

Chronic Marine Water Toxicity Testing

A list of species and tests included in this category may be found in the associated [QAPrPTableReference](#).

Terms appearing in the tables are defined in the [Surface Water Ambient Monitoring Program Quality Assurance Program Plan](#), which contains a glossary (Appendix E), as well as a list of abbreviations and acronyms (Appendix F).

Table 1: Quality Control¹: Chronic Marine Water Toxicity Testing

Negative Controls	Frequency of Analysis	Control Limits
Laboratory Control Water	Laboratory control water consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch.	Laboratory control water must meet all test acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Conductivity/Salinity Control Water	A conductivity or salinity control must be tested when these parameters are above or below the species tolerance.	Follow EPA guidance on interpreting data and refer to tables below for tolerance ranges.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch (e.g., pH adjustments, continuous aeration).	There must be no statistical difference between the laboratory control water and each additional control water within an analytical batch.
Sediment Control	Sediment control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests.	Sediment control must meet all data acceptability criteria (please refer to Section 7 of the appropriate EPA method/manual) for the species of interest.
Positive Controls	Frequency of Analysis	Control Limits
Reference Toxicant Tests	Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species.	Last plotted data point (LC50 or EC50) must be within 2 SD 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. An out of control reference toxicant test result does not necessarily invalidate associated test results. More frequent and/or concurrent reference toxicant testing may be advantageous if recent problems have been identified in testing.

¹Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 1: Quality Control¹: Chronic Marine Water Toxicity Testing (continued)

Field Quality Control	Frequency of Analysis	Control Limits
Sample Duplicate	5% of total project sample count	Recommended acceptable RPD<20%
Field Blanks	Based on project requirements	No statistical difference between the laboratory control water (or sediment control) and the field blank within an analytical batch
Bottle Blanks	Based on project requirements	No statistical difference between the laboratory control water and the equipment blank within an analytical batch

¹Unless method specifies more stringent requirements.

In special cases where the criteria listed in the above tables cannot be met, EPA minimum criteria may be followed. The affected data should be flagged accordingly.

Test data are reviewed to verify that the test acceptability criteria for a valid test have been met. Any test not meeting the minimum test acceptability criteria is considered invalid. All invalid tests should be repeated with the newly collected sample. If this is not possible, the test should be repeated with an archived sample and all tests must be properly flagged.

Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result. Before rejecting or accepting a test result as valid, the reviewer should consider the degree of the deviation and the potential or observed impact of the deviation on the test result. For example, if dissolved oxygen is measured below 4.0 mg/L in one test chamber, the reviewer should consider whether any observed mortality in that test chamber corresponded with the drop in dissolved oxygen.

Table 2: Corrective Action: Chronic Marine Water Toxicity Testing

Negative Controls	Corrective Action
Laboratory Control Water	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for the earliest possible receipt. Retests must be initiated within 30 hours of receipt, depending on the need for organism acclimation. The laboratory should try to determine the source of the control failure, document the investigation, and document the steps taken to prevent a recurrence.
Conductivity/Salinity Control Water	Affected samples and associated quality control must be flagged.
Additional Control Water	Based on the objectives of the study, a water sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence. This is not applicable for TIE method blanks.
Sediment Control	Based on the objectives of the study, a sediment sample that has similar qualities to the test sample may be used as an additional control. Results that show statistical differences from the laboratory control should be flagged. The laboratory should try to determine the source of variation, document the investigation, and document the steps taken to prevent a recurrence.
Positive Controls	Corrective Action
Reference Toxicant Tests	If the LC50 exceeds +/- two standard deviations of the running mean of the last 20 reference toxicant tests, the test should be flagged.
Field Quality Control	Corrective Action
Field Duplicate	For duplicates with a heterogeneous matrix, results that do not meet SWAMP criteria should be flagged. The project coordinator should be notified so that the sampling team can identify the source of variation and perform corrective action prior to the next sampling event.
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 action prior to the next sampling event.
Equipment 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 action prior to the next sampling event.

Table 3: Chronic Marine Water Testing: 7-Day Survival and Growth *Atherinops affinis* Toxicity Test

Method Recommendation	
EPA/600/R-95/136 (Test Method 1006.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥80% survival in controls, 0.85 mg average weight of original control larvae
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static renewal
Age at Test Initiation	9 – 15 days post-hatch
Replication at Test Initiation	5 (minimum)
Organisms/Replicate	5 (minimum)
Food Source	Newly-hatched <i>Artemia</i> nauplii
Renewal Frequency	Daily
Test Duration	7 days
Endpoints	Survival and growth (biomass)
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	5-36 ± 2 ‰
Temperature Range	20 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 µE/m ² /s OR 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	600 mL
Replicate Volume	200 mL
Feeding Regime	Twice daily
Laboratory Control Water	Dilution water should be 1-µm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	8 L for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, salinity, pH, ammonia, and temperature measurement per sample and per dilution
Daily Water Chemistry	One final DO measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample and per dilution (One DO per renewal)
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 5 or greater than 36 ppt.
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours @ 0 - 6 °C; dark

¹Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 4: Chronic Marine Water Testing: 7-Day Survival and Growth *Holmesimysis costata* Test

Method Recommendation	
EPA/600/R-95/136 (Test Method 1007.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥75% survival, average dry weight ≥0.40 µg in the controls
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static renewal
Age at Test Initiation	3 - 4 days post-hatch juveniles
Replication at Test Initiation	5 (minimum)
Organisms/Replicate	5 (minimum)
Food Source	Newly hatched <i>Artemia</i> nauplii (< 24 hours old)
Renewal Frequency	75% renewal at 48 hours and 96 h
Test Duration	7 days
Endpoints	Survival and growth (biomass)
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	34 ± 2‰
Temperature Range	15 ± 1.5 °C (±3 °C required)
Light Intensity	10 – 20 µE/m ² /s OR 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	1000 mL
Replicate Volume	200 mL
Feeding Regime	Twice per day
Laboratory Control Water	Dilution water should be 1-µm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	3 L for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, and temperature measurement per sample and per dilution
Initial Unionized Ammonia	One measurement per sample
Daily Water Chemistry	One final DO and temperature measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample and per dilution (One DO per renewal)
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 32 or greater than 36 ppt
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours @ 0 - 6 °C; dark

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²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 5: Chronic Marine Water Testing: 48-Hour Larval Development *Haliotis rufescens* Test

Method Recommendation	
EPA/600/R-95/136 (Test Method 995) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥80% normal shell development in the controls
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static non-renewal
Age at Test Initiation	n/a
Replication at Test Initiation	5 (minimum)
Organisms/Replicate	5 – 10 per mL
Food Source	Do not feed
Renewal Frequency	None
Test Duration	48 h
Endpoints	Normal shell development
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	34 ± 2‰
Temperature Range	15 ± 1.0 °C (±3 °C required)
Light Intensity	10 - 20 μE/m ² /s or 50 - 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	600 mL
Replicate Volume	200 mL or per method (or small volume alternative method)
Feeding Regime	Do not feed
Laboratory Control Water	Dilution water should be 1-μm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	2 L for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, ammonia, and temperature measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 32 or greater than 36 ppt
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column, interstitial water
Sample Container Type	Amber Glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours @ 0 - 6 °C; dark

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²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 6: Chronic Marine Water Testing: 48-hour Embryo-Larval Development *Mytilus galloprovincialis* and *M. spp.* Test

Method Recommendation	
EPA/600/R-95/136 or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥50% survival, ≥90% of those must have normal shell development
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static non-renewal
Age at Test Initiation	Within 4 hours of fertilization
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	150 – 300 (15-30/mL)
Food Source	Do not feed
Renewal Frequency	None
Test Duration	48 h
Endpoints	Survival of normal live prossidoconch larvae
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	28 - 34 ± 2‰
Temperature Range	15 ± 1.5 °C (±3 °C required)
Light Intensity	10 – 20 μE/m ² /s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	20 mL
Replicate Volume	10 mL
Feeding Regime	Do not feed
Laboratory Control Water	Dilution water should be 1-μm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	1L for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, ammonia, and temperature measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 28 or greater than 36 ppt.
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column, pore water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

¹Test data are reviewed to verify that test acceptability criteria (TAC) requirements for a valid test have been met. Any test not meeting these criteria is considered invalid. All invalid tests must be repeated with a newly collected sample.

²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 7: Chronic Marine Water Testing: 72-Hour Embryo Development *Strongylocentrotus purpuratus* and *Dendraster excentricus* Test

Method Recommendation	
EPA/600/R-95/136 or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥80% normal development in the controls
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static non-renewal
Age at Test Initiation	< 1 hr post fertilization
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	250 embryos
Food Source	Do not feed
Renewal Frequency	None
Test Duration	72 h
Endpoints	Normal development; survival can be included
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	34 ± 2‰
Temperature Range	15 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 µE/m ² /s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	30 mL
Replicate Volume	10 mL
Feeding Regime	Do not feed
Laboratory Control Water	Dilution water should be 1-µm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	250 mL for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, ammonia, and temperature measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 32 or greater than 36 ppt.
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column, interstitial water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours@ 0 - 6 °C; dark

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²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 8: Chronic Marine Water Testing: 20-Minute Fertilization *Strongylocentrotus purpuratus* and *Dendraster excentricus* Test

Method Recommendation	
EPA/600/R-95/136 or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥70% egg fertilization and appropriate sperm counts in controls
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static non-renewal
Age at Test Initiation	n/a
Replication at Test Initiation	4 (minimum)
Organisms/Replicate	~1,120 eggs
Food Source	Do not feed
Renewal Frequency	None
Test Duration	40 min (20 min plus 20 min)
Endpoints	Fertilization of egg
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	34 ± 2‰
Temperature Range	12 - 15 ± 1.0 °C (±3 °C required)
Light Intensity	10 – 20 μE/m ² /s or 50 – 100 ft-c
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	20-30 mL
Replicate Volume	5 mL
Feeding Regime	Do not feed
Laboratory Control Water	Dilution water should be 1-μm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	250 mL for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, ammonia, and temperature measurement per sample
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 32 or greater than 36 ppt.
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column, interstitial water
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	<48 hours @ 0 - 6 °C; dark

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²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.

Table 9: Chronic Marine Water Testing: 48-Hour Germination and Germ-Tube Length *Macrocystis pyrifera* Test

Method Recommendation	
EPA/600/R-95/136 (Test Method 1009.0) or validated and SWAMP-approved alternative method	
Data Acceptability Requirements	
<i>Parameter</i>	<i>Criteria</i>
Test Acceptability Criteria ¹	≥70% germination in the controls, ≥10 µm germ-tube length in the controls
Data Qualification	
<i>Test Conditions</i>	<i>Required</i>
Test Type	Static non-renewal
Age at Test Initiation	n/a
Replication at Test Initiation	5
Organisms/Replicate	Add 7500 spores/mL of test solution
Food Source	Do not feed
Renewal Frequency	None
Test Duration	48 h
Endpoints	Germination and germ-tube length
<i>Test Conditions</i>	<i>Recommended²</i>
Salinity	34 ± 2‰
Temperature Range	15 ± 1.0 °C (±3 °C required)
Light Intensity	50 ± 10 µE/m ² /s
Photoperiod	16 hours of ambient laboratory light, 8 hours dark
Test Chamber Size	600 mL
Replicate Volume	200 mL
Feeding Regime	Do not feed
Laboratory Control Water	Dilution water should be 1-µm filtered natural seawater or hyper-saline brine prepared from uncontaminated natural seawater plus reagent water
Minimum Sample Volume	2 L for one-time grab sample
<i>Sensitivity</i>	<i>Performance Criteria</i>
Reference Toxicant Testing	See Table 2
Water Chemistry	
<i>Test Parameter</i>	<i>Required Frequency</i>
Initial Water Chemistry	One DO, pH, salinity, ammonia, and temperature measurement per sample
Final Water Chemistry	One DO, pH, salinity, and temperature measurement per sample
<i>Test Parameter</i>	<i>Recommended Criteria</i>
Initial DO Range	4.0 mg/L - 100% Saturation
Salinity Control	Include appropriate controls if salinity is less than 32 or greater than 36 ppt.
Sample Handling/Collection	
<i>Test Parameter</i>	<i>Recommended Conditions</i>
Relevant Media	Water column
Sample Container Type	Amber glass
Sample Preservation	Wet or blue ice in field, 0 - 6 °C refrigeration in laboratory, dark at all times
Sample Receipt Temperature	0 - 6 °C
Holding Time	< 48 hours @ 0 - 6 °C; dark

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²Deviations from the summary of recommended test conditions must be evaluated on a project-specific basis to determine the validity of test results. Depending on the degree of the departure and the objective of the test, deviations from recommended conditions may or may not invalidate a test result.