CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Environmental Services Department
DIRECTOR'S OFFICE

January 21, 2011

VIA EMAIL: commentletters@waterboards.ca.gov

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
1001 I Street,
Sacramento, CA 95814

Re: Comment Letter - Policy for Toxicity Assessment and Control

Dear Mrs. Townsend:

The City of San José (City) appreciates the opportunity to submit comments on the State's draft policy for Toxicity assessment and control (Policy) on behalf of the City and the San José/Santa Clara Water Pollution Control Plant (Plant). The City supports and incorporates by reference comments provided by the following agencies on January 21st, 2010: the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), the Western States Petroleum Association (WSPA), and comments provided jointly by the Clean Water Associations of CASA, TriTAC, BACWA, CVCWA, RCRC, and SCAP.

As currently written, the City does not support the Policy. Specifically, the City is concerned about the establishment of numeric limits for toxicity testing, the chronic toxicity objective proposed in the Policy, and the statistical methodology used to determine compliance with the Policy. This proposed Policy is not an improvement over State Implementation Policy (SIP) procedures for WET and chronic WET requirements in NPDES Permits in San Francisco Bay Region 2. In particular, the use of the Test of Significant Toxicity (TST), a major component of the Policy, does not numerically implement a 25% effect level to determine an unacceptable level of chronic toxicity as stated in the Policy. These and other issues of concern are summarized below.

For context, current NPDES Permit requirements in the San Francisco Bay Area (Regional Water Quality Control Board, Region 2) typically require monthly monitoring of chronic and acute toxicity for large dischargers. Accelerated monitoring (twice per month testing) is triggered for shallow water dischargers after exceeding a three sample median of 1 chronic toxicity unit (TUc) or a single-sample maximum of 2 TUc or greater. (These triggers are 10 and 20 TUc respectively for deep water dischargers.) If accelerated monitoring then confirms consistent toxicity above either of these two triggers, a Toxicity Reduction Evaluation/Toxicity Identification Evaluation (TRE/TIE) is required to be conducted and a TRE Workplan must be submitted within 30 days of exceeding the chronic toxicity trigger. The failure of an NPDES permittee to perform required monitoring, report and respond to test exceedance triggers, or perform an adequate TRE/TIE investigation would constitute an NPDES violation and would be a basis for potential enforcement action by the Regional Water Quality Control Board.

This existing Region 2 implementation of the SIP is reasonable and appropriate given the uncertainties inherent in whole effluent toxicity testing. Unlike an exceedance of a specific pollutant, toxicity is not measured through an instrument that can be calibrated with precision or accuracy. Instead, toxicity is measured against a

comparison of biological response between control water and POTW effluent using several to dozens of individual test organisms that are sensitive to potential toxicants. The exceedance could be the result of one pollutant or a synergistic response to several pollutants or environmental factors. There is no way to know immediately if an exceedance resulted from a problem with the test organisms themselves (e.g. the supply stock), the laboratory testing conditions (e.g. the quality of food or control water), POTW operations or chemical additions, or a pollutant or combination of pollutants flowing into the Plant from the collection system. This is why EPA guidance lays out the general step-wise TRE/TIE investigation procedure that can be conducted as a response to detections of toxicity above a certain magnitude. This draft state Policy seems to ignore the EPA guidance, and decades of practical experience in whole effluent toxicity regulation.

The City of San Jose is uniquely qualified to comment on the draft Policy due to our recent experiences in toxicity investigations that were reported to the Region 2 Water Board earlier in 2010: From July 2009 to September 2010, the Plant experienced chronic toxicity in its treated effluent on seven occasions. The toxicity was detected measuring Ceriodaphnia dubia (water flea) reproduction using the IC25 (Inhibition Concentration 25%) endpoint. In accordance with the Plant's NPDES permit and EPA guidelines, the Plant conducted accelerated toxicity testing and drafted a Toxicity Reduction Evaluation (TRE) workplan that was implemented over a period of several months. The toxicity was generally low and not persistent. Several TIEs were performed. None of the TIE manipulations removed all of the toxicity, and the TIE manipulations provided mixed and sometimes conflicting results for different, or even the same, toxic events. The City made a sustained effort to identify the toxicant(s) responsible for the observed chronic toxicity. For example, the City spent in excess of $125,000 to contract labs for chronic testing and TIE investigations in addition to its own in-house testing. Additional chemical and bioassay analyses were performed by both in-house and contract laboratories. A team of Plant and toxicity experts was assembled to guide the TRE/TIE process. Collection system agencies, source control inspectors and pollution prevention experts assisted in the investigation. The City estimates that this effort cost in excess of $200,000 not including staff time to meet and confer regularly during periods of observed chronic toxicity. Despite considerable time and expense, the Plant was not able to identify the cause(s) of the observed chronic toxicity and the toxicity has not been detected since. In short, the City took all available steps to identify the cause(s) and source(s) of the observed chronic toxicity, but no pollutant(s) or source(s) were ever identified.

Had the draft Policy been in effect the Plant would have been cited for at least 4 NPDES violations in 2009 and 2010. Furthermore, in accordance with the draft Policy's use of the TST method, the initial testing that detected the toxic events would have evaluated a single Instream Waste Concentration (IWC) instead of a multiple concentration dilution series. This means there would have been no information, at least initially, as to the magnitude of toxicity involved which would have excluded an important piece of information to guide the ongoing investigations. None of this would have improved the success of these investigations or have improved water quality in the receiving water. Rather, the new Policy would have only increased the financial burden to the Plant. If adopted, this Policy would compel the City to petition the San Francisco Bay Regional Water Quality Control Board for dilution credit for chronic toxicity in order to avoid WET violations based on numeric limits rather than action triggers.

The following are specific recommendations:

1. Numeric Limits for WET:

Numeric limits for Whole Effluent Toxicity (WET) are problematic for Publicly Owned Treatment Works (POTWs). Dischargers cannot reasonably measure toxicity upstream or in influent to POTWs on a routine basis. Although EPA's Toxicity Reduction Evaluation guidance includes procedures to evaluate upstream

toxicity sources using methods such as the Refractory Toxicity Assessment tool[1]; such procedures and tools are complex and too costly for use in routine WET monitoring. Specific constituents of wastewater can be measured with relative ease and at reasonable cost, giving POTWs reasonable control over them. POTWs do not have the same control over toxicity because its makeup, source, magnitude, and persistence can vary greatly over time. The constituents that may be causing a toxic response in WET testing are not "known" and cannot be directly identified and measured in the same way as conventional and priority pollutants in wastewater. Therefore, establishing numeric limits that immediately apply to a single result, and issuing violations based on a single statistical pass/fail result, puts a tremendous onus on POTWs. Although the State's proposed WET Policy may result in immediate enforcement actions against POTWs, it is not likely that this enforcement will result in quicker resolution of the WET exceedances or improvement to water quality. Whole Effluent Toxicity simply cannot be addressed and corrected on the same time scale as chemical-specific exceedances.

Numeric limits for conventional and priority pollutants are established only after detailed consideration of an averaging period, a return frequency, and an overall numeric limit that is reliable. Numeric limits for WET testing must also include an implementation plan that takes into consideration the magnitude of the toxicity rather than using a simple pass/fail criteria.

Recommendation: Do not establish numeric limits for whole effluent chronic toxicity testing. Instead, retain the trigger system currently in use in the San Francisco Bay region (Region 2) which assesses magnitude and frequency of target exceedances to determine next steps in a tiered approach.

2. The Proposed WET Objective:

The City agrees with the draft Policy that "a 0.25 effect (or greater) at the IWC [Instream Waste Concentration] demonstrates an unacceptable level of chronic toxicity. (In general terms, this threshold is described as a inhibition of 25% or greater of a biological function (growth or reproduction) in a set of test organisms exposed to the waste stream at the instream waste concentration when compared to a set of identical organisms in laboratory control water.) However, the Test of Significant Toxicity (TST) evaluation method in the proposed Policy does not measure this objective. There is a disconnection between the stated null hypothesis: "H_0: Mean response (IWC) $\leq 0.75 \bullet$ mean response (control)" and the results of the statistical method used to evaluate this hypothesis. This is discussed in more detail below. The City also believes that the stated Regulatory Management Decision (RMD) of 0.80 for acute toxicity testing is appropriate.

Recommendation: The City recommends use of point estimation techniques (IC25 for chronic tests) rather than traditional NOEC or proposed TST statistical analyses for implementing toxicity triggers (or objectives). Point estimation techniques allow for the measurement of the confidence around the IC25 estimates (test results) and thereby quantify the uncertainty surrounding the results.

3. Test of Significant Toxicity (TST)

According to the EPA, the TST method was developed as an alternative to traditional statistical methods in evaluating WET results[2]. Presumably this addresses statistical false negative results (declaring a discharge not

[1] U.S. EPA. 1999. Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants. Office of Wastewater Management, U.S. Environmental Protection Agency, Washington, D.C. EPA/833B-99/002; August 1999.

[2] U.S. EPA. 2010. National Pollutant Discharge Elimination System Test of Significant Toxicity Technical Document. Office of Wastewater Management, U.S. Environmental Protection Agency, Washington, D.C. EPA 833-R-10-004; June 2010.

toxic when it is actually toxic) that may arise when using the traditional EPA evaluation of WET results. The assumption in both the EPA's draft TST implementation document and the State's proposed WET Policy is that a statistical endpoint (e.g. NOEC) is currently always used to evaluate toxicity in the NPDES program. This is not true. A biological dose response endpoint (the Inhibition Concentration of 25% or IC25) is the primary recommended tool for evaluating both toxicity and test data quality. The IC25 method has been used for years in Region 2 and is a superior method for calculating chronic toxicity units (TUc).

Point estimation techniques (e.g. IC25) allow for the calculation of confidence intervals around the estimated results so that the uncertainty of the estimated result is known. These techniques more accurately implement the proposed WET objectives in the draft Policy. For example, the null hypothesis for the chronic *Ceriodaphnia dubia* test is: "H_0: Mean response (IWC) $\leq 0.75 *$ mean response (control)." This hypothesis can be evaluated more directly and accurately by use of the IC25 than by either traditional EPA recommended statistical analysis or the TST. In contrast to statistical analyses, point estimation techniques, currently in use in Region 2, directly measure dose response. In rare instances where the IC is not calculable, a direct calculation of percent reduction from the Control, as in the determination of Reasonable Potential described in the policy, could be performed to determine compliance with the numeric objective (Mean Control Response-Mean IWC Response)/Mean Control Response).

City staff evaluated chronic toxicity results for the San Jose/Santa Clara Water Pollution Control Plant (Plant) for the past 60 months. During this period in which the Plant conducted a Toxicity Reduction Evaluation (TRE), the Plant detected toxicity in 9 chronic *Ceriodaphnia dubia* reproduction tests using the IC25 endpoint. Of the 9 failed test results based on IC25, the TST (and NOEC) agreed with all of them. However, there were two additional WET testing events which passed using the IC25 endpoint but failed the TST (see table 1 below). The first discrepancy was found in a test conducted by a contract lab in January 2010 which had a reduction of 22.0% for the IWC test compared to the control. The second discrepancy was more pronounced. In that instance, a test conducted in April 2010 resulted in an IC25 > 100% (the IWC). This test showed a reduction in reproduction of 16.9% compared to control animals and passed both non-parametric (using EPA flowchart) and parametric (less appropriate because of unequal variances between some pairwise comparisons) statistical tests. However, despite passing the IC25 end point, this test failed the TST.

Table 1. Summary of SJ/SC WPCP Chronic Toxicity Testing Results: 2006-2010

Number of Tests	NOEC	TST	IC25
67	**Passed**	**Passed**	**Passed**
9	**Failed**	**Failed**	**Failed**
1	**Passed**	**Failed**	**Passed**
1	**Failed**	**Passed**	**Passed**
1	**Failed**	**Failed**	**Passed**
1	**Passed**	**Failed**	**Failed**

A closer examination of the anomalous TST result for the April 2010 event revealed even more discrepancies as shown in Table 2. The three failed test concentrations (32, 75, and 100%) had reduced reproduction that did not exceed the numeric toxicity objective given in the Policy (i.e. 25%) but still failed the TST.

Table 2. Comparison of TST, IC25, and traditional statistical analysis for a single chronic test

Test Conc.	*t* Score	Mean Control Response	Control variance	Mean IWC Test Response	Test Variance	*n* Control	*n* Test	*b*	v	Critical *t*	TST	IC25	EPA Flowchart Statistics
32	0.0947	21.9	57.91	16.7	51.84	10	10	0.75	17	0.8633	Fail	Pass	Pass
42	1.1347	21.9	57.91	19.0	18.92	10	10	0.75	16	0.8647	Pass	Pass	Pass
56	2.2001	21.9	57.91	21.6	22.75	10	10	0.75	17	0.8633	Pass	Pass	Pass
75	0.5750	21.9	57.91	18.1	52.27	10	10	0.75	17	0.8633	Fail	Pass	Pass
100	0.6146	21.9	57.91	18.2	50.84	10	10	0.75	17	0.8633	Fail	Pass	Pass

Conc. – effluent concentration (%) b=0.75 for chronic Ceriodaphnia dubia test v - degrees of freedom

It is clear that the State is endeavoring to implement a chronic toxicity policy that will screen for discharges which have a sublethal effect on receiving water organisms at or above a 25% effect level. However, the TST is not the best tool for implementing the stated numeric criterion. Neither the TST nor traditional EPA statistical methods (i.e. NOEC) can provide complete assurance that a chronic test result is neither a "false positive" nor a "false negative." However, the IC25, by measuring a well-defined endpoint in an organism's dose response to a test water, provides the most scientifically defensible evaluation of a toxicity endpoint. In short, it is the scientific method which most accurately implements the criterion stated in the hypotheses contained in the draft Policy.

Recommendation: Use point estimation techniques (e.g. IC25) to determine compliance with numeric toxicity objectives (or targets) and use a 5-concentration test design to evaluate dose response to ensure data quality.

4. Implementation:

The draft WET Policy implementation scheme raises several major concerns for the City:

a) The draft Policy does not evaluate nor consider the **magnitude** of toxicity but relies instead on a simple pass/fail criterion. Paradoxically, using the implementation plan described in the Policy, two consecutive failed results would trigger a TRE, which then relies heavily on the magnitude of toxicity to determine potential causes and sources. In order for any subsequent Toxicity Identification Evaluation (TIE) to be successful, amelioration of toxicity by various treatments has to be ***quantified*** (i.e. use of a definitive test rather than a pass/fail screen at the IWC). TIEs are not likely to be successful at low toxicity and a workable State WET Policy must address the magnitude of toxicity in NPDES discharges.

b) The draft Policy includes a requirement to perform a 5-concentration definitive test during the accelerated monitoring phase (following a single "fail" event) while requiring the TST to be applied to all concentrations. However, there is no discussion or explanation of how the results from the additional four test concentrations are to be used to evaluate the chronic test results or to implement TIE testing.

c) The draft WET Policy diverges widely from current implementation of WET in NPDES Permits (at least in Water Board Region 2) in the way it triggers successive corrective action without regard to an averaging or weighting system that takes magnitude and frequency of toxicity into consideration. At the very least, the State Policy should incorporate a tiered approach based on magnitude of toxicity, similar to the >1 TUc (10TUc) and >2 TUc (20TUc) currently in place in NPDES Permits in Water Board Region 2.

d) The lack of a seamless continuity between the three phases of WET implementation (routine monitoring, accelerated monitoring, and TRE) is not trivial. For example, the EPA TST is designed to encourage NPDES dischargers to increase test power by increasing the number of test replicates (*n*). During routine monitoring, this may be possible since only a two concentration test is required (Control and IWC). However, during accelerated monitoring or TRE/TIE, this is not likely possible due to the requirement for a 5-concentration definitive test.

Recommendation: Replace the current all-or-nothing, pass/fail WET implementation approach with a phased, or tiered, approach which considers the magnitude and frequency of observed toxicity. Implement a tiered approach in which the methods used in routine monitoring of WET lead seamlessly to methods that will ultimately be employed during subsequent accelerated monitoring or TRE phases of NPDES WET testing.

The City looks forward to working with the State Water Board staff to develop a clear, effective Policy for assessing and implementing toxicity objectives in NPDES Permits in California.

Sincerely,

John Stufflebean
Director, Environmental Services
City of San José