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To: Surface Water Ambient Monitoring Program (SWAMP) Round Table

From: Bryn Phillips (UCD-Granite Canyon), Marie Stillway and Linda Deanovic (UCD-Aquatic Tox Lab), Debra Denton (EPA Region 9), Michael Lyons (RWQCB4), Mary Hamilton (RWQCB3), Amara Vandervort (MLML-QAT), Cassandra Lamerdin (MLML-DMT)

Subject: SWAMP Toxicity Work Group Recommendation for Evaluating Toxicity Data

Background

The SWAMP database currently utilizes a two-tiered approach to determining toxicity. This hypothesis-testing approach first compares the organism responses from ambient samples to the responses from appropriate controls using a t-test statistical comparison. This is followed by a comparison to a threshold value that is 20% less than the control response. There are four possible outcomes of this approach:

NSG	Not Significant Greater Similarity	Not significant compared to control sample based on statistical test at alpha level, CalculatedValue equal to or greater than CriticalValue. Has greater similarity to control sample, PercentEffect equal to or smaller than EvalThreshold. (No criteria met)
NSL	Not Significant Less Similarity	Not significant compared to control sample based on statistical test at alpha level, CalculatedValue equal to or greater than CriticalValue. Has less similarity to control sample, PercentEffect value larger than EvalThreshold. (Only second criterion met)
SG	Significant Greater Similarity	Significant compared to control sample based on statistical test at alpha level, CalculatedValue less than CriticalValue. Has greater similarity to control sample, PercentEffect equal to or smaller than EvalThreshold. (Only first criterion met)
SL	Significant Less Similarity	Significant compared to control sample based on statistical test at alpha level, CalculatedValue less than CriticalValue. Has less similarity to control sample, PercentEffect value larger than EvalThreshold. (Both criteria met)

The current approach will be replaced by another hypothesis-testing statistical approach. The US EPA's Test for Significant Toxicity (TST - U.S. EPA, 2010; Denton et al., 2011; Diamond et al., 2011) will be used for all endpoints with the exception of chronic *Ceriodaphnia dubia* % survival endpoint, which will be reported as the percent effect only. The TST uses the more robust Welch's t-test and incorporates a bioequivalence value in the formulation of the hypothesis.

This process strengthens the overall power of the analysis. TST results are reported as either a "pass" (i.e., non toxic) or "fail" (i.e., toxic), and the percent effect is reported to provide an indication of magnitude.

SWAMP Database

SWAMP will incorporate the TST into the database, toxicity template, and web checker; and will allow for the use of TST analysis and the storage of TST summary results. In addition, the SWAMP database will continue to store historic t-test summary results. Although the database will be able to store both types of summary results, only one of these two analysis methods will be stored in the database for any given toxicity test.

Toxicity Data Interpretation

Assessment groups need to develop lines of evidence for CWA 303(d) assessment purposes. In order to create solid lines of evidence, these groups need to follow consistent statistical procedures for determining toxicity.

It is the recommendation of the SWAMP Toxicity Work Group to utilize the SL qualifier to determine whether a sample is declared toxic when reviewing data analyzed with the two-tier method, and utilize the "fail" (i.e., toxic) qualifier to determine whether a sample is declared toxic when reviewing data analyzed with the TST method.

References

Denton, D.L., Diamond, J., Zheng, L., 2011. Test of Significant Toxicity: A statistical application of assessing whether an effluent or site water is truly toxic. *Environ Toxicol Chem* 1117-1126.

Diamond, J., Denton, D.L., Anderson, B.A., Phillips, B.M., 2011. It is time for changes in the analysis of whole effluent toxicity data. *Integrated environmental assessment and management* 8, 351-358.

U.S. EPA, 2010. National Pollutant Discharge Elimination System Test of Significant Toxicity Technical Document. EPA 833-R-10-004. Office of Wastewater Management. Washington DC.