Measurement Quality Objectives for Chronic Freshwater Sediment Toxicity Test Methods

The following Measurement Quality Objectives establish recommendations and requirements for chronic freshwater sediment toxicity testing conducted for the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) projects. Non-SWAMP projects should meet the minimum requirements established in the second edition of the U.S. EPA guidance document *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (600/R-99/064).

Table 1. Laboratory Quality Control for Chronic Freshwater Sediment Toxicity Test Methods

Negative Control	Frequency of Analysis	Measurement Quality Objective	Data Quality Indicator or Reasoning
Sediment Control	A sediment control, consistent with the appropriate U.S. EPA test method, must be used with each analytical batch.	The sediment control must meet all test acceptability criteria for the species of interest.	Evaluates the health and sensitivity of the test organisms.
Laboratory Overlying Water	Laboratory overlying water, consistent with the appropriate U.S. EPA test method, must be used with each analytical batch.	Laboratory overlying water must be of uniform quality for the species of interest (refer to U.S. EPA method manual 600/R-99/064).	Evaluates the health and sensitivity of the test organisms.

Positive Control	Frequency of Analysis	Measurement Quality Objective	Data Quality Indicator or Reasoning
Reference Toxicant Tests	One reference toxicant test per analytical batch is required when using organisms that are either commercially-supplied or wild-caught. Monthly reference toxicant testing is required for laboratories utilizing in-house cultures.	The last plotted data point (LC50 or EC50) should be within 2 standard deviations of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. A reference toxicant test outside of the 2 standard deviations does not invalidate the associated test results.	Used to assess intra-laboratory precision.

Table 2. Laboratory Quality Control Corrective Actions for Chronic Freshwater Sediment Toxicity Test Methods

Negative Control	Recommended Corrective Action
Sediment Control	Laboratories must begin retesting affected samples and the associated control within 7 days of test failure or after resampling. The laboratory should try to determine the source of the control failure, document the investigation, and record the steps taken to prevent a recurrence.

Positive Control	Recommended Corrective Action
Reference Toxicant Tests	If the LC50 exceeds ± 2 standard deviations of the running mean of the last 20 reference toxicant tests, the laboratory should investigate sources of variability, take actions to reduce identified sources of variability, and may perform an additional reference toxicant test during the same month.

Table 3. Field Quality Control for Chronic Freshwater Sediment Toxicity Test Methods

Quality Control	Frequency of Analysis	Measurement Quality Objective	Data Quality Indicator or Reasoning
Field Blanks	Based on project requirements.	No statistical difference between the laboratory control and the field blank within an analytical batch.	Used to measure bias introduced during sample collection and handling.
Bottle Blanks	Based on project requirements.	No statistical difference between the laboratory control and the bottle blank within an analytical batch.	Used to measure bias introduced during washing procedures prior to collection.

Table 4. Field Quality Control Corrective Actions for Chronic Freshwater Sediment Toxicity Test Methods

Quality Control	Recommended Corrective Action
Field Blanks	If contamination of the field blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the sampling team can identify the contamination source(s) and perform corrective actions prior to the next sampling event.
Bottle Blanks	If contamination of the bottle blanks and associated samples is known or suspected, the laboratory should flag the affected data. The project coordinator should be notified so that the laboratory or vendor can identify the contamination source(s) and perform corrective actions prior to the next sampling event.

Table 5. Sample Handling for Chronic Freshwater Sediment Toxicity Test Methods

Container	Sample Receipt Temperature	Sample Preservation	Holding Time
Amber glass (recommended)	0 – 6 °C (required)	Wet or blue ice in field; 0 – 6 °C refrigeration in laboratory (do not freeze); dark at all times (required)	<14 days (recommended) or <8 weeks (required)

Table 6. 10-Day Chronic Freshwater Sediment *Chironomus dilutus* Survival and Growth Toxicity Test

Test Acceptability Criteria	≥70% mean survival in the controls, and an average of ≥0.48 mg ash-free dry weight for surviving individuals (required)
Test Type	Whole sediment toxicity test with renewal of overlying water (required)
Age at Test Initiation	Second- to third-instar larvae (about 10-days old); all organisms must be third instar or younger with at least 50% of the organisms at third instar (required)
Replication at Test Initiation	8 (required minimum)
Organisms per Replicate	10 (required minimum)
Food Source	Flake fish food (required)
Temperature Range	23 °C ± 1 °C (recommended); the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Renewal Frequency	2 volume additions per day, continuous or intermittent (e.g. 1 volume addition every 12 hours; required)
Test Duration	10 days (required)
Endpoints	Survival and growth (required)
Conductivity	<12‰ salinity (recommended)
Light Intensity	100 – 1,000 lux (recommended)
Photoperiod	16 hours of ambient laboratory light, 8 hours dark (recommended)
Test Chamber Size	300 mL (recommended)
Replicate Volume	Sediment volume: 100 mL; overlying water volume: 175 mL (recommended)
Feeding Regime	1.5 mL per test chamber daily (recommended)
Minimum Sample Volume	2 L for one-time grab sample (recommended)
Laboratory Control Water	Culture water, well water, surface water, site water, or reconstituted water (recommended)
Sediment Control	Follow U.S. EPA method manual 600/R-99/064 (required)
Initial Overlying Water Chemistry	1 DO, pH, conductivity, ammonia, hardness, alkalinity, and temperature measurement (required)
Daily Overlying Water Chemistry	1 DO and temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, conductivity, ammonia, hardness, alkalinity, and temperature measurement (required)
Initial DO Range	>2.5 mg/L (required)

Table 7. 10-Day Chronic Freshwater Sediment *Hyalella azteca* Survival and Growth Toxicity Test

Test Acceptability Criteria	≥80% mean survival in the controls, and measurable growth (required)
Test Type	Whole sediment toxicity test with renewal of overlying water (required)
Age at Test Initiation	7 – 14 days old (required)
Replication at Test Initiation	8 (required minimum)
Organisms per Replicate	10 (required minimum)
Food Source	YCT (required)
Temperature Range	23 °C ± 1 °C (recommended); the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Renewal Frequency	100% twice daily renewal (required)
Test Duration	10 days (required)
Endpoints	Survival and growth (required)
Conductivity	<15‰ salinity (recommended)
Light Intensity	10 – 20 µE/m^2/s or 50 – 100 ft-c (recommended)
Photoperiod	16 hours of ambient laboratory light, 8 hours dark (recommended)
Test Chamber Size	300 mL (recommended)
Replicate Volume	Sediment volume: 100 mL; overlying water volume: 175 mL (recommended)
Feeding Regime	1.5 mL per test chamber every other day (recommended)
Minimum Sample Volume	2 L for one-time grab sample (recommended)
Laboratory Control Water	Culture water, well water, surface water, site water, or reconstituted water (recommended)
Sediment Control	Follow U.S. EPA method manual 600/R-99/064 (required)
Initial Overlying Water Chemistry	1 DO, pH, conductivity, ammonia, hardness, alkalinity, and temperature measurement (required)
Daily Overlying Water Chemistry	1 DO and temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, conductivity, ammonia, hardness, alkalinity, and temperature measurement (required)
Initial DO Range	>2.5 mg/L (required)