Amendments

to the

Water Quality Control Plan – Los Angeles Region

With respect to

Inland Surface Water Ammonia Objectives

April 25, 2002
Nonsubstantive revisions made on 02/04/03

Amendments:

Chapter 3. Water Quality Objectives

Ammonia

Ammonia is a pollutant routinely found in the wastewater effluent of Publicly Owned Treatment Works (POTWs), in landfill-leachate, as well as in run-off from agricultural fields where commercial fertilizers and animal manure are applied. Ammonia exists in two forms – un-ionized ammonia (NH_3) and the ammonium ion (NH_4^+). They are both toxic, but the neutral, un-ionized ammonia species (NH_3) is highly toxic to fish and other aquatic life. The ratio of toxic NH_3 to total ammonia ($NH_4^+ + NH_3$) is primarily a function of pH, but it is also affected by temperature and other factors. Additional impacts can also occur as the oxidation of ammonia lowers the dissolved oxygen content of the water, further stressing aquatic organisms. Ammonia also combines with chlorine (often both are present) to form chloramines – persistent toxic compounds that extend the effects of ammonia and chlorine downstream.

Oxidation of ammonia to nitrate may lead to groundwater impacts in areas of recharge.

The one-hour average objective is dependent on pH and fish species (salmonids present or absent), but not temperature. It is assumed that salmonids may be present in waters designated in the Basin Plan as "COLD" or "MIGR" and that salmonids are absent in waters not designated in the Basin Plan as "COLD" or "MIGR," in the absence of additional information to the contrary. The 30-day average objective is dependent on pH and temperature. At lower temperatures, the 30-day average objective also is dependent on the presence or absence of early life stages of fish (ELS). Water bodies with a Basin Plan designation of "SPWN" support high quality aquatic habitats suitable for reproduction and early development of fish and, therefore, these water bodies are designated as ELS present waters. The four-day average objective is 2.5 times the 30-day average objective.

In order to protect aquatic life, ammonia concentrations in inland surface ~~receiving~~ waters characteristic of freshwater ("freshwater" as determined by the provisions described herein under "IMPLEMENTATION," 1. Determination of Freshwater, Brackish Water, or Saltwater Conditions) shall not exceed the values ~~listed~~ calculated for the ~~corresponding~~ appropriate instream conditions shown in Tables 3-1 to 3-3 ~~3-4~~ (per U.S. EPA's most recent criteria guidance document, "1999 Update of Ambient Water Quality Criteria for Ammonia").

~~Timing of compliance with this objective will be determined on a case-by-case basis. Dischargers will have up to 8 years following the adoption of this plan by~~

~~*the Regional Board to (i) make the necessary adjustments/improvements to meet these objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia. If it is determined that there is an immediate threat or impairment of beneficial uses due to ammonia, the objectives in Tables 3-1 and 3-4 shall apply.*~~

~~*In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.*~~

For inland surface waters not characteristic of freshwater (as determined by the procedures in paragraph 1 of the Implementation Provisions below), concentrations of ammonia shall not exceed the values listed for the corresponding instream conditions in Tables 3-4 and 3-5.

For water bodies where Ammonia Water Effects Ratios (WERs) have been fully approved through the Basin Plan Amendment process, the objective will be multiplied by the WER to determine the site-specific objective.

In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater quality.

[Delete existing Tables 3-1 and 3-3 and rename existing Table 3-2 as new Table 3-4 and existing Table 3-4 as new Table 3-5.]

Table 3-1. One-hour Average Objective for Ammonia-N for Freshwaters (mg N/L)[1]

pH	Waters Designated COLD and/or MIGR	Waters Not Designated COLD and/or MIGR
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.885	1.32

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia

[1] *For freshwaters, the one-hour average concentration of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equations.*

For waters designated COLD and/or MIGR:

$$\text{One-hour Average Concentration} = \frac{0.275}{1+10^{7.204-pH}} + \frac{39.0}{1+10^{pH-7.204}}$$

Or for waters not designated COLD and/or MIGR:

$$\text{One-hour Average Concentration} = \frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}}$$

Table 3-2. 30-day Average Objective for Ammonia-N for Freshwaters Designated SPWN (mg N/L)

Temperature, °C

pH	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	6.67	6.46	6.06	5.68	5.33	4.99	4.68	4.39	4.12	3.86	3.62	3.39	3.18	2.98	2.80	2.62	2.46
6.6	6.57	6.36	5.97	5.59	5.25	4.92	4.61	4.32	4.05	3.80	3.56	3.34	3.13	2.94	2.75	2.58	2.42
6.7	6.44	6.25	5.86	5.49	5.15	4.83	4.52	4.24	3.98	3.73	3.50	3.28	3.07	2.88	2.70	2.53	2.37
6.8	6.29	6.10	5.72	5.36	5.03	4.72	4.42	4.14	3.89	3.64	3.42	3.20	3.00	2.82	2.64	2.47	2.32
6.9	6.12	5.93	5.56	5.21	4.89	4.58	4.30	4.03	3.78	3.54	3.32	3.11	2.92	2.74	2.57	2.41	2.25
7.0	5.91	5.73	5.37	5.04	4.72	4.43	4.15	3.89	3.65	3.42	3.21	3.01	2.82	2.64	2.48	2.32	2.18
7.1	5.67	5.49	5.15	4.83	4.53	4.25	3.98	3.73	3.50	3.28	3.08	2.88	2.70	2.53	2.38	2.23	2.09
7.2	5.39	5.22	4.90	4.59	4.31	4.04	3.78	3.55	3.33	3.12	2.92	2.74	2.57	2.41	2.26	2.12	1.99
7.3	5.08	4.92	4.61	4.33	4.06	3.80	3.57	3.34	3.13	2.94	2.76	2.58	2.42	2.27	2.13	2.00	1.87
7.4	4.73	4.59	4.30	4.03	3.78	3.55	3.32	3.12	2.92	2.74	2.57	2.41	2.26	2.12	1.98	1.86	1.74
7.5	4.36	4.23	3.97	3.72	3.49	3.27	3.06	2.87	2.69	2.53	2.37	2.22	2.08	1.95	1.83	1.72	1.61
7.6	3.98	3.85	3.61	3.39	3.18	2.98	2.79	2.62	2.45	2.30	2.16	2.02	1.90	1.78	1.67	1.56	1.47
7.7	3.58	3.47	3.25	3.05	2.86	2.68	2.51	2.36	2.21	2.07	1.94	1.82	1.71	1.60	1.50	1.41	1.32
7.8	3.18	3.09	2.89	2.71	2.54	2.38	2.23	2.10	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
7.9	2.80	2.71	2.54	2.38	2.24	2.10	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17	1.10	1.03
8.0	2.43	2.36	2.21	2.07	1.94	1.82	1.71	1.60	1.50	1.41	1.32	1.24	1.16	1.09	1.02	0.957	0.897
8.1	2.10	2.03	1.91	1.79	1.68	1.57	1.47	1.38	1.29	1.21	1.14	1.07	1.00	0.938	0.879	0.824	0.773
8.2	1.79	1.74	1.63	1.53	1.43	1.34	1.26	1.18	1.11	1.04	0.973	0.912	0.855	0.802	0.752	0.705	0.661
8.3	1.52	1.48	1.39	1.30	1.22	1.14	1.07	1.00	0.941	0.882	0.827	0.775	0.727	0.682	0.639	0.599	0.562
8.4	1.29	1.25	1.17	1.10	1.03	0.966	0.906	0.849	0.796	0.747	0.700	0.656	0.615	0.577	0.541	0.507	0.475
8.5	1.09	1.06	0.990	0.928	0.870	0.816	0.765	0.717	0.672	0.630	0.591	0.554	0.520	0.487	0.457	0.428	0.401
8.6	0.920	0.892	0.836	0.784	0.735	0.689	0.646	0.606	0.568	0.532	0.499	0.468	0.439	0.411	0.386	0.362	0.339
8.7	0.778	0.754	0.707	0.663	0.622	0.583	0.547	0.512	0.480	0.450	0.422	0.396	0.371	0.348	0.326	0.306	0.287
8.8	0.661	0.641	0.601	0.563	0.528	0.495	0.464	0.435	0.408	0.383	0.359	0.336	0.315	0.296	0.277	0.260	0.244
8.9	0.565	0.548	0.513	0.481	0.451	0.423	0.397	0.372	0.349	0.327	0.306	0.287	0.269	0.253	0.237	0.222	0.208
9.0	0.486	0.471	0.442	0.414	0.389	0.364	0.342	0.320	0.300	0.281	0.264	0.247	0.232	0.217	0.204	0.191	0.179

* At temperatures below 14 °C, the objective is the same as that shown for 14 °C.

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia[2]

[2] *For freshwaters designated SPWN, the thirty-day average concentration of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equation.*

$$\text{30-day Average Concentration} = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}} \right) * MIN\left(2.85, 1.45*10^{0.028*(25-T)}\right)$$

Where T = temperature expressed in ºC.

In addition, for freshwaters, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

Table 3-3. 30-day Average Objective for Ammonia-N for Freshwaters Not Designated SPWN (mg N/L)

	Temperature, °C								
pH	**0-7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15***
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641
8.9	0.917	0.86	0.806	0.756	0.709	0.664	0.623	0.584	0.548
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471

* At 15 °C and above, the 30-day average objective for waters not designated SPWN is the same as that for waters designated SPWN.

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia[3]

[3] *For freshwaters not designated SPWN, the thirty-day average concentration of total ammonia as nitrogen (in mg N/L) shall not exceed the values described by the following equation.*

$$\text{30-day Average Concentration} = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}} \right) * 1.45 * 10^{0.028*(25-MAX(T,7))}$$

Where T = temperature expressed in ºC.

In addition, for freshwaters, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

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IMPLEMENTATION

Implementation Provisions for the Application of Ammonia Objectives to Inland Surface Waters in the Los Angeles Region

1. Determination of Freshwater, Brackish Water or Saltwater Conditions[4]

(1) For inland surface waters in which the salinity is equal to or less than 1 part per thousand 95% or more of the time, the applicable objectives are the freshwater objectives, based on the US EPA "1999 Update of Ambient Water Quality Criteria for Ammonia." (2) For waters in which the salinity is equal to or greater than 10 parts per thousand 95% or more of the time, the applicable objectives are the inland surface water objectives in Tables 3-4 and 3-5. (3) For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the inland surface water objectives in Tables 3-4 and 3-5.

2. Selection of One-hour Average Objective – Salmonids Present vs. Salmonids Absent

It is assumed that salmonids may be present in waters designated in the Basin Plan as "COLD" or "MIGR" and that salmonids are absent in waters not designated in the Basin Plan as "COLD" or "MIGR," in the absence of additional information to the contrary.

3. Selection of 30-day Average Objective – Early Life Stage (ELS) Provision

Water bodies with a Basin Plan designation of "SPWN" support high quality aquatic habitats suitable for reproduction and early development of fish and, therefore, these water bodies are designated as ELS present waters. Early Life Stages are assumed present year-round unless a site-specific study is conducted which justifies a seasonal provision. The Basin Plan Amendment process must be followed to develop a seasonal beneficial use designation.

4. Existence of Threatened or Endangered Species

Where the Regional Board determines that endangered or threatened species in the Los Angeles Region are more sensitive to a pollutant than the species upon which the objectives are based, more stringent, site-specific modifications of the objectives shall be performed using U.S. EPA approved methods.[5] Temperature and pH must be adjusted to match the conditions used to calculate the objectives. Tests to determine site-specific objectives for threatened and endangered species can be conducted in site water or laboratory water.

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[4] The procedure described in this section to determine which objectives should be applied is the same method employed in the California Toxics Rule (title 40, Code of Federal Regulations, § 131.38(c)(3)) .

[5] U.S. EPA. 1985. "Guidance for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses". U.S. EPA. 1994. "Water Quality Standards Handbook, Second Edition", Chapter 3, Section 3.7.4 "The Recalculation Procedure".

5. Translation of Objectives into Effluent Limits[6]

If the Regional Board determines that water quality based effluent limitations are necessary to control ammonia in a discharge, the permit shall contain effluent limitations for ammonia using one of the following methods:

1. *Use the following procedure based on a steady-state model:*

   Step 1: Identify the applicable water quality objectives for ammonia.

   Step 2: For each water quality objective, calculate the effluent concentration allowance (ECA) using the following steady-state mass balance model:

   If a mixing zone has not been authorized by the Regional Board:

   $$ECA = WQO$$

   If a mixing zone has been authorized by the Regional Board.[7]

   $$ECA = \frac{WQO(Qd + Qs) - (CsQs)}{Qd} \quad \text{where } WQO > Cs$$

   $$ECA = WQO \quad \text{where } WQO \leq Cs$$

   Where *WQO = water quality objective*
   Cs = Pollutant Concentration of Upstream (mg/L)
   Qd = Flow Discharge (mgd or cfs)
   Qs = Flow Upstream (mgd or cfs)

   For the one-hour average objective, one of the following shall be used for the Qs term:

   1. *the lowest one-day flow based on a three-year return interval (1B3) when flow records are analyzed using EPA's 1986 DFLOW procedure.[8]*
   2. *the lowest one-day flow based on a ten-year return interval (1Q10) when flow records are analyzed using extreme-value statistics.[9]*
   3. *Other appropriate critical flow condition.*

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[6] The method whereby objectives are translated to effluent limits is similar to the method contained in the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (2000). The method is also consistent with that outlined in the U.S. EPA "Technical Support Document for Water Quality-based Toxics Control (1991).

[7] Mixing zones may be authorized on a discharge-by-discharge basis per the mixing zone provision in Chapter 4 of the Basin Plan.

[8] U.S. EPA. September 1986. Technical Guidance Manual for Performing Wasteload Allocation, Book VI, Design Conditions, Chapter 1, Stream Design Flow for Steady-State Modeling, PB92-231778.

[9] U.S. EPA. September 1986. Technical Guidance Manual for Performing Wasteload Allocation, Book VI, Design Conditions, Chapter 1, Stream Design Flow for Steady-State Modeling, PB92-231778.

For the 30-day average objective, one of the following shall be used for the Qs term:

1. *the lowest 30-day flow based on a three-year return interval (30B3) when flow records are analyzed using EPA's 1986 DFLOW procedure or*
2. *the 30Q10 or the 30Q5 (lowest 30-day flow based on a ten or five-year return interval) when flow records are analyzed using extreme-value statistics.*
3. *Other appropriate critical flow condition.*

Effluent concentration allowances based on a critical condition of 30Q10 are protective of both the 30-day average and the 4-day average. If a 30Q5 is used, it must be demonstrated that the 7Q10 (seven-day low flow which recurs once every ten years on the average) is protective of 2.5 times the 30-day average objective, to ensure that short-term (4-day) toxicity does not occur. The more stringent (i.e. lower) of the 30Q5 or the 7Q10 shall be used.

Step 3: For each ECA calculated in Step 2, determine the long-term average discharge condition (LTA) by multiplying the ECA with a factor (multiplier) that adjusts for effluent variability. The multiplier shall be calculated as described below, or shall be found in Table 3-6. To use Table 3-6, the coefficient of variation (CV)[10] for the effluent ammonia concentration must first be calculated. If (a) the number of effluent data points is less than 10, or (b) at least 80 percent of the effluent data are reported as not detected, then the CV shall be set equal to 0.6. When calculating the CV in this procedure, if a data point is below the detection limit in an effluent sample, one-half the detection limit shall be used as the value in the calculation. Multipliers for one-hour average, four-day average, and 30-day average objectives for ammonia that correspond to the CV can be found in Table 3-6.

ECA Multipliers:

$$\text{ECA multiplier}_{\text{1-hour99}} = e^{\left(0.5s^2 - zs\right)}$$

$$\text{ECA multiplier}_{\text{4-day99}} = e^{\left(0.5s_4^2 - zs_4\right)}$$

$$\text{ECA multiplier}_{\text{30-day99}} = e^{\left(0.5s_{30}^2 - zs_{30}\right)}$$

Where s = standard deviation

$$s = \left[\ln\left(CV^2 + 1\right)\right]^{0.5}$$

$$s^2 = \ln\left(CV^2 + 1\right)$$

[10] The coefficient of variation (CV) is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

$$s_4 = \left[\ln\left(CV^2/4+1\right)\right]^{0.5}$$

$$s_4^2 = \ln\left(CV^2/4+1\right)$$

$$s_{30} = \left[\ln\left(CV^2/30+1\right)\right]^{0.5}$$

$$s_{30}^2 = \ln\left(CV^2/30+1\right)$$

z = 2.326 for 99th percentile probability basis

LTA Equations:

$LTA_{1\text{-hour}99} = ECA_{1\text{-hour}} * ECA\ multiplier_{1\text{-hour}99}$

$LTA_{4\text{-day}99} = ECA_{4\text{-day}} * ECA\ multiplier_{4\text{-day}99}$

$LTA_{30\text{-day}99} = ECA_{30\text{-day}} * ECA\ multiplier_{30\text{-day}99}$

Step 4: Select the lowest (most limiting) of the LTAs derived in Step 3 (LTA_{min}).

Step 5: Calculate water quality based effluent limitations (a maximum daily effluent limitation, MDEL, and an average monthly effluent limitation, AMEL) by multiplying LTA_{min} (as selected in Step 4) with a factor (multiplier) that adjusts the averaging period and exceedance frequency of the objective, and the effluent monitoring frequency, as follows:

MDEL and AMEL Equations:

$MDEL = LTA_{min} * MDEL\ multiplier_{99}$

$AMEL = LTA_{min} * AMEL\ multiplier_{95}$

*The MDEL and AMEL multipliers shall be calculated as described below, or shall be found in Table 3-7 using the previously calculated CV and monthly sampling frequency (*n*) of ammonia in the effluent. If the LTA_{min} selected in Step 4 is $LTA_{4\text{-day}99}$ and the sampling frequency is four times per month or less, then* n *shall be set equal to 4. If the LTA_{min} selected in Step 4 is $LTA_{30\text{-day}99}$ and the sampling frequency is 30 times per month or less, then* n *shall be set equal to 30.*

MDEL and AMEL Mulitipliers:

$$MDEL\ multiplier_{99} = e^{\left(zs-0.5s^2\right)}$$

Where *z = 2.326 for 99th percentile probability basis*

$$s = \left[\ln\left(CV^2 + 1\right)\right]^{0.5}$$

$$s^2 = \ln\left(CV^2 + 1\right)$$

AMEL multiplier$_{95}$ = $e^{\left(zs_n - 0.5s_n^2\right)}$

Where *z = 1.645 for 95th percentile probability basis*

$$s_n = \left[\ln\left(CV^2 / n + 1\right)\right]^{0.5}$$

$$s_n^2 = \ln\left(CV^2 / n + 1\right)$$

n = number of samples per month

2. *Apply a dynamic model approved by the Regional Board.*

3. *If a Total Maximum Daily Load (TMDL) for ammonia is in effect, the permit shall contain effluent limitations for ammonia that are based on the waste load allocation for ammonia in the TMDL.*

[Tables 3-6 and 3-7 are new and should be inserted. (Underlining was not possible in these tables to indicate that it was an addition.)]

Table 3-6 - Effluent Concentration Allowance (ECA)
Multipliers for Calculating Long-Term Averages (LTAs)

Coefficient of Variation (CV)	One-hour Multiplier	4-day Multiplier	30-day Multiplier
	99th Percentile Occurrence Probability	99th Percentile Occurrence Probability 4 day	99th Percentile Occurrence Probability 30 day
0.1	0.797	0.891	0.959
0.2	0.643	0.797	0.919
0.3	0.527	0.715	0.882
0.4	0.440	0.643	0.846
0.5	0.373	0.581	0.812
0.6	0.321	0.527	0.78
0.7	0.281	0.481	0.75
0.8	0.249	0.440	0.721
0.9	0.224	0.404	0.693
1.0	0.204	0.373	0.667
1.1	0.187	0.345	0.642
1.2	0.174	0.321	0.619
1.3	0.162	0.300	0.596
1.4	0.153	0.281	0.575
1.5	0.144	0.264	0.555
1.6	0.137	0.249	0.535
1.7	0.131	0.236	0.517
1.8	0.126	0.224	0.5
1.9	0.121	0.214	0.483
2.0	0.117	0.204	0.468
2.1	0.113	0.195	0.453
2.2	0.110	0.187	0.438
2.3	0.107	0.180	0.425
2.4	0.104	0.174	0.412
2.5	0.102	0.168	0.4
2.6	0.100	0.162	0.388
2.7	0.098	0.157	0.377
2.8	0.096	0.153	0.366
2.9	0.094	0.148	0.356
3.0	0.093	0.144	0.346
3.1	0.091	0.141	0.337
3.2	0.090	0.137	0.328
3.3	0.089	0.134	0.32
3.4	0.088	0.131	0.312
3.5	0.087	0.128	0.304
3.6	0.086	0.126	0.297
3.7	0.085	0.123	0.29
3.8	0.084	0.121	0.283
3.9	0.083	0.119	0.277
4.0	0.082	0.117	0.271

Table 3-7 - Long-Term Average (LTA) Multipliers for Calculating Effluent Limitations

Coefficient of Variation	MDEL Multiplier	AMEL Multiplier		
	99th Percentile Occurrence Probability	95th Percentile Occurrence Probability		
(CV)		n=4	n=8	n=30
0.1	1.25	1.08	1.06	1.03
0.2	1.55	1.17	1.12	1.06
0.3	1.90	1.26	1.18	1.09
0.4	2.27	1.36	1.25	1.12
0.5	2.68	1.45	1.31	1.16
0.6	3.11	1.55	1.38	1.19
0.7	3.56	1.65	1.45	1.22
0.8	4.01	1.75	1.52	1.26
0.9	4.46	1.85	1.59	1.29
1.0	4.90	1.95	1.66	1.33
1.1	5.34	2.04	1.73	1.36
1.2	5.76	2.13	1.80	1.39
1.3	6.17	2.23	1.87	1.43
1.4	6.56	2.31	1.94	1.47
1.5	6.93	2.40	2.00	1.50
1.6	7.29	2.48	2.07	1.54
1.7	7.63	2.56	2.14	1.57
1.8	7.95	2.64	2.20	1.61
1.9	8.26	2.71	2.27	1.64
2.0	8.55	2.78	2.33	1.68