

Attachment H  
Total Residual Chlorine  
Discharge Limit Calculation  
NPDES Permit No. MA0103284  
Boston, MA

Water Quality Limitation Equation:

$$C_L = C_a + [(C_c - C_a)/(1/S_n + 1/S_b - 1/(S_n)(S_b))]$$

Given:

$C_L$  = water quality limitation

$C_a$  = maximum ambient data sample

$C_c$  = marine water quality criterion

$C_{c1}$  = 13 ug/l = Acute

$C_{c2}$  = 7.5 ug/l = Chronic

$S_n$  = flux-average nearfield dilution

$S_b$  = farfield background build-up dilution

$Q_{e1}$  = Maximum Daily Flow = 990 MGD

$Q_{e2}$  = Average Monthly Flow = 690 MGD

$I_d$  = Initial Dilution

$I_{d1}$  = 62.0:1 ratio, at 990 MGD, 1 part effluent to 62 parts receiving water

$I_{d2}$  = 69.1:1 ratio, at 690 MGD, 1 part effluent to 69.1 parts receiving water

$S_n$  = Flux-Average Nearfield Dilution

$S_{n1}$  = (62.0 x 1.15) = 71.3:1, at 990 MGD

$S_{n2}$  = (69.1 x 1.15) = 79.5:1, at 690 MGD

(Note: 1.15 = flux-average correction value for this diffuser outfall.)

$S_b$  = Farfield Background Build-up Dilution for a conservative toxic pollutant

$S_{b1}$  = 150:1, acute

$S_{b2}$  = 256:1, chronic

= 364:1, human health

Sample Calculation:

$$C_L = C_a + [(C_c - C_a)/(1/S_n + 1/S_b - 1/(S_n)(S_b))]$$

Acute:

$$C_L = 0 + [(13 - 0)/(1/71.3 + 1/150 - 1/(71.3)(150))]$$

$$C_L = [(13)/(0.014025) + (0.006666) - (0.000093502)]$$

$$C_L = 631 \text{ ug/l} = 0.631 \text{ mg/l}$$

Chronic:

$$C_L = 0 + [(7.5 - 0)/(1/79.5 + 1/256 - 1/(79.5)(256))]$$

$$C_L = [(7.5)/(0.012578) + (0.0039062) - (0.000049135)]$$

$$C_L = 456 \text{ ug/l} = 0.456 \text{ mg/l}$$

Therefore, the total residual chlorine limits for the tunnel outfall are: (1) maximum daily limit = 631 ug/l, and (2) average monthly limit = 456 ug/l

Footnotes:

1. Effluent limits for daily maximum total residual chlorine are based on the chronic values defined in the EPA Quality Criteria for Water, 1986 (Gold Book) as adopted into the State Water Quality Standards, multiplied by the available receiving water dilution.
2. Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on Water

Quality Standards. The Massachusetts Surface Water Quality Standards include the requirements for the regulation and control of toxic constituents and also require that EPA criteria established, pursuant to Section 304(a) of the CWA, shall be used unless a site specific criteria is established. The state will limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of the receiving waters are protected and maintained or attained.