TITLE 35: ENVIRONMENTAL PROTECTION
SUBTITLE C: WATER POLLUTION
CHAPTER II: ENVIRONMENTAL PROTECTION AGENCY

# PART 355
# DETERMINATION OF AMMONIA NITROGEN WATER QUALITY BASED EFFLUENT LIMITS FOR DISCHARGES TO GENERAL USE WATERS

## SUBPART A: INTRODUCTION



## SUBPART B: AMMONIA NITROGEN (as N) WATER QUALITY STANDARDS AND WQBELs



## SUBPART C: EFFLUENT MODIFIED WATERS



AUTHORITY: Implementing and authorized by Section 39 of the Illinois Environmental Protection Act [415 ILCS 5/39].

SOURCE: Adopted at 23 Ill. Reg. 7267, effective June 9, 1999; amended at 27 Ill. Reg. 15774, effective September 25, 2003.

## SUBPART A: INTRODUCTION

### Section 355.101 Purpose, Scope and Application

a) This Part contains procedures to determine water quality based effluent limits for ammonia nitrogen (as N) (ammonia nitrogen WQBELs) that are necessary to prevent waters of the State from exceeding water quality standards pursuant to 40 CFR 122.44(d)(1) and 35 Ill. Adm. Code 309.141(d)(3). Ammonia nitrogen WQBELs must be sufficient to ensure compliance with the water quality standards for ammonia nitrogen found in the Illinois Pollution Control Board (IPCB) regulations at 35 Ill. Adm. Code 302.202, 302.212 and 304.122.

b) Ammonia nitrogen WQBELs are applicable to the general use waters of the State.

c) There shall be an opportunity for compliance with the ammonia nitrogen water quality standards as provided by the IPCB regulations through application of allowed mixing, mixing zones and zones of initial dilution at 35 Ill. Adm. Code 302.102.

d) In addition to water quality based effluent limits, the discharge of ammonia nitrogen from a facility may be limited based on other provisions in the Environmental Protection Act [415 ILCS 5] (Act) and regulations adopted thereunder or the Federal Water Pollution Control Act, 33 USC 1251-1387 (FWPCA) and regulations adopted thereunder.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

### Section 355.103 Definitions

All terms in this Part shall have the meanings set forth in the Environmental Protection Act and in the IPCB regulations under 35 Ill. Adm. Code 301 and 302 except, for purposes of this Part, the following definitions apply:

"AWQMN" or "Ambient Water Quality Monitoring Network" means the network of sampling stations maintained by the Agency and located on streams throughout the State.

"Agency" means the Illinois Environmental Protection Agency.

"DMR" means discharge monitoring report.

"IPCB" means the Illinois Pollution Control Board.

"Kjeldahl" means the total of organic nitrogen and ammonia nitrogen.

"NPDES" means National Pollutant Discharge Elimination System.

"PEL" or "Preliminary Effluent Limitation" is an estimate of an allowable discharge concentration taking into consideration allowed mixing or dilution.

"PEQ" or "Projected Effluent Quality" is the maximum contaminant concentration estimated to be discharged by a facility or activity taking into account statistical analysis of the discharge or activity.

"Reasonable Potential Analysis" or "Reasonable Potential to Exceed" means the procedure to predict whether an existing or future discharge may cause or contribute to a violation of water quality standards, criteria or values.

"Summer" means the months of March through October, inclusive, when early life stages of sensitive organisms are assumed to be present. If early life stages of sensitive organisms are present in a water body during other months, these months are included as summer months.

"USEPA" means the United States Environmental Protection Agency.

"USGS" means the United States Geological Survey.

"WQBEL" or "Water Quality Based Effluent Limit" means an NPDES permit limit that ensures that applicable water quality standards and criteria are met in waters where such standards and criteria apply.

"Winter" means the months of November through February, inclusive, when early life stages of sensitive organisms are assumed to be absent. If early life stages of organisms for a water body exist in any of these months, these months will be considered summer months.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

## SUBPART B: AMMONIA NITROGEN (as N) WATER QUALITY STANDARDS AND WQBELs

**Section 355.201 Introduction**

The need for an ammonia nitrogen (as N) WQBEL is based on the reasonable potential of a discharge to cause or contribute to a violation of the applicable ammonia nitrogen water quality standard. During the NPDES permit review process, the Agency shall conduct an analysis of the reasonable potential for ammonia to exceed or contribute to excursions above the ammonia nitrogen water quality standard that may occur in the receiving water. This analysis shall be conducted for both acute and chronic water quality standards for periods when early life stages are absent (winter, see 35 Ill. Adm. Code 302.212(b)(2)(B)) and periods when early life stages are present (summer, see 35 Ill. Adm. Code 302.212(b)(2)(A)). The Agency may conduct this analysis for the subchronic standard when daily effluent ammonia samples are collected. The Agency may subdivide summer or winter periods into quarterly or monthly segments with analysis of reasonable potential corresponding to those smaller time segments in individual permit applications.

a) The first step in the reasonable potential analysis is to calculate the Projected Effluent Quality (PEQ), as provided in Section 355.205. The PEQ is then compared to the total ammonia nitrogen water quality standard as provided in Section 355.203. If the PEQ is less than or equal to the total ammonia nitrogen water quality standard as provided in Section 355.203, then no reasonable potential to exceed the standard exists and no effluent limitation will be established in the permit unless otherwise warranted under subsection (c) of this Section.

b) If the PEQ exceeds the applicable total ammonia nitrogen water quality standard as provided in Section 355.203, the analysis shall proceed to the determination of a mixing allowance as provided in Section 355.207.

c) If the wastewater prior to treatment contains total Kjeldahl nitrogen at levels in which a reasonable potential to exceed total ammonia nitrogen water quality standards as provided in Section 355.203 exists, then the discharge of ammonia nitrogen shall be limited in the NPDES permit by an ammonia nitrogen WQBEL. Reasonable potential to exceed water quality standards will be determined consistent with Sections 355.203 through 355.211 of this Part. Even if there appears to be no potential to exceed the water quality standards based on the effluent quality analysis in subsection (a) or (b), an ammonia nitrogen WQBEL shall be established.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.203 Calculation of Total Ammonia Nitrogen Numeric Water Quality Standards Regarding NPDES Permit Limits**

Temperature and pH affect the numeric total ammonia nitrogen water quality standard. Both

stream temperature and pH can be expected to be different than discharge temperature and pH; therefore, the calculation of the water quality standard and permit limits will be based on conditions expected to exist downstream of the discharge.

a) Where receiving stream specific data is available, that data shall be the basis for the selection of temperature and pH values to be used in calculating total ammonia nitrogen standards upon which an NPDES permit limit will be based. A data collection station downstream of the discharge at or beyond the point where complete mixing has occurred is preferred. When receiving stream specific data is not available, data from the closest representative Agency water quality monitoring station during the most recent five years will be used in this conversion formula. The temperature will be set at the $75^{th}$ percentile (75 percent of the values are less than) from data collected during the period for which the water quality standard is being calculated. The pH value will be set at the $75^{th}$ percentile (75 percent of the values are less than) from data collected during the period for which the water quality standard is being calculated. If the $75^{th}$ percentile pH value results in a permit limit for chronic exposure conditions (monthly average ammonia permit limit) less than 1.5 mg/L for the summer period or 4.0 mg/L for the winter period, the values will be recalculated based on a $50^{th}$ percentile pH value (half the values are less than). The permit limit will then be set at the value derived with a $50^{th}$ percentile pH as long as that value does not exceed 1.5 mg/L for the summer period and 4.0 mg/L for the winter period. If a $50^{th}$ percentile pH value would allow a higher summer limit than 1.5 mg/L, the limit will be set at 1.5 mg/L. If a $50^{th}$ percentile pH would allow a higher winter limit than 4.0 mg/L, the winter limit would be set at 4.0 mg/L. Limits based in the subchronic ammonia standard will be 2.5 times the chronic limit established by the above procedure.

1) Unless a different configuration is found by the Agency to be appropriate two permit limits for summer will be calculated separately using pH and temperature data from the following periods:

A) March, April, May, September and October.

B) June, July and August.

2) Unless a different configuration is found by the Agency to be appropriate, permit limits for winter will be calculated using pH and temperature data from November, December, January and February.

b) When sufficient stream specific information is available with simultaneous measurements of total ammonia, pH, and temperature, a relationship reflecting the dynamic interaction between pH, temperature and ammonia equilibrium may be

developed instead of the approach presented in subsection (a).

c) The above calculations allow acute, chronic and subchronic ammonia nitrogen water quality standards to be applied as daily maximum, monthly average and weekly average permit limits, respectively.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.205 Estimation of Projected Effluent Quality**

The Projected Effluent Quality (PEQ) is the estimation of the maximum expected effluent concentration. Individual PEQs shall be estimated for all summer and winter acute, chronic and subchronic exposure periods.

a) The PEQ shall be derived from representative facility specific data to reflect a 95 percent confidence level for the 95$^{th}$ percentile value. These data will be presumed to adhere to a lognormal distribution pattern with a coefficient of variation of 0.6 unless the facility's effluent data demonstrates a different distribution pattern. If facility specific data in excess of 10 data values is available, a facility specific coefficient of variation that is the ratio of the standard deviation to the arithmetic average may be calculated. The PEQ is derived as the upper bound of a 95 percent confidence bracket around the 95$^{th}$ percentile value through a multiplier from the following table applied to the maximum value in the data set that has its quality assured consistent with subsection (f).

PEQ = (maximum data point)(statistical multiplier)

Coefficient of Variation

| No. of Samples | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 |
|---|---|---|---|---|---|---|---|
| 1 | 1.4 | 1.9 | 2.6 | 3.6 | 4.7 | 6.2 | 8.0 |
| 2 | 1.3 | 1.6 | 2.0 | 2.5 | 3.1 | 3.8 | 4.6 |
| 3 | 1.2 | 1.5 | 1.8 | 2.1 | 2.5 | 3.0 | 3.5 |
| 4 | 1.2 | 1.4 | 1.7 | 1.9 | 2.2 | 2.6 | 2.9 |
| 5 | 1.2 | 1.4 | 1.6 | 1.8 | 2.1 | 2.3 | 2.6 |
| 6 | 1.1 | 1.3 | 1.5 | 1.7 | 1.9 | 2.1 | 2.4 |
| 7 | 1.1 | 1.3 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 |
| 8 | 1.1 | 1.3 | 1.4 | 1.6 | 1.7 | 1.9 | 2.1 |
| 9 | 1.1 | 1.2 | 1.4 | 1.5 | 1.7 | 1.8 | 2.0 |
| 10 | 1.1 | 1.2 | 1.3 | 1.5 | 1.6 | 1.7 | 1.9 |
| 11 | 1.1 | 1.2 | 1.3 | 1.4 | 1.6 | 1.7 | 1.8 |
| 12 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 |
| 14 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.6 |
| 15 | 1.1 | 1.2 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| 16 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| 17 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 |
| 18 | 1.1 | 1.1 | 1.2 | 1.3 | 1.3 | 1.4 | 1.5 |
| 19 | 1.1 | 1.1 | 1.2 | 1.3 | 1.3 | 1.4 | 1.5 |
| 20 | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.4 | 1.4 |
| 30 | 1.0 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 |
| 40 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 50 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 60 or greater | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

Coefficient of Variation

| No. of Samples | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |
|---|---|---|---|---|---|---|
| 1 | 10.1 | 12.6 | 15.5 | 18.7 | 22.3 | 26.4 |
| 2 | 5.4 | 6.4 | 7.4 | 8.5 | 9.7 | 10.9 |
| 3 | 4.0 | 4.6 | 5.2 | 5.8 | 6.5 | 7.2 |
| 4 | 3.3 | 3.7 | 4.2 | 4.6 | 5.0 | 5.5 |
| 5 | 2.9 | 3.2 | 3.6 | 3.9 | 4.2 | 4.5 |
| 6 | 2.6 | 2.9 | 3.1 | 3.4 | 3.7 | 3.9 |
| 7 | 2.4 | 2.6 | 2.8 | 3.1 | 3.3 | 3.5 |
| 8 | 2.3 | 2.4 | 2.6 | 2.8 | 3.0 | 3.2 |
| 9 | 2.1 | 2.3 | 2.4 | 2.6 | 2.8 | 2.9 |
| 10 | 2.0 | 2.2 | 2.3 | 2.4 | 2.6 | 2.7 |
| 11 | 1.9 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 |
| 12 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 |
| 13 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 |
| 14 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 |
| 15 | 1.7 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 |
| 16 | 1.6 | 1.7 | 1.8 | 1.9 | 1.9 | 2.0 |
| 17 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 | 1.9 |
| 18 | 1.6 | 1.6 | 1.7 | 1.7 | 1.8 | 1.9 |
| 19 | 1.5 | 1.6 | 1.6 | 1.7 | 1.8 | 1.8 |
| 20 | 1.5 | 1.5 | 1.6 | 1.6 | 1.7 | 1.7 |
| 30 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 |
| 40 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| 50 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 60 or greater | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

1) If the PEQ determined in this Section is less than or equal to the applicable

acute water quality standard, there is no reasonable potential and no WQBEL will be established in the permit unless otherwise warranted under Section 355.201(c).

2) If the PEQ as determined in this Section exceeds the applicable acute water quality standard but does not exceed the PEL determined through Section 355.209, there is no reasonable potential and no WQBEL will be established unless otherwise warranted under Section 355.201(c).

b) The Agency shall compare calculated PEQ values derived from monthly average effluent data, when available, with the applicable chronic water quality standard to evaluate the need for monthly average WQBEL using the same method described in subsection (a) of this Section. If a monthly average WQBEL is included in an NPDES permit, the Agency will also include a daily maximum WQBEL to enforce the acute water quality standard.

c) The Agency shall compare calculated PEQ values derived from the highest weekly average total ammonia effluent data, when available, with the applicable subchronic water quality standards to evaluate the need for a weekly average WQBEL using the same method described in subsection (a) of this Section.

d) The Agency may apply other scientifically defensible statistical methods for calculating PEQ at the 95 percent upper confidence level for use in the reasonable potential analysis. For new or existing discharges where no prior operating record is available, PEQ shall be estimated based on knowledge of the tributary wastewater characteristics and treatment facility capabilities. For existing sources where the PEQ for the term of the permit cannot be accurately characterized by historical performance data as specified in subsection (a) of this Section due to significant changes in tributary loading, plant operating parameters or other factors affecting treatment efficiency during the term covered by the permit, a PEQ representative of the future permit term may be estimated by analysis of the historical data consistent with subsection (a) with adjustment of the historical value to reflect the change expected from the anticipated loading or operating changes.

e) Regardless of the statistical procedure used, if the PEQ for ammonia nitrogen (as N) is less than or equal to the water quality standard, the Agency shall deem the discharge not to have a reasonable potential to exceed and a WQBEL shall not be required unless otherwise required under Section 355.201.

f) Data Requirements

The derivation of PEQ is based on the effluent quality demonstrated by self-monitoring data as required by the NPDES permit or Agency-generated data, such as effluent sampling or facility-related stream studies. Effluent data used in the derivation of PEQ shall be representative of the concentration and variability of ammonia nitrogen in the discharge anticipated for the applicable period of the NPDES permit. Data shall be collected and analyzed in accordance with USEPA or Agency approved sampling and analytical methods (40 CFR 136). The following criteria shall be followed in data selection:

1) the most recent five years of data shall be used unless the Agency determines that an alternative period better represents the time period for which effluent quality is being projected. Such alternative time periods may include, but are not limited to, shorter periods that reflect changed discharge characteristics resulting from changes in manufacturing activities or wastewater treatment systems; and
2) data anomalies resulting from collection, analysis or recording errors or atypical plant operating conditions may be eliminated from the data.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.207 Mixing Allowance**

If the PEQ for ammonia nitrogen (as N) is greater than the water quality standard, the Agency shall assess the level of treatment being provided by the discharger. If the discharger is providing (or will be providing) a level of treatment consistent with the best degree of treatment required by 35 Ill. Adm. Code 304.102(a), the PEQ derived under Section 355.205 shall be compared to the PEL determined by applying allowed dilution to the discharge consistent with Section 355.209.

**Section 355.209 Calculation of Preliminary Effluent Limitation**

a) The preliminary effluent limitation (PEL) is calculated in a mass balance approach reflecting allowed dilution as referenced in Section 355.207:

$$WQS = [(Q_e)(PEL) + (Q_d)(C_d)]/(Q_e + Q_d)$$

or

$$PEL = [WQS(Q_e + Q_d) - (Q_d)(C_d)]/Q_e$$

where:

| | | |
|---|---|---|
| WQS | = | applicable total ammonia nitrogen water quality standard pursuant to Section 355.203 |
| $Q_e$ | = | effluent flow rate |
| $Q_d$ | = | allowed mixing flow rate as determined in accordance with the provisions of 35 Ill. Adm. Code 302.212(c) |
| $C_d$ | = | background ammonia nitrogen (as N) concentration in mixing water |

Effluent flow rate shall be selected to coincide with the critical stream flow condition used to quantify allowed dilution. Typically this will be estimated to be

the average of the lowest three months average flow rate during the previous year for domestic wastewater sources. For industrial and other wastewater sources where flow rates are not directly correlated to climatic patterns, $Q_e$ will be estimated as the average of the highest three monthly average flow rates. With either approach, $Q_e$ shall be modified when future flows are expected to vary significantly from historical data.

b) The reasonable potential analysis shall be completed separately for the winter and summer periods and for acute, chronic and subchronic water quality standards. The Agency may subdivide summer or winter periods into quarterly or monthly segments with analysis of reasonable potential corresponding to those smaller time segments in individual permit applications. WQBELs based on the acute water quality standard shall be expressed as a daily maximum. WQBELs based on the chronic water quality standard shall be expressed as a monthly average. WQBELs based on the subchronic WQS shall be expressed as a weekly average.

(Source: Amended at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.211 Summary of the Results for a Reasonable Potential Analysis and the Determination of Ammonia Nitrogen WQBELs**

a) If the PEQ determined in Section 355.205 is less than or equal to the applicable water quality standard, there is no reasonable potential and no WQBEL will be established in the permit unless otherwise warranted under Section 355.201(c).

b) If the PEQ exceeds the applicable water quality standard but does not exceed the PEL determined through Section 355.209, there is no reasonable potential and no WQBEL shall be established unless otherwise warranted under Section 355.201(c).

c) If the PEQ exceeds the PEL determined through Section 355.209, there is reasonable potential to exceed the standard and the PEL shall be established as the WQBEL.

d) If a WQBEL is warranted under Section 355.201(c), the WQBEL shall be set at the PEL as determined through Section 355.209.

SUBPART C: EFFLUENT MODIFIED WATERS

**Section 355.301 Introduction (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.303 EMW Application Requirements (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.305 Evaluation of EMW Applications (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.307 Determination of EMW Designation (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.309 Procedures for Delineating an EMW (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.311 Ammonia Nitrogen Decay Equation (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.313 Restrictions Applicable to Discharges with EMWs (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)

**Section 355.315 Publication of EMWs (Repealed)**

(Source: Repealed at 27 Ill. Reg. 15774, effective September 25, 2003)