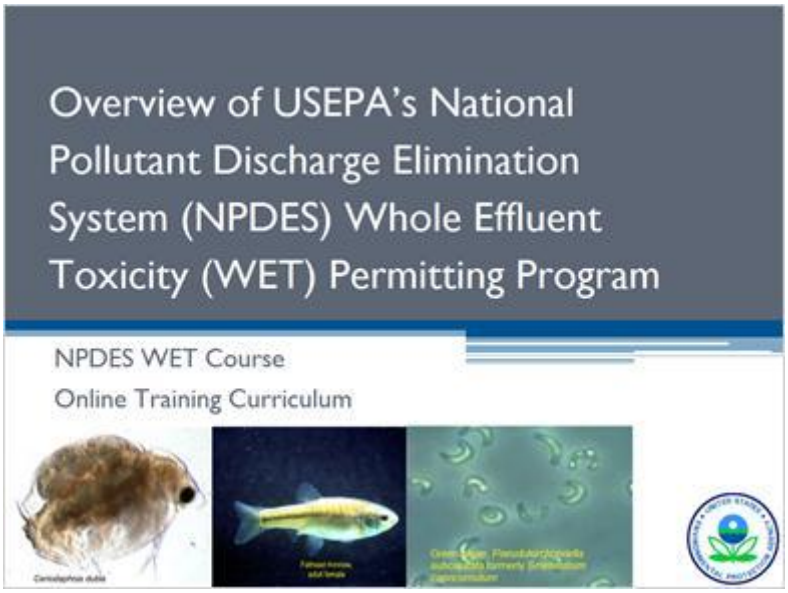
Module 1: Overview of USEPA's NPDES WET Permitting Program



Notes:

Welcome to this Overview of the United States Environmental Protection Agency's, hereafter USEPA, National Pollutant Discharge Elimination System (NPDES) Whole Effluent Toxicity (WET) Permitting Program. This presentation is part of a Web-based training series on Whole Effluent Toxicity sponsored by the USEPA's Office of Wastewater Management's Water Permits Division. You can review this stand-alone presentation, or, if you have not already done so, you might also be interested in viewing the other presentations in this series, which cover the use of Whole Effluent Toxicity under the NPDES permits program.

Before we get started with this presentation, I have one important housekeeping item.

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Notes:

First, let me introduce myself. My name is Laura Phillips, and I'm USEPA's National WET Coordinator with the Water Permits Division within the Office of Wastewater Management at the USEPA HQ in Washington D.C. Second, now for that housekeeping item.

You should be aware that all the materials used in this presentation have been reviewed by USEPA staff for technical and programmatic accuracy; however, the views of the speakers are their own and do not necessarily reflect those of the USEPA. The NPDES permits program, which includes the use of Whole Effluent Toxicity testing, is governed by the existing requirements of the Clean Water Act and USEPA's NPDES permit implementation regulations. These statutory and regulatory provisions contain legally binding requirements. However, the information in this presentation is not binding. Furthermore, it supplements, and does not modify, existing USEPA policy and guidance on Whole Effluent Toxicity in the NPDES permits program. USEPA may revise and/or update the contents of this presentation in the future.

Also, this module was developed based on the live USEPA HQ NPDES WET course that the Water Permits Division of the Office of Wastewater Management has been teaching to USEPA regions and states for several years. This course, where possible, has been developed with both the non-scientist and scientist in mind, and while not necessary, it is recommended

that a basic knowledge of biological principles and Whole Effluent Toxicity will be helpful to the viewer. Prior to this course, a review of the USEPA's Permit Writer's online course, which is also available at USEPA's NPDES website, is recommended.

When appropriate a blue button will appear on a slide. By clicking this button, additional slides will present information regarding either freshwater or marine USEPA WET test methods. When these additional slides are finished, you will be automatically returned to the module slide where you left off. The blue button on this slide provides the references for USEPA’s WET test methods that will be presented throughout this module.

Now, let’s review the use of Whole Effluent Toxicity in the NPDES permits program.

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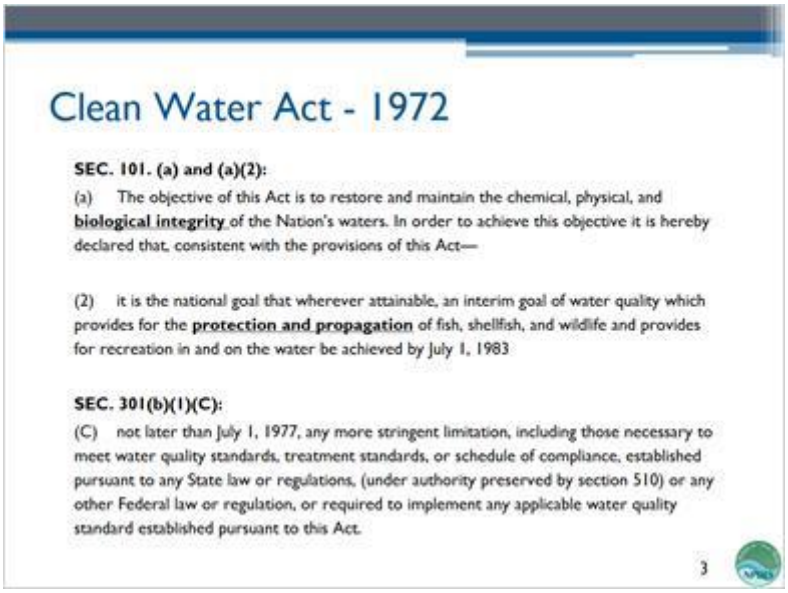

Notes:

Many of the requirements that the USEPA has placed into the NPDES permits program are there because of the Clean Water Act of 1972. The use of Whole Effluent Toxicity in the NPDES permits program stems directly from the Clean Water Act including Sections 101 and 301.

Section 101 (a) of the Clean Water Act indicates that the objective of the Act is to restore and maintain the chemical, physical, and **biological integrity** of the Nation's waters. Section (a) continues in paragraph (2) by indicating that it is a national goal that wherever attainable, that the interim water quality goal to provide for the **protection and propagation** of fish, shellfish, and wildlife and to provide for the recreation in and on the water is to be achieved by July 1, 1983. These two paragraphs in the Clean Water Act are the statutory goals underlying USEPA's WET program.

The statutory basis for requiring the implementation of Whole Effluent Toxicity or WET limits in NPDES permits is section 301(b)(1)(C) of the Act, which requires that permits include limits as stringent as necessary to meet state water quality standards. Most state water quality standards include chronic sublethal endpoints to meet the Clean Water Act's statutory goal for the protection and propagation of fish, shellfish, and wildlife. Thus, the chronic sublethal WET endpoints such as growth and reproduction, as reflected in the state water quality standards, are used in the NPDES permits program to protect the propagation of aquatic life.

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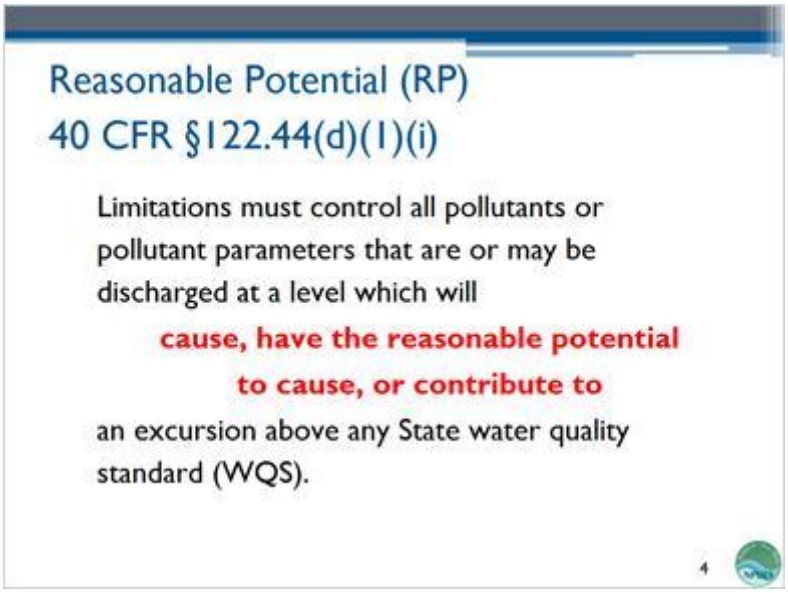

Notes:

USEPA's NPDES permit regulations located in the U.S. Code of Federal Regulations, Title 40 (hereafter 40 CFR), interprets and implements the Clean Water Act. Based on the Clean Water Act's provisions to protect the biological integrity of the nation's waters, the USEPA regulations require that all effluent discharges to the waters of the U.S. be assessed to determine whether there is the reasonable potential for an excursion of state water quality standards, such as the aquatic life protection criteria. The reasonable potential assessment for toxic impacts to aquatic life due to permitted effluent discharges at a level that would result in an excursion of a state's WET water quality standards is used to determine whether controls, such as NPDES permit limits, are necessary for wastewater discharges to surface waters. 40 CFR Section 122.44(d)(1)(i) requires limitations to control all pollutants or pollutant parameters that are or may be discharged at a level which will cause, or have the reasonable potential to cause or contribute to an excursion above any state water quality standard. The potential to cause or contribute to an excursion of a state water quality standard is the provision that provides preventive protection before there is an impact to aquatic organisms at a level that would result in an excursion of a state's WET water quality standard. Sometimes the words excursion and exceedance are used interchangeably; but based on the USEPA's NPDES regulatory

provisions, there is a specific application of these terms. When discussing NPDES water quality protection, it is important to remember that the term excursions is used with respect to water quality standards and that the term exceedance is used with respect to violations of NPDES permit limitations.

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Notes:

NPDES permit limitations may be technology-based or water quality-based. The NPDES regulations for the incorporation of both technology-based and water quality-based effluent limits are included in the federal NPDES permit regulations as cited on this slide. The goal of technology-based effluent limits is to have a zero discharge of pollutants and these types of NPDES permit limits are developed for all applicable pollutants of concern. If these permit limits are not sufficient to protect water quality pursuant to a state's relevant water quality standard (such as for WET), then a water quality-based effluent limit must be developed. For instance, if technology-based limits are not controlling the toxicity of the effluent such that there is still an excursion of a state's WET water quality standard, as demonstrated by Whole Effluent Toxicity monitoring, then a water quality-based NPDES permit limit is required.

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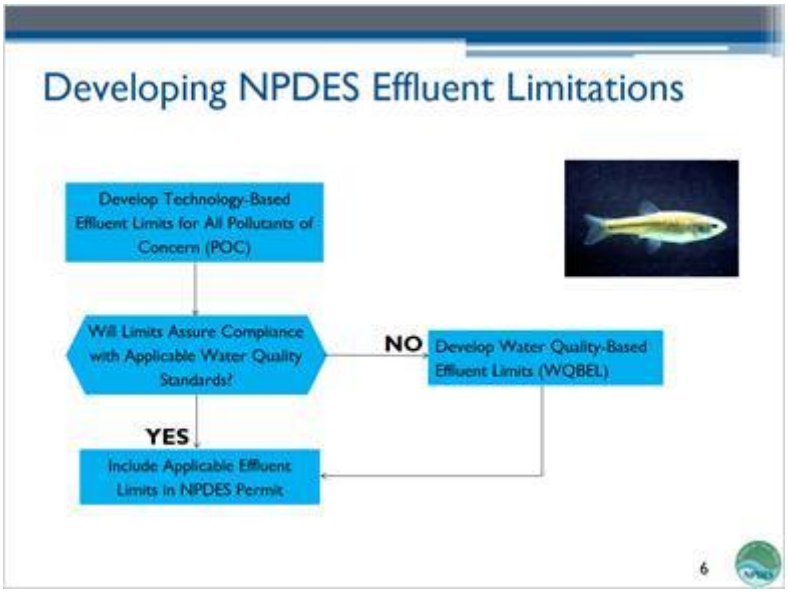

Notes:

This slide illustrates the NPDES regulatory approach just discussed using a decision tree when developing NPDES effluent limitations. First, technology-based effluent limits for all pollutants of concern are developed. Then, it is determined whether the limits will assure compliance with applicable state water quality standards. Thus, in terms of Whole Effluent Toxicity, the water quality standard is based on the aquatic life protection water quality criteria. If the technology-based limits will protect the applicable state water quality standards, then those limits are included in the NPDES permit. But if the technology-based limits will not protect a state's WET water quality standards, then Water Quality-based Effluent Limits, or WQBELs, are required to be developed.

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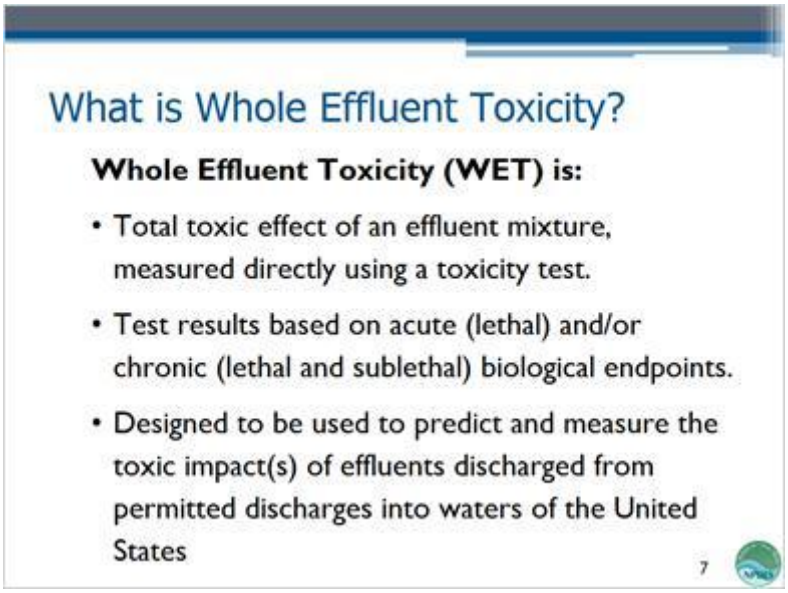


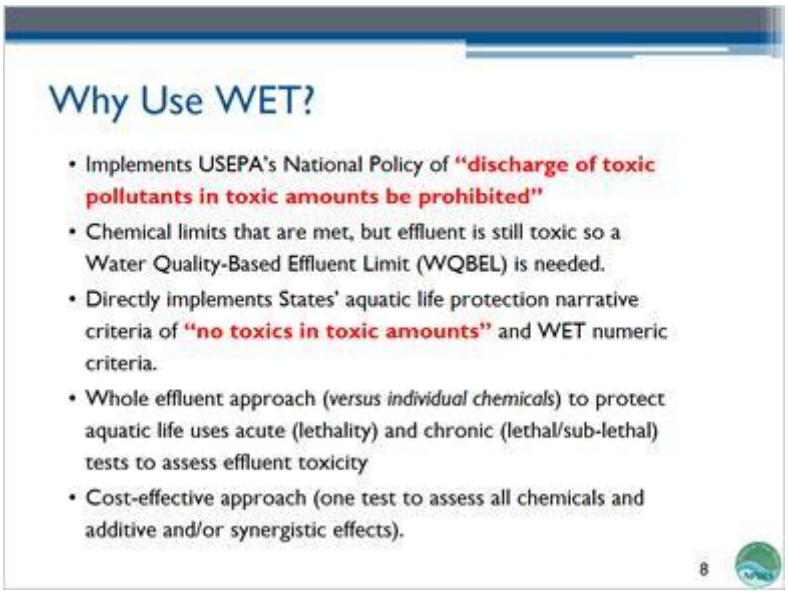
Notes:

What is Whole Effluent Toxicity? Whole Effluent Toxicity, or WET, is the total toxic effect of an effluent mixture measured directly using a toxicity test. The chemical-by-chemical approach, also referred to as chemical-specific NPDES permit provisions, may be protective of toxic impacts due to a single particular chemical, such as the use of a chemical-specific limitation for copper to protect aquatic life from impacts due to a toxic concentration of copper in the effluent. However, a chemical-specific approach does not protect against all of the potential and unknown contaminants that may be present simultaneously in the effluent. In addition, the chemical-specific approach does not protect against the additive and synergistic effects of the chemical mixtures in the effluent and for those chemicals for which criteria have not yet been developed. Since Whole Effluent Toxicity assesses the effluent as a whole mixture, the potential impact from all of the possible contaminants and their chemical interactions is evaluated.

WET test results can be based on the acute endpoint of lethality, or chronic endpoints, which incorporate both lethality and sublethal effects, for example, impaired reproduction, growth, or egg fertilization.

WET is designed to be used to measure the toxic impact of effluents from permitted effluent discharges into waters of the United States. This is intended to support the goals of the Clean Water Act of restoring and maintaining the biological integrity of our Nation's waters, including for

propagation, which is one of the chronic sublethal endpoints.



Notes:

So why use WET? Whole Effluent Toxicity directly supports the implementation of USEPA's National Policy, which prohibits the discharge of toxic pollutants in toxic amounts. As was mentioned on a previous slide, if chemical limits are met, but the effluent is measured as still toxic, then a water quality-based effluent limit, such as a WET limit, must be developed. Thus, the incorporation of Whole Effluent Toxicity as a water quality-based effluent limit directly implements the state's narrative aquatic life protection criteria of "no toxics in toxic amounts" or WET numeric criteria when a state has developed a numeric WET water quality standard. Numeric WET water quality standards will be discussed in detail later in this module. The Whole Effluent Toxicity approach can be a more cost-effective assessment than individual chemical monitoring since WET tests assess the cumulative effects of all chemicals in the effluent, including the potential for additive and/or synergistic effects.

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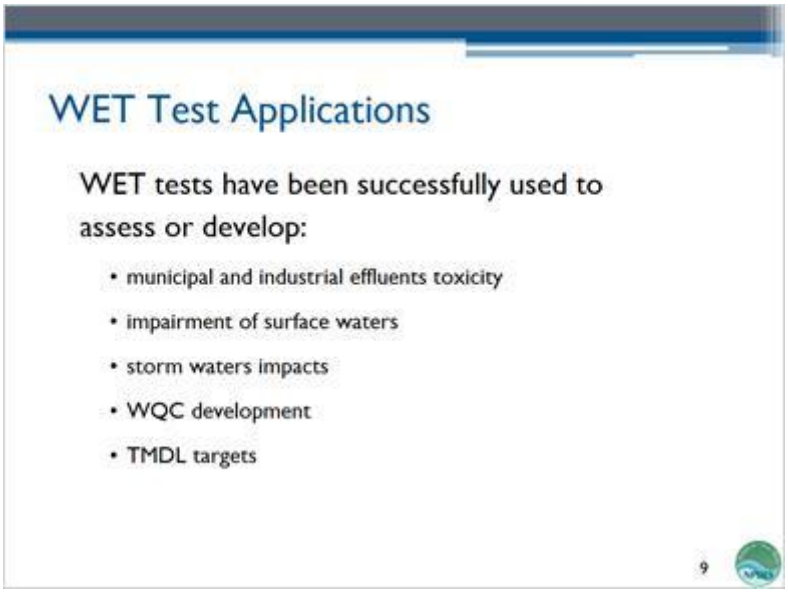

Notes:

How is WET testing applied? WET testing has been successfully used to assess: the toxicity of municipal and industrial effluents, water quality impairments of surface waters, possible storm water impacts, the development of water quality criteria for specific chemicals, and to set Total Maximum Daily Load, or TMDL, targets. Next, let's take a closer look at how municipal and industrial effluents can be assessed for possible toxic impacts to aquatic organisms under the NPDES WET permits program.

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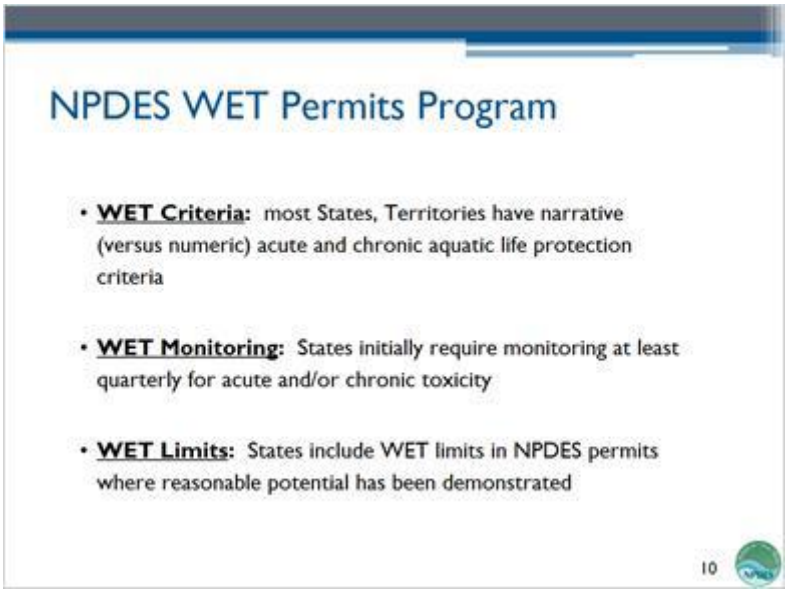

Notes:

The key factors with respect to the NPDES WET permits program are aquatic life protection or WET criteria, representative WET monitoring and WET limits developed to be protective of state WET water quality standards. In terms of WET criteria adopted by states and territories, most states have included narrative WET criteria, such as "no toxics in toxic amounts," into their water quality standards as previously mentioned. Some states include numeric criteria instead of narrative, and this WET implementation approach will be discussed later in this module. In terms of WET monitoring, states initially require at least quarterly monitoring for acute and/or chronic toxicity, including for chronic sublethal endpoints. There can be instances where permittees are permitted by the NPDES permit writer to monitor less frequently, but those should only be in situations where the effluent is stable and toxicity has not been observed in previous WET testing. For WET limitations, states include WET limits in their NPDES permits where reasonable potential has been demonstrated. For more information on USEPA's reasonable potential NPDES requirements and implementation, there is another module in this series specifically on WET reasonable potential. Over the next few slides, we will focus in on the first two important aspects just mentioned: WET criteria and representative WET monitoring.

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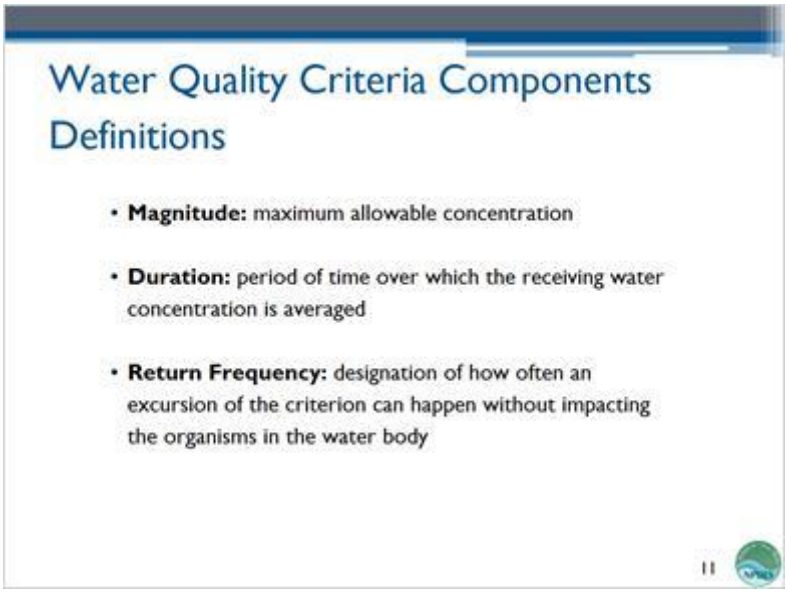

Notes:

All water quality criteria including WET criteria have three components: magnitude, duration, and return frequency. Magnitude is the maximum allowed concentration without causing an excursion of a state's water quality criteria and standards, while the duration is the period of time over which the receiving water concentration is averaged. The return frequency is a designation of how often an excursion of the criterion can happen without detrimentally impacting aquatic life in the water body. In the next slide, we will examine how these three components are defined in terms of the acute WET criterion.

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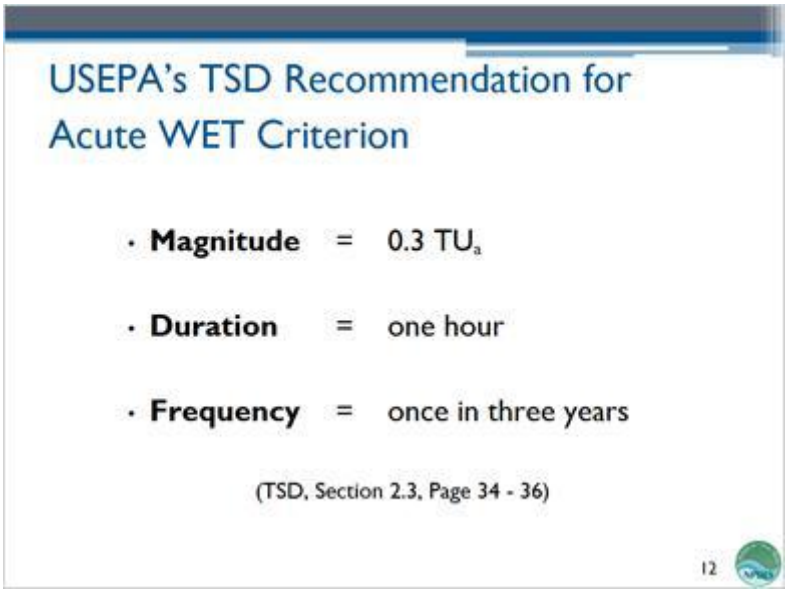
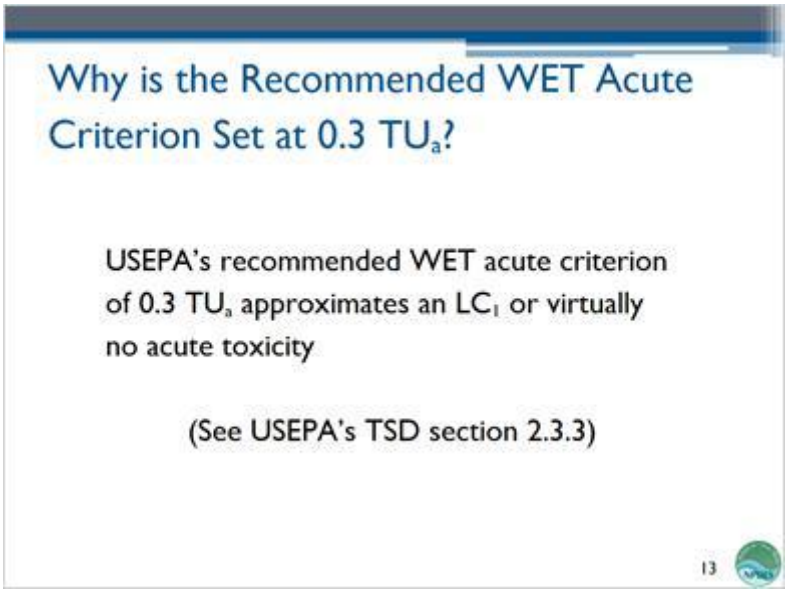


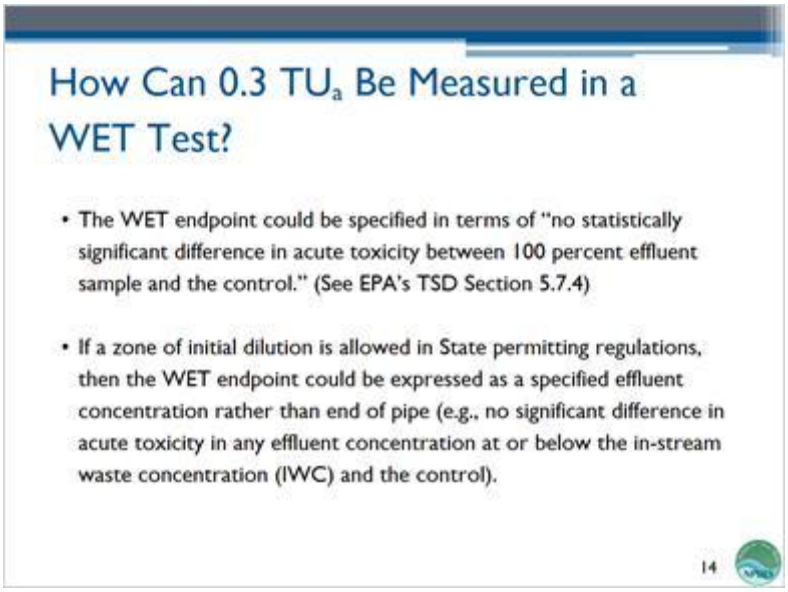
Notes:

USEPA WET criteria are based upon the same three key components as chemical-specific water quality criterion mentioned in the last slide: magnitude, duration, and frequency. In USEPA's 1991 Technical Support Document for Water Quality-based Toxics Control, commonly referred to as the USEPA's TSD, the magnitude for WET criteria is recommended to be 0.3 toxic units acute, or TU_a. Toxic units are defined as 100 divided by the statistical endpoint, which for acute WET is the LC_{50}, or the concentration that is lethal to 50% of the aquatic test organisms. Using acute TUs rather than the LC_{50} value makes the level of toxicity more intuitive, because as the TUs increase, the toxicity magnitude increases directly. This means that as the TUs increase, a smaller percentage of the effluent will result in an impact on aquatic life. TUs will be further discussed in the reasonable potential module. The recommended duration component for the acute WET criterion is 1 hour, and the frequency of return is once in three years.



Notes:

Why is the recommended WET acute criterion set at 0.3 TU_a? This is USEPA's recommendation in the USEPA's TSD because it approximates an LC_1, or 1% mortality, which is almost no acute toxicity. As noted in the USEPA's TSD Section 2.3.3, the factor of 0.3 TU_a was found to include 91 percent of the observed LC_1 to LC_{50} ratios in 496 effluent toxicity tests.



Notes:

Many times the question is asked: how can 0.3 TU_a be measured in a WET test? If there is no zone of initial dilution allowed in the state's water quality standards or the permitting regulations, and the acute criterion is permitted at the end of pipe, then the NPDES WET acute limit would be expressed as "no statistically significant difference in acute toxicity between 100 percent effluent sample and the control." This is the most sensitive application of an acute test and could be used for monitoring compliance with an acute criterion of 0.3 TU_a, where there is a lack of available dilution. In this case, the acute criterion would apply at the end of the pipe.

However, if the state water quality standards or permitting regulations allow for a zone of initial dilution, then the WET limit could be expressed as a specified effluent concentration accounting for the available dilution at the edge of the zone of initial dilution. For instance, the acute WET limit could be expressed as "no significant difference in acute toxicity in any effluent concentration at or below the In-stream Waste Concentration, or IWC, and the control."

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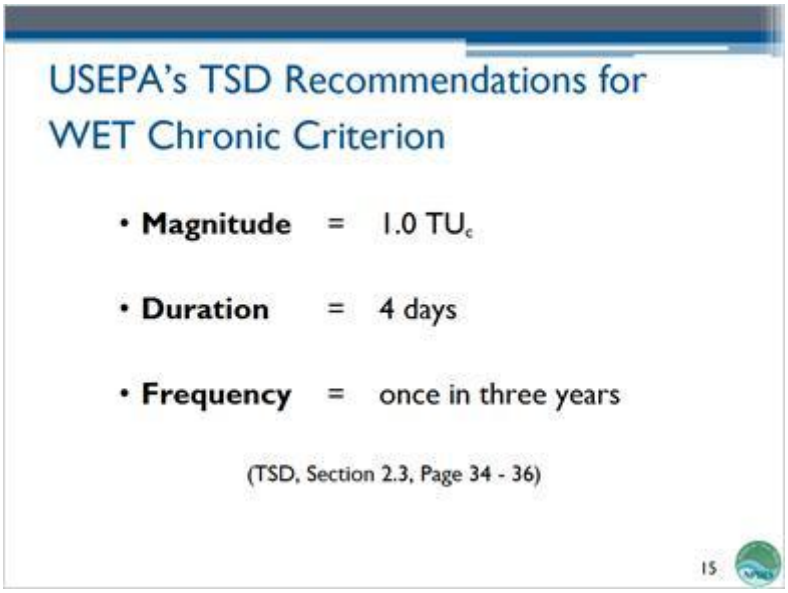
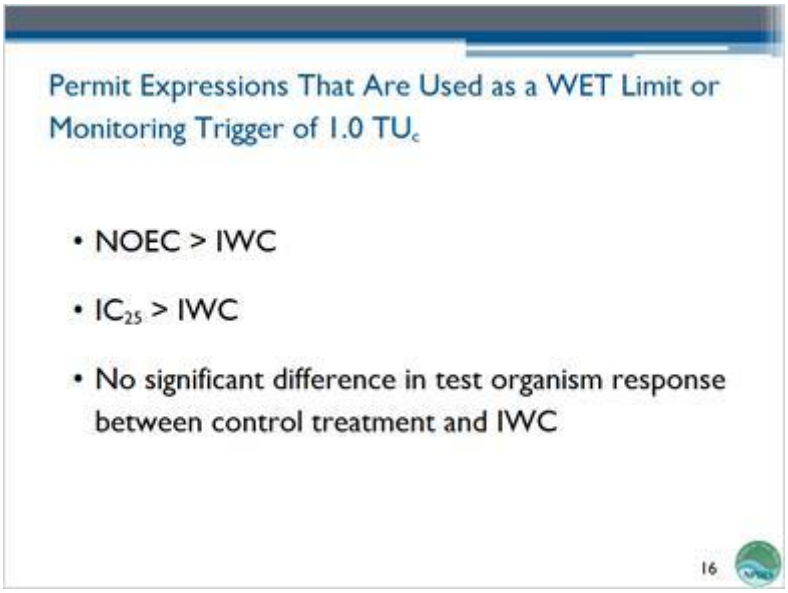


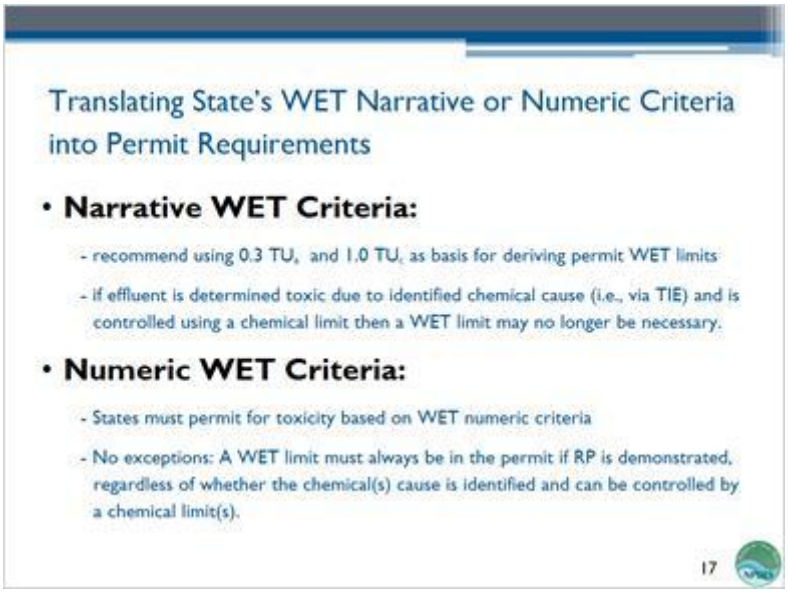
Notes:

We are now going to move from the acute WET criterion to the chronic WET criterion. As was demonstrated for the acute WET criterion, the chronic WET criterion has the same three components, including magnitude, duration, and frequency. The magnitude of the chronic WET criterion is recommended in USEPA's TSD to be 1.0 chronic toxic unit, or TU_c. Chronic toxic units are defined as 100 divided by the chronic endpoint, for example the Inhibition Concentration with a 25% effect, referred to as the IC_{25}, or a No Observed Effect Concentration, or NOEC. The recommended duration component of the chronic WET criterion is 4 days, which is a longer duration exposure to the effluent than the acute WET criterion duration exposure of 1 hour. This approach is used since chronic toxicity impacts to aquatic organisms are usually sublethal effects and not necessarily lethality. Therefore, the aquatic organism can sustain a longer exposure to the permitted effluent discharge. The frequency of return remains the same for the acute and chronic WET criterion of once in three years.



Notes:

There are multiple ways to express a NPDES WET limit or monitoring trigger of 1.0 TU_c in a permit. The first one listed here is based on the hypothesis endpoint, which is reported as a No Observed Effect Concentration, or NOEC; the permit limit or monitoring trigger would require the NOEC to be greater than the In-stream Waste Concentration, or IWC. This would ensure that the effluent discharge is not impacting aquatic life, because the IWC is a conservative estimate of the highest percentage of effluent that may be present in the receiving water under low flow conditions. A similar permit condition would be that the IC_{25} is greater than the IWC. This permit condition expression uses a point estimate endpoint of a chronic WET test to meet the chronic WET criterion of 1.0 TU_c. In this case, there has to be less than a 25 percent effect at the IWC for the effluent to be considered compliant with the NPDES permit limit. A third option would be to require no significant difference in the WET test organism response between the control treatment and the IWC effluent test concentration.



Notes:

There are a few recommendations when translating a state's WET narrative or numeric aquatic life protection criteria into NPDES permit requirements. For the narrative WET criteria, USEPA recommends using 0.3 TU_a and 1.0 TU_c for acute and chronic WET, respectively. This is the basis for deriving permit WET limits and for determining whether a WET limit is necessary based on a reasonable potential analysis. So using the narrative WET criteria, if the effluent is determined to be toxic or is shown to have a reasonable potential for toxicity, then a WET limit is necessary. However, if the chemical cause of toxicity is identified, typically using a Toxicity Identification Evaluation, and the toxicity is reduced, abated, or eliminated by including a chemical-specific permit limit, then a WET limit may no longer be necessary and can be removed from the permit either through an existing permit re-opener clause or in the next permit renewal. It is always a good permit implementation practice to include in the revised permit's fact sheet the rationale and information that supports the removal of the WET limit. However, when a numeric WET criterion is part of a state's water quality standard, then the state must include a WET limit in the permit based on the WET numeric criteria for the protection of aquatic life when reasonable potential has been demonstrated, even if the chemical cause has been identified and a chemical limit is also included in the permit.

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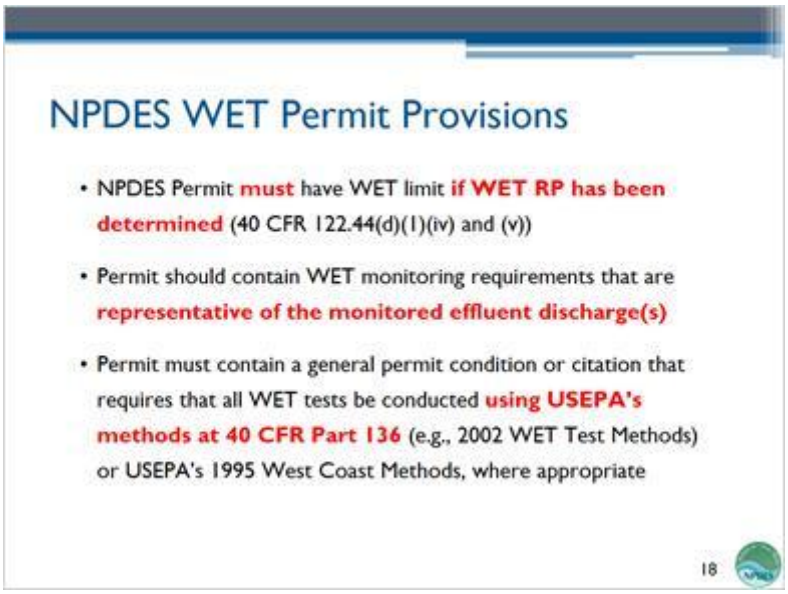


Notes:

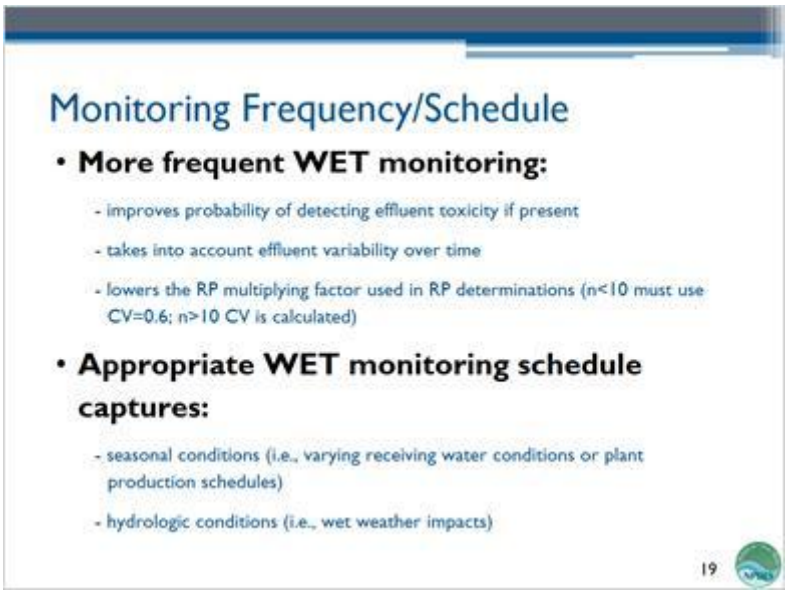
Let's review some of the provisions that need to be included in NPDES permits with respect to WET. NPDES permits must have a WET limit if reasonable potential has been determined. As we noted in the beginning of this module, this is in direct support of the Clean Water Act and included in USEPA's NPDES permit regulations contained in Title 40 of the Code of Federal Regulations or CFR at Part 122.44(d)(1)(iv) and (v).

Once it is established that a NPDES permit needs to contain a WET limit, the permit should contain WET monitoring requirements that are representative of the effluent discharge as required by USEPA's reasonable potential regulations, as well as other NPDES permitting regulations. If the effluent being discharged tends to vary either in flow or chemical composition over time or perhaps seasonally, quarterly or more frequent monitoring should be included to characterize the potential variability in the effluent. Effluents that have been demonstrated to be more stable in terms of concentrations of potential contaminants of concern may be able to be characterized at a monitoring frequency less than quarterly.

Another provision that should be included in NPDES permits with respect to WET, either directly or by reference, is that Whole Effluent Toxicity, is conducted using USEPA's test methods at 40 CFR Part 136. The promulgated

WET test methods at 40 CFR Part 136 include the 2002 acute freshwater and marine test methods, the 2002 short-term chronic freshwater test methods, and the 2002 short-term chronic marine test methods. The USEPA 1995 West Coast short-term chronic marine test methods are the recommended WET test methods for conducting chronic marine toxicity tests on the West Coast as allowed under 40 CFR Part 122.21(j)(5)(viii).

Let's take a closer look at the need for a representative monitoring frequency or schedule to be included in the NPDES permit.



Notes:

Including a representative or better yet a rigorous monitoring frequency or schedule in the permit will support properly characterizing the permitted effluent in terms of reasonable potential Whole Effluent Toxicity and also for WET permit limit compliance. More frequent WET monitoring will improve the probability of detecting effluent toxicity if present, will take into account effluent variability over time, and will lower the reasonable potential multiplying factor used in RP determinations, as discussed further in the reasonable potential module. An appropriate WET monitoring schedule will aid in capturing important seasonal conditions, such as varying receiving water conditions or plant production schedules, and may also support characterizing certain hydrologic conditions, such as storm water impacts. The next slide will illustrate the use of more frequent WET monitoring in terms of capturing potential toxicity in the permitted effluent.

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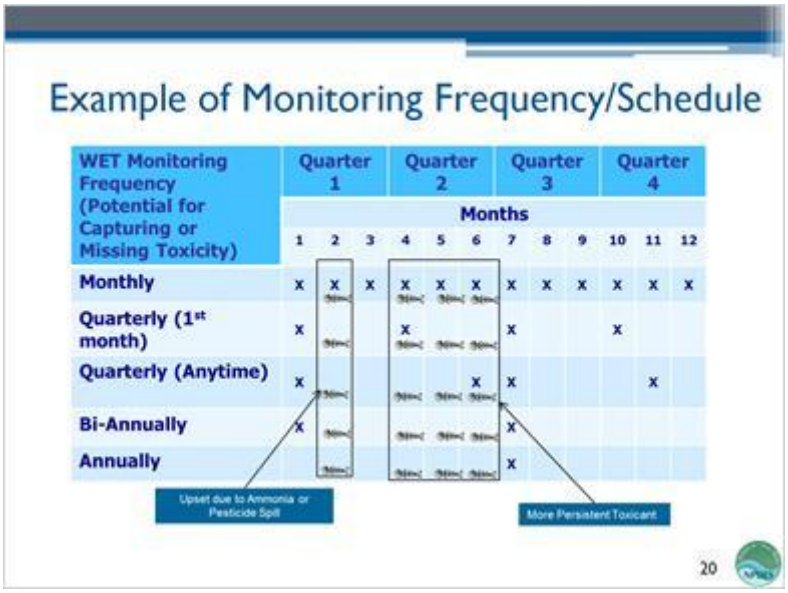

Notes:

Let's take a closer look at using different WET monitoring frequencies or schedules in NPDES permits. At the horizontal top of the chart are the quarters and the months of the year, and down the vertical side are the various potential WET monitoring regimes, including monthly, quarterly during the first month of the quarter, quarterly during any month of the quarter, bi-annually, and annual WET testing. Now, for example, imagine that there is a wastewater treatment upset at a facility and that there is high effluent ammonia, or perhaps a toxic spill, such as a pesticide that has not been completely treated. If the effluent discharger is monitoring at a high frequency, perhaps monthly, toxicity during these events may be captured. However, if a less frequent monitoring schedule is used, the probability of observing such toxic events in a WET test decreases. Another example might be if a more persistent toxicant was present in a permitted effluent; then perhaps monthly or quarterly WET testing may be sufficient to characterize the possible toxicity due to the discharged effluent. However, even in the case of a persistent toxicant, less frequent WET testing, for example only bi-annually or annually, will have less of an opportunity to capture toxicity in a WET test.

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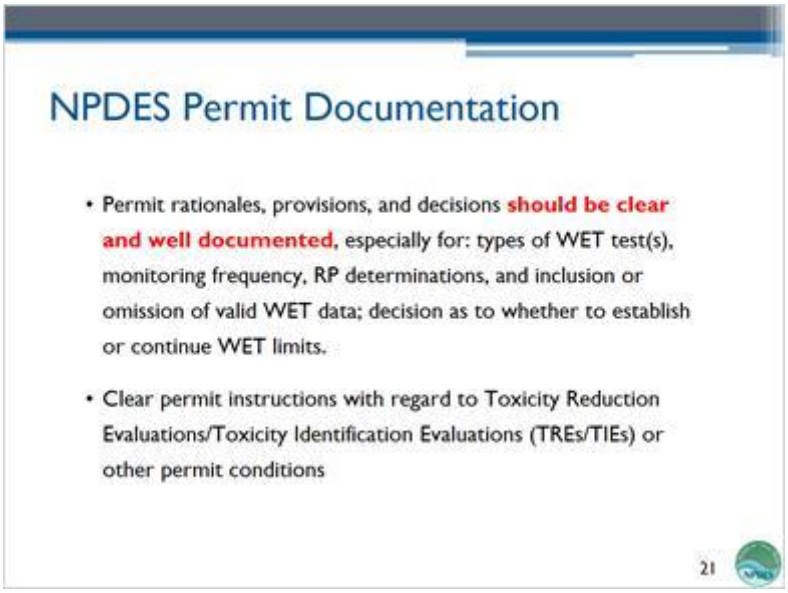

Notes:

When it comes to implementing WET into NPDES permits, clear and well documented rationales, provisions, and decisions regarding WET should be included in the permit fact sheet or administrative record. Provisions that should be clearly documented include: what is expected of the permittee with respect to the types of WET tests to be conducted, the required WET monitoring frequency, and how the generated valid WET test data is used or not used in reasonable potential determinations and NPDES permit compliance. If WET data generated over the course of a previous permit cycle is not used, the reasons for not using certain data or using other data needs to be clearly explained in the permit fact sheet or administrative record. If the WET limit is being modified or the monitoring frequency is being revised, the basis for any revisions needs to be clearly stated in the permit fact sheet or administrative record to prevent confusion on the part of the permittee, the laboratory, or future NPDES permit writers. Anything included in the NPDES permit becomes an enforceable requirement under USEPA NPDES permit regulations.

Another important aspect that needs to be clear and well documented in the NPDES permit is any instructions with regard to Toxicity Reduction Evaluations/Toxicity Identification Evaluations, also known as TREs/TIEs. TREs/TIEs are not requirements under USEPA's NPDES regulations, but if they are included in a NPDES permit, then they become a requirement by virtue of

inclusion into the permit. Therefore, clear and well-written instructions and expectations for what the permittee is to achieve regarding TREs/TIEs, including a detailed work plan and schedule, should be included in the permit.

Module 1: Overview of USEPA's NPDES WET Permitting Program

Notes:

This module provides an overview of USEPA's NPDES WET permitting program. State and USEPA permit writers need to provide well written NPDES permits which include documentation of WET permit decisions and requirements. For most of the U.S., the states have authorization to issue permits for the NPDES permits program. These states have been granted NPDES permit authorization by USEPA over their NPDES state permit programs but also coordinate with USEPA Regions. The USEPA Regions work with USEPA Headquarters, as necessary, on the implementation of state or USEPA regional NPDES permit programs. Other aspects of USEPA's NPDES permit program coordination and oversight include providing USEPA HQ NPDES WET training and technical expertise support to USEPA regions and states, including this USEPA HQ NPDES WET online course. The NPDES WET permits program coordination also considers recommendations from stakeholders, states, and USEPA regions on the USEPA NPDES WET permit program implementation approaches to make advancements or adjustments when appropriate and as necessary.

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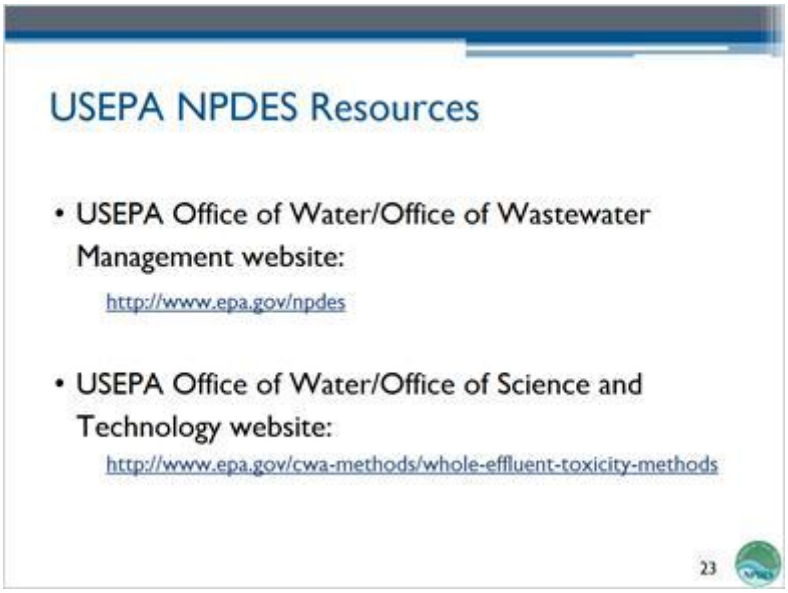

Notes:

The USEPA NPDES WET team is made up of a USEPA National WET coordinator in the Water Permits Division within the Office of Wastewater Management at the USEPA HQ in Washington D.C. and at least one NPDES WET coordinator in each USEPA region. Contact information for USEPA NPDES WET coordinators can be found on the Office of Wastewater Management's website provided on this slide.

Besides the USEPA HQ NPDES WET online training that you are viewing, there are many other WET resources on the web pages of USEPA's Office of Wastewater Management as well as USEPA's Office of Science and Technology. USEPA's Office of Wastewater Management is the office that manages the NPDES WET permits program with USEPA regions and NPDES states, while the Office of Science and Technology and Office of Research and Development are responsible for developing, updating and managing the USEPA Whole Effluent Toxicity test methods, including their inclusion into 40 CFR Part 136. The links here provide access to the NPDES web page of the Office of Wastewater Management where several documents, guidance, policy and other tools can be accessed to use towards NPDES WET permits implementation. The Office of Science and Technology link provides access to where the USEPA 2002 promulgated WET test methods can be found on the web. On the next slide we will review a few of these important documents that can be accessed on the web.

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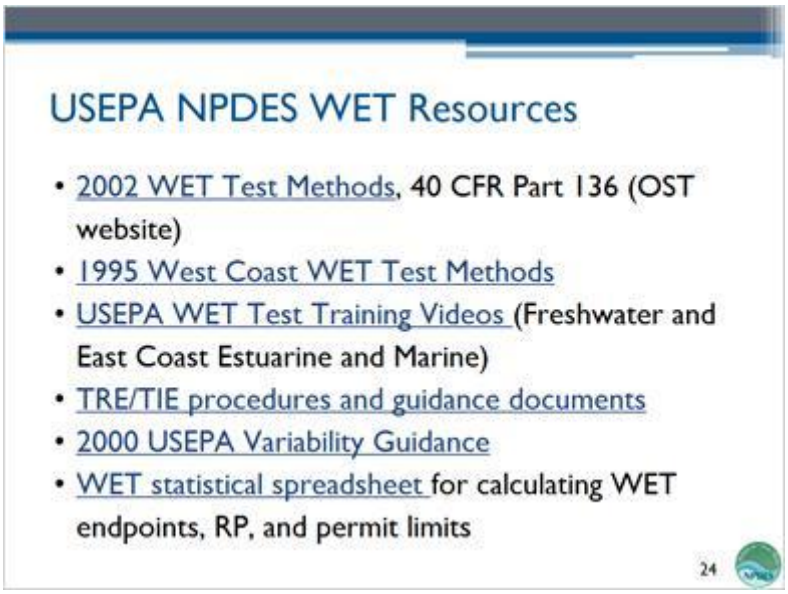

Notes:

There are many documents that have been published by USEPA that are available on USEPA's websites and cover different aspects of the NPDES WET permits program especially with respect to WET implementation. These include, but are not limited to, the USEPA 2002 WET test methods available through the Office of Science and Technology's website. The 1995 USEPA WET test methods can be accessed through the USEPA Region 9 or 10 websites. The USEPA WET test methods training videos for the USEPA's 2002 promulgated WET test methods can be found on the Office of Wastewater Management's NPDES website. The procedures and guidance documents for conducting TREs/TIEs can also be accessed through the Office of Wastewater Management website. Also included on the Office of Wastewater Management's NPDES website are recommended approaches for valid WET data interpretation, which can also be found in the "Resources" tab of this module. The OWM NPDES website also includes a Whole Effluent Toxicity statistical spreadsheet. The statistical WET spreadsheet is Excel based and will calculate several existing USEPA WET statistical endpoints and other permit calculations.

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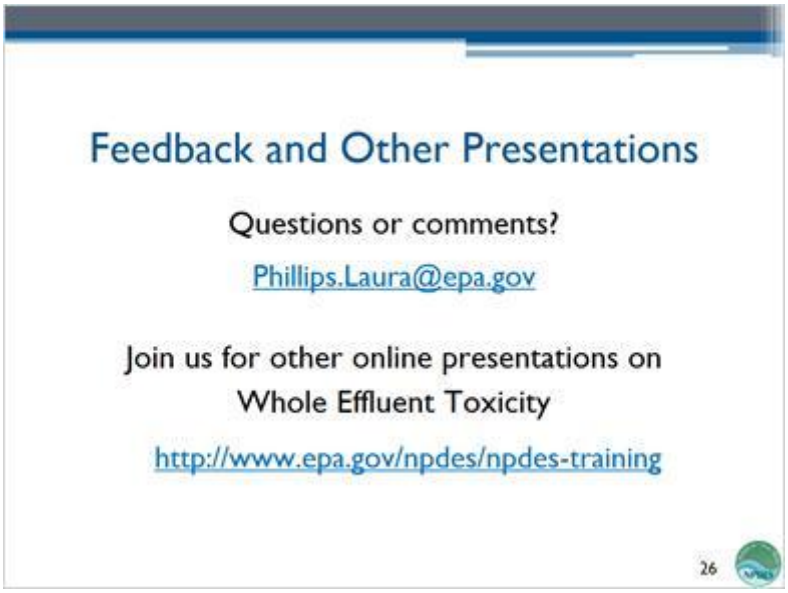

Notes:

Thank you for joining us for this USEPA's NPDES Whole Effluent Toxicity training presentation. We hope that you have enjoyed it!
If you have questions or comments on this or any part of the USEPA's NPDES WET online training curriculum, click on the email address given on this slide to send a message to Laura Phillips, USEPA HQ National WET Coordinator.
Remember, you will find all of the USEPA's NPDES WET online training presentations, under the USEPA's NPDES training section found on the Office of Wastewater Management's NPDES website.
See you next time!