October 3, 2016

Proposed Updates to the Whole Effluent Toxicity Program Guidance Document

The following describes proposed updates to the Whole Effluent Toxicity (WET) Program Guidance Document. Many of the proposed updates are based on revisions to ch. NR 106, Wis. Adm. Code, which became effective on September 1, 2016. Other revisions to the WET Guidance are also being proposed, not related to the rule revisions, based on other program needs. One example of this would be the addition of language in Chapter 1.3 to address the use of SorbX-100 to treat phosphorus and how this relates to potential toxicity concerns. See the "Summary of Proposed Revisions" below for a description of the proposed changes.

Comments should be submitted to DNRRULEPACKAGE4@wisconsin.gov by Wednesday October 26, 2017.

Background

The WET Guidance Document was created in 1996 to provide guidance for internal Wisconsin Department of Natural Resources (WDNR) staff and external stakeholders, to help make decisions related to WET program topics. The document includes 23 chapters covering topics ranging from collecting WET samples to putting monitoring and limits in permits, conducting toxicity reduction evaluations (TREs), and others. Part one (Chapters 1.1 – 1.14) was written primarily with DNR staff needs in mind, though others may find those chapters useful. Part two (Chapter 2.1 – 2.11) provides clarification of existing requirements and advice for permittees, WET labs, and others. Current versions of all WET guidance chapters can be found on-line at: http://dnr.wi.gov/topic/wastewater/WETguidance.html.

The WET Guidance Document has been revised several times since 1996, as the WDNR has gained experience with program implementation. After changes to ch. NR 106, Wis. Adm. Code, the Department is proposing to complete its 11th revision of this document, including updates to nine existing chapters and the addition of one new chapter (Chapter 1.14). The proposed guidance is an attempt to describe how WET-related changes in chapter NR 106, Wis. Adm. Code, are intended to be implemented. The suggested revisions to the guidance, and why they are thought to be needed, are described in the summary provided below.

Summary of Proposed Changes

The changes described are primarily intended to support revisions to chapter NR 106, Wis. Adm. Code, which became effective on September 1, 2016. New rule language includes modifications to WET reasonable potential (RP) procedures (the methods used to determine when WET limits are required), in order to bring Wisconsin's requirements in line with federal regulations promulgated by the USEPA. The most significant changes proposed to the draft guidance have been described below in order to bring them to the attention of the reader. Editorial and other less significant changes have also been made to make the guidance more readable, to update website links and other references, and to make other needed improvements. These minor changes are not described below. Revisions to the following chapters of the WET Guidance Document are proposed:

CHAPTER	TITLE	PURPOSE OF CHAPTER
1.1	Sampling For WET Testing	Where, when & how; Sampling checklist
1.2	Receiving Water Used to Make WET Determinations	RW used for dilution ratios, IWC, etc.
1.3	Representative Data, Reasonable Potential & WET Monitoring	Determining monitoring frequencies & limits
1.8	Enforcement Strategy	Violation response; Example situations
1.10	Ammonia & Associated WET Requirements	Addressing ammonia toxicity in WET tests
1.12	WET Limit Compliance Schedules	Standard & specialized compliance schedules
1.14	Standard WET Permit Language	Language used to implement WET requirements in WPDES permits
2.4	Toxic Units, $LC_{50,}$ and IC_{25} Values	Uses, definitions, calculations

CHAPTER	TITLE	PURPOSE OF CHAPTER
2.5	Relationship Between WET & Chemical-Specific Limits	Differences, when one should be used for another
2.10	Chlorides and WET Testing	Demonstrating that chloride is causing toxicity

Chapter 1.1 – Samples For WET Testing

Changes driven by Rule Package #3 (Board Order WT-31-10):

Chapter 1.1 was revised to remove a discussion of the previous s. 106.10, Wis. Adm. Code. Chapter 1.1 referred to an exemption in s. NR 106.10, which allowed certain substances to be present in an effluent, if they were present at levels found in the water supply. Chapter 1.1 previously discussed when this exemption applied to WET, toxicity caused by chlorine in these situations, and the appropriateness of modifying samples used in WET tests. Since rule revisions removed the exemption in s. NR 106.10, Wis. Adm. Code, this is being removed from the WET guidance, as well.

Changes driven by other WET Program Needs:

Standard language was added to wastewater permits in 2013, emphasizing that WET tests must be performed during normal operating conditions and that permittees cannot turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests. Chapter 1.1 has been updated to explain this standard language and its use in permits.

Guidance has been added to promote increased attention to weekend WET sample delivery. Many permittees and labs have experienced problems with couriers improperly delivering WET samples (especially on Saturdays), so more detailed guidance has been included to help readers understand what can be done to help avoid these problems in some cases.

Chapter 1.2 – Receiving Water Used to Make WET Determinations

Changes driven by other WET Program Needs:

Chapter 1.2 is being modified at the request of internal staff, to further clarify when use of receiving water flows downstream of the discharge are appropriate for WET determinations (stream flow to effluent flow ratios, instream waste concentrations, etc.). This guidance has been rewritten to say that decisions related to using the first downstream non-variance waterbody in WET determinations should be based on staff's knowledge of whether coldwater, warmwater sport fish, or warmwater forage fish populations are present in the waterbody. The proposed guidance better emphasizes that WET determinations should be meant to protect the populations in all non-variance classified waters, when they are known to be present at or near to the discharge location.

Chapter 1.3 – Representative Data, Reasonable Potential, Monitoring and Limits

Chapter 1.3 is meant to serve two purposes. The first purpose is to help staff select representative data and use that data and other site-specific information to make WET monitoring and limits decisions for each permit reissuance. Language has been added to help staff better determine when data is or is not representative of the discharge being evaluated.

The second purpose of the chapter is to provide instructions for staff when using the WET Checklist. The WET Checklist is a tool that was designed to help staff determine how much WET monitoring a permittee should conduct and whether or not a limit is required. To meet this second purpose, the chapter includes screen shots from the automated WET Checklist, followed by guidance related to the decisions that staff need to make and the information that should be entered. These instructions and guidance have been updated to reflect the new WET RP process required in ch. NR 106 and related determinations.

Changes driven by Rule Package #4 (Board Order WT-11-12):

Chapter 1.3 was revised to incorporate the new WET reasonable potential (RP) procedure in rule package #4. Chapter NR 106, Wis. Adm. Code, has been revised to include the WET RP procedure required in the USEPA's Great Lakes Water Quality Initiative (GLI), therefore the draft guidance has been updated to describe these procedures. This chapter was also revised to include a discussion of when minimum monitoring frequencies, toxicity reduction evaluation (TRE) schedules, and WET limit triggers may be appropriate based on a permittee's WET history and reasonable potential determination. Guidance has also been added to describe how WET limits should be calculated and expressed in permits.

Changes driven by other WET Program Needs:

Language in Chapter 1.3 related to the selection of representative data for use in WET determinations has been updated to reflect experience gained since the last revision. A note has been added to reflect the decision to disqualify WET data submitted between 2008-2011 by S-F Analytical Labs and another to direct staff to determine whether data collected before June 2005 (when WET test method updates were last implemented) are still representative before using them in WET determinations.

The WET Checklist and related guidance have been changed to remove points previously assessed for fish hatchery discharges, at the request of external stakeholders. WET data collected at ten DNR-owned fish hatcheries over the last several years has shown that the potential for effluent toxicity at these facilities has dropped dramatically since they've made efforts to significantly reduce the use of chemical additives. Tests conducted between 2007-2015 by the UW-Madison's State Lab of Hygiene have shown no acute or chronic toxicity at any of these hatcheries. The removal of these points from the Checklist process does not mean that no WET testing will be conducted at hatcheries in the future, but it removes discharge category as a factor adding to the overall point total. Additive use, discharge location, effluent variability, chemical-specific detects, or other factors may still cause testing to be recommended at some locations.

Chapter 1.8 – Enforcement Strategy

Changes driven by Rule Package #4 (Board Order WT-11-12):

Chapter 1.8 provides guidance for DNR staff, related to the enforcement of WET-related requirements in permits. This guidance has been updated to reflect the changes to the WET reasonable potential procedures. Previous guidance suggested that since WET limits were only assigned after repeated WET failures had occurred, WET limit violations were most often experienced by permittees who already had a history of toxicity problems and had not made enough effort to address them. Since the new WET RP procedures proposed in revisions to NR 106, Wis. Adm. Code, will result in some permittees getting WET limits after a single WET failure (or no WET failures), Chapter 1.8 now encourages staff to more carefully consider the permittee's WET history when pursuing stepped enforcement for WET limit violations. The guidance still recommends that WET violations be taken seriously, but stresses that repeated WET failures should be given more weight than one-time events.

Chapter 1.10 – Ammonia & Associated WET Requirements

Changes driven by Rule Package #4 (Board Order WT-11-12):

Revisions to chapter NR 106, Wis. Adm. Code, included the removal of ss. NR 106.36 and NR 106.38, which provided lagoon and stabilization pond systems that treat primarily domestic wastewater with an ammonia variance and stated that WET tests are not required to be performed during the months of December through May for this reason. Chapter 1.10 has been updated to remove references to this streamlined ammonia variance process and instead now describes how WET may be addressed if a permittee is granted an individual variance according to s. 283.15, Wis. Stat., for ammonia.

Chapter 1.12 – WET Limit Compliance Schedules

Changes driven by Rule Package #4 (Board Order WT-11-12):

Guidance in Chapter 1.12 is designed to help permits staff choose the appropriate compliance schedule requirements (e.g., steps needed under different scenarios, acceptable time between steps, etc.) when a toxicity reduction evaluation (TRE) schedule is necessary. This chapter has been revised to reference and support guidance in Chapter 1.3, which provides recommendations for when TRE schedules should be included in reissued permits.

Chapter 1.14 – Standard WET Permit Language (NEW CHAPTER)

Changes driven by other WET Program Needs:

Chapter 1.14 is a new chapter, created to provide staff with guidance related to writing WET-related monitoring, limits, and other requirements in wastewater permits. This chapter shows standard permit language and provides suggestions to help permit drafters customize the language for individual permit situations.

Chapter 2.4 – Toxic Units, LC_{50}, and IC_{25} Values

Changes driven by Rule Package #4 (Board Order WT-11-12):

Guidance related to the calculation and expression of WET limits is provided in this chapter. This guidance has been revised to reflect changes in the WET reasonable potential (RP) procedure proposed in rule package #4 and described in Chapter 1.3. Specifically, updated language is provided describing how to calculate acute and chronic limits according to the new RP procedures, including when an acute mixing zone (or zone of initial dilution) is allowed.

Chapter 2.5 – Relationship Between WET and Chemical-Specific Limits

Changes driven by Rule Package #4 (Board Order WT-11-12):

Guidance in this chapter has been revised to clarify when a chemical-specific limit may be used in lieu of a WET limit. Specifically, language has been updated to reflect changes to s. NR 106.89, Wis. Adm. Code, which specifies that chloride limits can be used in lieu of WET limits in cases where chloride has been shown to be the sole source of toxicity.

Chapter 2.10 – Chlorides and WET Testing

Changes driven by Rule Package #4 (Board Order WT-11-12):

Language has been updated to reflect changes to s. NR 106.89, Wis. Adm. Code, which spells out when chloride limits are used in lieu of WET limits when a point source discharge is working towards compliance with a water quality-based effluent limit (WQBEL) for chloride via a source reduction based permit, rather than a traditional permit which immediately imposes the WQBEL.

Changes driven by other WET Program Needs:

Table 1 of this chapter provides a range of known toxicity values for sodium chloride, based on reference toxicant testing regularly conducted by Wisconsin-certified WET labs. The ranges in Table 1, typically used as a benchmark for comparing

effluent levels to determine if chloride is solely responsible for an effluent's toxicity, have been updated based on more recent data (previous versions of this chapter reflected data submitted prior to May 2000).

CHAPTER 1.1 - Samples For WET Testing

The purpose of this chapter is to provide staff with guidance regarding sample type and location to be specified in WPDES permits and to provide guidance to permittees, consultants, and others taking WET samples. Permittees must follow permit requirements when taking WET samples.

NOTICE: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Effluent Sampling Location

This section is intended to help staff identify the appropriate location for WET sampling. According to Section 2.2 of the "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*" (Methods Manual; see http://dnr.wi.gov/topic/wastewater/WET.html), the effluent sample location must be identified in the WPDES permit. The DNR staff most familiar with the facility should help determine the best WET sampling location to be included in the permit. The location used by the permittee to collect other permit-required samples **may** be an appropriate location for effluent sampling, however, it should be verified that this location would provide a representative sample for WET testing.

Ideally, samples used in WET testing should represent the effluent as it is discharged into the environment. To accomplish this, the sampling location should be as near to the end of pipe as possible. Whenever possible, effluent samples should be collected after all chemical addition in the manufacturing process and/or wastewater treatment system (for example, after chlorination and dechlorination at a municipal wastewater treatment plant). An end of pipe sampling location is desirable because one of the goals of WET testing is to determine the effects of the entire effluent mix as it is discharged into the environment. Reasonable attempts should be made to collect this end of pipe sample - if necessary, staff should consider requiring the facility to install or move a dedicated sampler, use a portable sampler, or use an alternate sample type (for example, time proportional composites or grab samples, instead of flow proportional composites), if staff believe that a new location would be more representative. If Department staff determine that collecting an end of pipe sample is not possible, due to safety concerns or for other reasons, the sample should be collected as near to this point as possible.

Intake sample lines should be set in a location that will provide a well mixed sample away from any quiescent zone. This is often mid-stream and mid-depth in a channel situation. A weighted sieve may be necessary to position the sample line in a well-mixed location. Samples should be collected under normal operating conditions, unless there is a specific reason to collect a sample during an atypical situation. Sample security should be maintained in all situations. This may require a location inside a fence or sample building. Section 2.2.7 of the Methods Manual requires that samples be chilled with ice or another means of refrigeration **during and after** collection. All reasonable steps should be taken to obtain a sample and cool it to $\leq$ 4°C (without freezing) as quickly as possible. If a warm effluent is being collected during hot weather conditions and ice is being used to preserve the sample, additional ice may be needed during or after the collection period to cool the sample. Conversely, freezing conditions should be avoided in winter when selecting a location for the sampler.

Effluent Sample Type

Two samples collected over a three day (72-hr) period are needed to complete an acute test and three samples collected over a six day (144-hr) period are necessary to complete a chronic test, in most cases. Intermittent or seasonal discharges may require deviations from this standard sampling schedule (see Chapter 1.6 for a discussion of intermittent discharges: http://dnr.wi.gov/topic/wastewater/WETguidance.html). Operating conditions could change during the sampling period,

but tests should continue once they are started (e.g., a test in progress should continue even if the treatment plant enters an upset condition). Permittees and labs should be careful to note any changes or abnormal conditions on the lab slip and on the WET Test Report Form.

Most WET test samples should be collected as 24-hr flow-proportional composite samples, unless a time proportionate or grab sample is deemed appropriate due to a lack of effluent variability. Flow proportional sampling is usually most desirable to best represent effluent quality over a 24-hr period. If the facility sampler will not provide enough volume, a greater volume may be obtained by attaching a hose to the pump and running it outside of the sampler to a large cooler with a sample container on ice. Time composite samples may be acceptable when flow proportional is not available; however, this type of sample will not be as representative of effluent quality as a flow proportioned sample, if flow or effluent quality is variable over a 24-hr period.

A series of grab samples may be collected to provide a 24-hr composite when flow or time proportional sample collection is not possible. One grab sample may be appropriate if effluent quality is not expected to vary over a 24-hr period. For example, a single grab may be acceptable for municipal stabilization pond systems. In other situations, a grab sample or series of grab samples may be the only type that can be collected (e.g., in an enforcement case where sample security is paramount, where discharges are for short or intermittent periods, etc.). Sample type must be noted on chain of custody forms and on WET test report forms (see Section 6 of the Methods Manual for reporting requirements).

Effluent Sample Adjustments

Since the goal of WET testing is to simulate the conditions which occur as the discharge enters the environment, Section 4.15 of the Methods Manual requires that WET samples not be manipulated in any way (e.g., no dechlorination, filtration, aeration, pH adjustment, etc.), unless parallel testing is done to demonstrate what, if any, affect the manipulation had on the test. If a facility has reason to demonstrate that a chemical is the cause of toxicity, they may choose to demonstrate this by conducting parallel tests of adjusted and unadjusted effluent. For example, if it is necessary to collect WET test samples after chlorination but prior to dechlorination, it may be desirable to conduct side-by-side tests to show that any chlorine present in the sample is the only cause of toxicity. Side-by-side tests may also be desirable when deficiency toxicity is suspected (see Chapter 1.3, for more discussion).

Parallel tests should be similar in every way other than the adjustment being demonstrated. Controls should be included to show that the adjustment itself has not caused toxicity. No more chemical should be introduced into the sample than is absolutely necessary for a successful test; the adjustment chemicals themselves might be toxic or enhance the toxicity of other substances. The Department may use data from parallel tests to determine what has caused an effluent to fail a toxicity test, to determine whether follow up work is necessary, or to help determine an effluent's toxicity potential.

Wastewater Treatment Plant Conditions

As stated in standard permit language, permittees are ***NOT*** allowed to shut down chlorination, chemical addition, or other wastewater treatment processes during WET test sampling. Testing must be done under normal operating conditions. Permittees are not allowed to turn off or modify treatment systems, change production or waste treatment schedules, or change other normal operating or wastewater conditions during WET tests. Standard permit language in the WET footnote addresses this in the following manner:

> *WET testing shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests.*

If something unusual is occurring within the distribution or treatment system before testing begins, permittees should

contact the Department's Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) to discuss the situation and decide whether testing should be rescheduled. If conditions change during testing, tests should continue. Permittees and labs should note any changes or abnormal conditions on the lab slip and WET Test Report Form.

Sampler Care and Cleaning

Equipment used to collect effluent and receiving water samples for WET testing should be cleaned appropriately before use, in order to remove any potential sources of sample contamination. Artifactual toxicity can occur if equipment is not properly cleaned before sampling, due to chemicals that may be present. Microorganisms that colonize on dirty surfaces can cause biological interference in WET tests or produce endotoxins that are toxic to the WET test organisms.

It is strongly recommended that permittees replace all tubing and clean any parts that come in contact with effluent or receiving water samples, before sampling. If using automatic samplers, used tubing should be replaced with new tubing (including the pump head tubing) prior to every WET test. If this is not possible, all tubing should be cleaned and rinsed according to procedures outlined in the Methods Manual. All equipment used for collecting grab samples of effluent or receiving water should be cleaned in this manner, as well. The following is an excerpt from cleaning requirements found in Section 3.12 of the Methods Manual:

"All…sample containers…that are reused shall be cleaned according to the following procedures, except where sampling equipment may not be compatible with acids or acetone, in which case the manufacturer's recommended cleaning procedures should be followed:

1. *Soak 15 minutes and scrub with detergent in tap water, or clean in an automatic dishwasher.*
2. *Rinse twice with tap water.*
3. *Rinse with 10% HCl or 10% HNO_3 (v:v) to remove scale, metals, and bases.* ***Caution****: HNO_3 is a strong oxidizer and may react and combust with acetone.*
4. *Rinse twice with tap water.*
5. *Rinse once with liberal amounts of fresh, full-strength, reagent grade acetone (or an alternate solvent approved for use by the Department) to remove organic compounds. Use a fume hood or canopy.*
6. *Rinse three times with distilled or deionized water."*

Sample Acceptability

Samples must meet the following criteria, according to the Methods Manual (Section 2.4), in order to be acceptable for permit compliance. If samples do not meet these criteria and are rejected, tests may need to be restarted at the cost of the permittee.

Holding Time

The maximum holding time prior to the initial use of an effluent or receiving water sample for WET testing is 36 hours after the completion of sample collection. Sample holding time starts when a grab sample is collected or when a composite sampling period is completed and ends when organisms have been introduced into test chambers for all tests.

Temperature

The effluent sample temperature at the time of arrival at the lab must be $\leq 10^{o}C$ and there must be evidence that the sample was packed with ice during shipping. The sample temperature at the time of arrival at the lab may exceed $10^{o}C$ only if the time elapsed from the end of the sample period is < 4 hrs.

Guidelines for Sample Shipping and Handling

The following tips are from past experience and requirements in the Methods Manual regarding WET sample handling. By following these suggestions, the most common mistakes that invalidate or compromise samples can be avoided. Additional guidance regarding sample scheduling and volume can be found in Attachment 1 at the end of this chapter.

Samplers

When using a composite sampler, several problems can occur that can cause the sample to be missed or cause artifactual toxicity. Disconnection of tubing or power supplies is a common cause for missed samples. All tubing and cords should be secured to a surrounding structure to prevent accidental disconnection. Tubing connectors should be forced on as firmly as possible. Securing the connections with duct tape or nylon ties is recommended. Power supplies can be secured by tying or taping electrical cords together at junctions. If wet conditions are expected, the junctions should be wrapped with waterproof tape to avoid short circuits. If using batteries, make sure they are fully charged. In cases where frequent pumping is required or the temperature is very cold, the battery could be replaced during the sampling period.

Frozen lines can occur in winter when using a composite sampler. Freezing risk can be minimized by selecting a protected site for the sampler, repositioning tubing, or decreasing the intervals between sampling. If possible, select a site that is indoors or in an area that has a higher temperature due to the surrounding environment. The temperature of most effluents is usually above 40^{o}C, so areas nearer to the effluent should be warmer than those further away. Final contact troughs or wells may have a place to set the sampling equipment close to this warmer temperature (**Caution**: do not enter confined spaces unless trained to do so). Tubing should be positioned so that the inlet and outlet are sloped away from the sampler. Dips in tubing will collect water and freeze between sampling intervals. Decreasing the sampling intervals might keep tubing from freezing.

Containers

Samples are usually collected and shipped in Cubitainers© (1, 2.5 or 5 gallon), carboys, or similar containers. Containers that are used for collection should be new or washed according to the protocols described above.

Cooling

As required by Section 2.2.7 of the Methods Manual, WET samples must be chilled during collection, through the use of a refrigeration unit or in a cooler on ice. During hot weather or when collecting very warm effluents, it may be necessary to add more ice before the end of the sample period.

Documentation

The sample slip/chain of custody should be filled out as thoroughly as possible. The Methods Manual (Sections 2 and 6) requires that the facility name and outfall, sample temperature and pH, date of collection, time of collection, name of collector, and procedures used for effluent and receiving water sample collection be noted on chain of custody forms and WET Test Report Forms. Any unusual conditions (e.g., plant upsets, slug loads, weather conditions, flooding, algae blooms, etc.) in the WWTP or receiving water must also be noted on these forms.

Packing

Air must be forced out of collapsible sample containers. Samples should be shipped in a cooler, surrounded by ice (20 lbs), with all water drained from the cooler. If the sample is shipped via commercial carrier, samples and ice must be sealed within a large plastic bag, because the carrier will return the sample if it leaks in transit.

Shipping

Sampling schedules will need to accommodate shipping schedules (sampling periods should end as close to the shipping time as is practical) in order to insure that the < 36-hr holding time is met. Samples may be hand delivered by the permittee or shipped via a commercial carrier. Courier services may guarantee delivery within certain time

periods, with the purchase of shipping insurance.

In cases where a sample is very warm after collection, permittees may want to deliver the sample to the lab within the 4 hr time limit (described below) or add more ice during transit in order to meet ≤10°C arrival temperature criteria. If a very warm sample is shipped by a commercial carrier, samples should be pre-cooled prior to shipping.

Saturday Delivery

When chronic WET tests are being conducted, it may be necessary for the lab to receive an effluent sample on Saturday. When shipping samples to arrive on Saturday, ***coolers/shipping containers MUST be Labeled for "Saturday Delivery"*** (not "Overnight Delivery") or the shipping company will not deliver overnight samples until Monday morning. Saturday delivery is often a separate option that must be specified. "Overnight" or "Next Day Air" on Fridays usually means the next business day, which is Monday. In many cases, the shipping company may have "Saturday delivery" stickers that need to be affixed to the container.

It is the permittee's responsibility to see that their chosen courier understands that samples must arrive on Saturday in order for successful completion of the test. If samples are shipped from a courier "substation" (e.g., a hardware store or shopping plaza), permittees should make sure that shipments are marked for Saturday delivery (do not assume that store clerks understand the importance of this step). If samples do not arrive within the required < 36-hr holding time, samples could be rejected and tests restarted (see Section 2.4 of the Methods Manual), at additional cost to the permittee.

There may be circumstances outside of the permittee's control (e.g., winter weather) that result in late sample delivery. In these cases, individual samples may be conditionally acceptable if holding times fall outside specifications, depending on the degree of the departure and the objectives of the test. When this occurs, permittees (or their lab) should contact the Department's Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov or 608-267-7663) for permission to continue the test. Any deviation from holding time requirements must also be clearly described on the "WET Test Report Form" (see Section 6 of the Methods Manual). If Saturday delivery does not occur due to shipping company error, permittees should discuss this with shipping company management so that they can address the problem within their system and avoid future occurrences.

Lab Receiving

When the sample arrives at the lab, a record of the receipt must be produced by the lab (Section 2.4.4, Methods Manual). The Methods Manual requires documentation of the date and time the sample was received, the name of the person receiving the sample, and the lab number assigned to the sample. The lab also must measure and record the temperature and the pH of the sample, presence or absence of ice, and any abnormalities of the sample (i.e., open container, leakage, etc.) as soon as it arrives at the lab.

ATTACHMENT 1 - WET TEST SAMPLING CHECKLIST

This checklist is guidance for use when collecting samples for WET testing. Details are provided in the preceding chapter. Additional guidance may be provided by the lab completing the analysis. ***Permittees should discuss sampling schedules and volumes with their lab before testing.***

Pre-sampling Preparation:

1) Verify effluent sampling location is representative and according to permit requirements. Find a location to obtain receiving water that is accessible and safe (if receiving water is to be used).

2) Clean all sampling equipment (see preceding chapter, page 3) including any buckets or funnels used to collect receiving water. Replace the tubing in the pump head and have enough new tubing to run from the sampler to the sample point, if using an automatic sampler.

3) Verify shipping schedule with lab. NOTE: Courier services will usually guarantee delivery within certain time periods, with the purchase of shipping insurance. **Shipping insurance may cost from $5 - $30 per sample, but may prevent costs associated with test restarts or repeats.**

4) Make sure sufficient ice is available for sampler and shipping containers, especially in hot weather.

Sampling Schedule

Day	Activity
1	Set up automatic sampler to begin 24 hr composite period. Set controls to collect sufficient amount (usually 1.5 gal for acute; 3.0 gal for chronic). This step is not necessary if grab samples are used.
2	Collect effluent composite sample #1 (or grab, if appropriate). Collect receiving water grab sample. Send effluent #1 and receiving water to lab. Repeat Day 1 - set up sampler, set controls to collect sufficient amount, begin composite.
3	Collect effluent composite sample #2 (or grab, if appropriate). Send effluent sample #2 to lab. For an acute test, this completes sampling. If doing a chronic test, continue through days 4-6.
4	No activity.
5	Repeat Day 1 - set up sampler, set controls to collect sufficient amount, begin composite.
6	Collect effluent composite sample #3 (or grab, if appropriate). Send sample #3 to lab. ***Coolers MUST be Labeled for "Saturday Delivery" NOT "Overnight Delivery"*** or the shipping company will not deliver overnight samples until Monday morning.

The activities and dates on this checklist are general and should be used in consultation with specific lab instructions.

SPECIAL NOTES: Sample temperature upon arrival at the lab must be $\leq 10^{o}$C and there must be evidence that the sample was packed with ice during shipping. The amount of time from the end of the sampling period to the beginning of the test must not be > 36-hr (see preceding chapter for discussion).

CHAPTER 1.2 - Receiving Water Used to Make WET Determinations

The purpose of this chapter is to aid in the selection of the appropriate receiving water to use when determining dilution ratios, calculating the IWC, and for use as dilution waters.

NOTICE: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Receiving Water Use in WET Determinations

Since the initial promulgation of ch. NR 106, Wis. Adm. Code, in the late 1980's, the Department has been reviewing surface water discharges to determine the need for WET testing to assess the effluent's potential for impacts to fish and aquatic life communities. Receiving water type, location, and dilution are important factors that are considered when determining the appropriate WET requirements for a given situation. Since the magnitude of toxic effect usually increases as effluent concentration increases, one of the most important factors affecting WET potential is the dilution available in the receiving water. A very toxic effluent with an extremely large dilution may cause less environmental damage than a less toxic effluent with very little dilution. Since dilution and mixing are important considerations, the WET Checklist process described in Chapter 1.3 includes an evaluation of the relationship between receiving water flow and effluent flow. (See http://dnr.wi.gov/topic/wastewater/WETguidance.html)

When completing the WET Checklist, it is important to use the appropriate effluent and receiving water flow information to calculate receiving water to effluent flow ratios ($Q_{7,10}$:Q_e) and instream waste concentrations (IWC). Generally, coldwater, warmwater sport fish, and warmwater forage fish waters support a more diverse aquatic life community and warrant a higher level of protection. Conversely, waters historically referred to as "variance" waters (limited forage fish, limited aquatic life) usually have less diverse fish populations or macroinvertebrate-only communities. In recognition of this, the following approach is recommended which provides protection from acute toxicity impacts to all waters, moderate protection from chronic impacts to variance waters, and full protection from chronic impacts to all waters classified as coldwater, warmwater sport fish, or warmwater forage fish.

Since the aquatic communities that WET testing is designed to protect are always present in coldwater, warmwater sport fish, and warmwater forage fish communities, the receiving water used for making chronic WET determinations should be the first waterbody that the effluent encounters which supports any of these communities. If Department staff have information showing that the immediate waterbody supports a coldwater, warmwater sport fish, or warmwater forage fish community, chronic WET requirements such as the instream waste concentration should be determined using that receiving water.

In situations where the effluent is discharged into a waterbody that supports a limited forage fish or limited aquatic life community, the distance to the first waterbody that the effluent encounters which supports a coldwater, warmwater sport fish, or warmwater forage fish community (or the distance between the discharge and where the direct receiving water supports any of these populations) should be determined. When this distance is less than 4 miles, the receiving water flow to be used for chronic WET determinations should be that of the coldwater, warmwater sport fish, or warmwater forage fish waterbody downstream of the confluence, minus the effluent flow contributed by the discharger. If the distance to that waterbody is $\geq$ 4 miles, chronic WET testing is not usually recommended, unless information is available that shows a potential exists for impacts due to chronic toxicity (for example, if there have been chronic WET failures).

Staff should use their best professional judgment to select the appropriate receiving water flow to be used when making chronic WET determinations that will be protective of the appropriate aquatic life communities. Some example scenarios are illustrated at the end of this chapter. Once staff have chosen the appropriate waterbody to be used, the same waterbody should be used for stream flow to effluent flow ratios and IWC determinations.

As specified in s. NR 106.06(3)(b)2, Wis. Adm. Code, when an effluent is discharged to a waterbody without unidirectional flow (e.g., lakes, bays, impoundments), the default stream flow to effluent flow ratio is 10:1 and the IWC is 9%. These default values should also be used whenever a "variance" stream empties into a waterbody without unidirectional flow (i.e., when the first downstream coldwater, warmwater sport fish, or warmwater forage fish waterbody is a lake or pond). See Attachment 1 of this chapter for some examples of appropriate receiving water use in different discharge situations.

Requirements For Discharges to Wetlands

All wetlands in the state are currently classified as variance waters. To determine the $Q_{7,10}$:Q_e ratio and IWC for a facility that discharges to a wetland, staff should determine the point where the stream discharging from the wetland becomes a non-variance classification and use the flow characteristics at this point in WET determinations. If the wetland/stream does not change to a non-variance waterbody within 4 miles, judgments similar to those discussed above should be made to determine which waterbody is most appropriate for use. To calculate the IWC for facilities that discharge to wetlands that do not then discharge to other surface waters, staff should treat the discharge similar to a lake situation, as described above (i.e., the $Q_{7,10}$:Q_e = 10:1, IWC = 9%).

Receiving Water Diluent in WET Tests

According to Section 4.4 of the "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*" (Methods Manual; http://dnr.wi.gov/topic/wastewater/documents/WETMethodsManualEdition2.pdf), receiving water must be used in all chronic tests (unless otherwise specified in the permit) and in acute tests where a zone of initial dilution (ZID) has been approved. In acute tests that measure toxicity at the end of pipe (i.e., where no acute mixing zone/ZID has been approved), the use of receiving water for dilution is optional - a standard laboratory water may be used instead.

Correct identification of an appropriate receiving water sample location is important in cases where permittees are required to use receiving water as the diluent, because the objective of the WET test in those cases is to estimate the effect on the receiving water after the effluent has been mixed in and the extent to which the chemicals are biologically available to aquatic organisms. The Methods Manual requires the use of receiving water as diluent because this increases the environmental relevance of WET testing by more directly representing real-world effluent and receiving water interactions in the test. Use of receiving water for dilution improves the ability of WET tests to predict in-stream effects.

As required by the Methods Manual, a minimum of one representative grab sample of the receiving water is necessary for use in a WET test. In stream and river situations, the receiving water sample should be collected upstream of the discharge, with every attempt made to avoid contact with the permittee's and any other discharges' mixing zones. In situations where a lake, impoundment, bay, or other waterbody without unidirectional flow has been identified as the receiving water to be used for WET tests, a sampling location should be chosen that is outside of the influence of all known discharges.

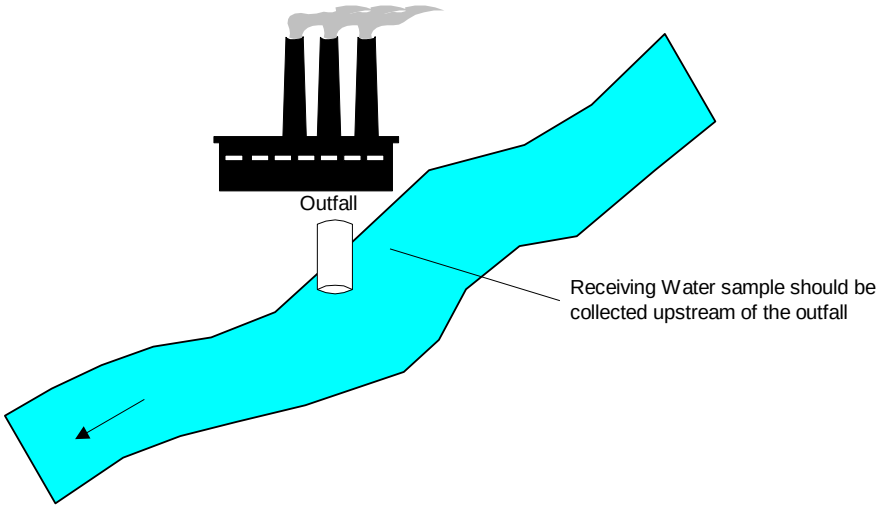
In situations where the water that is discharged into becomes a coldwater, warmwater sport fish, or warmwater forage fish waterbody within 4 miles, receiving water samples should be collected upstream of the outfall, as described above. In situations where a separate downstream waterbody was used for WET determinations, the receiving water sample should be collected from a site upstream of the confluence of the waterbody that is discharged into and the waterbody that was used for WET determinations.

What if the Samples Cannot Be Collected in the Receiving Water?

Under some conditions, like a lack of river flow during dry periods or icy conditions in winter months, it may be necessary to use a different dilution water. In situations where the direct receiving water is unavailable, the next best option might be another surface water with similar characteristics (i.e., in the same watershed, similar water chemistry and physical characteristics). If no alternate surface water can be identified, it may be necessary to use laboratory water for dilution. However, using lab water for dilution should be a last resort. Naturally occurring materials that complex with and potentially detoxify some compounds are absent from lab waters, therefore tests using lab water may overstate effluent toxicity effects on the receiving water environment. (See Chapter 2.11 for more guidance regarding the use of alternate dilution waters: http://dnr.wi.gov/topic/wastewater/WETguidance.html).

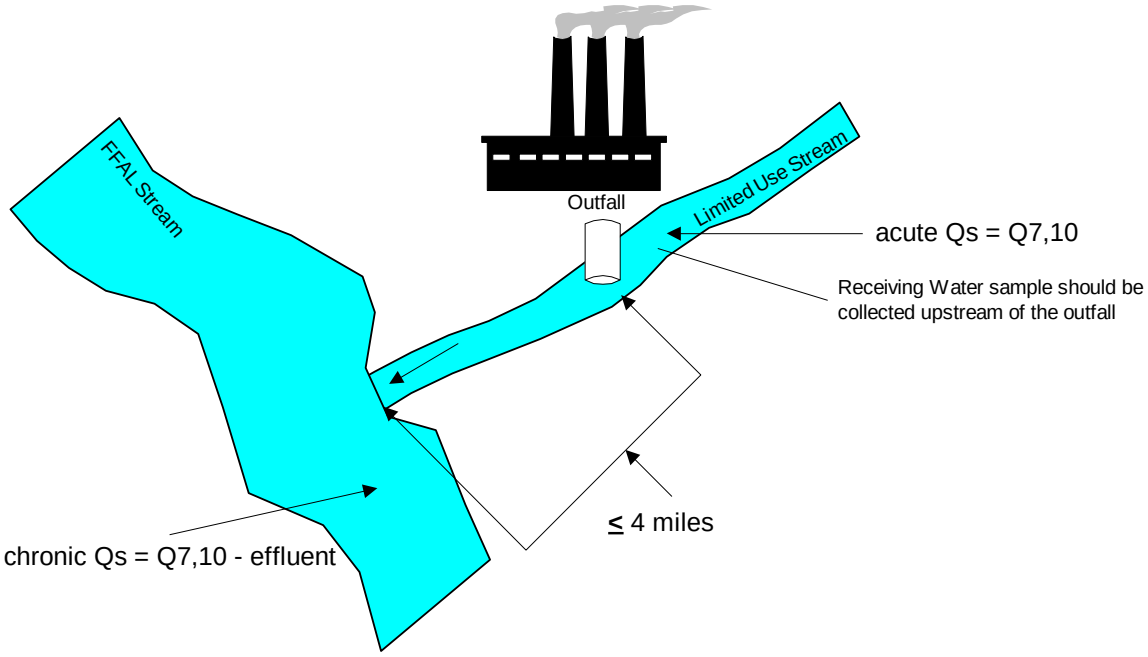
If an alternate receiving water or a lab water is identified in the permit as the required diluent, permit drafters should document the reason for this deviation in the fact sheet. If decisions about alternate dilution waters are necessary during the permit term, permittees (or their labs) must contact the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov or 608-267-7663) for permission to deviate from method requirements. Reasons for deviations from permit or WET method requirements must also be clearly described on the "WET Test Report Form" (see Section 6 of the Methods Manual).

Example #1: Fish and Aquatic Life (FFAL) Stream



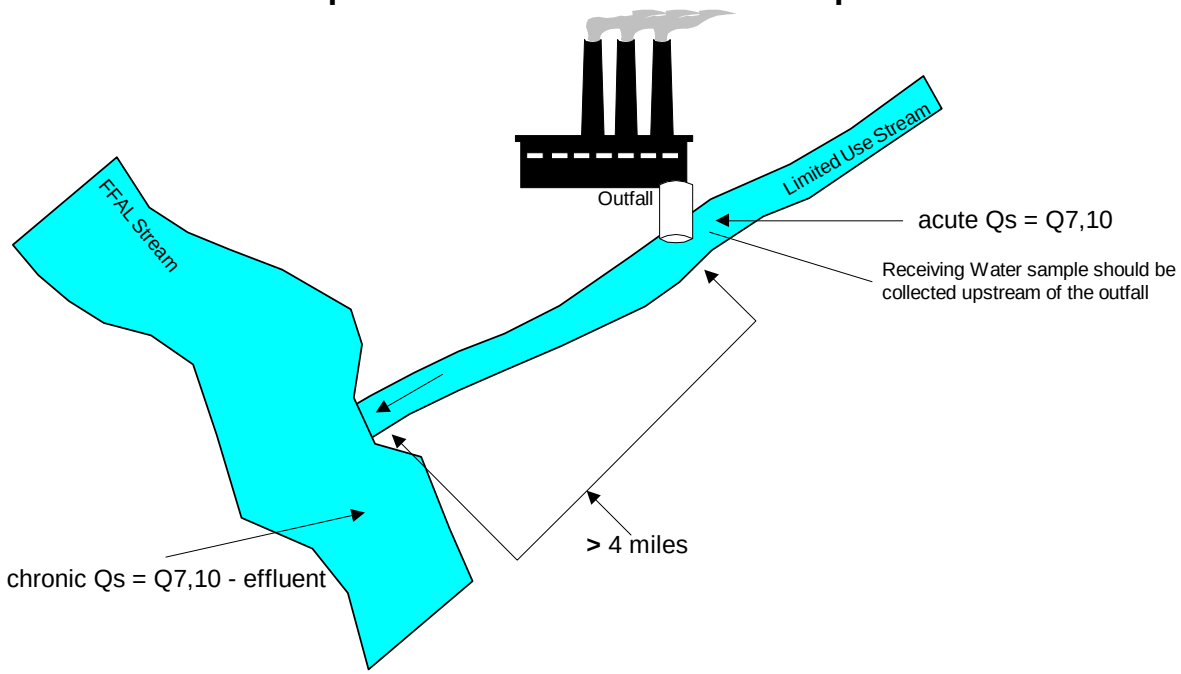
acute & chronic Qs = Q7,10 of receiving water
Need for acute and chronic testing evaluated using the WET Checklist:
Q7,10:Qe > 1,000:1 No WET usually recommended
Q7,10:Qe ≤ 1,000:1 & >100:1, Acute WET only usually recommended
Q7,10 ≤ 100:1 Acute & Chronic testing recommended

Example #2: Limited Use Stream w/Upstream Flow



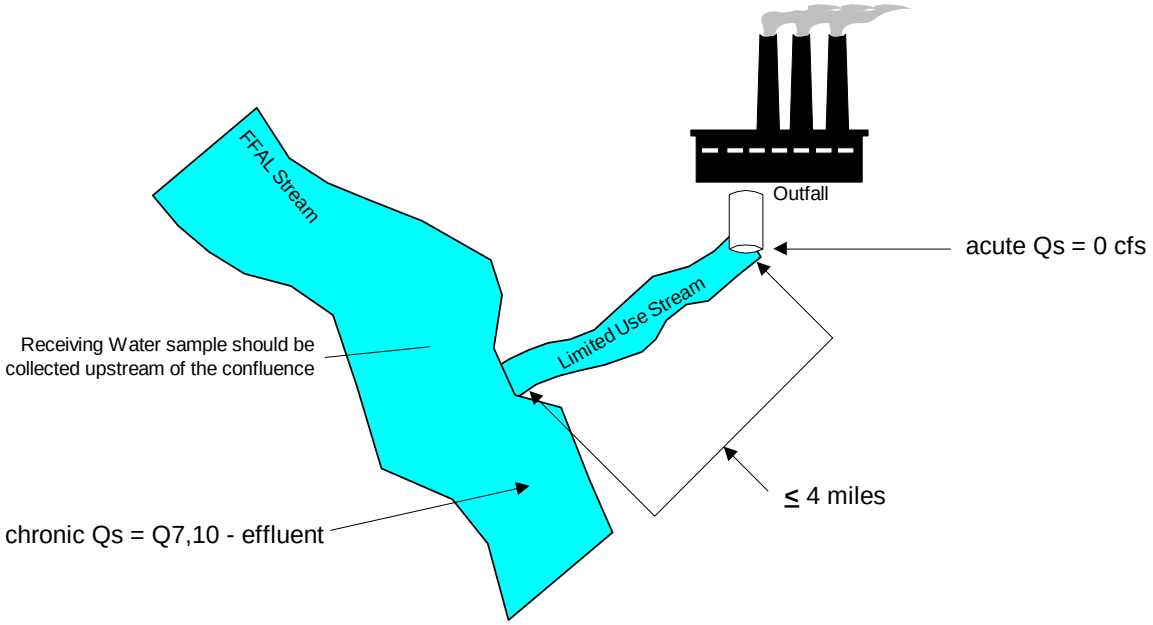
chronic Qs = Q7,10 of 1st downstream FFAL or higher
Need for acute and chronic testing evaluated using the WET Checklist:
Q7,10:Qe > 1,000:1 No WET usually recommended
Q7,10:Qe ≤ 1,000:1 & >100:1, Acute WET only usually recommended
Q7,10 ≤ 100:1 Acute & Chronic testing recommended

Example #3: Limited Use Stream w/Upstream Flow



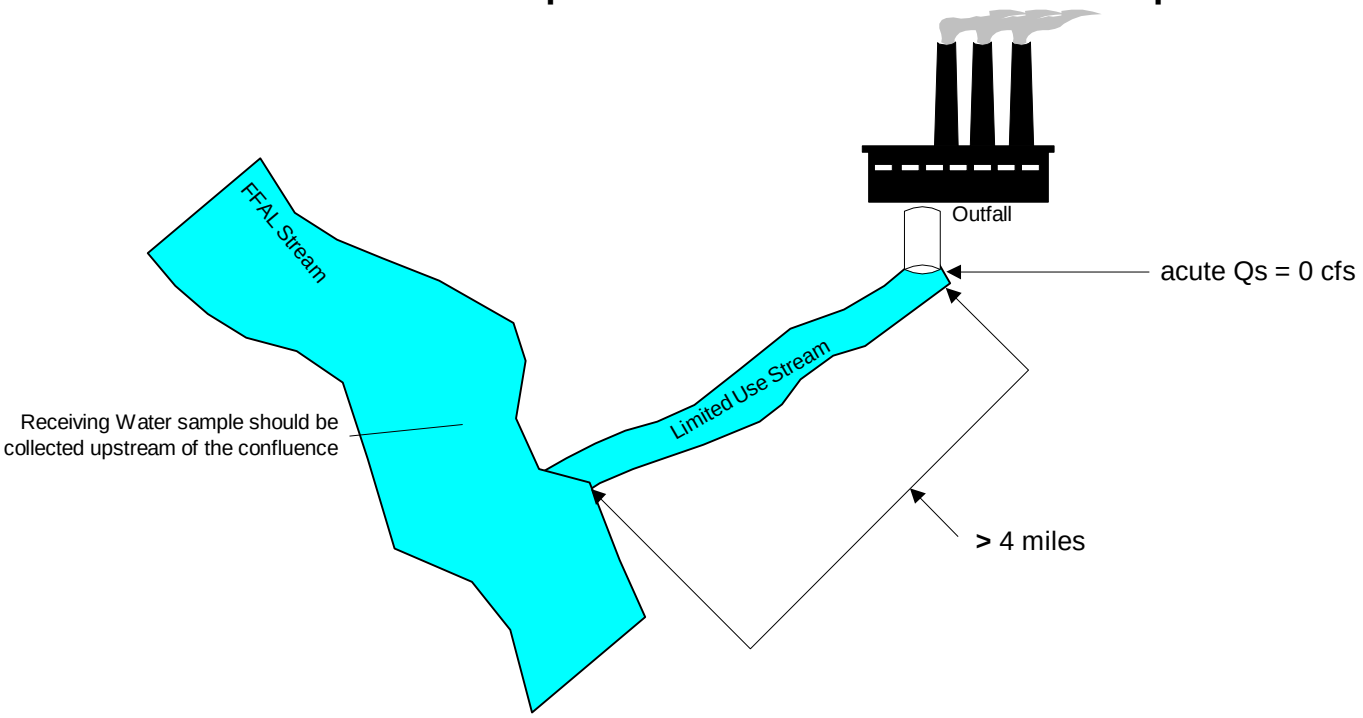
chronic Qs = Q7,10 of 1st downstream FFAL or higher
Need for acute and chronic testing evaluated using the WET Checklist:
Q7,10:Qe > 1,000:1 No WET usually recommended
Q7,10:Qe ≤ 1,000:1 Acute WET only usually recommended
No chronic recommended, unless historical toxicity problems are known.

Example #4: Limited Use Stream w/No Upstream Flow



chronic Qs = Q7,10 of 1st downstream FFAL or higher
Need for acute and chronic testing evaluated using the WET Checklist:
Q7,10:Qe >100:1, Acute WET only usually recommended
Q7,10 ≤ 100:1 Acute & Chronic testing recommended

Example #5: Limited Use Stream w/No Upstream Flow



Need for acute and chronic testing evaluated using the WET Checklist:
Qs = 0 cfs Acute WET usually recommended
No Chronic testing recommended unless historical toxicity problems are known

CHAPTER 1.3 - Representative Data, Reasonable Potential, Monitoring and Limits

This chapter was written to provide guidance for staff use when choosing representative data and considering facility-specific information in order to make decisions regarding WET monitoring and limitations, including instructions for use of the electronic WET Checklist.

Contents

NOTICE: This chapter and the associated SWAMP WET Checklist are intended solely as guidance, and do not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Staff Responsible For WET Determinations

In order to insure consistent and efficient decision making and in order to be able to describe the whole effluent toxicity (WET) determination process in this guidance, it is necessary to include recommendations that identify which WDNR staff should be making decisions regarding WET requirements. In order to make good decisions, the person responsible for making WET determinations needs to be familiar with receiving water and effluent conditions, water quality-based effluent limit (WQBEL) recommendations, and other site-specific information, or be able to easily obtain it (have access to field staff with this knowledge). In order to make the best informed decisions possible, it is necessary for WQBEL and WET determinations to be made via a collaborative effort with permit coordinator, compliance engineer/specialist, and WQBEL staff. In most cases WQBEL staff should make WET monitoring and limit recommendations by completing the WET Checklist concurrently with WQBEL recommendations, with compliance staff input related to facility-specific information. Once complete, WET recommendations are given to permit drafters for incorporation into permits.

Making WET Determinations Using Representative Data

It is important that decisions about monitoring and limits be made using data that is representative of the discharge being evaluated, as specified in s. NR 106.08, Wis. Adm. Code (see Figure 1), and discussed further in the guidance below.

Figure 1. NR 106.08(3) Representative Data

NR 106.08 Determination of the necessity for whole effluent toxicity testing requirements and limitations.

(3) Representative Data. Toxicity test data available to the department shall be considered representative when those data meet the following conditions:

(a) Data are representative of normal discharge conditions and current effluent quality;
(b) Data were produced by a lab certified or registered under ch. NR 149;
(c) Data were produced from toxicity test procedures specified in the WPDES permit; and
(d) Data were produced from toxicity tests that met all applicable QA/QC requirements specified in the WPDES permit.

(4) No Representative Data. If no representative discharge data are available for an effluent being discharged from a point source, whole effluent toxicity testing requirements are necessary if, in the judgment of the department, water quality standards may be exceeded. In such cases, all of the following factors shall be considered:

(a) Any relevant information which is available that indicates a potential for an effluent to impact the receiving water aquatic life community.
(b) Available dilution in the receiving water.
(c) Discharge category and predicted effluent quality.
(d) Proximity to other point source dischargers.

(7) Data Exclusions. The Department may exclude data from a WET reasonable potential determination when those data meet any of the following conditions:
(a) Data are not representative pursuant to sub. (3);
(b) Positive WET results are caused by deficiency toxicity only; or
(c) Positive WET results are caused by groundwater or surface water remediation needed to correct or prevent an existing surface or groundwater contamination situation or a public health problem.

Steps 1 and 2 below include a description of criteria that staff should consider as they review WET data prior to making decisions about the need for monitoring and limits. Step 3 describes using the WET Checklist to determine if limits are necessary and to help staff make WET monitoring frequency recommendations, and provides examples for various discharge scenarios.

Step 1: Collect and summarize all WET data (see below) and other related information,

Step 2: Select WET data which is representative of the discharge being evaluated (see p. 4), and

Step 3: Complete the WET Checklist (see p. 6) to determine the monitoring frequency and the need for WET limits.

The guidance in this chapter is intended to apply in most situations, but there may be situations where the general assumptions it is based on may not apply and deviations from the suggested criteria will be necessary. Decisions that are made contrary to the guidance should be shared with the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) and clearly documented, so others can tell why decisions were made. Examples and possible reasons for deviating from WET Checklist recommendations are given starting on page 38.

Step 1 - Data Collection and Summarization

When WQBEL staff are getting ready to make WET determinations, all available data for each outfall being evaluated should be collected and summarized. As a first step, staff should review data in the SWAMP WET database and print WET database summary reports. (Instructions for creating summary reports are found here: \\central\water\WQWT_PROJECTS\WY_CW_SWAMP\SWAMPUserManual\WET_Database.doc). **It is critical that staff review all available WET data for the facility that they are evaluating.** Staff should compare tests listed in the database with requirements in the previous permit, to insure that all data has been submitted to the Department. *(Note: There may be a delay between report submittal and data entry. Contact the Biomonitoring Coordinator, if it appears that tests have been completed recently which have not yet made it into the database.)* Database reports summarize WET data and allow for visual review of results and comparison to other effluent data. Since these reports include only summaries, manual retrieval of hard copy reports may be required in some cases (especially if there is a history of effluent toxicity). Detailed WET files are kept in the central office, so a call or email to the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) can be helpful when questions arise.

The Department uses its WET laboratory certification program, regular communication with labs and permittees, and staff and external customer training strategies to insure WET data quality. Data quality can be a complex issue and is determined for each test by the Biomonitoring Coordinator during the report review process (see Chapter 1.5 at http://dnr.wi.gov/topic/wastewater/WETguidance.html for more on data review). If data quality is questionable, a note is placed on the test report form and in the WET Database. Tests with poor data quality should be identified on reports from the WET Database, however, it may be necessary to check hard copies of report forms (which are kept in permit and WET files for the facility) or talk with the Biomonitoring Coordinator.

Only WET tests with clear documentation of data quality problems should be eliminated from the data set at this stage in the process. WET Database reports should include comments noting when problems have occurred or if results are questionable (see discussion of "Qualified Data" below in the next section). A quick call or email to the Biomonitoring Coordinator to verify the appropriateness of using such data could make things go more smoothly later on. If available, it may be useful to consult other effluent data when making decisions regarding the representativeness of WET data. For instance, flow data and results of conventional pollutant testing may be an indicator of abnormal treatment plant operations. It may also be helpful to compare WET results with other effluent data to look for similar trends.

Staff should clearly indicate in the WQBEL memo which WET data was used in RP decisions (and which were not) and discuss why any changes were made to data sets, so that others can understand why decisions were made.

Step 2 - Selecting Representative Data

Decisions about the need for WET limits and appropriate monitoring frequencies should be based on data that is representative of the discharge being evaluated. Once all valid WET data have been compiled (Step 1), additional screening of the data may be necessary. At this point in the process, only data that are clearly flawed have been screened out. Now, additional decisions can be made based on the complete body of data and other factors. Following is a list of considerations when selecting representative data. For many of these, staff may have to rely on the permittee to know whether there is a potential problem. For others, staff may have to dig a little deeper if things don't seem right.

1. **Qualified Data**. There may be notes in the WET Database concerning QA concerns or unusual circumstances at the time of sampling. In many cases when test acceptability concerns are noted, it may be appropriate to exclude the test from the data set. Tests completed during upset conditions may be excluded if it is determined that conditions were not representative of normal effluent conditions. However, recurrent plant upsets should not be excused. Staff should judge whether the problem regularly occurs or is due to poor operation. If regular upsets or poor operation represent normal conditions, the data should be used in making WET monitoring and limits decisions.

   Occasionally, tests must be repeated due to poor QA. When this happens, the unacceptable portions are usually repeated. Tests done under these conditions shouldn't be double-counted. For example, suppose toxicity tests were performed using the *Ceriodaphnia dubia* and fathead minnow. The fathead minnow portion was unacceptable, so that had to be repeated. The original acceptable *C. dubia* results and the repeated fathead minnow results should be counted together as one complete test. (Only 1 value, that of the most sensitive species, should be used in reasonable potential decisions).

2. **Laboratory capabilities and sample integrity.** Lab performance, results of recent audits, and sample quality may need to be considered when deciding whether to include WET data in reasonable potential decisions. All WDNR certified WET labs are audited regularly (on a ~3 year cycle) and audit reports are available. Any evidence of improper sample collection, preservation, or holding times should be considered (test results with these problems may have to be discarded). Tests done by labs not certified or registered according to ch. NR 149, Wis. Adm. Code, at the time the tests were done, are not acceptable for determining permit compliance. A list of currently certified WET labs can be found at: http://dnr.wi.gov/topic/wastewater/WETCertified.html

   Note: The DNR has reason to believe that tests completed by S-F Analytical Labs from July 2008 through March 2011 were not performed using proper test methods. WET data from this lab during this period has been disqualified and flagged as "not reliable" in the WET Database. These tests should not be used in reasonable potential decisions.

3. **"Inconclusive" tests.** Tests may be labeled "inconclusive" during the test report review process, when confounding factors have made the results difficult to interpret. For example, prior to changes made to WET test methods in 2004, inconclusive tests were often the result of the "pathogen effect" (a biological interference) in fathead minnow chronic tests (see Chapter 2.7 at http://dnr.wi.gov/topic/wastewater/WETguidance.html for a detailed discussion of this phenomenon). When the pathogen effect occurs, there is unusually high variability between replicates and an abnormal concentration-response (i.e., lower effluent concentrations have poorer performance than higher concentrations), which may make test results unreliable. In most cases, inconclusive tests cannot be used in reasonable potential decisions because confounding factors have made the results difficult to interpret and it is hard to tell whether the effluent would have "passed" or "failed" with the affected species. An exception to this would be when the unaffected species (i.e., the one that wasn't "inconclusive") showed toxicity. In that case, the portion of the test that failed should be used, even if the other half of the test was inconclusive. (Because if the inconclusive half had passed, the failing half would be used in the RP analysis.)

4. **WET Method Changes and Older WET Data.** Significant changes were made to WET test methods in 2004 and these changes were assumed to be fully implemented by certified labs by no later than June 2005. It may be appropriate to exclude data collected before July 1, 2005, unless 1) it shows repeated toxicity that was never resolved or 2) older data is all that is available and no significant changes have occurred which obviously make it unrepresentative. Still, staff should use judgment when determining whether treatment, process, or other significant changes have occurred which would render data unrepresentative. Staff should evaluate test data to determine whether factors such as treatment plant upgrades, industrial process modifications, or other significant changes have caused WET data to no longer be representative of the discharge, and should not disqualify data simply because it was not generated during the last permit term.

5. **Split samples.** Care should be taken to count only tests conducted on unique effluent samples. Tests are occasionally conducted simultaneously at two different labs, as a check on laboratory performance and/or sampling procedures, and should not be counted as separate tests in reasonable potential determinations. Information from these tests may point out problems, however, which may lead to data elimination (for example, if split samples indicate a contaminated sampler or lab error caused past toxicity problems).

6. **Contributing Sources.** It may be necessary to investigate source loadings to the WWTP, including industrial sources to a municipality. For example, abrupt changes in WET results may be explained by the shutdown of a local industry or the clampdown by a municipality on its industrial contributors. Wide fluctuations in data could represent slug loads from contributors that remain undetected for a time and then reoccur. Wide fluctuations in data caused by permanent industrial discharges or regularly discharged slug loads (for example, a high strength waste that is occasional, but expected) should not cause data to be thrown out. For industrial permittees, wide fluctuations in a data set could mean a change in manufacturing processes. Data gathered during a period when a particular process was used, that is no longer in use (and won't be used during the next permit term), are not likely to be representative of the present discharge and may be excluded. If significant changes have occurred to contributing sources within a treatment facility, WET data collected prior to these changes may no longer be representative.

7. **WWTP upgrades.** Consider whether treatment processes have been upgraded which could significantly affect toxicity removal through the plant. Remember that toxicity can be caused by many factors and an upgrade that only improves solids or BOD_5 removal may not affect effluent toxicity. Data collected prior to an upgrade should be thrown out, in most cases, only if data collected after the upgrade suggests a change in effluent toxicity.

8. **Toxicity Reduction Evaluations (TRE).** Data generated during toxicity reduction evaluations are not usually used in reasonable potential decisions, unless they were compliance-style tests done to demonstrate the successful completion of the TRE. Tests completed during a TRE often involve single-species, single dilutions, or modified samples, used in order to investigate toxicity and are not comparable to standard toxicity tests.

   Successful TREs usually identify the cause of toxicity, steps needed to eliminate toxicity, and results from WET tests conducted after implementation of changes showing that toxicity is gone (accounting for seasonal, process, source loading and other changes, when appropriate). Therefore, successfully completed TREs can significantly change a discharge's potential to exhibit toxicity. In most cases, successful completion of the TRE means that previously collected data (including that collected during the TRE) are no longer representative. When this is the case, only tests that were collected after the TRE that are representative of current discharge conditions should be used in reasonable potential decisions. If failures are present in the dataset, WQBEL staff should check permit files and talk to compliance staff and/or the Biomonitoring Coordinator to determine whether a TRE was conducted and completed successfully.

In order to demonstrate that previous WET data is no longer representative of the current discharge, information is needed that shows why it is no longer representative - for example, significant changes in wastewater treatment, contributing industries, or industrial processes. In most cases it will be necessary to provide WET data which shows a change in toxicity (e.g., data collected after changes were made). Depending on the seasonal nature of the discharge and other factors, 3-4 passing tests conducted under normal operating conditions (at least 30 days apart) are usually enough to demonstrate that changes have resulted in toxicity removal.

When making WET determinations as recommended by this guidance, staff should remember that data are not automatically representative of the discharge being evaluated. If it is determined that representative data are not available, staff should recommend WET monitoring and should not be bound to setting WET limits in the permit. When there is doubt regarding the representativeness of one or a few data points, additional WET data may clarify the representativeness of those data. When representativeness of existing data is questionable, more experienced permittees (or those helped along by supportive Department staff) will conduct additional tests when faced with results that could trigger a limit.

Other factors may cause data to be unrepresentative. Staff should use best professional judgment to determine when this is the case and talk to the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) if questions arise.

It is essential that decisions be well documented in WQBEL memos and fact sheets. Decisions will be more defensible if the Department can demonstrate it is actively applying a set of criteria in arriving at them. Documentation also helps to make future decisions and assess opportunities for program improvement. Decisions that are made contrary to the guidance here should be shared with the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) and clearly documented, so others can tell why decisions were made.

Step 3 - Determination of Monitoring Frequency and Need for a Limit

Once it is determined which data are representative, it can be decided whether a limit is necessary and how much monitoring should be done. WET limits are required as specified in ch. NR 106.08, Wis. Adm. Code (http://docs.legis.wisconsin.gov/code/admin_code/nr/100/106). Limits should be given whenever WET and/or other data shows there is a reasonable potential for toxicity to be present.

Figure 2. NR 106.08(1) Determining the Need for WET Limits

NR 106.08 Determination of the necessity for whole effluent toxicity testing requirements and limitations.
(1) GENERAL. The department shall establish whole effluent toxicity testing requirements and limitations whenever necessary to meet applicable water quality standards as specified in chs. NR 102 to 105 as measured by exposure of aquatic organisms to an effluent and specified effluent dilutions. When considering the necessity for whole effluent toxicity testing requirements and limitations, the department shall consider in-stream biosurvey data and data from ambient toxicity analyses, whenever such data are available.

Should WET limits be carried over into the next permit? Whole effluent toxicity and other facility-specific data should be reassessed and the WET Checklist redone with each permit reissuance. In situations where a WET limit was previously given and a successful toxicity reduction evaluation (TRE) was completed (permanent changes were made to remove toxicity), a limit may no longer be required. However, if WET limit violations occurred during the previous permit term and changes were not made to fix previous toxicity problems, the WET limit should be carried over into the next permit term. If questions exist, staff should talk to the Biomonitoring Coordinator.

WET Checklist (General Information)

In order to guide staff through the WET limit and monitoring decision-making process, an automated "WET Checklist" is provided in SWAMP. The Checklist is designed to assist staff that are deciding whether WET limits are necessary and what levels of WET monitoring should be assigned to individual discharges, based on their potential to exhibit toxicity or exceed water quality standards. As the potential for toxicity increases, more points accumulate in the Checklist and the more monitoring is recommended to insure that toxicity is not occurring. Step-by-step instructions and supporting guidance for use when completing the Checklist are provided below. The WET Checklist and this chapter are intended as guidance, and do not contain mandatory requirements except where statute or administrative rules are referenced. Staff should use the Checklist and their best professional judgment to make final monitoring and other WET-related decisions.

If staff have reason to deviate from Checklist recommendations, they should share their decisions with the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) and clearly document their decisions in the WQBEL memo so that others can tell why decisions were made.

Questions asked by the WET Checklist and the screens as they appear in SWAMP are presented below. After each screen is further instruction and explanation of the points given and information needed.

Minor Municipal Dischargers. If evaluating a minor municipal facility (< 1.0 MGD design flow) that receives only domestic wastewater, staff should consult the guidance in Chapter 1.11 (http://dnr.wi.gov/topic/wastewater/WETguidance.html) to determine if the in-depth analysis presented in the WET Checklist is necessary. A pop-up screen in the WET Checklist will remind users of this additional guidance, whenever the user indicates that a municipal facility is being evaluated.

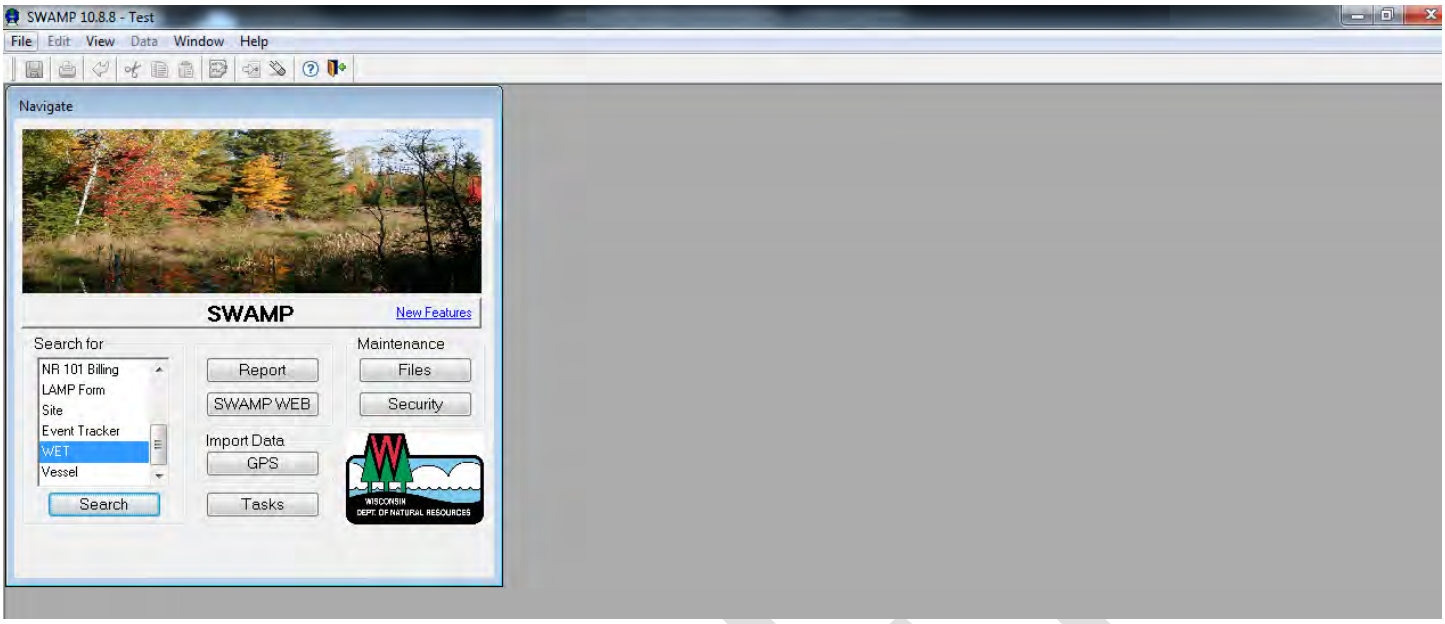
Points Assessed. The WET Checklist assigns points based on factors present that increase the chances for toxicity. Points are based on responses given and may be assessed towards acute, chronic, or both types of monitoring. Points given for each question are shown below after each screen shot. The "Points Assessed" tables indicate whether points are added to acute, chronic or both. The completed Checklist recommends acute and chronic WET limits (when needed), based on reasonable potential calculations required by s. NR 106.08, Wis. Adm. Code, and WET monitoring frequencies, based on points accumulated during the Checklist analysis. Once the Checklist is complete, the user can generate a summary of points assessed and answers given, by clicking on the "Generate" button shown on the lower right corner of the screen.

WET Checklist (Getting Started)

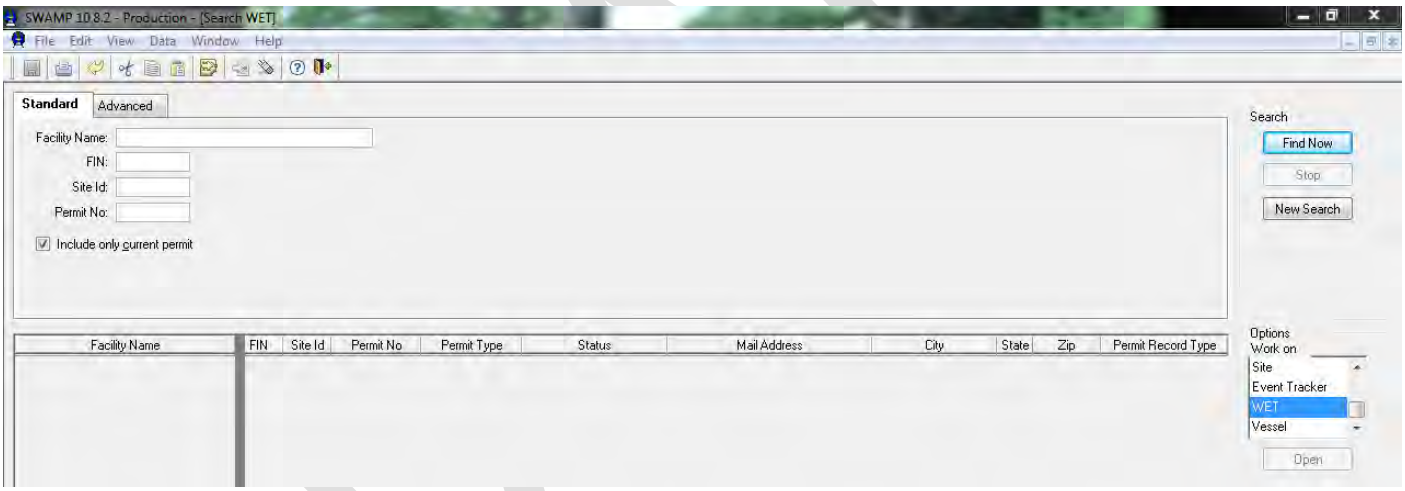
In order for the Checklist to work, information regarding effluent flow (annual average design flow), percent effluent withdrawn from the receiving water (withdrawal factor), receiving water flow ($Q_{7,10}$), receiving water classification, and acute mixing zone (ZID), will need to be entered in the "Sample Point" tab. This information must be entered before creating a new Checklist or revising an existing Checklist. (See attachment 3 at the end of this chapter for instructions on entering or changing data under the "Sample Point" tab in SWAMP).

Municipal effluent flows: Correct and up-to-date consultant engineered and DNR approved design flow information is kept in the System tab area in SWAMP. Staff should confirm that the design flow they are entering into the Surface Water tab for use in WET determinations is not in conflict with the Design Flow info at the System tab in SWAMP.

Receiving water flows: The WET Checklist uses the $Q_{7,10}$ entered in the Sample Point tab in SWAMP. If another receiving water flow value is appropriate, staff will need to calculate Qs:Qe ratios, AMZs, and IWCs outside of the checklist and note this difference in WQBEL memos.

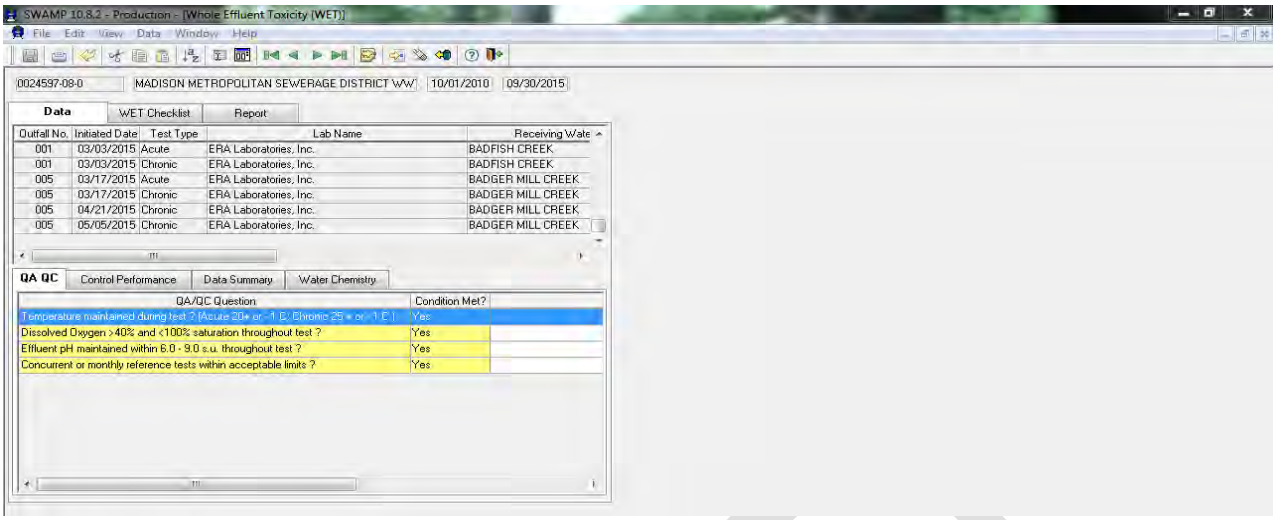


At the Navigate screen (shown above), click on "WET" in the "Search for:" box, then click on the "Search" button.



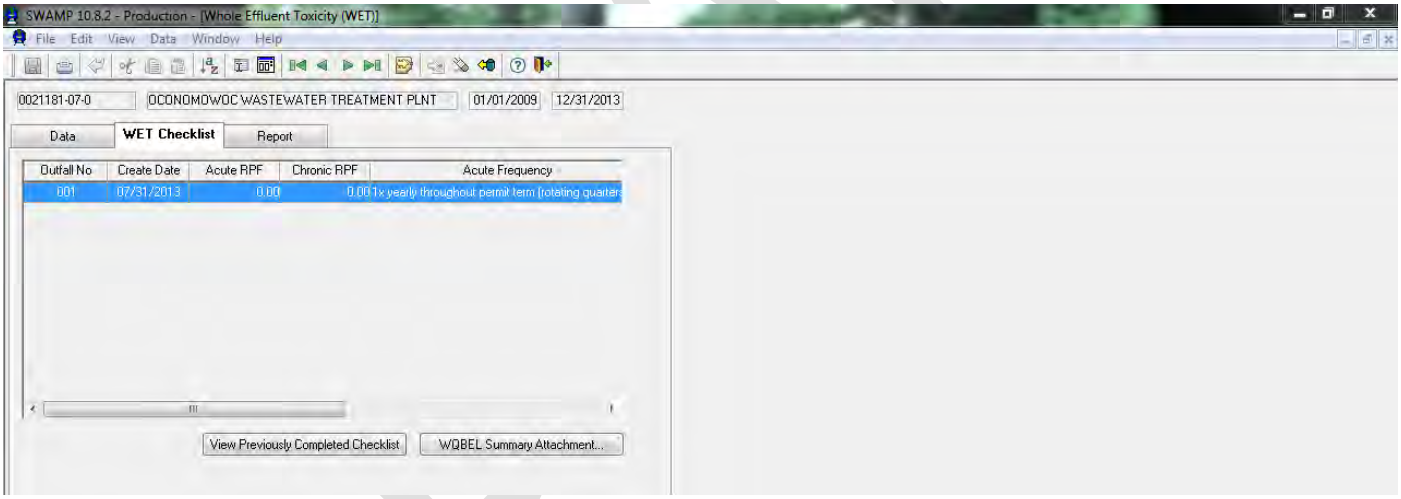
When the "Search WET" window appears (above), enter the permit number and click the "Find Now" button. From the list given, click on the facility you are interested in and then click on the "Open" button.

Previously created WET Checklists will be attached to the permit that was in effect when the analysis was being done. In other words, the WET Checklist for the permit marked "current" will be attached to the previous permit (now expired), since the previous permit was in effect when the current one was being drafted and the WET Checklist was created.



The “Whole Effluent Toxicity (WET)” screen (above) appears with the Data tab displayed. To modify an existing Checklist or to create a new one, select the “WET Checklist” tab from the “Whole Effluent Toxicity (WET)” screen (shown above).

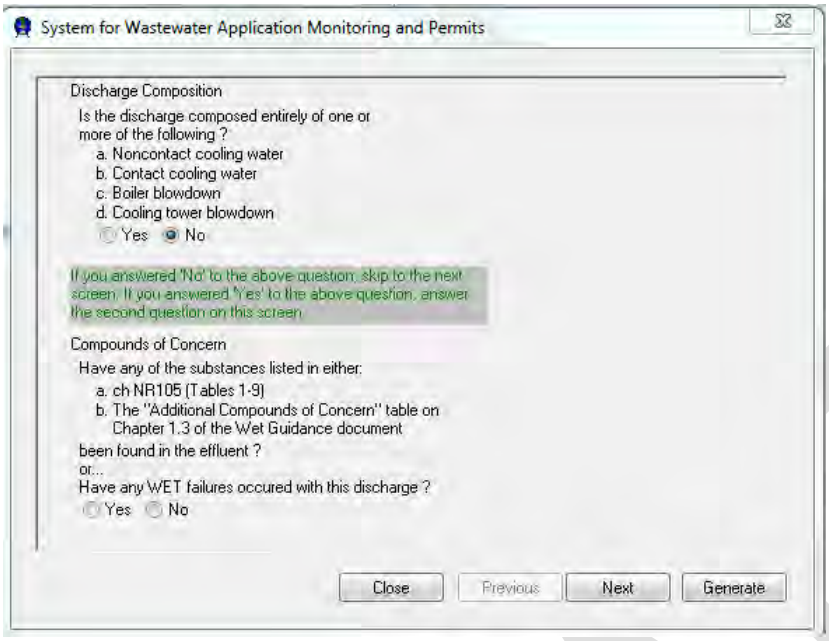
WET Checklist (Creating a New or Modifying an Existing Checklist)



The WET Checklist screen (shown above) will show a list of previously completed checklists (if there are any) for the given facility, the date each was created, the person who completed the last update, and other pertinent information. The screen above also allows the user to create an abbreviated summary of a completed WET checklist to be attached to a WQBEL document (click the “WQBEL Summary Attachment” button), or a more complete summary showing answers given, point totals, and monitoring and limit recommendations (click on “View Previously Completed Checklist” button).

To modify an existing Checklist, select the appropriate row, then double-click. To create a new Checklist, right-click in the WET Checklist tab area, then choose “insert”. Completed WET Checklists will be marked “final”, once the permit is reissued. Once marked final, users will no longer be able to modify that Checklist. A new Checklist can be created. Staff should contact the Biomonitoring Coordinator, if they need to modify a final Checklist.

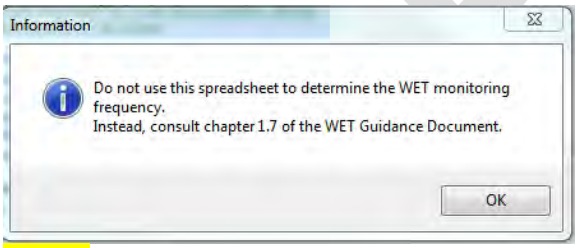
Non-process Waters & Compounds of Concern



The questions shown in the screen above are designed to determine whether the user has chosen the correct tool for determining WET monitoring frequencies. If the discharge is not made up entirely of noncontact cooling water, contact cooling water, cooling tower blowdown, or boiler blowdown (i.e., if the answer to the 1st question is "no"), the Checklist is appropriate and will continue to the facility information screen shown on page 11 (the answer to the 2nd question does not matter and the Checklist will not allow it to be answered). If it is solely a noncontact cooling water, contact cooling water, cooling tower blowdown, or boiler blowdown discharge (i.e., if the answer to the 1st question is "yes"), the Checklist only needs to be completed if WET failures have occurred or if "compounds of concern" have been detected (so the answer to the 2nd question will need to be given for the Checklist to continue).

If the discharge is made up solely of one of the categories mentioned above and no compounds of concern have been detected in that discharge and no WET failures have occurred (in other words, a "yes" is given in the 1st question, and a "No" in the 2nd), an information box will appear instructing the user to consult the *Water Quality Review Procedures for Additives* guidance (see http://dnr.wi.gov/topic/wastewater/Guidance.html).

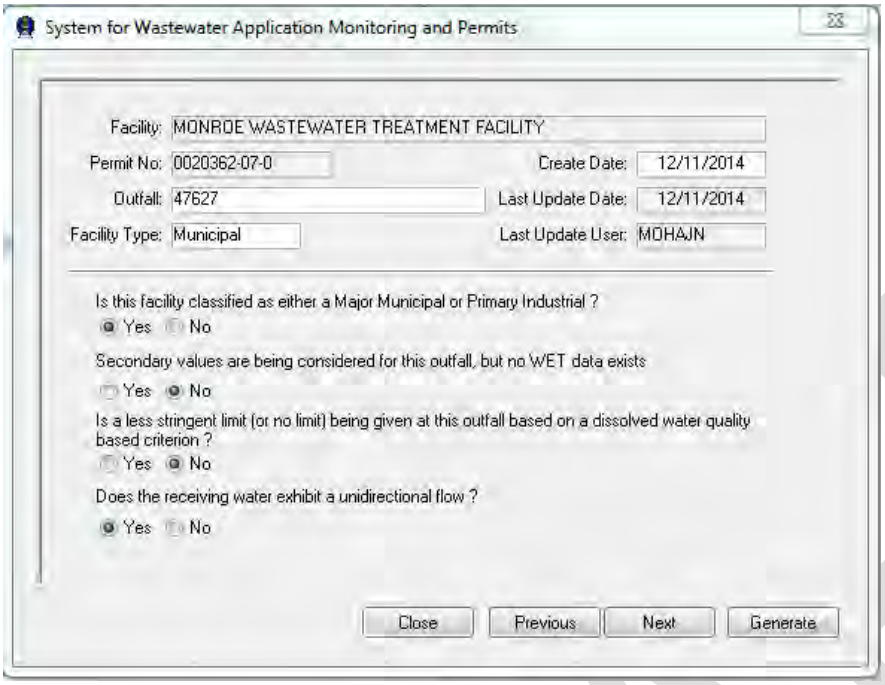
Additive Evaluations



Update.

If answers given in the Discharge Composition/Compounds of Concern screen indicate that the discharge is not composed entirely of noncontact cooling water, contact cooling water, boiler blowdown, or cooling tower blowdown, or if substances listed in ch. NR 105, Wis. Adm. Code, or the "Additional Compounds of Concern" table have been detected or WET failures have occurred, the Checklist will continue to the next screen.

Facility Type & Minimum Monitoring Frequency



Information entered in the screen above identifies the outfall being assessed, its discharge type, and other pertinent information. WET Checklists will need to be completed for each outfall at each facility, unless it has been decided that site-specific situations are better represented by conducting WET tests on combined outfalls (evaluations on combined outfalls will have to be done with the WET Checklist). The Checklist will automatically update the "last update date" and "last update user" each time the Checklist is revised.

Facility Type: The user must choose "municipal" or "industrial". (NOTE: all non-municipals are considered industrial for the purposes of this Checklist.) Indication of facility type is needed for the Checklist to continue, as future screens appear based on this designation.

Major Municipal or Primary Industrial: Federal regulations require that major municipal dischargers submit at least 4 acute and chronic WET tests with their permit reissuance application, as detailed in 40 CFR 122.21(j) (see Figure 3 below). It is recommended that these same testing minimums be applied to process wastewater discharges from primary industries. These federal regulations allow tests to be conducted within the previous term of the permit, so the Checklist recommends a minimum of 1x yearly acute and chronic monitoring (need for chronic is based on dilution) for major municipal and primary industrials, so that data can be available at the time of the next permit application. The Checklist does not assign points for this question, but instead evaluates whether the points given once the Checklist is complete are enough to satisfy this requirement. If less than 1x yearly testing would otherwise be recommended due to point totals, the Checklist recommends 1x yearly monitoring for these dischargers.

Secondary Values: In situations where secondary values are being considered, those substances are present at levels of concern, and no WET data is available, the *Water Quality Rules Implementation Plan* (1/98; Chapter 3A. "CALCULATION OF SECONDARY VALUES"), recommends that monitoring for that substance and at least 2x annual acute and chronic WET (need for chronic based on dilution) be required in the permit. The Checklist uses this question to insure this monitoring frequency is recommended whenever secondary values are considered. The *Water Quality Rules Implementation Plan* also recommends that chemical-specific monitoring be conducted on WET samples. See "Procedures for Deriving Wisconsin's Numeric Water Quality Criteria" for guidance on how to calculate secondary values.

Dissolved Water Quality Criteria: The *Water Quality Rules Implementation Plan* (1/98; Chapter 4. "DISSOLVED WATER QUALITY CRITERIA FOR HEAVY METALS"), recommends that 1x yearly acute & chronic WET be given to any discharge which receives a less stringent effluent limit (or no limit) based on a dissolved water quality criterion. The Checklist uses this question to insure that this monitoring frequency is recommended when effluent limits are given based on dissolved water quality criteria. WET in these situations should be applied at the point of application of the chemical-specific limit (regardless of stream classification, distance to full fish and aquatic life waters, etc.).

Figure 3. 40 CFR Part 122.21(j) Permit Application Requirements for Major Municipal Dischargers

§122.21 Application for a permit

(j) *Application requirements for new and existing POTWs.*

(5) *Effluent monitoring for whole effluent toxicity.* (i) All applicants must provide an identification of any whole effluent toxicity tests conducted during the four and one-half years prior to the date of the application on any of the applicant's discharges or on any receiving water near the discharge.

(ii) As provided in paragraphs (j)(5)(iii)-(ix) of this section, the following applicants must submit to the Director the results of valid whole effluent toxicity tests for acute or chronic toxicity for samples taken from each outfall through which effluent is discharged to surface waters, except for combined sewer overflows:

(A) All POTWs with design flow rates greater than or equal to one million gallons per day;

….

(iv) Each applicant required to perform whole effluent toxicity testing pursuant to paragraph (j)(5)(ii) of this section must provide:

(A) Results of a minimum of four quarterly tests for a year, from the year preceding the permit application; or

(B) Results from four tests performed at least annually in the four and one half year period prior to the application, provided the results show no appreciable toxicity using a safety factor determined by the permitting authority.

(v) Applicants must conduct tests with multiple species (no less than two species; e.g., fish, invertebrate, plant), and test for acute or chronic toxicity, depending on the range of receiving water dilution…

(vi) Each applicant required to perform whole effluent toxicity testing pursuant to paragraph (j)(5)(ii) of this section must provide the number of chronic or acute whole effluent toxicity tests that have been conducted since the last permit reissuance.

(vii) Applicants must provide the results using the form provided by the Director, or test summaries if available and comprehensive, for each whole effluent toxicity test conducted pursuant to paragraph (j)(5)(ii) of this section for which such information has not been reported previously to the Director.

…

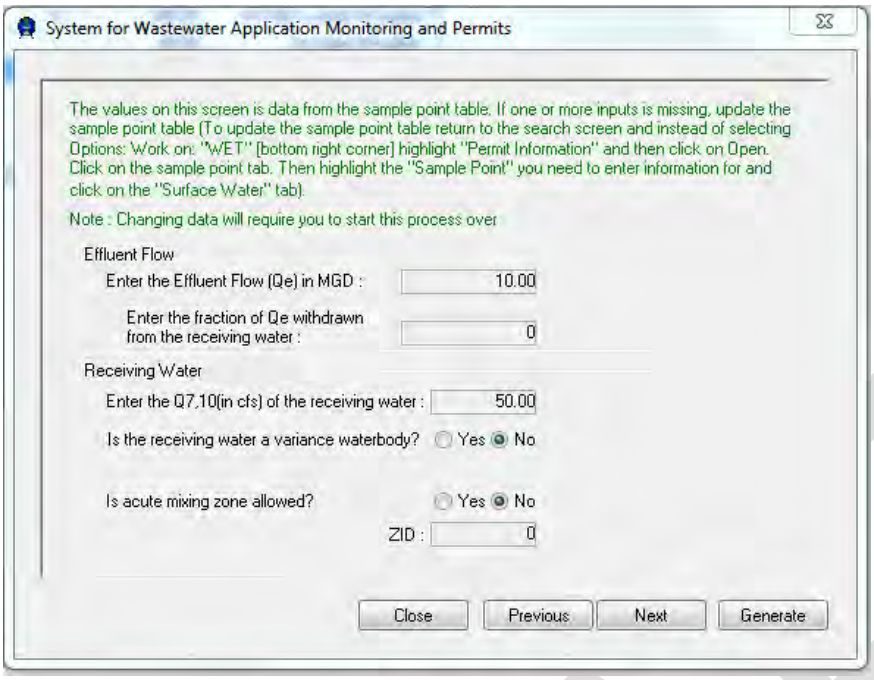
(ix) For whole effluent toxicity data submitted to the Director within four and one-half years prior to the date of the application, applicants must provide the dates on which the data were submitted and a summary of the results.

(x) Each POTW required to perform whole effluent toxicity testing pursuant to paragraph (j)(5)(ii) of this section must provide any information on the cause of toxicity and written details of any toxicity reduction evaluation conducted, if any whole effluent toxicity test conducted within the past four and one-half years revealed toxicity.

Available Dilution and Appropriate Mixing Zones

Because the magnitude of effect usually increases as a toxicant's concentration increases, one of the most important factors affecting the potential for environmental impacts due to effluent toxicity is the dilution available in the receiving water. A very toxic effluent may cause less environmental damage if there is a lot of receiving water dilution available, than a less toxic effluent if there is very little available dilution. Since dilution and mixing are important considerations used to determine types of WET testing, the Checklist evaluates this information.

The last question in the screen above asks whether the receiving water has a unidirectional flow in order to determine whether sufficient mixing is present at the point of discharge. If the receiving water is a flowing waterbody, the Checklist continues to the next screen. If the discharge is to a non-flowing waterbody (e.g., lake, pond, or static wetland), a "No" is given. Since adequate mixing does not occur in these situations, the Checklist assigns a default instream waste concentration (IWC) of 9% as required in s. NR 106.06, Wis. Adm. Code, and skips to the "Calculate Reasonable Potential" screen on page 16. (*NOTE: the Checklist uses this default 10:1 ratio and IWC = 9% for non-flowing waterbodies. If another ratio is appropriate, staff will have to calculate the IWC outside of the checklist and note this in WQBEL memos.)*



If any values are missing from this screen, the user will need to update information in the Sample Point tab, before continuing with the WET Checklist (see attachment 3). In most cases, the effluent flow (Q_e) used in the WET Checklist should be the annual average design flow for municipals or average annual actual flow for industrial dischargers. The Checklist uses this information to determine the appropriate $Q_{7,10}$:Q_e ratio, IWC, AMZ, and chronic dilution series, as shown below. The withdrawal factor (f) should be entered as a decimal (for example, if ½ is withdrawn from the receiving water, enter 0.5). This value will be used in the IWC calculation, as shown on page 16.

The waterbody type question in the screen above helps to determine the receiving water flow value that should be used to make WET determinations. This and the next 3 screens help choose that flow value according to the guidance in Chapter 1.2 (http://dnr.wi.gov/topic/wastewater/WETguidance.html). The type of flow used for these determinations should be the same as was used to calculate chronic WQBEL limits. In most cases, the flow value used to determine the need for chronic testing, calculate the IWC, and choose the correct chronic dilution series should be the $Q_{7,10}$ of the first non-variance classified waterbody encountered by the discharge. In situations where a flow other than the $Q_{7,10}$ was used (for example, a $Q_{4,3}$), that value may be substituted for the $Q_{7,10}$ in this ratio. *(NOTE: the checklist uses default values such as annual average effluent flow, 1/4 $Q_{7,10}$ and a 10:1 dilution ratio for lake dischargers. If other values are more appropriate in a given situation, staff will need to make these decisions outside of the Checklist and note this in WQBEL memos.)*

Variance Waterbodies. If the receiving water is classified as a variance waterbody as defined in Chapter 1.2, the Checklist continues to the next screen. If the receiving water is not a variance waterbody, the Checklist skips 3 screens and goes to the "Calculate Reasonable Potential" screen on page 16.

Acute mixing zone concentration (AMZ). Use of an AMZ is appropriate only in cases where a zone of initial dilution (ZID) has been approved as defined in s. NR 106.06 (3) (c), Wis. Adm. Code. See Figure 4 below for a discussion of how to use a ZID ratio to calculate the AMZ in each site-specific situation. The AMZ is used as the compliance endpoint in acute tests (i.e., the LC_{50} must be $\geq$ AMZ% to pass). In cases where a ZID has not been approved for the given discharge, acute compliance is determined at the end of pipe (i.e., the LC_{50} must be $\geq$ 100% to pass). No points are given based on the presence or absence of a ZID; the Checklist is used only to calculate the AMZ.

Figure 4. Acute Mixing Zone Concentration Calculation

When a zone of initial dilution, or acute mixing zone, has been granted for a discharge, it will typically be expressed as a ratio of the receiving water after it has mixed with the effluent compared to the effluent alone. For example, a ratio expressed as 19.5:1 means that 18.5 parts receiving water is mixing with 1 part effluent. The AMZ concentration to be used in WET tests for determining compliance is calculated as follows:

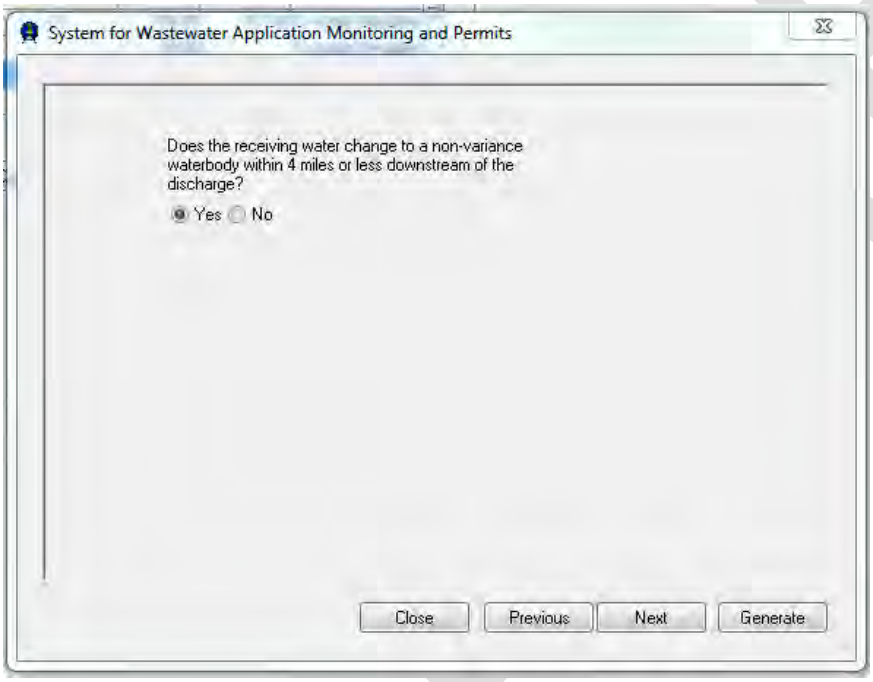
AMZ (as %) = (100 /receiving water + effluent ratio) x 3.3

For the example given above, where the dilution ratio is 19.5:1 (where 19.5 = 18.5 parts receiving water + 1 part effluent), the correct AMZ for acute tests would be:

(100 / 19.5) x 3.3 = 16.9

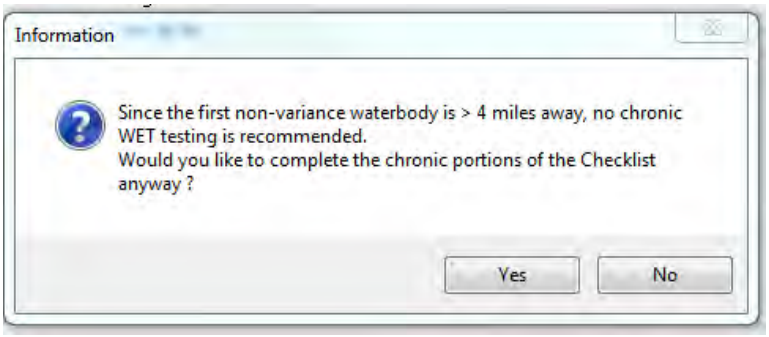
AMZ = 17%

Staff should be careful to note how the mixing zone dilution ratio was expressed in the first place - whether it includes the effluent or not. For example, if it's 19.5 parts receiving water only to 1 part effluent, then it should be expressed as 20.5 (total of effluent plus background) for the example above and the correct dilution in that case would be 16.1%. If it's 19.5 total to 1 (the 19.5 includes the effluent), then it's 16.9%.

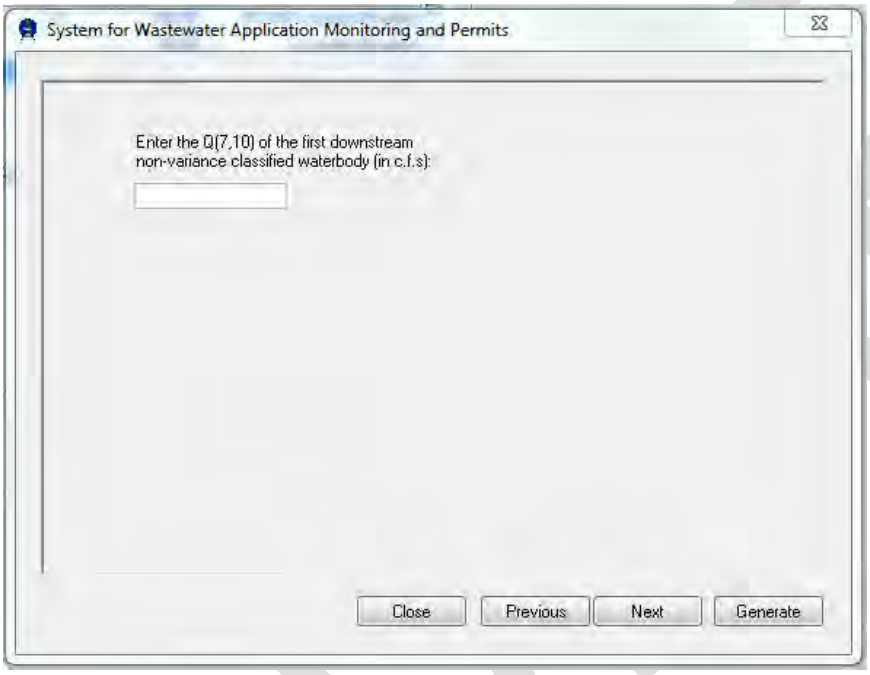


As described in Chapter 1.2, whenever the effluent is discharged directly into a variance waterbody the distance between the outfall and the point where the receiving water becomes a non-variance waterbody will have to be determined. When this distance $\leq$ 4 miles, the flow used should be that of the non-variance waterbody. If the distance is > 4 miles, chronic testing is usually not recommended unless data exists suggesting a potential for chronic impacts.

If chronic WET data exists for the outfall in question, and chronic WET failures have occurred, staff should consider whether additional chronic WET monitoring is necessary to insure that receiving water impacts are not occurring (see Chapter 1.2 for more discussion).



If the closest non-variance classified waterbody is > 4 miles away, the Checklist asks whether the user would like to evaluate chronic frequencies anyway, then continues to the reasonable potential screen (p. 16). If ≤ 4 miles away, the Checklist goes to the next screen shown below, where the $Q_{7,10}$ of the 1st downstream non-variance waterbody is entered.



After the appropriate $Q_{7,10}$ and the Q_e have been selected in the screens above, the Checklist calculates the $Q_{7,10}$:Q_e ratio, the IWC, and the appropriate chronic dilution series, as described below.

$Q_{7,10}$:Q_e Ratio. The stream flow to effluent flow ratio ($Q_{7,10}$: Q_e) is calculated to determine whether WET testing is unnecessary because of the amount of dilution that is present.

If the $Q_{7,10}$:Q_e > 1000:1, no WET testing is recommended, as dilution is high and the potential for impacts due to toxicity are low. Staff may determine that testing is necessary despite high dilution and the Checklist allows the user to continue in these circumstances. The Checklist does not need to be completed if no testing is determined to be necessary, however this decision should be clearly documented in the WQBEL and permit file, so others can tell why decisions were made.

If the $Q_{7,10}$:Q_e ≤ 1000:1 and > 100:1, the need for acute monitoring should be evaluated, but chronic monitoring is not recommended, since dilution is high and the potential for impacts due to chronic toxicity are low. Staff may determine that there is a need to evaluate chronic testing despite high dilution and the Checklist allows the user to continue in these cases.

If the $Q_{7,10}$:Q_e ≤ 100:1, the need for acute and chronic monitoring should be further evaluated. The Checklist will continue to the next screen and recommend acute and chronic monitoring frequencies based on final point totals.

Dilution Series. In the "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*" (Methods Manual), Section 4.12, the standard acute WET test dilution series is 6.25, 12.5, 25, 50, 100% and the standard chronic WET test dilution series is either 100, 30, 10, 3, 1% (if the IWC is ≤ 30%) or 100, 75, 50, 25, 12.5% (if the IWC is > 30%). These dilution series are appropriate for most situations and are recommended by the WET Checklist. The Methods Manual allows for alternate dilution series, if requested by the permittee and specified in the permit. For more discussion of dilution series, see Chapter 2.11 (http://dnr.wi.gov/topic/wastewater/WETguidance.html).

Instream waste concentration (IWC). The IWC is an estimate of the proportion of effluent (Q_e) to the total volume of water (Q_e +Q_s). Since toxicity typically increases as the concentration of a toxicant (or effluent) increases, one of the most important factors affecting the potential for impacts due to WET is dilution. A highly toxic effluent with a large amount of dilution available in the receiving water may cause less environmental impact than a slightly toxic effluent with very little available dilution. For this reason, outfalls with higher IWCs are given more points by the WET Checklist. The IWC is calculated according to s. NR 106.03(6), Wis. Adm. Code.

Figure 5. NR 106.03(6) Instream Waste Concentration Calculation

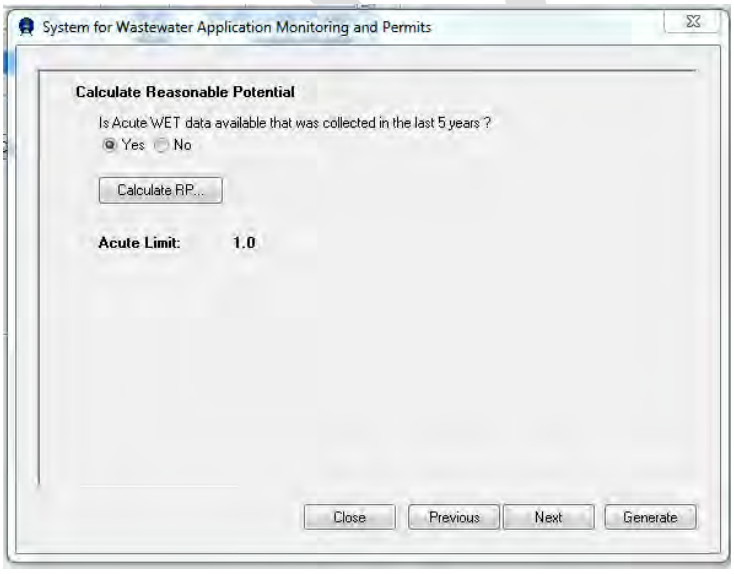
NR 106.03 Definitions. The following definitions are applicable to terms used in this chapter.
(6) "IWC" or "Instream waste concentration" means an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC is calculated according to the following equation:

$$IWC\ (as\ \%) = 100 \times \frac{Qe}{(1-f)Qe + Qs}$$

where:
Qe = effluent flow
f = fraction of the Qe withdrawn from the receiving water
Qs = receiving water flow (in most cases ¼ of a low flow value, such as the $Q_{7,10}$, is used in order to allow a free zone of passage for aquatic organisms).

POINTS ASSESSED (Chronic only)	
If the IWC is:	***Points given:***
≤ 35%	*0*
> 35 and ≤ 65%	*10*
> 65%	*15*

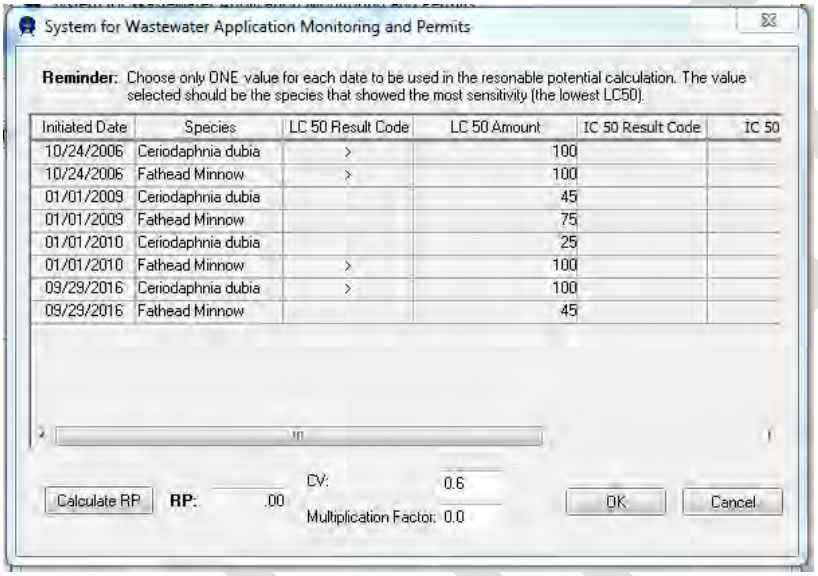
Acute WET Limit Determinations



In the screen above, the user indicates whether there is representative acute WET data available from the most recent 5 years for the discharge being evaluated. If no recent data is available, the Checklist assigns 5 points. This is done because more uncertainty exists in situations where testing has not been done in recent times than at those facilities that have produced recent data which shows toxicity problems are not a concern. The user clicks on "Calculate RP" if any representative data is available (even if ≥ 5 years old), in order to choose the data to be used to calculate the acute reasonable potential. The acute WET limit, calculated using the appropriate acute mixing zone (or no mixing zone) indicated for the facility, is also shown on this screen (Acute limit = 100/AMZ).

Points should be assigned (a "No" given) if no representative data is available from the last 5 years. This does not mean that older data cannot be used in reasonable potential decisions – it is recommended that all representative data be used in WET determinations. This is just a check to insure that WET monitoring has been done in the recent past.

Data Used to Calculate Reasonable Potential



The Checklist uses data selected in the screen above to calculate reasonable potential. WET limits are given whenever representative, facility-specific data shows the effluent may be discharged at a level that has the potential to cause or contribute to an excursion above a WET criterion, as specified in s. NR 106.08(6)(b). See Figure 6 below.

Decisions about reasonable potential, monitoring frequencies, and other WET determinations should be based on data that is representative of the discharge being evaluated, as discussed in step 2 on page 4. When the screen above opens, all valid WET data in the SWAMP WET Database for the selected outfall will appear. The user will have to select WET data to be used in the reasonable potential calculation, by highlighting one species from each test date to be used. Once the most sensitive species (see next paragraph) from each test has been highlighted, the user clicks "Calculate Reasonable Potential". The WET Checklist will choose the appropriate equation and show the resulting RP value.

Most sensitive species. The user should choose one value for each test date to be used in the RP calculation. The value selected should be the species that showed the most sensitivity (the lowest LC_{50} or $IC_{25/50}$) for each test. For example, if 2 tests were completed and the 1st resulted in an LC_{50} = 50% for *C. dubia* and an LC_{50} = 75% for the fathead minnow, and the 2nd resulted in an LC_{50} >100% for *C. dubia* and an LC_{50} = 25% for the fathead minnow, the user would select the *C. dubia* result (LC_{50} = 50%) from the 1st test and the fathead minnow result (LC_{50} = 25%) from the 2nd test.

Tests with one species. Permit-required WET tests require a battery of organisms, in order to represent different trophic levels and taxonomic groups. Because species sensitivity can change as effluent quality and makeup changes, tests conducted with only one species should not be included in reasonable potential calculations, in most cases. An exception should be made if the tested species failed the test – in this case, that species should be included in the RP analysis because if both species had been included and only one failed, the failed species would have been used in the RP analysis. Tests conducted in a manner consistent with permit requirements (e.g., full dilution series, etc.) should be used; screening tests for TREs (100% effluent only) cannot be used because no LC or IC value is generated from these tests.

Coefficient of Variation (CV). Section NR 106.08(6)(c) requires that the multiplication factor chosen from Table 4 be based on a CV = 0.6 whenever there are less than 10 toxicity detects in the dataset. (See Figure 6 below.) Since this will be the case in the majority of situations, the Checklist sets the CV = 0.6 in the screen above. If there are more than 10 detects in the given dataset, staff will have to calculate the appropriate CV, enter it into the space provided (replace the CV = 0.6) and add the correct multiplication factor from Table 4.

Table 4 Multiplication Factor. The multiplication factor from Table 4 in s. NR 106.08, Wis. Adm. Code, is used to convert the calculated effluent toxicity value to the estimated 95th percentile value. This multiplication factor must be chosen based on the number of detects (number of samples that resulted in an LC or IC < 100%) and the appropriate coefficient of variation. Staff should be careful to use the number of toxicity detects, not the total number of samples in the dataset, when selecting this multiplication factor.

When it has been determined that there is reasonable potential for a limit to be exceeded, that WET limit must be included in the permit. WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by the multiplication factor, in order to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable RP equation (shown in Figure 6) results in a value greater than 1.0.**

Figure 6. NR 106.08(6) Reasonable Potential Calculations

NR 106.08 Determination of the necessity for whole effluent toxicity testing requirements and limitations.

(6) REASONABLE POTENTIAL TO RECEIVE AN ACUTE OR CHRONIC WHOLE EFFLUENT TOXICITY LIMIT.

(b) *Reasonable potential.*

1. If a zone of initial dilution has not been approved, the potential to exceed an acute criterion shall be calculated using the following equation:

(TUa effluent) (B) > 1.0

Where:

TUa effluent= maximum calculated TUa from the most sensitive species in the data set
B= Reasonable potential multiplication factor determined under par. (c)
1.0= Numeric acute WET limitation in acute toxic units (TUa) derived from narrative criterion in s. NR 102.04(1)(d)

2. If a zone of initial dilution has been approved, the potential to exceed an acute criterion shall be calculated using the following equation:

[(TUa effluent) (B) (AMZ)] > 1.0

Where:

TUa effluent= Maximum calculated TUa from the most sensitive species in the data set
B= Reasonable potential multiplication factor determined under par. (c)
AMZ= Acute mixing zone concentration based on presence of a zone of initial dilution as defined in s. NR 106.03(1) expressed as a decimal
1.0= Numeric acute WET limitation in acute toxic units (TUa) derived from narrative criterion in s. NR 102.04(1)(d)

3. The potential to exceed a chronic criterion shall be calculated using the following equation:

[(TUc effluent) (B) (IWC)]> 1.0

Where:

TUc effluent= Maximum calculated TUc from the most sensitive species in the data set
B= Reasonable potential multiplication factor determined under par. (c)
IWC= Instream waste concentration as defined in s. NR 106.03(6) expressed as a decimal
1.0= Numeric chronic WET limitation in chronic toxic units (TUc) derived from narrative criterion in s. NR 102.04(4)(d)

(c) *Reasonable potential multiplication factor*. The reasonable potential multiplication factor in par. (b) is used to convert the calculated effluent toxicity value to the estimated 95th percentile value. The department shall use the following methods to select a reasonable potential multiplication factor:

1. Where there are < 10 individual toxicity **detects**, the multiplication factor shall be taken from Table 4 and based on a coefficient of variation of 0.6.
2. Where there are ≥ 10 individual toxicity **detects**, the multiplication factor shall be taken from Table 4 and based on coefficient of variation calculated as the standard deviation of the WET test endpoints (IC25, IC50 or LC50) divided by the arithmetic mean of the WET tests.

NR 106.08 (5) (c) Table 4 — Reasonable Potential Multiplication Factor.

	Coefficient of variation (CV)																			
Number of samples (n)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1	-	-	-	-	-	6.2		-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	3.8		-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	3.0		-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	2.6		-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	2.3		-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	2.1		-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	2.0		-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	1.9		-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	1.8		-	-	-	-	-	-	-	-	-	-	-	-	-
10	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6
11	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3
12	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0
13	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9
14	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6	2.7
15	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.5
16	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.4
17	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.3
18	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2
19	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1
20	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.0
21-100	(see table in NR 106)																			

NOTE: Red text is highlighted above to note that "number of samples" in column 1 is the number of detects in the dataset, not the total number of data.

(d) *Maximum toxicity values.* The Department shall set the TUc effluent and TUa effluent values in par. (b) equal to zero whenever toxicity is not-detected or the LC50, IC25, or IC50 equals or exceeds 100% effluent.

Reasonable Potential Could Be Present Even if a WET Failure Has Not Occurred

As a result of the WET reasonable potential procedures in s. NR 106.08 (6), Wis. Adm. Code (Figure 6), a limit will be required in almost all cases where a permittee has a WET failure in their dataset. Reasonable potential can also be indicated in situations where no WET failures have occurred, if toxicity was detected near enough to the applicable limit. The examples below demonstrate how this might occur.

NR 106.08(6)(b)
3. The potential to exceed a chronic criterion shall be calculated using the following equation:

[(TUc effluent) (B) (IWC)]> 1.0

Where: TUc effluent= Maximum calculated TUc from the most sensitive species in the data set
B= Reasonable potential multiplication factor determined under par. (c)
IWC= Instream waste concentration as defined in s. NR 106.03(6) expressed as a decimal
1.0= Numeric chronic WET criterion in chronic toxic units (TUc) derived from narrative criterion in s. NR 102.04(4)(d)

Example 1:

Date initiated	Chronic results		Maximum TUc (100/IC25)	Pass/ Fail
	C. dubia IC25	Fathead IC25		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	85%	>100%	**1.18**	Pass
12/09/2014	>100%	>100%	1.0	Pass

- IWC = 10% (**0.10**)
- Most sensitive result: IC25 = 85%; Maximum TUc = 100/85 = **1.18** (test passed; toxicity detected well below the limit)
- 5 WET tests, 1 toxicity detect. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = **6.2** (based on # of detects)

1.18 x 6.2 x 0.10 = 0.73; RP not shown, limit not required

Example 2:

Date initiated	Chronic results		Maximum TUc (100/IC25)	Pass/ Fail
	C. dubia IC25	Fathead IC25		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	55%	>100%	**1.82**	Pass
12/09/2014	>100%	>100%	1.0	Pass

- IWC = 25% (**0.25**)
- Most sensitive result: IC25 = 55%; Maximum TUc = 100/55 = **1.82** (test passed; toxicity detected nearer to the limit)
- 5 WET tests, 1 toxicity detect. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = **6.2** (based on # of detects)

1.82 x 6.2 x 0.25 = 2.82; RP is shown, limit is required

When Is a Compliance Schedule/Toxicity Reduction Evaluation Recommended?

Toxicity reduction evaluations include investigations by the permittee and their WET consultant to identify the chemical(s) causing toxicity. The **4th column** in Table 1 below shows when a TRE compliance schedule is recommended by the WET Checklist. (See Chapter 1.12 for more about what is included in a standard TRE compliance schedule.) In order to complete a successful TRE, toxicity has to be present in the effluent often enough so that sample manipulations can be done to characterize the toxicity and/or steps can be taken to trace the source of toxicity. Therefore, the WET Checklist recommends a TRE compliance schedule based on the total number of WET data and the number of failures that have occurred. In cases where data is limited or where toxicity has appeared infrequently, a TRE may not be recommended (the WET Checklist will not recommend a TRE, as shown in column 4). In these cases, the WET Checklist often recommends more frequent monitoring instead, in order to determine whether toxicity reappears over time. Standard language typically included in WPDES permits requires the permittee to conduct a TRE if WET failures occur during the permit term, so repeated bouts of toxicity may still trigger the need for a TRE (see Chapter 1.14: http://dnr.wi.gov/topic/wastewater/WETguidance.html).

The recommendations shown in Table 1 reflect those given by the WET Checklist and should be appropriate in many situations. However, staff should use their judgment to decide whether a TRE is needed in each case, especially where few failures have occurred or where other conditions might exist that make a compliance schedule inappropriate. A TRE should be required in most cases where valid, representative WET data indicates that reasonable potential is present and that the duration, magnitude, and frequency of WET failures is sufficient to be able to determine what is causing toxicity. A general rule of thumb may be that if more than 25% of completed tests have failed, and an explanation for toxicity has not been identified, then a TRE compliance schedule is probably appropriate. Staff should consult with the Biomonitoring Coordinator if they have questions or are uncertain whether a TRE is necessary.

Table 1. Compliance Schedules and Minimum Monitoring Frequencies

# data	# failures	RP shown? (limit required)	TRE schedule recommended?	Minimum monitoring frequency	Comments
1	0	No	No	NA	No limit or TRE recommended
1	0	Yes	No	1x annual	See "Reasonable potential may be present when a WET failure has not occurred".
1	1	Yes	No	1x annual	
2	0	No	No	NA	No limit or TRE recommended
2	0	Yes	No	NA	See "Reasonable potential may be present when a WET failure has not occurred".
2	1	Yes	No	1x annual	
2	2	Yes	No	1x annual	
3	0	No	No	NA	No limit or TRE recommended
3	0	Yes	No	1x annual	See "Reasonable potential may be present when a WET failure has not occurred".
3	1	Yes	No	1x annual	
3	2	Yes	**Yes**	2x annual	2x annual testing would be recommended only for the period after the compliance schedule ends and the WET limit has become effective.
3	3	Yes	**Yes**	Quarterly	Quarterly testing recommended after compliance schedule ends & the limit becomes effective.
4	0	No	No	NA	No limit or TRE recommended
4	0	Yes	No	1x annual	See "Reasonable potential may be present when a WET failure has not occurred".
4	1	Yes	No	1x annual	
4	2	Yes	**Yes**	2x annual	2x annual testing would be recommended only for the period after the compliance schedule ends and the WET limit has become effective.
4	3	Yes	**Yes**	Quarterly	Quarterly testing recommended after compliance schedule ends & the limit becomes effective.
4	4	Yes	**Yes**	Quarterly	Quarterly testing recommended after compliance schedule ends & the limit becomes effective.
≥ 5	0	No	No	NA	No limit or TRE recommended
≥ 5	0	Yes	No	1x annual	See "Reasonable potential may be present when a WET failure has not occurred".
≥ 5	< 25%	Yes	No	1x annual	
≥ 5	≥ 25% and ≤ 75%	Yes	**Yes**	Quarterly	Quarterly testing recommended after compliance schedule ends & the limit becomes effective.
≥ 5	> 75%	Yes	**Yes**	Quarterly	Quarterly testing recommended after compliance schedule ends & the limit becomes effective.

Minimum Monitoring Frequencies When Reasonable Potential is Indicated

The **5th column** in Table 1 shows the minimum WET monitoring frequencies recommended by the WET Checklist, based on the number of representative WET data available, the number of failures that have occurred, and whether or not reasonable potential has been indicated based on the procedure in s. NR 106.08, Wis. Adm. Code. The Checklist does not assign points based on this information, but instead evaluates whether the points given once the Checklist is complete are enough to satisfy this requirement. Other factors rated by the WET Checklist, such as the use of a large number of chemical additives or industrial contributors to a municipal treatment plant, may cause a higher monitoring frequency to be recommended. If less than the recommended monitoring frequency testing would otherwise be recommended due to point totals, the Checklist recommends the minimum monitoring frequency for these dischargers. According to federal regulations at 40 CFR Part 122.44(i)(2), monitoring must occur at least 1x yearly whenever a limit is present. **Therefore, in no case may staff recommend less than 1x annual monitoring when a WET limit is required.**

The recommendations shown in Table 1 reflect the minimums recommended by the WET Checklist and are intended to be appropriate in most situations. However, staff may decide that more or less monitoring is warranted in specific cases. Staff should use their best professional judgment to determine whether minimum monitoring frequencies given by the Checklist are appropriate. Staff should also use their BPJ to adjust monitoring frequencies if it has been decided that a TRE is not necessary. For example, if a TRE and quarterly monitoring for the period after the TRE was recommended by the WET Checklist, staff will need to decide if quarterly monitoring or some other frequency is appropriate for the entire term of the permit if it is decided that a TRE schedule will not be included in the permit.

WET Limit Trigger – Confirming Whether WET Data is Still Representative

WET limit triggers may be included in permits when staff are uncertain about the representativeness of WET data used in reasonable potential determinations. For example, say a permittee completed 4 WET tests between 2010-2014:

Date initiated	Chronic results		Pass/ Fail
	C. dubia IC25	Fathead IC25	
12/31/2010	25%	>100%	**Fail**
05/25/2011	>100%	>100%	Pass
06/10/2012	>100%	>100%	Pass
09/22/2013	>100%	>100%	Pass

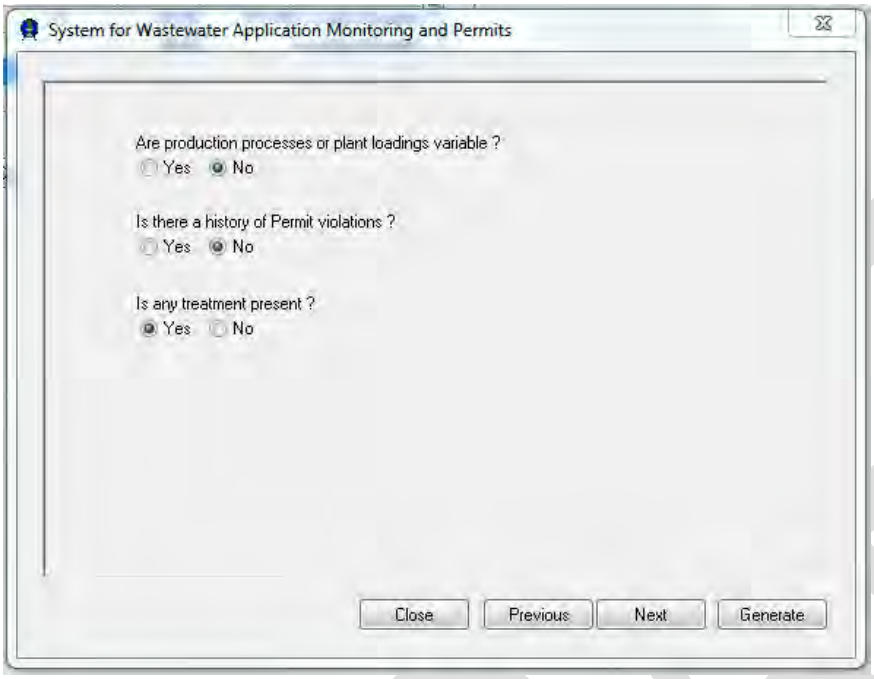
IWC = 55%

This hypothetical WPDES permit expired on 12/31/14 and is scheduled for reissuance in 2015. The permittee cannot provide definitive information, such as the results of a successful toxicity reduction evaluation, showing that the 2010 result is not representative of the current discharge. However, a local industry which contributes significantly to their influent changed their production process significantly in 2011 and it is likely that they are now sending a much less toxic wastewater to the POTW. Ideally, the permittee would have TRE investigations done before and after the changes were made at the industry which showed that toxicity was caused by that source and changes at the industry resulted in that toxicity being removed. Since the permittee in this example was not able to provide this type of information to the Department before their permit expired and the cause of the original toxicity is still uncertain, the 2010 result probably cannot be thrown out and should be included in the reasonable potential determination.

A trigger may be useful in a situation like this, however, to allow for more WET data to verify that reasonable potential still exists. A trigger usually allows for quarterly testing during the first 12 months of the permit to establish whether toxicity is present in the effluent or whether changes at the industry, in this example, truly resulted in the removal of toxicity. (See Chapter 1.12 http://dnr.wi.gov/topic/wastewater/WETguidance.html for example trigger language.) If no WET failures occur during that first 12 months, it is more likely that toxicity was removed and, therefore, a limit would

not be necessary in this example situation. If a failure did occur, then a limit would be necessary and the permittee could be required to complete a TRE compliance schedule designed to find and fix the source of toxicity.

Effluent Variability and WWTP Performance

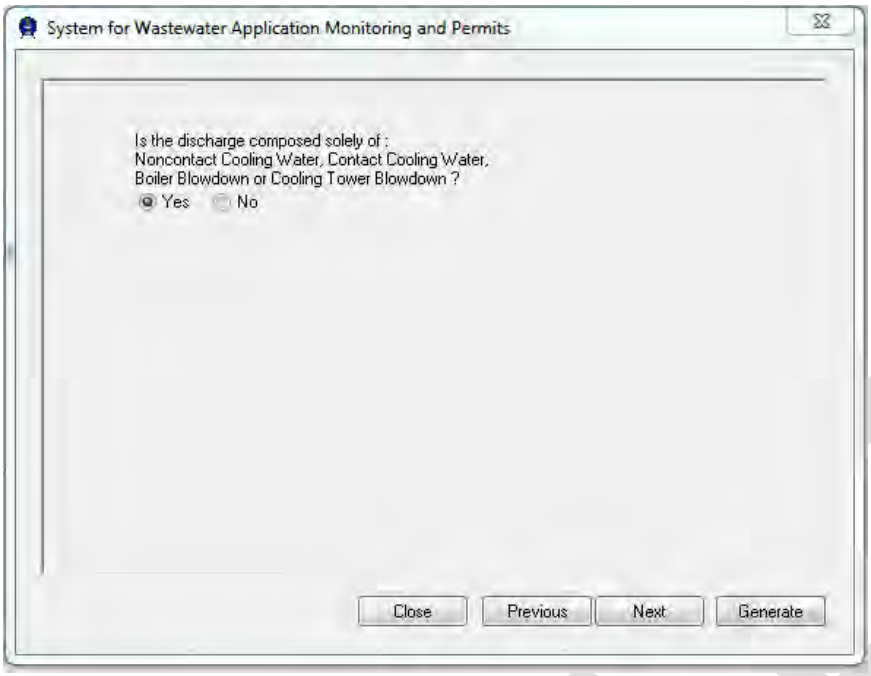


More variable effluents should be monitored more frequently because of the inconsistency of the effluent matrix. Less frequent monitoring may not represent effluent quality during different occurrences. Information requested here is used to assess whether the effluent is variable enough to warrant additional testing. Decisions are subjective and should be based on the knowledge and best professional judgment of the staff most familiar with the permitted facility.

- **Question #1, Loading or Production Variability:** As effluent characteristics change (due to contributing industries, hauled waste, leachate, infiltration, process changes, spills, etc.), so will toxicity. Judgments should be made whether waste entering the system is resulting in a variable effluent, or if the system is handling incoming variability and effluent characteristics are relatively unchanged. Answer "Yes" if the judgment is made that industrial process changes, wastewater inputs, inconsistent treatment efficiency, or other changing conditions are resulting in a variable effluent.

- **Question #2, Compliance History:** A permittee's compliance history may be an indication of the quality and consistency of operations or the ability to handle incoming waste, which effects effluent variability. Staff should enter a "Yes" if the facility has had significant violations (for example, those warranting enforcement actions such as verbal or written NONs). All effluent characteristics should be considered, not just toxics.

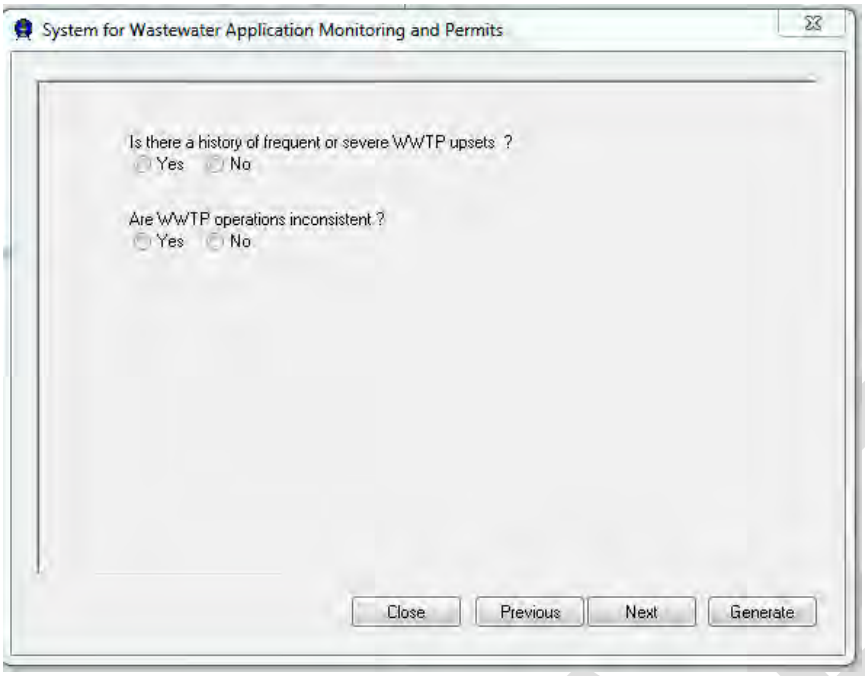
- **Question #3** is used to determine whether variability may be effected by inadequate treatment. A "No" should be given in question #3 for discharges that do not have wastewater treatment. If a no is given, the next screen will appear. If a yes is given to question #3, the next screen will be skipped and the subsequent screen will appear.



- **Question #4:** The screen above allows exemptions from points assessed for no treatment for four discharge categories. For all other discharge categories (including COW water discharges) a "No" should be given.

In situations where staff feel that points accumulated are not appropriate because the discharge would not otherwise warrant treatment, they should make adjustments to final monitoring recommendations. Staff should NOT adjust points in the electronic Checklist by giving false answers, because this will confuse the record (i.e., others will not be able to tell why answers were given). Adjustments to final recommendations should be justified, shared with the Biomonitoring Coordinator, and well documented so that others can tell why decisions were made.

POINTS ASSESSED (Both Acute & Chronic)		
Question#	***Answer***	***Points***
1	*NO*	*0*
1	*YES*	*5*
2	*NO*	*0*
2	*YES*	*5*
3 & 4	*BOTH YES*	*0*
3 & 4	*BOTH NO*	*10*
3 & 4	*3 NO, 4 YES*	*0*
3 & 4	*3 YES, 4 NO*	*0*

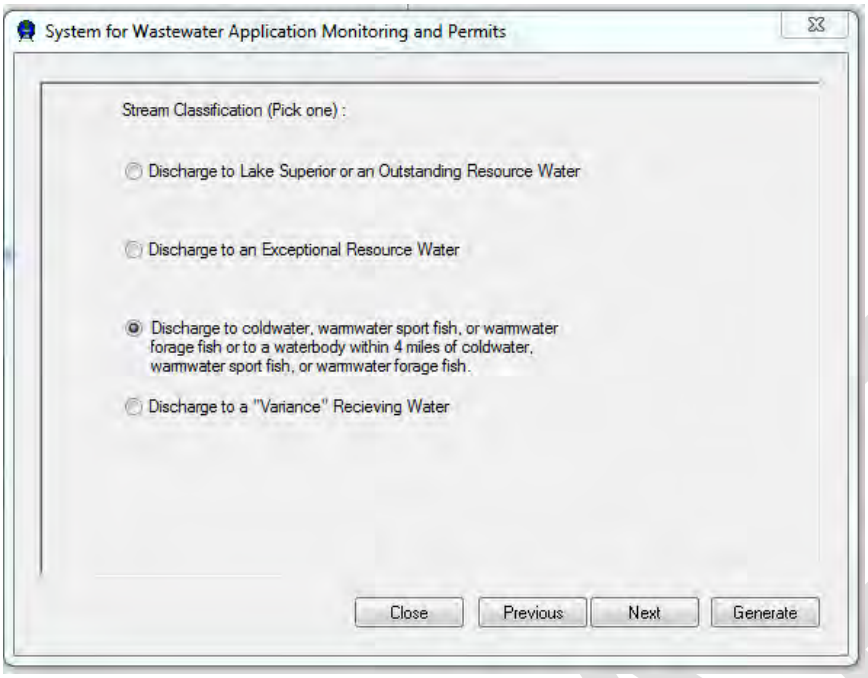


- **Question #1, Upsets:** Frequent or severe upsets may be an indication of poor operations, underdesign of a treatment plant, slug loads within the collection system, or other factors which raise the potential for toxicity. Staff should make judgments whether frequent upsets are unexplained or not handled properly, which may affect effluent variability.

- **Question #2, Operations:** The ability to maintain or restore quality treatment can impact effluent variability. If an operator is able to react quickly and effectively when treatment is upset, effluent characteristics are less likely to be altered for long periods. Conditions such as bulking and foaming, lost ability to nitrify, etc., may indicate poor treatment and impact toxicity. Concurrent cases of treatment problems and toxicity have been noted in many cases.

POINTS ASSESSED (Both Acute & Chronic)		
Question#	***Answer***	***Points***
1	*NO*	*0*
1	*YES*	*5*
2	*NO*	*0*
2	*YES*	*5*

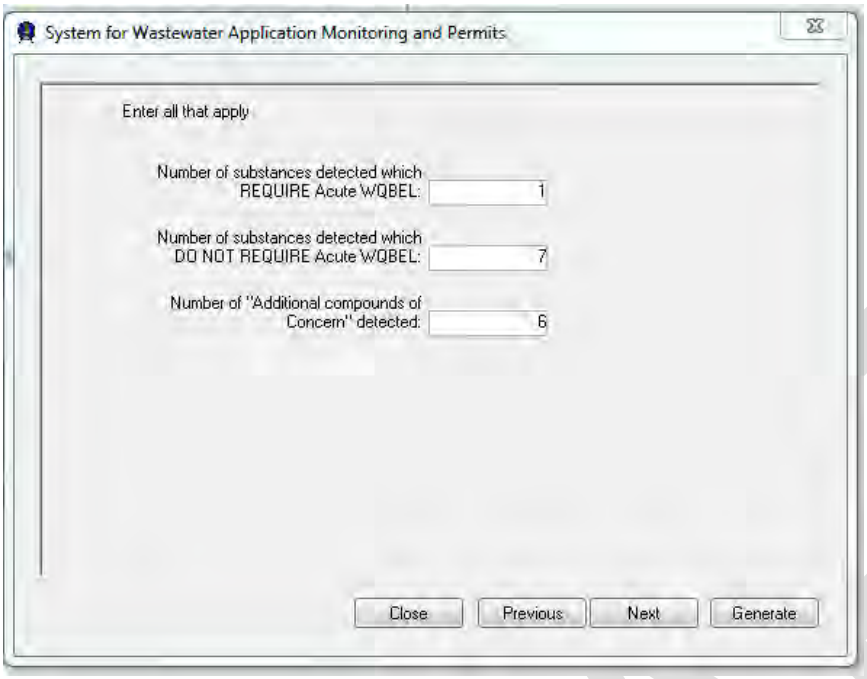
Stream Classification



WET tests use “indicator organisms” to mimic what happens in the environment when an effluent is introduced, to estimate the effluent concentration that may produce a harmful effect, and to predict concentrations that may interfere with the growth, development, and reproductive potential of aquatic organisms. Since “higher” classifications (e.g., exceptional/outstanding resource waters) designate waters where more sensitive populations or water quality exists, more monitoring is necessary to insure protection of these waters and the Checklist assigns points accordingly.

POINTS ASSESSED (Both Acute & Chronic)	
Answer	***Points***
Lake Superior or Outstanding Resource Water	*15*
Exceptional Resource Water	*12*
Full Fish & Aquatic Life or < 4 mi from FFAL	*5*
Variance	*0*

Chemical Specific Data – Acute



Water quality criteria are designed to be protective of aquatic life for the compounds that they limit. Chemical-specific limits alone can't account for additive or synergistic effects that occur when compounds are combined in an effluent. The more compounds present, the greater the potential is for additive or synergistic effects to occur. Staff should document which limits and/or detects were considered so it is clear to others why point totals were assigned. For a list of ch. NR 105, Tables 1 & 2, substances (i.e., those which may require acute WQBELs), and for a table of "Additional Compounds of Concern", see attachment 2 at the end of this chapter.

As mentioned in attachment 2, ammonia limits should be counted only if representative effluent data demonstrates the need for a WQBEL (limits that are simply "carried over" from a previous permit term should not be counted). However, if ammonia has been detected in the effluent, it should be counted in that category.

POINTS ASSESSED (Acute only)	
Answer	***Points***
Acute WQBELs	*5 for 1st + 1 for ea. additional, not to exceed 10 pts.*
Detects w/out WQBELs	*1 for 1st + 1 for add. not to exceed 3*
Additional Cmpds of Concern	*2 (for ≥ 1 substance)*

Additives – Acute

Additives come in a wide variety of mixtures and forms and are used in a number of applications (e.g., biocides, corrosion inhibitors, boiler water treatments, scale control, pH control, clarifying agents, industrial process polymers, and other solids control products). Most additives have not undergone the level of toxicity testing needed to calculate water quality criteria, therefore secondary values should be derived according to s. NR 105.05, Wis. Adm. Code, and the *Water Quality Review Procedures For Additives* guidance (http://dnr.wi.gov/topic/wastewater/Guidance.html) followed, whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge.

The WET Checklist is used where more complex wastewaters are being evaluated, such as industrial process wastewaters and municipal POTW effluents. The more additives that are present in an effluent, the more complex that wastewater becomes and the greater the potential for toxic impacts due to the mixture. Additives should be counted in the WET Checklist analysis shown above if they are added during or after the wastewater treatment process (or if no treatment is present). If they are added prior to treatment (e.g., a production additive at an industrial facility) they should be included in the evaluation only when wastewater treatment is not expected to remove or significantly alter the toxicity of these chemicals (for example, if less than secondary treatment is present). Chemicals added at the WWTP or to the final effluent should be included in this evaluation, regardless of the treatment type.

Special attention should be paid in all cases where permittees are adding chemicals to remove phosphorus (FeCl, alum, SorbX-100, etc.), especially those that are optimizing treatment to meet more stringent or interim phosphorus limits. Overuse of these chemicals may cause effluent toxicity – care should be taken to use only the amount of chemical that is necessary and no more. DNR field staff should provide assistance, where needed, to help permittees determine the proper amount of chemical to be used.

SorbX-100 and Other New P Treatment Chemicals. In 2015-16, several permittees in Wisconsin were piloting the use of SorbX-100 (a cerium chloride + lanthanum chloride mixture) in their treatment plants, to see if this product could help them to meet lower phosphorus limits (0.075 mg/l in many cases). Due to concerns raised by DNR staff, WET consultants, and permittees about the potential risks of adding significant amounts of a new, unknown product into the wastestream, the DNR asked for toxicity information from the maker of the product. Using the information submitted by

the manufacturer, staff were able to calculate secondary values, which can be used in place of water quality criteria when calculating water quality-based effluent limits. Those values for SorbX-100 are as follows:

- Secondary Acute Value = 3.88 mg/L
- Secondary Chronic Value = 0.216 mg/L

If used correctly (not over-applied), this product should remain with the solids and not reach the surface water. However, for the purposes of determining whether or not a WQBEL may be warranted, DNR assumes that all that is added will reach the final effluent. Since the effective levels being added at the time of this guidance were all reportedly well below these secondary value concentrations (and therefore discharged at even lower levels), no WQBELs appear to be required in most situations (i.e., if there is no reasonable potential to exceed the limit, no limit is needed). However, in cases where a permittee is at risk of the product at levels above the secondary value, a WQBEL should be included in the permit. When WQBELs are determined not to be necessary, staff should share the secondary value numbers with permittees in order to inform them about potentially toxic levels to be avoided at all costs.

In addition to calculating secondary values, the Department asked the State Lab of Hygiene to conduct WET tests at facilities where this product was being piloted. All acute and chronic WET tests conducted before this guidance was written had passed. Though promising, this data was limited to only a few facilities.

Given that this product is not expected to be discharged into surface waters at significant amounts and information collected before the date of this guidance does not indicate a risk to aquatic life at expected usage levels, the Department concluded that its use in WWTPs should be handled as other phosphorus treatment products (FeCl, alum) have been handled to date. That is, the product should not be treated as an "additive" as defined in the *Water Quality Review Procedures for Additives* guidance (see http://dnr.wi.gov/topic/wastewater/Guidance.html) and no effluent limits will be necessary in most places where it is used. However, the following should be done in the near term to insure that problems do not occur:

1. Compliance staff should ask permittees to conduct WET tests during treatment pilots using SorbX-100 or other new treatment chemicals.
2. Compliance staff should share secondary values with permittees and advise them to keep usage rates/effluent concentrations below these levels.
3. The WET Checklist will add points for using SorbX-100, to collect additional effluent data and to further protect against toxicity under different use/discharge situations.

If other new treatment chemicals come onto the market in response to the need for meeting lower phosphorus limits, a similar process may be necessary to evaluate whether significant toxicity concerns exist. If staff have questions related to the use of these types of products or other treatment chemicals and their potential for toxicity, they should contact the Biomonitoring Coordinator.

Toxicity potential from treatment chemicals. Some question whether the Checklist "penalizes" permittees for using treatment chemicals. While chemicals are often chosen as alternatives in wastewater treatment (i.e., chlorine to disinfect, chemicals to remove phosphorus, polymers to improve settling, etc.), they are not required and there may be alternatives which are less likely to cause toxicity. Points are added for treatment chemicals because they add to the potential for toxicity. It is important to realize that the use of treatment chemicals increases the potential for toxicity in wastewater.

Examples:

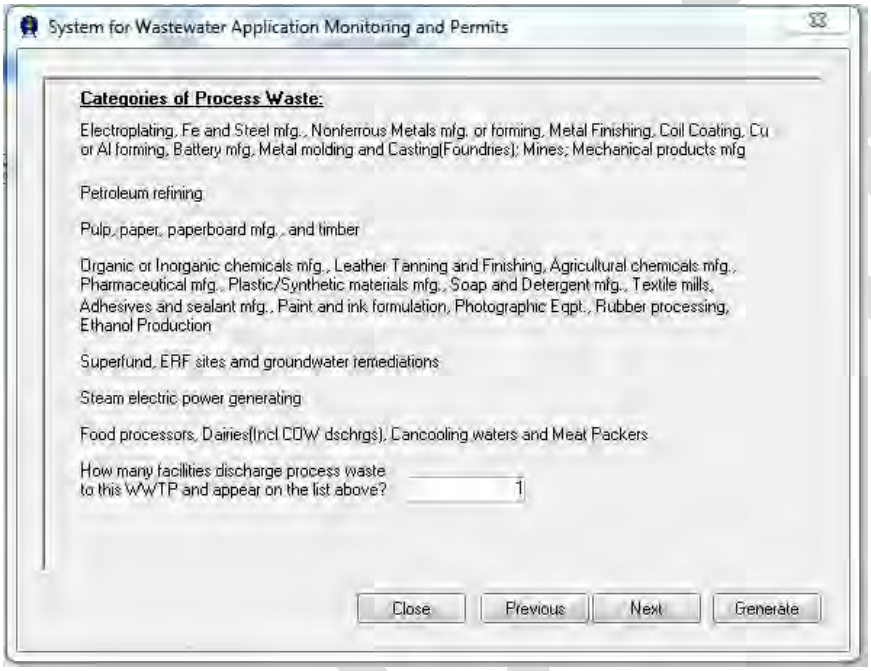
- ***Biocides*** - chlorine & other halogens, fungicides, herbicides, algaecides, bactericides, etc.

- ***Water Quality Conditioners*** - dechlorination chemicals, alum, ferric chloride, polymers, dyes, anti-scale, corrosion-inhibitors, pH adjustment chemicals, conditioning agents, etc. *Note: SorbX-100 is counted separately (see above) and should not also be counted as a water quality conditioner.*

If chlorination and dechlorination chemicals are added, points should be assessed for both (i.e., chlorine as a biocide, dechlorination chemicals as WQC). Points are also assessed if WQBELs for these substances are given.

POINTS ASSESSED (Acute only)	
Type	***Points***
Biocides	*3 pts. each (not to exceed 20 pts when combined w/WQC)*
Water Quality Conditioners	*1 pt. each (not to exceed 20 pts when combined w/biocides)*
SorbX-100	*15 points*

Industrial Contributors



Some industrial categories have more potential for causing effluent toxicity and industrial contributors to municipal treatment plants can increase their potential for toxicity, therefore, the Checklist asks for information related to industrial type and amounts of wastewater present. If the facility being evaluated is a municipality, the screen above will appear, asking for the number of industrial contributors. If the facility is industrial, the next screen will appear asking for the type of industrial discharger. In the screen below, points should be assessed only if the discharge contains **PROCESS** wastewater. Users should not include points for outfalls that contain only sanitary or other non-process wastewater.

Staff should use their judgment to include dischargers that do not fall strictly into one of the above categories. If staff feel that a discharger warrants the same points as one of the categories above, based on toxicity potential related to discharge type, they should assign points accordingly.

Industrial Discharge Category

POINTS ASSESSED (Acute & Chronic)	
Type	***Points***
Municipalities	*5 pts for 1st + 1 for ea. additional (not to exceed 15)*
Groups in bullets 1-3	*15*
Groups in 4th bullet	*10*
Groups in 5th bullet	*8*
Groups in 6th and 7th bullets	*5*
Groups in last bullet	*0*

Wastewater Treatment Type

Untreated wastewater has a higher potential for toxicity and therefore is assigned more points using information from the screen above. (No points are assigned for category 4.) Staff should assign points here for <u>all</u> discharges that do not have wastewater treatment (including those with cancooling waters, condensate of whey, etc.). In those situations where staff feel that points accumulated here are not entirely appropriate because the discharge would not otherwise warrant wastewater treatment, they should recommend adjustments to final monitoring recommendations instead of putting incorrect information into the Checklist. If combined outfalls are being addressed and treatment differs, the most conservative points should be given (for example, if one is treated & the other isn't, 10 points should be given due to the presence of untreated wastewater). **Adjustments to final recommendations should be justified, shared with the Biomonitoring Coordinator, and documented so that others can tell why decisions were made.**

POINTS ASSESSED (Acute & Chronic)	
Type	***Points***
No Treatment	*10*
Primary Treatment Only	*8*
Secondary or Better	*0*
NCCW, Boiler or Cooling Tower Blowdown	*0*

Ecological Impacts

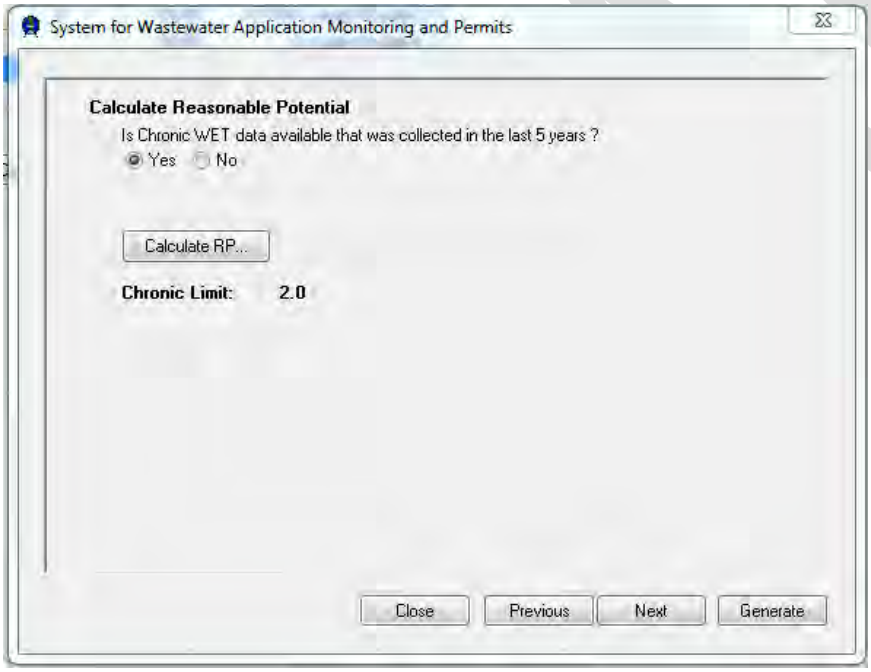
In situations where aquatic populations are under stress due to poor ecological conditions, toxicity from an effluent has a greater potential of causing environmental harm. Stressed individuals and populations may be less able to adapt or adjust to a toxic effluent. Since impacted areas could be more susceptible to toxicity, more severe impacts may occur to populations that are already stressed due to existing conditions, and past discharge problems may cause populations to be more sensitive to toxicity, it is appropriate to assign more monitoring to discharges that occur in areas where these concerns exist.

The second question in the screen above is designed to account for situations where data shows that a facility has contributed to problems in the receiving water (for example, fish kills or other impacts to benthic, macrophytic or aquatic organisms). More points are given to discharges that are thought to be the sole source causing an ecological impact; less are given to those who may be a partial contributor. Water quality impacts caused by compounds typically characterized as toxics may be the easiest to determine points for in this category, however, staff should also consider situations where impacts may be present that are not necessarily caused by toxics. For example, low dissolved oxygen levels or impacts due to excessive nutrient levels may also cause concern in these situations. Staff should determine whether past receiving water problems have been addressed and assign points accordingly.

POINTS ASSESSED (Acute & Chronic)	
Type	***Points***
Impacts solely due to discharger	*20*
Impacts contributed to by discharger	*5*
No impacts known	*0*

If it isn't necessary to evaluate the need for chronic WET monitoring because available dilution is high (see p. 12), the Checklist ends here.

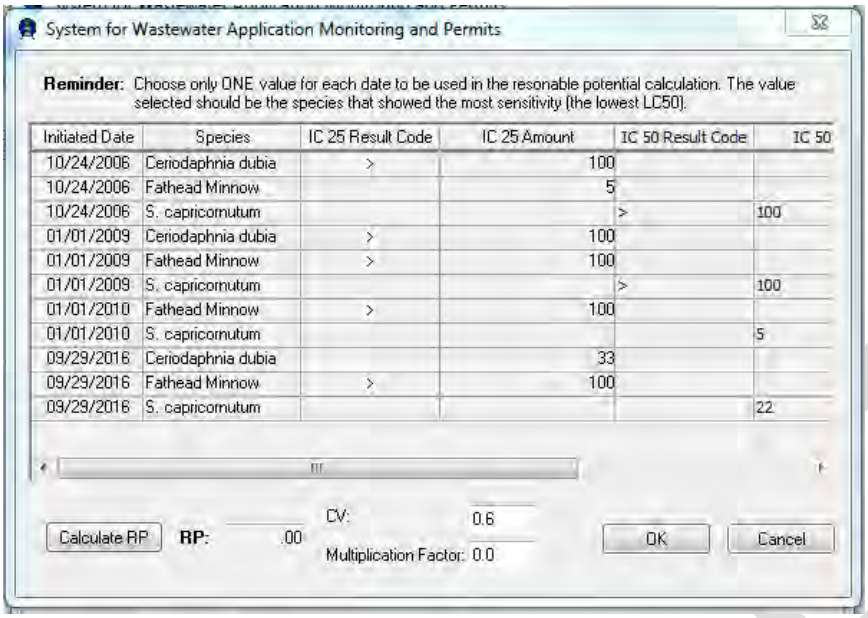
Chronic WET Limit Determinations



In the screen above, the user states whether there is representative chronic WET data available from the most recent 5 years for the discharge being evaluated. If no recent data is available, the Checklist assigns 5 points. This is done because more uncertainty exists in situations where testing has not been done in recent times than at those facilities that have produced recent data which shows toxicity problems are not a concern.

The chronic WET limit, calculated using the appropriate flow information indicated for the facility, is shown on this screen (Chronic limit = 100/IWC).

The user then clicks on “Calculate RP” if any representative data is available (even if $\geq$ 5 years old), in order to choose the data that is to be used to calculate the acute reasonable potential.



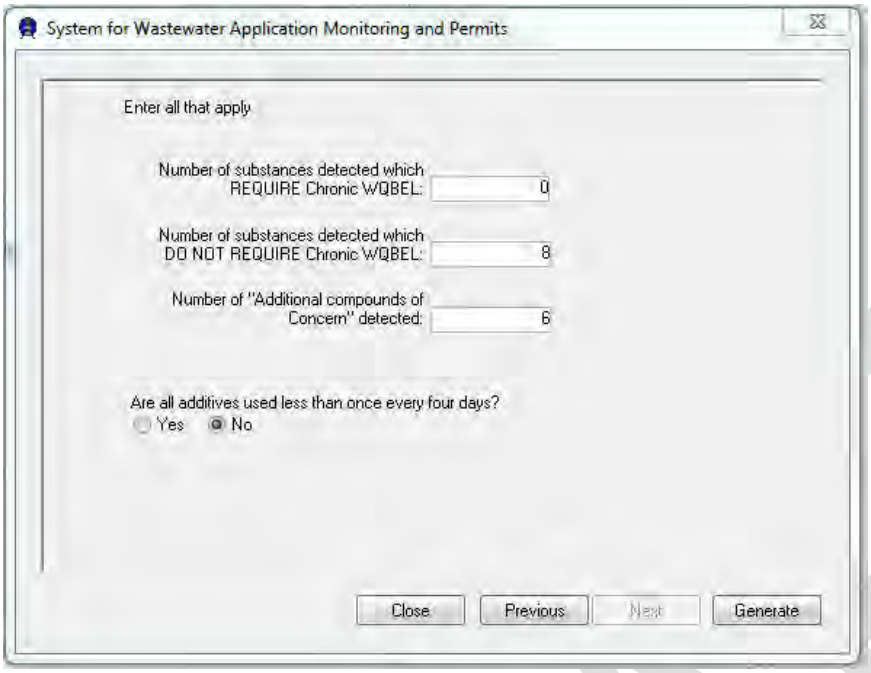
The Checklist uses data selected in the screen above to determine reasonable potential. Reasonable potential is defined as where an effluent "*is projected or calculated to cause an excursion above a water quality standard*" according to s. NR 106.08(6)(b), Wis. Adm. Code. (see page 19). WET limits should be given whenever representative, facility-specific data shows the effluent may be discharged at a level that has the potential to cause or contribute to an excursion above the WET criterion. Example reasonable potential decisions are shown in Attachment 1, at the end of this chapter.

Which data to use. When first opened, the WET data that appears in the screen above will include all data for that outfall in the WET Database. IC_{25}s are shown in the IC_{25} column for *Ceriodaphnia dubia* and fathead minnow tests; IC_{50}s are shown in the IC_{50} column for *Selenastrum* (green algae) tests. The user selects representative WET data that should be used in the reasonable potential determination, by highlighting one species from each test date that is to be used (the most sensitive species, or lowest IC value, from each test should be selected). Once the most sensitive species from each representative test has been highlighted, the user clicks the "calculate RP" button to determine the appropriate value.

Selenastrum capricornutum tests are often not included in the standard permit-required WET test battery. However, this species is included in chronic tests conducted by the UW-Madison State Lab of Hygiene and other labs. If *S. capricornutum* data has been collected for the discharge being evaluated, and it is believed to be representative of the discharge, it should be included in the RP analysis as described above (i.e., that species' test value should be selected, if it is the most sensitive endpoint). If this species is consistently the most sensitive in WET test failures, it may be appropriate to add it to the permit-required test battery. If staff have questions, they should contact the Biomonitoring Coordinator.

The same principles apply to the selection of chronic data, CV, and multiplication factors as that described in the section on acute data. Minimum monitoring frequencies, compliance schedules, and/or WET limit triggers are also recommended in similar situations for chronic as for acute (see p. 16 - 22).

Chemical Specific Data – Chronic



Water quality criteria are designed to be protective of aquatic life for the compounds that they regulate. However, chemical-specific limits are not designed to account for additive or synergistic effects that chemicals may have when they are combined in an effluent. WET testing can be used to determine whether additive or synergistic effects are occurring. The more compounds that are present in an effluent, the greater the potential may be for that effluent to exhibit these effects. Staff should document which limits and/or detects were considered (if any) so it is clear to others why point totals were assigned. Substances present at levels that cause chronic concerns (even if chronic limits are not given because acute limits are more restrictive) should be counted. For lists of substances found in ch. NR 105, Wis. Adm. Code, Tables 3 & 4 (i.e., substances which may require chronic WQBELs), and for a table of "Additional Compounds of Concern", see Attachment 2 at the end of this chapter.

As noted in Attachment 2, limits for ammonia should be counted as such in the WET Checklist only if effluent data shows the need for a WQBEL. Limits that are carried over from a previous permit, even though data suggests a limit is not needed, should not be counted as a limit in this evaluation. If ammonia has been detected in the effluent, it should be counted in that category.

POINTS ASSESSED (Chronic only)	
Answer	***Points***
Chronic WQBELs	*5 for 1st + 1 for ea. additional, not to exceed 10 pts.*
Detects w/out WQBELs	*1 for 1st + 1 for add. not to exceed 3*
Additional Cmpds of Concern	*2 (for ≥ 1 substance)*

Additives – Chronic

Are all additives used less than once every four days? Additives used less than 1 in 4 days are not given points towards chronic testing because less potential for chronic impacts is believed present. If a "No" is given here, points are given based on the answers given previously in the biocides/water quality conditioners screen (see p. 28).

POINTS ASSESSED (Chronic only)	
Answer	***Points***
YES	*0*
NO	*same points as acute*

Final WET Checklist Summary

Once answers are entered into the last screen, the Checklist is complete. The user clicks on the "Generate" button to complete the Checklist and preview a summary of answers, points assessed, and WET recommendations. The summary shows recommendations for limits and monitoring based on Checklist answers, the calculated AMZ and IWC and acute and chronic limits (as appropriate). Final WET limit and monitoring recommendations should be included in WQBEL memos and considered by permit drafters when putting WET monitoring and limits into the WPDES permit.

In cases where a WET limit is being recommended or where staff have made determinations that deviate significantly from this guidance, the Biomonitoring Coordinator should be copied on draft and final WQBEL memos (Kari.Fleming@wisconsin.gov; 608-267-7663). This information may be used for future WET program management decisions or guidance revisions.

WET Checklist recommendations are intended to apply in most situations, but there may be situations where the general assumptions it is based on do not apply and deviations will be necessary. Decisions that are made contrary to the guidance suggested here should be clearly documented, so others can tell why decisions were made. Specific examples and reasons for deviating from WET Checklist recommendations are given on pages 38-40.

Final Monitoring Frequency Recommendations

Monitoring recommendations based on point totals calculated by the WET Checklist are shown in Figure 7 below. As noted throughout this guidance chapter, final WET recommendations (monitoring frequencies, TRE schedules, etc.) should be made by WQBEL staff, using their best professional judgment and the advice provided by this chapter and the WET Checklist.

Standard permit language available in SWAMP (see Chapter 1.14) requires that WET monitoring continue until the permit is reissued. Standard language also requires that two retests be completed within 90 days of a failure, so staff should encourage permittees to schedule original tests so that retests can occur within the required period, when needed. Standard compliance schedule language which can be used when limits are required, is also included in SWAMP and is further described in Chapter 1.12.

Figure 7. Checklist Point Totals and Associated Monitoring Frequencies

Point Totals	Checklist Monitoring Recommendation	Comments
≤ 14 (ACUTE) **≤ 19 (CHRONIC)**	**No WET Tests Recommended**	WET testing is not usually recommended, since the potential for effluent toxicity is low.
15 - 24 (ACUTE) **20 - 24 (CHRONIC)**	**2 tests, per 5 year term**	Two tests each 5 years are recommended, since a few factors are present which cause concern. In order to insure that testing continues until permit reissuance, permit language should require that testing be done every other year, starting in year 2, until the permit is reissued (i.e., year 2, year 4, year 6, etc.). Tests should be required in different seasons, where possible.
25 - 34	**3 tests, per 5 year term**	3 tests each 5 years are recommended, due to a modest level of concern about toxicity. In order to insure that testing continues until permit reissuance, permit language should require that testing be done every other year, starting in year 1, until the permit is reissued (i.e., year 1, year 3, year 5, year 7, etc.). Tests should be required in different seasons, where possible.
35 - 44	**1x yearly**	One test is recommended each year during the permit term, due to a moderate level of concern about toxicity. Tests should be performed once each year, in successive quarters.
45 - 64	**2x yearly**	Two tests are recommended for each year during the permit term, due to a medium level of concern about toxicity. Tests should be performed during the 1st & 3rd quarters in odd numbered permit years (i.e., year 1, year 3, etc.) and the 2nd & 4th quarters in even numbered years (i.e., year 2, year 4, etc.).
65 - 84	**Quarterly**	Quarterly testing is recommended, due to a significant level of concern about effluent toxicity. Facilities that fall into this category usually have data that shows toxicity has been present.
≥ 85	**Bimonthly**	Testing every other month is recommended during the permit term, due to a substantial level of concern about toxicity. Facilities that fall into this category have historical data that shows toxicity to be present, and possibly data which shows an environmental impact has occurred due to the discharge. Tests should be performed at least 30 days apart, where possible.

Exceptions/special cases. Regardless of point totals, the following are true (see p. 11 for more discussion of each)

- If a major municipal or a primary industry, **a minimum** of annual acute & chronic (based on dilution) is recommended.
- If secondary values are considered and no WET data is available, **at least** 2x annual acute & chronic (based on dilution) is recommended.
- If WQBELs are recommended (or drop out) based on dissolved WQC, **at least** annual acute & chronic is recommended.
- If a limit is given, **minimum** monitoring frequencies apply (see page 22).

UW-Madison's State Laboratory of Hygiene (SLH) Environmental Toxicology Section

The SLH serves as a source of technical expertise and testing for WDNR staff. In situations where the Checklist recommends little or no monitoring, but staff determine during the permit term that more data is needed, the Environmental Toxicology Section can be asked to do testing in addition to that required in the permit. WET tests conducted at the SLH may be used to generate additional data for use in WET determinations, but cannot be used as a replacement or credit towards permit-required testing. You may contact the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) or the SLH directly (biomonitoring@mail.slh.wisc.edu; 608-224-6230) to request a WET test.

Calculation and Expression of WET Limits

The following shows how acute and chronic WET limits are calculated. In most cases, acute WET requirements are applied at "end of pipe" (no mixing is allowed) and the acute WET limit will equal 1.0 Acute Toxic Units (TU_a). In cases where mixing zone studies or other information has been submitted and a zone of initial dilution (ZID) has been approved for the outfall, the acute WET limit should be set at the edge of the approved acute mixing zone, as described below. Acute WET limits must be expressed as a daily maximum, as specified in s. NR 106.09(2)(f), Wis. Adm. Code.

- **Acute WET Limit = 1.0 Toxic Unit (TU_a)**
  Note: an acute WET limit = 100/AMZ TU_a, if a zone of initial dilution is allowed pursuant to s. NR 106.06 (3) (c), Wis. Adm. Code.
  AMZ = acute mixing zone concentration (see s. NR 106.09(2)(e), Wis. Adm. Code)

Chronic WET limits are set at the edge of the chronic mixing zone, using the applicable instream waste concentration. Chronic WET limits must be expressed as a monthly average, as specified in NR 106.09(3)(d), Wis. Adm. Code.

- **Chronic WET Limit = 100/IWC Toxic Units (TU_c)**
  IWC = instream waste concentration

Reasons For Changing Monitoring Frequencies

At times, there may be reason to delay testing until later in the permit or site-specific reasons for deviating from general Checklist recommendations. As stated before in this chapter, recommendations in this guidance are intended to apply in most situations, but there may be times when the assumptions it is based on do not apply and deviations from the suggested criteria are necessary. Some reasons why staff might decide to change recommendations are given below. Reasons for changes to guidance recommendations should be documented and shared with the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663), so that others can tell why decisions were made.

Previous permit's tests. Tests that were required but not completed during the last permit term (e.g., postponed during a toxicity reduction evaluation, retests not completed, etc.) should be added to the next permit term's recommendations.

Delay at permit reissuance. A period of 1-3 months may be allowed between reissuance and the first required test, in order to provide time for laboratory scheduling. Other reasons may exist, such as an upgrade or significant modification, which may warrant a delay between reissuance and WET testing. Staff should use their judgment to determine when adjustments are needed and document their reasons in the permit file (for example, in WQBEL or fact sheets).

Seasonal discharges. If a discharge is noncontinuous or seasonal, tests should occur when the factors of concern listed in the Checklist are present. For example, if the use of additives is a primary reason driving the need for WET monitoring, then WET testing should be required during periods of additive use. If the discharge does not occur long enough in a given year for the recommended monitoring frequency to be completed, the amount of required testing may be reduced accordingly. Additional guidance regarding monitoring frequencies and sampling schedules for seasonal or intermittent dischargers is given in Chapter 1.6: http://dnr.wi.gov/topic/wastewater/WETguidance.html.

Distance from a non-variance waterbody or higher amounts of available dilution. As discussed earlier in this chapter and in Ch. 1.2 (http://dnr.wi.gov/topic/wastewater/WETguidance.html), chronic WET monitoring may not be recommended if the discharge is located greater than 4 miles from the nearest downstream non-variance classified waterbody or if available dilution is high (> 100 : 1 stream flow to effluent flow ratio). However, it is important to realize that this may not be appropriate in all situations. If data exists which suggests a higher potential for chronic toxicity (for example, if previously performed chronic WET tests have failed), it may be necessary to require chronic monitoring to insure that

receiving water impacts are not occurring. If staff feel there are reasons to require chronic monitoring in these situations, they should make appropriate adjustments to the monitoring recommendations and document their reasons for doing so.

Groundwater remediation and other remediation type discharges. Where it has been determined that there is a need for WET testing of a discharge of this type, testing should begin as soon as possible after the discharge commences (first test usually within 90 days). These discharges are often of a short duration and any delays in testing may make testing difficult.

WWTP upgrades or other modifications. If a compliance schedule requires an upgrade, process change, or WWTP expansion that is expected to significantly change toxicity, WET monitoring may be postponed until construction is completed and the system is up and running. The WET Checklist should be completed based on WET data and toxicity potential as it exists at the time of permit issuance (since it is necessary for the permittee to demonstrate that the upgrade has reduced their potential), unless data is present which shows that the WWTP improvements will remove toxicity.

Compliance Schedules/Toxicity Reduction Evaluations. WET monitoring may be delayed during a WET limit compliance schedule and/or when a toxicity reduction evaluation (TRE) is being conducted. Chapter 1.12 provides guidance related to compliance schedules. Chapter 2.2 discusses TREs: http://dnr.wi.gov/topic/wastewater/WETguidance.html.

Permit terms of less than 5 years. The WET Checklist was designed for assessing discharges at the time of a standard permit reissuance, therefore recommended monitoring frequencies are based on a 5 year permit term. Staff may use the Checklist during permit modifications or when permits are to be reissued for shorter than 5 year terms to assess a discharge's toxicity potential, however, judgment should be used to adjust recommended frequencies to fit into the term of the reissued or modified permit. For example, if a modification is occurring with only 1 year left in the permit term and 3 tests are recommended, staff should determine whether 3 tests should be done during that year or if less testing would be sufficient to characterize the toxicity of the discharge.

Water quality variances. It may be appropriate to modify monitoring frequencies, test methods, or other WET requirements when a permittee has been granted a variance for a toxic compound that has the potential to cause (or may have already caused) WET failures. Changes to WET requirements should only be allowed if the permittee can demonstrate to the Department that the substance for which they were granted a variance is the only source of toxicity (i.e., the permittee would not be exempt from other toxicity sources) and should only be granted for the period for which the variance has been granted. All proposed WET monitoring, limit, or method changes due to variances should be discussed with the Biomonitoring Coordinator and documented in the permit file so that others can tell why changes were made.

Water quality variance for chloride. See Chapter 2.10 for a discussion related to WET monitoring and limits when a variance has been granted for chloride (http://dnr.wi.gov/topic/wastewater/WETguidance.html).

WET Limits as an Alternative to Secondary Values. Section NR 106.07(7), Wis. Adm. Code, states that the Department may establish a WET limitation according to s. NR 106.09, Wis. Adm. Code, as an alternative to a chemical-specific WQBEL based on a fish and aquatic life secondary acute or secondary chronic value determined according to ss.NR 105.05(4) and 105.06(6). The alternative WET limit has to meet all the following conditions:

1. The fathead minnow (*Pimephales promelas*) or the cladoceran *Ceriodaphnia dubia* were represented in the toxicological database used to generate the secondary value;
2. The permittee has requested the alternative WET limitation; and
3. WET testing shall be conducted at least once every three months during the entire term of the permit.

Deficiency Toxicity. Deficiency toxicity is defined as a condition where organisms are unable to survive because the surrounding water is lacking the necessary ions (e.g., sodium, calcium, magnesium, potassium, etc.) that must be available for them to survive. It is the opinion of DNR toxicologists that deficiency toxicity presented in a WET test will not have deleterious effects on receiving water organisms, as long as the necessary ions are introduced as soon as the effluent

contacts receiving water, soils, or sediments. If it can be demonstrated that positive WET results are due to deficiency toxicity only, it is reasonable to allow WET monitoring frequencies to be reduced. The following guidance is provided for those who wish to make such a demonstration:

In order to show that toxicity is caused by deficiency toxicity, the following may be demonstrated:

1. Hardness (as $CaCO_3$) in the unaltered sample (i.e., the wastewater as it is discharged) is < 45 mg/l;
2. Mortality in the *Ceriodaphnia dubia* test, in unaltered sample, is > 50%; and
3. The permittee has WET data, involving *C. dubia*, from at least 2 tests that includes the following:
   a) parallel tests with unadjusted vs. adjusted (to 45 mg/l hardness) sample, using reagents that have been added proportionally according to Figure 8:

Figure 8. Deficiency Toxicity Hardness Adjustment

RECIPE FOR EFFLUENT SAMPLE HARDNESS ADJUSTMENT			
REAGENT ADDED (mg/l)			
$NaHCO_3$	$CaSO_4H_2O$	$MgSO_4$	KCl
48.0	30.0	30.0	2.0

   b) Tests should include 4 replicates of at least 5 organisms in each; and
   c) The observed mortality in the altered sample is $\leq$ 10%.

If staff believe that deficiency toxicity exists, language may be placed in the permit allowing for a study similar to that above and for the dropping of WET monitoring after a successful demonstration. This demonstration should be made for each reissuance (exemptions from WET testing should only apply to one permit term).

Deficiency toxicity in condensate of whey (COW) discharges. Historically, it was believed that deficiency toxicity was responsible for results from WET tests at COW water discharges. Since the wastewater in these situations was thought to be only made up of condensate, the necessary ions were believed absent. In 1994-95, a study was conducted at the State Laboratory of Hygiene (SLH), in cooperation with the WDNR and 17 dairies, in an attempt to identify the cause of COW water toxicity. Study results showed: 1 not acutely toxic, 4 acutely toxic due to deficiency toxicity, 4 acutely toxic due to deficiency toxicity and ammonia, and 8 acutely toxic for unknown reasons (i.e., it was not deficiency or ammonia toxicity). Based on these results, it is obvious that it is necessary to continue to evaluate the potential for WET in COW water, however, we may allow COW water dischargers to demonstrate that WET results are impacted by deficiency toxicity, as described above. The following language may be used to allow demonstrations in COW discharge permits (this language is available as a standard requirement choice in SWAMP):

> *"If discharges consisting of condensate of whey (COW) wastewater only or non-contact cooling water mixed with COW waters (NCCW/COW) pass the first two acute toxicity tests and the first two chronic toxicity tests (if chronic toxicity testing is required) then the permittee is not required to perform additional toxicity testing during this permit term. If positive toxicity is experienced in any of the first two acute or chronic toxicity tests, the permittee may attempt to demonstrate that toxicity is due to ion deficiency. If it can be demonstrated that ion deficiency is the sole cause of toxicity in at least two consecutive positive tests, and the Department agrees in writing, the permittee will not be required to perform additional toxicity testing during this permit term. If it cannot be demonstrated that ion deficiency is the sole cause of toxicity in these tests, the permittee must complete the remaining toxicity tests."*

ATTACHMENT 1: Example Reasonable Potential Calculations

Example 1: Acute WET Reasonable Potential Evaluation (no approved ZID, WET failure present)

Date initiated	Acute WET Results		Maximum TUc (100/LC50)	Pass/ Fail
	C. dubia LC50	Fathead LC50		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	85%	>100%	1.18	Fail
12/09/2014	>100%	>100%	1.0	Pass

According to NR 106.08(6)(b), if a zone of initial dilution (ZID) has not been approved, reasonable potential to exceed the acute WET criterion is present when: (TUa effluent) (B) > 1.0, where TUa effluent is the most sensitive TUa in the data set and B is the multiplication factor from NR 106.08(5)(c), Table 4 (see page 19).

- Most sensitive result: LC50 = 85%; Maximum TUc = 100/85 = 1.18
- 5 WET tests in dataset, 1 toxicity detect. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = 6.2 (based on # of detects)

1.18 x 6.2 = 7.32

7.32 > 1.0, RP shown, limit is required (limit = 1.0 TUa)

Example 2: Acute WET Reasonable Potential Evaluation (no approved ZID, no WET failure present)

Date initiated	Acute WET Results		Maximum TUc (100/LC50)	Pass/ Fail
	C. dubia LC50	Fathead LC50		
12/31/2010	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	>100%	>100%	1.0	Pass
12/09/2014	>100%	>100%	1.0	Pass

According to NR 106.08(6)(d), TUc and TUa effluent values are equal to zero whenever toxicity is not detected (i.e., when the LC50, IC25, or IC50 > 100%).

0 < 1.0, RP not shown, no limit is required

Example 3: Acute WET Reasonable Potential Evaluation (with an approved ZID)

Date initiated	Chronic results		Maximum TUc (100/LC50)	Pass/ Fail
	C. dubia LC50	Fathead LC50		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	65%	>100%	1.54	Pass
09/22/2013	35%	>100%	2.85	Fail
12/09/2014	>100%	>100%	1.0	Pass

According to NR 106.08(6)(b), if a zone of initial dilution has been approved, reasonable potential to exceed the acute WET criterion is present when: [(TUa effluent) (B) (AMZ)] > 1.0, where TUa effluent is the most sensitive TUa in the data set and B is the multiplication factor from NR 106.08(5)(c), Table 4 (see page 19), and AMZ is the acute mixing zone concentration based on the zone of initial dilution approved according to NR 106.06 (3)(c).

- AMZ = 57% (0.57)
- Most sensitive result: LC50 = 35%; Maximum TUc = 100/35 = 2.85
- 5 WET tests in dataset, 2 toxicity detects. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = 3.8 (based on # of detects)

2.85 x 3.8 x 0.57 = 6.17

6.17 > 1.0, RP shown, limit is required (limit = 100/AMZ = 1.75 TUa)

Example 4: Chronic WET Reasonable Potential Evaluation (toxicity detected well below the limit, no WET failures)

Date initiated	Chronic results		Maximum TUc (100/IC25)	Pass/ Fail
	C. dubia IC25	Fathead IC25		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	85%	90%	1.18	Pass
12/09/2014	>100%	>100%	1.0	Pass

According to NR 106.08(6)(b), reasonable potential to exceed the chronic WET criterion is present when: [(TUc effluent) (B) (IWC)]> 1.0, where TUc effluent is the most sensitive TUc in the data set, B is the multiplication factor from NR 106.08(5)(c), Table 4 (see page 19), and IWC is the instream waste concentration calculated according to NR 106.03(6), Wis. Adm. Code.

- IWC = 10% (0.10)
- Most sensitive result: IC25 = 85%; Maximum TUc = 100/85 = 1.18 (test passed; toxicity detected well above the IWC)
- 5 WET tests in dataset, 1 toxicity detect. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = 6.2 (based on # of detects)

1.18 x 6.2 x 0.10 = 0.73

RP <u>not</u> shown, limit is not required

Example 5: Chronic WET Reasonable Potential Evaluation (toxicity detected near to the limit, but no WET failures)

Date initiated	Chronic results		Maximum TUc (100/IC25)	Pass/ Fail
	C. dubia IC25	Fathead IC25		
12/31/2010	>100%	>100%	1.0	Pass
03/25/2011	>100%	>100%	1.0	Pass
06/10/2012	>100%	>100%	1.0	Pass
09/22/2013	55%	90%	1.82	Pass
12/09/2014	>100%	>100%	1.0	Pass

- IWC = 25% (0.25)
- Most sensitive result: IC25 = 55%; Maximum TUc = 100/55 = 1.82 (test passed; toxicity detected nearer to the IWC)
- 5 WET tests in dataset, 1 toxicity detect. Multiplication factor (B) from NR 106.08(5)(c), Table 4 = 6.2 (based on # of detects)

1.82 x 6.2 x 0.25 = 2.82

RP shown, limit is required (limit = 100/IWC = 4.0 TUc)

ATTACHMENT 2: NR 105 and Additional Compounds of Concern

CATEGORY	SUBSTANCES	
	ACUTE	CHRONIC
WQBEL required 5 pts for 1st + 1 for each additional, not to exceed 15 pts.	Ammonia[1], Arsenic, Cadmium, Chloride, Chlorine, Chlorpyrifos, Chromium, Copper, Cyanide, Dieldrin, Endrin, Gamma-BHC, Lead, Mercury, Nickel, Parathion, Pentachlorophenol, Toxaphene, Zinc	Ammonia[1,2], Arsenic, Cadmium, Chloride, Chlorine, Chromium, Copper, Cyanide, Dieldrin, Endrin, Lead, Mercury, Nickel, Parathion, Pentachlorophenol, Zinc
Substance detected, but no WQBEL needed 1 point each, not to exceed 3 pts	Substances above detected in the effluent (including those given chronic WQBEL), but not given acute WQBEL	Substances above detected in the effluent (including those given acute WQBEL), but not given chronic WQBEL
"Additional Compounds of Concern" detected 2 points given if any detected	Any substances in "Additional Compounds of Concern" table below detected in the effluent	Any substances in "Additional Compounds of Concern" table below detected in the effluent

[1] Ammonia limits should be counted only if representative effluent data demonstrates the need for a WQBEL (limits that are simply "carried over" from a previous permit term, even though effluent data suggests they are no longer needed, should not be counted as WQBEL limits). If ammonia has been detected in the effluent, it should be counted as described in the second row of the table above.

[2] Ammonia WQBELs based on 4-day chronic toxicity criteria and expressed in permits as weekly average limitations should be counted. WQBELs based on 30-day criteria and expressed as monthly averages are not indicative of conditions in chronic WET tests (since chronic tests last 7 days) and should not be counted. If ammonia has been detected in the effluent, it should be counted as described in the table above.

Information given above is from Tables 1 & 2 (acute) and Tables 3 & 4 (chronic), in ch. NR 105, Wis. Adm. Code, March 2004. Users should check recent versions of the code to make sure that they are using the most up-to-date lists.

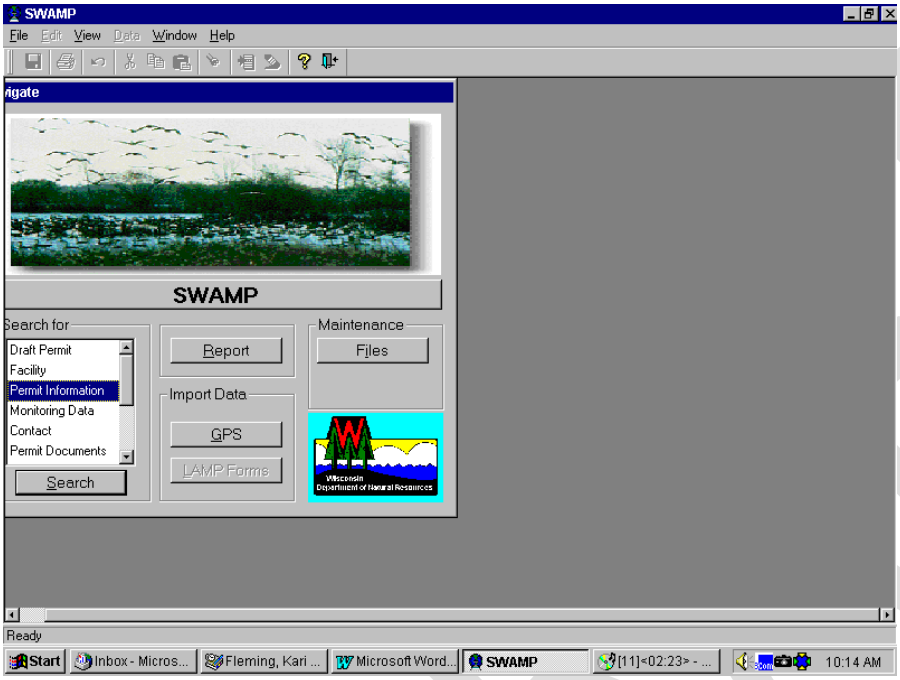
ADDITIONAL COMPOUNDS OF CONCERN (ACC)

Metals:	**Acid-Extractable Compounds:**	2,6-Dinitrotoluene	2,4-Dichlorophenoxyacetic acid
Antimony	P-Chloro-M-Cresol	Di-n-octyl Phthalate	Endosulfan
Beryllium	2-Chlorophenol	1,2-Diphenylhydrazine	Endosulfan Sulfate
Selenium	2,4-Dichlorophenol	Fluoranthene	Endrin Aldehyde
Silver	2,4-Dimethylphenol	Fluorene	Guthion
Thallium	4,6-Dinitro-O-Cresol	Hexachlorobenzene	Heptachlor
	2,4-Dinitrophenol	Hexachlorobutadiene	Heptachlor Epoxide
Volatile Organic Compounds:	2-Nitrophenol	Hexachlorocyclopentadiene	Malathion
Acrolein	4-Nitrophenol	Hexachloroethane	Methoxychlor
Acrylonitrile	Phenol	Indeno(1,2,3-cd)pyrene	PCBs
Benzene	2,4,6-Trichlorophenol	Isophorone	
Bromoform		Naphthalene	**Dioxin:**
Carbon Tetrachloride	**Base-Neutral Compounds:**	Nitrobenzene	2,3,7,8-TCDD (dioxin)
Chlorobenzene	Acenaphthene	N-Nitrosodimethylamine	
Chlorodibromomethane	Acenaphthylene	N-Nitrosodiphenylamine	**Other Non-Priority Pollutants:**
Chloroethane	Anthracene	N-Nitrosodipropylamine	Aluminum
2-Chloroethyl vinyl ether	Benzidine	N-Nitrosodiethylamine	Asbestos
Chloroform	Benzo(a)anthracene	N-Nitrosodi-n-butylamine	BHC-tech. grade
1,2-Cisdichloroethylene	Benzo(a)pyrene	N-Nitrosopyrrolidine	Bis(2-chloromethyl)ether
Dichlorobromomethane	3,4-Benzofluoranthene	Octachlorostyrene	3-Chlorophenol
1,1-Dichloroethane	Benzo(ghi)perylene	Pentachlorobenzene	4-Chlorophenol
1,2-Dichloroethane	Benzo(k)fluoranthene	Phenanthrene	Dichlorodifluoromethane
1,1-Dichloroethylene (vinylidene chloride)	Bis(2-chloroethoxy)methane	Pyrene	2,3-Dichlorophenol
	Bis(2-chloroethyl)ether	1,2,3,4-Tetrachlorobenzene	2,5-Dichlorophenol
1,2-Transdichloroethylene	Bis(2-chlorisopropyl)ether	1,2,4,5-Tetrachlorobenzene	2,6-Dichlorophenol
1,2-Dichloropropane	Di(2-ethylhexyl)phthalate (DEHP)	1,2,4-Trichlorobenzene	3,4-Dichlorophenol
1,1-Dichloropropene	4-Bromophenyl Phenyl Ether		1,3-Dichloropropane
2,3-Dichloropropene	Butyl benzyl phthalate	**Pesticides:**	2,3-Dinitrophenol
1,3-Dichloropropene	2-Chloronaphthalene	Aldrin	Fluoride
Ethylbenzene	4-Chlorophenyl Phenyl Ether	Alpha-BHC	Formalin

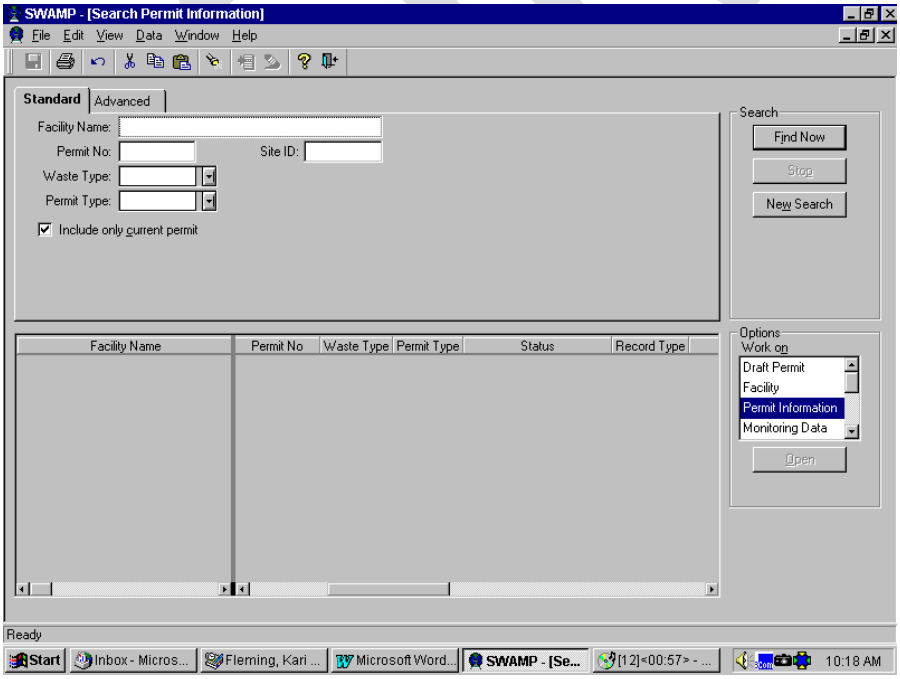
Methyl Bromide Methyl Chloride Methylene Chloride 1,1,2,2-Tetrachloroethane Tetrachloroethylene Toluene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethylene Vinyl Chloride	Chrysene Dibenzo(a,h)anthracene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 3,3'-Dichlorobenzidine Diethyl Phthalate Dimethyl Phthalate Di-n-butyl Phthalate 2,4-Dinitrotoluene	Beta-BHC Delta-BHC Chlordane Chlorpyrifos 4,4'-DDD 4,4'-DDE 4,4'-DDT Diazinon	Iron 2-Methyl-4-Chlorophenol 3-Methyl-6-Chlorophenol Mirex Photomirex 2,3,4,6-Tetrachlorophenol Trichlorofluoromethane 2,4,5-Trichlorophenol

ATTACHMENT 3: Changing Data in the Sample Point Table of SWAMP

In order for the WET Checklist to make decisions regarding the instream waste concentration (IWC), stream flow to effluent flow ratios, and other WET determinations, information regarding effluent flow (Qe), the fraction of Qe withdrawn from the receiving water (RW), RW flow ($Q_{7,10}$), and RW classification must be entered in the "Sample Point" table. This information must be entered before creating a new Checklist or revising an existing Checklist. This attachment includes instructions on how to enter this data into the Sample Point table.

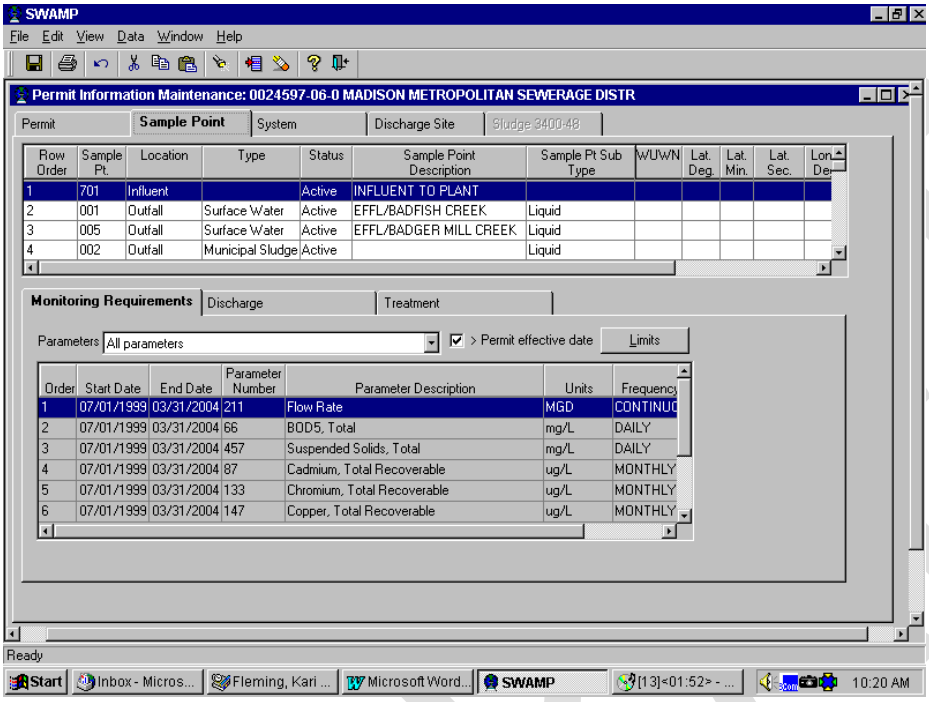


At the Navigate screen, click on "Permit Information" in the "Search for:" box, then click on the "Search" button.

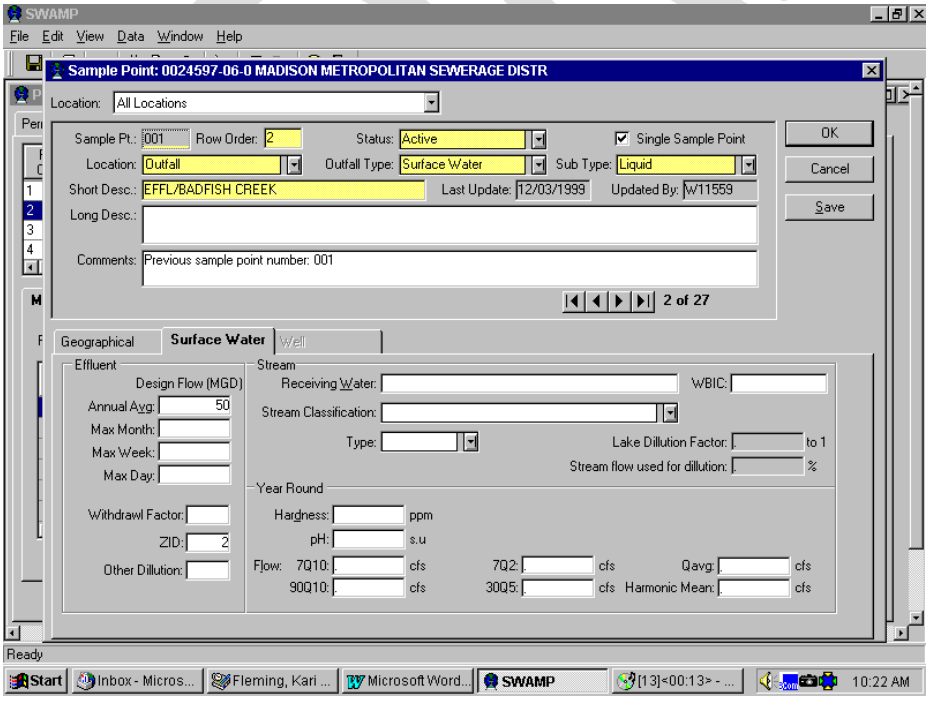


When this “Search Permit Information” screen appears, enter the facility name, FIN, Site ID, or permit number and then click on the “Find Now” button. The facility name and permit number will appear in the “Facility Name” box on the bottom half of the screen. Click on the name or permit number for the facility you are interested in and then click on the “Open” button.

In the “Permit Information Maintenance” screen (below), click on the “Sample Point” tab.



Double-click on the surface water outfall that you are interested in, then click on the “surface water” tab.



The effluent flow (Q_e) used in the WET Checklist is usually the annual average design flow for municipals or average annual actual flow for industrial dischargers. The Checklist will use this Q_e to determine the appropriate $Q_{7,10}$:Q_e ratio, IWC, and chronic dilution series (more discussion of these values are given later in this chapter). The withdrawal factor (f) should be entered as a decimal (for example, if the facility withdraws and uses 1/2 of the receiving water flow, enter 0.5). This value will be used as "f" in the IWC calculation (discussed later in this chapter). The $Q_{7,10}$ entered here is also used to determine the $Q_{7,10}$:Q_e ratio (used to determine need for acute and/or chronic testing), IWC, and to choose the chronic dilution series. Once the Q_e, $Q_{7,10}$, and f values are entered in the sample point table, return to the previously discussed screen in the WET Checklist.

CHAPTER 1.8 - Enforcement Strategy

The purpose of this chapter is to give example enforcement situations and to discuss appropriate responses to WET violations.

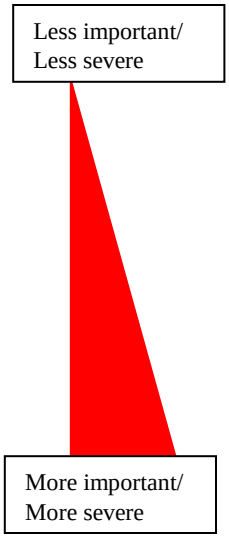
NOTICE: This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

WET Limit Violations

Many wastewater permits contain language requiring that whole effluent toxicity (WET) monitoring be conducted. Standard WET language requires follow up actions in the event of a test failure – typically two retests are required within 90 days. Additional toxicity reduction evaluation (TRE) follow up actions are required if a retest fails (see recommended permit language in Chapter 1.14: http://dnr.wi.gov/topic/wastewater/WETguidance.html).

In some cases, a permittee will be required to do WET monitoring but will not have a WET limit in their permit. In these cases where there is no WET limit in the permit, the failure of a WET test is not a permit violation. In situations where a WET limit is required in the permit, a WET test failure is a violation. (See Chapter 1.3 for how to express WET limits.)

WET-related permit violations can also occur if WET Test Report Forms are not submitted on time, if permit-required monitoring or retests are not done, if TRE follow up actions are not taken, or if compliance schedule steps are missed. Listed below are examples of possible WET noncompliance events. The list provides examples of noncompliance and shows a continuum from less important to more important noncompliance events. Please note that the list is not all-inclusive and that additional types of noncompliance may exist and should not limit an enforcement response. **Noncompliance events which should trigger a Notice of Noncompliance (NON) are shown in bold text below. A Notice of Violation (NOV) should be triggered in most cases where a permittee has experienced several bolded events or when one bolded event has occurred along with several non-bolded events.** The more "more important/more severe" events (towards the bottom) that occur, the more significant the enforcement follow up should be.



- WET monitoring only required, failure occurred (not a violation if no WET limit is present)
- WET test or retests done on time but WET Test Report Form not submitted within 45 days
- TRE information submitted, but not within the 60 days required in Standard Requirements
- WET tests not conducted by a certified lab as required by s. NR 149.20, Wis. Adm. Code.
- Failure to follow WET test methods required by WPDES permit
- WET compliance schedule date missed (late submittal)
- **Monitoring only required, WET tests not completed**
- **Monitoring only required, WET failure occurred (not a violation), retests not completed**
- **WET limit in permit, WET tests not completed**
- **WET compliance schedule date missed (no submittal)**
- **WET limit in permit, WET failure occurred (limit violation)**
- **WET limit in permit, WET failure occurred (limit violation) and retests not completed**
- **WET limit violation is an isolated incident; permittee does not have a history of WET failures**
- **WET limit violation indicates magnitude of toxicity is slight, potential is lower for environmental impact**
- **WET limit violation indicates magnitude of toxicity is severe & potential is high for adverse impact**
- **WET limit violation is not an isolated incident; there is a history of frequent or severe WET failures**

Persistence and Severity of Toxicity

WET limits, when given, will appear in the effluent limits table in the permit and be expressed in Toxic Units Acute (TU_a) or Toxic Units Chronic (TU_c). (See Chapter 1.3 for how to calculate and express WET limits.) The severity (or magnitude) of toxicity expressed in a WET test can be determined by comparing the test results to the permittee's limit. The higher the TU_a or TU_c, the more severe the toxicity.

More severe toxicity, even if it occurs only once or a few times, has the potential to cause adverse impacts to aquatic life. Repeated or constant toxicity, even if present at lower levels, also increases the potential for toxicity to cause adverse impacts to aquatic life. Therefore, more severe toxicity and repeated bouts of toxicity should be considered more seriously and given more weight than single and/or less severe events.

Response to WET Violations

It is recommended that all WET limit violations be taken seriously. WET monitoring is done infrequently, usually at most quarterly, therefore individual results should be given more weight. In addition, the test itself is intended to directly measure the potential for impairment of fish and aquatic life communities related to substances present in the effluent at toxic concentrations. Thus, all WET test failures indicate some potential for adverse impacts to the aquatic life community in the receiving water and appropriate action should be taken. As discussed above, more severe and repeated toxicity should be given more weight than single toxic events.

Follow up on violations should be in accordance with the stepped enforcement procedures outlined in the Environmental Enforcement handbook and the guidance document titled, "*Enforcement Strategy For The Wisconsin Department Of Natural Resources Water Pollution Control Program*". The continuum shown above provides guidance to staff related to when an NON or NOV action should be taken.

As noted above, retests and TRE actions are required when repeated WET failures occur. If a WET limit is present, it is critical that the permittee complete these activities to try to find and fix the source of toxicity. In general, the WDNR would not normally take serious enforcement action (e.g., referrals, fines) following WET limit violations, if staff agree that the permittee has adequately complied with its WPDES permit requirements for accelerated testing and conducting a TRE. More serious enforcement action would be appropriate if the permittee fails to aggressively conduct a TRE or is otherwise recalcitrant in addressing the toxicity. Exceptions to this general guideline include situations where the WET violations are of large magnitude or have contributed to a significant environmental impact; the permittee needs additional incentive to complete the corrective actions identified by a TRE; the permittee failed to eliminate/reduce toxicity within a reasonable time frame; or WET violation(s) were caused by circumstances within the control of the discharger and could have been reasonably avoided.

The Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) can provide assistance and should be notified when WET-related enforcement action is being considered. In cases where the situation may be controversial, repeated violations have occurred, or other non-standard conditions exist, it may be necessary to convene an interdepartmental team, including the Biomonitoring Coordinator, District staff, supervisors, legal staff, or others, to determine necessary actions. The Department's response to WET limit violations should be based on the site-specific circumstances involved. Ultimately, decisions on the appropriate enforcement steps should be made on a case-by-case basis, with input from the Biomonitoring Coordinator and compliance staff most familiar with the facility.

Inspections and Supplemental WET Monitoring

WET data and other related information should be collected and historical or existing toxicity problems should be

discussed with the permittee during every compliance inspection. In situations where problems are suspected or staff feel that more WET data is needed, staff may request testing from the UW-Madison State Laboratory of Hygiene (SLH) Environmental Toxicology Section. If an enforcement case is ongoing, or there is a good chance that future enforcement actions may be necessary, DNR staff should be present during SLH WET sampling (i.e., equipment setup, sample collection and shipping, etc.). Sampling equipment should be secured, if possible, and sample integrity maintained. Chain of custody forms should accompany samples and be filled out appropriately.

WET tests may be conducted by the SLH at the request of DNR staff and used to determine whether a problem exists or to generate additional data for use in WET determinations, but cannot be used as a replacement or credit towards permit-required testing. Staff may contact the Biomonitoring Coordinator or the SLH directly (608-224-6230 or biomonitoring@mail.slh.wisc.edu) to request a toxicity test.

WET Files

The Methods Manual requires WET Test Report Forms be sent directly to the Biomonitoring Coordinator in Madison within 45 days of test end. Upon receipt at the central office, forms are date-stamped and reviewed as soon as possible. (For details regarding the review process, see Chapter 1.5.) After a complete data review, the Biomonitoring Coordinator confirms whether the test passed or failed, enters test information into the SWAMP WET database, and sends copies to the appropriate field staff for comparison to permit conditions and placement in the permit file.

Signed WET Test Report Forms and other information collected by the Biomonitoring Coordinator for each facility (TRE reports, email correspondence, etc.) are placed in the "WET file" for the facility, which is kept in the central office in Madison. In many cases, more detailed WET-related information will be included in this WET file than in other permit files. Field staff should contact the Biomonitoring Coordinator for copies or to discuss information contained in this file.

CHAPTER 1.10 - Ammonia & Associated WET Requirements

The Department promulgated water quality standards for ammonia in s. NR 106.36, Wis. Adm. Code, on March 1, 2004, which adjusts WET requirements in certain situations. The following guidance is given in two parts:

Part One: The first part of this chapter provides guidance for Department staff, WET labs and permittees, regarding requirements in s. NR 106.36, Wis. Adm. Code, which allows effluent samples used in chronic fathead minnow WET tests to be modified to remove ammonia prior to testing when early life stage (ELS) - absent ammonia criteria are in effect.

Part Two: The second part of this chapter gives guidance for staff to use when making adjustments to WET requirements when a permittee has been granted a water quality standards variance for ammonia.

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Part One: WET Sample Modification When ELS-Absent Criteria Are In Effect

USEPA's *1999 Update of Ambient WQC for Ammonia* contains a provision to adjust (relax) chronic water quality criteria (WQC) for ammonia when water temperatures are colder (< 15º C) and early life stages (ELS) are absent, in order to account for reduced sensitivity to ammonia by juvenile and adult fish at lower temperatures. In Wisconsin, this translates into higher (less stringent) limits for ammonia during winter months. Fathead minnow ELS were used, with other data, to develop the adjustment between ELS present and absent criteria, and the fathead minnow is known to be very sensitive to ammonia. Of the data used to develop WQC for ammonia, only *Hyalella* (an invertebrate), *Musculium* (a mussel), and *Lepomis* (blue gill) ELS were more sensitive to ammonia than the fathead minnow ELS. Like fathead minnow ELS, *Lepomis* ELS would not be expected in receiving waters during the ELS-absent period.

It has been pointed out that a conflict may exist between allowing this less stringent ammonia criteria during ELS-absent periods and requiring WET tests during those same periods, since chronic WET tests are conducted using fathead minnow ELS. Under this scenario, a situation could arise where the permittee is in compliance with its effluent limit for ammonia during an ELS-absent time period, but have a positive (failing) chronic fish WET test due to ammonia during that same period. Because of this, s. NR 106.36, Wis. Adm. Code, allows samples used in chronic fathead minnow WET tests to be modified to remove ammonia prior to testing when certain conditions are met (See Figure 1).

Permit Language When ELS-Absent Criteria Are Applied

The following standard language may be added to WPDES permits when WQBELs based on ELS-absent criteria are given:

> *"Effluent samples used in chronic fathead minnow tests may be modified to remove ammonia prior to testing, according to s. NR 106.36(2), Wis. Adm. Code, during periods when ammonia limits based on early life stage-absent criteria are in effect."*

Figure 1. NR 106.36 Alternative whole effluent toxicity monitoring for certain discharges of ammonia.

(1) In addition to water quality based effluent limitations for ammonia, the department may establish whole effluent toxicity testing requirements and limitations pursuant to ss. NR 106.08 and 106.09.

(2) Chronic fathead minnow whole effluent toxicity test samples may be modified to remove ammonia prior to testing when all of the following conditions are met:

(a) The whole effluent toxicity test is being conducted during a period when ammonia effluent limitations based on early life stage absent criteria are in effect.

(b) The permittee has demonstrated compliance with applicable acute and chronic water quality based effluent limitations for ammonia during the testing period.

(c) Total ammonia measured in whole effluent toxicity test effluent samples is less than the applicable chronic water quality based effluent limitation contained in the WPDES permit, but greater than the "ammonia threshold number", determined as follows:

1. Measure the pH of the whole effluent toxicity test effluent sample after the sample has been warmed to the test temperature.

2. Using the pH value of the sample as determined in subd.1., determine the value of the ammonia multiplier in Table 1 for the pH range corresponding to the effluent pH.

3. Divide 100 by the appropriate in−stream waste concentration, as a percentage, contained in the WPDES permit; then multiply the resulting value by the ammonia multiplier determined in subd. 2. to obtain the ammonia threshold number.

(3) If all of the criteria in sub. (2) have been met, ammonia may be removed from the test sample.

Table 1.

Effluent pH (s.u., after warming)	Ammonia multiplier (mg/l total ammonia)
6.0 – 6.5	30
6.6 – 7.0	25
7.1 – 7.5	15
7.6 – 8.0	5
8.1 – 9.0	1

Modification of WET Samples During ELS-Absent Periods

As outlined above, it may be appropriate to conduct the fathead minnow portion of the chronic WET test on effluent samples that have been treated to remove ammonia prior to testing. When those conditions are met, effluent samples may be treated with zeolite resin prior to testing. Samples should be treated daily, before use in WET tests, rather than batch treated for multiple day usage. Ammonia, pH, hardness, and alkalinity should be measured prior to and after zeolite treatment. A blank (an extra negative control) should also be run through zeolite, to account for toxic artifacts due to the zeolite treatment. Samples used for fathead minnow chronic tests should not be modified in any way other than ammonia removal with the zeolite resin. Samples used in concurrent acute tests (fathead minnow and *Ceriodaphnia dubia*) and chronic tests with *C. dubia* are not to be modified prior to testing.

Decisions regarding WET monitoring frequencies and scheduling should be made according to guidance in Chapter 1.3 (http://dnr.wi.gov/topic/wastewater/WETguidance.html) and acute and chronic WET tests should be required during ELS-absent periods, when recommended by the guidance found there. Continued WET testing during winter months is important, when possible, because wastewater treatment (and, therefore, effluent toxicity) can be significantly different during colder weather. Chronic fathead minnow WET tests conducted during periods when ELS-absent ammonia criteria are in effect will still be used to assess whether toxicity is present due to other compounds. Toxicity due to ammonia and other compounds will also be assessed with acute WET tests and the *C. dubia* chronic test during these periods.

Can This Be Applied To Other Pollutants?

It is important to note that this is not just a matter of passing a chemical-specific limit for a toxicant and failing a WET test that identifies that chemical as the toxicant. This is a special case only for ammonia because this provision to adjust the chronic criteria during periods of the year when water temperatures are colder and fish ELS are absent is unique to ammonia. Ammonia is the only chemical for which data showing a difference in sensitivity between ELS and adult fish has been used to allow for an adjustment in the WQC in the absence of fish ELS. This approach is believed to be appropriate for ammonia because the early life stage used in the chronic fathead minnow WET test, and other early life stages that the fathead minnow is being used as a surrogate for, are not found in receiving waters during ELS-absent periods. Therefore, it is believed that a positive chronic fathead minnow WET test result caused by ammonia toxicity would not likely be indicative of negative effects in the receiving water because the life stages that experience those toxic effects would not be present. In addition, any significant chronic toxicity due to ammonia that may be harmful to other non-fish species present in the receiving water during colder periods should be indicated by *C. dubia* chronic tests.

Will Zeolite Remove More Than Ammonia?

Zeolite is composed of natural or synthetically created crystalline, hydrated alkali-aluminum silicates. When zeolite is exposed to an aqueous solution (such as an effluent), the positively charged resin removes cations from the solution. Since it is an effective ion exchange resin, zeolite has frequently been used in toxicity identification work (*Methods for Aquatic Toxicity Identification: Phase II TIE Procedures*, EPA/600/R-92/080), specifically to remove the ammonium ion (NH_4^+) from effluent samples. However, because of its ion exchange properties, it may also remove other cations such as heavy metals. In addition, although the primary action of zeolite is chemical (ion exchange), the physical manipulation of filtration also occurs during the process. Removal of compounds via filtration through zeolite may include surfactants and polymers. Changes in the ionic balance of the sample caused by the zeolite treatment may also cause chemicals that would not have caused toxic effects before zeolite treatment to be rendered biologically available.

While it is true that modification of samples with zeolite can remove substances other than ammonia and may modify the sample in other ways, the potential for this method to reduce the ability of the WET test to detect toxicity due to other substances should be small in most cases. In addition, substances other than ammonia that may be removed by zeolite, especially heavy metals, are typically more toxic to *C. dubia* than the fathead minnow. Since samples used in the *C. dubia* test are not being modified, that toxicity should still be detected. Additionally, since the presence of ammonia in a sample may mask toxicity caused by other substances, the removal of ammonia could allow for the detection of substances that may have been missed had ammonia been present.

Historical WET Data From Previous ELS-Absent Periods

In some cases, a permittee may have collected WET data during previous years when ELS-absent ammonia criteria would have been applicable. The question arises then of how to consider WET tests conducted under these conditions, when making permit-related decisions. The results of a fathead minnow chronic test completed during ELS-absent periods should not be used when assessing reasonable potential or choosing the WET monitoring frequency (i.e., in the WET Checklist process) if all of the following are true: 1) the test appears to have failed due to ammonia toxicity, 2) concurrent acute tests and chronic *C. dubia* tests did not show toxicity, and 3) the conditions listed in s. NR 106.36, Wis. Adm. Code (shown in Figure 1 above), are met.

It is important to keep in mind that this exclusion applies only to ammonia because it is the only water quality criterion that has an adjustment for the presence or absence of fish ELS. Any WET tests which showed toxicity in an acute test or a *C. dubia* chronic test, or in a fathead minnow chronic test due to any toxicant other than ammonia should not be

excluded from WET determinations. Results generated by acute tests and *C. dubia* chronic tests conducted during periods when ELS-absent ammonia criteria are in effect are still applicable for assessing effluent toxicity from all toxicants, including ammonia. If staff have questions regarding WET data collected during ELS-absent periods, they should contact the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663).

Part Two: WET Monitoring When an Ammonia Variance Has Been Granted

WET testing has been conducted on effluents from municipal and industrial point sources where toxicity potential was thought to be present since the late 1980s. Ammonia has been shown to be a common toxicant found in wastewater effluents and has been regulated accordingly in the WET program. WET test failures caused by ammonia are treated the same way as those caused by other toxicants. Ammonia-related WET failures occur most often during the winter months, especially in cases where stabilization ponds and aerated lagoons are used, because wastewater treatment is less effective (or ineffective) in colder temperatures. In most cases, higher ammonia levels will occur in wastewater during the months of December through May.

Permittees may be granted a variance to the ammonia water quality standard (WQS) as allowed in s. 283.15, Wis. Stats., due to socio-economic impacts or other factors. (See http://dnr.wi.gov/topic/wastewater/variances.html for more information on WQS variances.) As a condition of the variance, permittees may be given higher (less stringent) ammonia limits during the term of the variance. In these cases, it may be necessary to also adjust WET monitoring schedules to account for periods when levels of ammonia in the effluent are allowed to be present above water quality-based effluent limits that were applicable before the variance was granted.

Depending on the level of ammonia present in the effluent, toxicity may occur in acute and chronic tests and to one or all of the tested species. It is generally accepted that the fathead minnow will experience acute toxicity if ammonia is present at levels above 30 mg/l (at pH $\leq$ 7.5) and chronic toxicity if ammonia > 15 mg/l (at pH $\leq$ 7.5 and 100% IWC). *C. dubia*, on the other hand, would not be expected to show acute toxicity until ammonia is above 60 mg/l (at pH $\leq$ 7.5) and chronic *C. dubia* toxicity wouldn't be expected until levels are > 50 mg/l (at pH $\leq$ 7.5 and 100% IWC).

Depending on the level of ammonia expected to be present in the effluent, staff may determine that it is appropriate to not require WET testing at certain times of the year or to require that only *C. dubia* be tested. For example, if the maximum daily amount of ammonia present in the effluent is expected to stay above 15 mg/l, but below 50 mg/l in December through May, the permit could require that chronic WET tests be conducted at other times of the year (June – November). If it is desirable to collect WET data during the months of December – May in this same case, staff could require that testing be done using *C. dubia* only.

If it has been determined that the permittee should be granted (or has previously been granted) a variance for ammonia, staff should make decisions on whether or not to use previously collected WET data using the same logic as described above. If WET tests were collected under conditions that are being excluded for testing in the future, then it may be appropriate to remove those data from WET limit and monitoring determinations. WET test results that indicate toxicity is due to substances other than ammonia should still be used when making WET determinations.

Ammonia Toxicity and pH Drift

Natural processes which act to regulate the pH of natural waters also occur in mixtures of natural surface waters and effluents. With the exception of lagoon systems, effluent pH values are often lower than those in receiving waters, due to the presence of excess carbon dioxide resulting from the artificially high rates of respiration of microorganisms in wastewater treatment plants. When the effluent is discharged to surface waters (or mixed with receiving waters in

laboratory settings), respiration rates fall to "natural" levels and excess carbon dioxide is stripped, causing a pH rise or drift upwards. Significant pH drift can sometimes occur in WET tests, due to the static conditions present in the test. This can impact how much toxicity is expressed due to ammonia in these WET tests, since higher pHs result in more ammonia toxicity. Extra care should be taken in tests where ammonia is at or near toxic levels. Chapter 2.8 (http://dnr.wi.gov/topic/wastewater/WETguidance.html) discusses the use of CO2 entrapment methods to control pH drift and when it is required in permit-required WET tests.

Questions regarding WET test design, data interpretation, or the applicability of historical data should be directed to the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663).

CHAPTER 1.12 – WET Limit Compliance Schedules

This chapter is intended to help staff make decisions regarding appropriate time frames and requirements for WET limit compliance schedules in WPDES permits.

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Standard WET Limit Compliance Schedule

Whole effluent toxicity (WET) limits are established in a permit according to s. NR 106.08, Wis. Adm. Code, whenever representative, facility-specific WET data demonstrate that the effluent is or may be discharged at a level that will cause, have the potential to cause, or contribute to an excursion of a water quality standard. The Department evaluates all surface water dischargers to determine the need for WET limits and monitoring at the time of permit reissuance - see Chapter 1.3 for more discussion of WET reasonable potential and how the WDNR determines whether a WET limit is necessary in each situation (http://dnr.wi.gov/topic/wastewater/WETguidance.html).

When a new WET limit is required for the first time in a WPDES permit, it may be necessary to include a compliance schedule in order to give the permittee time to take the actions necessary to come into compliance with the new limit. Standard WET limit compliance schedules require that a Toxicity Reduction Evaluation (TRE) be completed, which is necessary to determine what is causing toxicity and what actions are needed to remove it and achieve compliance with the new limit. (See Chapter 2.2 for a more complete discussion of TREs.) A TRE compliance schedule should be given in most cases where representative WET data suggests that severe or repeated toxicity is present in the effluent.

A TRE compliance schedule may not be appropriate, however, in cases where limited WET data is available or where toxicity has not occurred for some time. Chapter 1.3 (Table 1) recommends when a TRE compliance schedule may need to accompany a new WET limit, based on the number of representative WET data available and the number of WET failures that have occurred. In cases where data is limited or toxicity has appeared infrequently, more frequent monitoring is recommended instead of a TRE, in order to determine whether toxicity reappears over time. Standard language in WPDES permits (see Chapter 1.14) requires that a TRE be completed if WET failures occur during the permit term.

In cases where a TRE compliance schedule is required, regular permit-required WET monitoring is usually postponed until after the compliance schedule is completed and the limit has become effective. TREs typically include toxicity screening using the most sensitive species (based on historical data), so regular permit-required, compliance-type WET tests are not necessary in addition to that screening during the compliance schedule period. Only the monitoring which accompanies the limit type should be postponed. (For example, if a chronic WET limit is given, chronic monitoring starts at the end of the compliance schedule, but acute WET monitoring begins at reissuance.) Monitoring should be required after the compliance schedule is completed and for the remainder of the permit term in order to demonstrate compliance with the WET limit.

The following is an example of typical TRE compliance schedule language and suggested dates for completion of each step. A schedule such as this is usually given when a permittee needs time to complete a full toxicity reduction evaluation. This includes time to investigate the source(s) of toxicity and to choose the best method for removing toxicity after the source has been identified. This schedule allows about 3 years from permit issuance to complete a TRE and meet the limit. Required steps or dates due should be adjusted if the permittee has already completed some of the work described.

Standard Compliance Schedule Dates

Required Action	Date Due
Submit **part one** of a Toxicity Reduction Evaluation (TRE) plan describing procedures to be used to identify the source(s) responsible for the effluent toxicity.	(1-3 months from permit issuance)
Implement part one of the TRE plan, make a reasonable attempt to identify the source(s) of the toxicity, and submit a report to the Department presenting the results of the evaluation.	(1 -1.5 yrs from permit issuance)
Submit **part two** of the TRE Plan describing actions to be taken to reduce or eliminate the toxicity identified in part one of the TRE and the dates by which those actions will be implemented.	(~1 month from the end of step 2)
Submit a progress report identifying the actions taken to date to implement part two of the TRE plan.	(about 1/2 way through part 2)
Complete all actions identified in the TRE plan and achieve compliance with the effluent toxicity limitation.	(1 -1.5 yrs from the end of step 2)

This version of the compliance schedule is available in the "picklist" when drafting a permit in the System for Wastewater Applications, Monitoring, and Permits (SWAMP). When including a TRE compliance schedule for a WET limit in a permit, staff should give specific dates for each step in the schedule rather than using a narrative such as, "6 months beyond permit issuance." Guidance in Chapter 2.2 includes guidance for permittees and labs regarding how to complete each step of the standard TRE compliance schedule.

Reasons for Deviating From the Standard Compliance Schedule

As suggested above, TRE compliance schedules usually allow about 3 years to find and fix toxicity problems. Most successful TREs include removal, reduction, substitution, or pretreatment of the source(s) and can usually be completed during a 3 year schedule. According to s. NR 106.117, Wis. Adm. Code, a WPDES permit limit compliance schedule cannot exceed 5 years in length, except when performing a study to alter a secondary value, therefore a WET limit compliance schedule cannot extend beyond 5 years.

Although most TREs can be completed in 3 years, it may be necessary to deviate from the standard schedule in some circumstances. Construction of a whole new treatment system or another major action are possible justifications for lengthening the time allowed by the compliance schedule. Conversely, a permittee may not need the full 3 years if they have already completed some parts of the TRE prior to permit reissuance (e.g., they've identified the source and only need time to remove it). Other circumstances may exist which call for a longer or shorter schedule, but it is important to insure that there is enough time (ideally, at least 1 year) between the end of the TRE and the end of the permit, to allow time for WET monitoring. It is necessary to conduct WET monitoring after the compliance schedule is complete in order to demonstrate compliance with the WET limit before the permit is reissued.

The following are some examples of reasons why staff may want to modify the standard TRE compliance schedule that appears in SWAMP. There may be other reasons which are not discussed here. Reasons for changing standard compliance schedule language should be explained in fact sheets, so that others can tell why decisions were made, and shared with the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663).

Major Modification or Construction of a New WWTP. Construction of a whole new treatment system or some other major action are possible justifications for lengthening the time allowed by the compliance schedule. In some cases, especially when staff have good reason to believe that past toxicity will be resolved by new treatment processes, it may be acceptable to leave out the compliance schedule altogether (e.g., a WET limit compliance schedule may be unnecessary in

addition to a compliance schedule for new facility construction). If a compliance schedule is not given for these reasons, the WET limit should be made effective and monitoring should start as soon as the upgrade is complete. When determining the correct amount of WET monitoring to assign after the completed upgrade, the WET Checklist (described in Chapter 1.3) should be completed based on WET data and toxicity potential as it exists at the time of permit issuance, since it is necessary for the permittee to demonstrate that the upgrade has reduced that potential.

Staff should remember that toxicity can be caused by many factors and an upgrade that removes more solids or BOD_5 may not necessarily improve the treatment or removal of substances causing effluent toxicity. If it is unclear whether an upgrade will resolve toxicity problems, it may be wise to require TRE studies prior to the upgrade to more clearly understand the cause. It is usually easier to judge whether treatment upgrades will better treat effluent toxicity when the cause of toxicity is known. If staff suspect that the upgrade will resolve past toxicity problems, but do not know this for sure, another option may be a WET limit and/or TRE "trigger" (see discussion below).

Chloride Source Reduction and WET Compliance Schedules. Special allowances may be given in situations where chloride is shown to be the sole cause of whole effluent toxicity. In some situations, it may be necessary to allow time to make this demonstration. More discussion and example schedules for these situations are given in Chapter 2.10.

Intermittent Discharges. The standard 3 year compliance schedule may not be appropriate if a discharge is intermittent or seasonal. In these cases, time allowed for each step may need to be adjusted to account for shorter discharge periods. Since these discharges occur for fewer days in a given year, more time may be needed between compliance schedule steps, in order to allow the permittee time to conduct toxicity investigations. For example, if an intermittent discharge only occurs for < 6 months of the year, it may be necessary to allow up to 2 calendar years for the completion of the first step, so that the permittee has enough time to collect samples, perform toxicity identification work, and confirm any findings.

Triggers. TREs are more difficult to perform when toxicity is less severe or occurs infrequently. Reasonable potential determinations may require that a WET limit be given when only one or a few WET failures have occurred, even if toxicity has not occurred for some time or if toxicity has not always been present in the effluent. In other cases, staff and/or the permittee may suspect that past failures which are driving WET limit recommendations are no longer representative of the current discharge, but there may not be enough conclusive data to leave those failures out of the reasonable potential calculation. Where any of these is the case, staff have a couple of options to consider. One is to extend the WET limit compliance schedule beyond the standard 3 years, in order to allow more time to determine whether toxicity is present in the effluent. Another option is to place a "trigger" in the permit. See Chapter 1.3 for additional discussion of when triggers may be used in permits.

A WET limit trigger may be most appropriate for situations where available toxicity data is dated, questionable, or limited, and staff feel that it is necessary to gather more WET data prior to the imposition of a WET limit or TRE compliance schedule. If a trigger is to be used in the permit, quarterly WET monitoring should be required, at a minimum, for the first twelve months of the permit and WET footnote and TRE compliance schedule language should be modified as shown below.

> **Trigger Language** (to be placed into the WET footnote directly below the "WET Testing Frequency" section):
>
> **WET Limit Applicability:** If any *(acute/chronic)* WET test completed during the first twelve months of this permit shows positive results, the remaining tests will be waived and the Whole Effluent Toxicity Compliance Schedule *(see p. X)* will be initiated. After the compliance schedule is completed, the *(acute/chronic)* WET limit will become effective and quarterly *(acute/chronic)* monitoring will be required for the remainder of the permit term. If no *(acute/chronic)* tests conducted in the first twelve months of this permit show positive results, the

compliance schedule will be waived, the limit will not become effective, and the *(acute/chronic)* monitoring shown above will be required.

WET compliance schedule language (with changes from the standard compliance schedule **highlighted**)

Required Action	Date Due
Submit part one of a Toxicity Reduction Evaluation (TRE) plan describing procedures to be used to identify the source(s) responsible for the effluent toxicity.	**90 days after 1st positive test noted in the 1st year**
Implement part one of the TRE plan, make a reasonable attempt to identify the source(s) of the toxicity, and submit a report to the Department presenting the results of the evaluation.	**(2 yrs from permit issuance)**
Submit part two of the TRE Plan describing actions to be taken to reduce or eliminate the toxicity identified in part one of the TRE and the dates by which those actions will be implemented.	(~1 month from the end of step 2)
Submit a progress report identifying the actions taken to date to implement part two of the TRE plan.	(about 1/2 way through part 2)
Complete all actions identified in the TRE plan and achieve compliance with the effluent toxicity limitation.	(1 -1.5 yrs from the end of step 2)

The permit will also need to include WET monitoring that will be required if the WET limit is not triggered. In most cases, monitoring frequencies can be reduced if no failures occur during the first twelve months (i.e., if the limit is not triggered). Staff may choose to use adjusted point totals from previous Checklist recommendations – removing any points for failed tests – to help determine an appropriate level of monitoring to require.

Reduction in Monitoring After the Successful Completion of a TRE

Permit language may be written to allow a reduction in monitoring, in certain circumstances, after a TRE has been successfully completed. For example, if frequent monitoring (bimonthly or quarterly) is to be included in the permit, permit language may be added which allows monitoring to be reduced after the permittee has submitted at least 12 months of WET data (if no toxicity occurs). It is important to note that when WET limits are given, the minimum monitoring frequency allowed by federal regulations at 40 CFR 122.44(i)(2), is 1x annually. The reduced monitoring frequency should be determined at the time of reissuance and placed in the permit. This reduced frequency may be determined by completing the WET Checklist under the assumption that toxicity is no longer present. WET limits cannot drop out and must remain effective until the next reissuance.

CHAPTER 1.14 – Standard WET Permit Language

The purpose of this chapter is to provide staff with guidance regarding how WET requirements should be specified in WPDES permits.

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This chapter is intended to help staff use the proper language in WPDES permits to implement state and federal WET regulations, the requirements of the "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*", and the guidance provided in other chapters of this document. Shown below is standard template language that appears in SWAMP. The callout boxes shown below provide some advice to permit drafters about how to modify this standard language, if necessary, for individual discharge situations. Permit drafters may need to make other modifications to WET permit language to fit site-specific situations. They should contact the Biomonitoring Coordinator (Kari.Fleming@wisconsin.gov; 608-267-7663) with questions related to the use of other alternate language. See Chapter 1.12 for advice about WET compliance schedule language.

WET Footnote

(appears beneath the effluent limits table for each outfall where WET testing is required)

1.1.1 Whole Effluent Toxicity (WET) Testing

Primary Control Water:

> Lab water is allowed in acute tests where a ZID is not allowed (compliance is determined in 100% effluent). Receiving water is required in chronic and acute with a ZID.
> See Chapter 1.2 (http://dnr.wi.gov/topic/wastewater/WETguidance.html) for more information.

Acute Mixing Zone Concentration (AMZ):

> Add this line if a zone of initial dilution (ZID) is approved for the discharge.

Instream Waste Concentration (IWC):

> This line is applicable only if chronic WET is required. Remove this line if there is no chronic monitoring.

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25%, and any additional selected by the permittee.

> Pick the applicable dilution series, based on the permittee's IWC. Delete the series that is not applicable.

- **Chronic:** *100, 30, 10, 3, 1% (if the IWC ≤30%)* ***or*** *100, 75, 50, 25, 12.5% (if the IWC >30%)* and any additional selected by the permittee.

WET Testing Frequency:

Pick one.

- **Acute** tests shall be conducted *(once every other year, once each year, twice each year, quarterly, or bimonthly)* in rotating quarters, in order to collect seasonal information about the discharge. For example, tests are required during the following quarters:

  Enter each applicable calendar quarter

  Specify the quarter.

  Acute WET testing shall continue after the permit expiration date (until the permit is reissued) in accordance with the WET requirements specified for the fourth calendar year of this permit. For example, the next test would be required in *(list appropriate quarter)*.

Pick one.

- **Chronic** tests shall be conducted *(once every other year, once each year, twice each year, quarterly, or bimonthly)* in rotating quarters, in order to collect seasonal information about the discharge. For example, tests are required during the following quarters:

  Enter each applicable calendar quarter

  Specify the quarter.

  Chronic WET testing shall continue after the permit expiration date (until the permit is reissued) in accordance with the WET requirements specified for the fourth calendar year of this permit. For example, the next test would be required in *(list appropriate quarter)*.

Testing: WET testing shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests.

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The Discharge Monitoring Report (DMR) form shall be submitted electronically by the required deadline.

Remove acute sentence if no acute is required.
Remove chronic sentence if no chronic is required.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than [X] for either species. The TU_a shall be calculated as follows: $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Toxic Unit - Chronic (TU_c) is greater than [Y] for either species. The TU_c shall be calculated as follows: $TU_c = 100 \div IC_{25}$.

Enter the correct values for X and Y:
X = 1.0, if a ZID is not allowed
X = (100 ÷ AMZ), if a ZID is allowed
Y = (100 ÷ IWC)
See Ch. 1.3 (http://dnr.wi.gov/topic/wastewater/WETguidance.html) for more information.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator, on "Whole Effluent Toxicity Test Report Forms". The 90 day reporting period shall begin the day after the test which showed a positive result. The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

WET Standard Requirements (appears near the end of the permit, in the "Standard Requirements" section)

Placed in all permits with WET monitoring:

2.2.2 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797*, November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

Change the species in this paragraph, if species other than C. dubia & fathead minnow are to be used in testing (rarely occurs).

Placed in all permits with WET monitoring:

2.2.3 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days after the completion of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;
- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including some or all of the following actions:
  (a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)
  (b) Identify the compound(s) causing toxicity
  (c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
  (d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)
- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;
- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

Placed in permits with WET monitoring & a chloride variance:

2.2.4 Whole Effluent Toxicity and Chloride Source Reduction Measures

Section NR 106.89, Wis. Adm. Code, states that chloride limitations can be used in the permit in lieu of whole effluent toxicity testing requirements and limitations until chloride source reduction actions are completed, under the following conditions.

When an acute chloride limitation is included in the permit, acute whole effluent toxicity testing and limitations may be discontinued until chloride source reduction actions are completed, according to s. NR 106.89, Wis. Adm. Code, if either:

- The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride exceeds 2,500 mg/l, or

- The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride is less than 2,500 mg/l, but in excess of the calculated acute water quality-based effluent limitation, and additional data are submitted which demonstrate that chloride is the sole source of acute toxicity.

When a chronic chloride limitation is included in the permit, chronic whole effluent toxicity testing and limitations may be discontinued until chloride source reduction actions are completed, according to s. NR 106.89, Wis. Adm. Code, if either:

- The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride exceeds 2 times the calculated chronic water quality-based effluent limitation, or

- The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride is less than 2 times the calculated chronic water quality-based effluent limitation, but in excess of the calculated chronic water quality-based effluent limitation, and additional data are submitted which demonstrate that chloride is the sole source of chronic toxicity.

Following the completion of chloride source reduction activities, the department shall evaluate the need for whole effluent toxicity monitoring and limitation.

Placed in permits with WET monitoring & a condensate of whey (COW) discharge:

2.2.5 COW/NCCW or COW Discharges - WET Testing Requirements

If discharges consisting of condensate of whey (COW) wastewater only or non-contact cooling water mixed with COW waters (NCCW/COW) pass the first two acute toxicity tests and the first two chronic toxicity tests (if chronic toxicity testing is required) then the permittee is not required to perform additional toxicity testing during this permit term. If positive toxicity is experienced in any of the first two acute or chronic toxicity tests, the permittee may attempt to demonstrate that toxicity is due to ion deficiency. If it can be demonstrated that ion deficiency is the sole cause of toxicity in at least two consecutive positive tests, and the Department agrees in writing, the permittee will not be required to perform additional toxicity testing during this permit term. If it cannot be demonstrated that ion deficiency is the sole cause of toxicity in these tests, the permittee must complete the remaining toxicity tests

Placed in permits with WET monitoring, when ammonia limits based on ELS-absent criteria:

2.2.6 Whole Effluent Toxicity and ELS-absent Criteria for Ammonia

Effluent samples used in chronic fathead minnow tests may be modified to remove ammonia prior to testing, according to s. NR 106.36(2), Wis. Adm. Code, during periods when ammonia limits based on early life stage-absent criteria are in effect.

CHAPTER 2.4 – Toxic Units, $LC_{50,}$ and IC_{25} Values

This chapter defines and discusses Lethal Concentration, Inhibition Concentration, and Toxic Unit toxicity test endpoints.

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Lethal Concentration (LC) Value

Acute whole effluent toxicity (WET) is measured using a multi-concentration test consisting of a control and five effluent concentrations. These tests are designed to provide dose-response information, expressed as the percent effluent concentration that is lethal to 50% of the test organisms (LC_{50}) within the prescribed period of time (48 or 96-hr). The lower the LC_{50} value, the more toxic the effluent. For example, an LC_{50} >100% means that full strength effluent did not kill half of the organisms. An LC_{50} = 50% means that half strength effluent killed 50% of the organisms.

Calculation. The LC_{50} is calculated differently depending on the characteristics of test data. The appropriate statistical tests used to calculate the LC_{50} are described in the "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*" (see http://dnr.wi.gov/topic/wastewater/documents/WETMethodsManualEdition2.pdf, Section 5). They are the graphical, probit, Spearman-Karber, and trimmed Spearman-Karber methods. An in-depth discussion on the appropriate use of each statistical package is given in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (http://water.epa.gov/scitech/methods/cwa/wet/).

Inhibition Concentration (IC) Value

The inhibition concentration (IC) is the statistical analysis used in chronic WET tests to estimate the sublethal effects of an effluent sample. An "IC_{25}" is an estimate of the concentration of effluent that causes a 25% reduction in a nonlethal endpoint, such as reproduction or growth, in a given time period (usually 7 days). An IC_{50} is an estimate of the effluent concentration that would cause a 50% reduction. The IC is compared to the instream waste concentration (IWC) for the effluent to determine whether there is potential for the effluent to cause sublethal effects to aquatic populations, once it has mixed with the receiving water. If the IC value is lower than the IWC, the effluent has the potential to cause chronic impacts in the receiving water. Methods used to calculate the IWC are described in Chapter 1.3 (http://dnr.wi.gov/topic/wastewater/WETguidance.html).

Calculation. The IC is calculated using a computer program developed by the USEPA, called the *IC_p* program. This program will generate a linear interpolation (e.g., IC_{25}), a bootstrap mean, and 95% confidence limits, when appropriate.

Confidence Intervals

The Methods Manual requires that test endpoints be reported as an LC_{50} for acute tests and an IC_{25} (for Ceriodaphnia dubia and fathead minnow) or IC_{50} (for green algae) for chronic tests. The 95% confidence intervals associated with these endpoints should also be reported, as an estimate of the precision (uncertainty) around the LC or IC value. As the 95%

confidence intervals of the point estimate increase, the uncertainty in that estimate of the statistical endpoint increases. The smaller the width of the confidence intervals, the more certain one can be that the endpoint determined by the statistical program is accurate. The certainty in point estimates is also a function of the dilutions tested and their proximity to the actual statistical endpoint being calculated. Confidence intervals and data interpretation are discussed in Chapter 1.5.

Toxic Units (TU)

LC and IC values may be somewhat counterintuitive, since the lower the value, the greater the toxicity. Because this feature of standard toxicity endpoints sometimes tends to confuse non-toxicologists, an alternative way of expressing toxicity data was developed, called a Toxic Unit.

An acute Toxic Unit (TU_a) = $100/LC_{50}$, which is the reciprocal of the effluent concentration that causes 50 percent of the organisms to die by the end of the acute exposure period. The chronic Toxic Unit (TU_c) = $100/IC_{25}$ or $100/IC_{50}$, which is the reciprocal of the effluent concentration that causes significant inhibition to the test organisms by the end of the chronic exposure period. This has the advantage that as toxicity increases, so does the TU value. WET limits are expressed in permits using Toxic Units (TU_a or TU_c).

WPDES Permit Language - Determination of Positive Results

An acute WET test will be considered a failure (or a "positive" result) if the acute Toxic Unit (TU_a) is greater than **X** for any tested species.

In most cases, acute WET requirements are applied at "end of pipe" (no mixing is allowed) and **X** will equal 1.0 TU_a.

- **Acute WET Limit = 1.0 Toxic Unit (TU_a)**

In cases where mixing zone studies or other information has been submitted and a zone of initial dilution (ZID) has been approved for the outfall, **X** would be set at the edge of the approved acute mixing zone, as described below.

- **Acute WET Limit = 100/AMZ Toxic Units (TU_a)**
  AMZ = acute mixing zone concentration (see s. NR 106.09(2)(e), Wis. Adm. Code)

Acute WET limits are expressed in the permit as a daily maximum, as specified in s. NR 106.09(2)(f), Wis. Adm. Code.

Chronic WET requirements are set at the edge of a site-specific chronic mixing zone, using the applicable instream waste concentration (IWC), as shown below. A chronic WET test will be considered a failure (or a "positive" result) if the chronic Toxic Unit (TU_c) is greater than 100/IWC for any tested species. The IWC will be specified in the permit.

- **Chronic WET Limit = 100/IWC Toxic Units (TU_c)**
  IWC = instream waste concentration

Chronic WET limits are expressed in the permit as a monthly average, as specified in s. NR 106.09(3)(d), Wis. Adm. Code.

CHAPTER 2.5 - Relationship Between WET and Chemical-Specific Limits

The purpose of this chapter is to describe the differences between WET and chemical-specific applications and to discuss why these may be used separately or in lieu of one another.

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The WDNR uses an integrated approach for controlling toxic pollutants that includes whole effluent toxicity (WET) testing and chemical-specific analyses to protect aquatic life. The use of WET testing in addition to chemical-specific testing is necessary due to several factors, including: 1) the limitations of chemical analysis methods, 2) inadequate toxicity data for some chemicals, and 3) the inability to predict the toxicity of chemicals when combined. Water quality criteria for individual pollutants provide protection against these compounds individually, but do not account for the effects they may have when combined in an effluent.

WET Failures From Compounds Without WQC

The WDNR has been using WET since 1988, in addition to chemical-specific testing, to measure, predict, and control the discharge of materials that may be harmful to aquatic life. Since then, there have been occasions where a positive WET test result was attributed to a compound that did not have promulgated water quality criteria (WQC). According to ch. NR 106, Wis. Adm. Code, permittees are responsible for effluent toxicity, whatever the cause.

The WET program has several major advantages over its counterpart chemical-specific approach with regards to water quality protection. Among the most important of those advantages is the ability of the WET test to evaluate the impact of all chemical constituents of an effluent. The entire chemical matrix has an effect on whether or not the organisms exposed to the effluent react in an adverse fashion. Using WET test procedures, factors such as additivity (1+1=2), synergism (1+1=3), and antagonism (2+2=3) can be addressed without the need for expensive chemical analysis for a myriad of known and unknown chemical compounds.

Establishment of water quality criteria for chemical compounds requires controlled laboratory conditions, including the use of "clean" water to eliminate the risk of introducing bias. Because of that limitation, WET tests offer another major advantage in that they can evaluate the potential for impact to a fish and aquatic life community by exposing the test organisms to a mix of effluent and natural receiving water. These mixtures often contain ligands with binding sites for many compounds that help render them unavailable to sensitive aquatic life, thus changing the measured toxicity. Further, compounds with toxicity related to water quality may be released or sequestered by naturally occurring conditions of the effluent/receiving water mix, as appropriate.

Chemical-specific Limits in Lieu of WET Limits

There may be some instances where a chemical-specific limit can be established in lieu of a WET limit. For instance, if the permittee can, through the use of toxicity reduction evaluation (TRE) procedures, identify and confirm the

chemical(s) responsible for an effluent's toxicity, then a limit for the identified toxicant may be appropriate in lieu of a WET limit. The chemical in question would have to have an established WQC or secondary value, according to ch. NR 106, Wis. Adm. Code.

An example of this may be the Department's policy for addressing chloride toxicity in wastewaters. The ultimate goal of the policy is for dischargers to comply with water quality-based effluent limits (WQBEL) for chloride, however, in recognition of the impracticality of end-of-pipe treatment options for chloride, the rules allow permittees to implement a source reduction plan that works towards the WQBEL. When a permittee gets a source reduction based permit, s. NR 106.89, Wis. Adm. Code, allows permittees to demonstrate chloride is the source of WET. If chloride is the sole cause of WET, the Department must include chloride limits in the WPDES permit in lieu of WET testing requirements until source reduction actions are completed. (See Chapter 2.10 for more details.)

CHAPTER 2.10 - Chlorides and WET Testing

This chapter supports s. NR 106.89, Wis. Adm. Code, providing guidance for making demonstrations that chloride is causing effluent toxicity.

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Why Is Chloride Treated Differently Than Other Toxic Compounds?

In most cases, the Department doesn't make a distinction about what causes whole effluent toxicity (WET) when determining permit requirements, because it is the permittee's responsibility to achieve and maintain WET compliance, regardless of the cause. The permittee is expected to identify the source of toxicity and fix it by whatever means necessary (e.g., source reduction, pretreatment, in-plant modifications). Chloride is unique, however, since it behaves conservatively and since wastewater treatment processes designed to remove it (e.g., reverse osmosis, ion exchange) have high capital equipment costs, operating & maintenance costs, high energy requirements, and produce large volumes of solid waste which make them undesirable environmental alternatives. So source reduction activities are more often the preferred approach for eliminating chloride from point source discharges to surface water.

WET-related Requirements in Wisconsin's Chloride Rule

Wisconsin chloride regulations are given in s. NR 106.80, Wis. Adm. Code, which spells out requirements for point sources that discharge wastewater containing chloride to surface waters of the state. The ultimate goal of that policy is for dischargers to comply with water quality-based effluent limits (WQBEL) for chloride. However, in recognition of the impracticality of end-of-pipe treatment for chloride, the rules allow permittees to request a source reduction based permit with a schedule to work towards the WQBEL, rather than a traditional permit which immediately imposes the WQBEL. When a source reduction based requirement is established in the WPDES permit, s. NR 106.89, Wis. Adm. Code, allows permittees to demonstrate that chloride is also responsible for WET failures. According to s. NR 106.89, Wis. Adm. Code, if chloride can be shown to be the sole cause of WET problems, chloride limits can be used in lieu of WET requirements until chloride source reduction measures are complete:

> **NR 106.89 Alternative whole effluent toxicity monitoring and limitations for dischargers of chloride.**
>
> (1) GENERAL. In addition to interim, target and calculated water quality-based effluent limitations and target values for chloride, the department may establish whole effluent toxicity testing requirements and limitations pursuant to ss. NR 106.08 and 106.09.
>
> (2) FINDINGS. The department finds all of the following:
>
> (a) Acute whole effluent toxicity limitations cannot be attained if the effluent concentration of chloride exceeds 2,500 mg/L;
>
> (b) Chronic whole effluent toxicity limitations cannot be attained if the effluent concentration of chloride exceeds 2 times the calculated chronic water quality-based effluent limitation;
>
> (c) Chloride limitations will be used in lieu of WET limitations to attain and maintain narrative criteria in ss. NR 102.04(1)(d) and NR 102.04(4)(d) in the cases where chloride is the sole source of acute or chronic whole effluent toxicity.

(3) CHLORIDE LIMITS IN LIEU OF ACUTE WET LIMITS. Chloride limitations shall be included in the WPDES permit in lieu of acute whole effluent toxicity testing requirements and acute whole effluent toxicity limitations until source reduction actions are completed if any of the following apply:

(a) The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride exceeds 2,500 mg/L, or

(b) The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride is less than 2,500 mg/L, but in excess of the calculated acute water quality-based effluent limitation, and additional data are submitted which demonstrate that chloride is the sole source of acute toxicity.

(4) CHLORIDE LIMITS IN LIEU OF CHRONIC WET LIMITS. Chloride limitations shall be included in the WPDES permit in lieu of chronic whole effluent toxicity testing requirements and chronic whole effluent toxicity limitations until source reduction actions are completed if either:

(a) The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride exceeds 2 times the calculated chronic water quality-based effluent limitation, or

(b) The permittee can demonstrate to the satisfaction of the department that the effluent concentration of chloride is less than 2 times the calculated chronic water quality-based effluent limitation, but in excess of the calculated chronic water quality-based effluent limitation, and additional data are submitted which demonstrate that chloride is the sole source of chronic toxicity.

(5) DECISION DOCUMENTATION. The department shall specify the decision to include chloride limitations in lieu of whole effluent toxicity limitations in the permit fact sheet.

(6) RE-EVALUATION. The department shall re-evaluate the need for whole effluent toxicity and chloride monitoring or limitations upon permit reissuance.

WET monitoring and limits may be excluded from permits if chloride limits are applied according to the procedures in s. NR 106.89, Wis. Adm. Code (when chloride is the sole source of toxicity). Standard permit language is provided in SWAMP and discussed in Chapter 1.14. Reasons for excluding WET requirements should be spelled out in the permit fact sheet. Once chloride source reduction is complete (i.e., WQBELs are being met), the need for WET monitoring and limits should be reevaluated. Monitoring may be necessary to show that all toxicity has been removed with the reduction of chloride.

Allowing for Additional Data to be Collected

In some cases, there may be some question as to whether chloride is the sole source of toxicity when a permit is being reissued. If this happens, a compliance schedule may be given to allow time to make this demonstration. The WET limit and appropriate monitoring (based on the assumption that chloride is not the cause) should be placed in the permit, in the event that the permittee cannot successfully demonstrate that chloride is the sole source of toxicity. Below are some example schedules that may be used in these situations.

If monitoring only recommended:

Whole Effluent Toxicity Compliance Schedule

Required Action	Date Due
Submit a study plan describing procedures to be used to demonstrate chloride is the sole source of effluent toxicity.	1-3 months (from permit issuance)
Implement the study plan, make a reasonable attempt to identify the source of toxicity, and submit a report to the Department presenting the results of the evaluation. If the Department determines that chloride is the sole source of toxicity, the **(acute/chronic)** WET monitoring required in section **(X)** will not be required. If this demonstration is not successful, the permittee must complete the **(acute/chronic)** WET monitoring required in section **(X)**.	1 -1.5 yrs (from permit issuance)

If monitoring and WET limit recommended:

Whole Effluent Toxicity Limit Compliance Schedule

Required Action	Date Due
Submit a study plan describing procedures to be used to determine the cause of effluent toxicity.	1-3 months (from permit issuance)
Implement the study plan, make a reasonable attempt to identify the source of toxicity, and submit a report to the Department presenting the results of the evaluation. If the Department determines that chloride is the sole source of toxicity, the remainder of this schedule, **(acute/chronic)** WET monitoring in section **(X)**, and the **(acute/chronic)** WET limit will not become effective. If this demonstration is not successful, the permittee must complete the remaining portions of this schedule and meet the WET limit in section **(X)**.	1 -1.5 yrs (from permit issuance)
Submit **part two** of the TRE Plan describing actions to be taken to reduce or eliminate the toxicity identified in part one of the TRE and the dates by which those actions will be implemented.	@ 1 month (from the end of step 2)
Submit a progress report identifying the actions taken to date to implement part two of the TRE plan.	about 1/2 way through part 2
Complete all actions identified in the TRE plan and achieve compliance with the effluent toxicity limitation.	1 -1.5 yrs (from the end of step 2)

What Additional Data Is Needed To Show That Chloride Is Causing Toxicity?

Section NR 106.89, Wis. Adm. Code, says the Department can place chloride limitations in the WPDES permit in lieu of WET monitoring and limits if either chloride is present at a preset level (2,500 mg/l for acute or 2x the WQBEL for chronic) or if effluent concentrations are above the WQBEL and additional data are submitted which demonstrate that chloride is the sole source of toxicity. So what is meant by "additional data"?

Normally, when an effluent has shown repeated toxicity, a permittee is required to perform a Toxicity Reduction Evaluation (TRE) to identify and fix the source(s) of toxicity. In toxicity identification steps, effluent samples may be manipulated to remove suspect chemicals (e.g., metals, organics) and then re-tested to see if toxicity remains. If a specific effluent manipulation removes toxicity, then the researcher has a clue about the source of toxicity. However, chloride is a unique substance that is not easily altered by chemical reactions, therefore traditional investigation methods do not work well for identifying chloride as the cause of toxicity. However, other information can be used to help determine if chloride is responsible for toxicity.

Most Sensitive Species. As shown in Table 1 (below), there is a significant difference in the sensitivities of WET test organisms to chloride, and that difference can provide useful information when determining whether chloride is the sole cause of toxicity. *Ceriodaphnia dubia* is the most sensitive to chloride (as NaCl), with an average acute critical concentration (LC_{50}) of about 2,500 mg/l and an average chronic critical concentration (IC_{25}) of about 720 mg/l. The algae species is less sensitive with an average IC_{50} of about 2,200 mg/l. The fathead minnow is the least sensitive of these 3 species, with an average LC_{50} more than twice as high as that for *C. dubia* and an IC_{25} more than four times as high. This relative sensitivity pattern is useful as a first step towards determining whether chloride is a significant source of toxicity. If the LC_{50} for the fathead minnow is lower than that for *C. dubia*, it is safe to rule out chloride as the primary toxicant. If the situation is reversed and chloride levels are near levels of concern, further data may be needed to verify whether chloride is the primary toxicant in the effluent.

TABLE 1. CHLORIDE TOXICITY VALUES (mg/l)		
	Acute	**Chronic**
Water Quality Criteria (according to ch. NR 105, Table 1 & Table 5)	757	395
Water Quality Based Effluent Limits (WQBEL) (according to ss. NR 106.06(3) and (4)).	1514	$\frac{(395)(Q_s+(1-f)Q_e) - (Q_s-fQ_e)(C_s)}{Q_e}$
Reference toxicant information (NaCl) (average of data from 5 labs, except algae data which represents SLH data only); (Acute = LC_{50}; chronic = IC_{25})	2500 (*C. dubia*)[1] 5830 (fhm)	720 (*C. dubia*)[2] 2220 (algae) 3080 (fhm)

1 *Range of last 20 LC_{50} values from reference toxicant tests using sodium chloride (NaCl) from all certified labs in 2014 was 1,710 – 3,540 mg/l.*
2 *Range of last 20 IC_{25} values from reference toxicant tests using NaCl from all certified labs in 2014 was 210 – 1,730 mg/l.*
· Q_s= receiving water flow (usu. $Q_{7,10}/4$); Q_e= effluent design flow (municipal) or average annual effluent flow (industrial); f = fraction of the effluent withdrawn from the receiving water; C_s= background concentration of the substance.
· fhm = fathead minnow (*Pimephales promelas*)

Effluent Chloride Concentration. Additional insight can be obtained by determining the chloride concentration in the effluent. As a general rule, if chloride levels are near or above the reference toxicant values shown in Table 1, the concentration may be high enough to adversely affect WET test species. If effluent levels are significantly lower than these values, chloride may not be the primary source of toxicity.

Phase I TIEs. Additional information can be obtained by conducting a toxicity identification evaluation (TIE). If Phase I TIE manipulations on effluent with high chloride levels indicate that toxicity cannot be eliminated or significantly reduced by any of the treatment steps, the chloride concentration in the effluent may be responsible for toxicity and should be further evaluated. Since the toxicity of chloride may be masked or affected by associated ions (see below), it may be necessary to include a determination of specific ion concentrations in the effluent before and after each step of the Phase I TIE protocol. (See Chapter 2.2 for more discussion of Phase I TIEs.)

One can also assess the cause(s) of toxicity by evaluating the concentration of major ions that compose the effluent's total dissolved solids (TDS). Measured concentrations of ions can be compared to literature or to laboratory-derived effect concentrations to determine if ion concentrations are above effect concentrations. Chemical fractionation schemes can provide additional information on whether inorganic toxic constituents are contributing to toxicity. Chromatographic columns containing cation and anion exchange resins have also been successfully used by researchers to help determine if inorganic salts are playing a role in toxicity.

Ionic Composition vs. Toxicity. TDS, conductivity, and salinity are often used as measures for ions in effluents. However, the correlation between increasing TDS or conductivity and toxicity may vary with ionic composition and therefore may not be the best predictor of toxicity due to chloride. Because chloride is not usually present as individual constituents but rather in combination with other ions, the toxicity of chloride may be masked or affected by associated ions. Therefore, it may be necessary to understand the effects of the various ions alone and to consider those caused by the combination of ions in the effluent.

For example, in one study, the effects of more than 2,900 ion solutions on *C. dubia*, *D. magna*, and the fathead minnow (*P. promelas*) were studied (Mount, et al, 1997). The relative ion toxicity was found to be $K^+ > HCO_3 > Mg^{2+} > Cl > SO_4^{2}$. For all of the salts tested, *C. dubia* was found to be the most sensitive species, when compared to *D. magna* and *P. promelas.* For certain salts, such as $CaSO_4$, toxicity to the three species was found to be similar, whereas for others (i.e., NaCl), the difference was great. In addition, the toxicity of Na^+ and Ca^{2+} salts was primarily attributable to the corresponding anion. For *C. dubia* and *D. magna,* the toxicity of chloride was sometimes reduced in solutions that were enriched with more than one cation.

Synthetic Effluents. Synthetic or "mock" effluents, which mimic the major ions in the effluent under evaluation, have also proven useful for the assessment of TDS toxicity. In this procedure, aliquots of the effluent are mixed with various amounts of synthetic effluent (based on chemical evaluation of the effluent for the major ions) in an effort to determine if the concentration of the measured anions and cations cause toxicity to the test organism. The hypothesis of this procedure is that if the effluent is diluted with various amounts of synthetic effluent that contain only the salts found in the effluent, then any unknown toxicants potentially in the effluent will also be diluted, resulting in a lessened acute or chronic toxicity response of the test organism. However, if TDS is the toxicant of concern in the wastewater, the corresponding acute or chronic toxicity responses would be similar.

In Summary, Chloride Toxicity May Be Indicated If:

- There is greater sensitivity by *Ceriodaphnia dubia* compared to *Daphnia magna*, *Selenastrum capricornutum* (algae), and the fathead minnow, together with high conductivity and/or chloride measurements.

- Phase I TIE manipulations show that: 1) pH adjustments don't remove toxicity and a precipitate is not visible in the pH adjustment test, pH adjustment and filtration test, or pH adjustment and aeration test; 2) there is no loss of toxicity in the post C18 SPE column tests, or a partial loss of toxicity, but no or little change in conductivity; 3) there is no change in toxicity with the EDTA addition test, sodium thiosulfate addition test, or the graduated pH test; 4) toxicity is not removed or reduced by passing the effluent over activated carbon; and 5) toxicity is removed or reduced by ion exchange resin.

- A mock effluent prepared with the same ions as the effluent exhibits similar toxicity as the effluent.

The above approaches can be used individually or together in a weight-of-evidence approach to demonstrate the part that chloride plays in effluent toxicity. Because of the differences between production and treatment processes and wastewater effluents, flexibility in the design of these studies is essential and approaches used are often facility specific. The guidance provided here is intended to describe general approaches which may be used to identify chloride as the primary cause of toxicity. It is up to the permittee, with help from their WET lab or consultant, to develop a study plan and to determine what is necessary to determine the cause of toxicity. **Communication/cooperation between the permittee and the Department is essential in plan development and implementation and will help ensure achievement of the study objectives.**

REFERENCES:

Goodfellow, et al. "Major Ion Toxicity In Effluents: A Review With Permitting Recommendations"; *Environmental Toxicology and Chemistry:* Vol. 19, No. 1, pp. 175–182.

Mount, et al. "Statistical Models to Predict Toxicity of Major Ions to *C. dubia*, *D. magna*, and fathead minnows"; *Environmental Toxicology and Chemistry:* Vol. 16, pp. 2009-2019.