

5.2.1 Effluent Limits/Acute 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. Chronic WET tests can apply to certain facilities; see section 5.2.2 of this Manual for Chronic 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, "Methods for Measuring Acute 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."

Acute WET tests shall be multiple dilution, static, non-renewal tests to determine the degree at which exposure to the effluent is acutely toxic to aquatic life. The endpoint for an acute test shall be expressed as an LC50 (the percent of effluent that is lethal to 50 percent of the exposed test organisms). An acute toxic unit is equal to 100/LC50.

Determining Applicability of Acute WET Test Requirement

The following types of facilities shall receive either toxic unit monitoring or a numeric acute toxic unit (TUa) 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 acute criterion of 0.3 TUa or the Missouri Water Quality Standard general toxicity criteria.

- Municipal or domestic sewage facility with an outfall design flow greater than or equal to 22,500 gallons per day (GPD).
- Municipal or domestic sewage facility that exceeds its design population equivalent (PE) for BOD₅ whether or not its design flow is being exceeded
- A facility that routinely exceeds their design flow

- A facility that has water quality-based effluent limitations for toxic substances (other than ammonia)
- A facility, whether primarily domestic or industrial, that is subject to production process alterations throughout the year; or handles large quantities of toxic substances, or substances that are toxic in large amounts
- A facility where the permit writer has determined there is reasonable potential for the discharge to be toxic to aquatic life.
- A stormwater discharge where the permit writer has determined there is reasonable potential for the discharge to be toxic to aquatic life. WET should not be applied to all stormwater discharges, only to those for which additional factors are identified that justify WET monitoring or limits, such as those found below under “Determining Reasonable Potential.”

Determining Test Type & Duration

The suitability of test type and the test duration is 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 Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012, 2002; Table IA, 40 CFR Part 136). For Acute WET Tests, the duration of the test may be assigned as either 48 hours or 96 hours. In most cases, a 48-hour test is assigned. The 96-hour test duration is usually reserved for special cases, such as the treatment technology used or type of waste is not completely understood, or in situations where a 48-hour test is otherwise deemed unsuitable to satisfy concerns for aquatic life protection.

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

- For WET testing of continuous discharges, the 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.
- For WET testing of stormwater discharges, a grab sample shall be required to be collected for analysis within three hours of the first occurrence of discharge or runoff. In most cases a 24-hour composite sample is not appropriate for stormwater discharges.

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.

- A municipal or domestic sewage facility with an outfall design flow greater than or equal to 22,500 gallons per day (GPD), but less than 1.0 million gallons per day (MGD) shall conduct and submit to the Department an acute WET test no less than once per permit cycle.
- A municipal or domestic sewage facility that has an outfall design flow greater than 1.0 MGD; but less than 10.0 million gallons per day (MGD), or continuously or routinely exceeds their design flow; or exceeds its design population equivalent (PE) for BOD₅ whether or not its design flow is being exceeded; or has water quality-based effluent limitations for toxic substances (other than ammonia), shall conduct and submit to the department an acute WET test no less than once per year.
- A facility, whether primarily domestic or industrial, that is subject to production processes alterations throughout the year; or handles large quantities of toxic substances, or substances that are toxic in large amounts; shall conduct and submit to the Department an acute WET test no less than once per year.
- A facility where the permit writer has determined there is reasonable potential for the discharge to be toxic to aquatic life shall conduct and submit to the Department an acute WET test no less than once per year.
- Test interval and scheduling for stormwater discharges shall be determined on a case-by-case basis. Stormwater toxicity can be fleeting and difficult to reproduce, therefore, test scheduling should be based on site-specific conditions.

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 TUa limit should be applied. Factors that may indicate the reasonable potential to exceed the acute criterion include:

- Failures reported for the pass/fail type test previously required by permits.
- Past exceedance of a numeric WET limit.
- TUa results >1 for facilities that do not have mixing available. When using an LC50 as the test endpoint, the acute toxicity test has an upper sensitivity level of 100% effluent, or 1.0 TUa. 1.0 TUa or greater shall be considered reasonable potential if no mixing is available. When mixing is available an instream wasteload allocation must be calculated to determine reasonable potential.
- A past exceedance of the acute aquatic life criterion of 0.3 TUa. Most test results will be based on an LC50 endpoint with an upper sensitivity level of 1.0 TUa. However, if there

is data available with a different endpoint that indicates exceedance of the acute criterion, it should be used to determine reasonable potential.

- 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.

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 acute aquatic life criterion is 0.3 TUa.

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

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)
 $C_e = 0.3 \text{ TUa}$

Where: C = downstream concentration

Cs = upstream concentration (default assumption = 0)

Qs = upstream flow

Ce = effluent concentration

Qe = effluent flow

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.

$$\text{LTA}_a = 0.3\text{TUa} (0.321) = 0.0963 \text{ TUa} \quad [\text{CV} = 0.6, 99^{\text{th}} \text{ Percentile}]$$

3. Determine Permit Limits

$$\text{MDL} = 0.0963\text{TUa} (3.11) = 0.3 \text{ TUa} \quad [\text{CV} = 0.6, 99^{\text{th}} \text{ Percentile}]$$

Where no mixing is allowed the acute criterion must be met 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. Therefore, when the allowable effluent concentration is 100% a limit of 1.0 TUa will apply. If greater test sensitivity is necessary, the permit writer should consider implementing chronic WET tests in the permit.

If more than 50% of the organisms survive at 100% effluent, the permittee should report TUa <1.

Schedules of Compliance

Facilities demonstrating reasonable potential that receive new limits shall be given time to comply with limits in accordance with department policy. When a facility is receiving a schedule for a toxic parameter, such as ammonia, the WET schedule of compliance should be the same as the other toxic parameter. Additional guidance on compliance schedules can be found in Section 7.1.5.

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 TUa 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 Acute 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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