

5.2.2 Effluent Limits/WET Tests/Chronic WET tests

Applicability:

Describes procedures for implementing Whole Effluent Toxicity (WET) Test requirements found in 10 CSR 20-7.015(9)(L). At permit issuance or renewal, the department will use valid and representative data to establish on a case-by-case basis, whether a discharge causes, has the reasonable potential to cause or contributes to an excursion from general water quality criteria. The Water Quality Standards General Criteria, in particular 10 CSR 20-7.031(4)(D), (F) and (G), support careful examination of the toxicity, or potential toxicity of contaminant discharges. Acute WET tests can apply to certain facilities; see section 5.2.1 of this Manual for Acute WET applicability.

Content:

WET tests measure the degree of response of exposed aquatic test organisms to an effluent sample or a sample mixture of some proportion of effluent with control water (e.g., laboratory water or a non-toxic receiving water sample). WET testing is used as a second approach, in addition to the chemical-specific approach, to implementing water quality standards in NPDES permits. For more information on developing chemical-specific water quality based effluent limits see section 5.4.

Under 10 CSR 20-6.010(8)(A)4, WET tests are required to be performed by specialists who are properly trained in conducting the test according to the methods prescribed by the Federal Government as referenced in 40 CFR 136. Further, the EPA Guidance Manual, "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters for Freshwater and Marine Organisms" specifies, "These methods are restricted to use by, or under the supervision of, analysts experienced in the use or conduct of, and interpretation of data from, aquatic toxicity tests. Each analyst must demonstrate the ability to generate acceptable test results with the methods using the procedures described in this methods manual."

Chronic WET tests shall be 7-day, static, renewal tests to determine the degree at which exposure to the effluent is chronically toxic to aquatic life. The endpoint for the chronic test expressed as an IC25 (the percent of effluent that has an inhibitory effect on 25% percent of the exposed test organisms). A chronic toxic unit is equal to 100/IC25.

Determining Applicability of Chronic WET Test Requirement

The following types of facilities shall receive either toxic unit monitoring or numeric chronic toxic unit (TUc) limits upon permit issuance or renewal. Numeric limits shall only apply when the permit writer has determined that there is potential to exceed EPA's recommended chronic criterion of 1.0 TUc or the Missouri Water Quality Standard general toxicity criteria.

- Municipal wastewater treatment plants (WWTPs) with a design flow of greater than 1.0 million gallons per day.
- Discharges with pollutants that pose a strong probability of causing chronic toxicity, such as pesticides or certain other chemicals may be required to conduct chronic WET tests regardless of dilution.
- Industrial dischargers with toxic parameters in the discharge; that may alter production processes; or facilities which handle large quantities of toxic substances or substances that are toxic in large amounts shall conduct chronic WET.

- Chronic WET tests do not normally apply to stormwater discharges due to their intermittent nature.
- Where no mixing is allowed the acute aquatic life criterion of 0.3 TUa applies at the end of the pipe. However, when using an LC50 as the test endpoint, the acute toxicity test has an upper sensitivity level of 100% effluent, or 1.0 TUa. If less than 50% of the test organisms die at 100% effluent, the true LC50 value for the effluent cannot be measured, effectively acting as a detection limit. On a case-by-case basis, a permit writer may determine that a chronic test is necessary to quantify effluent toxicity when the acute test is insufficiently sensitive.

Determining Test Type & Duration

The suitability of test type and the test duration is usually determined during permit issuance or renewal (see 5.4.1 and 5.4.2 of the Permit Manual). Species and short-term test methods for estimating the acute toxicity of NPDES effluents are found in the fifth edition of *Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/013, 2002; Table IA, 40 CFR Part 136). For Chronic WET Tests, the duration of the test may be assigned as either 7 days or 96 hours. In most cases, a 7-day, static, renewal test is assigned.

Test Species

- All WET tests shall be performed with at least two (2) representative, diverse species. 10 CSR 20-7.015(9)(L)4.B. specifies that all WET tests shall be performed with *Pimephales promelas* (fathead minnow) and *Ceriodaphnia dubia* (water flea), except facilities which discharge to receiving streams designated as cold-water fisheries.
- Facilities which discharge to receiving streams designated as cold-water fisheries may be required to perform WET tests using *Oncorhynchus mykiss* (rainbow trout) instead of the fathead minnow.
- Other test species for which test methods are provided in 40 CFR 136.3 may be approved on a case-by-case basis. Alternative species can be approved in accordance with the procedures found in 40 CFR 136.4.

Sample Type

Chronic WET testing sample type should be the same as that used for BOD and TSS in Table A of the permit, unless there is additional justification for modifying the WET sample type.

Test Interval and Scheduling

The testing schedule and interval shall be determined at permit issuance or renewal or using the permit writer's best professional judgment within the confines of this guidance. WET tests shall generally be scheduled to coincide with environmental concerns that are dependent upon the nature of the discharge.

- Municipal WWTPs with a design flow of greater than 1.0 million gallons per day, but less than 10 million gallons per day, shall conduct and submit to the Department a chronic WET test no less than once per permit cycle. This is in addition to annual acute test requirements, acute testing is not required during the year of the chronic test. These minimum testing frequencies may be increased based on toxic parameters present in a facility's in the effluent, demonstrated toxicity in previous WET tests, or based on impacts to the receiving stream.

- Municipal WWTPs with a design flow of greater than 10 million gallons per day), and which have less than 15:1 dilution available in mixing zone shall conduct and submit to the department a chronic WET test no less than once per year.
- For industrial dischargers with toxic parameters in the discharge; that may alter production processes; or facilities which handle large quantities of toxic substances or substances that are toxic in large amounts, the permit writer shall use best professional judgment to schedule chronic WET tests at times of increased potential for toxicity.

EPA's Technical Support Document for Water Quality Based Toxics Control (TSD) recommends a frequency of once in three years. This guidance may apply to situations that are not addressed by department policy outlined above.

Determining Reasonable Potential

When sufficient data are available, the permit writer shall conduct a reasonable potential analysis (RPA) on numeric WET test data according to the EPA's Technical Support Document for Water Quality Based Toxics Control (TSD). However, the TSD recommends a minimum data set of 10 points for conducting site-specific RPAs. In many cases the permit writer will not have adequate numeric data available to conduct a statistically sound RPA, but may be able to make a reasonable potential determination based on other available information. When the permit writer does identify a facility with reasonable potential to exceed the acute criterion, a numeric TUc limit should be applied. Factors that may indicate the reasonable potential to exceed the acute criterion include:

- A past exceedance of the chronic aquatic life criterion of 1.0 TUc.
- TUc results exceeding previous permit limits.
- Documented compliance problems that indicate effluent toxicity.
- Biological community impairments in the receiving stream.
- Toxic materials at the facility that are not subject to water quality standards.
- Multiple toxic materials at the facility that may interact or accumulate in a manner that causes toxicity.

These factors, individually or in combination, may allow the permit writer to make a best professional judgment decision to determine reasonable potential exists to violate general water quality criteria found in 10 CSR 20-7.031(3)(D), (F) and (G). The application of numeric TUa limits shall be justified in the permit fact sheet. Information on past WET test results can be found in the WET test Access Database located at T:\WET Test database\converted toxicity. Scanned results may also be available in the permit folder on the T: drive. Permit writers should use these resources to support reasonable potential determinations.

When there is insufficient information to determine reasonable potential, the permit writer shall apply monitoring only. If a facility wants to make a demonstration of no reasonable potential, they may conduct additional testing and submit a minimum of 10 results for consideration.

Calculating Allowable Effluent Concentration and Dilution Series

Allowable effluent concentration (AEC) establishes the instream effluent concentration of interest. It is the concentration of effluent found in the stream after mixing. 10 CSR 20-7.015(9)(L)4. requires a dilution series be established based on the AEC. Facilities that discharge to unclassified, Class C, Class P with default mixing considerations, or Lakes [10 CSR 20-7.031(4)(A)4.B.(IV)(b)] have an AEC of 100% and the dilution series is 100%, 50%, 25%, 12.5%, & 6.25%. Facilities that discharge to classified P streams with more than default mixing

allowances shall have an AEC that considers the zone of initial dilution (ZID). Acute AEC is calculated as follows:

$$\text{Acute AEC\%} = ((\text{design flow}_{\text{cfs}} + \text{ZID}_{7\text{Q}10}) / \text{design flow}_{\text{cfs}})^{-1} \times 100 = \text{##\%}$$

When mixing is allowed, specify a dilution series that brackets the AEC. The recommended default series (100%, 50%, 25%, 12.5%, & 6.25%) should be used to bracket the AEC. The AEC should replace the concentration it is closest to, for example, if AEC = 35%, the dilution series should be 100%, 50%, 35%, 12.5% & 6.25%. If the AEC is less than 12.5, in which case choose 100% effluent, 50%, 25%, AEC and ½ AEC.

Calculating Permit Limits

In cases where there is insufficient information to make a reasonable potential determination, the permit writer should apply a monitoring only requirement for WET test. When the permit writer can determine that there is reasonable potential to exceed the criterion, a water quality based effluent limit for WET should apply. The permit should specify that monitoring results are reported in acute toxic units. Wasteload allocations can be calculated using EPA's recommended chronic aquatic life criterion is 1.0 TUc.

1. Wasteload allocations are calculated where applicable using water quality criteria or water quality model results and the dilution equation below:

Where: C = downstream concentration

Cs = upstream concentration (default assumption = 0)

Qs = upstream flow

Ce = effluent concentration

Qe = effluent flow

Chronic WLA: $C_e = ((1.55 + 0.0)1.0 - (0.0 * 0.0))/1.55$
 $C_e = 1.0 \text{ TUc}$

In order to compare the chronic WLA to the Acute WLA, the acute WLA needs to be converted to chronic toxic units. The acute WLA is converted by multiplying by an acute-to-chronic ratio (ACR). Optimally, this ratio is based on effluent data. Otherwise a default value of 10 is used per the TSD.

Acute WLA: $C_e = ((Q_e + Q_s)0.3 - (C_s * Q_s))/Q_e$ (EPA/505/2-90-001, Section 4.5.5)
 $C_e = 0.3 \text{ TUa} * 10 = 3.0 \text{ TUa,c}$

2. Determine the Long-Term Average (LTA)

If the permit writer has a minimum of 10 data points a site-specific coefficient of variation (CV) shall be calculated; otherwise a default value of 0.6 is used per the TSD.

$$\text{LTA}_c = 1.0 (0.527) = \mathbf{0.527 \text{ TUc}} \quad [\text{CV} = 0.6, 99^{\text{th}} \text{ Percentile}]$$

$$\text{LTA}_{a,c} = 3.0 (0.321) = 0.963 \text{ TUa,c} \quad [\text{CV} = 0.6, 99^{\text{th}} \text{ Percentile}]$$

3. Determine Permit Limits

Use the most protective long-term average.

MDL = 0.527 (3.11) = **1.64 TUc**
Percentile]

[CV = 0.6, 99th

PERMIT LANGUAGE

For Missouri State Operating Permits, standard language has been developed and approved for inclusion with all permits for which a WET test is required. It is mandatory that this standardized language is used for new permits and that any permits that are renewed have their old language replaced with the new, standardized language. This WET test language can be found on the T: drive at T:_PERMITTING DOCUMENTS\Draft Permit Templates\4_WET Test Language.

REPORTING WET TEST RESULTS

A standard form for use by permittees to report the results of WET tests to the agency shall be utilized by all permittees in reporting WET test results. Submission of the completed form is a permit requirement. The form will be provided to the permittee along with discharge monitoring report (DMR) forms at the time of permit issuance or renewal. The form and the laboratory report shall be submitted with the permittee's DMRs. Permittee's using eDMR shall enter numeric TUc results and upload lab reports to the internet page. The form includes the minimum reporting requirements for successful completion of a WET test as mandated by 40 CFR 136 and explained in the most current edition of "Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms".

Legal References:

Code of State Regulations:

10 CSR 20-7.031(3)(D), (F), (G), (I)2.A & B,	Water Quality Standards - General Criteria (D) Toxicity to Humans, Animals or Aquatic Life (F) Acute toxicity to Livestock or Wildlife (G) Impairments to Natural Biological Community (I)2.A & B - Mixing Zones and Unclassified Waters Criteria (WET Tests)
10 CSR 20-7.031(4)(A)5	Water Quality Standards - Specific Criteria - Chronic Toxicity
10 CSR 20-7.015(9)(L)	WET Test Requirements

Code of Federal Regulations

40 CFR Part 136	Guidelines Establishing Test Procedures for the Analysis of Pollutants
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United States Statutes

Clean Water Act, Section
101(a)(3)

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