

Measurement Quality Objectives for Acute and Chronic Marine Sediment Toxicity Test Methods



The following Measurement Quality Objectives establish recommendations and requirements for acute and chronic marine 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 1994 U.S. EPA guidance document *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods* (600/R-94/025).

Table 1. Laboratory Quality Control for Acute and Chronic Marine 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-94/025).	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 Acute and Chronic Marine 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 Acute and Chronic Marine 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 Acute and Chronic Marine 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 Acute and Chronic Marine 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 Acute Marine Sediment *Ampelisca abdita* Survival Toxicity Test

Test Acceptability Criteria	≥90% mean survival in the controls (required)
Test Type	Whole sediment, static non-renewal (required)
Size at Test Initiation	3 – 5 mm (no mature males or females; required)
Replication at Test Initiation	4 (required minimum)
Organisms per Replicate	20 (required minimum)
Food Source	Do not feed (required)
Temperature Range	20 °C ± 1°C (recommended); the time-weighted average of daily temperature readings must be within 1 °C of the desired temperature; the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Test Duration	10 days (required)
Endpoint	Survival (required)
Salinity	28 ppt ± 2 ppt (recommended)
Light Intensity	10 – 20 µE/m ² /s or 50 – 100 ft-c (recommended)
Photoperiod	Continuous luminance (recommended)
Test Chamber Size	1 L (recommended)
Replicate Volume	Sediment volume: 175 mL (~2 cm); overlying water volume: 800 mL (recommended)
Minimum Sample Volume	3 L for one-time grab sample (recommended)
Laboratory Control Water	Clean natural seawater or reconstituted water (recommended)
Sediment Control	Clean sediment from organism collection site (sieved through 500 µm screen; recommended)
Initial Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Initial Interstitial Water Chemistry	1 pH, salinity, and ammonia measurement (recommended)
Daily Overlying Water Chemistry	1 temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Final Interstitial Water Chemistry	1 pH, salinity, and ammonia measurement (recommended)
Initial DO Range	>90% saturation (recommended)

Table 7. 10-Day Acute Marine Sediment *Eohaustorius estuarius* Survival Toxicity Test

Test Acceptability Criteria	≥90% mean survival in the controls (required)
Test Type	Whole sediment, static non-renewal (required)
Size at Test Initiation	3 – 5 mm (no mature males or females; required)
Replication at Test Initiation	4 (required minimum)
Organisms per Replicate	20 (required minimum)
Food Source	Do not feed (required)
Temperature Range	15 °C ± 1 °C (recommended); the time-weighted average of daily temperature readings must be within 1 °C of the desired temperature; the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Test Duration	10 days (required)
Endpoint	Survival (required)
Salinity	20 – 34 ppt ± 2 ppt (recommended)
Light Intensity	10 – 20 µE/m ² /s or 50 – 100 ft-c (recommended)
Photoperiod	Continuous luminance (recommended)
Test Chamber Size	1 L (recommended)
Replicate Volume	Sediment volume: 175 mL (~2 cm); overlying water volume: 800 mL (recommended)
Minimum Sample Volume	3 L for one-time grab sample (recommended)
Laboratory Control Water	Clean natural seawater or reconstituted water (recommended)
Sediment Control	Clean sediment from organism collection site (sieved through 500 µm screen; recommended)
Initial Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Initial Interstitial Water Chemistry	1 pH, salinity, and ammonia measurement (recommended)
Daily Overlying Water Chemistry	1 temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Final Interstitial Water Chemistry	1 pH, salinity, and ammonia measurement (recommended)
Initial DO Range	>90% saturation (recommended)

Table 8. 48-Hour Chronic Marine Sediment-Water Interface *Mytilus galloprovincialis* Larval Development Toxicity Test

Test Acceptability Criteria	≥50% mean survival in the controls, and ≥90% mean normal development (required)
Test Type	Whole sediment, static non-renewal (required)
Age at Test Initiation	Within 4 hours of fertilization (required)
Replication at Test Initiation	6 (required minimum)
Organisms per Replicate	250 ± 10% embryos (required minimum)
Food Source	Do not feed (required)
Temperature Range	15 °C ± 1 °C (recommended); the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Test Duration	48 hours (required)
Endpoint	Normal development (required)
Salinity	34 ppt ± 2 ppt (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	Intact sediment cores or 500 mL beaker coupled with 25 μm screen tube (recommended)
Replicate Volume	Sediment volume: 175 mL (~2 cm); overlying water volume: 800 mL (recommended)
Minimum Sample Volume	3 L for one-time grab sample (recommended)
Laboratory Control Water	Clean natural seawater or reconstituted water (recommended)
Sediment Control	Clean sediment from organism collection site (sieved through 500 μm screen; recommended)
Initial Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Daily Overlying Water Chemistry	1 temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Initial DO Range	4.0 mg/L – 100% saturation (recommended)

Table 9. 72-Hour Chronic Marine Sediment-Water Interface *Strongylocentrotus purpuratus* Larval Development Toxicity Test

Test Acceptability Criteria	≥80% normal development in the controls (required)
Test Type	Whole sediment, static non-renewal (required)
Age at Test Initiation	<1 hour, post fertilization (required)
Replication at Test Initiation	6 (required minimum)
Organisms per Replicate	250 embryos (required minimum)
Food Source	Do not feed (required)
Temperature Range	15 °C ± 1 °C (recommended); the maximum temperature must not deviate from the minimum temperature by more than 3 °C (required)
Test Duration	72 hours (required)
Endpoint	Normal development (required)
Salinity	34 ppt ± 2 ppt (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	Intact sediment cores or 500 mL beaker coupled with 25 μm screen tube (recommended)
Replicate Volume	Sediment volume: 175 mL (~2 cm); overlying water volume: 800 mL (recommended)
Minimum Sample Volume	3 L for one-time grab sample (recommended)
Laboratory Control Water	Clean natural seawater or reconstituted water (recommended)
Sediment Control	Clean sediment from organism collection site (sieved through 500 μm screen; recommended)
Initial Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Daily Overlying Water Chemistry	1 temperature measurement (required)
Final Overlying Water Chemistry	1 DO, pH, salinity, ammonia, and temperature measurement (required)
Initial DO Range	4.0 mg/L – 100% saturation (recommended)