ARKANSAS
ENERGY & ENVIRONMENT | ENVIRONMENTAL QUALITY

State of Arkansas

Continuing Planning Process

DRAFT

2020 Edition

WORKING DOCUMENT

Introductory Notes

- The Antidegradation Implementation Methodology is available as a separate document.
- All names and hyperlinks included in this document are subject to clerical and administrative updates as necessary.

Chapter

1

Chapter 1 Water Quality Management Program

The Continuing Planning Process (CPP) is required by the Clean Water Act (CWA) § 303(e),[1] 40 CFR § 130.5,[2] and Ark. Code Ann. § 8-4-208(a). Arkansas developed and obtained approval of the CPP on January 24, 1983. Subsequent modifications were made in July 1989, November 1991, April 1993, January 1995, and June 1999.

The general purpose of the CPP is to describe the principal operational procedures of the state of Arkansas water quality management programs and permits. The U.S. Environmental Protection Agency (EPA) encourages states to review and revise their existing CPP as necessary. CPP review is not mandated in a certain timeframe. However, EPA does have authority to approve the CPP.

EPA recommends the use of a water quality-based approach in order to meet CWA goals. That is, an increased effort is directed toward those impaired waters not attaining water quality, not supporting one or more designated/existing uses, or has one or more completed Total Maximum Daily Loads (TMDL). The Arkansas Department of Energy and Environment, Division of Environmental Quality (DEQ) has been revising its water quality management program to better identify water quality issues; to develop the means by which those issues can be resolved; and to better define Arkansas's water quality standards (WQS) that protect the designated/existing uses of the state's waters. Arkansas's WQS are set forth in Arkansas Pollution Control and Ecology Commission's (APC&EC) Rule 2.

The State may determine the format of its CPP as long as the minimum requirements of the Clean Water Act (CWA) and this rule are met. According to 40 CFR §130.5(b), the following processes must be described in each State CPP, and the State may include other processes at its discretion. The nine specific 40 CFR §130.5(b) requirements are located in the CPP, as follows:

(1) Chapter 1 through Chapter 7: The process for developing effluent limitations and schedules of compliance at least as stringent as federal requirements [40 CFR §130.5(b)(1)].

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[1] 33 U.S.C. § 1313(e).
[2] 44 CFR § 130.5 is included by reference in Arkansas Pollution Control & Ecology Commission Rule 6.

DEQ will issue permits that protect receiving water quality using effluent limitations that are consistent with the Clean Water Act (CWA) and the corresponding Code of Federal Regulations. DEQ has adopted applicable rules that parallel the federal regulations to establish effluent limitations in Rule 6, which incorporate the provisions of 40 CFR §§122, 124, 125, 129, 133, 401, 403, and 405 through 471.

In no case will a permit contain an effluent limitation that is less stringent than required by the applicable effluent guidelines in effect at the time a new permit is issued or in effect at the time the permit is reissued or modified. In no case will a permit contain an effluent limit that causes or contributes to a violation of the water quality standards.

The process for determining permit limits as discussed in Chapters 2 (Technology-Based Effluent Limits) and 4 (Water Quality-Based Effluent Limits) does not include requirements of the State of Arkansas's Antidegradation Implementation Methodology. Prior to issuing an NPDES permit, the permit writer should consult the Antidegradation Implementation Methodology (available as a separate document) to ensure that the permit is in accordance with the Antidegradation Policy located in Chapter 2 of Rule 2. Documentation of the process of determining permit limits will be provided in the permit Fact Sheet or Statement of Basis.

The Antidegradation Implementation Methodology is available on the DEQ Office of Water Quality webpage.

Schedules of compliance may be issued to allow permittees time to institute changes needed to meet permit limits.

(2) Section 1.22: The process for incorporating elements of any applicable areawide waste treatment plans under §208 and applicable basin plans under §209 of the Act [40 CFR §130.5(b)(2)].

(3) Section 1.7 and Chapter 7: The process for developing TMDLs and individual water quality based effluent limitations for pollutants in accordance with section 303(d) of CWA and 40 CFR §130.7(a) [40 CFR §130.5(b)(3)].

DEQ prepares the Arkansas Integrated Water Quality Monitoring and Assessment Report, or the Integrated Report, every two years in accordance with Clean Water Act (CWA) §303(d) and §305(b), 40 CFR §130.7(b) reporting requirements, and EPA guidance. The Integrated Report is a comprehensive assessment of the State's water quality, it includes the 303(d) list which describes impaired waterbodies and pollutants of concern. DEQ prioritizes TMDL development based on several factors including the severity and persistence of pollutant sources, significance of the waterbody for public use or resource value, availability of data, and applicability of existing pollution controls (such as State No-Discharge and NPDES permits). A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as a tool for restoring water quality. DEQ follows EPA guidance and methods when writing TMDLs and submits them to EPA for review and approval in accordance with §303(d) of the CWA, EPA's implementing regulations (40 CFR §130.7).

(4) Chapter 3: The process for updating and maintaining Water Quality Management Plans (WQMP), including schedules for revision [40 CFR §130.5(b)(4)].

(5) Section 1.15: The process for assuring adequate authority for intergovernmental cooperation in the implementation of the State WQMP program [40 CFR §130.5(b)(5)].

The DEQ works with many other state agencies to assure proper implementation of programs and regulatory efforts to manage, protect, and improve water quality. DEQ and the Arkansas Department of Health (ADH) are required by law or regulation to carry out certain activities jointly, including implementation of sewerage regulation and review of plans and specifications for treatment works.

(6) Sections 1.2 and 1.17: The process for establishing and assuring adequate implementation of new or revised water quality standards, including schedules of compliance, under section 303(c) of the Act [40 CFR §130.5(b)(6)].

Every three years, DEQ conducts a comprehensive review of the state's Water Quality Standards (WQS) established in Rule 2. This triennial review is a federal Clean Water Act (CWA) requirement that integrates the most current science and technology in setting the WQS.

(7) Section 1.14: The process for assuring adequate controls over the disposition of all residual waste from any water and wastewater treatment processing [40 CFR §130.5(b)(7)].

The disposition of residual waste from water and wastewater treatment processes is controlled by the issuance of state individual and general permits. Management of the residuals is included as conditions in the permit issued.

(8) Section 1.16: The process for developing an inventory and ranking, in order of priority of needs for construction of waste treatment works required to meet the applicable requirements of 40 CFR §122.44 [40 CFR §130.5(b)(8)].

The CWA of 1987 established the State Water Pollution Control Revolving Fund under which federal grants are awarded to states for deposit in the State's Revolving Loan Fund (SRLF).

(9) Section 1.18: The process for determining the priority of permit issuance [40 CFR §130.5(b)(9)].

DEQ will use this priority as a guide to allocate resources to issue permits based upon potential risk to human health and the environment. Compliance concerns, economic impacts, human health concerns, and construction season concerns may also be taken into consideration.

1.1 Background

Section 303 of the CWA requires plans for the establishment of effluent limitations and schedules of compliance; identification of those waters within the state for which technology-based effluent limits would not be stringent enough to attain applicable WQS and a priority ranking system for these "water quality limited" waterbodies; and establishment of Total Maximum Daily Loads (TMDLs) for the water quality limited waterbodies.

The initial wasteload allocations (WLA) or more recent wasteload studies provide the effluent limits necessary for the design of wastewater treatment plants. These permits are issued or updated as necessary to ensure that WQS are met.

The compliance monitoring and enforcement program ensures that permitted facilities are meeting the requirements of their permits. Compliance monitoring is performed by DEQ district field inspectors. These field inspectors also investigate complaints, respond to chemical spills, and take samples for the fixed Ambient Water Quality Monitoring Network.

DEQ's Water Quality Monitoring Networks provide monitoring data for trend analysis, water quality data for the Integrated Water Quality Monitoring and Assessment Report (305(b) Report), and serve as a "flag" to implement more intensive sampling as necessary.

The 305(b) report compiled biennially as required by the CWA, is a comprehensive assessment of the State's water quality. The 303(d) list summarizes the causes and sources of pollution for those waters not attaining water quality standards. The Integrated Report is a combined reporting of the 305(b) report and 303(d) list.

TMDLs may be established for waterbodies on the 303(d) list. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as a tool for restoring water quality. Components of a TMDL are the allocations of the load to point and nonpoint sources of pollution; loading for future growth in the watershed; and a margin of safety.

1.2 Water Quality Standards (Promulgated as APC&EC Rule 2) Establishment and Revision

Water Quality Standards (WQS) serve as the cornerstone of States' water quality management programs and consist of three basic elements:

- **Antidegradation Policy** – Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
- **Designated Uses** – Extraordinary Resource Waters, Ecologically Sensitive Waterbody, Natural and Scenic Waterways, Primary Contact Recreation, Secondary Contact Recreation, Aquatic Life, Domestic Water Supply, Industrial Water Supply, Agricultural Water Supply, and other uses.
- **Criteria –** Characteristics that are protective of the designated uses (both narrative

statements and numeric magnitude).

A fourth element is typically included at the discretion of the State:

- General policies used in the implementation of WQS (mixing zones, zones of passage, flow applicability policies, variances, etc.).

States and tribes promulgate WQS in order to attain CWA Section 101(a) “fishable/swimmable” objectives, which are to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters; and wherever attainable, achieve a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water. In establishing WQS, states are also instructed to consider the value of other water uses.

Clean Water Act programs including NPDES, TMDL, 401 Certification, Section 404 Permitting, and 305(b) and 303(d) assessment and reporting rely upon the water quality standards (WQS) as the basis for achieving the goals of the Clean Water Act.

In Arkansas, WQS are established pursuant to the provisions of Sub-Chapter 2 of the Arkansas Water and Air Pollution Control Act (Act 472 of the Acts of Arkansas for 1949, as amended; Ark. Code Ann. 8-4-101 et seq) and promulgated as Arkansas Pollution Control and Ecology Commission (APC&EC) Rule 2.

Federal Regulations at 40 CFR §131.20 require that States “… from time to time, but at least once every 3 years, hold public hearings for the purpose of reviewing applicable water quality standards…” Therefore, the WQS are reviewed and amended or updated as appropriate at a minimum of every three years. In addition, APC&EC may be petitioned by any party to amend the WQS at any time in accordance with Arkansas Code § 8-4-202(c). Arkansas follows the steps below to accomplish the review and public hearing requirements for WQS rulemaking:

- Stakeholder meeting(s) to solicit informal feedback from the public
- Approval by the Governor of Arkansas
- Approval of initiation of rulemaking by the APC&EC
- Notice of Public Hearing (at least 45 days prior to the hearing date), notice of public comment period on the proposed rule, and notice of availability of proposed amendments to Rule 2 and documentation of analysis supporting all WQS amendments recommended
- Public Hearing
- Consideration and response to public comments
- Approval of proposed Rule 2 by APC&EC
- Review and approval of Rule 2 by Committee of the Arkansas General Assembly
- Certification that the WQS in Rule 2 were adopted pursuant to state law
- Submittal of Rule 2 and documentation of analysis supporting all WQS amendments to EPA Region 6
- Approval of WQS in Rule 2 by EPA Region 6

1.3 Biological Integrity

1.3.1 Implementation

It is the expressed goal of the CWA and the Arkansas Water and Air Pollution Control Act to protect the biological integrity of the waters of the state. Implementation of this goal is provided for in APC&EC Rule 2.405. Aquatic biota must be maintained in order to support the designated aquatic life uses. Revision of existing water quality standards or establishment of any new water quality standards must ensure protection of biological integrity and that further degradation does not occur. Biological integrity must be maintained in order to support the designated aquatic life uses. All surface waters of the state have been designated to support aquatic life uses in accordance with APC&EC Rule 2.302, unless specifically removed through the Use Attainability Analysis process outlined in 40 CFR §131.10(g), APC&EC Rule 2.303, and/or APC&EC Rule 2.306.

1.3.2 Aquatic Life Verification Procedures

APC&EC Rule 2.505 includes several exceptions as to when the ecoregion dissolved oxygen criteria are not applicable and when other criteria apply to waterbodies. These exceptions include:

- During the critical season, as defined in Rule 2.106, when certain characteristics are associated with the waterbody such as a watershed size of less than 10 square miles and an instream flow of less than one cubic foot per second (1.0 cfs);
- In areas where groundwater input may dominate instream flows;
- During the primary season, as defined in Rule 2.106, in streams with a watershed size of less than 10 square miles and an instream flow of less than 1.0 cfs; and
- If it is either suspected or confirmed that any of the above conditions exist, field verification of the presence/absence of aquatic biota is needed. Aquatic biota is described in Rule 2.106.

Evaluation Process

Determining the presence/absence of aquatic biota in small watershed streams is different than determining the support/nonsupport status of the aquatic life designated use. Even though physical characteristic information such as instream conductivity, water temperature and stream flow is preferred information, it is not necessary.

For this purpose, it is only necessary to document if aquatic biota are present in the waterbody. A variety of documentation techniques can be used such as taking pictures, collection and preservation, or an extensive aquatic life investigation. However, more thorough investigations increase the confidence level of decision makers when making a final determination of the presence/absence of aquatic biota in a waterbody. At any level of investigation, the minimum information required includes:

- Name of the waterbody
- County which it is located
- Location, e.g. at Highway 1 approximately XX miles south of Little Rock
- Global Positioning System (GPS) coordinates (if available)
- Watershed size (if known)
- Name of the Investigator(s)
- Name of entity that performed the evaluation (if applicable)
- Address of the entity (preferred)
- Phone number
- Email address (if available)
- Sample collection method (picture, seine, net, etc.)
- Water quality information such as temperature, flow, conductivity (if available)
- Macroinvertebrate community data, scientific names if possible
- Fish community data, scientific names if possible
- Other aquatic biota presence, common and/or scientific names

1.4 Integrated Reporting: 305(b) and 303(d) List

Section 305(b) of the Clean Water Act (CWA) requires states to perform a comprehensive assessment of the state's water quality, which is to be reported to Congress every two years. In addition, Section 303(d) of the Clean Water Act requires states to prepare a list of impaired waters on which TMDLs or other corrective actions must be implemented. Current U.S. Environmental Protection Agency (EPA) guidance recommends producing an integrated report combining requirements of the Clean Water Act for Sections 305(b) reporting and 303(d) submissions. The combined report is the *Integrated Water Quality Monitoring and Assessment Report.* This report is prepared using the *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b), and 314 of the Clean Water Act* (EPA 2006) and supplements.

The 305(b) report summarizes the conditions of the surface and ground waters in the state. The condition of the waters is determined by the extent of designated use support and WQS attainment. Physical, chemical, and biological data is used in the support and attainment decision making process. Numerous sources of data are combined and assessed during this process. The waters that are either not attaining one or more water quality criteria, or not supporting one or more designated uses are placed on the 303(d) list and prioritized for restoration activities. These activities may be, but are not limited to, implementation of TMDLs, revision of NPDES permit limits, implementation of nonpoint source management practices, and/or alternative approaches to control pollution.

Highest priority waters for implementation of pollution controls include those with the most serious water quality problems and those with the most valuable designated uses, such as existing domestic water supplies, Extraordinary Resource Waters, and Ecologically Sensitive Waterbodies. A complete list of the priority criteria is found in the most current Integrated Report (305(b)/303(d)).

For more information on the Integrated Report, visit the following link:

https://www.adeq.state.ar.us/water/planning/integrated/303d/pdfs/2018/final-2018-305b-report.pdf

1.5 Wetlands Protection

Through the CWA, regulatory authority for the protection of wetlands has been delegated to the EPA (Section 401) and the USACE (Section 404). EPA has since delegated Section 401 (Water Quality Certifications) responsibilities to states or authorized tribes. Refer to Section 1.8 for a more detailed explanation. Additionally, activities occurring in the Waters of the State which may cause an exceedance of a standard must be evaluated and covered by a Short Term Activity Authorization (STAA) as established in Rule 2.305. Refer to Section 1.9 for more information on STAAs.

1.6 Groundwater Protection Program

The goal of the Groundwater Protection Program is to document existing groundwater quality and to identify anthropogenic impacts on drinking, agricultural, industrial, and other groundwater supplies. This is accomplished by long-term monitoring, working with other offices of DEQ and state agencies in formulating groundwater protection policies, and other means, including but not limited to the requirements to monitor groundwater quality at permitted facilities to identify potential adverse effects.

The current goal of DEQ's groundwater monitoring program is to have an established groundwater monitoring network within each fresh-water aquifer system in the state and to report groundwater quality by individual aquifer systems. The program monitors approximately 250 wells and springs for potential sources of contamination from inorganic, volatile, and semi-volatile pollutants. Monitoring areas are sampled on an approximately three-year revolving basis. The resulting data is intended to be used for analysis of groundwater quality trends in support of contamination prevention strategies. The ambient monitoring program includes pesticides in row-crop agricultural areas such as the Mississippi Embayment and the Gulf Coastal Plain.

Office of Water Quality personnel manage groundwater remediation projects as needed, on cases that are not overseen by other DEQ Offices such as Office of Land Resources. In the absence of statewide groundwater standards, federal Maximum Contaminant Levels (MCLs), Human Health Medium-Specific Screening Levels, and Health Advisory Limits (HALs) are used to establish groundwater remediation goals.

The Groundwater Protection Program provides funding assistance to other state groundwater protection programs such as the Wellhead Protection Program implemented by ADH. Program personnel also offer technical assistance to researchers investigating potential sources of contamination such as pesticides, confined animal operations, and salt-water intrusion. These preventive endeavors include joint efforts with universities and other state and federal agencies.

1.7 Total Maximum Daily Load (TMDL)

States are required to develop TMDLs (or implement alternative actions) to address water quality impairment(s). TMDL is the maximum amount of a pollutant that can occur in a waterbody and attain water quality standards.

DEQ follows EPA guidance and methods when developing TMDLs and submits them to EPA for review and approval in accordance with §303(d) of the CWA and EPA's implementing regulations (40 CFR §130.7). DEQ consults the EPA 'Region 6 TMDL checklist' to ensure all required documentation is submitted to EPA with the corresponding rationale for the TMDL decisions. TMDLs are calculated using the following formula:

$$\mathrm{TMDL} = \Sigma\mathrm{WLA} + \Sigma\mathrm{LA} + \mathrm{MOS} + \mathrm{FG}$$

Where:

WLA	=	Waste Load Allocation – the allowable discharge of a pollutant from regulated sources, point or nonpoint
LA	=	Load Allocation – the contribution of a pollutant from non-regulated sources, typically nonpoint and background
MOS	=	Margin of Safety – a portion of the TMDL that is retained to help to ensure that implementation of the TMDL will result in water quality standards attainment
FG	=	Future Growth – optional portion of the TMDL capacity retained to accommodate new or increased sources of loading that may occur

For more information visit the following link:

https://www.adeq.state.ar.us/water/planning/integrated/tmdl/

1.8 401 Water Quality Certifications

The Clean Water Act authorizes each state to issue a 401 Water Quality Certification (401 Certification) for any project that needs a Federal 404 Permit. The 401 Certification is verification by the state that the project will not violate water quality standards. DEQ works with applicants to avoid and minimize impacts to water quality and instream habitat.

The U.S. Army Corps of Engineers (USACE) is responsible for issuing permits for activities involving the discharge of dredged or fill materials to waters of the U.S. pursuant to Section 404 of the CWA. DEQ is not delegated primacy for the issuance or enforcement of Section 404 permits, but does review the permits for purposes of state certification, state certification with conditions, waiver, or denial under CWA Section 401.

A 401 Certification is needed for the placement of dredge and fill materials in waters of the United States (WOTUS). Examples include but are not limited to: large construction projects (i.e. residential development construction, shopping centers, etc.), streambank stabilization projects, and road construction projects. WOTUS are defined by Section 404 of the Clean Water Act as all waters that may be susceptible to use in interstate or foreign commerce. This includes intrastate lakes, rivers, streams (including intermittent streams), wetlands, and wetlands adjacent to jurisdictional waters. The permitting and certification process is shared between DEQ and the U.S. Army Corps of Engineers.

For projects that fall under a USACE general nationwide permit and are not on Extraordinary Resources Waters, Ecologically Sensitive Waterbodies, or Natural and Scenic Waterways, a general 401 Water Quality Certification is issued along with the 404 Permit. DEQ has determined that these projects have minimum long-term impact on waters of the state. USACE general nationwide permits and general 401 certifications are issued every 5 years and conditions for individual permit requirements may change as the permit renews. Refer to the most current general 401 certification for details.

For projects that do not meet the qualifications for a general nationwide permit, a joint public notice is issued by USACE and DEQ.

Individual 401 water quality certifications are required for projects that have the potential to impact Extraordinary Resource Waters (ERWs), Ecologically Sensitive Waterbodies (ESWs), or Natural and Scenic Waterways (NSWs) of the state.

1.9 Short Term Activity Authorization (STAA)

Designing a project to avoid impacts on a waterbody is encouraged. In instances where impacts are unavoidable, a Short Term Activity Authorization (STAA) is required. A STAA allows for an individual or entity to perform in-stream work that may cause a temporary water quality violation in waters of the state. Any activity, including but not limited to, the entry of machinery, debris removal, bridge construction/demolition, and other activities conducted in any water that might temporarily cause a violation of the Arkansas Water Quality Standards (Rule 2), must be authorized by the DEQ director through a STAA. This authorization does not grant an applicant permission to supersede any other state or federal permitting requirements. A STAA authorization must be obtained prior to beginning in-stream work. The length of each STAA's authorization period is based on the work that is being performed, but will not exceed more than six months. If the covered activity is not completed in the time frame designated in the STAA, the applicant may apply for a new STAA.

STAAs authorized on waters designated as Extraordinary Resource Water (ERW), Ecologically Sensitive Waterbody (ESW), Natural and Scenic Waterway (NSW), those waters on the impaired waterbodies list (303(d)) for turbidity, or with a TMDL for turbidity may have additional sampling requirements depending on the scope of the project.

1.10 Use Attainability Analysis

For each proposal to modify or remove a fishable/swimmable use, a written report will be submitted to the Director of DEQ. This requirement is driven by 40 CFR §131.10(j) of the Water Quality Standards Rule which requires States to conduct a use attainability analysis (UAA) whenever: (1) the State designates or has designated uses that do not include the uses specified in section 101(a)(2) of the Act; or (2) the State wishes to remove a designated use that is specified in section 101(a)(2) of the Act or adopt subcategories of uses specified in section 101(a)(2) that require less stringent criteria. The uses specified in section 101(a)(2) of the Act are commonly referred to as the fishable/swimmable uses.

A UAA is a structured scientific assessment of the factors affecting the attainment of uses specified in Section 101(a)(2) of the Clean Water Act (the fishable/swimmable uses). The factors to be considered in such an analysis include the physical, chemical, biological, and economic use removal criteria described in EPA' s water quality standards regulation (40 CFR 131.10(g)(1)-(6)).

The basic guidance for conducting a UAA can be found in *Technical Support Manual for Conducting Waterbody Surveys and Assessments for Conducting Use Attainability Analyses* (EPA, 1983).

The basic guidance for conducting a UAA of Site Specific Criteria can be found using the following link: https://www.adeq.state.ar.us/water/planning/reports.aspx

1.11 Temporary Variance from Water Quality Standards

A *water quality standards variance* (WQS variance) is a time-limited designated use and criteria for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the WQS variance. Procedures for obtaining a temporary WQS variance must be in accordance with APC&EC Rule 2.309, 40 CFR §131.14, and EPA guidance in the Water Quality Standards Handbook: Second Edition, Chapter 5, Section 5.3 (EPA-823-B-12-002).

1.12 Source Control

1.12.1 Point Source Controls

Point sources are controlled by the National Pollutant Discharge Elimination System (NPDES) permit program delegated to Arkansas by EPA on November 1, 1986; the state permit program which has been in existence since 1949; TMDLs; state WQS; and the Water Quality Management Plan (WQMP, see Chapter 3).

In addition to the NPDES permits program, DEQ also administers the issuance of permits for the construction or physical modification to a wastewater treatment or disposal system. DEQ requires: (1) a permit to be obtained prior to construction or alteration of the treatment system; (2) submission of an acceptable application showing the character of the waste; and (3) submission of plans and specifications concerning the method of treatment to ensure that WQS will not be violated.

1.12.2 Non-Point Source Controls

The Arkansas Department of Agriculture (ADA) administers the Nonpoint Source Pollutant Management Plan with an emphasis on funding BMPs in priority watersheds. More information can be found on the website:
http://www.anrc.arkansas.gov/

1.12.3 Watershed-Specific Requirements

As per APC&EC Rule 6.601, all surface discharges of wastewater in the Lake Maumelle Basin are prohibited, with the exception of discharges permitted under the NPDES stormwater discharge program.

As per APC&EC Rule 6.602, and Rule 5.901, the Director shall not issue a permit or coverage pursuant to Rule 6 for a CAFO in the Buffalo National River Watershed (USGS HUC 11010005) with: (1) 750 or more swine weighing 55 pounds or more; or (2) 3,000 or more swine weighing less than 55 pounds.

1.13 No-Discharge (Land Application and Subsurface) Permits

Under the authority of Ark. Code Ann. § 8-4-203, "No-Discharge" permits are issued for waste disposal systems that do not discharge directly to waters of the state, pursuant to Ark. Code Ann. § 8-4-217(a)(2). These permits include confined animal operations, land application of beneficial waste, waste storage facilities, and underground injection wells (subsurface wastewater disposal systems (under the Arkansas Pollution Control and Ecology Commission's (APC&EC) Rule 17)).

APC&EC Rule 5, Liquid Animal Waste Management Systems, requires all confined animal operations that utilize a liquid waste management system in Arkansas to obtain a permit from DEQ.

Permits are also issued for the land application of beneficial industrial process wastes. To be considered beneficial, land application of the waste must provide agronomic improvement to the application site, such as crop nutrients, soil conditioning, crop irrigation, protection of surface and groundwater, etc. The most common types of beneficial wastes include grease trap wastes, wastewater treatment biosolids, water treatment residuals, wastewater treatment effluent, and food processing wastes.

Land application of wastewater treatment biosolids is subject to the requirements in 40 CFR §503; however, DEQ has the authority to establish more stringent policies. In cooperation with the ADH, DEQ issues permits under authority of APC&EC Rule 17 to facilities that utilize subsurface wastewater disposal, such as septic tanks and leach fields.

Regulatory jurisdiction of a subsurface wastewater disposal system depends on the type and volume of waste.

1.14 Residual Management

Any person or entity engaged in domestic wastewater collection, or treatment processes where domestic wastewater treatment facility solids, biosolids derived products, water treatment residuals, and industrial waste are generated and subsequently land applied or disposed, is required to have either a valid NPDES, No-Discharge, or a Solid Waste Disposal permit that covers this activity.

It is the responsibility of the permittee and licensee to ensure the proper handling of all domestic wastewater treatment facility solids, biosolids and domestic septage. Transportation of domestic treatment facility wastewater solids, biosolids and septage to domestic wastewater treatment facilities; permitted septage pits, ponds or lagoons; or solids land application sites shall be achieved in a manner which prevents leaking or spilling of the solids onto the highways, streets, roads, waterways, or other land surfaces.

The disposition of residual waste from water treatment process is controlled by the issuance of a general permit (ARG640000) for a point source discharge to surface waters. Management of the residuals is included as special condition in the permit issued.

1.15 Intergovernmental Cooperation

The authority that DEQ has under the CWA allows DEQ to develop effective lines of communication and cooperation with other local, state (Division of Heritage and Arkansas Department of Health), and federal (U.S. Fish and Wildlife/Conway Field Office, US Army Corp of Engineers, and US Environmental Protection Agency, Region 6) agencies in order to implement water quality management programs. DEQ coordinates day-to-day intergovernmental relations with municipalities and state and local agencies that become involved with water quality issues and various projects. An agreement by DEQ and EPA Region 6 outlines the relationship between the agencies as they work together to protect the environment and health and safety of the citizens of the state.

Arkansas is authorized to administer federal programs under the CWA. Various grants and state funds, as well as program permitting fees, supplement the federal grant monies received through the CWA Section 106 funding.

DEQ has Memoranda of Agreement or Understanding with many other state and federal agencies including the Missouri Department of Natural Resources, the Oklahoma Department of Energy and Environment, EPA Region 6, the Arkansas Department of Health (ADH), and the Arkansas Department of Agriculture (ADA) which addresses a cooperative agreement concerning the Upper White River Watershed. DEQ coordinates with the ADH on review of plans, specifications, and permit for domestic wastewater treatment system, locating water supply intakes in relation to wastewater discharges in streams and rivers, and monitoring of wells. Section 319 funds under the CWA are used for programs and projects for non-point source management. Section 319 funds support the implementation of the Arkansas Non-point Source Management Program. Funding proposals are used to ensure that the most appropriate projects are selected for funding.

1.16 Construction of Waste Treatment Works

The Construction Assistance Revolving Loan Fund Program (created by Ark. Code Ann. §15-5-900 *et. seq.*) is a major source of federal funds that provided for the construction of wastewater treatment projects, as well as sewage treatment plants, pumping stations, collection, intercept sewers, rehabilitation of sewer systems, and the control of combined sewer overflows.

The ADA administers a program of loans and refinancing for various wastewater treatment needs in the State of Arkansas.

1.17 Compliance Schedules

"Compliance schedule" or "schedule of compliance" is a schedule of remedial measures included in a permit or an order, including an enforceable sequence of interim requirements (for example, actions, operations, or milestone events) leading to compliance with an effluent limit, or other conditions.

(1) **Permitting**. The primary means to be used for controlling municipal, non-municipal, and industrial waste discharges shall be through the issuance of waste discharge permits. Waste discharge permits, whether issued pursuant to the National Pollutant Discharge Elimination System or otherwise, must be written so the discharges authorized will meet the water quality standards. No waste discharge permit can be issued that causes or contributes to a violation of water quality criteria, except as provided in the schedule of compliance. Permittees discharging treated wastes in compliance with the terms and conditions of permits are not subject to civil and criminal penalties on the basis that the discharge violates water quality standards.

(2) General allowance for compliance schedules.
   a. Permits and orders issued by DEQ for existing discharges may include a schedule for achieving compliance with effluent limits and water quality standards that apply to:
      i. Aquatic life uses; and
      ii. Uses other than aquatic life.
   b. Schedules of compliance shall be developed to ensure final compliance with all water quality-based effluent limits and the water quality standards as soon as practicable. DEQ will decide whether to issue schedules of compliance on a case-by-case basis. Schedules of compliance may not be issued for new discharges. Examples of schedules of compliance that may be issued include:
      i. Construction of necessary treatment capability;
      ii. Implementation of necessary best management practices; and
      iii. Completion of necessary water quality studies related to implementation of permit requirements to meet effluent limits.

c. For the period of time during which compliance with water quality standards is deferred, interim effluent limits shall be formally established, based on the best professional judgment of DEQ. Interim effluent limits may be numeric or nonnumeric, or both.
d. Prior to establishing a schedule of compliance, DEQ shall require the discharger to evaluate the possibility of achieving water quality standards via non-construction changes (e.g., facility operation, pollution prevention). Schedules of compliance shall require compliance with the specified requirements as soon as practicable. Compliance schedules shall generally not exceed the term of any permit unless DEQ determines that a longer time period is needed to come into compliance with the applicable water quality standards.
e. DEQ may authorize compliance schedules in accordance with EPA regulations if:
    i. The permittee is not able to meet its waste load allocation in the TMDL solely by controlling and treating its own effluent;
    ii. The permittee has made significant progress to reduce pollutant loading during the term of the permit;
    iii. The permittee is meeting all of its requirements under the TMDL as soon as possible; and
    iv. Actions specified in the compliance schedule are sufficient to achieve water quality standards as soon as possible.

1.18 Determining the Priority of Permit Issuance

1.18.1 Individual Permits

Timely issuance of NPDES permits is crucial to ensuring that appropriate effluent limits and other conditions are in force for each discharger**.** There are many factors that affect the time period for issuing a permit. These factors include, but are not limited to: the characteristics of the discharge; the characteristics of the receiving stream; whether or not DEQ has an acceptable model for the receiving stream or Waste Management Plan (WMP); whether or not DEQ has water quality data on the receiving stream; the location of the discharge in relationship to drinking water intakes, the location of land application area; whether or not a public hearing must be held; the work load of DEQ at the time of application; etc. Therefore, the time it takes to issue a permit can vary greatly between permit applications. DEQ can never guarantee any permit applicant at a certain time period for making a permit decision. Table 1-1 gives the minimum and maximum time periods for the different DEQ steps in processing a permit application after the application was received. Also, general priority for issuance of individual permits not on hold by EPA or for other reasons is:

1. Construction permits
2. New major facilities
3. New minor facilities
4. Modifications of active permits
5. Expiring or administratively continued major facilities

6. Expiring or administratively continued minor facilities

Table 1-1: Ideal NPDES Timeline for Issuing or Renewing an Individual Permit		
Step	Minimum Time in Days	Maximum Time in Days
Administrative Review	1	5
Public notice of the application	10	30
Technical review of application		
Determine limits and permit conditions	30	60
Visit with facility	5	5
EPA review (as required)	0	30
Public notice period	30	30
Draft permit review by the permittee	5	5
Public hearing (if necessary)	30	30
Prepare response to comments	5	15
Issue permit decision	4	10

1.18.2 General Permits

Table 1-2: NPDES Timeline for Issuing or Renewing a General Permit	
Step	Minimum Days Prior to Expiration
Notice of Intent to renew or issue	365*
Public notice	365
Public hearing (if necessary)	180
Issue permit decision	180**

* The Division's notice of intent to renew/not renew a general permit is required to be published by ACA 8-4-203(m)(5)(A)(i) at least 365 days before the expiration of the general permit.
** Reissuance of a general permit is required by ACA 8-4-203(m)(5)(B) at least 180 days prior to its expiration date.

1.19 Enforcement Branch

DEQ issues two types of permits for wastewater treatment facilities. National Pollutant Discharge Elimination System (NPDES) permits require wastewater dischargers to monitor and regulate levels of pollutants discharged from their facilities to the waters of the state by maintaining compliance with required discharge quantities and/or concentrations (effluent limits) for pollutants. The NPDES program relies heavily on self-monitoring and self-reporting by the permittee to determine compliance with effluent limits. In addition to the NPDES program, DEQ's State No-Discharge permits are issued to facilities that treat wastewater but do not have a point-source discharge to the waters of the state, such as drip irrigation treatment systems or CAFO waste lagoons.

DEQ Office of Water Quality's Enforcement Branch is responsible for the tracking and enforcement of both "discharge" and "no discharge" waste systems, as well as relevant regulatory or statutory violations. The Enforcement Branch tracks all self-monitoring reports and Non-Compliance Reports (inspection reports, compliance schedule event reports, Discharge Monitoring Reports (DMR), etc.) required by permits and/or enforcement actions. All Discharge Monitoring Report data is entered into a federally-maintained national data base system known as the Integrated Compliance Information System (ICIS).

The enforcement program relies on well-developed compliance monitoring systems designed to identify and correct violations, help establish an enforcement presence, collect evidence needed to support enforcement actions where there are identified violations, and help target and rank enforcement priorities.

The Enforcement Branch monitors compliance and is responsible for initiating the appropriate level of enforcement action against facilities that have No-Discharge state-issued permits, unpermitted facilities, and NDPES major and minor facilities, including stormwater dischargers permitted to discharge into the waters of the state, coverage under general permits, and industrial users of publicly owned treatment works in cities without an approved local pretreatment program.

An enforcement action is any informal or formal action taken to address the failure to comply with applicable statutes, regulations, rules, plans, policies, or enforcement orders. The Enforcement Branch addresses violations through a variety of mechanisms, including an informal "enforcement action" in the form of a letter stating DEQ is aware of the violation. Corrective courses of action are strongly suggested. Formal enforcement actions are taken if the violation is not resolved or if the violation is deemed Significant Non-Compliance (SNC).

DEQ Office of Water Quality's Enforcement Branch implements and enforces water quality laws, regulations, rules, policies, and plans to protect the waters of the state. Timely and consistent enforcement is critical to the success of the water quality program and to ensure that the people of Arkansas have clean water. The goal of the Enforcement Branch is to protect and enhance the quality of the waters of the state by defining an enforcement process that addresses water quality problems in the most efficient, effective, and consistent manner.

1.20 Wastewater Operator Licensing Program

DEQ Office of Water Quality's Enforcement Branch employees oversee the Wastewater Operator Licensing Program, traveling the state to test and license operators of municipal and industrial wastewater treatment plants. Certain wastewater treatment plant must have a licensed operator to make operational decisions for the plant. The operator must be licensed at an equal or greater classification than the plant's classification. Requirements for the licensing of wastewater treatment plant operators were established by Arkansas Pollution Control and Ecology Commission Rule 3. DEQ posts training opportunities and maintains data searches for licensed wastewater operators in the state.

The following facilities that are not using any chemical in the treatment process(es) are exempt from Rule 3 licensed operator requirements.[3]

1. Quarry operations
2. Wet deck operations
3. All UIC facilities (with the exception of drip irrigation systems)
4. All Salt water disposal facilities
5. Petroleum storage and handling facilities
6. Hydrostatic testing operations
7. Landfarm operations

1.21 Compliance Branch

The field inspectors will conduct timely complaint and compliance site visit inspections and document their finding. Specific activities occurring during the inspections should be documented clearly and reported after the inspection. The field inspectors will not provide site-specific interpretive technical assistance or legal assistance during compliance inspections. Upon completion of an inspection, the Field Inspectors shall communicate with the Permits Branch regarding permit issues or unpermitted site determinations as necessary prior to mailing hard copy of the inspection report to the facility.

1.22 State and Areawide Agencies/Planning

DEQ uses state funds, fee funds, grant funds from CWA §106, and the following methods to ensure a holistic approach to water quality management:

- Annual negotiations with EPA
- Bi-annual development of the Integrated Water Quality Monitoring and Assessment Report (Integrated Report).
- TMDL development and implementation schedule (included in the Integrated Report).
- Implementation of the Clean Water Act
- 208 Plan update
- Water Quality Standards triennial review

DEQ has been designated as the state planning agency on matters pertaining to water quality and will conduct planning on the state level.

The APC&EC establishes rules and regulations for the prevention, control, and abatement of new or existing water pollution. DEQ's Office of Water Quality conducts and

[3] Operator Licensing Requirements Memo dated 11/29/2010 from Office of Water Quality.

coordinates various planning programs initially prescribed under CWA Sections 208 and 209. These programs continue as part of the CPP as mandated under CWA Section 303(e).

In instances of multi-agency planning programs, such as CWA Section 208, DEQ will serve as the reviewing arm of the Office of the Governor in the certification process. CWA Section 208(a)(2), required that the governor of each state identify areas within the state which, as a result of urban-industrial concentrations or other factors, had substantial water quality control problems, including those areas which were located in two (2) or more states. DEQ will coordinate the public participation activities and will provide assistance when possible. Under CWA Section 208, states were required to designate areawide waste treatment management planning agencies and develop plans that include the identification and construction of treatment works needed to meet municipal and industrial needs for a design period of at least 20 years.

Chapter

2

CHAPTER 2 TECHNOLOGY-BASED EFFLUENT LIMITATIONS

2.1 Introduction

Effluent limits specify the amount of pollutants that may be discharged from a permitted facility. Technology-based effluent limitations (TBELs) are based on a technology which is available to treat the pollutants at a reasonable cost pursuant to 40 CFR §122.44 (a). This chapter discusses TBELs. Chapter 4 discusses water quality-based limitations (WQBELs) which are based on the effect of the pollutants in the receiving water pursuant to 40 CFR §122.44 (d).

Figure 2.1 illustrates the general process for developing effluent limitations in an NPDES permit.

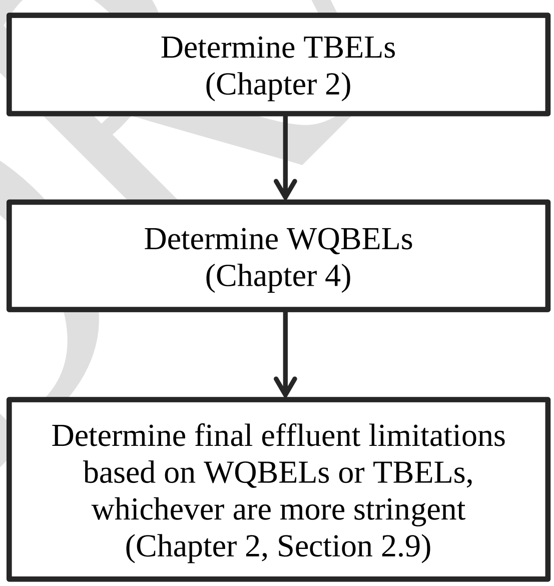

Figure 2.1: NPDES Permit Effluent Limits Development Process Overview

There are currently federal effluent limitation guidelines (ELGs) for 56 industrial categories for industrial dischargers. The effluent guidelines for industrial dischargers are summarized in 40 CFR §§405-471. For municipal dischargers there are TBELs set forth in 40 CFR §133 which are most commonly referred to as the secondary treatment regulations.

There are two general approaches to deriving TBELs. A permit engineer can use the applicable ELGs to derive TBELs, or the permit engineer may use Best Professional Judgement (BPJ) in establishing site-specific TBELs if there are no ELGs applicable for a particular industrial category.

2.2 Levels of Control Technologies in ELGs

- **BPT:** Best Practicable Control Technology currently available. BPT is the first level of technology-based effluent controls for direct dischargers and is applicable to all types of pollutants (conventional, non-conventional, and toxic (priority) pollutants).
- **BCT:** Best Conventional Control Technology. BCT is the level of treatment that succeeds BPT, and is only for conventional pollutants.
- **BAT:** Best Available Technology Economically Achievable. BAT is applicable to non-conventional and toxic (priority) pollutants.
- **NSPS:** New Source Performance Standards. NSPS is applicable to all types of pollutants. The statutory deadline for meeting NSPS requirements is known as the "new source date". The new source date depends on the applicable ELG.
- **PSES:** Pretreatment Standards for Existing Sources. PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs, including incompatibility with the POTW's chosen biosolids disposal methods. PSES for indirect dischargers are technology-based and are analogous to BAT requirements.
- **PSNS:** Pretreatment Standards for New Sources. PSNS have the same function as PSES and are issued at the same time as NSPS. PSNS for indirect dischargers are technology-based and are analogous to NSPS requirements.

NOTE: When applying applicable ELGs, permit writers do not have the authority to extend the statutory deadlines in an NPDES permit; thus, all applicable technology-based requirements (i.e., effluent guidelines and case-by-case limitations based on BPJ) must be applied in NPDES permits without the benefit of a compliance schedule.

2.3 Using ELGs

Use of ELGs should consider the following:

2.3.1 Categorize the Discharger

To be able to use the effluent guidelines, it is necessary to know what kind of processes are being performed at the facility being permitted. There are several sources of information available to a permit engineer to learn about an industry to determine the applicable ELG as follows:

- Table of existing point source categories. Existing point source categories are arranged in alphabetical order and are cross referenced to applicable 40 CFR Parts. This table is Exhibit 5-11 in the EPA 2010 NPDES Permit Writers Manual and subsequent updates.
- SIC code and/or NAICS code for the facility. Some ELGs base their applicability upon the SIC code of the facility (e.g. organic chemical manufacturing).
- EPA's ELG Development Documents. These published documents contain information about the industrial processes that were considered when EPA developed the ELG.
- EPA has industry experts located in Washington, D.C. and in the regional offices. EPA lists these experts in the training manual for the permit writing course, and on the EPA website. The following link to the EPA website contains the most recent contact information about the contacts for each ELG: https://www.epa.gov/eg/forms/contact-us-about-effluent-guidelines
- A site visit of the facility being permitted can be helpful in determining the type of process and applicable ELGs. This inspection is most valuable if the permit engineer has done some background work before the site visit.

2.3.2 Determine Whether Existing or New Source Standards Apply

BPT, BCT, and BAT are applicable to existing sources. NSPS is applicable to new sources. An evaluation will occur to determine which standard is applicable to the facility and the permit decisions will be documented in the fact sheet or statement of basis. See Section 5.2.2.4 of EPA 2010 Permit Writer Manual for more details on making this determination.

2.3.3 Determine Representative Production Rate

Most of the EPA effluent guidelines are mass-based and expressed in terms of allowable pollutant discharge per unit of production (i.e., production normalized) as opposed to flow normalized effluent guidelines that are expressed as concentration limits. Determining production-based limits requires the establishment of a representative production rate. The objective in determining the production for a facility is to develop a single estimate of the long-term average daily production that can reasonably be expected to prevail during the next permit term (In most cases, this is not the design production rate). A representative production rate will be established using the past 2 to 5 years. Using the highest year of production might be an appropriate and reasonable measure of production. In evaluating gross production figures, the number of production days should be considered to derive a production unit per day value. The "average daily production" will be calculated for each of the past 2 to 5 years, and then the highest "average daily production" may be used to apply to the effluent guideline. The derivation of the effluent guidelines incorporates an allowance for the daily and monthly variations. For renewal permits, if it is determined that the representative production rate is within 20% of the production rate used in the previous permit, then the limits may remain unchanged or be adjusted based on a new production rate. If the permittee knows that there will be a significant (20% or greater) increase in production sometime during the course of the new permit, tiered limits may be implemented in a permit to be effective at the time production changes. Alternatively, the permit may be modified before the time of production changes.

2.4 Derive TBELs

The final calculations of the TBELs are performed using the applicable effluent guidelines and production rates. The following subsections describe various processes used for calculating TBELs.

2.4.1 Tiered Discharge Limitations

If production rates are expected to change significantly during the life of the permit, tiered limits may be included as allowed by 40 CFR §122.45(b)(2)(ii)(A)(i). These limits would become effective when production exceeds a threshold value, such as during seasonal production variations. Tiered limits should be used only after careful consideration and only when a substantial increase or decrease in production is likely to occur. Generally, up to a 20 percent fluctuation in production is considered to be within the range of normal variability, while changes in production higher than 20 percent could warrant consideration of tiered limitations. The following example illustrates application of tiered limitations.

<u>Example:</u>

A permittee submits a renewal application with highest production of 50,000 lbs/year. However, the permittee believes that in the next two years their production will increase to 80,000 lbs/year. The permittee could have five sets of limits (Tiers) as follows (20%, 40%, 60%, 80%, and 100% of a production rate of 80,000 lbs/year):

- Tier 1 for production of less than or equal to 16,000 lbs/year
- Tier 2 for production of between 16,001 and 32,000 lbs/year
- Tier 3 for production of between 32,001 and 48,000 lbs/year
- Tier 4 for production of between 48,001 and 56,000 lbs/year
- Tier 5 for production of between 56,001 and 80,000 lbs/year

The effluent limitations for each tier would be calculated based on the highest production within each tier (i.e., 16,000 lbs/year for Tier 1, 32,000 lbs/year for Tier 2, etc.)

2.4.2 Multiple Regulated Processes

If a facility operates multiple processes where each process is covered by a different effluent guideline subcategory, the appropriate technology-based effluent limits for the combined processes can be determined using the building block approach. The building block approach involves determining the technology-based mass limit for each individual process/subcategory, and then combining all the individual calculated mass limits into one mass limit. Exhibit 5-18 on Page 5-36 of the 2010 Permit Writers Manual provides an example building block approach for applying effluent guidelines.

The building block approach can be applied in other circumstances as well. Other situations where the building block approach may be applied are discussed in Sections 2.4.3, 2.4.4, and 2.4.5 below.

2.4.3 Mixture of Mass-Based and Concentration-Based Requirements

The limitations in effluent guidelines for some pollutants are production-normalized, mass-based limitations in some subparts and concentration-based limitations in other subparts. When all the wastewater streams go to the same treatment system, the permit writer would need to convert the concentration-based limitations to mass-based limitations so they could be combined with the production-normalized, mass-based limitations and applied to the combined wastewater streams.

2.4.4 Mixture of Different Concentration-Based Requirements

Some facilities could have multiple operations that are each subject to different concentration-based requirements for the same pollutant but with wastewater streams that combine before treatment. In such a case, a flow-weighted concentration-based limitation may be established as the TBEL for the combined wastewater streams. Alternatively, the concentration-based requirements may be converted to equivalent mass-based requirements using flow data and then the mass-based requirements may be combined into a single limitation for the combined wastewater streams.

2.4.5 Mixture of Regulated and Unregulated Wastewater Streams

In some cases, wastewater streams containing a pollutant regulated by an ELG can combine with other wastewater streams containing a pollutant not regulated by an ELG. In these cases, the permit writer could use BPJ to establish a TBEL for the unregulated wastewater stream(s) and calculate a final TBEL for the combined wastewater stream. For example, if one of the wastewater streams contributing to an industrial facility's discharge is sanitary wastewater, the permit writer could use BPJ to apply the secondary treatment standards for domestic wastewater and calculate BOD_5 (5-day biochemical oxygen demand) mass limitations for that wastewater stream using the concentration-based requirements and an estimate of the flow rate that is expected to represent the flow rate during proposed permit term. A final TBEL for BOD_5 could then be calculated for the combined sanitary and process wastewater streams by combining the two mass limitations using the building block approach.

2.5 Mass and Concentration Limits

Most of the technology-based effluent limitations for industrial facilities are expressed in terms of allowable mass of pollutant per unit of production. In some instances, it is inappropriate to express effluent limitations in terms of mass. This includes limitations for pH, temperature, radiation, or in those cases where the mass of the pollutant discharged cannot be related to a measure of operation (for example if stormwater is commingled with process water). Concentration limits in addition to mass limits are appropriate in some cases to discourage the reduction in treatment efficiency during low flow periods and require proper operation of treatment units at all times. Supplementing mass-based limitations with concentration-based limitations may be especially appropriate where the requirements in the effluent guidelines are flow-normalized (i.e., the effluent guidelines includes a concentration requirement but directs the permit writer to calculate a mass-based TBEL using the concentration requirement and the wastewater flow).

2.6 Internal Outfalls

The NPDES regulations at 40 CFR §122.45(h) provide authorization to identify internal outfalls when effluent limitations at the final outfall are impractical or infeasible. These internal compliance points might be necessary to ensure proper treatment of persistent, bioaccumulative, and toxic pollutants that are discharged in concentrations below analytical detection levels at the final effluent outfall or other pollutants that may be diluted by flows (e.g., cooling water) not containing the pollutant in detectable amounts. Some effluent guidelines may require the use of internal outfalls unless the effluent limitation is adjusted based on the dilution ratio of the process wastewater to the wastewater flow at the compliance point. Examples of effluent guidelines with required internal compliance points include the Metal Finishing effluent guidelines (§433) and the Pulp, Paper, and Paperboard effluent guidelines (§430). Accordingly, any internal outfall monitoring should be identified that might be required by the applicable ELG and appropriate monitoring requirements be included in the final permit.

2.7 Technology-Based Effluent Limitations for Publicly Owned Treatment Works (POTWs)

TBELs for POTWs are set forth in 40 CFR §133. POTWs represent the largest category of dischargers requiring NPDES permits. The federal regulations at 40 CFR §403.3 define a POTW as a treatment works that is owned by a state or municipality, which includes any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature, and also includes sewers, pipes, and other conveyances only if they convey wastewater to a POTW treatment plant.

2.7.1 Secondary Treatment Standards

Table 2-1 summarizes the secondary treatment standards specified in 40 CFR §133.102 for BOD_5 and $CBOD_5$ (5-day carbonaceous biochemical oxygen demand), TSS (total suspended solids), and pH.

Note: Both BOD_5 and $CBOD_5$ standards are shown, but the permit may contain either of these parameters and is not required to contain both.

Table 2-1: Secondary Treatment Standards

Parameter	Monthly Average	7-day Average
BOD_5	30 mg/l	45 mg/l
$CBOD_5$	25 mg/l	40 mg/l
TSS	30 mg/l	45 mg/l
pH	Within the limits of 6.0 – 9.0 s.u.[4]	
BOD_5 (or $CBOD_5$) and TSS removal (concentration)	Not less than 85%	

2.7.2 Equivalent to Secondary Treatment Standards

Some biological treatment technologies, such as trickling filters or waste stabilization ponds, are capable of achieving significant reductions in BOD_5 (or $CBOD_5$) and TSS but might not consistently achieve the secondary treatment standards for these parameters. In 1984, EPA promulgated regulations at 40 CFR §133.105 that include alternative standards that apply to facilities using "equivalent to secondary treatment". A facility must meet all three of the following criteria in 40 CFR §133.101(g) to qualify for application of these alternative standards:

Criteria #1 – Consistently Exceeds Secondary Treatment Standards: The BOD_5 (or $CBOD_5$) and TSS effluent concentrations consistently achievable through proper operation and maintenance exceed the secondary treatment standards. The term "effluent concentrations consistently achievable through proper operation and maintenance" is defined in 40 CFR §133.101(f) as:

1) For a given parameter, the 95^{th} percentile value for the monthly average effluent quality achieved by a treatment works in a period of at least 2 years, excluding values attributable to upsets, bypasses, operational errors, or other unusual conditions; and
2) A 7-day average value equal to 1.5 times the monthly average value derived in item 1 above.

[4] Unless the POTW demonstrates that: (1) inorganic chemicals are not added to the wastestream as part of the treatment process; and (2) contributions from industrial sources do not cause the pH of the effluent to be less than 6.0 s.u. or greater than 9.0 s.u.

Criteria #2 – Principal Treatment Process: The principal treatment process must be a trickling filter or waste stabilization pond (i.e., the largest percentage of BOD and TSS removal is from a trickling filter or waste stabilization pond system).

Criteria #3 – Provides Significant Biological Treatment: The treatment works provides significant biological treatment of municipal wastewater. The regulations at 40 CFR §133.101(k) define significant biological treatment as using an aerobic or anaerobic biological treatment process in a treatment works to consistently achieve a monthly average of at least 65 percent removal of BOD_5.

Each facility should be considered on a case-by-case basis to determine whether it meets these three criteria. If the facility has made substantial changes in its operations or treatment process during the current permit term, best professional judgement (BPJ) may be employed to use data for a period that is representative of the discharge at the time the permit is being drafted. Facilities that do not meet all three criteria are not eligible for equivalent to secondary standards. For such facilities, secondary treatment standards apply.

Table 2-2: Equivalent to Secondary Treatment Standards

Parameter	Monthly Average	7-day Average
BOD_5	45 mg/l	65 mg/l
$CBOD_5$	40 mg/l	60 mg/l
TSS	45 mg/l	65 mg/l
pH	Within the limits of 6.0 – 9.0 s.u.[4]	
BOD_5 (or $CBOD_5$) and TSS removal (concentration)	Not less than 65%	

2.7.3 Adjusted TSS Requirements for Waste Stabilization Ponds

In accordance with EPA regulations adopted in 1974 and revised in 1984, states can adjust the allowable TSS concentration for waste stabilization ponds upward from those specified in the equivalent to secondary standards to conform to TSS concentrations achievable with waste stabilization ponds. 40 CFR §133.103(c) defines "TSS concentrations achievable with waste stabilization ponds" as the effluent concentration achieved 90 percent of the time within a state that are achieving the levels of effluent quality for BOD_5 specified in the equivalent to secondary standards. To qualify for an adjustment up to as high as the maximum concentration allowed, a facility must use a waste stabilization pond as its principal process for secondary treatment and its operation data must indicate that it cannot achieve the equivalent to secondary standards. EPA published approved alternate TSS requirements for Arkansas in the September 20, 1984 federal register. The alternate TSS requirement for Arkansas is 90 mg/l based on a monthly average.

For new stabilization pond systems where no data yet exists to evaluate Criteria #1 in Section 2.7.2, the secondary treatment standard for BOD_5 or $CBOD_5$ (30 mg/l or 25 mg/l, respectively, for the monthly average) and the adjusted TSS equivalent to secondary standards for TSS (90 mg/l monthly average) are applied, if the water quality model supports these limits. At the next permit renewal, the effluent data should be evaluated to determine if the facility is still eligible for continuing the adjusted TSS standard or if lower limits are required.

2.8 Mass Limits for POTWs

40 CFR §122.45(b)(1) requires using the design flow of a POTW to calculate mass limitations. The following equation is used to calculate the mass limit of a POTW:

$$\text{Mass (lb/day)} = \text{Design Flow (MGD)} \times \text{Concentration (mg/l)} \times 8.34$$

2.9 TBELs vs. WQBELs

The permit development process for both POTWs and industrial dischargers consists of deriving TBELs as required in 40 CFR §122.44(a), then a determination whether, after application of the TBELs, the discharge will cause, have the reasonable potential to cause, or contribute to an excursion above a narrative or numeric criterion within a state water quality standard (WQS). If it is determined that the TBELs will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, WQBELs which are more stringent than the TBELs are developed as required in 40 CFR §122.44(d). The permit includes final effluent limitations, which represent the more stringent of the TBELs and WQBELs, that implement all applicable technology and water quality standards in the permit. The permit's fact sheet or statement of basis documents the decision-making process for deriving the TBELs and/or WQBELs and establishing permit conditions pursuant to 40 CFR §§124.7, 124.8, and 124.56.

Chapter

3

Chapter 3 WATER QUALITY MANAGEMENT PLAN (WQMP)

DEQ maintains a WQMP in accordance with Section 208 of the Clean Water Act. These requirements are codified in 40 CFR §130.6. The terms WQMP and 208 Plan refer to the same document, and these terms are used interchangeably throughout this chapter.

At minimum, the following items are included in the WQMP:

1) Permittee's name
2) Permit number
3) Planning segment where the discharge is located
4) Receiving stream
5) Monthly average (unless otherwise specified) effluent limits for parameters derived with a model (BOD_5, $CBOD_5$, TSS, NH_3-N, DO (Inst. Min.))
6) Effluent flow limits (if applicable) based upon a Hydrograph Controlled Release (HCR)
7) Monthly average (unless otherwise specified) effluent limits for Total Phosphorus, if applicable
8) Instantaneous Maximum effluent limits for Total Residual Chlorine (if applicable)
9) Other parameters based on studies
10) Approximate area of watershed
11) 7Q10 flow of applicable receiving stream
12) Link to latest modeling analysis
13) Total Loads established by TMDL for each Assessment Unit (Total Maximum Daily Load, Wasteload Allocation, Load Allocation, Margin of Safety, and Future Growth); and individual permit limits established by TMDL.
14) Latest dates of the following actions: 208 Plan update public notices, 208 updates sent to EPA for review, 208 updates technically accepted by EPA, Governor Certifications sent to EPA, and EPA approval of Governor's Certification.

3.1 Updating the WQMP

The WQMP will be updated to add new facility information or revise existing facility information as necessary. The procedures in this section should be followed to ensure that the WQMP (if applicable) is consistent with permits. 208 Plan reviews may include a previous model or an updated model to ensure compliance with the in-stream DO standards listed in APC&EC Rule 2.505. 208 Plan reviews may also use APC&EC Rule 6 or a TMDL. Modeling can be performed by DEQ staff or a qualified person of the permit applicant's choice. Modeling results must be technically accepted by EPA Region 6 in accordance with the procedures in this section.

Wasteload allocations (WLAs) for facilities with discharge flows less than or equal to 0.1 MGD, which are developed using Streeter-Phelps modeling or APC&EC Rule 6, will be considered technically acceptable without EPA Region 6 review.

WLAs which are developed using Streeter-Phelps modeling for facilities with discharge flows greater than 0.1 MGD are included in a WQMP update, and will be submitted to EPA Region 6 via email for technical review. EPA may acknowledge via email to DEQ the receipt of a submitted modeling package and the status of its review. EPA will provide a technical review response to these submittals to DEQ within 30 days of receipt of a complete modeling package. If an EPA response is not received within 30 days, the WLA(s) will be considered technically acceptable as submitted. Technically acceptable WQMP updates for individual facility WLAs derived using Streeter-Phelps modeling, and any other 208 updates that involve updates to effluent limits contained in the 208 Plan, will be public noticed for a 30 day comment period when the draft permit is public noticed, either in the same public notice or a separate public notice. Following the completion of the public notice for the WQMP update, responding to any comments received, and receiving technical acceptance from EPA Region 6 for any changes from the originally submitted update, DEQ will perform the WQMP update, at which time the WLAs included in the WQMP update will be immediately effective for use in the permit. The final step in the WQMP update process consists of the DEQ Director, on behalf of the Governor, sending a Governor certification letter to EPA Region 6 for formal approval listing the WQMP updates that were public noticed and made since the previous Governor certification.

The procedures stated above will not apply to situations concerning development of a TMDL for an impaired waterbody. In cases where a TMDL is developed and public noticed, the public notice will also include the proposed WQMP update to include the associated allocations set forth in the TMDL. When the TMDL is approved by EPA, the TMDL is to be automatically incorporated into the WQMP with the associated WLAs for applicable facilities. The approval of the TMDL will be considered equivalent of a WQMP update approval and Governor certification. Consequently, approved TMDLs will be immediately effective for implementation in NPDES permits and not be required to be included in the Governor certifications.

3.2 Developing Oxygen Demanding Water Quality Effluent Limitations

Effluent limits for all oxygen demanding wastewater discharges shall be developed to maintain the DO standards (APC&EC Rule 2.505) for the receiving waters and to meet requirements listed in Rule 6. Limits shall include total suspended solids (TSS) (for most discharges) and BOD_5 (or $CBOD_5$ if there is an ammonia limit). Ammonia nitrogen (NH_3-N) and effluent DO shall be included if applicable. Effluent concentrations from water quality models will be utilized as the dischargers monthly average limits for BOD (or

CBOD) and NH_3-N (if applicable) and instantaneous minimum DO for typical situations where the assimilative capacity is based on modeling at critical conditions (7Q10).

3.2.1 Reservoirs/Lakes

Effluent limits for domestic wastewater discharging directly to a lake or reservoir are mandated in APC&EC Rule 6.401.

3.2.2 Streams and Rivers

Effluent limits for oxygen demanding sources discharging to a stream are determined via DO modeling. The instream DO standard for the receiving stream is determined from APC&EC Rule 2.505.

3.3 Guidance for DO Modeling

General guidance for DO modeling can be found in the following documents (or latest revisions):

- “Memorandum of Agreement Between U.S. Environmental Protection Agency and Arkansas Department of Environmental Quality” (MOA), concerning dissolved oxygen modeling procedures.
- “Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication,” EPA 823/B-97-002, March 1997.
- “Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling (Second Edition),” EPA/600/3-85-040, June 1985.
- Textbooks or other published literature.
- Observed site specific input values, if available.
- Sections 3.3.1 through 3.3.4 of this CPP document.

Specific values of model coefficients that are presented in the following subsections of this CPP are from the MOA referenced above. These values are general guidance (not absolute requirements) to be considered along with the 1997 and 1985 EPA modeling documents listed above. Alternative site-specific coefficient values may be considered on a case-by-case basis with appropriate justification.

3.3.1 Carbonaceous Decay Rates (K_d)

CBOD Decay Rates (K_d rates) (at 20 °C) of 0.5-0.8 per day will be used in small streams (7Q10 < 100 cfs) with generally rocky substrates. The higher values within the range may be assigned to streams with high stream slopes. Decay rates of 0.3-0.4 per day will be used for small streams with sandy substrates. Values less than 0.3 per day will be used in larger streams or rivers (7Q10 > 100 cfs) due to dilution ratios. Recommended K_d values (at 20 °C) for larger streams or rivers based on level of treatment are 0.2 per day for secondary treatment and 0.1 per day for advanced treatment. Deviations from these rates may be allowed with appropriate justification such as BOD time series data for that discharge or for similar discharges.

3.3.2 Reaeration Rates (K_a)

Reaeration rates (K_a rates) used in computer modeling can be derived from numerous formulas, most of which incorporate stream depth and velocity or stream velocity and slope. The "Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling" manual [EPA/600/3-85/040] (EPA 1985) provides guidance on reaeration equations, including ranges of depths and velocities for which different equations are recommended. Numerous equations for estimating a stream's reaeration rate have been developed and are presented in the 1985 EPA manual. Reaeration rates used in computer modeling can be either manually entered or computed using an equation presented in the 1985 EPA manual. The O'Connor-Dobbins formula, using stream depth and velocity, and the Tsivoglou formula, incorporating slope and velocity, are two of the most commonly used equations used to derive reaeration rates. Any deviations from using reaeration rates derived from these equations will be justified on a case by case basis in the documentation submitted to EPA. In addition, all reaeration rates greater than 12/day (at 20°C) will be justified by inclusion of pertinent stream data such as stream slope, velocity, or other factors that might create a higher K_a. In most situations the reaeration rate will be less than or equal to 12/day (at 20°C).

One of the commonly used equations was developed by E.C. Tsivoglou and is shown in equation below:

$$K_a = 16.38(C)(Slope)(Velocity)$$

Where:

K_a	=	Reaeration rate at 20 °C (1/day)
C	=	Escape Coefficient
	=	0.11 when stream flow < 10 cfs
	=	0.079 when stream flow ≥ 10 cfs and < 25 cfs
	=	0.054 when stream flow ≥ 25 cfs
$Slope$	=	Stream slope (feet/mile)
$Velocity$	=	Stream velocity (feet/second)

Another commonly used equation for estimating a stream's reaeration rate is the O'Connor-Dobbins formulation shown in the following equation:

$$K_a = \frac{12.9U^{0.5}}{H^{1.5}}$$

Where:

K_a = Reaeration rate at 20 °C (1/day)
U = Stream velocity (feet/second)
H = Stream depth (feet)

3.3.3 Nitrogenous Decay Rates (K_n)

Nitrogenous Decay Rates (K_n) used in modeling will generally be in the 0.3-0.4 per day range for most Arkansas streams (shallow, rocky bottom substrate). K_n values of 0.1-0.2 per day will be used in the major rivers of the state which have large flows, high stream depths, or sand, silts or clay substrates. Deviations from these rates may be allowed with appropriate justification such as nitrogenous BOD (NBOD) time series data, instream calibration data for the waterbody of interest, or approved modeling for similar waterbodies.

3.3.4 Sediment Oxygen Demand (SOD) Rates

Table 3-1 provides the SOD demand for most Arkansas streams based on projected instream TSS after mixing and the type of substrate at water temperature of 20°C. These values are corrected to the temperature used in the model using the Arrhenius relationship shown in Section 3.3.5 if the model used does not convert automatically. For example, the MultiSMP model does not convert automatically and the user must correct these SOD rates to the modeled temperature for input into the model.

<table>
<tr><th colspan="7">Table 3-1: Sediment Oxygen Demand (SOD) for Various Temperatures and Ecoregions[5]</th></tr>
<tr><th colspan="6">Rocky Substrate[4]</th><th>Applicable Ecoregions[6]</th></tr>
<tr><td>TSS[1]</td><td>SOD_{20}</td><td>SOD_{22}</td><td>SOD_{29}</td><td>SOD_{30}</td><td>SOD_{31}</td><td rowspan="6">Ozark Highlands
Boston Mountains
Ouachita Mountains</td></tr>
<tr><td>15[2]</td><td>0.3</td><td>0.34</td><td>0.51</td><td>0.54</td><td>0.57</td></tr>
<tr><td>20[2]</td><td>0.5</td><td>0.56</td><td>0.84</td><td>0.90</td><td>0.95</td></tr>
<tr><td>30[2]</td><td>1.0</td><td>1.12</td><td>1.69</td><td>1.79</td><td>1.90</td></tr>
<tr><td>45[3]</td><td>1.4</td><td>1.57</td><td>2.37</td><td>2.51</td><td>2.66</td></tr>
<tr><td>90[3]</td><td>1.8</td><td>2.02</td><td>3.04</td><td>3.22</td><td>3.42</td></tr>
<tr><th colspan="6">Mixed Substrate</th><td rowspan="7">Arkansas River Valley
Gulf Coastal Plain</td></tr>
<tr><td>TSS[1]</td><td>SOD_{20}</td><td>SOD_{22}</td><td>SOD_{29}</td><td>SOD_{30}</td><td>SOD_{31}</td></tr>
<tr><td>15[2]</td><td>0.4</td><td>0.45</td><td>0.68</td><td>0.72</td><td>0.76</td></tr>
<tr><td>20[2]</td><td>0.7</td><td>0.79</td><td>1.18</td><td>1.25</td><td>1.33</td></tr>
<tr><td>30[2]</td><td>1.3</td><td>1.46</td><td>2.20</td><td>2.33</td><td>2.47</td></tr>
<tr><td>45[3]</td><td>1.6</td><td>1.80</td><td>2.70</td><td>2.87</td><td>3.04</td></tr>
<tr><td>90[3]</td><td>1.9</td><td>2.13</td><td>3.21</td><td>3.40</td><td>3.61</td></tr>
<tr><th colspan="6">Sandy Substrate[4]</th><td rowspan="7">Arkansas River Valley
Gulf Coastal Plain
Delta</td></tr>
<tr><td>TSS[1]</td><td>SOD_{20}</td><td>SOD_{22}</td><td>SOD_{30}</td><td>SOD_{31}</td><td>SOD_{32}</td></tr>
<tr><td>15[2]</td><td>0.5</td><td>0.56</td><td>0.90</td><td>0.95</td><td>1.01</td></tr>
<tr><td>20[2]</td><td>0.8</td><td>0.90</td><td>1.43</td><td>1.52</td><td>1.61</td></tr>
<tr><td>30[2]</td><td>1.5</td><td>1.69</td><td>2.69</td><td>2.85</td><td>3.0</td></tr>
<tr><td>45[3]</td><td>1.8</td><td>2.02</td><td>3.22</td><td>3.42</td><td>3.62</td></tr>
<tr><td>90[3]</td><td>2.0</td><td>2.25</td><td>3.58</td><td>3.80</td><td>4.02</td></tr>
</table>

1 Projected TSS instream after mixing.

2 TSS values are from MOA with EPA concerning dissolved oxygen modeling. SOD values for rocky substrate are the lower end of range given in the MOA. SOD values for sandy substrate are the upper end of range given in the MOA.

3 These TSS concentrations are outside of the range given in the MOA, so the corresponding SOD values are estimated.

4 SOD values given in this table are the lower and upper ends of the recommended range. SOD values between the upper and lower values are acceptable based on nature of substrate.

5 Deviations from these rates may take place in situations of high instream dilution, which significantly reduces the impact of the benthal (sediment) deposits on oxygen consumption. In these situations, justification on a case by case basis will be provided in the documentation submitted to EPA.

6 Applicable ecoregions are based on the general characteristics of waterbodies within each ecoregion (Rocky, Gravel, or Mixed). A different substrate type may be used based on site specific observations of the particular stream in question.

3.3.5 Temperature

Temperature affects the rate at which reactions proceed. In accordance with Rule 2.505, models are performed at maximum allowable temperature standards given in Rule 2.502 for critical season and at 22°C during primary season. Reaction rates are generally expressed in units of: 1/day at 20°C. If the reactions are occurring at a temperature other than 20°C, then the reaction rates must be corrected for the new temperature. The most commonly used expression to adjust reaction rates for temperature is the modified Arrhenius relationship shown in the equation below:

$$K_T = (K_{20°\mathrm{C}})\Theta^{(T-20)}$$

Where:
K_T = Reaction rate at the new temperature (1/day)
$K_{20°\mathrm{C}}$ = Reaction rate at 20 °C (1/day)

The Θ values for each of the reaction rates vary slightly from reference to reference, but those used in the MultiSMP modeling analysis are 1.024 for K_a, 1.047 for K_d, and 1.080 for K_n. Sediment oxygen demand rates are manually entered into MultiSMP for the stream temperature being modeled because MultiSMP does not automatically temperature-correct the SOD rate.

3.3.6 Effect of Aquatic Plants on Dissolved Oxygen (DO)

Effects on DO due to the presence of aquatic plants (e.g., algae or macrophytes) are usually not considered. However, the difference between total daily productivity and total daily respiration (P-R) can be directly input to some models such as MultiSMP. In other models such as QUAL-TX and LA-QUAL, constant concentrations of chlorophyll *a* can be specified. Appropriate documentation is needed to include the effects of aquatic plants on DO.

3.3.7 Model Uncertainty

An allowance of 0.2 mg/L DO depression below the water quality criterion may be acceptable to account for uncertainty in a steady state uncalibrated dissolved oxygen model.

3.3.8 Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)

Carbonaceous biochemical oxygen demand ($CBOD_5$) is a measure of oxygen demand in receiving waters. Most oxygen-demanding discharges have permit limits for $CBOD_5$ or BOD_5. These limits are either technology-based limits or water quality-based limits from DO modeling, whichever is more stringent. The model commonly used to predict the dissolved oxygen deficit from CBOD is the Streeter-Phelps equation. However, other modeling could be used.

3.3.9 Ultimate CBOD ($CBOD_u$) to 5-day ($CBOD_5$) Ratio

The effluent $CBOD_u$ to $CBOD_5$ ratio is required in dissolved oxygen modeling to to convert model output (as $CBOD_u$) to permit limits (as $CBOD_5$). The ratio typically used is 2.3 for municipal/domestic wastewater based on the range of values reported in Appendix A of "Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical

Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication," EPA 823/B-97-002, March 1997.

The $CBOD_u$ to $CBOD_5$ ratio of industrial wastewater is highly dependent on the type of industry manufacturing processes, treatment schemes or operation, and other factors. For industrial wastewater, the $CBOD_u$ to $CBOD_5$ ratio used in the model is typically derived from previously approved models for the facility, actual test data of the facility effluent, data from a similar type of process from another facility, or published document(s) for that industry.

3.3.10 Model Theory

At the outfall, CBOD of the river/wastewater mixture (L_0) is given by:

$$L_0 = \frac{Q_r L_r + Q_w L_w}{Q_r Q_w}$$

Where:

L_0 = Ultimate CBOD at the point of waste discharge
Q_r = Flow in the river upstream of the discharge
L_r = Ultimate CBOD of the river water
Q_w = Flow of the wastewater from the discharge
L_w = Ultimate CBOD in the discharged wastewater

As time passes (i.e., the water moves downstream) the oxygen content of the river water is consumed in the same way oxygen is consumed in the CBOD test. CBOD (L_0) in a river at time (t) is given by:

$$L_t = L_0 * e^{(-K_d t)}$$

where K_d is the deoxygenation constant that can be adjusted for temperature using the modified Arrhenius equation shown in Section 3.3.5. If an average velocity or flow is known, the CBOD for a given distance downstream and how much DO remains can be calculated, which depends both on the rate of deoxygenation (K_d) and on the rate of reoxygenation or reaeration (K_a).

3.3.11 Streeter-Phelps Equation:

The modeling is based on the Streeter-Phelps dissolved oxygen deficit equation and the organic demand found in the waterbody sediment. The equation below shows the Streeter-Phelps relationship with the additional components to account for nitrification and SOD:

$$D_t = DO_{sat} - DO_t$$

$$D_t = \left(\frac{K_d \times \mathrm{CBOD_u}}{K_a - K_d}\right)\left(e^{-K_d \times t} - e^{-K_a \times t}\right) + \left(\frac{K_n \times \mathrm{NBOD_u}}{K_a - K_n}\right)\left(e^{-K_n \times t} - e^{-K_a \times t}\right) + \left(\frac{\mathrm{SOD}}{K_a \times H}\right)\left(1 - e^{-K_a \times t}\right) + D_0 \times e^{-K_a \times t}$$

Where:

D_t	=	Dissolved oxygen deficit (mg/l) at location downstream with travel time of t (days)
DO_{sat}	=	Dissolved oxygen concentration at saturation (mg/l)
DO_t	=	Dissolved oxygen conc. (mg/l) at location downstream with travel time of t (days)
$\mathrm{CBOD_u}$	=	Ultimate carbonaceous BOD of the stream immediately after mixing (mg/l)
$\mathrm{NBOD_u}$	=	Ultimate nitrogenous BOD immediately after mixing
	=	$4.57 \times$ Ammonia N (mg/l)
K_a	=	Reaeration rate constant (1/day)
K_d	=	CBOD decay rate constant (1/day)
K_n	=	NBOD decay rate constant (1/day)
SOD	=	Sediment oxygen demand (g/m^2/day)
H	=	Average water depth (m)
D_0	=	Dissolved oxygen deficit immediately after mixing (mg/l)

The impact of CBOD is determined at the critical stream flow condition. The critical stream flow condition is usually the 7-day average low flow with a recurrence interval of 10 years (7Q10).

To plot DO versus distance downstream, the following equation is used at each point:

$$D_t = DO_{sat} - DO_t$$

The resulting plot is called an oxygen sag curve.

Since the CBOD is decreasing as time goes on, at some point, the rate of deoxygenation becomes less than the rate of reaeration. At this point the DO reaches a minimum (called the critical point). Downstream of the critical point, reaeration begins to occur faster than deoxygenation, so the DO begins increasing.

Using calculus and the Streeter-Phelps equation, critical time or distance can be solved iteratively:

$$\left(\frac{K_d \times CBOD_u}{K_a - K_d}\right) K_d e^{-K_d \times t_c} + \left(\frac{K_n \times NBOD_u}{K_a - K_n}\right) K_n e^{-K_n \times t_c} = \left(\frac{K_d \times CBOD_u}{K_a - K_d} + \frac{K_n \times NBOD_u}{K_a - K_n} + \frac{SOD}{K_a - 1} - D_0\right) K_a e^{-K_a \times t_c}$$

K_R = Reaeration rate (1/day)
K_D = Deoxygenation rate (1/day)
D_0 = Initial dissolved oxygen deficit (g/m^3)
L_0 = Initial Oxygen Demand or Ultimate CBOD (g/m^3)

3.3.12 Stream Hydraulic Values (Velocity, Width, and Depth)

Stream hydraulic values to input into the model are commonly derived using power function equations. Power functions may be developed relating flow with velocity, depth, and width. These equations take on the form as follows:

$$\text{Velocity} = aQ^d$$

$$\text{Depth} = bQ^e$$

$$\text{Width} = cQ^f$$

Where:

a, b, c are coefficients for the stream
d, e, f are exponents defining the basic relationships

Recognizing that stream flow is the product of cross sectional area and velocity, and that cross sectional area is the product of width and depth, it can be shown that the sum of the exponents, $d + e + f = 1$, and that the product of the coefficients, $a \times b \times c = 1$. Using these relationships, the hydraulic values (velocity, width, and depth) used in modeling are normally calculated using one of the following sets of power function equations. The appropriate set of equations is chosen based on expected stream depth or width at the given streamflow. Field verification or aerial photo software such as Google Earth or equivalent can be used to estimate the expected stream width at the discharge location under evaluation to help choose an appropriate set of equations that best represent the stream.

Equation Set 1 (Small Streams with Q < 0.31 cfs):

$\text{Velocity (fps)} = 0.085Q^{0.6}$
$\text{Depth (ft)} = 0.751Q^{0.3}$
$\text{Width (ft)} = 15.665Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 2 (Slow and Deep Streams with Q > 0.31 cfs):

Velocity (fps) $= 0.025396Q^{0.5}$
Depth (ft) $= 0.8523684Q^{0.4}$
Width (ft) $= 46.1963Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 3 (Streams with below average velocity and depth with Q > 0.31 cfs):

Velocity (fps) $= 0.0491357Q^{0.5}$
Depth (ft) $= 0.659186Q^{0.4}$
Width (ft) $= 30.8741Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 4 (Streams with average velocity and depth with Q > 0.31 cfs):

Velocity (fps) $= 0.07232Q^{0.5}$
Depth (ft) $= 0.5677Q^{0.4}$
Width (ft) $= 24.355Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 5 (Streams that are slightly faster and shallower than average with Q > 0.31 cfs):

Velocity (fps) $= 0.0739796Q^{0.5}$
Depth (ft) $= 0.5353916Q^{0.4}$
Width (ft) $= 25.2474Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 6 (Streams that are faster and shallower than average with Q > 0.31 cfs):

Velocity (fps) $= 0.088886Q^{0.5}$
Depth (ft) $= 0.492814Q^{0.4}$
Width (ft) $= 22.8288Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 7 (Fastest and shallowest streams with Q > 0.31 cfs)

Velocity (fps) $= 0.114282Q^{0.5}$
Depth (ft) $= 0.4352519Q^{0.4}$
Width (ft) $= 20.104Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

The following hydraulic equations may be used for the following larger rivers (generally > 100 cfs):

Equation Set 8 (Arkansas River):

Velocity (fps) $= 0.01Q^{0.5}$
Depth (ft) $= 0.1667Q^{0.4}$
Width (ft) $= 600Q^{0.1}$

Where:

Q = Streamflow (cfs), including discharger

Equation Set 9 (Ouachita River, Black River, White River, Red River):

Velocity (fps) $= 0.04526Q^{0.4}$
Depth (ft) $= 0.7Q^{0.27}$
Width (ft) $= 31.5657Q^{0.33}$

Where:

Q = Streamflow (cfs), including discharger

3.4 Total Suspended Solids (TSS)

Total suspended solids (TSS) can cause turbidity/reduced clarity in waterbodies and it can also impact the benthic environment if it settles. The organic portion of TSS can create an oxygen demand in the water column or on the bottom of the stream if it settles. Oxygen demand from TSS in the water column will already be accounted for by BOD analyses of unfiltered samples. In order to comply with WQS, TSS limits may be necessary in the permit. TSS limits in the permit are as follows:

1) For domestic wastewater, DEQ will typically issue TSS limits 1-2 times the BOD_5 limits. Minimum and maximum TSS limits issued will be 15 mg/l and 30 mg/l, except in special cases such as discharge to a large stream where dilution ratios are greater than 100:1, or in cases where higher limits have previously been set in a prior permit and the dissolved oxygen model supports the previously set TSS limits based on the corresponding sediment oxygen demand (SOD) value from Section 3.3.4 that is used in the model.

2) For municipal (POTW) wastewater, the secondary treatment regulations in 40 CFR §133 will be followed to establish permit limits for TSS, provided that the dissolved oxygen model supports the secondary treatment TSS limits based on the corresponding sediment oxygen demand (SOD) value from Section 3.3.4 that is used in the model. For more details on this subject see Section 2.6.

3) For industrial wastewater, TSS limits will be set on a case-by-case basis.

3.5 Ammonia Nitrogen (NH_3-N)

Ammonia nitrogen permit limits will be set to the most stringent of the following three quantities: (1) technology based limits (if applicable); (2) effluent concentrations necessary to meet instream dissolved oxygen standards based on dissolved oxygen model projections; or (3) concentrations necessary to prevent instream toxicity based on APC&EC Rule 2.512. Ammonia toxicity calculations are discussed in more detail in Chapter 4.

3.6 Effluent Limitations in WQMP

The effluent limitations in the WQMP normally represent the monthly average limits, except for dissolved oxygen (normally expressed as an instantaneous minimum) and total residual chlorine (normally expressed as an instantaneous maximum). Any deviations from these standard practices will be noted in the WQMP for that particular limit.

Chapter

4

Chapter 4 WATER QUALITY-BASED EFFLUENT LIMITATIONS

Effluent limits may be based on the technology which is available to treat the pollutants at a reasonable cost (technology-based) pursuant to 40 CFR §122.44(a), or they may be based on the effect of the pollutants in the receiving water (water quality-based) pursuant to 40 CFR §122.44(d), whichever is more stringent. Technology-based effluent limitations (TBELs) are covered in Chapter 2. Figure 4.1 illustrates the general process for developing effluent limitations in an NPDES permit.

Determine TBELs
(Chapter 2)

↓

Determine WQBELs
(Chapter 4)

↓

Determine final effluent limitations
based on WQBELs or TBELs,
whichever are more stringent
(Chapter 2, Section 2.9)

Figure 4.1: NPDES Permit Effluent Limits Development Process Overview

This chapter discusses the development of water quality-based effluent limits pursuant to APC&EC Rule 2.

4.1 Water Quality Standards and Criteria

Any discharge to waters of the State must meet the requirements of Arkansas's Water Quality Standards (WQS), as amended. Water quality standards are provisions of APC&EC Rule 2 approved by EPA that describe the desired condition of a waterbody or the level of protection or mandate how the desired condition will be expressed or established for such waters in the future.Water quality standards have three components:

- Designated Uses of the waterbody,
- Criteria to protect designated uses, and
- Antidegradation Requirements to protect existing uses and high-quality waters

Water quality criteria (referred to as "criteria") is the basis for water quality effluent limits that are included in NPDES. Permits. Criteria can be numeric (e.g., the maximum pollutant concentration levels permitted in a waterbody) or narrative (e.g., criteria that describes the desired conditions of a waterbody being "free from" certain negative conditions).

Water quality effluent limits are based on in-stream water quality criteria. The conversion from water quality criteria to effluent limits considers the receiving water flows available for dilution, mixing zone restrictions, upstream concentrations of substances, and the variability associated with the parameter discharged. Many of the numeric criteria values are dependent on other water quality parameters such as pH, temperature, and hardness. Water quality criteria may be based on acute, chronic, or human health assumptions.

The types of pollutants addressed are:

- **Toxic pollutants:** sometimes referred to as "priority pollutants." EPA identified 129 pollutants from the 65 families of pollutants specified in Section 307(a) of the Clean Water Act. These pollutants are listed at 40 CFR §423, Appendix A.
- **Conventional pollutants:** the five pollutants as defined by Section 304(a)(4) of the Clean Water Act and listed at 40 CFR §401.16. Those are:
    - Biochemical oxygen demand (BOD) or other oxygen demands,
    - Total suspended solids (non-filterable) (TSS),
    - pH,
    - fecal coliform bacteria (FCB) or other bacteria indicators, and
    - oil and grease (O&G).
- **Nonconventional pollutants:** any pollutant not already defined as a toxic or conventional pollutant.

4.2 Post-Third Round NPDES Permit Implementation Strategy

Over the history of the NPDES permit program, EPA has focused on two primary concepts to abate the discharge of pollutants. First, EPA has utilized a technology-based control approach. This was reflected in permits originally issued with requirements for secondary treatment (municipalities) and BPT (industries). More recently permits have required implementation of the BCT, BAT (industries) and pretreatment program development (municipalities). Secondly, EPA has addressed water quality as impacted primarily by conventional (or oxygen demanding) parameters. This has occurred through the use of specific state WQS (and the resulting Water Quality Management Plans) for specific pollutants. EPA Region 6 moved into the “third round” of NPDES permits in 1987. The focus of these "post BAT" permits was to move beyond the first two phases of control and insure that adequate controls are being implemented to confirm that human health and aquatic life are being adequately protected on a site-specific receiving stream basis. EPA Region 6 developed its third round policy on March 11, 1987, adopted a strategy to implement this policy on April 1, 1987, and revised this policy on October 31, 1989. On October 1, 1992 and in support of the National Policy, EPA Region 6 adopted a policy for Post Third Round NPDES permitting. DEQ has adopted EPA Region 6 *“Post-Third Round Permitting Strategy”* as an implementation procedure. The following sections describe the strategy used to assure that a discharge meets the requirements of these procedures.

4.3 Analytical Method Sensitivity and Reporting

For the purposes of this document, “Minimum Quantitation Limit” (MQL) is synonymous with the following terms related to analytical method sensitivity: “minimum quantification limit”, “minimum level,”[5] “quantitation level”, “reporting limit”, “level of quantitation”, and “limit of quantitation.”

Minimum Quantitation Limit (MQL) refers to either the sample concentration corresponding to the lowest calibration point in a method **or** a multiple of the method detection limit (approximately 3 × method detection limit), whichever is higher. At the MQL, the lab can confidently qualitate and quantitate a target analyte. Any values below the MQL are considered “estimated.”

The method detection limit is defined as “the minimum concentration of a substance that can be measured and reported with 99% confidence that the measured concentration is distinguishable from method blank results.”[6] In other words, the method detection limit is the lowest concentration the lab can determine a substance is present. However, the lab cannot accurately measure the amount present at the method detection limit concentration. The method detection limit is a statistical determination using results of analysis of replicate samples spiked at very low values and this limit may vary from lab to lab.

“Sufficiently sensitive” EPA approved analytical methods capable of detecting and measuring pollutants at, or below, the <u>Required Minimum Quantitation Limit (MQL)</u> are mandatory. An EPA approved method is considered “sufficiently sensitive” where one of the following criteria (A, B, or C) is met:

A. The laboratory <u>Achieved MQL</u> ≤ the <u>Required MQL</u>; or
B. The laboratory <u>Achieved MQL</u> > the <u>Required MQL</u>, **but** the amount of the

[5] Term for Minimum Quantitation Limit (MQL) as used in the 40 CFR.
[6] Appendix B to 40 CFR §136, Method Update Rule, August 7, 2017.

pollutant in a facility's discharge is high enough that the method detects and quantifies the level of the pollutant; or

C. The method has the lowest MQL of the analytical methods approved under 40 CFR §136 or required under any applicable effluent limit guideline (ELG) found in 40 CFR §400 through 471 for the measured parameter.

When there is no analytical method that has been approved under 40 CFR §136, and is not otherwise required by the Director, the applicant may use any suitable method but shall provide a description of the method. When selecting a suitable method, other factors such as a method's precision, accuracy, or resolution, may be considered when assessing the performance of the method.

4.4 Minimum Quantitation Limits (MQLs)

Table 4-1 lists the Minimum Quantitation Limits (MQLs) based on 40 CFR §136. The MQL is defined as the lowest concentration at which a particular substance can be quantitatively measured. Although the listed MQLs are the lowest concentrations required to be used in the calibration of a measurement system, they are not necessarily the minimum acceptable sensitivity. They were chosen to be appropriate for a scan of all pollutants present in a discharge and do not represent the most sensitive analysis that may be achieved for a particular pollutant (volatile and semi volatile organics).

Table 4-1: Minimum Quantitation Limits (MQLs)

Metals and Cyanide		MQL (µg/L)
Antimony	(Total Recoverable)	60 [1]
Arsenic	(Total Recoverable)	0.5 [1]
Beryllium	(Total Recoverable)	0.5 [1]
Cadmium	(Total Recoverable)	0.5 [2]
Chromium	(Total Recoverable)	10 [1]
Chromium	(3+)	10 [1]
Chromium, dissolved	(6+)	10 [1]
Copper	(Total Recoverable)	0.5 [2]
Lead	(Total Recoverable)	0.5 [2]
Mercury	(Total Recoverable)	0.005 [1]
Molybdenum	(Total Recoverable)	30 [9]
Nickel	(Total Recoverable)	0.5 [1]
Selenium	(Total Recoverable)	5 [1]
Silver	(Total Recoverable)	0.5 [2]
Thallium	(Total Recoverable)	0.5 [1]
Zinc	(Total Recoverable)	20 [1]
Phenols	(Total Recoverable)	5
Cyanide	(Total Recoverable)	10 [1]
Dioxin		**MQL (µg/L)**
2,3,7,8-Tetrachloro-dibenzo-p-dioxin (TCDD)		0.00001

Table 4-1: Minimum Quantitation Limits (MQLs)	
Volatile Compounds	**MQL (µg/L)**
Acrolein[4]	50
Acrylonitrile[4]	20
Benzene[4]	10
Bromoform[5]	10
Carbon Tetrachloride[5]	2
Chlorobenzene[5]	10
Chlorodibromomethane[5]	10
Chloroethane[6]	50
2-Chloroethyl vinyl ether[4]	10
Chloroform[5]	10
Dichlorobromomethane[5]	10
1,1-Dichloroethane[5]	10
1,2-Dichloroethane[5]	10
1,1-Dichloroethylene[5]	10
1,2-Dichloropropane[5]	10
1,3-Dichloropropylene[5]	10
Ethylbenzene[5]	10
Methyl Bromide [Bromomethane][6]	50
Methyl Chloride [Chloromethane][6]	50
Methylene Chloride[5]	20
1,1,2,2-Tetrachloroethane[5]	10
Tetrachloroethylene[5]	10
Toluene[5]	10
1,2-trans-Dichloroethylene[5]	10
1,1,1-Trichloroethane[5]	10
1,1,2-Trichloroethane[5]	10
Trichloroethylene[5]	10
Vinyl Chloride[5]	10
Acid Compounds	**MQL (µg/L)**
2-Chlorophenol	10
2,4-Dichlorophenol[5]	10
2,4-Dimethylphenol[7]	10
4,6-Dinitro-o-Cresol [2 methyl 4,6-dinitrophenol][8]	50
2,4-Dinitrophenol[5]	50
2-Nitrophenol[6]	20
4-Nitrophenol[5]	50
p-Chloro-m-Cresol [4 chloro-3-methylphenol][5]	10
Pentachlorophenol[5]	5
Phenol[5]	10
2,4,6-Trichlorophenol[5]	10

Table 4-1: Minimum Quantitation Limits (MQLs)	
Base/Neutral Compounds	**MQL (µg/L)**
Acenaphthene	10
Acenaphthylene[5]	10
Anthracene[5]	10
Benzidine[4]	50
Benzo(a)anthracene[5]	5
Benzo(a)pyrene[5]	5
3,4-Benzofluoranthene[5]	10
Benzo(ghi)perylene[6]	20
Benzo(k)fluoranthene[5]	5
Bis(2-chloroethoxy) methane[5]	10
Bis(2-chloroethyl) ether[5]	10
Bis(2-chloroisopropyl) ether[5]	10
Bis(2-ethylhexyl) phthalate[5]	10
4-Bromophenyl phenyl ether[5]	10
Butyl benzyl phthalate[5]	10
2-Chloronapthalene[5]	10
4-Chlorophenyl phenyl ether[5]	10
Chrysene[5]	5
Dibenzo (a,h) anthracene[6]	5
1,2-Dichlorobenzene[5]	10
1,3-Dichlorobenzene[5]	10
1,4-Dichlorobenzene[5]	10
3,3'-Dichlorobenzidine[6]	5
Diethyl Phthalate[5]	10
Dimethyl Phthalate[5]	10
Di-n-Butyl Phthalate[5]	10
2,4-Dinitrotoluene[5]	10
2,6-Dinitrotoluene[5]	10
Di-n-octyl Phthalate[5]	10
1,2-Diphenylhydrazine[4]	20
Fluoranthene[5]	--
Fluorene[5]	10
Hexachlorobenzene[5]	5
Hexachlorobutadiene[5]	10
Hexachlorocyclopentadiene[5]	10
Hexachloroethane[6]	20
Indeno (1,2,3-cd) pyrene (2,3-ophenylene pyrene)	5
Isophorone[5]	10
Naphthalene[5]	10
Nitrobenzene[5]	10
N-nitrosodimethylamine[6]	50
N-nitrosodi-n-propylamine[6]	20
N-nitrosodiphenylamine[6]	20

Table 4-1: Minimum Quantitation Limits (MQLs)	
Phenanthrene[5]	10
Pyrene[5]	10
1,2,4-Trichlorobenzene[5]	10
Pesticides	**MQL (µg/L)**
Aldrin	0.01
Alpha-BHC[7]	0.05
Beta-BHC[7]	0.05
Gamma-BHC (Lindane)[7]	0.05
Delta-BHC[7]	0.05
Chlordane[7]	0.2
4,4'-DDT[7]	0.02
4,4'-DDE (p,p-DDX)[7]	0.1
4,4'-DDD (p,p-TDE)[7]	0.1
Dieldrin[7]	0.02
Alpha-endosulfan[7]	0.01
Beta-endosulfan[7]	0.02
Endosulfan sulfate[7]	0.1
Endrin[7]	0.02
Endrin aldehyde[7]	0.1
Heptachlor[7]	0.01
Heptachlor epoxide (BHC-hexachlorocyclohexane)	0.01
Chlorpyrifos	0.07
PCB-1242	0.2
PCB-1254	0.2
PCB-1221	0.2
PCB-1232	0.2
PCB-1248	0.2
PCB-1260	0.2
PCB-1016	0.2
Toxaphene[7]	0.3

[1] CRDL (Contract Required Detection Level).

[2] Method 213.2, 239.2, 220.2, 272.2.

[3] Dioxin National Strategy.

[4] No CRQL (Contract Required Quantitation Limit) established.

[5] CRQL basis, equivalent to ML (Minimum Level).

[6] ML basis, higher than CRQL.

[7] CRQL basis, no ML established.

[8] CRQL basis, higher than ML.

[9] Based on ×3.3 Instrument Detection Level published in 40 CFR §136, Appendix C.

4.5 Reasonable Potential Factor

Reasonable potential factors or multipliers are used to compensate for small data sets. Larger data sets are more desirable because they are generally less variable and more representative of the discharge than smaller data sets. The estimate of variability which is most commonly used is the coefficient of variation (CV). The CV of a data set is the ratio of the standard deviation of the data set to the mean of the data set. The best estimate of effluent variability can be derived from a set of results from random effluent samples for the toxic parameter. As a general rule of thumb, because the distribution of values from wastewater treatment is non-normally distributed, any number of samples less than 10 is probably not an accurate predictor of distribution. To better characterize the effects of effluent variability and reduce uncertainty in the process of deciding whether to require an effluent limit, the Technical Support Document (TSD) [EPA 505/2-90-001 March 1991] provides documentation of the EPA's assumptions in determining the multipliers in Table 3-2 to derive the 95th percentile effluent concentration based on a limited sample size. A CV of 0.6 is recommended by EPA if no other estimate is available. As an alternate method for estimating percentiles from limited data sets with an assumed lognormal distribution, DEQ has developed a procedure to evaluate limited data sets to determine the potential for the higher effluent concentrations to exceed a state WQS.

4.5.1 Effluent Data Sets of 10 or Less Values

If 10 or less representative facility-specific effluent samples are available, the geometric mean of the data will be multiplied by a factor from Table 4-2 based on a default CV of 0.6, and assumption of the sample size of 10 for evaluation of reasonable potential.

4.5.2 Effluent Data Sets of 11 – 20 Values

If 11 to 20 representative facility-specific effluent samples are available, either (1) the 95th percentile concentration of the data set will be used for evaluation of reasonable potential, OR (2) the geometric mean of the data set will be multiplied by a factor from Table 4-2 based on the sample size and a default CV of 0.6, or a calculated CV of the data set, for evaluation of reasonable potential.

4.5.3 Effluent data Sets of 21 or More Values

If 21 or more representative facility-specific effluent samples are available, the 95th percentile of the data set will be used for evaluation of reasonable potential. Use of the Table 4-2 is not needed in this situation.

Table 4-2: Reasonable Potential Multipliers
Coefficient of Variation

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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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

4.6 False Positives

Data submitted and certified on a discharge monitoring report is presumed to be valid data. However, it is possible for lab, sampling, data entry or other errors to produce false positive results that come to light only after results are reported. In such a case, the permittee may submit an amended discharge monitoring report with an explanation of the evidence. If the permittee can demonstrate, to the Division's satisfaction, that the result is truly a false positive, it may be removed from the permittee's record, and the reasonable potential (RP) analysis may continue without further consideration of the known false positive result.

4.7 Non-representative data or data determined to be inappropriate

Non-representative data or data determined to be inappropriate should not be used in the evaluation process. Examples of such situations include: data points representing statistical outliers (any data greater than the average plus or minus 2 standard deviations), data collected prior to significant changes in inputs or processes, data collected greater than four and a half years prior to the date of evaluation, inappropriate laboratory or method QA/QC, use of a non-certified laboratory, use of unapproved sampling and analytical methods, and insufficient analytical sensitivity. In general, data will not be discarded unless it is determined to be non-representative or inappropriate for any of the reasons stated above.

4.8 Evaluation of Toxic Effluent Data

Toxic concentration of each effluent pollutant after mixing with the receiving stream flow is compared with the applicable state water quality standards (WQS) established in APC&EC Rule 2. For evaluating toxic substances not listed in APC&EC Rule 2, other EPA literature values may be considered as appropriate.

The steps in Table 4-3 show the sequence of activities and calculations required to conduct a reasonable potential analysis on reported effluent data:

Table 4-3: Sequence of Activities and Calculations Required to Conduct a Reasonable Potential Analysis on Reported Effluent Data		
Step 1	**Identify substances**	Examine the effluent monitoring record and identify those substances for which instream criteria exist (i.e. WQS).
Step 2	**Calculate effluent statistics**	Determine number of data points and follow procedure given in Section 4.5.
Step 3	**Calculate receiving water flow statistics**	Generate or obtain receiving water flow statistics for 7Q10 and Long-Term Average Flow. Use applicable percentage of flow for applicable mixing zone (MZ) and zone of initial dilution (ZID).
Step 4	**Estimate upstream substance concentrations**	Obtain data for upstream concentrations (if available). Typically use the geometric mean of data set.
Step 5	**Mass balance dilution equation**	Use the mass balance equation to calculate an instream waste concentration (IWC) for each identified substance
Step 6	**Compare IWC result with criteria value**	Compare the calculated values with the corresponding criteria. If any are exceeded, proceed with deriving a permit limit.

4.8.1 Reasonable Potential Calculations

If calculated Instream Waste Concentrations (IWCs) exceed the WQS there is RP for the discharge to cause an instream excursion above the allowable ambient concentration of the numeric standard and therefore, based on 40 CFR §122.44(d)(1)(iii),[7] the permit must contain effluent limits for the pollutant.

Calculate the pollutant IWC, as shown in the following equation:

[7] 40 CFR § 122.44(d)(1)(iii) is included by reference in APC&EC Rule 6.

$$IWC = \frac{(C_e \times Q_e) + (C_b \times Q_b)}{(Q_e + Q_b)}$$

Where:

C_e = Pollutant concentration in the effluent
C_b = Pollutant concentration upstream (mg/L)
Q_e = Effluent flow (cfs) [Note: cfs = MGD x 1.547]
Q_b = fraction of upstream flow (cfs) based on MZ and ZID

1. Evaluate and calculate effluent concentration C_e (Section 4.8.2).
2. Evaluate and calculate upstream water quality C_b (Section 4.9).
3. Effluent Flow Q_e (Section 4.13.1).
4. Fraction of Upstream Flow (based on mixing zone and zone of initial dilution Q_b (Section 4.12.1).

4.8.2 Effluent toxic data evaluation

An important step (1st step) in performing a reasonable potential evaluation is to assure that data used to characterize effluent and receiving water quality is defensible and is representative.

Concentrations reported as total recoverable can be converted to the dissolved form or convert WQ toxic criteria to total recoverable by use of the translator formula (see Section 4.10.2).

It is the intent for applicants and permittees to use analytical methods capable of detecting and measuring the pollutants at or below the Required Minimum Quantitation Limits (MQLs) provided on the PPS form. On the PPS form, the permittee will enter the laboratory’s “Achieved MQL” which may be lower than the Required MQL.

The following scenarios should be considered during a reasonable potential evaluation:

A. Laboratories sometimes report “Non-detect (ND)” rather than “less than (<) achieved MQL” values (i.e. “ND” rather than “< 10 µg/l”). When the applicant reports non-detect (ND) rather than “< achieved MQL” and the entire data set consists of only a single ND or if all values in the data set are ND, no further evaluation is necessary.

Example for Zinc:

Table 4-4A: Reasonable Potential Evaluation Example for Non-Detect (ND) Reported Value			
Required MQL	**Achieved MQL**	**Reported Value**	**Evaluation**
20 µg/l	10 µg/l	ND	No further evaluation is necessary

B. When the applicant reports "less than (<) achieved MQL" (such as < 10 µg/l): For reported values of "< achieved MQL" no judgement regarding the presence of analyte in the sample can be made. The sample could contain no target analyte at all or could contain an amount just below the MQL. Given this uncertainty, analytical results of "< achieved MQL" are considered to be ½ the achieved MQL for evaluation purposes.

Example for Zinc:

Table 4-4B: Reasonable Potential Evaluation Example for Reported Values Less Than Achieved MQL			
Required MQL	**Achieved MQL**	**Reported Value**	**Evaluation**
20 µg/l	10 µg/l	< 10 µg/l	Use ½ the achieved MQL, which is 5 µg/l

C. When the applicant reports the actual value, below or above the achieved MQL (such as 12 µg/l), the reported value will be used in evaluation.

Example for Zinc:

Table 4-4C: Reasonable Potential Evaluation Example for Reported Values Above or Below the Achieved MQL			
Required MQL	**Achieved MQL**	**Reported Value**	**Evaluation**
20 µg/l	10 µg/l	8 µg/l	use 8 µg/l
20 µg/l	10 µg/l	12 µg/l	use 12 µg/l

D. If the data set consists of a mixture of a) non-detect results, b) detected values, and c) values reported as "< achieved MQL", then the "non-detect results" and "< achieved MQL results" are considered to be ½ the achieved MQL, and used in conjunction with the detected values for evaluation purposes.

Example of Zinc:

Table 4-4D: Reasonable Potential Evaluation Example for Mixed Reported Values			
Required MQL	**Achieved MQL**	**Reported Value**	**Evaluation**
20 µg/l	10 µg/l	ND	use 5 µg/l
		< 10 µg/l	use 5 µg/l
		4 µg/l	use 4 µg/l
		12 µg/l	use 12 µg/l

The following examples illustrate how the results are evaluated for scenarios A through D:

Table 4-4E: Zinc Scenario Summary for Achieved MQL of 10 µg/L (PPS Required MQL of 20 µg/L)			
Example	**MQL**	**Reported Value**	**Evaluation**
A	10 µg/l	ND	No further evaluation is necessary
B	10 µg/l	< 10 µg/l	Use ½ the MQL, which is 5 ug/l
C	10 µg/l	12 µg/l	12 µg/l
D	10 µg/l	Data set of the following results when a geometric mean is calculated:	Use:
		ND	5 µg/l (1/2 the MQL)
		< 10 µg/l	5 µg/l (1/2 the MQL)
		4 µg/l	4 µg/l
		12 µg/l	12 µ/l

Office of Water Quality should consider best engineering judgment for situations that do not fit any of the scenarios shown in Table 4-4.

4.8.3 Additional Data Evaluation

In most situations, a singular datum will be available for the initial screening and DEQ will have to assume that the available datum is representative of the effluent characteristics of the respective pollutant. In some cases, the evaluation will result in the inclusion of the limit in the draft permit. If prior to finalization of the permit, the permittee submits additional data, the new data will be reviewed and the draft limit will be reevaluated.

4.9 Upstream Receiving Water Toxic Data Evaluation

For upstream data, calculate the geometric mean of the data set for evaluation of reasonable potential. At least 5 years of data, if available, should be used.

4.10 State Numerical Aquatic Toxicity Criteria Calculations

The APC&EC has adopted specific numeric criteria for protection of aquatic life acute and chronic toxicity in APC&EC Rule 2.508. Dissolved metals shall be calculated based on a water-effect ratio (WER), and total hardness or pH.

Note: 40 CFR § 122.45(c) requires that *effluent limits* for metals in NPDES permits be expressed as *total recoverable*, unless:

1) an applicable effluent standard or limitation has been promulgated under the CWA and specifies the limitation for the metal in the dissolved or valent or total form; or
2) in establishing permit limitations on a case-by-case basis under §125.3, it is necessary to express the limitation on the metal in the dissolved or valent or total form to carry out the provisions of the CWA; or
3) all approved analytical methods for the metal inherently measure only its dissolved form (e.g., hexavalent chromium). The translator is used to predict the dissolved to total recoverable fraction that will occur in the receiving water from the total recoverable metal in the effluent (See Section 4.10.2).

4.10.1 Water-Effect Ratio (WER)

A water-effect ratio (WER) of 1 is assigned to the criteria calculation equation. To be assigned a value other than 1, the permittee must provide DEQ adequate studies to support the use of a different value. The WER may be used to adjust the standard to a site-specific value. If the ultra-clean analysis and source examination still indicates the permittee cannot comply with the limits, the permittee may perform a site-specific water-effect ratio. See 40 CFR §131, "Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; State Compliance."

The WER approach compares bioavailability and toxicity of a specific pollutant in receiving water and in laboratory test water. It involves running toxicity tests for at least two species, measuring LC50 for the pollutant using the local receiving water collected from the site where the criterion is being implemented, and laboratory toxicity testing water made comparable to the site water in terms of chemical hardness. The ratio between site water and lab water LC50 is used to adjust the state acute and chronic criteria to site specific values.

The WER is computed as a specific pollutant's acute or chronic value measured in water from the site covered by the standard, divided by the respective acute or chronic toxicity value in laboratory water. The acute value used is the LC50 generated by standard toxicity testing protocol. More simply, the WER is the LC50 of receiving stream-effluent mix (site water) versus the LC50 of laboratory water. An LC50 is the concentration of a toxicant (metal) which is lethal to 50% of the test organisms.

4.10.1.1 Requirements for Development of Water-Effect Ratio (WER) for Parameters other than Aluminum, Copper, Cadmium, Nickel, Lead, Silver, Zinc

1. Each WER determined must be specific for a single pollutant.
2. A permittee who elects to do a site pollutant study or a water-effects study must submit a study plan for review before conducting the study to the Water Quality Planning Branch of the DEQ Office of Water Quality. In some waterbodies there may be no practical advantage in conducting the study.
3. The guidance for conducting a study to establish a WER is presented in DEQ Guidance on Determination and Use of Water-Effect Ratios for Metals. This document is available on the DEQ website: http://www.ADEQ.state.ar.us/water/default.htm.
4. Submission of the final report for WER determination should be at least 12 months prior to the effective date of final permit limits to allow for review by DEQ and submission to EPA for review and comments. If comments are not received from EPA on the WER within 60 days of submission, the facility may proceed with the third-party rulemaking process. Any changes to the final limits will be handled through the permit major modification and revision of APC&EC Rule 2.

4.10.1.2 Use of Biotic Ligand Model (BLM) for Site-Specific Criteria Development for Copper, Cadmium, Nickel, Lead, Silver, Zinc, and Other BLM Metals as Available

The BLM is a metal bioavailability model software licensed by Windward Environmental LLC that uses the latest science and information on water chemistry conditions in a water body to calculate a site-specific water quality criterion for metals. The scientific basis of the BLM is that toxicity is primarily related to the amount of metal bound to a biochemical receptor on an organism (e.g., gill membrane on a fish). Many water quality characteristics can affect the bioavailability, and thus the toxicity, of the toxic metal of interest.

The ambient water quality input parameters needed to run the BLM model are given as follows:

- Temperature
- pH
- Dissolved organic carbon (DOC)
- Major cations (calcium, magnesium, sodium, and potassium)
- Major anions (sulfate and chloride)
- Alkalinity
- Sulfide
- Nitrate (for silver runs)

Each BLM model run results in a single instantaneous criterion based on a single data set of inputs. An instantaneous criterion is a "snapshot in time" (i.e., it is a criterion that reflects the water chemistry at one specific instant in time and at one specific location). Because some of the BLM input parameters are known to vary seasonally, DEQ recommends that multiple data sets of inputs be used which reflect the seasonal variability of the input parameters over the course of all seasons. At a minimum, samples of all BLM input parameters should be taken once per month for a twelve-month period in the waterbody of interest in order to derive a site-specific criterion that is representative of seasonal variations. If the water quality parameters and BLM-derived criteria are relatively constant over a range of seasonal and flow conditions, then using the geometric mean of all BLM-derived instantaneous criteria may be appropriate. Conversely, if a water body exhibits significant seasonal variations in the input parameters and BLM-derived instantaneous criteria, then it may be best to develop seasonal criteria using seasonal geometric means.

DEQ strongly encourages any facility that plans to pursue development of site specific criteria, to first submit a BLM sampling plan to the Planning Branch of the Office of Water Quality for review and approval prior to beginning the sampling. Although DOC is not a regulated contaminant, there are several scientifically-defensible methods available to measure DOC, such as EPA Method 415.3, as well as methods developed by ASTM International and *Standard Methods for the Examination of Water and Wastewater*.

BLM Model Software and User Manual can be viewed and downloaded from the following link:

https://www.windwardenv.com/biotic-ligand-model/

4.10.2 Conversion Factors and Translators for Metal Criteria

The National Toxics Rule (NTR) establishes numerical criteria for toxic pollutants. The NTR dissolved metal criteria is converted to total using the translator mechanism that utilizes the statewide partition coefficient outlined below prior to comparison with the IWC calculated using total effluent data.

Dissolved metals WQS established in the NTR will be converted to total values by the use of statewide linear partition coefficients for streams and lakes, based on site-specific TSS values/measurements (Delos et., al, 1984, *Technical Guidance for Performing Wasteload Allocation Book II: Streams and Rivers. Chapter 3: Toxic Substances, for U.S. Environmental Protection Agency* (EPA-440/4-84-022). This translator mechanism involves determining a linear partition coefficient for the metal of concern and using this to determine the fraction of metal dissolved, so that the dissolved metal ambient criteria may be eventually translated to a total effluent limit. The mechanism has been adopted and is widely used in other states within the region. TSS (mg/l) is a variable within the conversion function.

4.10.2.1 Linear Partition Coefficient Formula

The linear partition coefficient formula for streams and lakes is as follows:

$$K_p = K_{po} \times TSS^{\alpha}$$

Then,

$$\frac{C}{C_T} = \left(\frac{1}{(1 + (K_p)(TSS)(10^{-6})}\right)$$

Where:

K_p	=	Linear partition coefficient
K_{po}	=	Obtained from Table 4-5
α	=	Obtained from Table 4-5
TSS	=	Total Suspended Solids (mg/l)
$\frac{C}{C_T}$	=	Fraction of metal dissolved
C_d	=	Dissolved criteria value for metal in WQS

Therefore;

$$\frac{C}{C_T} = \left(\frac{1}{(1 + (K_{po})(TSS^{(1+\alpha)})(10^{-6})}\right)$$

Then,

$$\textbf{Total Metal} = \frac{C_d}{\left(\frac{C}{C_T}\right)}$$

Table 4-5: Linear Partition Coefficients for Priority Metals in Streams and Lakes[8]				
Metal	Streams		Lakes	
	K_{po}	α	K_{po}	α
Arsenic	0.48×10^6	-0.73	0.48×10^6	-0.73
Cadmium	4.00×10^6	-1.13	3.52×10^6	-0.92
Chromium[9]	3.36×10^6	-0.93	2.17×10^6	-0.27
Copper	1.04×10^6	-0.74	2.85×10^6	-0.90
Lead[10]	2.80×10^6	-0.80	2.04×10^6	-0.53
Mercury	2.90×10^6	-1.14	1.97×10^6	-1.17
Nickel	0.49×10^6	-0.57	2.21×10^6	-0.76
Silver[11]	2.40×10^6	-1.03	Assume equal to stream	
Zinc	1.25×10^6	-0.70	3.34×10^6	-0.68

Note: A reopener clause shall be placed in the permit in the event the permittee develops a site-specific partition coefficient. The permit may be reopened to include the revised permit limits based on a site-specific partition coefficient. In cases where no partitioning coefficient is available, direct application of the standard is used unless a site-specific partitioning coefficient is developed.

4.11 Upstream Variability

Some criteria vary with other chemical or physical parameters. The aquatic life criteria for some metals in freshwater vary with hardness of the receiving water. The criteria for ammonia vary with temperature and pH.

The following receiving stream hardness, pH, TSS, and temperature shall be used for calculations as necessary:

[8] Delos, C. G., W. L. Richardson, J. V. DePinto, R. B. Ambrose, P. W. Rogers, K. Rygwelski,J. P. St. John, W. J. Shaughnessey, T. A. Faha, W.N. Christie. Technical Guidance for performing Waste Load Allocations, Book II: Streams and Rivers. Chapter 3: Toxic Substances, for the U. S. Environmental Protection Agency. (EPA-440/4-84-022).

[9] Linear partition coefficients shall not apply to the Chromium VI numerical criterion. The approved analytical method for Chromium VI measures only the dissolved form. Therefore, permit limits for Chromium VI shall be expressed in the dissolved form.

[10] Reference page 18 of EPA memo dated March 3, 1992, from Margaret J. Staiskowski (WH-586) to Water Management Division Directors, Region I-IX.

[11] Texas Environmental Advisory Council, 1994.

4.11.1 Hardness

Hardness is based on Table 4-6. Alternative site-specific hardness data may be considered on a case-by-case basis.

Table 4-6: Mean Hardness by Receiving Stream and Ecoregion	
Stream Values	
Arkansas	125 mg/l
Red River	211 mg/l
Ouachita River	28 mg/l
White River	116 mg/l
St. Francis River	103 mg/l
Ecoregion Values	
Gulf Coastal	31 mg/l
Ouachita Mountains	31 mg/l
Arkansas River Valley	21 mg/l, use 25 mg/l[12]
Boston Mountains	22 mg/l, use 25 mg/l[12]
Ozark Highlands	148 mg/l
Delta	81 mg/l

4.11.2 pH

The pH values for toxicity evaluation will be based on the ecoregion values as stated in Table 4-7.

4.11.3 TSS

The TSS for the toxics reasonable potential evaluation will be based on Table 4-7 shown below based on the discharger location. An alternative TSS value may be allowed on a case-by-case basis.

Table 4-7: TSS Values to Use in Toxics Reasonable Potential Evaluation	
Discharge Location	**TSS (mg/l)**
Ouachita Mountains Ecoregion	2.0
Ozark Highlands Ecoregion	2.5
Boston Mountains Ecoregion	1.3
Arkansas River Valley Ecoregion	3.0
Gulf Coastal Ecoregion	5.5
Delta Ecoregion	8.0

[12] Based on 40 CFR § 131.36(c)(4)(i) the minimum hardness allowed in calculating criteria for metals shall not be less than 25 mg/L, as calcium carbonate, even if the actual ambient hardness is less than 25 mg/l.

Table 4-7: TSS Values to Use in Toxics Reasonable Potential Evaluation

Discharge Location	TSS (mg/l)
Arkansas River (Fort Smith to Dardanelle L&D)	12.0
Arkansas River (Dardanelle L&D to Terry L&D)	10.5
Arkansas River (Terry L&D to L&D No. 5)	8.3
Arkansas River (L&D No. 5 to mouth)	9.0
White River (above Beaver Lake)	Use Ecoregion Value
White River (below Bull Shoals Lake to Black River)	3.3
White River (from Black River to mouth)	18.5
St. Francis River	18.0
Ouachita River (above Caddo River)	Use Ouachita Mountain Ecoregion Value
Ouachita River (below Caddo River)	Use Gulf Coastal Ecoregion Value
Red River	33.0

4.12 Mixing Zone (MZ) and Zone of Initial Dilution (ZID)

A mixing zone is an area where an effluent discharge undergoes mixing with the receiving waterbody. For toxic discharges, a zone of initial dilution (ZID) may be allowed within the mixing zone. Acute toxicity shall not exist at, or beyond, the edge of the ZID. Chronic toxicity shall not exist at, or beyond, the edge of the mixing zone.

Where mixing zones are allowed, the effects of wastes on the receiving stream shall be determined after the wastes have been thoroughly mixed with the mixing zone volume.

Mixing zones are not allowed for the parameters of bacteria, oil and grease, or where the upstream flow is less than the critical flow or where the upstream concentration of a waste parameter exceeds the specific criteria for that waste parameter.

Lakes and reservoirs shall be evaluated using the jet-mix model. Mixing zones shall not prevent the free passage of fish or significantly affect aquatic ecosystems.

A mixing zone shall not include any domestic water supply intake.

4.12.1 Stream Mixing Zone and Zone of Initial Dilution Determination

Where mixing zones are allowed, the effects of wastes on the receiving stream shall be determined after the wastes have been thoroughly mixed with the stream water. Outfall structures should be designed to minimize the extent of mixing zones to ensure rapid and complete mixing. Mixing zone and zone of initial dilution determination procedure is as follows:

4.12.1.1 Large Streams (7Q10 ≥ 100 cfs)

For aquatic life toxic substances in larger streams (those with 7Q10 flows equal to or greater than 100 cfs), the mixing zone shall not exceed 1/4 (25%) of the cross-sectional area and critical flow volume of the stream. The remaining 3/4 (75%) of the stream shall be maintained as a zone of passage for swimming and drifting organisms, and shall remain of such quality that stream ecosystems are not significantly affected.

4.12.1.2 Small Streams (7Q10 < 100 cfs)

In the smaller streams (7Q10 flows less than 100 cfs), no more than 2/3 (67%) of the cross-sectional area and/or critical flow volume of smaller streams should be devoted to mixing zones thus leaving at least 1/3 (33%) of the cross-sectional area free as a zone of passage for swimming and drifting organisms, and shall remain of such quality that stream ecosystems are not significantly affected.

4.12.2 Mixing Zone and ZID Calculations

Calculations for mixing zone and ZID for aquatic toxicity and other pollutants with exception of WET (See Chapter 6) are as follows. The ZID shall be 50% of the mixing zone in all streams with some exceptions.[13]

4.12.2.1 Mixing Zone for Chronic Aquatic Life Toxicity

- Large Streams (7Q10 ≥ 100 cfs): 25% of the critical flow
  - ($0.25 \times 7Q10$)
- Small Streams (7Q10 < 100 cfs): 67% of the critical flow
  - ($0.67 \times 7Q10$)

4.12.2.2 ZID for Acute Aquatic Life Toxicity

- Large Streams (7Q10 ≥ 100 cfs): 13% of the critical flow
  - ($0.13 \times 7Q10$)
- Small Streams (7Q10 < 100 cfs): 33% of the critical flow
  - ($0.33 \times 7Q10$)

- Mississippi River
- Arkansas River
- White River below confluence of Black River
- Ouachita River below confluence with Little Missouri River
- Red River

[13] In the following streams the ZID shall be 25% of the mixing zone (i.e., $0.06 = 0.25 \times 0.25$). Additionally, when a high rate diffuser is used in the following streams, then the ZID may equal 50% of the mixing zone (i.e., $13\% = 0.50 \times 0.25$).

4.12.3 Lake Mixing Zone and ZID Calculations

Because of the dilution generated by the entrainment of ambient fluid in lakes and reservoirs, the concentration of the contaminant diminishes with distance from the end of discharge pipe. This situation occurs when a fluid is discharged in the environment through a pipe located on the bank of a lake or reservoir, or submerged in a lake or reservoir. In lakes and reservoirs, Mixing Zone and ZID will be determined by using the jet mix equation below. Mixing Zone and ZID for lakes and reservoirs may be considered on a case-by-case basis by site-specific studies.

The following jet mix equation[14] shall be used for Mixing Zone and ZID for lakes and reservoirs:

$$PE = \frac{500 \times D}{X}$$

Where:

PE	=	Percent effluent at distance X (e.g. a calculated 5% effluent = dilution factor of 0.05)
D	=	Discharge pipe diameter (ft)
X	=	Distance from end of discharge pipe (ft)
	=	[Aquatic life criteria] 25 ft for acute criteria (ZID), and 100 feet for chronic criteria (mixing zone)
	=	[Human health criteria] 200 ft for mixing zone

4.12.4 Critical Flows

The flow volume used as upstream dilution flows in calculating concentrations of pollutants from permitted discharges. These flows may be adjusted for mixing zones. The following critical flows are applicable:

Table 4-8: Critical Flows	
For	**Critical Flow**
Seasonal Aquatic Life	The critical flow for months of December through May will be adjusted to 1 cfs minus the design flow of any point source discharge (may not be less than zero (0))
Human Health	Harmonic mean flow or long-term average flow

[14] Derived from equation number 9.8 in Section 9.2 of "Environmental Fluid Mechanics", March 2014, Thayer School of Engineering, Dartmouth College. A link to this document is given below:
https://engineering.dartmouth.edu/~d30345d/courses/engs151/chapters.html

Table 4-8: Critical Flows	
For	**Critical Flow**
Minerals	Harmonic mean flow, except as follows: • Rule 2.511(A) Site Specific Mineral Criteria listed with an asterisk - 4 cubic feet per second. • Rule 2.511 (C) Domestic Water Supply: 7Q10.
Metals and Conventional Pollutants	7Q10

4.13 Flow Calculations

The following definitions shall be used for calculations including facility and stream flow:

4.13.1 Effluent Flow

Table 4-9: Effluent Flow	
Facility	**Effluent Flow**
POTW or Domestic wastewater	Design flow of the facility
Industrial wastewater	Highest monthly average flow occurring in the most recent two-year period of record. If a significant seasonal variability in flow is present, a seasonal regulatory effluent flow may be calculated for a particular season of the year. Allowances should be made to account for expected fluctuations in production and resulting discharge levels over the life of the permit. Another reasonable flow may be used at the discretion of DEQ. Additionally, the design flow of the treatment system could be used if actual flow data is determined to be not representative, or if no actual data exists.

4.13.2 Stream Flow

For calculations of permit limits all flows and data collected throughout the year, including elevated flows due to rainfall events, must be taken into account. The following subsection describes the typical methods of stream flow determinations.

4.13.2.1 Long Term Average Stream Flow

In order to establish a long term average flow value that represents both the high and the low end of long-term streamflow oscillations, no less than 10 years of daily streamflow data from a gauging station or other flow measurement method is generally used to calculate the long term average. The long-term average is typically the arithmetic mean.

4.13.2.2 7Q10 Stream Flow

A flow volume equal to the lowest mean daily discharge during seven (7) consecutive days of a year which, on the average, has a recurrence interval of 10 years. A 7Q10 (also written as Q7-10) value is typically based on the latest USGS low flow document (Low-flow characteristics and regionalization of low-flow characteristics for selected streams in Arkansas, USGS Scientific Investigations Report 2008-5065). USGS StreamStats web-based program can also be used. The 7Q10 may be updated based on additional gauge data that has been verified but not yet published in an updated low flow document. 7Q10 can be calculated manually using log-Pearson Type III probability statistics or by inputting stream flow data into EPA's DFLOW (a computerized tool for low flow analysis). Other technically approvable means of determining 7Q10 may be considered. A minimum of 10 years of daily streamflow data is generally used to calculate the 7Q10. The 7Q10 may be calculated on an annual or a seasonal basis.

4.13.2.3 Harmonic Mean Flow

Harmonic mean flow is a type of mean flow calculated by summing the reciprocals of individual flow measurements then dividing the sum by the number of measurements.

4.13.2.3.1 Gauged Station

Data for calculating the harmonic mean flow may be obtained from a USGS gauge station. A minimum of 10 years of daily streamflow measurements is generally used to calculate a harmonic mean flow. The following equation is used to calculate harmonic mean flow:

$$\text{harmonic mean flow} = \left(\frac{\sum_{i=1}^{N_T - N_0} \frac{1}{Q_i}}{N_T - N_0}\right)^{-1} \times \left(\frac{N_T - N_0}{N_T}\right)$$

Where:

Q_i = Non-zero flow
N_T = Total number of flow values

N_0 = Number of zero flow values

This equation calculates harmonic mean using a correction factor to account for zero flows in the same manner in which EPA's DFLOW program functions.

4.13.2.3.2 Ungauged Site

Stream flow statistics are often needed at ungauged sites, where no stream flow data are available to compute the statistics. USGS StreamStats may be used to obtain estimates of stream flow statistics for ungauged sites. StreamStats provides tools and base maps useful for verifying the accuracy of the basin delineations and for correcting them, if necessary. StreamStats for Arkansas can be used to estimate flows for small streams. Alternative method calculations may be allowed with DEQ approval.

4.13.2.3.3 Known 7Q10

By knowing low flow (7Q10) and average flow, harmonic flow may be calculated as follows:[15]

$$Q_{hm} = [1.194 \times (Q_{am})^{0.473}] \times [(7Q10)^{0.552}]$$

Where:

Q_{hm} = Harmonic flow
Q_{am} = Arithmetic mean

A minimum of 10 consecutive years of flow data must be obtained to develop an accurate harmonic mean.

4.13.3 Stream Flow Applicable to Stormwater Only Discharges

For discharges of stormwater only in individual NPDES permits where the receiving stream is ephemeral or intermittent, the ratio of stormwater discharge to stream flow may be determined on a case by case basis.

[15] Technical Support Document (TSD) for Water Quality-based Toxics Control [EPA 505/2-90-001 March 1991].

4.14 Water Quality Based Toxic Effluent Limit Calculations

Water quality based toxic effluent limits are calculated by the two-value WLA process (Acute LTA and Chronic LTA). The WLAs are numbers not to be exceeded, in the receiving stream in order to protect aquatic life.

The Division uses an estimate of variability (coefficient of variation (CV)) for these parameters in the effluent to define a distribution of values with a long term average (LTA) such that there is a one percent probability (0.01) of exceedance of the WLA. Long-term and short-term averages defined for each parameter. Effluent limits for each parameter are defined for the more limiting of the acute LTA or the chronic LTA. The 95^{th} percentile (0.05 probability) is used in calculating the monthly average limit and the 99^{th} percentile (0.01 probability) is used in calculating the 7-day average or daily maximum.

The following subsection describes the process of deriving effluent limitations for toxics:

4.14.1 Aquatic Life Effluent Limits

Limits are calculated based on the procedure recommended in the March 1991 EPA TSD (Box 5-2, page 100 of 1991 TSD).

Step 1: Calculate acute and chronic water quality criteria as a total recoverable for the aquatic life toxicity WQS in APC&EC Rule 2.508 based on hardness, pH (as applicable), WER, or BLM. 40 CFR §122.45(c) requires that *effluent limits* for metals in NPDES permits be expressed as *total recoverable*, with a few exceptions (see note in Section 4.10). The translator is used to predict the dissolved fraction to total recoverable amount that will occur in the receiving water from the total recoverable metal in the effluent (See Section 4.10.2).

Step 2: Calculate chronic wasteload allocation (WLA_c)

$$\mathrm{WLA_c} = \frac{\left(\left(\mathrm{WQS} \times (Q_e + Q_b)\right) - (Q_b \times C_b)\right)}{Q_e}$$

Where:

Q_e	=	Effluent discharge flow (cfs)
Q_b	=	0.25 × critical flow for Larger Stream (7Q10 ≥ 100 cfs)
	=	0.67 × critical flow for Small Streams (7Q10 < 100 cfs)
C_b	=	Upstream concentration (mg/l)
WQS	=	Chronic aquatic toxicity standards (Step 1)

Step 3: Calculate acute wasteload allocation ($\mathrm{WLA_a}$)

$$\mathrm{WLA_a} = \frac{\left(\left(\mathrm{WQS} \times (Q_e + Q_b)\right) - (Q_b \times C_b)\right)}{Q_e}$$

Where:

Q_e	=	Effluent discharge flow (cfs)
Q_b [16]	=	0.13 × critical flow for Larger Stream (7Q10 ≥ 100 cfs)
	=	0.33 × critical flow for Small Streams (7Q10 < 100 cfs)
C_b	=	Upstream concentration (mg/l)
WQS	=	Acute aquatic toxicity standards (Step 1)

Step 4: Calculate the long-term averages ($\mathrm{LTA_a}$ and $\mathrm{LTA_c}$) which will comply with the wasteload allocations $\mathrm{WLA_a}$ and $\mathrm{WLA_c}$. *Aquatic toxicity criterion LTAs are calculated on a 90 percent probability basis.* Whether the receiving water is a stream or lake, toxicity criterion LTAs are calculated in the same fashion. Assume the following:

1) Effluent concentrations are described by a log normal probability distribution (the logarithm of the effluent concentrations is normally distributed).

2) The coefficient variance (CV) of the effluent concentrations is 0.6 (CV = Standard Deviation / Mean).

3) The effluent should satisfy the WLA 90% of times.

$$\mathrm{LTA}_a = \mathrm{WLA_a} \times e^{\left((0.5\times\sigma^2)-(z\times\sigma)\right)}$$

Where:

LTA_a	=	Acute LTA
σ^2	=	$\ln((\mathrm{CV})^2 + 1)$
CV	=	0.6
z	=	1.282 for 90th percentile probability basis

So,

σ^2	=	0.307
σ	=	0.554

[16] **Except:**

- 0.06 × critical flow in the Mississippi, Arkansas, White (below confluence with Black River), Ouachita (below confluence with Little Missouri River), and Red Rivers.
- 0.13 × critical flow if high rate diffuser is used in the Mississippi, Arkansas, White (below confluence with Black River), Ouachita (below confluence with Little Missouri River), and Red Rivers.

$$\mathrm{LTA_a} = \mathrm{WLA_a} \times e^{\left((0.5\times 0.307)-(1.282\times 0.554)\right)}$$

$$\mathrm{LTA_a} = 0.57 \times \mathrm{WLA_a}$$

$$\mathrm{LTA_c} = \mathrm{WLA_c} \times e^{\left((0.5(\sigma_4)^2-(z\times\sigma_4)\right)}$$

Where:

LTA_c = Chronic LTA
$(\sigma_4)^2$ = $\ln\left(\frac{(\mathrm{CV})^2}{4}+1\right)$
CV = 0.6
z = 1.282 for 90th percentile probability basis

So,

$(\sigma_4)^2$ = $\ln\left(\frac{(0.6)^2}{4}+1\right) = 0.08617$
σ_4 = 0.2935

$$\mathrm{LTA_c} = \mathrm{WLA_c} \times e^{\left((0.5\times 0.08617)-(1.282\times 0.2935)\right)}$$

$$\mathrm{LTA_c} = 0.72 \times \mathrm{WLA_c}$$

In summary:

$$\mathrm{LTA_a} = 0.57 \times \mathrm{WLA_a}$$
$$\mathrm{LTA_c} = 0.72 \times \mathrm{WLA_c}$$

Step 5: Select the smaller LTA of the $\mathrm{LTA_a}$ or $\mathrm{LTA_c}$ from Step 4 (limiting LTA) to use in step 6 to calculate the maximum daily effluent limit (MDL) and the monthly average effluent limit (AML).

Step 6: Determine the LTA multiplier to calculate monthly average limit (AML) based on the 95th percentile. A minimum of four samples per month will be used in this calculation. The LTA multiplier is dependent on the number of samples per month. For four samples per month (see Section 5.5.3 on page 107 of the March 1991 EPA TSD), an LTA multiplier of 1.55 is appropriate (see calculation below). If the number of samples per month is greater than four, use the default LTA multiplier of 1.55 or recalculate the LTA multiplier for correct number of samples per month (see Table 5-2 on page 103 of the March 1991 EPA TSD). Assume CV of 0.6 or calculate CV if 11 or more data points are available and 95th percentile probability basis for monthly average.

$$\mathrm{AML} = \mathrm{LTA} \times e^{\left((z\times\sigma_n)-(0.5(\sigma_n)^2\right)}$$

Where:

AML	=	Monthly Average Limit
$(\sigma_n)^2$	=	$\ln\left(\frac{(\mathrm{CV})^2}{n}+1\right)$
CV	=	0.6
z	=	1.645 for 95th percentile probability basis

Example calculation for $n = 4$:

$$(\sigma_4)^2 = \ln\left(\frac{(0.6)^2}{4}+1\right) = 0.086$$

$$\sigma_4 = 0.293$$

$$\mathrm{AML} = \mathrm{LTA} \times e^{((1.645\times 0.293)-(0.5\times 0.086))}$$

$$\mathbf{AML} = \mathbf{LTA} \times \mathbf{1.55}$$

Maximum Daily Limit

Calculate maximum daily limit (MDL) based on the 99th percentile:

$$\mathbf{MDL} = \mathbf{LTA} \times \boldsymbol{e}^{((\boldsymbol{z}\times\boldsymbol{\sigma_n})-(\mathbf{0.5}(\boldsymbol{\sigma_n})^{\mathbf{2}})}$$

Where:

MDL	=	Maximum Daily Limit
$(\sigma_n)^2$	=	$\ln\left(\frac{(CV)^2}{n}+1\right)$
CV	=	0.6
z	=	2.326 for 99th percentile probability basis

Example calculation for $n = 1$:

$$(\sigma_1)^2 = \ln\left(\frac{(0.6)^2}{1}+1\right) = 0.307$$

$$\sigma_1 = 0.554$$

$$\mathrm{MDL} = \mathrm{LTA} \times e^{((2.326\times 0.554)-(0.5\times 0.307))}$$

$$\mathbf{MDL} = \mathbf{LTA} \times \mathbf{3.11}$$

In summary:

$$\mathbf{AML} = \mathbf{LTA} \times \mathbf{1.55}^*$$
$$\mathbf{MDL} = \mathbf{LTA} \times \mathbf{3.11}^*$$

***** These values can be obtained from Table 5.2 of the 1991 TSD.

4.14.2 Human Health Effluent Limits

APC&EC Rule 2.508 establishes specific human health criteria for certain pollutants. If there is a reasonable potential for discharge to cause an instream excursion above any of these human health criteria, the permit must include an effluent limit for the pollutant.

Note: Limits are calculated based on the procedure recommended in the latest EPA TSD.

Step 1: Calculate wasteload allocation (WLA).

$$\text{WLA} = \frac{\left(\left(\text{WQS} \times (Q_e + Q_b)\right) - (Q_b \times C_b)\right)}{Q_e}$$

Where:

Q_e	=	Effluent discharge flow (cfs)
Q_b	=	Long term average flow or harmonic mean flow
C_b	=	Upstream concentration (mg/l)

Step 2: Calculate monthly average (AML) and daily maximum (MDL) final limitations:

1) Permit limits are set at the 99th percentile for the MDL and the 99th percentile for the AML
2) Four (4) samples per month
3) CV = 0.6

$$\text{AML} = \text{WLA}$$

$$\text{MDL} = \text{AML} \times \left(\frac{\text{MDL}}{\text{AML}}\right)$$

Where:

$\frac{\text{MDL}}{\text{AML}}$ = Maximum Daily Limit to Monthly Average Limit ratio from Table 5-3, p. 106 of TDS[17] for 99% probability

Note: Use four (4) samples or less, (MDL/AML) = 1.64

$$\text{MDL} = \text{AML} \times 1.64$$

In summary:

$$\mathbf{AML = WLA}$$
$$\mathbf{MDL = AML \times 1.64}$$

4.14.3 Mercury

The chronic aquatic life criteria for mercury is based on accumulation of methylmercury in aquatic organisms. If effluent conditions for mercury are warranted to address the chronic aquatic life criterion (chronic WLA drives the condition) then the permit may include alternative conditions to address mercury which may be applicable based on TMDL implementation strategies.

4.15 Other Specific Pollutants - Conventional and Nonconventional

This section addresses bacteria, dissolved oxygen, pH, turbidity, temperature, minerals, ammonia, total suspended solids, biochemical oxygen demand, and nutrients.

4.15.1 Bacteria Limits

For permitting purposes, the primary contact season is to be May 1 – September 30; whereas the secondary contact season is to be October 1 – April 30.

For continuous dischargers, the permit contains a water-quality bacteria limit based on Rule 2.507.

4.15.2 Biochemical Oxygen Demand (BOD) or Carbonaceous Biochemical Oxygen Demand (CBOD) Limits

Biochemical oxygen demand (BOD) or Carbonaceous Biochemical Oxygen Demand (CBOD) is a measure of oxygen demand in receiving waters. Most oxygen-demanding discharges have permit limits for BOD or CBOD. These limits are either technology-based limits or water quality-based limits from DO modeling, whichever is more stringent. The model used to predict dissolved

[17] Technical Support Document (TSD) for Water Quality-based Toxics Control [EPA 505/2-90-001 March 1991].

oxygen deficit from BOD is based on the Streeter-Phelps equation. BOD or CBOD limits in the permit are discussed in Chapter 3.

4.15.4 Total Suspended Solids (TSS) Limits

In order to comply with WQS narrative criteria or any applicable effluent limitation guideline, TSS limits may be necessary in the permit. These limits are based on either technology-based limits from effluent limitation guideline, from DO modeling using corresponding sediment oxygen demand (SOD) rate (see Section 3.3.4), or APC&EC Rule 6, whichever is more stringent. TSS limits in the permit are discussed in Chapter 3.

4.15.5 Ammonia Nitrogen (NH_3-N) Toxicity Limits

Ammonia nitrogen permit limits will be set to the most stringent of the following three quantities: (1) technology based limits (if applicable); (2) effluent concentrations in DO model projections; or (3) concentrations necessary to prevent toxicity based on Rule 2.512. Effluent concentrations in DO model projections are discussed in Chapter 3.

Toxicity based ammonia nitrogen limits (hereafter ammonia) will be calculated based on APC&EC Rule 2.512(D) which is based on pH and temperature. The following tables provide instream ammonia criteria (after mixing) that were calculated using default values of pH and temperature for different ecoregions and different seasons. Alternative site-specific pH and temperature data may be considered on a case-by-case basis after this data has been submitted to DEQ for review and approval. Daily maximum or weekly average permit limits for ammonia should be based on maintaining an instream ammonia concentration (after mixing) no higher than the values listed as 4-day averages in Tables 4-10A, 4-10B, 4-11A, and 4-11B. Monthly average limits should be based on maintaining an instream ammonia concentration (after mixing) no higher than the 30-day averages in Tables 4-10A, 4-10B, 4-11A, and 4-11B. Calculations of instream ammonia concentrations after mixing should be done using the upstream flow conditions specified in Section 4.13.2.2 of the CPP. The calculations for the primary season can be based on seasonal or monthly 7Q10 flows rather than annual 7Q10 flows by using USGS Scientific Investigations Report 2008-5065 “Low-Flow Characteristics and Regionalization of Low-Flow Characteristics for Selected Streams in Arkansas.”

Table 4-10A: (Minor Permits) Instream Value for Ammonia after Mixing[18]

Fish Early Life Stages Normally Present: *Critical Season (April to October)*

Stream	Temp (°C)	pH	4-day avg (mg/L)	30-day avg (mg/L)
Arkansas River	32	7.6	3.2	3.2
Arkansas River Valley	31	6.7	5.6	5.6
Boston Mountains	31	6.9	5.3	5.3
Delta (Least-Altered)	30	7.1	5.2	5.2
Delta (Channel-Altered)	32	7.1	4.6	4.6
Gulf Coastal	30	6.6	6.1	6.1
Ouachita Mountains	30	7.1	5.2	5.2
Ouachita River (L Missouri to Mouth)	32	6.7	5.2	5.2
Ozark Highlands	29	7.6	3.9	3.9
St. Francis River	32	7.2	4.4	4.4
Red River	32	7.5	3.5	3.5
White River (Dam #1 to Mouth)	32	7.7	2.9	2.9

Table 4-10B: (Minor Permits) Instream Value for Ammonia after Mixing[18]

Fish Early Life Stages Normally Absent: *Primary Season (November to March)*

Stream	Temp (°C)	pH	4-day avg (mg/L)	30-day avg (mg/L)
Arkansas River	14	7.6	10.3	10.3
Arkansas River Valley	14	6.7	16.7	16.7
Boston Mountains	14	6.9	15.8	15.8
Delta (Least-Altered)	14	7.1	14.7	14.7
Delta (Channel-Altered)	14	7.1	14.7	14.7
Gulf Coastal	14	6.6	17	17
Ouachita Mountains	14	7.1	14.7	14.7
Ouachita River (L Missouri to Mouth)	14	6.7	16.7	16.7
Ozark Highlands	14	7.6	10.3	10.3
St. Francis River	14	7.2	13.9	13.9
Red River	14	7.5	11.3	11.3
White River (Dam #1 to Mouth)	14	7.7	9.3	9.3

[18] These criteria values come from Rule 2.512 and 2005 Implementation Memo.

Table 4-11A: (Major Permits) Instream Value for Ammonia after Mixing[18]

Fish Early Life Stages Normally Present: *Critical Season (April to October)*

Stream	Temp (°C)	pH	4-day avg (mg/L)	30-day avg (mg/L)
Arkansas River	32	7.6	3.2	1.3
Arkansas River Valley	31	6.7	5.6	2.2
Boston Mountains	31	6.9	5.3	2.1
Delta (Least-Altered)	30	7.1	5.2	2.1
Delta (Channel-Altered)	32	7.1	4.6	1.8
Gulf Coastal	30	6.6	6.1	2.4
Ouachita Mountains	30	7.1	5.2	2.1
Ouachita River (L Missouri to Mouth)	32	6.7	5.2	2.1
Ozark Highlands	29	7.6	3.9	1.6
St. Francis River	32	7.2	4.4	1.7
Red River	32	7.5	3.5	1.4
White River (Dam #1 to Mouth)	32	7.7	2.9	1.2

Table 4-11B: (Major Permits) Instream Value for Ammonia after Mixing[18]

Fish Early Life Stages Normally Absent: *Primary Season (November to March)*

Stream	Temp (°C)	pH	4-day avg (mg/L)	30-day avg (mg/L)
Arkansas River	14	7.6	10.3	4.1
Arkansas River Valley	14	6.7	16.7	6.7
Boston Mountains	14	6.9	15.8	6.3
Delta (Least-Altered)	14	7.1	14.7	5.9
Delta (Channel-Altered)	14	7.1	14.7	5.9
Gulf Coastal	14	6.6	17	6.8
Ouachita Mountains	14	7.1	14.7	5.9
Ouachita River (L Missouri to Mouth)	14	6.7	16.7	6.7
Ozark Highlands	14	7.6	10.3	4.1
St. Francis River	14	7.2	13.9	5.6
Red River	14	7.5	11.3	4.5
White River (Dam #1 to Mouth)	14	7.7	9.3	3.7

The following information must be considered to calculate the ammonia toxicity limit in the permit:

Q_b	=	Critical upstream flow of receiving stream
	=	7Q10 cfs × 0.25 for Larger Stream (7Q10 ≥ 100 cfs)
	=	7Q10 cfs × 0.67 for Small Streams (7Q10 < 100 cfs)
Q_e	=	Facility Effluent flow (cfs)
C_b	=	Upstream concentration (mg/l), based on average value recorded at monitoring station in DEQ's most current 305(b) Report
C_e	=	Effluent concentration (mg/l) = permit limit
IWC	=	Chronic ammonia toxicity criterion (from Tables 4-10 or 4-11)

The following mass balance formula can used to calculate the permit limits:

$$\text{IWC} = \frac{\left((C_e \times Q_e) + (C_b \times Q_b)\right)}{Q_e + Q_b}$$

When rearranged, the formula can be used to solve for the effluent concentration, C_e:

$$C_e = \frac{\left(\text{IWC} \times (Q_b + Q_e) - (C_b \times Q_b)\right)}{Q_e}$$

Example:
A minor facility discharges wastewater with the average flow of 0.5 MGD to Clear Creek in the Boston Mountains with an ammonia limit (dissolved oxygen-based limit) of 5 mg/l (year-round) and upstream flow (7Q10) of 0.2 cfs. What is the permit limit?

Solution:

Q_b	=	Critical upstream flow of receiving stream
	=	0.2 cfs × 0.67 = 0.13 cfs
Q_e	=	Facility Effluent flow (cfs) = 0.5 MGD = 0.77 cfs
C_b	=	Upstream concentration (mg/l) = 0 mg/l (assumed in this example)
C_e	=	Effluent concentration (mg/l) = permit limit
IWC	=	Chronic ammonia toxicity criterion (from Tables 4-10 or 4-11)
	=	IWC for the Boston Mountains (daily max) from Tables 4-10A and 4-10B for a minor permit
	=	5.3 mg/l (April – October) and 15.8 mg/l (November – March)

For minor permits, the monthly average is set equal to the daily maximum. Rearranging the Mass Balance Equation to solve for allowable limits:

$$\text{IWC} = \frac{\left((C_e \times Q_e) + (C_b \times Q_b)\right)}{Q_e + Q_b}$$

$$C_e = \frac{\left(\text{IWC} \times (Q_e + Q_b) - (C_b \times Q_b)\right)}{Q_e}$$

April - October:

$$C_e = \frac{\left(5.3 \times (0.77 + 0.13) - (0 \times 0.13)\right)}{0.77} = 6.2 \text{ mg/l}$$

Nov - March:

$$C_e = \frac{\left(15.8 \times (0.77 + 0.13) - (0 \times 0.13)\right)}{0.77} = 18.5 \text{ mg/l}$$

From the Streeter-Phelps DO model, the DO-based ammonia limits are as follows:

$$\text{Monthly Average} = 5 \text{ mg/l (year} - \text{round)}$$
$$\text{Daily Maximum} = 5 \times 1.5 = 7.5 \text{ mg/l (year} - \text{round)}$$

Therefore, ammonia nitrogen limits in the permit would be as follows:

	Monthly Average (mg/l)	Daily Maximum (mg/l)
April – October	5	6.2
November – March	5	7.5

4.15.6 Total Phosphorus (TP)

All point source discharges into the watershed of waters officially listed on Arkansas's 303(d) list for nutrients may be considered for discharge permit limits based on Rule 2.509. Additionally, waters in nutrient surplus watersheds as determined by Act 1061 of 2003, codified at Ark. Code Ann. § 15-20-1104 and Arkansas Natural Resources Commission Title 22, and subsequently designated nutrient surplus watersheds may have TP limits included in the permit.

In order to establish a data base of point source loadings of nutrients to waters of the state, NPDES permit requirements will include monitoring for total phosphorus (TP) with frequency at least once per month for a minimum of three (3) years for the following facilities:

1) All major municipal facilities;
2) All minor municipals with food processing plants as industrial users;
3) All food processing facilities;
4) All other non-municipal facilities with significant organic waste in process water; and
5) Other facilities as necessary at the DEQ Director's discretion.

4.15.7 Nitrate + Nitrite – Nitrogen (NO_3 + NO_2-N)

In order to establish a data base of point source loadings of nutrients to waters of the state, NPDES permit requirements will include monitoring for NO_3 + NO_2-N with frequency of at least once per month for a minimum of three (3) years for the following facilities:

1) All major municipal facilities;
2) All minor municipals with food processing plants as industrial users;
3) All food processing facilities;
4) All other non-municipal facilities with significant organic waste in process water; and
5) Other facilities as necessary at the DEQ Director's discretion.

APC&EC Rule 6 also limits discharges to 10 mg/l of NO_3 + NO_2-N for discharges which enter the groundwater (losing streams).

4.15.8 Total Residual Chlorine (TRC)

Unless determined by a site-specific study, the concentrations at the edge of the mixing zone will be calculated by multiplying the highest daily maximum reported value for the last two years for TRC by critical dilution as follows:

$$(\text{Effluent concentration}) \times \left(\frac{\text{Critical Dilution \%}}{100}\right) = \text{IWC}$$

To determine critical dilution for the equation above, refer to Chapter 6. This IWC value should be less than or equal to the criteria. Otherwise, BMP requirements or limits will be included in the permit.

4.15.9 pH

Most permits have pH limits of 6.0 – 9.0 standard units. However, pH outside of this range is allowed if, after mixing with receiving stream at critical flow conditions, the resulting mixture is within the range of 6.0 – 9.0 standard units. Also, in accordance with 40 CFR §133.102(c): "The effluent values for pH shall be maintained within the limits of 6.0 to 9.0 unless the publicly owned treatment works demonstrates that: (1) Inorganic chemicals are not added to the waste stream as part of the treatment process; and (2) contributions from industrial sources do not cause the pH of the effluent to be less than 6.0 or greater than 9.0." A spreadsheet is available at the link given below or by request to predict pH effects of a point source discharge in the receiving stream after mixing.

E:\NPDES MAIN\Spreadsheets\Major Municipal Spreadsheets\pH calculation for above 9 Worksheet.xlsx

4.15.10 Dissolved Oxygen (DO)

Unless otherwise justified, all permitted DO limits are normally implemented as an instantaneous minimum as determined by the Streeter-Phelps model. For facilities with technology limits not based on the Streeter-Phelps model, the DO limit is set at the water quality standard for that receiving stream to ensure that the discharge will not cause or contribute to a violation of the DO standard.

4.15.11 Minerals (Cl, SO_4, and TDS)

Site Specific Mineral Quality Criteria and Domestic Water Supply Criteria can be found in Rules 2.511(A) and (C), respectively. From these standards, only chlorides (Cl), sulfates (SO_4), and total dissolved solids (TDS) have specific numerical value. Rule 2.511(B) are ecoregion benchmark values which are intended to be used for development of site-specific criteria if necessary for the particular waterbody being evaluated.

The following expression is used to evaluate the mineral Instream Waste Concentration (IWC):

$$\text{IWC} = \frac{\left((C_e \times Q_e) + (C_b \times Q_b)\right)}{Q_e + Q_b}$$

Where:

Q_b	=	Upstream flow of receiving stream
	=	Harmonic mean flow for streams listed in Rule 2.511(A) without an asterisk, or
	=	4 cfs for streams listed in Rule 2.511(A) with an asterisk, or
	=	7Q10 for domestic water supply criteria
Q_e	=	Effluent discharge flow (cfs)
C_b	=	Upstream concentration (mg/l) based on Table 4-12
C_e	=	Reported geometric mean mineral concentration in effluent (mg/l)
IWC	=	Instream waste concentration (mg/l); $\text{IWC}_{\text{stream}}$ will reference IWCs for comparison with Stream Mineral values. $\text{IWC}_{\text{drink}}$ will reference IWCs for comparison with the Domestic Water Supply criteria.

4.15.11.1 Upstream Values for Minerals

The upstream value to be used in determining final effluent limits as follows:

4.15.11.1.1 Small streams (7Q10 less than 100 cfs)

The upstream value to be used in determining final effluent limits for small streams (7Q10 less than 100 cfs) is the mean concentration by ecoregions as follows.

Table 4-12: Mineral Upstream Values			
Ecoregion[19]	**Chlorides**	**Sulfates**	**TDS**
Gulf Coastal Plains	5	13	67
Ouachita Mountains	3	6	53
Arkansas River Valley	4	4	51
Boston Mountains	3	3	37
Ozark Highlands	6	6	143
Delta	9	10	188

4.15.11.1.2 Large streams (7Q10 greater than 100 cfs)

The upstream value to be used in determining final effluent limits for large streams is the geometric mean concentration of the closest upstream station for the last ten years.

4.15.11.2 Minerals Limits Determination

If DEQ has determined from the submitted effluent test results for minerals that RP exists for either site specific mineral quality criteria or domestic water supply criteria, then limits will be calculated. In accordance with Rule 2.104 permit limits will become effective after three (3) years from effective date of the permit. Monitoring and reporting requirements will be included in the permit for the first three (3) years. Limits for minerals can be calculated as follows:

$$C_e = \frac{\left(\mathrm{IWC} \times (Q_b + Q_e) - (C_b \times Q_b)\right)}{Q_e}$$

C_e = Based on stream mineral values the limit will be utilized as the monthly average concentration limitation. The maximum daily discharge limits will be 2 times greater than the monthly average.[20]

[19] June 1987 Physical, Chemical, and Biological Characteristics of Least-Disturbed Reference Streams in Arkansas's Ecoregions publication by DEQ.
[20] Page 104 of Section 5.4.2 of TSD for Water Quality-Based Toxics Control EPA 505/2-90-001 March 1991.

4.15.12 Temperature

Temperature in the water quality standards is limited in two ways. Each waterbody classification has an upper temperature limit and a maximum allowable temperature rise above natural temperature outside of the mixing zone. The point of compliance with the temperature standards is at critical conditions. The critical condition for maximum allowable temperature is the period of the year when the natural average temperature of the receiving water is the highest. The evaluation of maximum temperature rise should consider the period of the year when the natural average temperature of the receiving water is the lowest. A spreadsheet is available for evaluation of both of these criteria for temperature via the link below, or can be requested from the Office of Water Quality. Any data that indicates a violation of water quality standards should be verified in the receiving water and the permit should contain a water-quality temperature limit based on Rule 2.502, if necessary.

E:\NPDES MAIN\Spreadsheets\Protected Spreadsheets\Temperature Evaluation.xlsx

4.16 Maximum Daily Limit Determination

A maximum daily limit represents the absolute maximum allowable load or concentration of a substance that a facility may release into a receiving stream in one day. This limit may be based on water quality constraints, or sector-specific or case specific technology considerations. The value is typically represented by the *99th percentile* of existing or required performance.

Permit engineers typically multiply the monthly average limits by (1.5 – 2) to derive the daily maximum limits[25]. For ammonia toxicity the maximum daily limit is determined from monthly average criteria given in Rule 2.512 multiplied by 2.5.

4.17 Average Monthly Limit (AML) Determination

Because it is difficult and sometimes impossible to continuously monitor the effluent to ensure compliance with the MDL, the concept of Average Monthly Limit (AML) is used. The AML represents the maximum averaged load or concentration of a substance that a facility may release into a receiving stream over a specified time period. Typically, this value represents the 95th percentile of existing or required performance. The value of the AML can also vary based on monitoring frequency.

The value of an average of a number of samples is related to the number of samples taken and the variability of the data. The more samples taken, the closer the result should be to the population (or true) mean. Similarly, the lower the variability of the data for a given sample size, the closer the result should be to the long-term mean. These relationships are used to develop an Average Monthly Limit.

It is important to account for these relationships because it is impossible to monitor most substances continuously. What values are occurring between those times that samples are taken is predicted by understanding the shape of the population distribution. The general equation for determining Average Monthly Limit percentiles is:

$$\mathrm{AML} = \mathrm{LTA} + z\left(\frac{s^2}{n}\right)^{0.5}$$

Where:

AML	=	Average Monthly Limit
LTA	=	Long Term Average (mean)
n	=	Number of samples per month
s	=	Standard deviation
z	=	z score for the normal distribution
	=	1.64 for the 95th percentile

The above equation can be used for the calculation of Average Monthly Limits except lognormal distribution assumptions are usually followed and thus the functional equation becomes:

$$\mathrm{AML} = \mathrm{LTA} \times e^{\left((z \times s_n) - (0.5(s_n)^2)\right)}$$

Where:

AML	=	Average Monthly Limit
LTA	=	Long Term Average (mean)
s_n^2	=	$\ln\left(\frac{(\mathrm{CV})^2}{n} + 1\right)$
n	=	Number of samples per month
z	=	z score for the normal distribution
	=	1.64 for the 95th percentile

4.18 Mass Limitations Calculations

Mass limits are calculated based on the following formula:

$$\text{Mass limits (lbs/day)} = \text{Concentration (mg/l)} \times \text{Flow (MGD)} \times 8.34$$

4.19 Permit Limits Less than Detection Level

If the calculated permit limit for any pollutant is less than the detection level, the calculated value is used as the permit limit and a footnote is added to specify that the method detection level will be used to determine compliance.

4.20 Effluent Limitations where Average Upstream Level Exceeds WQS

If the average upstream value exceeds the WQS criteria then the permit is issued with a water quality based limitation equivalent to the WQS at the end of the pipe. This allows for a permit that does not contribute to or cause an exceedance of a WQS (40 CFR §122.44(d)(1)(iii)[21]). The permit may include a reopener clause to allow permit modification if, as a result of a UAA, WQS are revised.

4.21 Hydrograph Controlled Release (HCR) Systems

In Hydrograph Controlled Release (HCR) systems, the facility is authorized to discharge only when the stream flow is sufficient to ensure that the instream water quality criteria, as listed in Rule 2, is not exceeded. In an HCR system, treated effluent under an individual NPDES Permit is discharged in conjunction with a determined minimum upstream stream flow (or ratio) which is sufficient to maintain instream water quality criteria after mixing. During periods when stream flow is above this determined minimum stream flow or ratio, treated effluent may be discharged proportionally as appropriate to maintain the instream criteria. For stormwater discharges, an HCR or upstream stream flow to stormwater discharge ratio should be determined using event duration basis rather than instantaneous measurements.

An HCR system is not a wastewater treatment system. However, HCR systems can be a very cost-effective alternative to upgrading an existing treatment system or building a new treatment system. The development and use of HCR systems shall be on a case by case basis after DEQ approval of appropriate technical and engineering design information submitted by the permittee to characterize operation of the system.

[21] 40 CFR § 122.44(d)(1)(iii) is included by reference in APC&EC Rule 6.

Chapter

5

Chapter 5 MONITORING AND SAMPLING REQUIREMENTS

This chapter presents guidance and provides the technical references and statutory references which a permit engineer should consider when establishing the special permit conditions for frequency of sampling, sample types, sampling locations and the analytical methods in a wastewater discharge permit for a specific pollutants. Whole Effluent Toxicity (WET) monitoring and sampling requirements are discussed in Chapter 6.

This chapter helps the permit engineer determine what methods to follow to establish monitoring conditions in a permit. The monitoring and reporting conditions section of an NPDES permit generally includes specific requirements for the following items:

- Monitoring locations.
- Monitoring frequencies.
- Sample type.

5.1 Monitoring Location

The permit engineer is responsible for determining the most appropriate monitoring location(s) and indicating the location(s) in the permit. Ultimately, the permittee is responsible for providing a safe and accessible sampling point that is representative of the discharge [§122.41(j)(1)].

The permit engineer should consider the following questions when selecting a monitoring location:

- Is the monitoring location on the facility's property?
- Is the monitoring location accessible to the permittee and the permitting authority?
- Will the results be representative of the targeted wastestream?
- Is monitoring at internal points needed?
- Is the monitoring location following the final treatment unit?

5.2 Monitoring Frequency

To establish a monitoring frequency, the permit engineer should consider the variability of the concentration of various parameters by reviewing effluent data for the facility (e.g., from discharge monitoring reports [DMRs]) or, without actual data, information from similar dischargers. A highly variable discharge should require more frequent monitoring than a discharge that is relatively consistent over time (particularly in terms of flow and pollutant concentration). Other factors that should be considered when establishing appropriate monitoring frequencies include the following:

- Compliance history
- Cost of monitoring
- Location of the discharge
- Nature of the pollutants.

To ensure representative monitoring, permit conditions could be included to require monitoring on the same day, week, or month for parameters that might be correlated in some way. For example, coordinating the monitoring requirements for parameters such as pathogens and chlorine or metals and pH can provide information for both compliance assessment and determination of treatment efficacy.

5.3 Type of Samples

The permit engineer must specify the sample type for all parameters required to be monitored in the permit. The permit engineer should determine the sample type on the basis of the characteristics of each specific discharge. Certain sample collection and storage requirements are identified as part of the analytical methods specified in §136. The three common sample types are grab, composite, and continuous.

5.3.1 Grab Sample

A grab sample is an individual sample collected in less than 15 minutes time. It represents more

or less "instantaneous" conditions. Grab samples are appropriate when the flow and characteristics of the wastestream being sampled are relatively constant. A grab sample is appropriate when a sample is needed to:

- Monitor an effluent that does not discharge on a continuous basis.
- Provide information about instantaneous concentrations of pollutants at a specific time.
- Corroborate composite samples.
- Monitor parameters not amenable to compositing (e.g., temperature).

Grab samples must be used for pH, temperature, cyanide, total phenols, total residual chlorine (TRC), oil and grease (O&G), fecal indicator bacteria (FIB), sulfide, and volatile organic compounds [40 CFR §122.21 (g)(7) and 40 CFR §403.12(g)(3)].

5.3.2 Composite Sample

Composite samples might provide a more representative measure of the discharge of pollutants over a given period than grab samples. Composite samples are collected over time, either by continuous sampling or by mixing discrete samples, and represent the average characteristics of the wastestream during the sample period.

Composite samples are collected either manually or with automatic samplers. "Composite sample" is a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing a minimum of four (4) effluent portions collected at equal time intervals (but not closer than one hour apart) during operational hours, within the 24-hour period, and combined proportional to flow or a sample collected at more frequent intervals proportional to flow over the 24-hour period.

5.3.3 Continuous Monitoring

Continuous monitoring is another option for a limited number of parameters such as TOC, temperature, pH, conductivity, fluoride and dissolved oxygen. Continuous monitoring may be required on a case by case basis. The environmental significance of the variation of any parameter in the effluent should be compared to the cost of continuous monitoring equipment available for that parameter.

The regulations concerning pH limits allow for a period of excursion when the effluent is being continuously monitored (40 CFR §401.17). Continuous monitoring or labor-intensive periodic monitoring by grab sampling is necessary where pH excursions are allowed.

5.4 Recommendation of Permit Frequency and Sample Type Requirements

The following tables can be used as a guideline to provide an overview of the considerations involved in determining appropriate measurement for NPDES permit frequencies and sample types, and how to properly incorporate the appropriate requirements in an NPDES permit based on permitted effluent flow (MGD). It also provides guidance to the public and to the regulated community on how DEQ intends to exercise its discretion in implementing its policy.

Consulting with individuals, including the permittee, who are knowledgeable about the facility or type of operation will save time on appeals, enforcement and future permit renewal or modification efforts. A good source of information about a facility is the inspector who deals with the facility or similar facilities.

Table 5-1A[22]: Frequency and Sample Type For Flow, $CBOD_5$ or BOD_5, TSS, NH_3-N, DO, pH, TRC, FIB, and O&G				
Flow (MGD)	Flow		$CBOD_5$ or BOD_5, TSS, NH3-N, DO, pH,[23] TRC,[23] FIB, and O&G[23]	
	Measurement Frequency	Sample Type	Measurement Frequency	Sample Type
0 to 0.05	2/week	Instantaneous	1/quarter	Grab
0.051 to 0.10	2/week	Instantaneous	1/month	Grab
0.11 to 0.5	5/week	Instantaneous	2/month	Grab
0.51 to 1.0	Daily	Totalizing Meter	3/month	Composite[23]/Grab
1.01 to 5.0	Daily	Totalizing Meter	3/week	Composite[23]/Grab
5.01 to 10.0	Daily	Totalizing Meter	5/week	Composite[23]/Grab
10.01 and up	Daily	Totalizing Meter	Daily	Composite[23]/Grab
variable	2/week (when discharging)	Instantaneous	1/month (when discharging)	Grab

Table 5-1B[22]: Frequency and Sample Type for Nutrients and Toxic Pollutants		
Pollutant	Measurement Frequency	Sample Type
Nutrients	Case by case	Grab
Toxic Pollutants	1/month	Composite[23]

5.5 Monitoring Frequency Reductions (Excluding WET Testing)

The reduction of monitoring frequency for demonstrated good performance is generally applied at the time of permit renewal and major modification of the permit and the monitoring frequency is reduced from baseline frequency. The baseline monitoring frequency is the frequency in the current permit.[24] The monitoring frequency reduction decision-making process is presented in the following sections.

WET Testing monitoring frequency reductions are discussed in Chapter 6.

5.5.1 Decision-Making Process

The following framework may be used to determine if a particular facility is eligible for reductions, and, if so, the amount of these reductions.

- The guidance applies to both major and minor individual NPDES permits for direct discharges.
- Each facility's enforcement history is analyzed to assess eligibility for

[22] Source: Memo dated July 15, 1993 from Mo Shafii through Mark Bradley to NPDES Permit Engineers.
[23] Total residual chlorine, pH, cyanide, and temperature samples cannot be "composited" under any circumstances [*FR/Vol.70, No. 198/pg 60157*]
[24] Memo dated June 12, 2020 from Guy Lester to Bob Blanz, *OWQ Monitoring Frequency Reduction Guidelines*

reductions under the guidance.

- The monitoring frequency reduction for a parameter can only be granted one time during a permit term for that specific parameter. Frequency reductions may also be considered through a major permit modification application.
- For each existing eligible facility, the compliance history for each parameter for which a monitoring reduction is requested is examined for any violations generally during the past two years or as specified by permit conditions.
- New permittees should go through one permit cycle (5 years) before being eligible for consideration for reduced monitoring.
- Facilities which satisfy the entry criteria but are not experiencing discharges of 75% or less of their permitted levels of water quality-based parameters may still be eligible for reductions in monitoring/reporting frequencies. Monitoring will only be reduced for such parameters if the applicant can demonstrate a coefficient of variation (ratio of standard deviation to the mean) of 0.20 or less and no monthly average limit violation for the two-year averaging period. Reduction will be allowed as shown in Table 5-2.
- Monitoring reduction for effluent data which has not been continuously reported over the two-year period, interrupted or discontinuous data, intermittent, short-term, and batch discharges must be considered on a case by case basis. These will require performance data for longer than two years to determine a long-term average.

5.5.2 Procedures

Monitoring reduction may be granted during the permit term at the request of the permittee and as appropriate as follows:

1. Calculate long-term average (mean) effluent concentration for the pollutant of concern (POC) during the past two years.
2. Calculate Ratio as a percentage of long-term average effluent concentration for the past 2-year period of record (Step 1) to monthly average concentration limit of POC in the existing permit.
3. Use the information in Table 5-2, which is based on the existing monitoring frequency, to determine the potential monitoring frequency reduction.
4. Use the information in Table 5-3 if the ratio of long-term effluent average to monthly average limit is greater than 75% and a coefficient of variation (CV) of 0.2 or less, to determine the potential monitoring frequency reduction.

Table 5-2: Performance-Based Monitoring Frequency Reductions with a Ratio of Long-Term Effluent Average (LTA) to Monthly Average Limit (MAL) 75% or less				
Baseline Monitoring	Ratio of LTA to MAL			
	75-66%	65-50%	49-25%	<25%
7/week	5/week	4/week	3/week	1/week
6/week	4/week	3/week	2/week	1/week
5/week	4/week	3/week	2/week	1/week
4/week	3/week	2/week	1/week	1/week
3/week	3/week	2/week	1/week	1/week
2/week	2/week	1/week	2/month	1/month
1/week	1/week	1/week	2/month	1/2months
2/month	2/month	2/month	2/month	1/quarter
1/month	1/month	1/month	1/quarter	1/6months

Table 5-3: Performance-Based Monitoring Reduction with a Ratio of Long-Term Effluent Average (LTA) to Monthly Average Limit (MAL) 100-76% and a CV of 0.2 or less	
Baseline Monitoring	Reduced Monitoring
7/week	6/week
6/week	5/week
5/week	4/week
4/week	No reduction
3/week	
2/week	
1/week	
2/month	
1/month	

5.5.3 Residency Criteria for Continued Participation

Permittees are expected to maintain the performance levels that were used as the basis for granting monitoring reductions. To remain eligible for these reductions, the permittee should have no significant noncompliance (SNC) violations of effluent limitations for the parameters for which reductions have been granted, have submitted all required DMRs, and has not been subject to recent formal enforcement action. The permitting authority may require increased monitoring for facilities that are subject to formal enforcement actions or do not maintain exemplary performance levels. This information will be reviewed during permit renewals or at any other point during the permit cycle.

Chapter

6

Chapter 6 WHOLE EFFLUENT TOXICITY

Whole effluent toxicity (WET) is the total toxicity of an effluent measured directly with a toxicity test. WET testing is necessary because Office of Water Quality cannot develop water quality criteria for every one of the thousands of possible toxic pollutants in wastewater discharges. WET testing is also the only method available to a permit engineer for assessing the toxic interaction of pollutants in wastewater.[25] The goal of the WET rule is the eventual elimination of the discharge of toxics in toxic amounts.

WET requirements are established for all DEQ discharges classified as majors (e.g., ≥ 1.0 MGD design flow or MRAT ≥ 80). WET requirements may also be applied on a case-by-case basis to minor dischargers with a known or suspected toxic potential.

EPA's current Policy on Independent Applicability precludes over-riding one form of aquatic protection with another, e.g. WET requirements cannot be precluded on the basis that a biological survey did not find impairment to aquatic community.[26]

6.1 WET Options (Acute or Chronic)

WET is evaluated for a reasonable potential to violate the water quality standards based on one of the following:

6.1.1 Acute WET

If the facility discharges to a large stream (7Q10 > 100 cfs) ***and*** the dilution ratio, i.e. the ratio of the upstream flow, 7Q10, to the discharge flow, Q_e, is greater than 100:1 ([7Q10: Q_e] > 100:1), acute WET testing is required.

An acute test is conducted over a period of 48 hours (*Pimephales promelas* and *Daphnia pulex*) and the endpoint is mortality. This endpoint is expressed as the No Observed Effect Concentration (NOEC). The NOEC is defined as the greatest effluent dilution at and below which toxicity that is statistically different from the

[25] Rule 2.408.
[26] Final Policy on Biological Assessments and Criteria, dated August 13, 1991.

control (0% effluent) at the 95% confidence level does not occur. Acute test failure is defined as a demonstration of a statistically significant lethal effect at test completion to a test species at or below the critical dilution.

6.1.2 Chronic WET

If the facility discharges to small stream (7Q10 ≤ 100 cfs), and the dilution ratio is less than or equal to 100:1 ([7Q10: Q_e] ≤ 100:1), then chronic WET testing is required.

A chronic test is conducted over a period of 7 days (*Ceriodaphnia dubia* and Fathead minnow) and the endpoint measured is mortality and sub-lethal effects, for example changes in reproduction or growth. This endpoint is expressed as the No Observed Effect Concentration (NOEC). The NOEC is the greatest effluent dilution at and below which toxicity (lethal or sub-lethal) that is statistically different from the control (0% effluent) at the 95% confidence level does not occur. Chronic lethal test failure is defined as a demonstration of a statistically significant lethal effect at test completion to a test species at or below the critical dilution. Chronic sub-lethal test failure is defined as a demonstration of a statistically significant sub-lethal effect (i.e., growth or reproduction) at test completion to a test species at or below the critical dilution.

6.1.3 Stormwater Only Discharge and Short-Term Emergency Outfall Discharge

Stormwater only “Short-term” discharge is defined as a discharge of not more than five consecutive 24-hour periods; precipitated by a storm event. Separate short-term discharge events must be separated by more than five days and must not total more than 10 days during a 30-day period. If the facility’s discharge is “Short-term” stormwater only, regardless of the receiving stream 7Q10 and the ratio of the upstream flow to the discharge flow, acute WET testing is required.

An acute test is conducted over a period of 48 hours (*Pimephales promelas* and *Daphnia pulex*) and the endpoint is mortality. This endpoint is expressed as the No Observed Effect Concentration (NOEC). The NOEC is defined as the greatest effluent dilution at and below which toxicity that is statistically different from the control (0% effluent) at the 95% confidence level does not occur. Acute test failure is defined as a demonstration of a statistically significant lethal effect at test completion to a test species at or below the critical dilution.

Stormwater only “Long-term” discharge is defined as discharges of more than five consecutive 24-hour periods; precipitated by a storm event or separate short-term discharges which are not separated by at least five days or separate short term discharge events totaling more than 10 days during a 30-day period. If the facility’s discharge is “Long-term” stormwater only, Sections 6.1.1 or 6.1.2 apply as specified above.

"Short-term Emergency" discharge is defined as a discharge of not more than five consecutive 24-hour periods. Separate short-term discharge events must be separated by more than five days and must not total more than 10 days during a 30-day period.

If the facility's discharge is "Short-term Emergency" only, regardless of the receiving stream 7Q10 and the ratio of the upstream flow to the discharge flow, acute WET testing is required. An acute test is conducted over a period of 48 hours (*Pimephales promelas* and *Daphnia pulex*) and the endpoint is mortality. This endpoint is expressed as the No Observed Effect Concentration (NOEC). The NOEC is defined as the greatest effluent dilution at and below which toxicity that is statistically different from the control (0% effluent) at the 95% confidence level does not occur. Acute test failure is defined as a demonstration of a statistically significant lethal effect at test completion to a test species at or below the critical dilution.

"Long-term Emergency" discharge is defined as discharges of more than five consecutive 24-hour periods; or separate short-term discharges which are not separated by at least five days or separate short term discharge events totaling more than 10 days during a 30 day period. If the facility's discharge is "Long-term Emergency" only, Sections 6.1.1 or 6.1.2 apply as specified above.

6.2 Critical Dilution (CD)

Critical dilution (low flow dilution) must be calculated by using the following formula:

6.2.1 Acute Toxicity

$$\mathrm{CD} = \left(\frac{Q_e}{Q_e + (0.25 \times 0.1 \times 7\mathrm{Q}10)}\right) \times 100$$

6.2.2 Chronic Toxicity

For Large Streams (7Q10 ≥ 100 cfs):

$$\mathrm{CD} = \left(\frac{Q_e}{Q_e + (0.25 \times 7\mathrm{Q}10)}\right) \times 100$$

For Small Streams (7Q10 < 100 cfs):

$$\mathrm{CD} = \left(\frac{Q_e}{Q_e + (0.67 \times 7\mathrm{Q}10)}\right) \times 100$$

6.3 Dilution Series

Table 6-1 will be used to determine the dilution series. However, the dilution series may be modified, as appropriate, if the critical dilution is greater than 80% effluent and the facility has WET limits in permit. According to EPA Region 6 WET Permitting Strategy (May, 2005) due to the potential difficulty of resolving toxicity and/or identifying toxicants responsible for sub-lethal effects in effluent concentrations greater than 75% effluent, sub-lethal limits will be implemented at the 80% effluent level at this time.

After determining the critical dilution (CD), find that number in column 4. The dilution series is established in the row that number appears in. Example, for a CD of 30%, the series would be 13%, 17%, 23%, 30% and 40%, plus the required 0% Control. This ensures that there will be only one (1) dilution above the CD, which aids the statistical analysis. For facilities with CDs greater than 75%, the CD is the highest dilution and there will be four dilutions and the 0% control below the CD. For facilities with CDs equal to or less than 1%, the CD will be set as 1% in the permit.

Table 6-1 0.75 Dilution Series

Control (0)	1	2	3	4 (CD)	5
	0.4	0.6	0.8	1.0	1.3
	0.8	1.1	1.5	2.0	2.7
	1.3	1.7	2.3	3.0	4.0
	1.7	2.3	3.0	4.0	5.3
	2.1	2.8	3.8	5.0	6.7
	2.5	3.4	4.5	6.0	8.0
	3	4	5	7	9
	3	5	6	8	11
	4	5	7	9	12
	4	6	8	10	13
	5	6	8	11	15
	5	7	9	12	16
	5	7	10	13	17
	6	8	11	14	19
	6	8	11	15	20
	7	9	12	16	21
	7	10	13	17	23
	8	10	14	18	24
	8	11	14	19	25
	8	11	15	20	27
	9	12	16	21	28
	9	12	17	22	29
	10	13	17	23	31
	10	14	18	24	32
	11	14	19	25	33
	11	15	20	26	35

Table 6-1 0.75 Dilution Series

Control (0)	1	2	3	4 (CD)	5
	11	15	20	27	36
	12	16	21	28	37
	12	16	22	29	39
	13	17	23	30	40
	13	17	23	31	41
	14	18	24	32	43
	14	19	25	33	44
	14	19	26	34	45
	15	20	26	35	47
	15	20	27	36	48
	16	21	28	37	49
	16	21	29	38	51
	16	22	29	39	52
	17	23	30	40	53
	17	23	31	41	55
	18	24	32	42	56
	18	24	32	43	57
	19	25	33	44	59
	19	25	34	45	60
	19	26	35	46	61
	20	26	35	47	63
	20	27	36	48	64
	21	28	37	49	65
	21	28	38	50	67
	22	29	38	51	68
	22	29	39	52	69
	22	30	40	53	71
	23	30	41	54	72
	23	31	41	55	73
	24	32	42	56	75
	24	32	43	57	76
	24	33	44	58	77
	25	33	44	59	79
	25	34	45	60	80
	26	34	46	61	81
	26	35	47	62	83
	27	35	47	63	84
	27	36	48	64	85
	27	37	49	65	87
	28	37	50	66	88
	28	38	50	67	89
	29	38	51	68	91
	29	39	52	69	92

Table 6-1 0.75 Dilution Series

Control (0)	1	2	3	4 (CD)	5
	30	39	53	70	93
	30	40	53	71	95
	30	41	54	72	96
	31	41	55	73	97
	31	42	56	74	99
	32	42	56	75	100
24	32	43	57	76	
24	32	43	58	77	
25	33	44	59	78	
25	33	44	59	79	
25	34	45	60	80	
26	34	46	61	81	
26	35	46	62	82	
26	35	47	62	83	
27	35	47	63	84	
27	36	48	64	85	
27	36	48	65	86	
28	37	49	65	87	
28	37	50	66	88	
28	38	50	67	89	
28	38	51	68	90	
29	38	51	68	91	
29	39	52	69	92	
29	39	52	70	93	
30	40	53	71	94	
30	40	53	71	95	
30	41	54	72	96	
31	41	55	73	97	
31	41	55	74	98	
31	42	56	74	99	
32	42	56	75	100	

6.4 Recommendation of Permit Frequency and Sample Type Requirements

The following tables as a guideline provide an overview of the considerations involved in determining appropriate measurement for NPDES permit frequencies and sample collection types requirements, and how to properly incorporate the appropriate requirements in an NPDES permit based on permitted effluent flow (MGD). It also provides guidance to the public and to the regulated community on how DEQ intends to exercise its discretion in implementing its policy.

Table 6-2: Frequency and Sample Type Requirements for WET Testing		
Flow (MGD)	**Measurement Frequency**	**Sample Type**
≤ 2	1/quarter	24-hr composite
> 2	1/quarter	24-hr composite
Minor facilities	1/quarter	24-hr composite
Minor municipal*	2/year	24-hr composite

* Minor municipal facility with no failures for at least 5 years.

WET testing frequencies for facilities with a history of WET testing failures and WET limit violations will be determined on a case-by-case basis and may be more frequent than stated above. WET testing frequencies for facilities discharging into sensitive environments will be determined on a case-by-case basis and may be more frequent than stated above.

6.4.1 Monitoring Reductions

New facilities and new outfalls at existing facilities will not be eligible for reduced WET monitoring until three consecutive years of WET testing has been completed.

ARG790000 facilities will not be eligible for reduced WET monitoring until six (6) consecutive months of passing WET testing have been completed.

Facilities with new WET limits will not be eligible for reduced monitoring until one permit cycle (five years) is completed.

For acute WET testing, a monitoring frequency reduction will not be granted less than once per year for the less sensitive species (usually the Fathead minnow) and not less than twice per year for the more sensitive species (usually the *Daphnia pulex*).

For chronic WET testing, a monitoring frequency reduction will not be granted less than twice per year for both species. Monitoring frequency reductions for facilities with no violations over a minimum of two-years are found in Table 6-3.

Table 6-3: Performance Based Monitoring Frequency Reductions for WET		
Test Type	**Current Frequency**	**Potential Reduced Frequency**
Acute	Monthly	Bi-monthly or Quarterly
Acute	Bi-monthly	Quarterly
Acute	Quarterly	Twice per year for the more sensitive species Once per year for the less sensitive species

Table 6-3: Performance Based Monitoring Frequency Reductions for WET		
Test Type	**Current Frequency**	**Potential Reduced Frequency**
Acute	Twice per year	Once per year for the less sensitive species None for the more sensitive species
Chronic	Monthly	Bi-monthly or Quarterly
Chronic	Bi-monthly	Quarterly
Chronic	Quarterly	Twice per year
Chronic	Twice per year	None
ARG790000 Acute	Monthly	Twice per year

WET testing frequency reductions expire when the permit expires. Facilities must revert back to the original WET testing frequency that is stated in the permit.

For facilities where permit renewal is being held up by no fault of the permittee, the following language regarding WET testing frequency reduction applies after permit renewal:

> The permittee may apply for a testing frequency reduction upon the successful completion of the first four consecutive quarters of testing after the expiration date of the previous permit, for one or both test species, provided that all of the following conditions are met:
>
> i. The permittee tested quarterly upon the expiration date of that permit, and
> ii. The issuance of the renewed permit was not delayed by any fault of the permittee, and
> iii. No lethal or sub-lethal effects are demonstrated at or below the critical dilution for the first four consecutive quarters of testing after the expiration date of the previous permit.
>
> If any of the above conditions are not met, standard WET testing frequency reduction conditions apply.

6.4.2 Fish Hatchery/Aquaculture Facility WET

WET testing is not required for those fish hatcheries and aquaculture facilities that have a design flow of less than 1 MGD.

WET testing is required for those fish hatcheries and aquaculture facilities that have a design flow of greater than or equal to 1 MGD.

Fish hatcheries and aquaculture facilities shall perform one (1) Whole Effluent Toxicity (WET) test during the permit term. Sampling of the effluent for this WET test shall be performed when the facility is administering disease control chemicals (DCC).

The results of the test shall be submitted to the Water Quality Planning Branch of the Office of Water Quality for review. The report shall include:

A. Start date of DCC administration;
B. End date of DCC administration;
C. A description, including the name, of the DCC;
D. The amount of DCC administered;
E. The location of DCC administration (i.e. tank or raceway);
F. The name of the personnel administering the DCC.

If the final results of WET testing show that toxicity exists in the discharge, the permit may be reopened to include additional WET testing requirements or limits.

6.5 Whole Effluent Toxicity Permit Limit Determination

The EPA has developed a statistical approach to better characterize the effects of effluent variability and to make more certain the process of deciding whether to require an effluent limit. EPA's approach to project an estimated maximum concentration for the effluent combines knowledge of effluent variability, as estimated by a coefficient of variation, with the uncertainty due to limited data. The estimated maximum concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level. The projected effluent concentration after consideration of dilution can then be compared to an appropriate water quality criterion to determine the potential for exceeding that criterion and the need for an effluent limit.

An effluent has "reasonable potential" to exceed a receiving water quality standard if it cannot be demonstrated with a high level of confidence that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water criteria at specified low-flow conditions. The procedure outlined below requires that test's NOEC values be converted to Toxic Units (TUs) in order to perform the following calculations (TU = 100/NOEC). However, it is not necessary for permittees to report test results in TUs. EPA Region 6 has elected to use reasonable potential multiplying factor values from Table 3-2 of the EPA Technical Support Document, the 99% confidence level, and 95% probability basis. EPA Region 6 has developed a computer application to perform these calculations. Where there have been no test failures (lethal or sub-lethal) in the previous five years, the default finding is that reasonable potential (RP) does not exist and WET limits are not required. However, WET monitoring may be required.

6.5.1 Reasonable Potential Calculations Using Effluent Data Only

EPA recommends finding that a permittee has "reasonable potential" to exceed a receiving water quality standard if it cannot be demonstrated with a high confidence level that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water criteria at specified low-flow conditions.

Step 1: Convert the past five years of NOEC to TU $\left(\mathrm{TU} = \frac{100}{\mathrm{NOEC}}\right)$.

Step 2: Determine the number of total observations (n).

Step 3: Determine the highest TU value observed in the effluent (C_e).

Step 4: Determine the CV for the data set:

If $n \leq 10$

The CV is estimated to equal 0.6. For less than 10 data the uncertainty in the CV is too large to calculate a standard deviation or mean with sufficient confidence.

If $n > 10$

The CV is calculated as standard deviation/mean of the past five years' data.

Step 5: Determine Reasonable Potential Multiplying Factor (RPMF) from Table 6-4, based on number of samples in a five-year period (n) in step 2 and the CV in Step 4.

Step 6: Calculate receiving water concentration (RWC) in $\mathrm{TU_c}$ or $\mathrm{TU_a}$ as follows:

RWC = C_e (Step 3) × RPMF (Step 5) × proposed critical dilution of the permit/100

$$\mathrm{RWC} = C_e \times \mathrm{RPMF} \times \frac{\mathrm{CD}}{100}$$

Step 7: Compare the projected maximum RWC to the applicable standard (criteria maximum concentration [CMC], criteria continuous concentration [CCC]) or (100/critical dilution)). If RWC is less than (100/critical dilution), reasonable potential does not exist.

Example:
Consider the following results of toxicity measurements of an effluent with the critical Dilution of 100%. Calculate RWC:

	1	2	3	4	5	6	7	8	9	10	11	12
NOEC	56	32	100	75	75	42	100	100	75	32	100	100

Step 1: Convert NOEC to TU $\left(\mathrm{TU} = \frac{100}{\mathrm{NOEC}}\right)$

	1	2	3	4	5	6	7	8	9	10	11	12
NOEC	56	32	100	75	75	42	100	100	75	32	100	100
TU	1.79	3.13	1.0	1.33	1.33	2.38	1.0	1.0	1.33	3.13	1.0	1.0

Step 2: Number of data, $n = 12$

Step 3: Highest TU, $C_e = 3.13$

Step 4: $\text{CV} = \frac{\text{Standard Deviation}}{\text{Mean}} = \frac{27.4}{73.9} = 0.4$

Step 5: From Table 6-4, $\text{RPMF} = 1.4$ for $\text{CV} = 0.4$ and $n = 12$

Step 6: $\text{RWC} = C_e \times \text{RPMF} \times \frac{\text{CD}}{100} = 3.13 \times 1.4 \times \left(\frac{100}{100}\right) = 4.4\ \text{TU}$

Step 7: $\text{RWC} = 4.4\ \text{TU} > 1\ \text{TU}$, reasonable potential (RP) exists, permit requires WET monitoring and WET limit.

When using EPA Region 6's RP calculation spreadsheet, the following apply:

- Calculate RP using the CD for the revised permit.
- When an NOEC of 0 is reported, use 1 less than the lowest dilution used for that test for RP calculations.

6.5.1.1 Whole Effluent Toxicity Permit Limit Implementation

WET Limits are not required to be added when:

- Limits are not required to be added when there are less than 10 data points and no failures were noted during the permit cycle even if the calculation spreadsheet notes RP.
- Limits are not required to be added when only 1 failure was noted during the permit cycle even if the calculation spreadsheet notes RP.
- Limits are not required when a TRE or other documented corrective actions have eliminated previous effluent toxicity.

WET Limits are required when:

- Limits are required when more than 1 unexplained failure was noted during the permit cycle and the calculation spreadsheet notes RP.
- Limits are required when a TRE is inconclusive or does not result in elimination of effluent toxicity.

WET Limits are implemented as follows:

- For acute WET tests, a finding of RP with more than one lethal failure reported requires an acute limit for that species.
- For chronic WET tests, a finding of RP with more than one

unexplained lethal and/or sub-lethal failure reported requires a chronic limit for that species.
  - For Chronic limits, the facility will report the lowest NOEC value for survival or growth for Fathead minnow or survival or reproduction for *C. dubia*.

- Limits will be reported using the following Parameter codes:
  - Acute Fathead minnow: 51714
  - Acute *Daphnia pulex*: 51711
  - Chronic Fathead minnow: 51714
  - Chronic *C. dubia*: 51710
- When the effluent fails the chronic endpoint below the required limit, increased frequency testing[27] for the affected species is required and will increase to monthly until such time compliance with the limit is demonstrated for a period of three consecutive months.
- If conducting increased frequency testing due to a limit failure (demonstration of significant toxic effects at or below the limit) the results will be reported on an "Unscheduled DMR".
  - Unscheduled DMRs will report parameters 51714, TEM6C, TOM6C, TQM6C when Fathead minnow acute limits are included in the permit.
  - Unscheduled DMRs will report parameters 51711, TEM3D, TOM3D, TQM3D when *Daphnia pulex* acute limits are included in the permit.
  - Unscheduled DMRs will report parameters 51714, TLP6C, TOP6C, TPP6C, TGP6C, TQP6C when Fathead minnow chronic limits are included in the permit.
  - Unscheduled DMRs will report parameters 51710 TLP3B, TOP3B, TPP3B, TGP3B, TQP3B when *C. dubia* chronic limits are included in the permit.

6.6 Conditions Specific to WET Monitoring Requirements

6.6.1 Lethality Failures

The permittee shall conduct a total of three retests[28] for any species that demonstrates significant lethal effects at or below the critical dilution in a valid test. The retests shall be conducted monthly during the next *three* consecutive

[27] **Increased frequency test**: a test conducted after a limit violation for a permittee with WET limits. Increased frequency tests are conducted monthly until such time compliance with WET limit is demonstrated for a period of three consecutive months. Increased frequency tests are reported on Unscheduled DMRs. Increased Frequency test reports must be provided to DEQ.

[28] **Retest**: a test conducted after a lethal or sub-lethal failure at or below the critical dilution for a permittee with WET monitoring only. Retests are monthly during the next three consecutive months after the test failure. These are reported via retest codes on the DMR. If retests are not conducted because there were no failures, the permittee will report NODI 9 for the retest codes. Retest reports must be provided to DEQ.

months. If any of the retests demonstrates significant lethal effects at or below the critical dilution, persistent toxicity is confirmed and the permittee shall initiate TRE requirements.

6.6.2 Sub-lethal Failures

The permittee shall conduct a total of three retests for any species that demonstrates significant sub-lethal effects at or below the critical dilution in a valid test. The retests shall be conducted monthly during the next *three* consecutive months. If any two of the three retests demonstrate significant sub-lethal effects at 75% effluent or lower, persistent toxicity is confirmed and the permittee shall initiate TRE requirements. Persistent toxicity can also be confirmed by a pattern of toxicity demonstrated by multiple significant sub-lethal effects at 75% effluent.

6.6.3 Retest Codes

If conducting retests due to a test failure (demonstration of significant toxic effects at or below the critical dilution) the following Parameter codes will be used:

- Acute or Chronic Fathead minnow Retest 1: 22418
- Acute or Chronic Fathead minnow Retest 2: 22419
- Acute or Chronic Fathead minnow Retest 3: 51444
- Acute *Daphnia pulex* or Chronic *C. dubia* Retest 1: 22415
- Acute *Daphnia pulex* or Chronic *C. dubia* Retest 2: 22416
- Acute *Daphnia pulex* or Chronic *C. dubia* Retest 3: 51443

6.7 Toxicity Reduction Evaluation (TRE)

Within 90 days of confirming persistent toxicity (at least two lethal failures and/or at least three sub-lethal failures in a consecutive four-month period), the permittee shall submit a Toxicity Reduction Evaluation (TRE) Action Plan and Schedule for conducting a TRE. The TRE Action Plan shall specify the approach and methodology to be used in performing the TRE. A Toxicity Reduction Evaluation is an investigation intended to determine those actions necessary to achieve compliance with water quality-based effluent limits by reducing an effluent's toxicity to an acceptable level. A TRE is defined as a step-wise process which combines toxicity testing and analyses of the physical and chemical characteristics of a toxic effluent to identify the constituents causing effluent toxicity and/or treatment methods which will reduce the effluent toxicity. The goal of the TRE is to maximally reduce the toxic effects of effluent at the critical dilution.

The permittee shall initiate the TRE Action Plan within 30 days of plan and schedule submittal. The permittee shall assume all risks for failure to achieve the required toxicity reduction.

The permittee shall submit a quarterly TRE Activities Report, with the Discharge

Monitoring Report in the months of January, April, July, and October, containing information on toxicity reduction evaluation activities.

The permittee shall submit a Final Report on Toxicity Reduction Evaluation Activities no later than 28 months from confirming toxicity in the retests, which provides information pertaining to the specific control mechanism, selected that will, when implemented, result in reduction of effluent toxicity to no significant toxicity at the critical dilution. The report will also provide a specific corrective action schedule for implementing the selected control mechanism.

Quarterly testing during the TRE is a minimum monitoring requirement. EPA recommends that permittees required to perform a TRE not rely on quarterly testing alone to ensure success in the TRE, and that additional screening tests be performed to capture toxic samples for identification of toxicants. Failure to identify the specific chemical compound causing toxicity test failure will normally result in a permit limit for whole effluent toxicity limits per federal regulations at 40 CFR §122.44(d)(1)(v).

6.8 Concurrent Chemical-Specific Sampling and Analysis

DEQ may require concurrent chemical-specific analyses on samples collected for WET testing purposes where there is reason to believe substances may cause or contribute to WET. Permittees must submit the results of concurrent chemical-specific testing with the WET test report. Permittees must collect sufficient sample volumes for the testing laboratory to perform concurrent chemical-specific testing in addition to the WET testing.

6.9 WET Test Review Process

When permit-required WET tests are conducted the following review process will be carried out for submitted tests.

Test review is an important part of the overall quality assurance program and is necessary for ensuring that all test results are reported accurately. Test review should be conducted on each test by both the testing laboratory and the regulatory authority.

1) Results will be examined to verify the sample was maintained at the proper temperature from time of collection to arrival at the testing laboratory. Also, results will be examined to determine if the sample meets the test initiation and renewal holding time.

2) Results will be examined to verify if the test meets the test duration requirements.

a. Acute Tests (48-hour tests): +/- 2 hours from the time the test was initiated, minimum of 46 to a maximum of 50 hours after initiation.
b. Chronic *P. promelas* tests (7-day tests = 168 hours): +/- 2 hours from the time the test was initiated, minimum of 166 hours to a maximum of 170 hours.
c. Chronic C. *dubia* tests: test is terminated when 60% or more of the surviving control females have produced their third brood OR at the end of 8 days (192

Hours) whichever occurs first. The acceptable window of termination for 8 days is a minimum of 190 hours to a maximum of 194 hours.

3) Evaluate the test results for the effluent to verify that the laboratory met the test acceptability criteria (TAC) as specified in the test method. All invalid tests must be repeated with a newly collected sample, as specified in the permit. A repeat test[29] must be completed within the reporting period.

4) Results will be examined based on the "Summary of Test Conditions and TAC" section for the specific method to determine whether the required and recommended test conditions were met.

5) Statistical results will be examined to verify that the recommended flowcharts for statistical analysis were followed. Any deviation from the recommended flowcharts for selection of statistical methods should be noted in the data report.

6) The concentration-response relationships of the tests will be examined. These are reviewed to ensure that calculated test results are interpreted appropriately. All WET test results (from multi-concentration tests) reported under the NPDES program will be reviewed and reported according to EPA guidance on the evaluation of concentration-response relationship (see EPA. 2000. *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing* (40 CFR §136[30]) EPA 821-B00-004).

7) Results of the associated reference toxicant test and current control chart will be reviewed.

8) The within-test variability of individual tests will be reviewed. Permits requiring sub-lethal endpoints will be reviewed and variability criteria will be applied as described in the method manuals section on test review (see EPA. 2002. *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. EPA 821-R-02-013, Section 10.2, and EPA. 2002. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. EPA 821-R-02-012, Sec. 12-2).

9) DEQ will then approve the test as a pass, fail, or invalid for each endpoint.

[29] **Repeat test**: a test conducted after a previous test is deemed invalid by DEQ. Invalid tests are not test failures or limit violations; however, the test report must be provided to DEQ. Repeat tests must be conducted within the same monitoring period otherwise the permittee will have to report NODI H on their DMR.

[30] 40 CFR §136 is included by reference in APC&EC Rule 6.

Table 6-4. Reasonable Potential Multiplying Factors: 95% Confidence Level and 95% Probability Basis

Samples	Coefficient of Variation																			
	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	1.4	1.9	2.6	3.6	4.7	6.2	8.0	10.1	12.6	15.5	18.7	22.3	26.4	30.8	35.6	40.7	46.2	52.1	58.4	64.9
2	1.3	1.6	2.0	2.5	3.1	3.8	4.6	5.4	6.4	7.4	8.5	9.7	10.9	12.2	13.6	15.0	16.4	17.9	19.5	21.1
3	1.2	1.5	1.8	2.1	2.5	3.0	3.5	4.0	4.6	5.2	5.8	6.5	7.2	7.9	8.6	9.3	10.0	10.8	11.5	12.3
4	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.3	3.7	4.2	4.6	5.0	5.5	6.0	6.4	6.9	7.4	7.8	8.3	8.8
5	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.6	5.9	6.2	6.6	6.9
6	1.1	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.5	4.7	5.0	5.2	5.5	5.7
7	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9
8	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.9	4.0	4.2	4.3
9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.8	3.9
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	1.2	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	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.8	1 9	1.9	2.0	2.0	2.0	

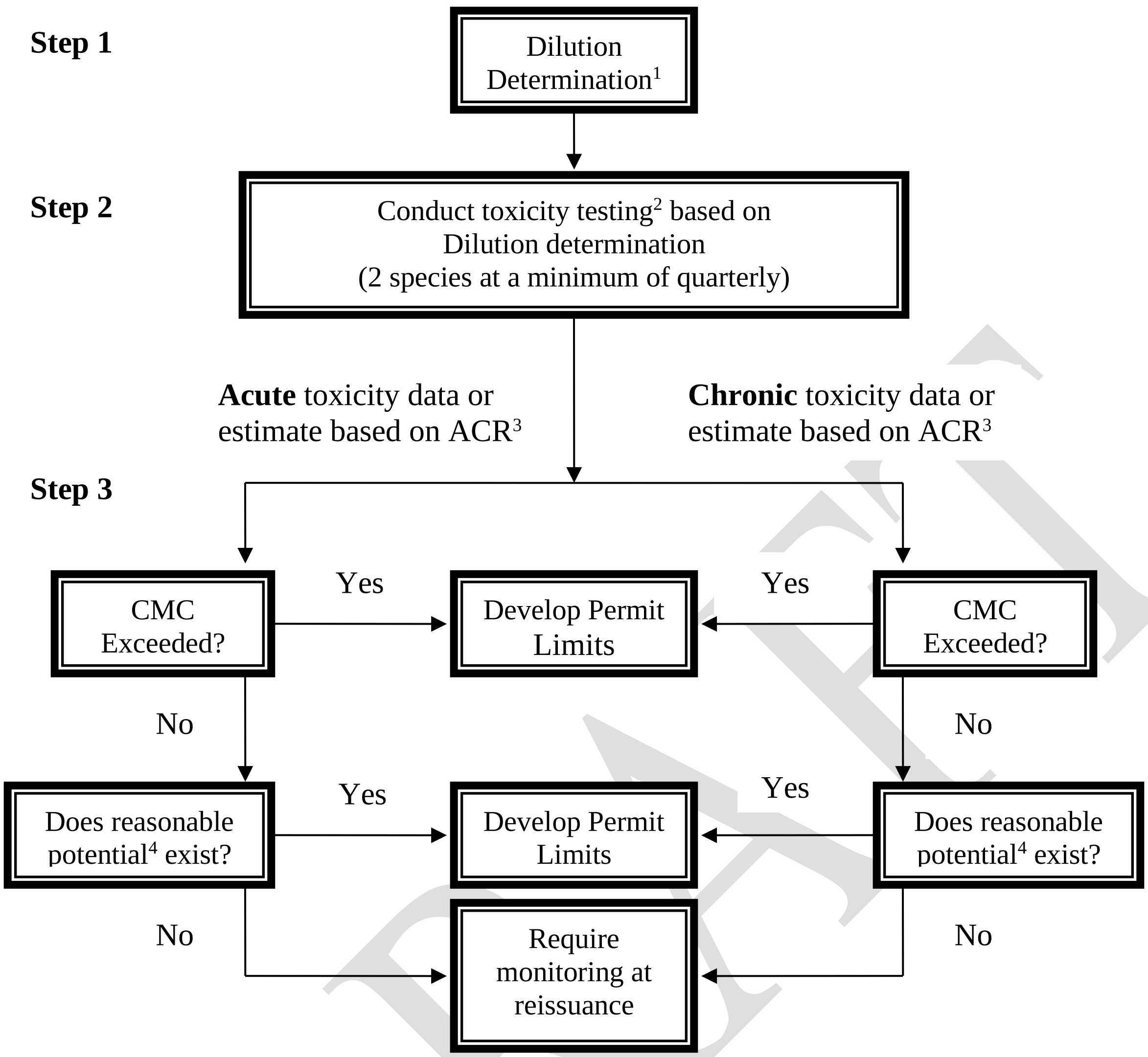

Figure 6.1: Flow Chart for Determination of WET Limitations

[1] Dilution determination should be performed for critical flows and any applicable mixing zones.

[2] Toxicity Testing recommendations:

a) Dilution > 100:1, acute testing check CMC only

b) Dilution ≤ 100:1, conduct chronic testing, check CCC with data and CMC using acute data or ACR

[3] ACR: acute to chronic ratio.

[4] Reasonable potential: Use procedures above.

Chapter

7

Chapter 7 PUBLIC PARTICIPATION AND NOTICE

Office of Water Quality works with the Office of Operations and Outreach of DEQ to help Arkansans participate in the environmental decision-making processes. As part of Arkansas's public participation program, DEQ utilizes its website (http://www.ADEQ.state.ar.us), statewide newspaper advertisements, and public meetings to facilitate public participation.

DEQ will implement a public participation program as a basic part of the planning process. The following will be part of the public participation program in Arkansas. Procedures soliciting public participation during the development of TMDLs for watersheds and WLAs for wastewater treatment facilities, Water Quality Management Plan (WQMP), and draft permits are described in the specific chapter. In addition to the requirements under the federal Clean Water Act, DEQ Rule 8, Administrative Procedures, provide the framework for public participation.

The public participation program is an active program designed to seek out those who can provide useful inputs and those who will be affected by the plan.

The public participation program will include provisions for disseminating information to the public. Data and information available to planners is easily accessible to the public. Depositories of documents and data will be clearly identified and remain open for public use at generally convenient times.

Relevant information will be provided as required by EPA public participation guidelines (40 CFR Part 25) in order to assist the public in understanding and responding to water quality programs. Lengthy documents or complex technical materials that relate to significant decisions will be summarized for public and media uses in the form of fact sheets or newsletters and will be used to provide notice that the materials are available at DEQ's central offices or at other convenient locations. Relevant information and evidence, when submitted by citizens, will be respectfully considered.

A current list of interested persons and organizations to be notified concerning significant actions taken or anticipated will be maintained.

Anyone with email capability can sign up for free, automatic delivery of news releases, regulatory notices, program updates, and other postings to our website. By subscribing to the

Email List at the following web site:
https://www.ADEQ.state.ar.us/poa/pi/emaillists.aspx.

In instances of multi-agency planning programs, such as CWA Section 208 Areawide Waste Treatment Planning, DEQ will serve as the reviewing arm of the Office of the Governor in the certification process. DEQ will coordinate the public participation activities and will provide assistance when possible.

To access the DEQ Office of Water Quality, go to: http://www.ADEQ.state.ar.us/water

This website provides answers to frequently asked questions, information on water quality, inspections, enforcement actions, definitions, permits, and CWA questions. Permit information can be obtained using several different search options, including permit number, facility name, or DEQ Facility Identification Number (AFIN) at the following website:
https://www.adeq.state.ar.us/home/pdssql/pds.aspx

To access Arkansas rules, go to: http://www.ADEQ.state.ar.us/regs

To access EPA Region 6, go to: http://www.epa.gov/region06

7.1 Public Notice of the Individual Permit Application

Public notice of an administratively complete application for a permit shall be published in a newspaper of general circulation in the county in which the proposed facility or activity is to be located, or, for a statewide permit, in a newspaper of statewide circulation. Any interested person may request a public hearing on the proposed permit by giving DEQ a written request within ten (10) business days of the publication of the notice.

7.2 Public Notice of the Individual Draft Permit

Notice of the draft permitting decision shall be published in a newspaper of general circulation in the county in which the facility or activity proposed to be permitted is located, or, for a statewide permit, in a newspaper of statewide circulation. When DEQ causes the notice to be published, the notice may be combined with other notices of permitting decisions.

The public notice describes the procedures for the formulation of final determinations and shall provide for a public comment period of 30 days. During this period, any interested persons may submit written comments on the permit and may request a public hearing to clarify issues involved in the permitting decision. A request for a public hearing shall be in writing and shall state the nature of the issue(s) proposed to be raised in the hearing.

Prior to the close of the public comment period, the Director may extend the period for written public comments for up to an additional twenty (20) calendar days, through a public notice, if exceptional circumstances warrant.

A copy of the permit and public notice will be sent via email to the Corps of Engineers, the Regional Director of the U.S. Fish and Wildlife Service, Department of Parks, Heritage and Tourism, the EPA, and the Arkansas Department of Health.

7.3 Public Notice of General Permits

Public notice and participation procedures must meet requirements specified by Rule 8 and those specified in the Arkansas Air and Water Pollution Control Act. Additional participation procedures may be specified within the general permit.

7.4 Public Notice of TMDLs (New, Modified, or Withdrawn)

TMDLs are required to have a public review process under 40 CFR §130.7. Public participation opportunities for TMDLs in Arkansas are in compliance with 40 CFR § 25 and APC&EC Rule 8.

Prior to or upon publication of public notice of a draft TMDL, DEQ will notify all affected NPDES permittees, non-point sources identified in the TMDL, affected local governments (cities, counties), municipalities, and other relevant stakeholders.

Public notice will occur through a newspaper of statewide circulation and/or through DEQ's website. The notice will contain agency staff contact information. A statement should be included that any interested person may request a public hearing on the proposed TMDL by giving DEQ a written request within 30 calendar days of the publication of the notice.

Additionally, the public notice will also include the proposed WQMP update (208 Plan update) to include the associated allocations set forth in the TMDL. When the TMDL is approved by EPA, the TMDL is to be automatically incorporated into the WQMP. The submittal and approval of the TMDL by EPA will be considered equivalent to a WQMP update approval.

The request for the public hearing shall be received in writing or e-mail and shall state reasons for the necessity of a public hearing. A public hearing may be held at the DEQ Director's discretion.

Prior to the close of the public comment period, the Director may extend the period for written public comments for up to an additional 20 calendar days, through a public notice, if exceptional circumstances warrant.

Written public comments will be accepted by either regular mail or e-mail until the end of the public comment period as specified in the public notice. E-mail comments must be sent to the e-mail address specified in the public notice.

DEQ shall make available the draft TMDL and other material relevant to the draft TMDL for inspection on the DEQ website and shall make available for reproduction at the DEQ

North Little Rock office during the public comment period.

After the public notice period has expired, DEQ shall consider all comments received as a result of the public notice and may revise the draft TMDL as it considers appropriate.

Prior to the public comment period, DEQ may solicit from EPA a precursory review of any TMDL. EPA, upon request, may review and submit to DEQ its comments, objections, or recommendations on the draft TMDL. Comments received from EPA on the draft TMDL may be incorporated before the public notice period; however, if comments are not received from EPA on the draft TMDL, DEQ will proceed with the public notice process. Comments received during the 30-day public notice period will be responded to for each issue raised and will be included with the draft TMDL. A copy of the draft TMDL, the public notice announcement, the attachments, response to comments, and any other applicable materials included in the TMDL checklist will be submitted to EPA Region 6. Upon receipt of the draft TMDL, EPA will have 30 days to approve or disapprove the TMDL. Wasteload allocations for individual point sources which are developed under an EPA-approved TMDL shall be included in the WQMP through a WQMP update following the public notice period, and after response to any comments received (40 CFR §130.6(c)(1) and (2)).

7.5 Public Participation and Notice of WQS (Promulgated as APC&EC Rule 2) for Triennial Review

DEQ follows the steps below to accomplish the review and public participation and notice requirements for WQS rulemaking:

- Stakeholder meeting(s) to solicit informal feedback from the public
- Approval by the Governor of Arkansas
- Approval of initiation of rulemaking by the APC&EC
- Notice of Public Hearing (at least 45 days prior to the hearing date), notice of public comment period on the proposed rule, and notice of availability of proposed amendments to Rule 2 and documentation of analysis supporting all WQS amendments recommended
- Public Hearing
- Consideration and response to public comments
- Approval of proposed Rule 2 by APC&EC
- Review and approval of Rule 2 by Committee of the Arkansas General Assembly
- Certification that the WQS in Rule 2 were adopted pursuant to state law
- Submittal of Rule 2 and documentation of analysis supporting all WQS amendments to EPA Region 6
- Approval of WQS in Rule 2 by EPA Region 6

See Section 1.2 of the CPP for more information.

7.6 Public Notice of WQMP (208 Plan) Updates

DEQ will follow the procedure given in Chapter 3 of this document for submittal of proposed 208 Plan updates to EPA for technical acceptance. Technically acceptable WQMP updates for individual facility effluent limits derived using Streeter-Phelps modeling will be public noticed for a 30-day comment period when the draft permit is public noticed, either in the same public notice or a separate public notice. Following the completion of the public notice for the WQMP update, responding to any comments received, and receiving technical acceptance from EPA Region 6 for any changes from the originally submitted update, DEQ will perform the WQMP update, at which time the individual permit limits included in the WQMP update will be immediately effective for use in the permit. The final step in the WQMP update process consists of the DEQ Director, on behalf of the Governor, sending a Governor certification letter to EPA Region 6 listing the WQMP updates that occurred since the most recent Governor Certification for final approval.

The procedures stated above will not apply to situations concerning development of a TMDL for an impaired waterbody. In cases where a TMDL is developed and public noticed, the public notice will also include the proposed WQMP update to include the associated allocations set forth in the TMDL. When the TMDL is approved by EPA, the TMDL is to be automatically incorporated into the WQMP. The submittal and approval of the TMDL will be considered equivalent of a WQMP update technical acceptance and final approval. Consequently, approved TMDLs will be immediately effective for implementation in NPDES permits and not be required to be included in Governor certifications.

7.7 Public Notice of Individual 401 Certification

Public notice of an administratively complete request for a 401 water quality certification for projects that are located directly on Extraordinary Resource Waters (ERWs), Ecologically Sensitive Waterbodies (ESWs), or Natural and Scenic Waterways (NSWs) shall be published once in a newspaper of general circulation in the county in which the proposed activity is located for a 30 day comment period. If there are no comments or concerns that need to be addressed at the close of the comment period, a final 401 certification will be provided to the applicant and the USACE project manager.