RESPONSE TO COMMENTS
DRAFT NPDES PERMIT AK-002143-1
CITY OF VALDEZ
WASTEWATER TREATMENT PLANT

On September 12, 2001, the Environmental Protection Agency (EPA) issued a draft National Pollutant Discharge Elimination System (NPDES) permit for the Valdez Wastewater Treatment Plant (WWTP). The public comment period for the draft permit extended from September 12 to October 12, 2001. The EPA received comments from the City of Valdez Wastewater Department in a letter dated October 2, 2001. Stipulations of the State of Alaska Department of Environmental Conservation (ADEC) 401 certification were also received. The comments and stipulations are presented below along with the EPA's responses.

CITY OF VALDEZ COMMENTS

Comment No. 1

We are requesting the submission date of the Toxicity Reduction Evaluation (TRE) plan to be due 1 year from the effective date of this permit. We feel an extension would be warranted due to the WET testing occurring in the 4th year of this permit.

Response

The EPA agrees, Section I.C.5 *Preparation of Initial Toxicity Reduction Evaluation (TRE) Plan* in the final permit has been revised to extend the submission date of the TRE plan to 1 year from the effective date of the final permit.

Comment No. 2

Average Annual Flow - Currently the plant calculates the average monthly flow through the plant and this information is presented in a spreadsheet. Any increases in hydraulic loading would be apparent. It is our opinion that calculations of an average annual flow on a monthly basis is redundant and that current calculations are sufficient in determining if the hydraulic loading is encroaching on the design criteria.

Response

As presented in the permit under Section I.F *Design Criteria Requirement*, planning efforts for a facility plan are initiated when the average annual flow exceeds 85% of the design flow of the facility. It is a policy of EPA Region 10 to include this monthly check of the average annual flow in order to insure that the permittee has a strategy to maintain compliance with effluent limits when the treatment plant flows are nearing the design capacity of the treatment plant. The condition has been retained in the final permit.

Comment No. 3
At this time HDR Engineering is in the process of developing a master plan for the City of Valdez wastewater treatment system. It would be in our best interest to wait for their recommendations before upgrading our Operation and Maintenance plan. We are requesting the Operation and Maintenance plan be reviewed and updated within 1 year of the effective date of this permit.

Response
The EPA agrees, Section I.G *Operation and Maintenance Plan Review Requirements* in the final permit has been revised to extend the submission date of the Operation and Maintenance plan to 3 years from the effective date of the final permit. This date corresponds to when facility additions/modifications must be operational in accordance with ADEC Stipulation No. 1.

Comment No. 4
The average annual snowfall in Valdez is 350 inches with snowfall beginning in late October and lasting until May. At times it may be impossible to fulfill the ambient monitoring requirements outlined in Table 3. We are asking that language be incorporated in the permit to include these environmental factors and possible access limitations.

Response
Note 5 has been added to Section I.D *Ambient Monitoring Requirements* in the final permit that specifies that ambient monitoring samples must be obtained as long as it is safe to do so. If monitoring can not be conducted due to unsafe conditions, an explanation shall be included with the ambient water monitoring report.

Comment No. 5
We are asking that the sampling location for fecal coliform at three sites on the edge of the mixing zone in Port Valdez be reduced or the exact sites clearly identified. It would be impossible to collect a sample from the far edge of the mixing zone in the depths of the Port without launching a boat. It is impractical to haul a boat to the sampling location each time a sample is to be collected. Collecting two samples along the shoreline of the Port, within the mixing zone, would be more reasonable.

Response
The mixing zone and fecal coliform sampling locations have been addressed as part of the ADEC 401 Certification. Refer to ADEC stipulations 2 and 4 below. ADEC has authority to develop and grant mixing zones, not the EPA.

Comment No. 6
Monthly Average Total Residual Chlorine - Currently this is not a reported limitation on the Discharge Monitoring Report (DMR). Is this to be a new reporting value and limit of the permit?

Response
Section 1.A *Effluent Limitations* in the final permit has been modified to include the existing effluent limitations for chlorine for the time period of the effective date of the permit through May 31, 2005. The permittee will not be required to report the average monthly chlorine concentration during that time period for discharge to Unnamed Stream No. 221-60-11390.

The final permit includes average monthly limitations for chlorine for discharge to Port Valdez (Table 2) and effective beginning June 1, 2005 for discharge to Unnamed Stream No. 221-60-11390 (in Table 1). The permittee will be required to report the average monthly chlorine concentration for those discharges.

Comment No. 7
Total Residual Chorine and Dissolved Oxygen - Table 2 of the draft permit presents the parameter units as µg/L. Presently these two parameters are reported on the DMR as mg/L. What will be the reporting units for these parameters on the DMR?

Response
In order to prevent possible confusion regarding reporting units, the final permit reporting limits for total residual chlorine and dissolved oxygen have been changed to mg/L.

Comment No. 8
Residue - How is residue to be reported on the DMR?

Response
Upon further consideration, the reporting requirement for residue has been removed from the final permit.

Comment No. 9
We are unsure if a biosolids permit application (Form 2S) is on file with the EPA. If not, could you please send a copy of this application to fulfill the sludge management requirements of the NPDES permit.

Response
The City submitted a biosolids permit application (Form 2S) with the EPA in 1999. If the conditions of that permit application change, the City should send in an updated permit application. Form 2S may be obtained on the EPA website (http://epa.gov/npdes). Additional questions regarding the sludge management requirements may be directed to Nancy Sonafrank with the State of Alaska Solid Waste Program at phone: (907) 451-2135 or email: nancy_sonafrank@envircon.state.ak.us.

ADEC 401 CERTIFICATION STIPULATIONS

Stipulation No. 1

The Alaska Department of Fish and Game has declared that the receiving water is an anadromous fish spawning area. According to 18 AAC 70.255(g)(h)(1), the ADEC cannot allow a mixing zone for any parameter in an anadromous fish spawning area. The ADEC therefore must require that the effluent quality either meet all of the limitations for the parameters listed in the State of Alaska Water Quality Standards at the point of entry into the receiving water, or the discharge to this area must be discontinued.

The City of Valdez has verbally agreed to implement a solution as soon as reasonably possible and will submit progress reports to the Alaska Department of Fish and Game at least every six months. Since the discharge of treated wastewater has been occurring since shortly after the plant came on line, the ADF&G will not initiate enforcement actions provided the discharge is halted within 18 months, or provided due diligence is demonstrated by the City of Valdez and significant progress toward resolution is shown by the progress reports.

Since this is an existing discharge and the effluent quality is not anticipated to change significantly in the foreseeable future, the ADEC will not require the discharge to be stopped immediately, but instead will require the City of Valdez to implement the following steps and procedures:

a. Study and decide on the course of action the City of Valdez will take to either improve the quality of the effluent or eliminate the discharge of the effluent to the current receiving area, within 18 months after the effective date of the NPDES permit. The department must be notified in writing within the 18-month time frame of the results of the study and final decision.

b. Design and obtain plan approval from the ADEC for any additions or modifications to the facility within 24 months after the effective date of the NPDES permit.

c. Construct and have operational any additions and/or modifications to the facility within 36 months from the effective date of the NPDES permit.

The ADEC will consider changes to the time schedule upon written request from the permittee. Any deviations from the above schedule must be agreed to in writing by both the ADEC and the permittee.

This permit will allow the discharge of treated effluent into the existing fresh water stream/ditch, for up to 36 months after the effective date of the NPDES permit, provided that the following conditions are met:

a. The permittee must be in compliance with the time schedule.

b. The permittee must be making satisfactory progress toward improvement of the quality of the effluent or the removal of the effluent from the small fresh water stream/ditch.

c. The permittee must remain in compliance with the requirements of this certification.

Response
The EPA agrees. A compliance schedule (based on the above stipulation) has been added to the final permit as Note 9 in Section I.A *Effluent Limitations*, which requires the permittee to either come into compliance with water quality standards at the end-of-pipe for discharge to Unnamed Stream No. 221 60-11390 or cease discharge to the stream.

Stipulation No. 2
The ADEC designates a mixing zone (MZ) in the marine waters in the Port of Valdez for up to the first 36 months of the permit, (or less if the decided upon course of action is to meet water quality standards at the end of the pipe), and after the first 36 months of the permit if the effluent discharge is rerouted to marine water. The limitations must be met outside of the mixing zone boundary for the following parameters; fecal coliform bacteria, total chlorine, nutrients, metals, pH, dissolved oxygen and whole effluent toxicity. The mixing zone is defined as the area comprised of a semi circle in the receiving water with a radius extending 100 meters, (at M.L.L.W.) from the point of entry into the Port of Valdez. Computer modeling to determine the exact mixing zone size was not conducted for this discharge due to the unusual nature of the receiving area, however a dilution factor has been assigned for this discharge. The dilution factor is 20:1. The physical size of the mixing zone may be adjusted if it is later determined that the 20:1 dilution is not achieved within 100 meters of the entry point into the Port of Valdez.

Response
The EPA agrees. The mixing zone description (Section I.D.6) in the final permit has been modified based on the above stipulation. In addition, a note has been added to Section I.D.6 that states that no mixing zone is allowed for discharge to Unnamed Stream No. 221-60-11390.

Stipulation No. 3
The ADEC also requires the following limitations during the life of the NPDES permit:

<u>Discharges to the freshwater stream/ditch, (up to the first 36 months of the NPDES permit).</u>
Flow - 1.5 million gallons per day (mgd), monthly average; 2.5 mgd, daily maximum
Biochemical oxygen demand, (BOD5), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total suspended solids, (TSS), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total chlorine – 0.04 mg/l, detection limit of 0.1 mg/l
Dissolved oxygen – 7 mg/l, minimum, 17 mg/l maximum
pH – 6.5-8.5 S.U.
Whole effluent toxicity – NOEC = 20 TUc (5 % effluent)

Nutrients - WQS's limits x 20:1 dilution factor
Metals - WQS's limits x 20:1 dilution factor
Oil and grease – no sheen
All other parameters – limits as per WQS's
Effluent fecal coliform bacteria – 200 FC/100 ml, monthly average
400 FC/100 ml, weekly average

Discharges directly to the Port of Valdez (after rerouting of the discharge to marine water).

Flow - 1.5 million gallons per day (mgd), monthly average; 2.5 mgd, daily maximum
Biochemical oxygen demand, (BOD5), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total suspended solids, (TSS), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total chlorine – 0.04 mg/l, detection limit of 0.1 mg/l
Dissolved oxygen – 2 mg/l, minimum, 17 mg/l maximum
pH – 6-9 S.U.
Whole effluent toxicity – NOEC = 20 TUc (5 % effluent)
Nutrients - WQS's limits x 20:1 dilution factor
Metals - WQS's limits x 20:1 dilution factor
Oil and grease – no sheen
All other parameters – limits as per WQS's
Effluent fecal coliform bacteria – 200 FC/100 ml, monthly average
400 FC/100 ml, weekly average
800 FC/100 ml, daily maximum

Discharges to the freshwater stream/ditch, (after 36 months of the NPDES permit if the discharge to fresh water continues)

Flow - 1.5 million gallons per day (mgd), monthly average; 2.5 mgd, daily maximum
Biochemical oxygen demand, (BOD5), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total suspended solids, (TSS), - 45 mg/l, monthly average; 65 mg/l, weekly average; the percent removal must be greater than 65 percent
Total chlorine – 0.002 mg/l, detection limit of 0.1 mg/l
Dissolved oxygen – 7 mg/l, minimum, 17 mg/l maximum
pH – 6.5-8.5 S.U. and within 0.5 pH units of the receiving water
Whole effluent toxicity – NOEC = 1 TUc (100 % effluent)
Nutrients - WQS's limits
Metals - WQS's limits
Oil and grease – no sheen
Effluent fecal coliform bacteria – 20 FC/100 ml, monthly average
40 FC/100 ml, weekly average

Response

The response to this stipulation is provided in two parts:

- Discharge to Unnamed Stream No. 221-60-11390
- Discharge to Port Valdez

Discharge to Unnamed Stream No. 221-60-11390

Parameters for which effluent limitations have been revised in the final permit, or for which the effluent limitations differ from those stipulated by ADEC are discussed below.

Flow

Table 1. *Effluent Limitations Outfall 001 (To Unnamed Stream No. 221-60-11390)* of the final permit has been revised to include flow rate limitations of 1.5 million gallons per day (mgd) for a monthly average and 2.5 mgd for a daily maximum.

BOD and TSS

There are no changes to the permit limits for BOD and TSS. The BOD and TSS limits in the permit are based on secondary treatment standards. The above stipulation from ADEC is requesting the less stringent equivalent-to-secondary treatment standards. In accordance with 40 CFR 133.101(g), facilities are eligible for consideration for equivalent-to-secondary treatment standards only if the effluent quality consistently achieved, despite proper operation and maintenance, is in excess of the secondary treatment standards. The Valdez WWTP consistently achieves effluent concentrations that meet the secondary treatment standards. Therefore, the facility is not eligible for equivalent-to-secondary treatment standards. Because the BOD and TSS limitations in the permit are more stringent than the requested ADEC limits, and because the facility does not qualify for consideration for equivalent-to-secondary treatment standards, the BOD and TSS limitations have been retained in the final permit.

Total Residual Chlorine

Total residual chlorine limits for the final permit are listed below:

Time Period	Monthly Average	Maximum Daily
Effective Date of the Permit through May 31, 2005	---	0.01 mg/L
Effective beginning June 1, 2005	0.001 mg/L	0.003 mg/L
	0.01 lbs/day	0.04 lbs/day

Table 1. *Effluent Limitations Outfall 001 (to Unnamed Stream No. 221 60-11390)* of the final permit has been revised accordingly. Effluent limits for the time period from the effective date of the permit through May 31, 2005 are equal to the existing permit limits. The "anti-backsliding" provision (40 CFR § 122.44(l)) prohibits less stringent effluent limitations than those in the previous permit. Hence, because the chlorine limits in the ADEC stipulation are less stringent than the existing limits, the final permit retains the existing chorine limits through May 31, 2005. Effluent limits for the time period effective beginning June 1, 2005 are based on meeting water

quality standards at the end-of pipe. Calculations for the chlorine effluent limits are provided at the end of this document.

Because the effluent limits are not quantifiable using EPA approved analytical methods, the permittee will be in compliance with the effluent limits provided the total residual chlorine residual is at or below the compliance level of 0.1 mg/L.

pH

A sentence has been added to Note 3 in Section I.A *Effluent Limitations* of the final permit that states that effective beginning June 1, 2005, the effluent pH must be within 0.5 pH units of the receiving water.

Whole Effluent Toxicity

The permittee will be required to conduct WET testing during the fourth year of the permit. If the permittee has elected to continue discharge to Unnamed Stream No. 221-60-11390, chronic toxicity testing requirements will be triggered when the NOEC exceeds 1 TUc (100 percent effluent concentration). Notes 1, 3 and 4 in Section I.C *Whole Effluent Toxicity Testing* of the final permit have been revised accordingly.

Fecal Coliform Limits

Fecal coliform limits (in FC/100 ml) for the final permit are listed below:

Time Period	Monthly Average	Weekly Average	Maximum Daily
Effective Date of the Permit through May 31, 2005	200	400	800
Effective beginning June 1, 2005	20	40	–

Table 1. *Effluent Limitations Outfall 001 (to Unnamed Stream No. 221 60-11390)* of the final permit has been revised accordingly.

Fecal coliform limits for the period from the effective date of the permit through May 31, 2005 are equal to the existing permit limits. Effluent limits for the time period effective June 1, 2005 are equal to end-of pipe limits with no dilution. The effluent limits are in agreement with the ADEC stipulation.

Discharge to Port Valdez

Table 2. *Effluent Limitations Outfall 002 (To Port of Valdez)* has been added to the final permit which lists effluent limits for the direct discharge to Port Valdez. The flow requirement, and effluent limits for BOD and TSS in the final permit are identical to those for the discharge to Unnamed Stream No. 221-60-11390. See discussion above for those parameters under "Discharge to Unnamed Stream No. 221-60-11390." Additional effluent limitations specific to

Port Valdez discharge are discussed below.

Total Residual Chlorine

Total residual chlorine limits for the final permit are listed below:

Monthly Average	Maximum Daily
0.03 mg/L	0.07 mg/L
0.4 lbs/day	0.9 lbs/day

These limits have been included in Table 2. *Effluent Limitations Outfall 002 (To Port of Valdez)* in the final permit. Effluent limits are based on meeting marine water quality standards at the edge of the mixing zone with a 20:1 dilution. Calculations for the effluent limits are provided at the end of this document.

Because the effluent limits are not quantifiable using EPA approved analytical methods, the permittee will be in compliance with the effluent limits provided the total residual chlorine residual is at or below the compliance level of 0.1 mg/L.

Dissolved Oxygen

The most stringent State water quality standards for DO for marine water uses are as follows:

"Surface DO concentration in coastal water may not be less than 6.0 mg/L for a depth of one meter except when natural conditions cause this value to be depressed. DO may not be reduced below 4 mg/L at any point beneath the surface. DO concentrations in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed. In no case may DO levels exceed 17 mg/L. The concentration for DO may not exceed 110% of saturation at any point of sample collection."

The final permit requires a minimum DO concentration of 2 mg/L and a maximum DO concentration of 17 mg/L. The minimum value accounts for dilution in the mixing zone. The DO limits are included in Table 2. *Effluent Limitations Outfall 002 (To Port of Valdez)* of the final permit.

pH

The most stringent State water quality standard for both fresh water and marine water uses requires that ambient pH be in the range of 6.5 to 8.5 standard units. A less stringent standard requires a mixing zone analysis, taking into account the alkalinity of the effluent and receiving water. The permit retains a pH limit for the effluent of between 6.5 to 8.5.

Whole Effluent Toxicity

Section I.C *Whole Effluent Toxicity Testing* of the final permit has been modified to include WET testing requirements for marine discharge. WET testing is required during the fourth year of the

permit. A statement has been added to Section I.C, which states that the permittee will be required to follow the marine discharge WET testing requirements if the permittee has elected to discharge to Port Valdez. Chronic toxicity testing requirements will be triggered when the NOEC exceeds 20 TUc (5 percent effluent concentration).

Fecal Coliform

Table 2. *Effluent Limitations Outfall 002 (To Port of Valdez)* of the final permit includes the following fecal coliform limits as authorized by the State based on a 20:1 dilution in the mixing zone:

Monthly Average	200 FC/100 ml
Weekly Average	400 FC/100 ml
Daily Maximum	800 FC/100 ml

Stipulation No. 4

The ADEC requires monitoring at the outside edge of the mixing zone for fecal coliform bacteria. A minimum of three samples for fecal coliform bacteria analysis shall be collected in each of the following months; June, July, August September, and once during the time period December through March of each year of the permit. The monitoring may be decreased after two years if the results indicate that the quality of the discharge has not caused the State of Alaska Water Quality Standards to be exceeded outside of the mixing zone. The samples shall be collected from two down current sites and one up current site at the edge of the mixing zone. The sample collection should take place during varying tidal stages for each sampling event.

Response

Note 3 *Fecal Coliform Monitoring* in Section I.D *Ambient Monitoring Requirements* of the final permit has been revised in accordance with the above stipulation.

Stipulation No. 5

The ADEC requires that a sign be placed on the shoreline near the outfall line. The sign should state that secondary treated domestic wastewater is being discharged, the name and owner of the facility and the approximate location and size of the mixing zone. The signs should inform the public that certain activities, such as the harvesting of shellfish for raw consumption and bathing should not take place in the mixing zone and give a contact number for additional information.

Response

The above stipulation has been added as Note 8 *Outfall Location Signs* under Section I.D *Ambient Monitoring Requirements* of the final permit.

ADDITIONAL PERMIT MODIFICATIONS

Chlorine Reporting Requirements

Note 7 has been inserted in Section I.A *Effluent Limitations* that clarifies reporting requirements when monitoring results are below the Minimum Level (ML) for chlorine. The note states that for purposes of reporting on the DMR, if a value is greater than the ML, the permittee must report the actual value. If a value is less than the ML, the permittee must report "< 0.1 mg/L" on the DMR. For purposes of calculating monthly averages, zero may be used for values less than the ML.

Effluent Limitation for Residues

The narrative effluent limitation for residue (Note 8) in Section I.A *Effluent Limitations* of the final permit has been revised to be more understandable. The revised narrative effluent limit is as follows: "There shall be no discharge of floating solids or visible foam, or oily wastes which produce a sheen on the surface of the receiving water."

Ambient Monitoring Frequency

The ambient monitoring frequencies for ammonia, pH, temperature, and stream flow have been revised to coincide with the monitoring frequencies specified by ADEC for fecal coliform. The frequency will be once per month during the months of June, July, August and September and once during the time period of December through March for each year of the permit. Table 4 *Ambient Monitoring Requirements* of the final permit has been revised accordingly. There are no effluent limits specified for these parameters, monitoring is included in the permit for the purpose of acquiring background information.

CHLORINE LIMIT CALCULATIONS

Background information on developing water quality based effluent limitations was provided in the Fact Sheet. The following are the calculations for the total residual chlorine effluent limits for fresh water discharge with no mixing zone and marine water discharge with a mixing zone.

Chlorine Limits Protective of Fresh Water Uses - No Mixing Zone

Appropriate Water Quality Criteria

The most stringent State water quality criteria for total residual chlorine to protect freshwater designated uses are:

Acute: 0.019 mg/L
Chronic: 0.002 mg/L

Develop Wasteload Allocations

With no dilution, the WLA is equal to the water quality criterion:

$WLA_{acute} = C_d = 0.019$ mg/L

$WLA_{chronic} = C_d = 0.002$ mg/L

Where,

WLA_{acute} = Acute Wasteload Allocation
$WLA_{chronic}$ = Chronic Wasteload Allocation

Develop Effluent Limitation Based on WLAs

A. Convert WLAs to Long Term Averages

$$LTA_{acute} = WLA_{acute} \times \exp[0.5\sigma^2 - z\sigma]$$

$WLA_{acute} = 0.019$ mg/L
CV = coefficient of variation of effluent data = 0.6

This is the EPA recommended default value for the CV. The default value was used since the majority of the reported chlorine effluents concentrations from the facility have been less than the EPA designated "Minimum Level" for chlorine analysis (of 0.1 mg/L). This CV is revised from the value used in development of the draft permit limits (a CV of 1.081). The development of the draft limits did not account for effluent values being less than the Minimum Level.

$\sigma^2 = \ln(CV^2 + 1) = 0.307$
$\sigma = 0.555$
$z = 2.326$ for 99th percentile

$$LTA_{acute} = 0.019 \times \exp[0.5 \times 0.307 - 2.326 \times 0.555] = 0.00610 \text{ mg/L}$$

$$LTA_{chronic} = WLA_{chronic} \times \exp[0.5\sigma_4^2 - z\sigma_4]$$

$WLA_{chronic} = 0.002$ mg/L
$CV = 0.6$
$\sigma_4^2 = \ln(CV^2 \div 4 + 1) = 0.0862$
$\sigma_4 = 0.294$
$z = 2.326$ for 99th percentile

$$LTA_{chronic} = 0.002 \times \exp[0.5 \times 0.0862 - 2.326 \times 0.294] = 0.0011 \text{ mg/L}$$

B. Average Monthly and Maximum Daily Permit Levels

$LTA_{chronic}$ is lower than LTA_{acute}, therefore use $LTA_{chronic}$ to calculate the permit levels.

$MDL = LTA \times exp[z\sigma - 0.5\sigma^2]$

LTA = 0.0011 mg/L
CV = 0.6
$\sigma^2 = ln(CV^2 + 1)$ = 0.307
σ = 0.555
z = 2.326 for 99th percentile

$MDL = 0.0011 \times exp[2.326 \times 0.555 - 0.5 \times 0.307] = 0.003$ mg/L

$AML = LTA \times exp[z\sigma_n - 0.5\sigma_n^2]$

LTA = 0.0011 mg/L
CV = 0.6
$\sigma^2 = ln(CV^2 \div n + 1) = ln(0.6^2 \div 8 + 1)$ = 0.0440
n = number of samples per month = 8
σ = 0.210
z = 1.645 for 95th percentile

$AML = 0.0011 \times exp[1.645 \times 0.210 - 0.5 \times 0.044) = 0.001$ mg/L

C. Calculate Mass Loading Limitations

Mass Loading (lbs/day) = Concentration Limit (mg/L) x Design Flow Rate (mgd) x 8.34

MDL = 0.003 mg/L x 1.5 mgd x 8.34 = 0.04 lbs/day
AML = 0.001 mg/L x 1.5 mgd x 8.34 = 0.01 lbs/day

Chlorine Limits Protective of Marine Water Uses

Appropriate Water Quality Criteria

The most stringent state water quality criteria for total residual chlorine to protect marine water designated uses are:

Acute: 0.013 mg/L
Chronic: 0.002 mg/L

Develop Wasteload Allocations

With a 20:1 dilution, and an assumed background concentration of zero, the WLA is equal to:

$WLA_{acute} = C_d \times D = 0.013 \text{ mg/L} \times 20 = 0.26$

$WLA_{chronic} = C_d \times D = 0.002 \text{ mg/L} \times 20 = 0.04$

Where,

WLA_{acute} = Acute Wasteload Allocation
$WLA_{chronic}$ = Chronic Wasteload Allocation

Develop Effluent Limitation Based on WLAs

A. Convert WLAs to Long Term Averages

$LTA_{acute} = WLA_{acute} \times \exp[0.5\sigma^2 - z\sigma]$

WLA_{acute} = 0.26 mg/L
CV = 0.6
$\sigma^2 = \ln(CV^2 + 1)$ = 0.307
σ = 0.555
z = 2.326 for 99th percentile

$LTA_{acute} = 0.26 \times \exp[0.5 \times 0.307 - 2.326 \times 0.555] = 0.0835 \text{ mg/L}$

$LTA_{chronic} = WLA_{chronic} \times \exp[0.5\sigma_4^2 - z\sigma_4]$

$WLA_{chronic}$ = 0.04 mg/L
CV = 0.6
$\sigma_4^2 = \ln(CV^2 \div 4 + 1)$ = 0.0862
σ_4 = 0.294
z = 2.326 for 99th percentile

$LTA_{chronic} = 0.04 \times \exp[0.5 \times 0.0862 - 2.326 \times 0.294] = 0.0211 \text{ mg/L}$

B. Calculate Average Monthly and Maximum Daily Permit Levels

$LTA_{chronic}$ is lower than LTA_{acute}, therefore use $LTA_{chronic}$ to calculate the permit levels.

$MDL = LTA \times \exp[z\sigma - 0.5\sigma^2]$

LTA = 0.0211 mg/L

$CV = 0.6$
$F^2 = \ln(CV^2 + 1) = 0.307$
$F = 0.555$
$z = 2.326$ for 99th percentile

$MDL = 0.0211 \times \exp[2.326 \times 0.555 - 0.5 \times 0.307] = 0.07$ mg/L

$AML = LTA \times \exp[zF_n - 0.5F_n^2]$

$LTA = 0.0211$ mg/L
$CV = 0.6$
$F^2 = \ln(CV^2 \div n + 1) = \ln(0.6^2 \div 8 + 1) = 0.0440$
n = number of samples per month = 8
$F = 0.210$
$z = 1.645$ for 95th percentile

$AML = 0.0211 \times \exp[1.645 \times 0.210 - 0.5 \times 0.044] = 0.03$ mg/L

C. Calculate Mass Loading Limitations

Mass Loading (lbs/day) = Concentration Limit (mg/L) x Design Flow Rate (mgd) x 8.34

MDL = 0.07 mg/L x 1.5 mgd x 8.34 = 0.9 lbs/day
AML = 0.03 mg/L x 1.5 mgd x 8.34 = 0.4 lbs/day