

EXHIBIT 13  
ADMINISTRATIVE RECORD # 78



January 2003  
RG-194 (Revised)

# Procedures to Implement the Texas Surface Water Quality Standards

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Water Quality Division

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

# Procedures to Implement the Texas Surface Water Quality Standards

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**THIS IS A GUIDANCE DOCUMENT AND SHOULD NOT BE  
INTERPRETED AS A REPLACEMENT TO THE RULES.**

The Texas Surface Water Quality Standards may be found in  
30 Texas Administrative Code (TAC) Sections (§§) 307.1-.10.

Prepared by  
Water Quality Division

RG-194  
January 2003

# Whole Effluent Toxicity Testing (Biomonitoring)

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## Applicability

Whole effluent toxicity (WET) testing, also known as biomonitoring, is required in permits where the potential exists for the effluent to cause toxicity in the receiving water (30 TAC §307.6(e)(2)(A) and 40 CFR 122.44(d)(1)(v)). The TNRCC requires WET testing for domestic wastewater facilities with a final permitted average flow of 1 million gallons per day (MGD) or greater, most major industrial facilities, and other facilities that have the potential to cause toxicity in the receiving water.

**Domestic dischargers.** The TNRCC requires WET testing of domestic wastewater dischargers that have **any** of the following conditions:

- an average permitted flow of 1 MGD or greater
- a final phase of their permit with a design flow of 1 MGD or greater
- an approved pretreatment program with significant industrial users discharging into their collection systems
- the potential to cause toxicity in the receiving water.

Permittees with more than one flow phase in their permit begin WET testing upon expansion to 1 MGD or greater.

Complementing the WET testing requirements, the TNRCC requires all domestic dischargers with an average permitted flow equal to or greater than 1 MGD to dechlorinate their chlorinated effluent or to employ another form of disinfection. TNRCC does not require effluent dechlorination for facilities discharging directly to the Rio Grande.

**Industrial dischargers.** The TNRCC requires WET testing of:

- EPA-classified major industrial dischargers with continuous-flow outfalls
- other industrial dischargers with continuous-flow outfalls with the potential for causing toxicity.

Although the TNRCC generally does **not** require WET testing of once-through cooling water outfalls or of EPA-classified minor industrial dischargers, the TNRCC will normally require WET testing of such discharges in **any** of the following situations:

- the permittee applies water treatment chemicals or biocides
- the TNRCC determines that the effluent has the potential to cause toxicity in the receiving water
- the permit requires water-quality-based effluent limits (WQBELs) to protect aquatic life because the effluent analysis exceeded the screening criteria
- the permittee commingles other potentially toxic waste streams with the once-through cooling water
- the cooling water source and the receiving water are different water bodies.

The rest of this chapter covers the following topics:

- **types of WET tests** (chronic and 48-hour acute—page 102; 24-hour acute—page 114)
- **test acceptability criteria** (chronic and 48-hour acute—page 104; 24-hour acute—page 116)
- **test frequency** (chronic and 48-hour acute—page 105; 24-hour acute—page 116)
- **dilution series, dilution water, and type of WET tests**—page 108
- **toxicity reduction evaluations** (chronic and 48-hour acute—page 111; 24-hour acute—page 117)
- **toxicity control measures** (chronic and 48-hour acute—page 113; 24-hour acute—page 118)
- **toxicity caused by some specific pollutants**—dissolved salts (page 119), ammonia (page 123), and Diazinon (page 125).

## Chronic and 48-Hour Acute Tests

The TNRCC may require permittees to conduct 7-day chronic or 48-hour acute WET tests to measure compliance with the requirements of 30 TAC §307.6(e). Toxicity in these tests is defined as a statistically significant difference (at the 95% confidence level) between the survival, reproduction, or growth of the test organisms at or below a specified effluent dilution (the critical dilution) compared to the survival, reproduction, or growth of the test organisms in the control (0% effluent).

## Test Types

The permit will specify that tests be conducted using the latest version of the appropriate EPA method. These methods can be found in the following publications (or their most recent versions):

- *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition*, EPA-821-R-02-013, October 2002
- *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition*, EPA-821-R-02-014, October 2002
- *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition*, EPA-821-R-02-012, October 2002.

The permittee may use a revised method if one becomes available during the term of the permit. Alternate test methods are subject to EPA review and approval. Depending on the type of receiving water, the permit will specify chronic or 48-hour acute tests to assess toxicity to freshwater or saltwater organisms. The test organisms used for each type of test are listed below:

### ***Freshwater streams and lakes (salinity < 2 ppt):***

- CHRONIC** 3-brood *Ceriodaphnia dubia* (water flea) survival and reproduction test  
7-day *Pimephales promelas* (fathead minnow) larval survival and growth test
- ACUTE** 48-hour *Daphnia pulex* (water flea) survival test  
48-hour *Pimephales promelas* (fathead minnow) survival test

### ***Marine receiving water (salinity ≥ 2ppt):***

- CHRONIC** 7-day *Mysidopsis bahia* (mysid shrimp) survival and growth test  
7-day *Menidia beryllina* (inland silverside) larval survival and growth test
- ACUTE** 48-hour *Mysidopsis bahia* (mysid shrimp) survival test  
48-hour *Menidia beryllina* (inland silverside) survival test

Permittees may substitute other EPA-approved tests and species if they obtain approval from the TNRCC during the permit application process (see the sections of this document entitled "Toxicity Attributable to Dissolved Salts" on page 119 and "Site-Specific Standards for Total Toxicity" on page 145).

Typically, if the segment criterion for total dissolved solids (TDS) or the site-specific TDS concentration in the receiving water is too high to support *Ceriodaphnia dubia* or *Daphnia pulex*, *Daphnia magna* (water flea) will be substituted as the invertebrate test organism after the need to make the substitution is demonstrated. The permittee may submit evidence substantiating the need for an alternative species before or during the application process. However, draft permits with alternate tests, alternate species, or testing requirements that exclude a species are subject to EPA review and approval.

### ***Test Acceptability Criteria***

The permittee will have to repeat any toxicity test, including the control and all effluent dilutions, that fails to meet **any one** of the following criteria:

#### ***Chronic freshwater***

- a mean survival of 80% or greater in the control
- a mean number of 15 or greater water flea neonates per surviving adult in the control
- a mean dry weight of 0.25 mg or greater for surviving fathead minnow larvae in the control
- a coefficient of variation percent (CV%) of 40 or less between replicates in the control and in the critical dilution for
  - ▶ the young of surviving females in the water flea reproduction and survival test and
  - ▶ the growth and survival endpoints in the fathead minnow growth and survival test.

However, if statistically significant lethal or sublethal effects are exhibited at any dilution, a CV% greater than 40 does not invalidate the test.

- a test population of < 40% males in a single concentration or < 40% males in a whole test for the water flea reproduction test

### ***Chronic saltwater***

- a mean survival of 80% or greater in the control
- a mean dry weight of 0.20 mg or greater for surviving mysid shrimp in the control
- a mean dry weight in the control of 0.50 mg or greater for surviving unpreserved inland silverside and 0.43 mg or greater for surviving preserved inland silverside
- a CV% of 40 or less in the control and in the critical dilution in the growth and survival tests. However, if statistically significant lethal or sublethal effects are exhibited at any dilution, a CV% greater than 40 does not invalidate the test.

### ***48-hour acute freshwater and saltwater***

- a mean survival of 90% or greater in the control
- a CV% of 40 or less in the control and in the critical dilution. However, if significant lethality is demonstrated, a CV% greater than 40 does not invalidate the test.

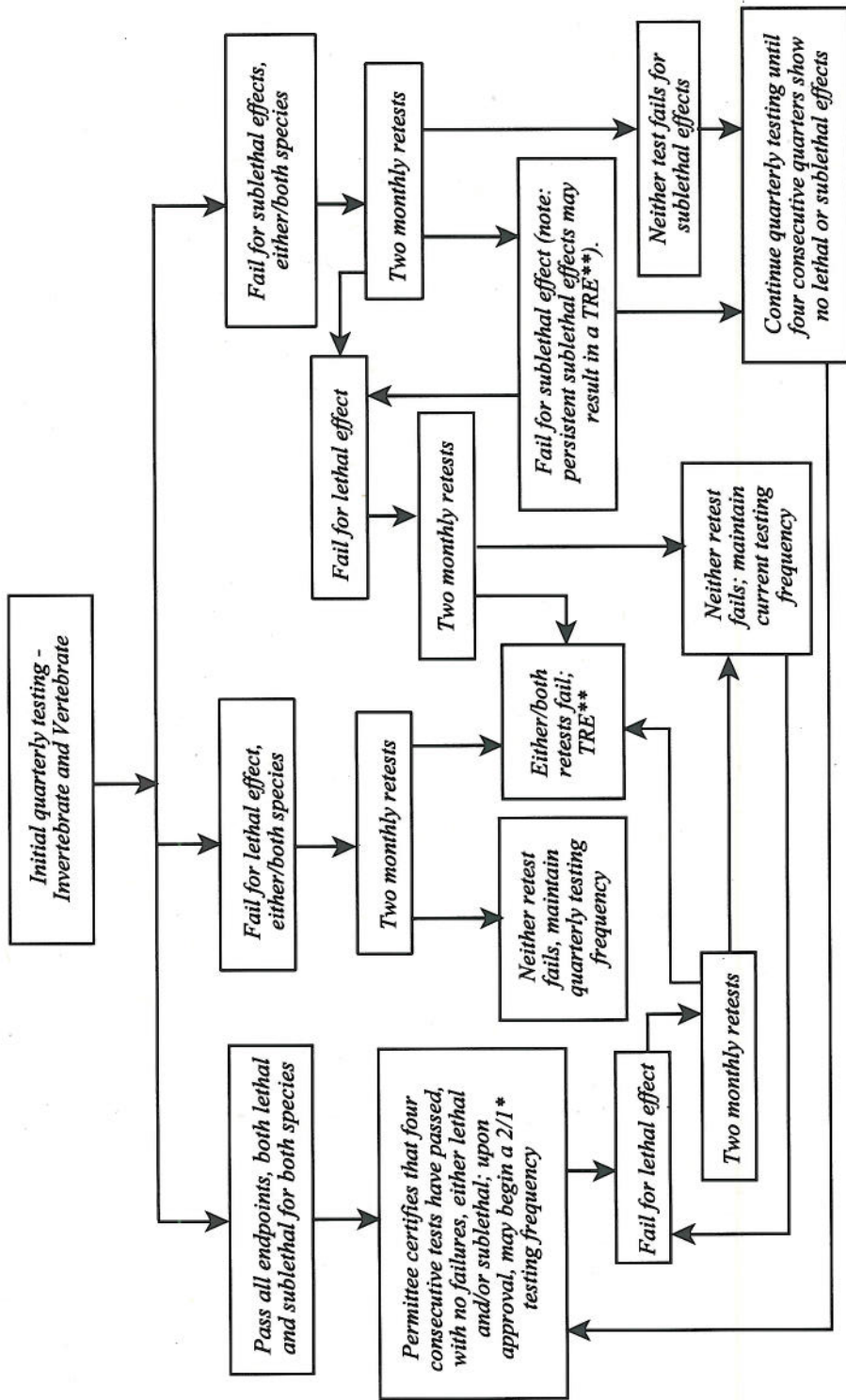
Also note that tests should be ended within a period of two hours before the appropriate test end time to two hours afterward.

## ***Test Frequencies***

***General.*** Figure 8 on page 106 illustrates the WET testing frequencies for domestic and industrial wastewater treatment facilities subject to biomonitoring requirements. Except in unusual circumstances, WET testing is performed quarterly for both the vertebrate and the invertebrate test species for the first year the permit is in effect. Quarterly testing is needed to adequately assess the variability and toxic potential of effluents. Below this minimum frequency, the chance of missing toxic events increases.

Permits issued after adoption of EPA's Post Third-Round Policy (10/01/1992) contained minimal test frequencies; these were based on intensive WET monitoring data acquired before 1992 that demonstrated an absence of toxicity. This information is now outdated because effluent additives, processes, and treatments may have changed over the long and short term. Periodic reassessment of an effluent's variability and toxic potential is needed to ensure an adequate level of protection for the receiving water.





\* 2/1 denotes testing the invertebrate species twice per year and the vertebrate species once per year.  
 \*\* Toxicity Reduction Evaluation

Figure 8. Chronic and 48-Hour WET Testing Frequencies

If control of toxicity is demonstrated by the absence of significant effects in the last four consecutive quarterly tests for both the invertebrate and the vertebrate test species, the TNRCC may, at the written request of the permittee, reduce the testing frequency to not less than once per six months for the invertebrate and not less than once per year for the vertebrate for the remainder of the permit term. This is the minimum test frequency that will be assigned. Permittees with established WET limits or who are already monitoring at a quarterly frequency for other reasons are not eligible to apply for a reduction in monitoring frequency. Different frequencies may be specified on a case-by-case basis. Due dates for test results are specified in the permit.

**Additional considerations.** Dischargers will perform quarterly testing when there is insufficient data to determine reasonable potential to cause toxicity. The TNRCC will consider additional factors in determining whether there is reasonable potential to cause toxicity, such as:

- whether the facility has an approved pretreatment program
- existing data from discharge monitoring reports
- compliance history
- whether WQBELs for the protection of aquatic life (derived from Table 1 criteria of the TSWQS) are required, based on data submitted during the application process.

The TNRCC may require more frequent WET testing for permittees that have historical WET testing problems.

**During a TRE.** The TNRCC will require all dischargers to perform WET tests at least once per quarter if they are conducting a toxicity reduction evaluation (TRE). This frequency only applies to the species that demonstrated significant lethality. For more information on TRE's, see the section entitled "Toxicity Reduction Evaluations" on page 111.

**With a WET limit.** The minimum testing frequency in a permit with a WET limit is once per quarter for five years following the effective date of the WET limit. This frequency only applies to the species to which the WET limit applies. If no significant lethal effects are demonstrated at or below the critical dilution in any tests for the affected species within five years of the effective date of the WET limit, the discharger may provide a written request to reduce the frequency to twice per year until the permit expiration date.

WET testing frequencies may be specified on a case-by-case basis where seasonal toxicity is apparent. TNRCC staff will use best professional judgement to establish testing frequencies when a chemical-specific (CS) limit or best management practice (BMP) is placed in the permit to control effluent toxicity at the conclusion of a TRE.

## ***Dilution Series, Dilution Water, and Type of WET Test***

***Dilution series.*** Chronic and 48-hour acute tests are based on the critical dilution in the receiving water. The critical dilution represents the percentage of effluent at the edge of the mixing zone during critical low-flow (that is, the 7Q2) or critical-mixing conditions. The test results at the critical dilution are statistically compared with the test results at the control dilution (0% effluent) to measure compliance. The permit specifies the critical dilution and the dilution series as well as the type of WET tests required.

The dilution series consists of four effluent concentrations in addition to the critical dilution. For domestic dischargers, the average permitted flow is normally used to calculate the critical dilution. For industrial dischargers who are renewing permits, the highest monthly average flow from the preceding two years is normally used to calculate the critical dilution. For new or expanding industrial facilities, the design flow is used to calculate the critical dilution.

***Dilution water.*** As specified in the permit, receiving water unaffected by the discharge should be used as the control and as dilution water for at least the first series of WET tests performed after a new permit is issued.

If the receiving water demonstrates pre-existing instream toxicity (by failing to meet the appropriate test acceptability criteria for survival in the control), the test is considered invalid, and a repeat test has to be performed unless all of the following conditions were met:

- a synthetic lab water control was performed in addition to the receiving water control
- the test indicating receiving water toxicity was carried out to completion
- the permittee submitted all test results indicating receiving water toxicity with the reports and information required by the permit.

Upon demonstrating that the receiving water is toxic, the permittee may, upon TNRCC approval, substitute synthetic dilution water for receiving water as the control and as dilution water in all subsequent tests for that permit term. The physical and chemical properties (for example, pH, hardness, TSS, alkalinity) of the synthetic dilution water should be similar to those of the receiving water. Permittees should submit the substitution request in writing.

***Type of test.*** The TNRCC determines what type of WET test (freshwater or marine, acute or chronic) to place in the permit based on the salinity and

critical conditions of the receiving waters. In general, TNRCC staff consider salinities at or above 2,000 mg/L (2 ppt) to represent saltwater conditions.

If the TNRCC determines that WET testing is required for a storm water discharge, TNRCC staff may use an analysis of the watershed to determine runoff volumes for dilution estimates. In addition, the TNRCC may require WET testing or other methods to protect water bodies with endangered species.

**INTERMITTENT STREAMS WITH NO SIGNIFICANT AQUATIC LIFE USE.** Permittees that discharge into intermittent streams with no significant aquatic life use will conduct 48-hour acute testing with a critical dilution of 100% effluent.

**INTERMITTENT STREAMS WITH PERENNIAL POOLS.** Permittees that discharge into intermittent streams with perennial pools will conduct chronic testing with a critical dilution of 100% effluent.

**INTERMITTENT STREAMS WITH SEASONAL AQUATIC LIFE USES.** TNRCC may require dischargers to conduct chronic testing to protect intermittent streams that may have seasonal aquatic life uses. TNRCC determines the critical dilution from the typical flows in the season in which the use occurs.

**INTERMITTENT STREAMS WITHIN THREE MILES OF A PERENNIAL FRESHWATER STREAM.** Permittees that discharge into intermittent streams that flow into a perennial stream within a moderate distance downstream (normally 3 miles) will conduct either a 48-hour acute or a chronic test. The type of test depends on the size of the discharge relative to the flow of the perennial water downstream.

If the effluent flow equals or exceeds 10% of the low-flow of the perennial water, the permittee will conduct chronic testing with a critical dilution representative of the percentage of effluent in the perennial stream during low-flow. If the effluent flow is less than 10% of the low-flow in the perennial stream, the permittee will conduct 48-hour acute toxicity tests with a critical dilution of 100% effluent. The TNRCC generally requires permittees that discharge into intermittent streams within 3 miles of a bay, estuary, or tidal river to conduct chronic marine testing.

**PERENNIAL FRESHWATER STREAMS.** Permittees that discharge directly into perennial freshwater streams or rivers with a designated or significant aquatic life use will conduct chronic testing; the critical dilution will be based on the effluent flow and critical low-flow of the stream or river. If the critical dilution is less than 5%, the TNRCC requires 48-hour acute testing and uses an acute-to-chronic ratio (ACR) of 10:1 to determine the appropriate critical dilution. The ACR is the ratio of the acute toxicity of

an effluent or toxicant to its chronic toxicity. It is used to estimate the chronic toxicity based on acute toxicity results. An ACR of 10 represents the upper 90<sup>th</sup> percentile of the ACR data available to EPA in 1991.

**LAKES.** Permittees that discharge to a lake will normally conduct chronic WET tests with a critical dilution of 15% if the effluent flow is less than or equal to 10 MGD and the mixing zone is 100 feet wide. If the effluent flow is greater than 10 MGD or if the mixing zone is less than 100 feet wide, the TNRCC typically uses the horizontal Jet Plume equation to determine the percentage of effluent at the edge of the mixing zone (see the chapter in this document entitled "Mixing Zones and Critical Conditions" on page 39). In these cases the critical dilution is generally greater than 15%. The TNRCC assigns a critical dilution of 100% effluent for discharges greater than 100 MGD.

**BAYS, ESTUARIES, AND WIDE TIDAL RIVERS.** Permittees that discharge into bays, estuaries, and wide tidal rivers ( $\geq 400$  feet across) will normally conduct chronic WET tests with a critical dilution of 8% if the effluent flow is less than or equal to 10 MGD. If the effluent flow is greater than 10 MGD, the TNRCC uses the horizontal Jet Plume equation to determine the percentage of effluent at the edge of the mixing zone (see the chapter of this document entitled "Mixing Zones and Critical Conditions" on page 39). The TNRCC assigns a critical dilution of 100% effluent for discharges greater than 100 MGD.

**NARROW TIDAL RIVERS.** Permittees that discharge into narrow tidal rivers ( $< 400$  feet across) will normally conduct chronic WET tests with the critical dilution based on upstream flow whenever flow information is available. In the absence of site-specific data such as dispersion dye studies or nearby flow measurements, the critical dilution typically is not less than 8% to ensure the same level of protection given to other marine waters. If upstream flows are not available, the horizontal Jet Plume equation is used to determine the critical dilution at the edge of the mixing zone. Critical dilutions calculated in this way are greater than 8% because the mixing zone size is less than 200 feet.

***Diffusers.*** An effluent diffuser installed at the end of a discharge pipe may increase mixing and lower critical dilutions. See the section of this document entitled "Diffusers" on page 49 for more information. The effluent percentage at the edge of the mixing zone for a diffuser discharge is usually determined through modeling. This effluent percentage, if determined to be appropriate, is normally used as the critical dilution for chronic WET testing. If the critical dilution is less than 5%, the TNRCC may instead require 48-hour acute testing using an ACR of 10:1 to determine the appropriate critical dilution.

## ***Toxicity Reduction Evaluations (TREs)***

***When is a TRE performed?*** If a permittee fails a WET test, that is, statistically significant lethality occurs to either test species exposed to effluent at or below the critical dilution, the permittee will conduct two retests. (A retest is another test performed on a sample taken on a different day.) The two retests are to be conducted monthly during the next two consecutive months. If persistent lethality is demonstrated by failure of one or both retests, the permittee will perform a TRE. Note that all test data must be submitted for review regardless of whether the test was valid or invalid.

***TRE purpose and content.*** The purpose of the TRE is to determine the cause and source of toxicity, determine methods to reduce or eliminate the toxicity, and develop a schedule for taking corrective action. Persistent sublethal effects may also have to be addressed by a TRE. Components of a TRE may include, but are not limited to:

- chemical analyses
- effluent characterization test (physical/chemical properties)
- WET tests on effluent before and after characterization test manipulations
- WET tests on effluent after chemical/physical separations
- source identification evaluation or toxicity source evaluation
- instream WET tests
- chemical identification after chemical/physical separations of toxic phase
- assessment of treatment technology available to remove the toxic substance from the effluent.

All test data must be submitted for review regardless of whether the test was valid or invalid.

For more information on methods used in TREs, see the following documents (or their most recent versions):

- *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I*, EPA/600/6-91/005F, May 1992
- *Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures, Second Edition*, EPA/600/6-91/003, February 1991
- *Methods for Aquatic Toxicity Identification Evaluations: Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity*, EPA/600/R-92/080, September 1993

- *Methods for Aquatic Toxicity Identification Evaluations: Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity*, EPA/600/R-92/081, September 1993

**TRE Plan.** The permit requires the discharger to submit a general outline for performing a TRE within 45 days of the retest that confirms lethality. The outline should describe the preparations the permittee will take to develop and implement a TRE. Within 90 days of the retest that confirms lethality, the permit requires the discharger to submit a detailed TRE plan. The TRE plan should describe the specific approach and methodology the permittee will use during the TRE and include schedules for chemical and biological testing, specific activities, a sampling plan, a quality assurance plan, and project organization. The TRE schedule and approach may be modified as necessary during the process.

Toxicity attributable to dissolved salts, ammonia, or Diazinon is discussed in the sections of this document entitled:

- “Toxicity Attributable to Dissolved Salts” (see page 119)
- “Ammonia Toxicity” (see page 123)
- “Toxicity Attributable to Diazinon” (see page 125).

**Quarterly reports.** As required by the permit, the permittee must submit quarterly reports to TNRCC that describe TRE progress and results. The permit also requires the permittee to complete the TRE and submit a final report within 28 months of the retest that confirms lethality. Permittees may request an extension to the 28-month time limit. The extension, however, must be warranted, and approval is contingent upon permittees demonstrating (1) due diligence in pursuit of the TRE and (2) the existence of circumstances beyond their ability to control.

**Ceasing a TRE.** Permittees may cease TRE activities if they demonstrate to the executive director that the effluent no longer causes lethality to the test organisms. The permit defines a cessation of lethality as no significant lethality at the critical dilution, using test procedures specified in the permit, for a period of 12 consecutive months with at least monthly testing. This permit language accommodates situations where operational errors and upsets, spills, or sampling errors triggered the TRE, in contrast to a situation where a single toxicant or group of toxicants cause lethality.

The permittee may only apply the cessation of lethality provision once every five years. If the effluent again demonstrates persistent, significant lethality to the same species within a five-year period, the TNRCC will amend the permit to add a WET limit with a compliance period (if appropriate). If the permittee can identify and confirm the toxicant and/or identify an appropriate control measure, the permittee may apply for a

permit amendment before the effective date of the WET limit, removing the WET limit and replacing it with an alternate toxicity control measure.

When a permittee ceases TRE activities under the cessation of lethality provision, that permittee continues WET testing as required in the permit. This provision is not applicable if the lethality ceases for 12 consecutive months as a result of the permittee taking corrective action. Corrective actions include source reduction or elimination, process changes, housekeeping improvements, changes in chemical use, and/or modification to wastewater treatment.

## **Toxicity Control Measures**

Near the conclusion of the TRE and associated corrective measures, the TNRCC may amend the permit to specify toxicity control measures. These may include a chemical-specific (CS) limit, a best management practice (BMP), or a WET limit, if appropriate, for one or both species demonstrating persistent significant lethality.

**CS Limit.** The TNRCC may use the CS limit in lieu of a WET limit if the CS limit can adequately address toxicity. In order to be eligible for a CS limit, the permittee has to demonstrate that one or more known toxicants caused the lethality and should attempt to determine a specific concentration of the toxicant that does not cause lethality.

**BMP.** The TNRCC may specify a permit requirement for a BMP if such a provision can adequately address toxicity. In terms of WET testing, BMPs are defined as a practice or combination of practices that remove toxicity from the effluent by eliminating the source of toxicity. If successful, the BMP becomes an enforceable part of the permit. A BMP does not include making housekeeping changes or operational changes to reduce toxicity. In these cases, the source of toxicity still remains.

**WET Limit.** Failure to identify the toxicant or toxicants, presence of multiple toxicants, or lack of a routine test method capable of detecting a pollutant at levels causing toxicity, are examples of cases where a CS limit or BMP may be inadequate to address toxicity. In such cases, where

- reasonable potential has been demonstrated to violate the narrative criteria regarding toxicity in 30 TAC §307.6(b)(1) and/or (2) and
- no other appropriate toxicity control measure has been identified,

the permit will be amended to add a WET limit with a compliance period (if appropriate). Upon reaching the effective date of the WET limit, a



testing frequency of once per quarter is required for the next five years for the species to which the WET limit applies.

If the permittee does not comply with the WET limit (that is, fails a test), the permittee is considered in violation of the permit and receives a written Notice of Violation (NOV). The testing frequency for the species in question increases to monthly until compliance is demonstrated for a period of three consecutive months. After compliance is demonstrated, the permittee may resume quarterly testing. However, if the permittee fails a test during the increased monthly testing period, the permittee will be referred to TNRCC's Enforcement Division for formal enforcement action. This process is illustrated in Figure 9 on page 115.

## 24-Hour Acute (100% End-of-Pipe) Tests

In addition to conducting chronic or 48-hour acute tests, dischargers are required to conduct 24-hour acute tests using 100% effluent. This end-of-pipe test measures compliance with 30 TAC §307.6(e)(2)(B) of the TSWQS, which requires that greater than 50% of the test organisms survive exposure to 100% effluent for 24 hours. This provision is designed to ensure that water in the state will not be acutely toxic to aquatic life.

In addition to facilities mentioned previously in the section "Applicability" (see page 101), the TNRCC may require 24-hour acute testing for intermittent process water outfalls and/or storm water outfalls with the potential for causing toxicity. Dischargers with multiple outfalls will test each outfall that has the potential to cause toxicity. Multiple outfall samples may not be composited.

### Test Types

The permit will specify that the tests be conducted using the latest version of the appropriate EPA method. These methods can be found in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition*, EPA-821-R-02-012, October 2002 (or the most recent version). The permittee may use a revised method if one becomes available during the term of the permit. Alternate test methods are subject to EPA review and approval. Depending on the type of receiving water, the permit will specify 24-hour acute tests to assess toxicity to freshwater or saltwater organisms. The test organisms for each type of test are as follows:

#### *Freshwater streams and lakes (salinity < 2 ppt):*

- 24-hour *Daphnia pulex* (water flea) survival test

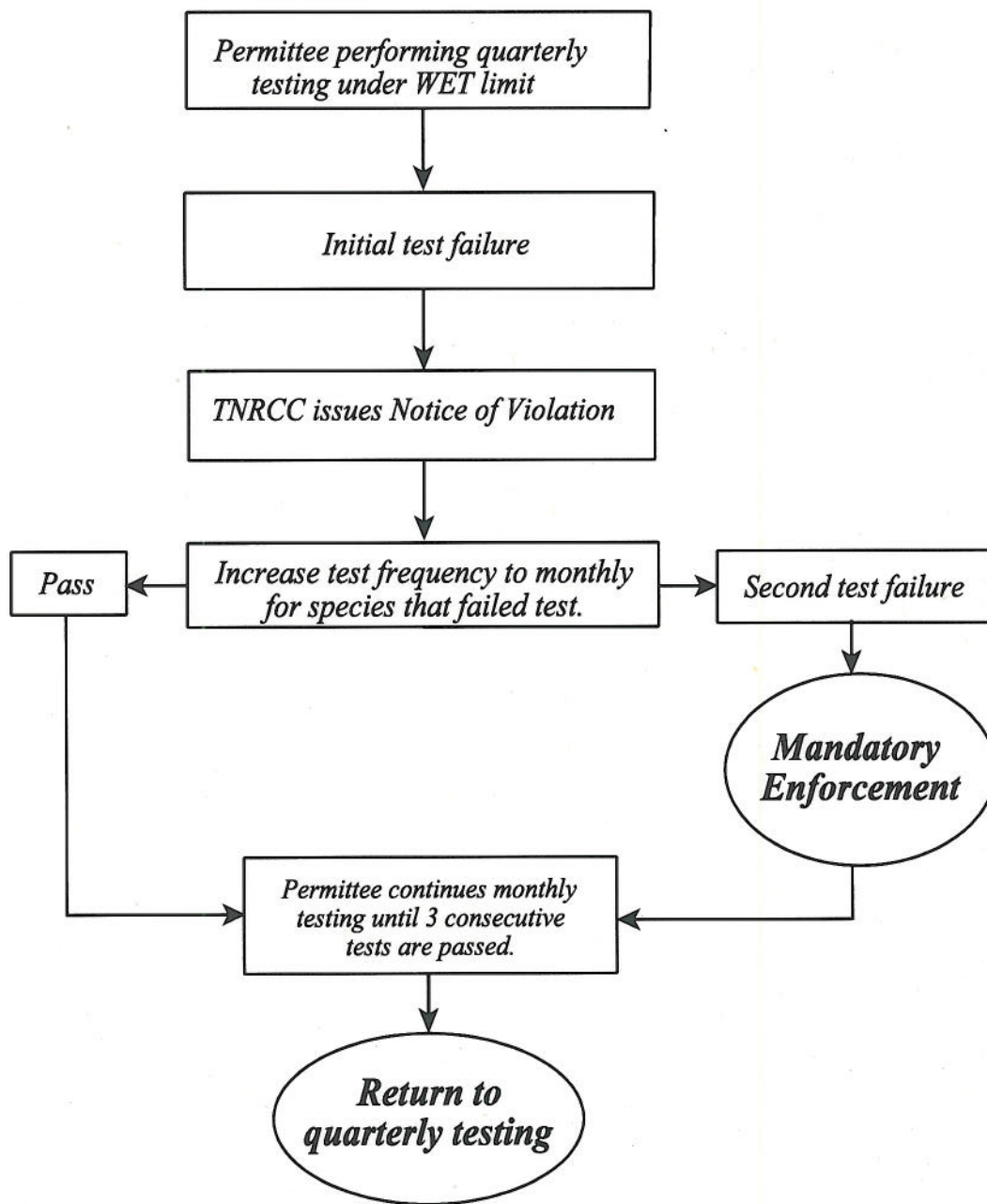


Figure 9. Procedure for Addressing WET Limit Violations

- 24-hour *Pimephales promelas* (fathead minnow) survival test
- 24-hour *Ceriodaphnia dubia* (water flea) survival test. Use of this test species is only allowed where the permittee substitutes the results of the 7-day chronic test for this testing requirement as discussed in the section of this document entitled "Test Substitution" on page 118.

***Marine receiving water (salinity  $\geq$  2 ppt):***

- 24-hour *Mysidopsis bahia* (mysid shrimp) survival test
- 24-hour *Menidia beryllina* (inland silverside) survival test

Permittees may substitute other EPA-approved tests and species if they obtain approval from the TNRCC before or during the permit application process (see the sections in this document entitled "Toxicity Attributable to Dissolved Salts" on page 119 and "Site-Specific Standards for Total Toxicity" on page 145).

Typically, if the segment TDS criterion or site-specific TDS concentration in the receiving water is too high to support *Ceriodaphnia dubia* or *Daphnia pulex*, *Daphnia magna* (water flea) is substituted as the invertebrate test organism. However, draft permits with alternate tests, alternate species, or testing requirements that exclude a species are subject to EPA review and approval.

### **Test Acceptability Criteria**

The permittee will have to repeat any toxicity test, including the control, if the mean survival of the control is less than 90%. Also note that tests should end within a period of one hour before the appropriate test end time to one hour afterward.

### **Test Frequencies**

The frequencies for 24-hour acute WET tests are based on (1) previous WET testing results or (2) the results of two 24-hour WET tests performed by the applicant and submitted as part of the wastewater permit application.

- Permit applicants that are currently conducting WET tests do not need to resubmit test results or conduct the 24-hour WET tests specified in the permit application.

- Permit applicants that **are not** currently conducting WET tests but meet the criteria for performing WET tests as described in the permit application should conduct the appropriate 24-hour WET tests. These test results should be submitted with the application.

If both application tests pass (exceed 50% survival), the applicant will normally be required to conduct 24-hour acute WET tests at a frequency of once per six months.

If either application test fails, the permittee has the opportunity during the application process to conduct two retests in consecutive weeks for each species that failed. All test data must be submitted for review regardless of whether the test was valid or invalid.

If any of the retests fail, the permittee is required to initiate a TRE upon permit issuance. For more information, see the section of this document entitled "Toxicity Reduction Evaluations" on page 117.

If all retests pass, the permittee is required to conduct 24-hour acute WET tests at a minimum frequency of once per quarter for the species that initially failed and once per six months for the species that passed.

### ***Toxicity Reduction Evaluations (TREs)***

Failing a 24-hour acute WET test necessitates two retests over consecutive weeks. If both retests pass, the permittee continues testing at the original frequency designated in the permit. If one or both of the retests fail, the permittee is required to initiate a TRE. From the date that lethality is confirmed, the permittee has three years to comply with 30 TAC §307.6(e)(2)(B). Permittees may request an extension to the three-year limit. As stated in the permit language, however, the extension must be warranted and is contingent upon permittees demonstrating (1) due diligence in pursuit of the TRE and (2) the existence of circumstances beyond their ability to control.

The 24-hour acute TRE requirements are similar but not identical to those discussed in the section of this document entitled "Toxicity Reduction Evaluations" on page 111. Since the permittee should normally comply with 30 TAC §307.6(e)(2)(B) within three years, the permit specifies completion of the TRE and submission of a final TRE report within 18 months of the failed retest. Permittees may request (in writing) an extension to the 18-month time limit. The extension, however, must be warranted and is contingent upon permittees demonstrating (1) due diligence in pursuit of the TRE and (2) the existence of circumstances beyond their ability to control.

The permit also specifies that the TRE continue unless the permittee demonstrates to TNRCC that the effluent has ceased to cause lethality. The permit defines a cessation of lethality as greater than 50% survival after 24 hours of exposure to 100% effluent for 12 consecutive weeks with at least weekly sampling and testing.

### ***Toxicity Control Measures***

Near the third year's end, the TNRCC will amend the permit to include a CS limit, a BMP, or a WET limit. A CS limit or a BMP must adequately address the effluent's toxicity. If not, the permit is amended to add a WET limit with a compliance period (if appropriate). Upon reaching the effective date of the WET limit, a testing frequency of once per quarter is required for the next five years.

If the permittee does not comply with the WET limit (that is, fails a test), the permittee is considered in violation of the permit and receives a written Notice of Violation (NOV). The testing frequency for the species in question increases to monthly until compliance is demonstrated for a period of three consecutive months. After compliance is demonstrated, the permittee may resume quarterly testing. If, however, the permittee fails a test during the increased testing period, the permittee will be referred to TNRCC's Enforcement Division for potential formal enforcement action. This process is illustrated in Figure 9 on page 115.

### **Test Substitution**

The TNRCC normally requires permittees to conduct the chronic or 48-hour acute WET tests and the 24-hour acute (100% end-of-pipe) WET tests as separate permit requirements. If the chronic or 48-hour acute WET test includes a test of 100% effluent in the dilution series, the permit allows the results from that test (after 24 hours of exposure) to fulfill the requirements in the 24-hour acute tests. The permittees then report the survival of organisms in the 100% effluent concentrations after 24 hours.

The permit stipulates that the 24-hour acute WET testing provision applies whether the test results submitted are for this requirement, the 48-hour acute requirements, or the chronic requirements. The permittee may add a 100% effluent dilution to chronic or 48-hour acute tests and submit the results after 24 hours to fulfill the 24-hour acute testing requirements.

## Toxicity Attributable to Dissolved Salts

Permittees may be exempt from compliance with the total toxicity provisions in the TSWQS if they demonstrate that dissolved salts are causing the effluent to be toxic. This exemption is allowed under the definition of toxicity in the TSWQS and under the 24-hour, 100% end-of-pipe acute toxicity provisions (30 TAC §307.6(e)(2)(B)).

The definition of toxicity in the TSWQS excludes adverse effects caused by concentrations of dissolved salts when the salts originate in a permittee's source water. This exemption would affect compliance with the chronic and 48-hour acute WET testing provisions.

According to 30 TAC §307.3(a)(65), "Source water is defined as surface water or groundwater that is used as a public water supply or industrial water supply (including cooling water supply). Source water does not include brine water that is produced during the extraction of oil and gas, or other sources of brine water that are substantially uncharacteristic of surface waters in the area of the discharge."

Also, dischargers that exhibit 24-hour acute toxicity caused by (1) concentrations of dissolved salts that originate from the source water or (2) an excess, deficiency, or imbalance of dissolved salts in the effluent are exempted from compliance with the 24-hour, 100% end-of-pipe acute toxicity provision. These exemptions, which are specified in 30 TAC §307.6(e)(2)(B), do not include instances where individually toxic components (for example, the pollutants listed in Table 1 of the TSWQS) have formed a salt compound that is causing the effluent to be toxic.

Figure 10 on page 121 outlines the steps necessary for proving that dissolved salts are responsible for the toxicity and for receiving the exemption. The following two sections further explain the exemptions for dissolved salts.

### ***TDS Exemption—24-Hour Acute (100% End-of-Pipe) Tests***

When a permittee believes failure of the 24-hour acute tests occurred because of dissolved salts and seeks an exemption for that demonstration of toxicity, the permittee will have to demonstrate that dissolved salts are a cause of toxicity in the effluent. Because the effluent may have multiple toxicants, the permittee then has to prove that dissolved salts are the **primary** cause of toxicity. The following paragraphs describe the process in more detail.

***Are dissolved salts a cause of toxicity?*** To confirm that dissolved salts are a cause of toxicity in the effluent, the permittee is required to conduct at

least one set of toxicity identification evaluation (TIE) characterization tests including an ion-exchange procedure.

- If the TIE tests fail to prove that dissolved salts are a cause of toxicity, the permittee will continue with the TRE to identify the toxicant or toxicants and to reduce or eliminate the acute toxicity.
- If the TIE tests show that dissolved salts are a cause of toxicity in the effluent, the permittee then has to prove that they are the **primary** cause of acute toxicity.

*Are dissolved salts the primary cause of toxicity?* The permittee should use a combination of the following techniques to show that dissolved salts are the primary cause of acute toxicity:

- conduct WET tests using an alternate species that is more tolerant of dissolved salts
- conduct side-by-side WET tests using the toxic effluent as well as a mock effluent formulated to mimic the ionic composition of the effluent
- perform measurements of high levels of dissolved salts in the effluent
- perform an analysis of the ionic components of the dissolved salts
- use computer models that predict the acute toxicity of saline waters
- perform WET tests using sea salts that are formulated to correct ionic imbalances.

The permittee may suggest other methods to demonstrate that dissolved salts are the primary cause of toxicity for the TNRCC's review and consideration.

- If these techniques show that dissolved salts are not the primary cause of acute toxicity, the permittee will continue with the TRE to address the toxicity.
- If the techniques prove that dissolved salts are the primary cause of toxicity, the TRE requirements cease.

When the TRE requirements cease because dissolved salts are the primary source of acute toxicity, the TNRCC evaluates or requires the permittee to evaluate the use of an alternative test species or modified test protocol. The permittee may be required to continue conducting the 24-hour acute tests if an alternate test protocol successfully resolves the acute toxicity

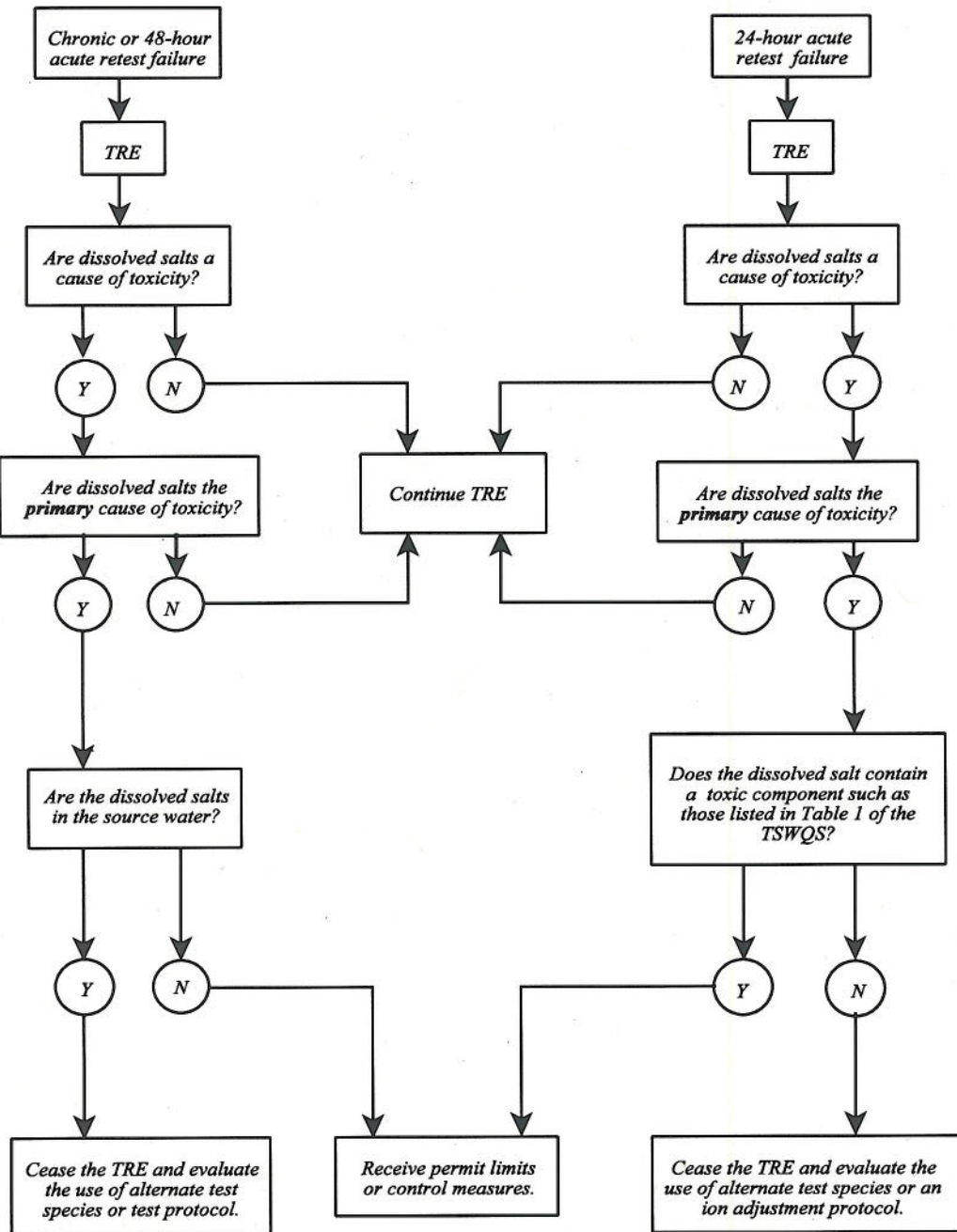


Figure 10. Procedure for Exemption from Total Toxicity Requirements because of Dissolved Salts



caused by the dissolved salts in the effluent. The TNRCC then initiates an amendment of the permit to include these measures.

If an alternate species is unavailable, or if test protocol modifications such as ionic adjustments are unsuccessful, the permittee will most likely be required to continue testing with the standard test species that is unaffected by the dissolved salts.

### ***TDS Exemption—Chronic and 48-Hour Acute Tests***

When a permittee believes effluent toxicity evidenced by a chronic or 48-hour acute WET test is caused by dissolved salts and seeks an exemption for that demonstration of toxicity, the permittee should follow an approach similar to that described in the previous subsection. EPA will review any protocol that could affect permits or other regulatory actions that are subject to EPA approval.

First, permittees have to show that dissolved salts are a cause of toxicity in the effluent. Since the effluent may contain multiple toxicants, permittees have to prove that dissolved salts are the **primary** source of toxicity. Next, permittees have to show that the dissolved salts are coming from their source water. Permittees need to complete each step in this process to receive the exemption for dissolved salts. The following paragraphs describe this process in more detail.

***Are dissolved salts a cause of toxicity?*** To confirm that dissolved salts are a cause of effluent toxicity, the permittee will conduct at least one set of TIE characterization tests including an ion-exchange procedure. If the TIE tests show that dissolved salts are not a cause of effluent toxicity, the permittee will continue with the TRE to identify the toxicant or toxicants and to reduce or eliminate the toxicity.

If the TIE tests show that dissolved salts are a cause of effluent toxicity, the permittee then has to prove that they are the **primary** cause of toxicity.

***Are dissolved salts the primary cause of toxicity?*** The permittee may use the techniques described in the previous section “24-Hour Acute (100% End-of-Pipe) Tests” on page 119 to prove that dissolved salts are the primary cause of toxicity. If these techniques fail to do so, the permittee will continue with the TRE to address the toxicity. If the techniques prove that dissolved salts are the primary cause of toxicity, the permittee then has to prove that the dissolved salts are coming from the source water.

***Are dissolved salts coming from source water?*** To help prove that dissolved salts originate from the source water, the permittee should sample the facility's intake water and/or raw water source and compare its

dissolved salt concentration and ionic composition with those of the effluent. Increases in the dissolved salt content of the effluent due to process evaporation should also be evaluated where appropriate. In any case, if the effluent's TDS concentration is greater than that of the source water or if the effluent's ionic composition varies significantly from that of the source water, effluent limits or control measures may be included in the permit.

- If the dissolved salts are not from the source water, the permittee has to comply with the total toxicity provisions of the TSWQS. If a protocol for an instream biological survey is approved by EPA, it may be possible for the permittee to attempt to demonstrate that aquatic life in the receiving water is not adversely affected by the total dissolved solids (TDS) levels in the proposed permit.
- If the dissolved salts are from the source water, the permittee may cease the TRE. Upon cessation of the TRE, TNRCC staff will, in conjunction with the permittee, evaluate the use of an alternative test species or a modified test protocol. The permittee may be required to continue testing if modifying the test protocol or using an alternate species resolves the toxic effect of the dissolved salts in the effluent. The TNRCC will then amend the permit to include these measures.

If an alternate species is unavailable or tests using a modified test protocol still demonstrate toxicity due to dissolved salts, the permittee will most likely be required to continue testing with the standard test species that is unaffected by the dissolved salts.

Discharges to marine waters are reviewed on a case-by-case basis and are subject to EPA review and approval in accordance with the MOA between the TNRCC and EPA concerning the TPDES program.

## **Ammonia Toxicity**

### ***Controlling Potential Ammonia Toxicity***

Ammonia, a common component of domestic wastewater, has been shown to be toxic to aquatic organisms. Models used to determine effluent limits for oxygen-demanding constituents do not account for the toxicity that ammonia can exert. Therefore, to preclude instream toxicity, some permits may now include either modified limits for total ammonia or a WET limit with a WET testing frequency of six times a year when all of the following conditions are met:

- the discharge is to freshwater **and**
- the facility has a critical dilution of 50% or greater **and**

- the facility has permitted ammonia limits to maintain instream dissolved oxygen criteria, or it has categorical ammonia limits.

The modified ammonia limits or WET limit apply to the following types of facilities:

- major domestic facilities (average permitted flow  $\geq 1$  MGD)
- minor domestic facilities (average permitted flow  $< 1$  MGD) that discharge to a water body that
  - contains a threatened or endangered species or
  - is listed for ammonia on an EPA-approved 303(d) list
- all major industrial facilities.

By following these guidelines, TNRCC will ensure that it is not authorizing the discharge of toxic amounts of ammonia.

### ***Toxicity Attributable to Ammonia***

TNRCC recognizes that a technology-based daily average ammonia-nitrogen limit of 3 mg/L generally precludes toxicity to freshwater test species, specifically the fathead minnow. Therefore, the TNRCC will implement this limit as the TRE resolution for toxicity attributable to ammonia. This resolution applies solely to domestic wastewater treatment plants discharging to freshwater with ammonia as the primary toxicant. The ammonia limit will be implemented in permits as follows:

- For those facilities whose permits contain interim or final effluent phases that include a daily average ammonia-nitrogen limit of 3 mg/L, the persistent lethality requirements are suspended until the effective date of the limit.
- For those facilities whose permits do not contain interim or final effluent phase that include a daily average ammonia-nitrogen limit of 3 mg/L, TNRCC staff will amend the permits to include this limit.
- Facilities whose permits contain interim or final effluent phases that include seasonal ammonia-nitrogen limits or ammonia-nitrogen limits greater than 3 mg/L will be evaluated by TNRCC staff on a case-by-case basis for the appropriateness of the specified limit. If the limit appears incapable of precluding toxicity, TNRCC staff will amend the permit to include a daily average ammonia-nitrogen limit of 3 mg/L.

The 3 mg/L ammonia-nitrogen limit is normally implemented in lieu of a WET limit. However, should this limit prove ineffective in precluding

toxicity, TNRCC staff will amend the permit to include an alternative limit and/or corrective measures protective of the receiving waters.

## Toxicity Attributable to Diazinon

The TSWQS contain a special provision (30 TAC §307.6(e)(2)(E)) for those domestic wastewater facilities demonstrating Diazinon as the primary cause of effluent toxicity. Once the permittee demonstrates this, using standard TIE characterization tests and other analytical techniques, and also demonstrates that Diazinon is ubiquitous within the wastewater collection system, TNRCC will amend the permit. The amendment requires the permittee to address toxicity as follows:

1. **Public Education Program (PEP).** The permittee will be required to implement a PEP, emphasizing education and awareness to prevent Diazinon from entering the collection system. The PEP should include, but not be limited to, the following components:
  - a. *Users Survey*—The permittee should survey all suspected users of Diazinon. The survey should be comprehensive, including individuals as well as businesses. The survey should identify those source groups and/or individuals that should receive the information described in 1.b.
  - b. *Information Development*—The permittee should develop information for dissemination to source groups and individuals. This information should include best management practices for use of Diazinon and other pesticides and alternative methods of pest control besides the use of organophosphate pesticides.
  - c. *Disseminating Information*—The targeted audience should be assured of receiving the developed information through a number of means, including the media, mailings, and public presentations.
2. **Diazinon Monitoring.** The permittee will monitor wastewater influent and effluent for Diazinon while continuing to biomonitor using the most sensitive species. The results of the WET testing and the Diazinon monitoring should be submitted in quarterly reports.

Should Diazinon not prove to be the primary cause of toxicity or not be ubiquitous within the wastewater collection system, the permittee will resume the TRE. In addition, should the permittee not address Diazinon toxicity as described above with due diligence, the TRE requirements remain in effect. In either case, TNRCC may amend the permit to specify appropriate toxicity control measures as given in 30 TAC §307.6(e)(2)(D).