Technical Report #956

Stormwater Monitoring Coalition Toxicity Testing Laboratory Guidance Document

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EXECUTIVE SUMMARY

Aquatic toxicity testing has become a standard measurement in stormwater management. Samples collected in the field are brought back to the laboratory, where test organisms are exposed and their response – ranging from lethality to critical life stage development or reproduction success – is measured using very uniform and repeatable methods. Cumulatively, stormwater management agencies in southern California spend nearly $1 million annually conducting toxicity tests.

The Southern California Stormwater Monitoring Coalition (www.SoCalSMC.org) includes 15 regulated and regulatory agencies from Ventura to San Diego, and one of their goals is to combine data sets for making comparisons between watersheds or over time. One challenge to using toxicity testing is that the various SMC member agencies currently utilize different test species and a variety of endpoints. Although standardized methods are used by the multiple contract laboratories who conduct SMC toxicity testing, the method protocols typically have options or interpretations left to the laboratory, potentially leading to different test outcomes. This uncertainty is compounded by concerns about the toxicity test's inherent variability within each laboratory.

As a result of these challenges, the SMC decided to conduct a laboratory intercalibration study to assess comparability. The goal was to identify some key recommended test species and endpoints, quantify intra- and inter-laboratory variability for each test, and make recommendations for how to minimize that variability, where applicable. An Advisory Committee was created to help design, implement, and interpret the intercalibration study, then construct the recommendations in this Guidance Manual.

The recommended test species include two freshwater species (*Ceriodaphnia dubia* 6-8 day chronic survival and reproduction test and *Hyalella azteca* 96-hour acute survival test) and two marine species (*Strongylocentrotus purpuratus* and *Mytilus galloprovincialis* short-term chronic larval development tests) based on commonality to current monitoring requirements and maintaining existing trends, sensitivity to toxicants, and ease of testing/cost, amongst other criteria. Two iterations of laboratory intercalibrations were conducted. Each iteration was comprised of four samples, delivered blind to each laboratory; lab dilution water, lab dilution water spiked with copper, runoff sample created with artificial rainfall, and a duplicate. Comparability was evaluated based on three factors; test acceptability (negative control and reference toxicant response), intra-laboratory precision (duplicate sample response), and inter-laboratory precision (among lab response). Up to 10 laboratories participated including contract labs, municipal monitoring labs, and research labs. All of the laboratories were certified by the State of California for toxicity testing.

After two intercalibration iterations, nearly all laboratories scored comparable (moderate to very high comparability) for three of the four species (four of five endpoints) including both marine species, *Hyalella* (the newest method), and the survival endpoint for *Ceriodaphnia* (Table ES-1) However, approximately half the laboratories scored moderate or better comparability for the *Ceriodaphnia* reproduction test, and these laboratories were not consistent between intercalibration rounds. While intra-laboratory precision was generally comparable for *Ceriodaphnia* reproduction, there was a range of responses among laboratories to each sample, including the lab dilution water. The best inter-laboratory precision for the *Ceriodaphnia* reproduction test was observed for the runoff sample.

Table ES-1. Summary of laboratory comparability scoring for *Ceriodaphnia dubia* (6-8 day) survival and reproduction, *Hyalella* survival, *Strongylocentrotus* embryo development, or *Mytilus* embryo development tests.

Lab	*Ceriodaphnia* Survival		*Ceriodaphnia* Reproduction		*Hyalella* Survival		*Strongylo-centrotus* Development	*Mytilus* Embryo Development
	Round 1	*Round 2*	*Round 1*	*Round 2*	*Round 1*	*Round 2*	*Round 1* [a]	*Round 1* [a]
A	Moderate	High	Very High	Low	Low	High	Moderate	- [b]
B	Very High	High	Moderate	High	Low	High	-	-
C	Low	High	Low	High	Low	Very High	-	-
E	Moderate	-	Moderate	-	-		-	Very High
F	Moderate	High	Moderate	Low	Low	Very High	Moderate	Low
G	High	-	High	-	-	-	-	-
H	Low	-	Low	-	-	-	-	-
I	High	Moderate	High	Low	Moderate	Very High	High	Very High
J	Low	High	Low	Low	High	Very High	Moderate	Moderate

[a] Only tested in Round 1

[b] – indicates sample not tested

Based on these results, all four species can be recommended for future use as part of the SMC monitoring programs. Specific guidance for stormwater testing is given for potential variability-inducing steps including hardness of dilution water, feeding, sample handling and water renewals, and aging of organisms. Additional intercalibrations are recommended specifically for the *Ceriodaphnia* reproduction test to assess sources of variability in both stormwater and laboratory dilution water.

Full text:
http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/956_StrmWtrMonitCoalitToxTestingLabGuid.pdf