

AQUATIC TOXICITY

TERMS AND ACRONYMS USED IN AQUATIC TOXICITY

The **acute Whole Effluent Toxicity (WET) test** is short term, generally 4 days or less, usually with multiple concentrations. Mortality is the response measured.

The **chronic WET test** runs for a longer period of time, generally 7 days but may be longer, measuring continuous long-term effects such as reproduction for the Ceriodaphnia dubia and growth in the fathead minnow. The chronic test also tests for mortality and may have multiple or single concentrations.

Test conditions and durations of the WET tests vary with the National Pollutant Discharge Elimination System (NPDES) permits. Methods and procedures used to test effluents are strictly defined by the EPA guidelines and Region VIII requirements.

Test organisms	
Ceriodaphnia dubia	A small invertebrate commonly known as a "water flea" and found throughout most of the aquatic world.
Pimephales promelas	More popularly known as the "fathead minnow", is widely distributed in North America.
Both animals are raised in-house to maintain a readily available source of healthy test organisms. These test organisms are used in Whole Effluent Toxicity (WET) testing for both acute and chronic tests.	

Terms and Acronyms	
Acute	A stimulus that lasts a brief time. Acute aquatic toxicity tests last 48 hours for Ceriodaphnia dubia and 96 hours for fathead minnows. Mortality is the response measured.
Bioassay	A test used to evaluate the relative potency of a chemical by comparing its effect on a living organism with respect to a "standard" control.
CO ₂	Carbon Dioxide
Chronic	A stimulus that lingers. In the case of the ceriodaphnia, the toxicity test continues until 3 broods are born in 60% of the control population. Average number of young is the response measured. Fathead minnow chronic tests last seven days. Growth weight is the response measured.
Composite sample	Effluent water that is caught over a continuous period of recorded time by a trickle, or by use of an auto sampling device. It may also be a series of grab samples taken at recorded time intervals and blended into a single sample.
Control	A treatment in a toxicity test that duplicates all the conditions of the exposure treatments but contains no test material.
Dilution Water	(diluent) Water used to dilute the test water in an aquatic toxicity test in order to prepare different percentages of an effluent. Can be reconstituted or receiving water.
Effluent	A liquid industrial discharge or sewage, which may be released to the environment.

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TERMS AND ACRONYMS USED IN AQUATIC TOXICITY, continued

Terms and Acronyms, continued	
Flow-Thru (system)	An exposure system for aquatic toxicity tests in which the test solutions and control water flow into and out of test chambers or flumes on a once-through basis either intermittently or continuously.
Grab sample	Effluent or dilution water that is caught in the briefest possible time it takes to fill the rinsed container.
IC	Inhibition Concentration – A point estimation of the chemical concentration that would cause a given percent reduction (e.g. IC ₂₅) in a non-lethal biological measurement of the test organisms, such as reproduction or growth.
IC25	Inhibition Concentration – (Causes 25% reduction in reproduction of growth)
LC50	Lethal Concentration: 50% - The concentration of pollutant in water to which test organisms are exposed that is statistically or observably estimated to be lethal to 50% of the test organisms.
LOEC	Least Observable Effect Concentration - The lowest concentration in a dilution series having a statistically significant toxic effect (death, reduced fecundity, or curtailed growth) on an exposed population of test organisms when compared to the controls.
NOEC	No Observable Effect Concentration - The highest concentration of a pollutant in a toxicity test that has no statistically significant adverse effect (death, reduced fecundity, or curtailed growth) on the exposed population of test organisms when compared to the controls.
NPDES	National Pollutant Discharge Elimination System
Non-Renewal	Implies that once a toxicity test is set up, it remains undisturbed and unreplaced throughout its total time interval.
Receiving Water	(influent) This is the water that the industry/city obtains for its use before it is processed and becomes effluent.
Reconstituted Water	A water used in culturing and testing animals prepared with deionized water and reagent grade chemicals.
Renewal	Implies that the controls and dilution waters are replaced each 24 hours of a static toxicity test.
Screen Test	A preliminary test used to estimate the concentrations to be used in a real test or to observe consistency of an effluent on a routine basis. This test is available and priced according to requirements of the client.
Static (system)	An exposure system for aquatic toxicity tests in which the test chambers contain still solutions of test materials and controls. Tests are static renewal or static non-renewal.
T.C.P.	Toxicity Confirmation Procedures
T.I.E.	Toxicity Identification Evaluation
T.R.E.	Toxicity Reduction Evaluation
TU	Toxic Unit – A standard mechanism for quantifying whole effluent toxicity. The TU increases as toxicity increases. Acute Toxic Unit (TU _a) is 100/LC ₅₀ . Chronic Toxic Unit is 100/IC ₂₅ or 100/NOEC.
Toxicity Test	Determines the adverse toxic effects of a test material at a specific stimulus level or concentration using living organisms.
WET	Whole Effluent Toxicity
Zero Headspace	When a lid is placed on a container so that no airspace or air bubbles exist below it.

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1. ACUTE TOXICITY

TEST	AMOUNT OF EFFLUENT	AMOUNT OF RECEIVING WATER ⁽¹⁾
Acute Tests, Single Species		
48 hour <i>Ceriodaphnia dubia</i> 5 concentrations + control 4 replicates per concentration daily renewal	1 gallon	1 gallon
96-hour fathead minnow 5 concentrations + control 2 replicates per concentration daily renewal.	2-3 gallons ⁽⁴⁾	2-3 gallons ⁽⁴⁾
48-hour fathead minnow 5 concentrations + control 2 replicates per concentration daily renewal.	1 gallon	1 gallon
Acute Tests, 2 Species		
48 hour <i>Ceriodaphnia dubia</i> and 96 hour fathead minnow Test conditions as above	2-3 gallons ⁽⁴⁾	2-3 gallons ⁽⁴⁾
Reduced Acute Tests		
48 hour <i>Ceriodaphnia dubia</i> OR 96 hour fathead minnow 1 concentration + control 4 replicates (<i>Ceriodaphnia dubia</i>) 4 replicates (fathead minnow) daily renewal	1 gallon	1 gallon
As above with CO₂ headspace pH control, available		
Non-renewal acute toxicity tests are one-half available		
If Dissolved Oxygen is <4.00 mg/L Aeration is required, available		

2. CHRONIC TOXICITY

TEST	AMOUNT OF EFFLUENT	AMOUNT OF RECEIVING WATER ⁽¹⁾
Short-term Chronic Tests, Single Species ⁽²⁾		
7 day fathead minnow 5 concentrations + control 4 replicates per concentration daily renewal	3-7 gallons total ⁽⁶⁾	3-8 gallons total ⁽⁶⁾
7 day <i>Ceriodaphnia dubia</i> 5 concentrations + control 10 replicates per concentration daily renewal	3 gallon total	2 gallons total

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2. CHRONIC TOXICITY, continued

TEST	AMOUNT OF EFFLUENT	AMOUNT OF RECEIVING WATER ⁽¹⁾
Short-term Chronic Tests, 2 Species ⁽²⁾		
7 day fathead minnow and <u>Ceriodaphnia dubia</u> test conditions same as 7 day fathead	3-7 gallons total ⁽⁶⁾	3-8 gallons total ⁽⁶⁾
Reduced Chronic Tests ⁽²⁾		
7 day fathead minnow 1 concentration + control 4 replicates per concentration daily renewal	(3)	(3)
7 day <u>Ceriodaphnia dubia</u> 1 concentration + control 10 replicates per concentration daily renewal	(3)	(3)
Reduced Chronic Tests, 2 Species ⁽²⁾		
7 day fathead minnow and <u>Ceriodaphnia dubia</u> - test conditions as above	(3)	(3)
As above with CO₂ headspace pH control, available		

3. Wyoming CBNG Toxicity

TEST	AMOUNT OF EFFLUENT
Acute Tests, Single Species	
48 hour Daphnia Magna 5 concentrations + control 5 replicates per concentration daily renewal	1 gallon
96-hour fathead minnow 5 concentrations + control 5 replicates per concentration daily renewal.	4 gallons
Acute Tests, 2 Species	
48 hour Daphnia Magna and 96 hour fathead minnow Test conditions as above	4 gallons
Short-term Chronic Tests, Single Species ⁽²⁾	
7 day fathead minnow 5 concentrations + control 5 replicates per concentration daily renewal	7 gallons total
As above with CO₂ headspace pH control, available	

NOTES:

⁽¹⁾ First priority for diluent should be the receiving waters. If that is unsuitable, then moderately hard (80-100, expressed as mg CaCO₃/L) reconstituted water should be used for diluent.

⁽²⁾ Chronic tests require 3 effluent samples delivered every other day. Receiving water sample is taken only once at the beginning of the test.

⁽³⁾ Effluent and receiving water demands are determined by the concentration required by NPDES permit.

⁽⁴⁾ Amount of effluent and receiving water determined by evaluations performed

⁽⁵⁾ Because the bulk of the analysis effort for this testing is spent during the first day, tests that need to be cancelled before completion will be charged a minimum of 75% of the fee.

⁽⁶⁾ Amount depends on dilutions/concentrations required by permit