PERMITTING GUIDANCE DOCUMENT FOR IMPLEMENTING LOUISIANA SURFACE WATER QUALITY STANDARDS WATER QUALITY MANAGEMENT PLAN VOLUME 3

October 26, 2010

VERSION 8

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
LDEQ OFFICE OF ENVIRONMENTAL SERVICES

Contents

1. Introduction

The Louisiana Department of Environmental Quality (LDEQ) through its Office of Environmental Assessment administers and reviews the Louisiana Surface Water Quality Standards as Title 33 Louisiana Administrative Code, Part IX, Chapter 11. The Office of Environmental Services is also charged with the responsibility of maintaining and enhancing the waters of the State through the permit process. This document establishes procedures to effectively incorporate the water quality standards into wastewater discharge permits. Although all applications for permits to discharge wastewaters are considered on a case-by-case basis, the LDEQ believes that a consistent approach to application reviews is important. A permit applicant may provide information and data throughout the technical review period, additional to that required by the Secretary, to assist the LDEQ staff in the site specific assessment and draft permit development. All preliminary determinations by the LDEQ staff in the development of a permit - including instream uses, impact analysis, antidegradation, effluent limits, and all other specifications of the permit - are subject to additional review and revisions through the public review/hearing process.

2. Application of Numerical Standards and Use Attainability

Numerical criteria as specified in LAC 33:IX.1113.C will be applied for the appropriate designated water use(s) on each water body. Both aquatic life and human health criteria as specified in LAC 33:IX.1113.C. will be reviewed and the most stringent applied for the corresponding designated use on each water body. In cases where no numerical criteria are specified, regulation of toxic substances will follow LAC 33:IX.1121. The appropriate criteria will be applied to the specified waterbodies and to their tributaries, distributaries, and interconnected streams and water bodies if they are not specifically named, unless it can be shown through a use attainability analysis that unique chemical, physical, and/or biological conditions indicate that the uses designated are not appropriate and/or that site specific criteria based on appropriate uses can be developed. Those water bodies designated as intermittent streams, man-made watercourses, naturally dystrophic waters, wetlands, or waterbodies with site-specific criteria may be excluded from some numerical criteria as specified in LAC 33:IX.1123 and/or LAC 33:IX.1113.C.

Numerical criteria applied to named water bodies to specifically protect their use as drinking water supplies, oyster propagation, or outstanding natural resource waters will not apply to tributaries and distributaries of these water bodies unless so specified. In addition, the variance procedure specified in LAC 33:IX.1109.D may be used to temporarily suspend criteria or to provide time to research site specific criteria on a case-by-case basis.

3. Application of Metals Criteria

A conversion mechanism to translate dissolved metals to total metals has been developed since most LPDES permits state their metals in terms of total, not dissolved.

Metals criteria for aquatic life protection are based on dissolved metals concentrations in ambient waters. They are a function of hardness ($CaCO_3$), which typically will be obtained from average two-year data compilations contained in the latest Louisiana Water Quality Data Summary (Units in mg/L). However, other comparable data compilations or reports or water body specific data provided by the applicant may be considered. The minimum hardness shall be 25 mg/L and the maximum hardness shall be 400 mg/L used in hardness dependent metal criteria calculations in accordance with 40 CFR 131.36(c)(4)(I). Effluent hardness may be used in determining the hardness of the receiving waters on a case-by-case basis. An applicable example would be an effluent dominated stream. An effluent dominated stream, for the purposes of this discussion, would be defined as stream containing at least 50% or more effluent (maximum 30-day flow) during critical flow events. The LDEQ will implement a dissolved-total metal conversion detailed below. This 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 translated to a total effluent limit.

The formula for streams and lakes is as follows:

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

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

K_p = Linear partition coefficient
TSS = suspended solids concentration receiving stream, units in mg/L.
K_{po} = found from Table 1 below
α = found from Table 1 below
C_D/C_T = Fraction of metal dissolved
Cr = Dissolved Criteria value for metal in water quality standards

$$\text{Total Metal} = Cr/(C_D/C_T)$$

Table 1
LINEAR PARTITION COEFFICIENTS FOR PRIORITY METALS IN STREAMS AND LAKES
(Delos et al, 1984) (*1)

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 III (*2)	3.36×10^6	-0.93	2.17×10^6	-0.27

Metal	Streams		Lakes	
	K_{po}	α	K_{po}	α
Copper	1.04×10^6	-0.74	2.85×10^6	-0.90
Lead (*3)	2.80×10^6	-0.8	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
Zinc	1.25×10^6	-0.70	3.34×10^6	-0.68

(*1) Delos, C. G., W. L. Richardson, J. V. DePinto, R. B. Ambrose, P. W. Rogers, K. Rygwelski, J. P. St. John, W. J. Shaughnessy, 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)

(*2) 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. See 40 CFR § 122.45(c)(3).

(*3) "Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals", February, 1992, Health and Ecological Criteria Division, Office of Science and Technology, U.S. Environmental Protection Agency.

In lieu of a Louisiana site specific model, the formula for Texas estuaries has been adopted for Louisiana estuaries:

$$K_D = 10^b \times TSS^m$$

K_D = Linear partition coefficient
TSS = suspended solids concentration, lowest 15th percentile, receiving stream. Units are in mg/L.
b = Intercept, found from Table 2
m = Slope, found from Table 2 below

$$\frac{C_D}{C_T} = \frac{1}{1 + \frac{(K_D)\ (TSS)}{1 \times 10^6}}$$

C_D/C_T = Fraction of metal dissolved
Cr = Dissolved Criteria value for metal in water quality standards

Total Metal = $Cr/(C_D/C_T)$

Table 2
LINEAR PARTITION COEFFICIENTS FOR PRIORITY METALS IN ESTUARIES
(Benoit and Santschi, 1991)*

Metal	Intercept (b)	Slope (m)
Copper	4.86	-0.72
Lead	6.06	-0.85
Zinc	5.36	-0.52

* Benoit, G. and Santschi, P. H., 1991. Trace Metals in Texas Estuaries. Prepared for the Texas Chemical Council. Texas A & M University at Galveston, Department of Marine Sciences.

The only site specific input into the models is the lowest 15th percentile TSS data from the sub-segment or nearest sub-segment receiving waterbody as indicated in the Water Quality Management Plan, Louisiana Water Quality Data Summary.

The LDEQ will determine the lowest 15th percentile TSS values using data from the Water Quality Data Summary or USGS data or other data sources in lieu of site specific data. The permittee may supply site specific lowest 15th percentile TSS (mg/L) and 2 year hardness (as $CaCO_3$) (mg/L) data (minimum 2 year data set with a 1/month monitoring frequency) included with the facility's application if the permittee wants site specific consideration. Effluent TSS may be used in determining the TSS of the receiving waters on a case-by-case basis. An applicable example would be an effluent dominated stream. An effluent dominated stream, for the purposes of this discussion, would be defined as stream containing at least 50% or more effluent (maximum 30-day flow) during critical flow events.

If there is no partition coefficient listed for a metal in question, then dissolved to total ratio (C_d/C_t) shall equal 1. The metal will be evaluated as if the dissolved concentration equals the total recoverable concentration. A compliance schedule may be established for a period of up to 3 years. Monitoring requirements or appropriate technology based effluent limitations established pursuant to 40 CFR § 122.44.(a) will be established during the interim period. The permittee may develop a site-specific linear partition coefficient during the interim period. A water quality reopener clause may be placed in the permit to allow for a permit modification using a site-specific linear partition coefficient for the metal of concern.

If a water-quality based limit is required for mercury in either fresh, estuarine or marine waters after the linear partition coefficient (Table 1), effluent variability (5.A.), and screening (5.B.) have been applied, then

LDEQ may require that the edible portion of aquatic species of concern must be analyzed to determine whether the concentration of methyl mercury exceeds the FDA action level (1.0 mg/kg) in accordance with LAC 33.IX.1113, Table 1. At LDEQ's option the FDA action level of 1.0 mg/kg for methyl mercury shall be limited in the permit in lieu of total or dissolved water quality based limits. Exceedances of the FDA action level shall be handled in accordance with LAC 33.IX.1113, Table 1, footnote 10. The permittee shall submit an aquatic species tissue sampling plan and analysis for approval by LDEQ. New discharges may be granted a compliance schedule (9.).

4. Mixing Zone and Related Flows

A. General permitting applications:

Acute aquatic life toxicity numerical criteria shall be applied at the edge of the zone of initial dilution (ZID). Chronic aquatic life toxicity numerical criteria shall be applied at the edge of the mixing zone (MZ). Human health criteria are to be met below the point of discharge after complete mixing. No mixing zones or fractions of flow shall apply to human health criteria. For aquatic life waterbody categories 1 through 4, we will use the fractions of critical flow listed in LAC:33:IX.1115, Table 2a. For human health waterbody categories 1 through 3, we will use the appropriate flow listed in LAC:33.IX.1115, Table 2b. For aquatic life waterbody categories 5 through 7, we will use the radial distances listed in LAC:33:IX.1115, Table 2a. For human health waterbody categories 4 through 6, we will determine the mixing conditions on a case-by-case basis.

The LDEQ Office of Environmental Services will normally make use of the following to calculate water quality based limits:

1. The maximum 30-day average flow for the last 2 years for industrial dischargers;

2. Shall use the design flow for designated POTWs;

3. The expected flow, for other treatment works treating domestic sewage which are not designated POTW's based upon (a) the most recent "Sewage Loading Guidelines", Appendix B, Chapter XIII of the State of Louisiana Sanitary Code or (b) other applicable data approved by the Department.

B. Man-made water courses:

Where available, site-specific critical flow and harmonic mean flow will be applied to man-made water courses. In the absence of site-specific flow data, LDEQ shall consider each situation on a case by case basis.

The uses designated for the man-made watercourse may determine whether the flow used should be that of the man-made watercourse or that of the next downstream waterbody. Uses that are not designated for the man-made watercourse will be protected in the next downstream waterbody.

C. Critical Flow and Harmonic Mean Flow Determinations

Tidal Flows

The tidal flow algorithm as used by DEQ uses the "tidal prism" principle, with inputs of (1) the affected surface area (upstream of the point at which the determination is made), (2) the tidal range, and (3) the period of elapsed time covered by the tidal range to determine the "average or typical flow averaged over one tidal cycle".

1. Determine the surface area upstream of the discharge point affected by the tidal range that will be determined in the computation (See Item 2 below).

2. Determine the typical tidal range (in feet) that affects the surface discussed in Item 1 above. The range is the vertical distance between "high" and "low" tide elevations and occurs in one-half of the tidal cycle.

3. Multiply the surface area by the tidal range to determine the volume of water stored (or released from storage) during the tidal half-cycle. The unit of volume is the cubic foot.

4. Divide the volume calculated in Item 3 by the number of seconds in the tidal half-cycle. The result (in cubic feet per second) is defined as the average discharge necessary to store (or release) this computed volume of water in the time defined by the tidal half-cycle. This is the "average or typical flow averaged over one tidal cycle."

5. The average discharge computed in Item 4 is then divided by three to arrive at the "critical flow" used to determine effluent limits for aquatic life criteria. Effluent limits for human health criteria shall be calculated using the average flow calculated in Item 4.

Low Flow Calculations

DEQ uses the following protocol to determine the 7Q10 at ungaged sites.

Use of Technical Report 35 "**Analysis of the Low-Flow Characteristics of Streams in Louisiana**" is recommended. Equations used require the determination of:

1. Drainage Area, (A), in square miles,
2. Annual Precipitation, (P), in inches per year,
3. Channel Slope, (S), between the 10% and 85% main channel length, in feet per mile.

The Annual Precipitation is determined from a map contained in TR-35 that must be used. Drainage area and channel slope can be measured from 7-1/2 minute quadrangle maps.

For region 2 as delineated in TR-35:

$7Q10 = 1.22*10^{-6}*A^{1.10}*(P-35)^{3.15}*S^{0.68}$;

For region 3 as delineated in TR-35:

$7Q10 = 2.37*10^{-4}*A^{1.01}*(P-35)^{0.85}*S^{0.94}$;

where the 7Q10 is defined as "the discharge for 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days, in cubic feet per second (ft^3/s) and A, P, S, have been previously defined.

Regions 1 and 4 have no developed equations. Many of the streams in both these areas either go dry during the year or go stagnant with no discernable flow. At streams in these two areas where there is no measured stream flow, a good estimate of the 7Q10 is zero.

Another method that can be employed is to use a drainage area ratio. The 7Q10 at a gaged site can be transferred to a nearby stream by taking the ratio of the two drainage areas and multiplying it by the known 7Q10 at the gaged site. The two streams should be in the same hydrologic region. This method has less certainty than using the equations.

Use of either method must be taken with caution. The relationship between the 7Q10 and basin characteristics is very hard to define and the equations presented are only estimates. There can be a high degree of variability.

In cases where the critical flow is less than or equal to 0.1 cfs, 0.1 cfs shall be the default critical flow for streams not designated intermittent at LAC 33.IX.1123, Table 3.

Harmonic Mean Flow

Harmonic Mean Flow (HMF) will be computed using the program originated by EPA as outlined in the Technical Support Document (EPA, 1991) and available on STORET to compute the HMF when sufficient streamflow data is available. This program runs on data from streamflow stations with data in STORET and adjusts the HMF for zero flow events within the data. The HMF may be used directly if the discharge outfall site is on the same stream and near the streamflow station; the HMF for the outfall site may be estimated on the basis of relative drainage area if the discharge station site is upstream or downstream of the outfall site. If the outfall site is on a different stream, the HMF will be estimated on the basis of relative drainage area (a flow per square mile) if the two stream basins can said to be hydrologically similar (shape, soils, elevations, rainfall, vegetation, cultural features, etc.) Use of a drainage area basis is considered technically feasible because the average flow events (arithmetic mean, harmonic mean) are strongly associated with rainfall events and the surface area exposed to those events. To avoid gross errors, good judgement is called for in ascribing "likeness" to the two basins. In cases where the harmonic mean flow is less than or equal to 1 cfs, 1 cfs shall be the default harmonic mean flow for streams not designated intermittent at LAC 33.IX.1123, Table 3.

D. Prevention of Impacts from Overlapping Mixing Zones

To assure that water uses are not impaired due to effluent mixing in areas of drinking water intakes and overlapping mixing zones, DEQ has in place a variety of assessment programs. On a biennial basis for the Section 305(b) Water Quality Inventory, DEQ reviews available water quality data to prepare a list of impaired waterbodies as required under Section 303(d). Those waterbodies identified on the 303(d) list are further evaluated and screened for the source of impairment and whether they are due to overlapping mixing zones. In addition to this effort, DEQ takes the following steps to insure the protection of drinking water intakes:

1. Permit writer will consider proximal point source dischargers and drinking water intakes during permit development.

2. DEQ will acquire information from the Louisiana Department of Health and Hospitals (LDHH), Safe Drinking Water Program Section, regarding exceedances of maximum contaminant levels (MCL's) in surface drinking water supplies. This information will be summarized in the biennial Water Quality Inventory [305(b) Report]. Monthly ambient monitoring data for organic pollutants collected on the Mississippi River will also be assessed to determine whether impairment of water quality or uses is occurring.

3. If a water quality problem in a waterbody and/or at a drinking water supply is identified, the discharger's effluent data will be examined to determine whether the pollutant causing the criteria exceedance is discharged by the permittee.

4. If a use impairment is suspected, the Engineering Section will conduct a site-specific study to determine the degree of impact resulting from the discharger.

5. **Establishing Permit Limits**

DEQ will require water quality based limits for pollutants that are present in the discharge as determined by appropriate sampling or are involved in the manufacturing process. The LDEQ will consider effluent variability in the derivation of permit limits using EPA's Technical Support Document[1] (TSD) procedures.

A. Limit Derivation

This derivation process applies to all pollutants where chronic aquatic life are to be met at the edge of the mixing zone (MZ), acute aquatic life criteria are to be met at the edge of the zone of initial dilution (ZID), and human health criteria are to be met below the point of discharge after complete mixing (LAC 33:IX.1115.C). Freshwater aquatic criteria will be used for waters with average ambient salinity less than 2,000 parts per million (ppm). Marine aquatic criteria will be used for waters with average ambient salinity greater than or equal to 10,000 ppm. In areas of brackish water (defined in LAC 33:IX.1105), the applicable criteria are the more stringent of the freshwater or marine criteria, as described in LAC 33:IX.1113.C.6.b and d. Total Maximum Daily Load (TMDL) type WLAs shall be used in lieu of a site-specific dilution (Complete Mix Balance Model, Fischer Model, etc.) type WLAs as they are developed. TMDL type WLAs account for all known and unknown sources of a pollutant with each known source receiving a certain fraction of the TMDL. TMDL and respective WLA calculation procedures shall be in accordance with "Louisiana Total Maximum Daily Load Technical Procedures". The Louisiana technical procedures document follows EPA protocol expressed in the document, "Guidance for Water Quality-Based Decisions: The TMDL Process", EPA 440/4-91-001 to the extent that is appropriate for Louisiana's hydrologic conditions. Intermittent discharges will be handled on a best professional judgement basis.

Complete Mix Balance Model for Waste Load Allocation and Critical Dilution:

Dilutions at the edge of the Mixing Zone (MZ), the Zone of Initial Dilution (ZID), after complete mixing using harmonic mean and full 7Q10 flow (no fraction of flow), and allowable effluent concentrations at End of Pipe (EOP) for waterbody categories 1, 2, 3, and 4 (LAC 33:IX.1115, Tables 2a and for

[1] Technical Support Document for Water Quality-based Toxics Control, EPA Pub. No. 505/2-90-001, PB91-127415, March 1991.

waterbody categories 1,2,3 (LAC 33:IX.1115, Table 2b.) are typically calculated using the Complete Mix Balance Model. However, other dilution models may be used as appropriate upon agreement by LDEQ and EPA Region 6, Water Management Division:

Formulas:

Dilution Factor = $Qe/([Qr_a, Qr_{hhnc}, Qr_{hhc}]*Fs + Qe)$
WLA = $(Cr/\text{Dilution Factor}) - (Fs*[Qr_a, Qr_{hhnc}, Qr_{hhc}]*Cu/Qe)$

Qe = Plant effluent in MGD.
$Qr_a, Qr_{hhnc}, Qr_{hhc}$ = Critical flow or harmonic mean flow of receiving stream, MGD, LAC 33:IX.1115,Tables 2a and 2b. Qr_a is the critical flow (7Q10) of the receiving stream that applies to aquatic life numerical criteria. Mixing zones and fractions of flow shall apply. Qr_{hhnc} is the 7Q10 of the receiving stream that applies to human health non-carcinogen numerical criteria. Fractions of flow shall not apply. Qr_{hhc} is the harmonic mean flow of the receiving stream that applies to Human Health carcinogens. Fractions of flow shall not apply.
Fs = MZ, ZID flow fraction, LAC 33:IX.1115, Table 2a. For Human Health criteria (carcinogens and non-carcinogens), Fs is always assumed to = 1.
Cr = Numerical criteria value from LAC 33:IX.1113, Table 1 (toxics).
Cu = Ambient instream concentration for pollutant. In the absence of accurate supporting data, assume Cu = 0.
WLA= Concentration for pollutant at end-of-pipe based on Aquatic Life and Human Health numerical criteria (site specific dilution type)

If the calculated value of WLA is less than or equal to zero, then WLA shall equal zero.

Fischer Model for Waste Load Allocation and Critical Dilution:

The Fischer model for pipe discharges (the simple model outlined on page 328 of "Mixing in Inland and Coastal Waters") and the Fischer variation for canals will be used for dilution calculations for aquatic life waterbody categories 5, 6, and 7 (LAC 33:IX.1115, Table 2a) in the absence of site specific data or until a model is developed specifically for Louisiana. If the applicant can provide site specific data, this data may be used in lieu of the Fischer model. For human health waterbody categories 4,5, and 6, mixing conditions will be determined on a case-by-case basis.

Formulas:

Discharge from a pipe:

$$\text{Critical Dilution} = \frac{(2.8)\ Pw\ \pi^{1/2}}{Pf}$$

$$WLA = \frac{(Cr-Cu)\ Pf}{(2.8)\ Pw\ \pi^{1/2}}$$

Discharge from a canal:

$$\text{Critical Dilution} = \frac{(2.38)(Pw^{1/2})}{(Pf)^{1/2}}$$

$$WLA = \frac{(Cr-Cu)\ Pf^{1/2}}{2.38\ Pw^{1/2}}$$

Pf = Allowable plume distance in feet, specified in LAC 33.IX.1115, Table 2a, for aquatic life criteria. Allowable plume distance for human health criteria shall be determined on a case-by-case basis.
Pw = Pipe width or canal width in feet
Cr = Numerical criteria value from LAC 33:IX.1113, Table 1 (toxics).
Cu = Ambient instream concentration for pollutant. In the absence of accurate supporting data, assume Cu = 0.
WLA= Concentration for pollutant at end-of-pipe based on aquatic life and human health numerical criteria (site specific dilution type)

For Cr, WLA, and Cu, keep units consistent, i.e., if Cr is in ug/L then WLA, LTA, and Cu will be in ug/L.

The following individual WLA's (either site-specific dilution or TMDL type) are converted to long term averages (LTA) and permit limits using multipliers derived below (Derivation of Multipliers) based on TSD procedures:

WLA_a (ZID, acute allowable effluent concentration, EOP)
WLA_c (MZ, chronic allowable effluent concentration, EOP)
WLA_h (human health allowable effluent concentration, EOP)

1) Derivation of Multipliers for Calculating Long Term Average (LTA) and Permit Limits:

Assumptions	Basis
n_1 = 4 day averaging period for chronic LTA.	Based on TSD recommendations in Chapter 2 section 2.3.4, Duration for Single Chemicals and Whole Effluent Toxicity p 35, and Appendix C pp D-2 to D-3.
CV = 0.6	Based on TSD recommendations, Chapter 5, section 5.5.2, Coefficient of Variation, p 107, and Appendix A.
Z_1 = 2.326, 99% probability basis for WLA --> LTA and LTA--> Daily Max Z_2 = 1.645, 95% probability LTA --> Daily Avg	Based on effluent discharge from a treatment system fitting a lognormal distribution (See sections 5.2.2, 5.3.1, and Appendix E). 99% and 95% probabilities selected on the basis of recommendations in Chapter 5, section 5.5.4 in the TSD.
n_2 = 12 samples per month	12 was selected on the basis of the 3/week monitoring frequency policy for pollutants of concern in major permits.

Multiplier Calculations for all waterbodies:

Derivation of LTA:

a) 99%, Acute (LTA_a):

$$LTA_a = WLA_a \times e^{[0.5 \ln(CV^2 + 1) - Z_1 (\ln(CV^2 + 1))^{1/2}]}$$

$$= WLA_a \times e^{[0.5 \ln(0.6^2 + 1) - 2.326 (\ln(0.6^2 + 1))^{1/2}]}$$

$$= WLA_a \times 0.3211$$

b) 99%, Chronic (LTA_c):

$$LTA_c = WLA_c \times e^{[0.5 \ln(CV^2/n_1 + 1) - Z_1 (\ln(CV^2/n_1 + 1))^{1/2}]}$$

$$= WLA_c \times e^{[0.5 \ln(0.6^2/4 + 1) - 2.326 (\ln(0.6^2/4 + 1))^{1/2}]}$$

$$= WLA_c \times 0.5274$$

c) Human Health (LTA_h):

$$LTA_h = WLA_h = \text{Maximum 30-Day Value}$$

Therefore, LTA multipliers for Louisiana Waterbodies:

$LTA_a = WLA_a \times 0.32$
$LTA_c = WLA_c \times 0.53$
$LTA_h = WLA_h$

2) Conversion of LTA into Permit Limits:

a) 12 samples, 99% Daily Maximum:

$$\text{Daily Maximum} = LTA \times e^{[Z_1 (\ln(CV^2 + 1))^{1/2} - 0.5 \ln(CV^2 + 1)]}$$

$$= LTA \times e^{[2.326 (\ln(0.6^2 + 1))^{1/2} - 0.5 \ln(0.6^2 + 1)]}$$

$$= LTA \times 3.114$$

b) 12 samples, 95% Maximum 30-Day Value:

$$\text{Maximum 30-Day Value} = LTA \times e^{[Z_2 (\ln(CV^2/n_2 + 1))^{1/2} - 0.5 \ln(CV^2/n_2 + 1)]}$$

$$= LTA \times e^{[1.645 (\ln(0.6^2/12 + 1))^{1/2} - 0.5 \ln(0.6^2/12 + 1)]}$$

$$= LTA \times 1.307$$

c) 12 samples, 99% Human Health:
Maximum 30-Day Value = WLA = LTA

$$\text{Daily Maximum} = \text{Max 30-Day} \times \frac{e^{[Z_1 (\ln(CV^2 + 1))^{1/2} - 0.5 \ln(CV^2 + 1)]}}{e^{[Z_2 (\ln(CV^2/n_2 + 1))^{1/2} - 0.5 \ln(CV^2/n_2 + 1)]}}$$

$$= \text{Max 30-Day} \times \frac{e^{[2.326\,(\ln(0.6^2 + 1))^{1/2} - 0.5\,\ln(0.6^2 + 1)]}}{e^{[1.645\,(\ln(0.6^2/12 + 1))^{1/2} - 0.5\,\ln(0.6^2/12 + 1)]}}$$

$$= \text{Maximum 30-Day Value} \times \frac{3.114}{1.307}$$

$$= \text{Maximum 30-Day Value} \times 2.38$$

3) Select the most limiting LTA to derive permit limits (Water Quality Based Limits, (WQBL's)):

If aquatic life LTA is more limiting:

Daily Maximum = Min(LTA_a, LTA_c) x 3.11
Maximum 30-Day Value = Min(LTA_a, LTA_c) x 1.31

If human health LTA is more limiting:

Daily Maximum = LTA_h x 2.38
Maximum 30-Day Value = LTA_h

The resulting allowable effluent concentration is converted into a mass value using the following formula:

Daily Maximum concentration and Maximum 30-Day concentration are converted to lbs/day. Concentration units are in mg/L, flow units are in MGD, and mass unit are in lbs/day.

Daily Maximum concentration x Qe x 8.34 = Daily Maximum mass
Maximum 30-Day concentration x Qe x 8.34 = Maximum 30-Day mass

This represents the total water quality based mass limit available to the facility for discharge.

The basis for the assumptions used in the derivation of these multipliers is the Technical Support Document, as stated above. Other coefficients of variation, monitoring frequencies, and probability bases may be considered on a site-specific basis by LDEQ. The burden of demonstrating that such other bases are more appropriate for the facility's discharges lies with the applicant.

B. Determining the need for Water Quality Based Limits:

1) Screen against technology-based limits

If technology-based limits are present for the pollutant being screened then the calculated technology-based mass limits are screened against the calculated effluent water quality based mass limits. The screen is conducted for both maximum 30-day and daily maximum values. For example, it is possible to have a daily average effluent WQBL and a daily maximum technology-based limit for the same pollutant.

If the screen indicates that an effluent WQBL is more limiting than the technology-based limit for a particular pollutant, then that effluent WQBL shall be placed in the permit (40 CFR § 122.44.(d)). However, if the applicant indicates that the pollutant is not involved in manufacturing processes at the facility, reduced monitoring frequencies shall be considered.

2) Screen against EOP values; no technology-based limits present for the pollutant being screened:

The LDEQ will adopt the policy set forth at EPA Region 6 regarding "reasonable potential" for a pollutant to exceed a water quality standard as expressed in a letter dated October 8, 1991 from Jack Ferguson, EPA Region 6 to Jesse Chang, LDEQ. See Appendix A with accompanying attachment. The estimate of the upper range of concentration or mass average EOP values has been set at the 95th percentile using the lognormal distribution. If the estimated 95th percentile of a data set for a pollutant exceeds the calculated effluent daily average WQBL, then effluent WQBL's shall be placed in the permit. The estimate of the 95th percentile is obtained by the following relationship:

average pollutant concentration or mass end-of-pipe (EOP) * 2.13 = 95th percentile average pollutant concentration or mass.

A single measurement of pollutant concentration/mass or the geometric mean of multiple measurements ($\leq$10) may be used to estimate the upper range value (95th percentile). The 95th percentile may be calculated directly from the data set if the data set contains greater than 20 values. Any single measurement or group of measurements with values reported below the MQL, shall be treated as a zero value see section 7, Threshold Reporting. If a data set contains a mix of values that are both above and below the MQL, the values that are below the MQL will be assumed to be present at a value of 50% of the MQL, unless specifically stated in the application. If the geometric mean(s) are not readily available or supplied with the application, the arithmetic mean(s) may be substituted for the geometric mean.

3) Deriving effluent WQBL's in nonattainment waters

a) STREAM BACKGROUND CONCENTRATIONS EXCEED WATER QUALITY STANDARDS

Where the stream background pollutant concentrations exceed the water quality standard(s) at the point of application (chronic mixing zone, zone of initial dilution, or human health mixing zone), the LDEQ shall initiate the development of a TMDL, as time and resources permit, for the receiving stream. However, until the development of a TMDL, the LDEQ shall impose a water quality-based limit based on a Waste Load Allocation (WLA) that does not include a consideration of background pollutant concentration(s). A permit reopener clause shall be included in the permit to incorporate the results of the TMDL.

b) STREAM BACKGROUND CONTRIBUTIONS PLUS DISCHARGE CONTRIBUTIONS CAUSE EXCEEDANCE OF WATER QUALITY STANDARDS

Where the stream background pollutant mass contributions plus discharge pollutant mass contributions result in an exceedance of the water quality standard(s) at the point of application (chronic mixing zone, zone of initial dilution, or human health mixing zone), the LDEQ shall initiate the development of a TMDL, as time and resources permit, for the receiving stream. However, until the development of a TMDL, the LDEQ shall impose a water quality-based limit based on a Waste Load Allocation (WLA) that does not include a consideration of background pollutant concentration(s). A permit reopener clause shall be included in the permit to incorporate the results of the TMDL.

C. Permit Limit Units; Mass and Concentration

Permit limit units shall be established in accordance with 40 CFR § 122.45.(f).

D. Examples

Numerical examples are included in Appendix D.

6. Sampling Frequency

As a matter of policy, the minimum sampling frequency will generally be set at the number of samples needed for adequate monitoring of overall treatment system performance (toxic, conventional, and nonconventional pollutants) with respect to the contaminants of primary concern and the parameters that are reflective of the adequacy of treatment system performance. Generally, this will be a minimum of once per week for chemical specific water quality based parameters. For contaminants which are not expected to be discharged, the sampling frequency may be less; e.g., for those priority pollutants that are not being discharged by an Organic Chemicals Plastics and Synthetic Fibers (OCPSF) facility, the sampling frequency will generally be set at once per year. In making the final determination, LDEQ will consider characteristics of the treatment system, effluent, the receiving stream, detection limits, and factors unique to sampling including analytical methods and turn around time. For example, quarterly sampling is determined appropriate for dioxin considering that current analysis (EPA method 1613) for dioxin is time consuming with laboratory turn around time typically exceeding six (6) weeks. The regulated community is encouraged to provide the LDEQ, at the time of permit application, data on those contaminants not expected or expected only infrequently in a facility's discharge.

7. **Threshold Reporting**

The LDEQ will generally implement Minimum Analytical Quantification Levels (MQL's) that are currently being used by EPA Region VI for detection limits. See Appendix B. However, the specified MQL's in Appendix B are subject to change. Using more sensitive analytical test methods, the LDEQ may impose permittee effluent-specific MQL values lower than the listed MQL values in Appendix B for discharges to receiving streams with known water quality problems or for discharges to receiving streams where numerical criteria may be exceeded. If the calculated permit limit for any pollutant is less than the MQL, LDEQ will use the MQL to determine compliance however the calculated limit will be put in the permit.

The permittee may develop an effluent specific method detection limit (MDL) in accordance with Appendix B to 40 CFR Part 136. For any pollutant for which the permittee determines an effluent specific MDL, the permittee shall send to EPA Region 6 and the LDEQ a report containing QA/QC documentation, analytical results, and calculations necessary to demonstrate that the effluent specific MDL was correctly calculated. An effluent specific minimum quantification level (MQL) shall be determined in accordance with the following calculation:

$$MQL = 3.3 \times MDL$$

Upon written approval by EPA Region 6 and the LDEQ, the effluent specific MQL may be utilized by the permittee for all future Discharge Monitoring Report (DMR) calculations and reporting requirements.

8. **Biological Toxicity Testing**

The LDEQ Office of Environmental Services will utilize the most current LDEQ and EPA agreed biomonitoring protocols.

The Clean Water Act and federal regulations at 40 CFR § 122.44(d)(1) establish the basis for whole effluent toxicity (WET), or biomonitoring requirements for wastewater discharge permits issued under the NPDES and LPDES permitting programs. The applicable federal and state regulations require that the permitting authority determine, during the permit development period, whether the reasonable potential exists for an effluent to cause or contribute to an excursion above a State's narrative or numeric criterion for the protection of aquatic life. As per LAC 33:IX.2707.D.1.e and/or 40 CFR § 122.44(d)(1)(v), "...When the permitting authority determines, using procedures in LAC 33:IX.2707.D.1.b [and/or 40 CFR § 122.44(d)(1)(ii)]..., toxicity testing data, or other information, that a discharge causes, has the reasonable potential to cause or contribute to an instream excursion above a narrative criterion within an applicable state water quality standard, the permit must contain effluent limits for whole effluent toxicity." A WET limit is a permit control required where the reasonable potential exists for an exceedance of the State water quality criteria for protection of aquatic life and a specific toxicant(s) has not been identified and controlled via a Toxicity Reduction Evaluation (TRE). A chemical-specific limit may be established in lieu of a WET limit where the permitting authority demonstrates, in the fact sheet or statement of basis, that the chemical limit will preclude toxicity. All available, valid, and relevant information will be used in making permitting decisions. LDEQ WET permitting practices follow the current agency policy on independent applicability.

References to sub-lethal effects in this Section apply only to chronic testing. Where the permit establishes 7-Day chronic test requirements, the reasonable potential analysis will be performed for both lethal and sub-lethal effects. Where the permit established 48-Hour acute test requirements, the reasonable potential analysis will be performed on lethal effects.

WET requirements are established for all LDEQ discharges classified as majors. (e.g., POTW ≥ 1.0 mgd design flow) and significant minors with the exception of once-through, non-contact cooling water discharges to which no chemical treatment is added. WET requirements may also be applied on a case-by-case basis to minor dischargers with a known or suspected toxic potential.

Chronic toxicity tests shall generally be required of those discharges with potential toxicity (LAC 33:IX.1113.B.5) using critical dilutions as determined by an applicable dilution model (See section 5,**"Establishing Permit Limits"**) for discharges into the waterbody categories as specified in LAC 33:IX.1115.D. However, the LDEQ Office of Environmental Services reserves the right to impose equivalent acute toxicity testing in addition to, or in lieu of, chronic toxicity testing (LAC 33:IX.1121.B.3) for minor facilities (EPA Region 6 classification) or discharges that have a critical dilution of five percent (5%) or less. When data is available, a site specific acute to chronic ratio (ACR) may be calculated. An ACR of 10:1 can be used in the absence of site specific data. The LDEQ will use a 0.75 dilution series in accordance with EPA Region 6 guidance. Also, in accordance with EPA Region 6 WET permitting strategy, permits shall require biomonitoring at some frequency for the term of the permit or where available data show reasonable potential to cause lethality or sub-lethality, the permit shall require a whole effluent toxicity (WET) limit or chemical-specific limit(s).

Major dischargers into intermittent streams and wetlands that lack perennial standing water shall be required to conduct 48 hour acute toxicity tests at the critical dilution of 100% effluent. However, chronic aquatic standards shall be met at the permitted discharge point based on the downstream perennial waterbody's low flow conditions. Toxicity testing for discharges into man-made watercourses will depend upon the uses designated for each watercourse. Chronic tests at instream critical flows will be required for those man-made watercourses with full fish and wildlife propagation uses.

During the term of the permit, if biomonitoring data demonstrates statistically significant lethal or sublethal toxic effects at the critical dilution or lower effluent dilutions, permittees will be required to retest their effluent monthly for the next three months to determine if toxicity is persistent or occurs on a periodic basis. The purpose of this testing is to determine whether toxicity is present at a level and frequency that will provide toxic sample results to use in performing a toxicity reduction evaluation (TRE). The additional tests are not performed for the purpose of confirming whether the original test failure was 'real'. If no additional test failures occur during the three-month period, the testing frequency will be once per quarter for the term of the permit or until another test failure occurs. If effluent toxicity is persistent, whole effluent toxicity (WET) limits and/or a Toxicity Reduction Evaluation (TRE) requirement will be applied, as appropriate. If the data indicates toxicity is intermittent, LDEQ may require biomonitoring at an increased frequency, and may require the facility to conduct a TRE.

In instances prior to permit issuance or reissuance where available data demonstrate reasonable potential to cause statistically significant lethal or sub-lethal effects, LDEQ will use the following procedures to require a whole effluent toxicity limit (WET limit) in the permit. WET limits shall be permitted as 30-day average minimum (or daily average) No Observed Effect Concentration (NOEC) for both acute and chronic testing and either a 48-hour minimum NOEC for acute testing or 7-day minimum NOEC for chronic testing. LDEQ will review all available effluent and instream information before deciding to establish a limit. NOTE – EPA’s current Policy on Independent Applicability precludes over-riding one form of aquatic protection with another, e.g., WET limits cannot be precluded on the basis that a biological survey did not find impairment to aquatic community. Because the Region 6 States have narrative criteria for aquatic life protection, a chemical specific limit may be substituted for a WET limit where the permitting authority demonstrates, in the fact sheet or statement of basis (as applicable), that limits on the chemical compound will preclude further toxic discharges.

LDEQ has established the following approaches to determine whether an effluent has demonstrated reasonable potential to cause or contribute to instream toxicity. During permit development, the previous five years’ WET data will be evaluated using a predictive statistical procedure similar to that presented on pages 52-54 of EPA’s Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001), Second Printing). If reasonable potential for WET is determined to exist based on that analysis and considering all other available information, WET limits will be included in the permit. A three year compliance schedule will be provided in all cases where WET limits are required based on this procedure.

Where there are < 10 test results per species at the time of permitting and calculations using this data indicate a high probability that reasonable potential exists, and LDEQ determines the existence of reasonable potential, then the permit must be issued with a WET limit.

After a permit is issued with monitoring-only requirements and the effluent fails the survival endpoint of a valid, permit-scheduled toxicity test, and also fails one or more of the required retests, the effluent will have met the definition of reasonable potential for WET. LPDES permits require the permittee to perform a 28-month Toxicity Reduction Evaluation (TRE), upon such a demonstration. At the end of the TRE, LDEQ will consider all information submitted and establish appropriate controls to prevent future toxic discharges, including WET and/or chemical-specific limits. A chemical-specific limit may be substituted where LDEQ can clearly demonstrate, in the permit fact sheet or statement of basis, that the toxicity has been fully characterized, the toxicant identified and confirmed, and appropriate controls selected. Where appropriate, a compliance schedule of up to three years may be allowed to attain compliance. In rare cases, a Best Management Practice (BMP) may be included as a permit control. If additional testing indicates that a chemical-specific limit or a BMP does not result in controlling lethal toxicity, the permit may then be revised to include lethal WET limit(s). LDEQ recognizes that special circumstances may warrant other actions, and may make occasional adjustments to the above policy based on special circumstances, however no such action shall result in a lowered level of aquatic life protection.

After a permit is issued with monitoring-only requirements and the effluent fails the sub-lethal endpoint (i.e., growth or reproduction) of a valid, permit scheduled toxicity test, the permittee shall be required to conduct retests once per month for the following three months. If any two of the three additional tests demonstrates significant sub-lethal effects at 75% effluent or lower, the effluent will have met the definition of reasonable potential for WET and the permittee shall initiate a 28-month sub-lethal TRE. At the end of the sub-lethal TRE, LDEQ will consider all information submitted and establish appropriate controls to prevent future toxic discharges, including WET and/or chemical-specific limits. A chemical-specific limit may be substituted where LDEQ can clearly demonstrate, in the permit fact sheet or statement of basis, that the toxicity has been fully characterized, the toxicant identified and confirmed, and appropriate controls selected. Where appropriate, a compliance schedule of up to three years may be allowed to attain compliance. In rare cases, a Best Management Practice (BMP) may be included as a permit control. If additional testing indicates that a chemical-specific limit or a BMP does not result in controlling sub-lethal toxicity, the permit then may be revised to include sub-lethal WET limit(s). LDEQ recognizes that special circumstances may warrant other actions, and may make occasional adjustments to the above policy based on special circumstances, however no such action shall result in a lowered level of aquatic life protection.

The minimum monitoring frequency for species under a WET limit is once per quarter for the term of the permit. WET limits may be removed from a permit after the first five years in effect, based on a demonstration of no lethal or sub-lethal effects during that period.

The following charts provide the process for determining the biomonitoring testing frequency. The chart for WET Testing (Monitoring Only; No Limits) below gives a general approach for permittees with no history of toxicity problems. Permittees will be required to biomonitor for the term of the permit.

WET Testing (Monitoring Only; No Limits):

Discharge Receiving Waters	Test Type	Monitoring Frequency	
		Most Sensitive	Least Sensitive
Critical Dilution < 1%	Acute	1/year	1/year
All Others	Chronic	1/quarter (*1)	1/quarter (*1)
All Others	Acute	1/quarter (*1)	1/quarter (*1)

(*1) Upon successfully passing the first four consecutive quarters of WET testing after permit issuance/reissuance and in the absence of subsequent lethal and/or sub-lethal toxicity, the permittee may request a reduction in monitoring frequency. Generally, this shall be 1/6 months for the most sensitive species and 1/year for the least sensitive species upon certification of fulfillment of the WET testing requirements, and also providing that the effluent continues to exhibit no lethal or sub-lethal effects. During the permit development process, if significant and/or intermittent toxicity (lethal and/or sub-lethal) is noted, the testing frequency reduction option is not available.

WET Limits:

Discharge Receiving Waters	Test Type	Monitoring Frequency	
		Most Sensitive	Least Sensitive
All	Chronic	1/quarter (*1)	1/quarter (*1)
All	Acute	1/quarter (*1)	1/quarter (*1)

(*1) There shall be no reduction in monitoring frequency for five (5) years from the effective date of the WET limit.

C. Test Species

For freshwater (average ambient salinity is < 2 ppt), acute tests will utilize Daphnia pulex and Pimephales promelas while chronic tests will utilize Ceriodaphnia dubia and Pimephales promelas.

For marine waters (average ambient salinity is $\geq$ 2 ppt), Mysidopsis bahia and Menidia beryllina will be used for both acute and chronic tests.

9. Compliance Schedules

The LDEQ Office of Environmental Services may include compliance schedules to allow adequate time to meet water quality based limits and progress reports will generally be required. Compliance schedules will generally be no longer than three years

10. Wetland Assimilation of Nutrient Rich Discharges

LDEQ recognizes that many of the state's wetlands are deteriorating due to changes to hydrology and the resultant lack of nutrients, suspended solids, and a high natural subsidence rate. Therefore the department may allow the discharge of the equivalent of secondarily treated effluent into wetlands for the purposes of nourishing and enhancing those wetlands. The approval process will require:

A. A feasibility assessment that includes:

1. delineation of the available wetland(s),
2. a list of landowners and the availability of ownership and/or easement agreement(s),

3. a description and the suitability of the type (classification) of wetland(s) available,
4. the number of acres of wetlands required for assimilation,
5. uses that currently exist within the wetland (i.e., hunting, fishing, swimming, oyster propagation, etc.),
6. long-term average loading rates (and basis for calculations) to the wetland (not to exceed 15g TN/square meter/yr and 4g TP/square meter/yr),*
7. a proposed reference area for evaluation purposes, and
8. hydrology and hydrograph of the proposed assimilation area and possible distribution system layout.

B. A baseline study of the wetland that includes the discharge area and the reference ar

1. classification of the flora present,
2. vegetative productivity,
3. sediment analysis for metals and nutrients,
4. water level measurements/analyses, including salinity, dissolved oxygen conductivity, nitrogen series and total phosphorus,
5. water quality measurements, and
6. accretion measurement(s).

C. Upon permit issuance** the permittee will be required to conduct ongoing biological measurements to ensure the biological integrity of the wetland. The quantity and frequency of the measurements will be dependant upon the flow of the discharge and the loading rate to the wetland, but may include, but is not limited to sampling in the discharge area and the reference site for variations in:

1. floral species diversity (Terrestrial Plant Ecology. Chapter 9. Method of Sampling the Plant Community Barbour, et al 1987),
2. above-ground productivity (Methods for Estimating the Primary Production of Forest. P. J. Newbould 1967; Effect of forest management practices on southern wetland productivity, W. H. Conner, 1994; The use of wetlands in the Mississippi River Delta for wastewater assimilation: a review, Day, J. W. et al 2004),
3. water stages,
4. metals and nutrient analysis from plant tissue samples,
5. metals and nutrient analysis from sediment samples,
6. water quality analysis of metals, nutrient, and other components, and
7. accretion measurement(s).

Statistical analysis will be included in the permit requirements as follows: "One-way analysis of variance will be carried out to compare treatment and control area parameters using statistical software. An alpha probability level of <0.05 will be used to define a significant difference. Comparison of means with significant ANOVA tests will be made using Tukey-Kramer Honestly Significant Difference (HSD) test (Sall and Lehman 1996)." Other statistical tests may be used as appropriate and would be described in the facility reporting.

D. As found in LAC 33:IX.1113.B.12, the following biological criteria shall apply to a wetland receiving a discharge:
E. "Due to effluent addition, the discharge area shall have no more than a 20% reduction in the rate of total above-ground wetland productivity over a 5-year period as compared to a reference area..."
F. The following language provides permit implementation guidance for the biological criteria.

Area Definitions
The Discharge Area is defined as the area of wetlands directly affected by effluent addition, and is inclusive of the delineated assimilation area. The Reference Area is defined as wetland area that is nearby and similar to the Discharge Area, but that is not affected by effluent addition. The Reference Area and Discharge Area will be determined through the required feasibility and baseline studies described in Sections 10.A and 10.B above.

____
* Site-specific loading rates may be applied, if scientifically justified and adopted by LDEQ.
** To avoid confusion and to provide a better understanding of permitting requirements, an example permit application is included in Appendix G of this volume and an example permit is included in Appendix H.

Background and Basis for Criteria Implementation and Assessment
Above ground primary productivity is a key measurement of overall ecosystem health in the wetlands of south Louisiana (Conner 1994; Day et al. 2004). Primary productivity is dependent on a number of factors, including hydrology, nutrient availability and past management practices (Conner 1994; Conner and Day 1976, 1988a and b; Ewel & Odum 1984). The underlying ecological model is that the addition of secondarily-treated nutrient rich municipal wastewater to south Louisiana wetlands will promote vertical accretion through increased organic matter production and deposition, counteracting the effects of hydrological isolation and subsidence. This is supported by Rybczyk et al. (2002) who reported increased soil accretion rates at the Thibodaux wastewater discharge area, and by Hesse et al. (1998) that showed higher growth rates of cypress trees at the Breaux Bridge wastewater discharge area, an area that has received wastewater effluent for over 50 years.

Methods for Measuring Above-ground Productivity in Forested Wetlands
At forested wetland sites, 10 x 100 m quadrates should be established to measure forest productivity. Productivity of a forested wetland is defined as the sum of stem growth (perennial productivity) and leaf and fruit fall (ephemeral productivity). Aboveground net primary productivity (NPP) should be calculated as the sum of ephemeral and perennial productivity, and presented as live dry weight per square meter per year basis (g dry wt m-2 yr-1).

Perennial productivity should be calculated using diameter at breast height (dbh) measurements of all trees with dbh greater than 3.2 cm. Measurements of dbh should be taken during two consecutive winters when trees are dormant, and biomass calculated using allometric equations (Megonigal et al. 1997; Scott et al. 1985). The following steps should be used to calculate perennial productivity:

- Estimate biomass (in kg) from dbh using allometric equations
- Sum biomass per study site and divide by area (in m2) of study site. This calculates the biomass per unit area (kg m-2) for each year and study site.
- Subtract Yr1 biomass (kg m-2) from Yr2 biomass, and multiply by 1000. This calculates Net Primary Productivity (NPP) as g m-2 yr-1.

Ephemeral productivity should be measured using 0.25 m2 leaf litter boxes, with screened bottoms and approximately 10 cm wide sides. Six boxes should be placed randomly in each 10 x 100 m quadrates. Leaves and other materials that collect in the boxes should be gathered bimonthly, separated into leaves and woody material, dried to a constant weight, and weighed. Ephemeral productivity should be calculated by summing the dried weight of leaves from each box over one year and extrapolating to grams per m2.

Methods for Measuring Above-ground Productivity in Emergent Wetlands

At each non-forested marsh study site, end of season live biomass should be measured using five randomly placed 0.06 m2 quadrates 10-20 m from the bayou edge in areas of relatively homogenous herbaceous vegetation. Samples should be collected from the quadrats during the last two weeks of September or the first two weeks of October. Vegetation within the quadrate should be cut as close to the marsh surface as possible, stored in labeled paper bags, brought back to the laboratory, and refrigerated until processing. Live material should be separated from dead, and dried at 60°C to a constant weight. Aboveground net primary productivity should be calculated by extrapolating the live dried weight of each sample to grams per m2.

Calculating Daily Maximum and Maximum 30-Day Permit Limitations for Total Phosphorus and Nitrogen Based on Long-Term Loading Rates

The following language provides guidance on the implementation of the long-term average nutrient loading rates.

Based on the Yearly long-term Average Loading Rates specified above and the acreage of wetland into which the effluent is discharged, an effluent loading rate will be calculated and included in the permit. First the yearly loading rates are converted from grams/square meter to pounds/acre. The product is divided by 365 days/year to calculate the daily long-term average loading rate. The dividend is inserted into the calculation of permit limits using the statistical approach by using the same multipliers to determine the daily maximum (3.11) and maximum 30-day (1.31) loading rate limits.

4g TPm-2yr-1 = 35.6 lbs. TP acre-1yr-1

15g TNm-2yr-1 = 133.8 lbs. TN acre-1yr-1

As an example, if the discharge was to 234 acres, then

the yearly loading rate is:

(35.6 lbs. TP acre-1yr-1) * 234 acres = 8330 lbs. TP/year

the long term average daily loading rate is:

(8330 lbs. TP/year)/365 days/year = 22.8 lbs. TP/day

Using the multipliers found on page 12 of this volume,

the daily maximum discharge loading rate is:

(22.8 lbs. TP/day) * 3.11 = 70.9 lbs. TP/day

the maximum 30-day discharge

(22.8 lbs. TP/day) * 1.31 = 29.9 lbs. TP/day

References

Barbour, et al. 1987, Terrestrial Plant Ecology, Chapter 9, Method of Sampling the Plant Community.

Conner, W. H. 1994. Effect of forest management practices on southern forested wetland productivity. Wetlands 14:27-40.

Conner, W. H., and J. W. Day. 1976. Productivity and composition of a Baldcypress-Water Tupelo site and a bottomland hardwood site in a Louisiana swamp. American Journal of Botany 63:1354-1364.

Conner, W.H. and J.W. Day, Jr. 1988a. Rising water levels in coastal Louisiana: Implications for two forested wetland areas in Louisiana. Journal of Coastal Research 4(4):589-596.

Conner, W.H. and J.W. Day, Jr. 1988b. The impact of rising water levels on tree growth in Louisiana. Pages 219-224 in Hook, D.D. et al. (eds.), the Ecology and Management of Wetlands, Vol. 2: Management, Use and Value of Wetlands. Croom Helm Ltd Publishers, England.

Day, John W., Jae-Young Ko, J. Rybczyk, D. Sabins, R. Bean, G. Berthelot, C. Brantley, A. Breaux, L. Cardoch , W. H. Conner, C. Courville, J.N. Day, A.J. Englande, S. Feagley, E. Hyfield, R. Lane, J. Lindsey, J. Mistich, W. Mitsch, E. Reyes, R. Twilley, A. Yáñez-Arancibia, and X.W. Zhang. 2004. The use of wetlands in the Mississippi Delta for wastewater assimilation: A review. Ocean and Coastal Management 47:671-691.

Ewel, C.E. and H.T. Odum. Cypress Swamps. 1984. University Press of Florida. 472 pp.

Hesse, I.D, J. Day, and T. Doyle. 1998. Long-term growth enhancement of Baldcypress (Taxodium Distichum) from municipal wastewater application. Environmental Management. 22:119-127.

Megonigal, J. P., W. H. Conner, S. Kroeger, and R. R. Sharitz. 1997. Aboveground production in southeastern floodplain forests: a test of the subsidy-stress hypothesis. Ecology 78:370-384.

Rybczyk, J., J. Day, and W. Conner. 2002. The impact of wastewater effluent on accretion and decomposition in a subsiding forested wetland. Wetlands 22: 18-32.

Scott, M. L., R. R. Sharitz, and L. C. Lee. 1985. Disturbance in a Cypress-Tupelo wetland: an interaction between thermal loading and hydrology. Wetlands 5:53-68.

APPENDIX A

TEXT OF LETTER FERGUSON (EPA) TO CHANG (LDEQ) DATED 10/8/91 CONCERNING THE DETERMINATION OF THE NEED FOR WATER QUALITY-BASED PERMIT EFFLUENT LIMITATIONS

The Region 6 Permits Branch has developed a procedure for effluent data analysis that we will use in FY92 to determine when a water quality based permit limitation is necessary. Our regulations call for the imposition of a permit limit if there is a "reasonable potential" to exceed a water quality standard. The limited effluent data obtained with the permit application may not represent a complete picture of the actual range of pollutant concentrations.

Assessing the potential to cause a water quality violation is one of many points which need to be covered in water quality standard implementation documents. To date, the only state permitting implementation to address "reasonable potential" is that developed by the Texas Water Commission. The Region 6 staff has worked up a sound and straightforward method that we will use in writing permits for the other states in the region, providing us with a workable alternative to the method described in the Technical Support Document for Toxics.

Our letter of January 3, 1991, described a statistical approach that would allow us to use a single piece of data or a small number of effluent measurements to estimate the upper range of concentrations that could be discharged and cause an exceedance of a standard. This procedure can be used to estimate the 95th percentile of an effluent data set, or the value that would be expected to exceed 95% of effluent concentrations in a discharge. The estimate of the 95th percentile is obtained by the following relationship:

pollutant concentration * 2.13 = 95th percentile pollutant concentration

The procedure is based upon the relationship of the geometric mean to the 95th percentile in a lognormal distribution, assumes a constant coefficient of variance and is independent of the number of data points considered.

A single measurement of pollutant concentration or the geometric mean of multiple measurements may be used to estimate the upper range value. The upper range estimate of the pollutant is then used to calculate the concentration of that toxic parameter after dilution in the receiving stream. For example, if a permittee reported an effluent measurement of 4.0 µg/L of cadmium, the upper range of cadmium expected for that discharge would be estimated as 8.5 µg/L. The permit writer would determine if a discharge of 8.5 µg/L of cadmium would cause an exceedance of the applicable water quality criteria.

Our permit writers will begin using the above procedure in writing FY92 permits to examine the potential of a discharge to cause an excursion above a water quality standard. For Texas permits, reasonable potential to violate a standard will be assessed in the manner described in the TWC implementation policy. A permit limit will be imposed on Texas dischargers if the effluent pollutant concentration is within 85% of the allowable value. The permittee will measure and report that parameter if within 70% of the limit.

All of our states should address the "reasonable potential" of a discharge to cause excursions above water quality standards in an implementation document or their Continuing Planning Process. They may reference the method Region 6 has developed or adopt something of equivalent stringency.

Accommodating the uncertainty in effluent data will be protective and will likely result in a higher number of permits containing water quality-based limits. We believe our approach will provide the permit writers with a consistent, clean and equitable technique of implementing water quality standards. Please let met know if you have any questions on this. If your staff has questions on the underlying statistics, they may speak with Jane Watson of my staff at (214) 655-7175.

ATTACHMENT TO LETTER FERGUSON (EPA) TO CHANG (LDEQ) DATED 10/8/91

REGION 6 APPROACH
DETERMINING REASONABLE POTENTIAL

Region 6 has developed a procedure to extrapolate limited data sets to better evaluate the potential for the higher effluent concentrations to exceed a State water quality standard. Our method yields an estimate of a selected upper percentile value. We believe that the most statistically valid estimate of an upper percentile value is a maximum likelihood estimator which is proportional to the population geometric mean. If one assumes the population of effluent concentrations to fit a lognormal distribution, this relationship is given by:

$$Cp = Cmean * \exp(Zp * \sigma - 0.5 * \sigma^2)$$

where: Zp = normal distribution factor at p^{th} percentile

$$\sigma^2 = \ln(CV^2 + 1)$$

To calculate the maximum likelihood estimator of the 95th percentile, the specific relationship becomes:

$$C95 = Cmean * \exp(1.645 * \sigma - 0.5 * \sigma^2)$$

if CV is assumed = 0.6,

$\sigma^2 = .307$

The ratio of the estimated 95th percentile value to the mean (C95/Cmean) is calculated :

C95/Cmean = 2.13

A single effluent value or the geometric mean of a group of values is multiplied by the ratio to yield the estimate of the 95th percentile value.

The following table shows the ratio of the upper percentile to the mean for the 90th, 95th, and 99th percentiles

Ratio of Upper Percentiles to Geometric Mean

Percentile	Z	C%/Cmean
90	1.283	1.74
95	1.645	2.13
99	2.386	3.11

APPENDIX B

MINIMUM QUANTIFICATION LEVELS (MQLs)

LOUISIANA SURFACE WATER QUALITY STANDARDS

Minimum quantification levels for state water permitting assessments are set at the following values based on the listed published analytical methods (SM = Standard Methods, 18th Edition).

NONCONVENTIONAL		MQL (μg/L)
Phenolics, Total Recoverable (4AAP)(*1)		5
Chlorine (Total Residual)		33
3-Chlorophenol (*1)		10
4-Chlorophenol (*1)		10
2,3-Dichlorophenol (*1)		10
2,4-Dichlorophenol (*1)		10
2,5-Dichlorophenol (*1)		10
2,6-Dichlorophenol (*1)		10
3,4-Dichlorophenol (*1)		10
2,4-D (*1)		10
2,4,5-TP (Silvex) (*1)		4
METALS		
Aluminum (Total)		2.5
Antimony (Total)		60
Arsenic (Total) (*1)		5
Beryllium (Total)		0.5
Cadmium (Total) (*1)		1
Chromium (Total)		10
Chromium (3+) (*1)		10
Chromium (6+) (*1)		10
Copper (Total) (*1)		3
Lead (Total) (*1)		2
Mercury (Total) (*1)		0.0005/0.005
Molybdenum (Total)		30
Nickel (Total) (*1)	[Freshwater]	5
Nickel (Total) (*1)	[Marine]	5
Selenium (Total)		5
Silver (Total)		0.5
Thallium (Total)		0.5
Zinc (Total) (*1)		20
Cyanide (Total)		10
DIOXIN		
2,3,7,8-TCDD (*1)		0.00001

VOLATILE COMPOUNDS	
Acrolein	50
Acrylonitrile	20
Benzene (*1)	10
Bromoform (*1)	10
Bromodichloromethane (*1)	10
Carbon Tetrachloride (*1)	2
Chlorobenzene	10
Chlorodibromomethane (*1)	10
Chloroethane	50
2-Chloroethylvinylether	10
Chloroform (*1)	10
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
Dichlorobromomethane (*1)	10
1,1-Dichloroethane	10
1,2-Dichloroethane (*1)	10
1,1-Dichloroethylene (*1)	10
1,2-Dichloropropane	10
1,3-Dichloropropylene (*1)	10
Ethylbenzene (*1)	10
Methyl Bromide [Bromomethane]	50
Methyl Chloride [Chloromethane]	50
Methylene Chloride (*1)	20
1,1,2,2-Tetrachloroethane (*1)	10
Tetrachloroethylene (*1)	10
Toluene (*1)	10
1,2-trans-Dichloroethylene	10
1,1,1-Trichloroethane (*1)	10
1,1,2-Trichloroethane (*1)	10
Trichloroethylene (*1)	10
Vinyl Chloride (*1)	10

ACID COMPOUNDS	
2-Chlorophenol (*1)	10
2,4-Dichlorophenol (*1)	10
2,4-Dimethylphenol (*1)	10
4,6-Dinitro-o-Cresol (*1)	50
2,4-Dinitrophenol (*1)	50
2-Nitrophenol (*1)	20
4-Nitrophenol (*1)	50
p-Chloro-m-Cresol (*1)	10
Pentachlorophenol	5
Phenol (*1)	10
2,4,6-Trichlorophenol (*1)	10

<u>BASE/NEUTRAL</u>

Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzidine (*1)	50
Benzo(a)anthracene	5
Benzo(a)pyrene	5
3,4-Benzoflouranthene	10
Benzo(ghi)perylene	20
Benzo(k)fluoranthene	5
Bis(2-chloroethoxy) Methane	10
Bis(2-chloroethyl) Ether	10
Bis(2-chloroisopropyl) Ether	10
Bis(2-ethylhexyl) Phthalate	10
4-Bromophenyl Phenyl Ether	10
Butylbenzyl Phthalate	10
2-Chloronaphthalene	10
4-Chlorophenyl Phenyl Ether	10
Chrysene	5
Dibenzo(a,h) anthracene	5
3,3'-Dichlorobenzidine	5
Diethyl Phthalate	10
Dimethyl Phthalate	10
Di-n-butyl Phthalate	10
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
Di-n-octyl Phthalate	10
1,2-Diphenylhydrazine	20
Fluoranthene	10
Fluorene	10
Hexachlorobenzene (*1)	5
Hexachlorobutadiene (*1)	10
Hexachlorocyclopentadiene (*1)	10
Hexachloroethane	20
Indeno(1,2,2-cd)pyrene	5
Isophorone	10
Naphthalene	10
Nitrobenzene	10
n-Nitrosodimethylamine	50
n-Nitrosodi-n-Propylamine	20
n-Nitrosodiphenylamine	20
Phenanthrene	10
Pyrene	10
1,2,4-Trichlorobenzene	10

PESTICIDES

Aldrin (*1)	0.01
Alpha-BHC	0.05
Beta-BHC	0.05
Gamma-BHC [Lindane] (*1)	0.05
Delta-BHC	0.05
Chlorodane (*1)	0.2
4,4'-DDT (*1)	0.02
4,4'-DDE (*1)	0.1
4,4'-DDD (*1)	0.1
Dieldrin (*1)	0.02
Alpha-Endosulfan (*1)	0.01
Beta-Endosulfan (*1)	0.02
Endosulfan Sulfate	0.1
Endrin (*1)	0.02
Endrin Aldehyde	0.1
Heptachlor (*1)	0.01
Heptachlor Epoxide	0.01
PCB-1242 (*1)	0.2
PCB-1254 (*1)	0.2
PCB-1221 (*1)	0.2
PCB-1232 (*1)	0.2
PCB-1248 (*1)	0.2
PCB-1260 (*1)	0.2
PCB-1016 (*1)	0.2
Toxaphene (*1)	0.3

(*1) Numerical criteria for this parameter present in Table 1 of LAC 33:IX.1113

APPENDIX C

TEXT OF LETTER NORTON AND GARDNER (EPA-REGION 6) TO STENGER (EPA-REGION 6) DATED 1/8/91 CONCERNING WET LIMIT DILUTION SERIES

We recommend setting a constant dilution series for WET limits that brackets the critical dilution set as the NOEC (No Observed Effect Concentration). There are a number of benefits derived from taking this approach that we recommend will result in the use of the most efficient, powerful, and scientifically defensible statistical procedure (parametric analysis). In addition, this approach provides for consistency and permit writer ease. The new Acute Manual for toxicity testing (Sept. 1991) recommends using a 0.5 or greater dilution series. After looking at the dilution series produced by various factors for use in WET limits, we chose 0.75 as the factor which dealt dilution concentrations from low-end critical dilutions to high-end critical dilutions. This 0.75 dilution series factor was chosen for several reasons. First, this value produced dilution series which provided reasonable separation between concentrations at all critical dilutions. Second, this value does not allow any dilution concentration for any given critical dilution an exposure concentration that exceeds approximately three (3) times the critical dilution of that given series. This allows for adequate difference in dilution concentrations without significantly increasing the potential for zero variability within groups of a given dilution concentration (leading then to the use of the less preferable statistical procedure, non-parametric analysis). Finally, the 0.75 dilution series factor follows the recommendations set forth in the new Acute toxicity testing manual.

The attached table lists critical dilutions from 1 to 100 with the dilution series corresponding to the use of the 0.75 dilution factor. The concentrations are rounded off to the nearest whole number. This table could be incorporated into the Permit Writers Guide along with the rationale for choosing this factor. Permit writers (example, Arizona Chemical NOEC = 4.8%) may wish to calculate their own series using the 0.75 factor for precision purposes.

0.75 DILUTION SERIES

		CRITICAL DILUTION		
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

CRITICAL
DILUTION

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
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

				CRITICAL DILUTION	
	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
	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	

				CRITICAL DILUTION
31	42	56	74	99
32	42	56	75	100

APPENDIX D

EXAMPLE OF WATER QUALITY BASED LIMIT CALCULATION AND SCREENING PROCEDURES

A facility is discharging 0.5 MGD (2 year, 30-day max) into a stream with a critical flow of 6.189 cfs or 4 MGD. The harmonic mean is 16.091 cfs or 10.4 MGD. The flow basis for calculating effluent WQBL's and technology based limits shall be the same for this example. Assume 1 final outfall. The sample pollutant of concern is benzene. The designated uses for the hypothetical receiving stream include primary and secondary contact recreation and aquatic life propagation. The designated uses of the hypothetical stream do not include drinking water supply. HHc or hhc stands for "human health carcinogen". HHnc or hhnc stands for "human health non-carcinogen".

The numerical criteria (Cr) for benzene are:

Freshwater acute aquatic life = 2249 ug/L
Freshwater chronic aquatic life = 1125 ug/L
Human health, non-drinking water = 12.5 ug/L
Benzene is a listed human health carcinogen.

Technology-based limits for benzene are:

OCPSF Guideline, Subpart J,
for Benzene, Daily Maximum = 134 ug/L
OCPSF Guideline, Subpart J,
for Benzene, Maximum 30-Day = 57 ug/L

Reported end-of-pipe values for benzene are:

Maximum 30-Day Avg.= 150 ug/L
Daily Maximum = 320 ug/L

$Qe = 0.5$ MGD
$Qr_a = 4$ MGD
$Qr_{hhnc} = 10.4$ MGD
Fs = 1 for MZ and 0.1 for ZID

$$\text{ZID Dilution} = \frac{(0.5)}{(4)*(0.1) + (0.5)} = 0.5556$$

$$\text{MZ Dilution} = \frac{(0.5)}{(4)*(1) + (0.5)} = 0.1111$$

$$\text{HHc Dilution} = \frac{(0.5)}{(10.4)*(1) + (0.5)} = 0.0459$$

Benzene is a carcinogen, so the human health non-carcinogen dilution calculation was not necessary.

Acute protection at ZID:	Chronic protection at MZ:	Human health:
$WLA_a = \frac{2249\ ug/L}{0.5556}$	$WLA_c = \frac{1125\ ug/L}{0.1111}$	$WLA_h = \frac{12.5\ ug/L}{0.0459}$
= 4048 ug/L	= 10,126 ug/L	=272.5 ug/L
LTA_a = 4048 ug/L x 0.32 = 1295 ug/L	LTA_c = 10126 ug/L x 0.53 = 5367 ug/L	LTA_h =272.5 ug/L

The limiting parameter is LTA_h = 272.5 ug/L

WQBL's:

Daily Maximum = 272.5 ug/L x 2.38 = 648.5 ug/L
Maximum 30-Day Avg.= 272.5 ug/L (no multiplier used if human health criteria is most limiting)

Converting to mass using mass balance formula (mg/L x MGD x 8.34):
Daily Maximum = 648.5 ug/L/1000 x 0.5 MGD x 8.34 = 2.704 lbs/day
Maximum 30-Day Avg. = 272.5 ug/L/1000 x 0.5 MGD x 8.34 = 1.136 lbs/day

Screening Procedure; Technology Based Limits:

First, technology limits need to be set for the hypothetical facility:

Mass limits need to be calculated for the technology-based limits, which in this case are the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) guidelines, Subpart J, which are concentration based for the toxics and include the pollutant benzene:

OCPSF Subpart J Guideline for benzene:
Maximum 30-Day Avg.= 57 ug/L or 0.057 mg/L
Daily Maximum = 134 ug/L or 0.134 mg/L

OCPSF Guideline concentration x Flow x 8.34 = technology mass limit for benzene:

Maximum 30-Day = 0.057 mg/L x 0.5 MGD x 8.34 = 0.24 lbs/day
Daily Maximum = 0.134 mg/L x 0.5 MGD x 8.34 = 0.56 lbs/day

Screening; choose the lesser of the calculated effluent WQBL's and technology-based limits:
Maximum 30-Day Avg. effluent WQBL = 1.14 lbs/day
Maximum 30-Day OCPSF Guideline limit = 0.24 lbs/day

Daily Maximum effluent WQBL = 2.70 lbs/day
Daily Maximum OCPSF Guideline limit = 0.56 lbs/day

For both Maximum 30-Day Avg. and Daily Maximum limits, technology was the lesser or more limiting value.

Resulting permit limits at the final outfall:
Maximum 30-Day Avg. = 0.24 lbs/day
Daily Maximum = 0.56 lbs/day

Screening Procedure Using Reported End-of-Pipe (EOP) Values in the Absence of Technology-Based Limits:

For this example, let's assume that there are no appropriate technology-based limits (OCPSF) available for the pollutant of concern, benzene. First, "reasonable potential" for exceeding the maximum 30-day effluent WQBL needs to be established:

As stated in section 5.B, "reasonable potential" is established by multiplying the average reported EOP value by 2.13. "Reasonable potential" addresses the statistical likelihood that a reported discharge value would or would not exceed an effluent WQBL. This is set at 95% confidence using a lognormal distribution as stated in section 5.B.

"Reasonable potential" calculation:
0.15 mg/L x 2.13 = 0.32 mg/L

Use mass balance to convert concentration to mass for screening purposes:

0.32 mg/L x 0.5 MGD x 8.34 = 1.33 lbs/day

Screening; compare the calculated maximum 30-day effluent WQBL and the results of the "reasonable potential" calculation:

Maximum 30-Day Avg. effluent WQBL = 1.14 lbs/day
Reported EOP value x 2.13 = 1.33 lbs/day

If the reported EOP value x 2.13 is greater than the calculated maximum 30-day Avg. effluent WQBL then both maximum 30-day Avg. and daily maximum effluent WQBL's shall be placed in the permit. Generally, if the reported EOP value x 2.13 is less than the calculated maximum 30-day Avg. effluent WQBL, no numerical limit would be placed in the permit, however monitoring may be required on a BPJ basis. Since the reported EOP value x 2.13 is greater than the calculated maximum 30-day Avg. effluent WQBL, the limits would be as follows:

Maximum 30-Day Avg. = 1.14 lbs/day
Daily Maximum = 2.70 lbs/day

APPENDIX E

CARCINOGEN AND NON-CARCINOGEN DESIGNATIONS FOR NUMERICAL CRITERIA

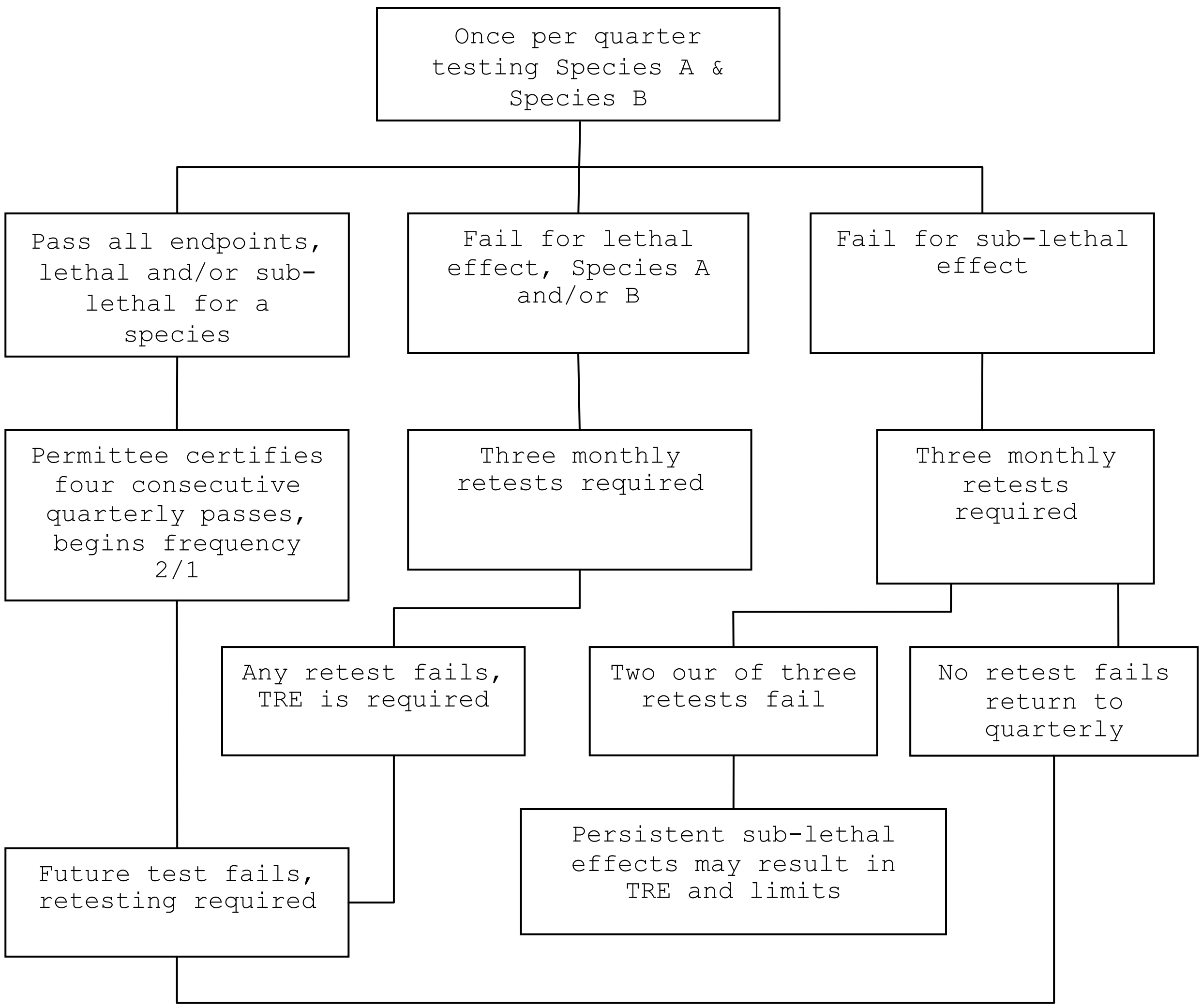
Name	Cancer Group
Carcinogen*	
1. Aldrin	B2
2. Chlordane	B2
3. DDT	B2
4. TDE (DDD)	B2
5. DDE	B2
6. Dieldrin	B2
7. Heptachlor	B2
8. Lindane (Hexachlorocyclohexane, gamma BHC)	B2 (Potency Slope Factor Pending)
9. PCB	B2
10. Toxaphene	B2
11. Benzene	A
12. Carbon Tetrachloride	B2
13. Chloroform	B2
14. 1,2-Dichloroethane (EDC)	B2
15. 1,1,2-Trichloroethane	C
16. 1,1,2,2-Tetrachloroethane	C
17. 1,1-Dichloroethylene	C
18. Trichloroethylene	B2
19. Tetrachloroethylene	B2
20. Vinyl Chloride	A
21. Bromoform	B2
22. Bromodichloromethane	C
23. Methylene Chloride	B2
24. Methyl Chloride	B2 (Human Health Criteria Removed)
25. Dibromochloromethane	B2
26. Benzidine	A
27. Hexachlorobenzene (HCB)	B2
28. Hexachlorobutadiene (HCBD)	C
29. 2,3,7,8-Tetrachlorodibenzo-p-dioxin	B2
30. Chromium VI	-
Non-Carcinogen*	
1. Endosulfan	-
2. Endrin	D
3. Ethylbenzene	D
4. Toluene	D

5. 1,1,1-Trichloroethane	D (Human Health Criteria Removed)
6. 1,3-Dichloropropene	-
7. 2-Chlorophenol	-
8. 3-Chlorophenol	-
9. 4-Chlorophenol	-
10. 2,3-Dichlorophenol	-
11. 2,4-Dichlorophenol	-
12. 2,5-Dichlorophenol	-
13. 2,6-Dichlorophenol	-
14. 3,4-Dichlorophenol	-
15. Phenol (Total)	-
16. Arsenic	-
17. Chromium III	-
18. Zinc	-
19. Cadmium	-
20. Copper	-
21. Lead	-
22. Mercury	-
23. Nickel	-
24. Cyanide	-

*Based on EPA Carcinogen Classification System
A - Human Carcinogen, Adequate Human Data
B2- Probable Human Carcinogen, Adequate Animal Data - Inadequate Human Data
C - Possible Human Carcinogen, Inadequate Animal Data - No Human Data
D - Not Classifiable as to Human Carcinogenicity

APPENDIX F

Minimum WET Testing Frequency Flow Chart



This flow chart represents the MINIMUM WET testing frequencies for major dischargers. Additional WET testing may be appropriate.