

REVISIONS TO THE MEASUREMENT QUALITY OBJECTIVES FOR ACUTE AND CHRONIC TOXICITY TESTS

State Water Resources Control Board

SWAMP Technical Memorandum

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INTRODUCTION

In early 2018, the Surface Water Ambient Monitoring Program (SWAMP) Toxicity Work Group, consisting of staff from the SWAMP Information Management and Quality Assurance Center (SWAMP IQ), the U.C. Davis Aquatic Health Program Laboratory, and the U.C. Davis Marine Pollution Studies Laboratory at Granite Canyon, revised the Measurement Quality Objectives (MQO) for acute and chronic toxicity tests. These revisions, published on July 20th, 2018, were the first to be made to these MQOs since 2013. After this initial release, additional revisions were published on August 22, 2018. In May 2019, the formatting of the revised toxicity MQOs was changed to meet the accessibility standards established by Assembly Bill No. 434. In October 2021, the acute *Pimephales promelas* survival test method MQOs were added. These changes are outlined below.

GENERAL REVISIONS

- An introductory paragraph explaining the applicability of the MQOs was added.
- A column identifying the “Data Quality Indicator or Reasoning” was added to the laboratory and field quality control tables.
- The footnote was removed from Table 1.
- Quality control requirements for sediment controls were removed from the water column toxicity test MQOs.
- References to the “EPA” were changed to “U.S. EPA.”
- The “Control Limits” column in Table 1 was retitled “Measurement Quality Objective.”
- The “Conductivity/Salinity Control Water” and “Additional Control Water” rows in Table 1 were replaced with “Additional Control Water for Manipulated Samples” and “Additional Control Water for Unmanipulated Samples.”
- The “Measurement Quality Objective” for reference toxicant tests in Table 1 was revised.
- The “Equipment Blanks” row was removed from Table 2.
- The “Field/Sample Duplicate” rows were removed from Tables 1 and 2.
- Field quality control requirements and corrective actions were moved to individual tables (Tables 3 and 4, respectively).
- A more in-depth recommendation for reference toxicant test corrective actions was provided in Table 2.
- The Sample/Handling Collection portion of all test method tables was removed and placed into its own table (Table 5).
- All test method tables were reformatted.
- The “Method Recommendation” row was removed from all test method tables.
- The “Reference Toxicant Tests” row was removed from all test method tables.
- The recommended pH range was removed from all test method tables.

- Required DO measurements for renewal water chemistry were rewritten (i.e. “2 DO measurements [1 in old solution and 1 in new solution]”).
- The temperature range requirement for each method was rewritten (i.e. “the maximum temperature must not deviate from the minimum temperature by more than 3 °C”).
- The footnotes addressing Test Acceptability Criteria (TAC) and deviations from recommended test conditions were removed from all test method tables.

ACUTE FRESHWATER TOXICITY TEST METHODS

- Conductivity and ammonia final water chemistry requirements were added to all test methods.
- Temperature was added to the renewal water chemistry requirements of all test methods.
- A 96-hour *Chironomus dilutus* survival test was added.
- A 96-hour *Pimephales promelas* survival test was added.

96-Hour Acute Survival *Ceriodaphnia dubia* Toxicity Test Method

- The recommended replicate volume was changed to 15 mL.
- The feeding regime was revised to include the food measurement (i.e. 0.1 mL each).
- The recommended conductivity range was changed to 100 – 1,900 µS/cm.

96-Hour Acute Survival *Hyalella azteca* Toxicity Test Method

- The recommended laboratory control water was changed to “culture water, well water, surface water, site water, or reconstituted water.”
- The conductivity recommendation was changed to <15‰ salinity.
- The minimum sample volume was changed to 2.5 L.

ACUTE MARINE TOXICITY TEST METHODS

- These test methods were not included in previous iterations of the MQOs and, as such, are entirely new to the program.

CHRONIC FRESHWATER TOXICITY TEST METHODS

- Test methods were placed into alphabetical order, based upon the genus of the test species.
- Conductivity and ammonia final water chemistry requirements were added to all test methods.
- Temperature was added to the daily/renewal water chemistry requirements for all test methods.

- A growth endpoint was added to the acute 10-day *Hyalella azteca* survival test, which was subsequently moved to the chronic freshwater toxicity test MQOs.
- A 10-day *Chironomus dilutus* survival and growth test was added.

6-8-Day Chronic Survival and Reproduction *Ceriodaphnia dubia* Test Method

- The test duration was reworded.
- The feeding regime was explained in greater detail.
- Replicate volume was changed to 15 mL.
- Conductivity parameters were changed to “100 - 1,900 $\mu\text{S}/\text{cm}$; substitute with *H. azteca* if conductivity is $>2,500 \mu\text{S}/\text{cm}$ (recommended).”
- Minimum sample volume was increased to 2.5 L.

10-Day Chronic Survival and Growth *Hyalella azteca* Test Method

- Replication at test initiation was increased to 5.
- The renewal frequency was changed to “...day 2, 4, and 6.”
- The feeding regime was changed to “1.5 mL every other day after water renewals.”
- Recommended conductivity was changed to $<15\text{‰}$ salinity.
- Minimum sample volume was increased to 2.5 L.

7-Day Chronic Survival and Growth *Pimephales promelas* Test Method

- Renewal frequency was changed to “80% daily renewal.”
- Conductivity parameters were changed to “100 – 1,900 $\mu\text{S}/\text{cm}$; substitute with alternate species if conductivity is $>6,000 \mu\text{S}/\text{cm}$ (e.g. *A. affinis*; recommended).”
- Test chamber size was changed to 500 mL.
- Replicate volume was changed to 250 mL.
- Feeding regime was changed to “On days 0 – 6, feed 0.1 g of newly hatched *Artemia* nauplii 3 times daily at 4-hour intervals or, as a minimum, 0.15 g twice daily at 6-hour intervals (at the beginning of the work day prior to renewal, and at the end of the work day following renewal); sufficient nauplii are added to provide an excess (recommended).”

96-Hour Chronic Growth *Selenastrum capricornutum* Test Method

- The “EDTA Addition” row was removed.
- The conductivity recommendation was changed to $<1,500 \mu\text{S} / \text{cm}$; substitute with alternate species if conductivity is $>3,000 \mu\text{S} / \text{cm}$ (recommended).”
- The “Renewal Frequency” row was removed.
- A “shaking rate” of “100 cpm continuous, or twice daily by hand (recommended)” was added.

- Conductivity and ammonia measurements were added to the final water chemistry requirements.

CHRONIC MARINE WATER TOXICITY TEST METHODS

- Test methods were placed into alphabetical order, based upon the genus of the test species.
- The “Salinity Control” row was removed for each test method.
- A 7-day survival and growth *Americamysis bahia* toxicity test was added.

7-Day Chronic Survival and Growth *Atherinops affinis* Test Method

- A required minimum significant difference (MSD) of <25% was added to the TAC.
- The renewal frequency was changed to “80% daily renewal.”
- The food source was updated with *Artemia* nauplii age (i.e. <24 hours old).
- The feeding regime was updated to specify 40 nauplii.
- Temperature was added to the daily water chemistry requirements.

48-Hour Chronic Larval Development *Haliotis rufescens* Test Method

- A required MSD of <20% was added to the TAC.
- The “Renewal Frequency” row was removed.
- The test chamber size was changed to 20 mL.
- The minimum sample volume was changed to 1 L.

7-Day Chronic Survival and Growth *Holmesimysis costata* Test Method

- A required survival MSD of <40%, and a growth MSD of <50 µg were added to the TAC.
- The temperature range was changed to “13 °C ± 1 °C (recommended for mysids collected north of Pt. Conception); 15 °C ± 1 °C (recommended for mysids collected south of Pt. Conception).”

48-Hour Chronic Germination and Germ Tube Length *Macrocystis pyrifera* Test Method

- A required MSD of <20% for both germination and germ tube length was added to the TAC.
- The “Renewal Frequency” row was removed.

48-Hour Chronic Larval Development *Mytilus galloprovincialis* and *M. spp.* Test Method

- A required MSD of <25% for normal shell development was added to the TAC.
- The organism per replicate range was changed to 15 – 20 per mL.

- The endpoint was rewritten.
- Removed “Renewal Frequency” row.
- The temperature range was changed to “15 °C or 18 °C ± 1 °C.”

72-Hour Chronic Embryo Development *Strongylocentrotus purpuratus* and *Dendraster excentricus* Test Method

- A required MSD of <25% for embryo development was added to the TAC.
- Removed “Renewal Frequency” row.
- The temperature range was changed to “15 °C or 18 °C ± 1 °C.”
- Test chamber size was changed to 20 mL.

20-Minute Chronic Fertilization *Strongylocentrotus purpuratus* and *Dendraster excentricus* Test Method

- A required MSD of <25% for egg fertilization was added to the TAC.
- The age at test initiation was changed to “<1 hour, post fertilization.”
- The organism per replicate was changed to “~1,120 eggs and not more than 3,360,000 sperm per test tube.”
- The “Renewal Frequency” row was removed.
- The temperature range was changed to “12 °C or 15 °C ± 1 °C.”
- Test chamber size was changed to 20 mL.
- The minimum sample volume was changed to 1 L.

FRESHWATER SEDIMENT TOXICITY TEST METHODS

- A 10-day chronic *Chironomus dilutus* survival and growth test method was added.

10-Day Chronic Survival and Growth *Hyalella azteca* Test Method

- Renewal frequency was changed to “100% twice daily renewal.”
- Feeding regime was changed to “1.5 mL YCT every other day.”
- Laboratory control water was changed to “culture water, well water, surface water, site water, or reconstituted water.”
- The sediment control language was reworded.
- Temperature was added to the daily overlying water chemistry requirements.
- The initial DO range was changed to “>2.5 mg/L.”

MARINE SEDIMENT TOXICITY TEST METHODS

- All “Test Types” have been re-labeled “whole sediment, static non-renewal.”
- The “Renewal Frequency” row was removed from all test methods.

Revisions to the Measurement Quality Objectives for Acute and Chronic Toxicity Tests

- A 48-hour chronic *Mytilus galloprovincialis* larval development test method was added.
- A 72-hour chronic *Strongylocentrotus purpuratus* larval development test was added.

10-Day Acute Survival *Ampelisca abdita* Test Method

- The temperature range was changed to “20 °C ± 1°C; the time-weighted average of daily temperature readings must be within 1 °C of the desired temperature.”
- The initial DO range was changed to >90% saturation.

10-Day Acute Survival *Eohaustorius estuarius* Test Method

- The temperature range was changed to “15 °C ± 1 °C; the time-weighted average of daily temperature readings must be within 1 °C of the desired temperature.”
- The initial DO range was changed to >90% saturation.