss of a chemical homing signal. Also a factor that could have been important in the 1970 Department of Fish and Game studies and now are chemicals that interfere with the Chinook salmon ability to detect the homing signal from its home waters.

The homing signal issue from the original home waters is a flow related issue that may influence Delta flow management issues. The issue will not likely be addressed by more SJR DWSC flow. Flows from non home water sources may be harmful to fish homing by diluting the homing signal waters. It is possible that a lot of money could be spent solving the DWSC low DO problem and there still would be a chinook salmon homing problem since this problem is controlled by other factors.

It is evident that considerable work needs to be done before a technically valid DO TMDL goal can be established that will protect aquatic life resources of the DWSC and allow uninhibited chinook salmon migration. Fixing the homing problem will likely require control of home water tributary flow through the DWSC and control of flows to prevent elevated temperatures in the DWSC.

If you have an interest in receiving the Issues report, Appendix F, please let me know.

Fred