Comments on the SWRCB Draft

Total Residual Chlorine and Chlorine-Produced Oxidants Policy of California

submitted by
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January 4, 2006

The California State Water Resources Control Board (SWRCB 2005) issued a draft policy for regulating Total Residual Chlorine and Chlorine-Produced Oxidants for preliminary comment. I have been involved in investigating the water quality impacts of chlorine since 1955 where my masters degree research at the University of North Carolina was devoted to some reactions of the aquatic chemistry of chlorine dioxide. My PhD degree dissertation at Harvard University obtained in 1960 was devoted to a study of the chlorination of phenol as it relates to controlling tastes and odors in domestic water supplies. For 30 years I held university professorships in environmental engineering/science at several major US universities where I conducted several graduate level research projects on the fate and water quality impacts of chlorine used in disinfecting domestic wastewaters. This research included detailed studies on the persistence of the chlorine used for wastewater disinfection in five different domestic wastewaters treatment plants that discharge to four Colorado Front Range rivers. These studies represented an over $100,000 three year effort. Several major publications evolved out of these studies that include, Lee et al. (1982), Heinemann et al. (1983), Newbry et al. (1983) and Lee (1986). These studies included an evaluation of chlorine persistence in river waters and caged fathead minnow toxicity tests in the effluent chlorine plume.

Also a paper covering the studies that I conducted on the persistence of chlorine in the Delaware Estuary used for controlling fouling of once through cooling (waste heat dissipation) condensers at an electric generating station located near Philadelphia, PA

In 1989 when I retired from university graduate level teaching and research and became active as a consultant in California water quality issues, I was shocked to find that California had not adopted the US EPA water quality criteria for chlorine. It was well known in the 1980s that residual chlorine in POTW wastewaters effluents was a major cause of aquatic life toxicity in the receiving waters for domestic wastewater discharges. California is long overdue in adopting a statewide residual chlorine water quality policy.

Presented below are my comments on the SWRCB (2005) draft chlorine residual water quality policy.

Water Quality Objectives
The water quality objectives set forth on page 4 of the draft policy are appropriate. These objectives should be applied as proposed as a 1 hr average and 4 day average at the point where the wastewater is discharged to the receiving waters.

The proposed compliance schedule of not exceed five years is too long. No more than two years should be allowed to achieve compliance with these objectives.

Monitoring Requirements
With regard to the statement,
"*Continuous monitoring* of chlorine residual or dechlorination residual concentrations shall be required in all facilities." The chlorine residual should be applied to the concentration of residual chlorine at the point of effluent discharge to ambient state waters.

The statement,
"*If continuous monitoring is not required, grab samples shall be collected at least every 30-minutes during each intermittent period of chlorination.*" The 30 minute grab sampling may not be sufficiently frequent to properly characterize an intermittent discharge. Every 15 minutes should be the maximum grab sampling period during intermittent chlorination periods.

Quantification/Reporting Requirements
The statement,
"*On-line chlorine residual devices must have the ability to record measurements at no less than one per minute and record concentrations in parts per million (mg/L or ppm) to two decimals*." needs to be revised. The "*Two decimals*" should be replaced by "0.01 *mg/L*." It is possible to interpret this statement to mean that reporting to only 0.09 mg/L is acceptable.

The statement, *"During calibration processes, the discharger shall limit the calibration solution to no more than 0.500 part per million and verify the solution concentration by Method 4500-Cl E as found in – Standard Methods for the Examination of Water and Wastewater, 20th edition, whose stated detection limit is 0.010 part per million."*

It is inappropriate to allow calibration at 0.500 ppm. Calibration at this concentration may not produce reliable results at the WQO concentration. The maximum calibration concentration should be 0.01 mg/L.

The statement, "*All readings at or above the QRL shall be recorded to two decimals"*
Since "to two decimals" may be interpreted differently by various individuals a minimum concentration for reliably recording the results should be specified.

The statement,
"*All readings recorded beginning with the hour and for 59 minutes afterwards shall be collected. All ND readings within this time frame shall be converted to zero. From the readings, the discharger shall compute the arithmetic mean, which shall be the value that*

is compared with the permit effluent limit." has several problems. It is inappropriate to assume that all ND are zero. It is readily possible that concentrations just less than the detection limit could significantly contribute to the overall average residual for the averaging period. I would use the traditional approach of assuming one half the detection limit.

Our studies showed that the arithmetic average is not reliable to average the chlorine residual. We found that the integrated average of a plot of concentration versus time gave reliable estimates of "average" concentration of organism exposure. This comment applies to both the one hour and four day average determination.

The statement,
"*A positive residual dechlorination agent in the effluent indicates that chlorine is not present in the discharge, which can validate a zero residual reading on the chlorine analyzer."* This statement is too broad since it would not apply to all possible dechlorination agents such as slow acting chemicals. There are analytical methods that can determine residual chlorine reliable at critical concentrations.

The *Whole Effluent Toxicity*[3] (WET) testing mentioned on page 8 should be done with flow through tests where a reliable chlorine residual is present that represents the effluent discharged to the receiving waters.

Mixing Zones and Site Specific Objectives
The statement,
"*To the extent authorized by the applicable regional water quality control plan (Basin Plan), a Regional Water Board may grant a mixing zone for a discharge of TRC or CPO. Allowance of a mixing zone is discretionary.* Mixing zones should not be allowed for residual chlorine discharges since allowing mixing zones will permit toxicity to some forms of aquatic life such as benthic organisms and fish that can be attracted to warm effluent in the winter.

References
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SWRCB, "Total Residual Chlorine and Chlorine-Produced Oxidants Policy of California," draft, State Water Resources Control Board, Division of Water Quality, Sacramento, CA December (2005).