Massachusetts Department of Environmental Protection - Drinking Water Program

Ground Water Rule – Log Credit Determination

Public Water Suppliers with Gaseous or Liquid Chlorine

Instructions for Form: GWR Form A – Log Credit

Introduction: In preparation for the Ground Water Rule (GWR), and in accordance with 310 CMR 22.04(1)(a)3., the Massachusetts Department of Environmental Protection's Drinking Water Program (MassDEP/DWP) requires all GWR applicable public water systems (PWS) with chlorine disinfection to determine the viral log inactivation currently achieved at their system and the additional log treatment required to meet 4-log virus treatment. By completing this form, PWSs and the MassDEP will be better prepared to respond to future fecal contamination events. All PWSs currently using chlorine disinfection must make this determination and *mail two completed and signed form to MassDEP Regional Office, Attn: DWP GWR .* PWSs with multiple wells and/or chlorination points must perform this calculation for each disinfected point of entry and submit a schematic indicating the relative location of these points and connecting pipes (i.e. are wells connected prior to chlorination); hand drawn schematics are acceptable.

If you need assistance completing this form, please contact the Massachusetts Coalition for Small System Assistance at http://www.masmallwatersystem.org or your regional MassDEP GWR contact listed below. An MS Word version of form is available at: http://www.mass.gov/dep/water/approvals/dwsforms.htm#gwr

Central: Kelly Momberger – 508-849-4023
Western: Jim Bumgardner – 413-755-2270
Northeast: Jim Dillon – 978-694-3231
Southeast: Mike Quink – 508-946-2766

Background: Beginning December 1, 2009, all PWSs must comply with the new federal GWR. This rule is intended to increase public health protection against potential viral contamination in ground water sources. The GWR does not require disinfection or treatment of all ground water systems. However, those systems with significant deficiencies or documented fecal contamination will be required to take corrective actions and might be required to provide 4-log (99.99%) treatment of viruses.

If your treatment system does not provide 4-log inactivation and/or removal of viruses, you must conduct triggered monitoring in accordance with the GWR requirements in response to each positive total coliform sample collected under the Total Coliform Rule. If fecal contamination is verified at a your PWS during triggered source water monitoring, you will be required to issue Tier 1 public notification and provide emergency disinfection to meet 4-log treatment of viruses while your PWS is evaluated.

How to determine whether a chlorinated ground water system is providing 4-log (99.99%) inactivation of viruses: Inactivation of viruses using a chemical disinfectant is based on the "CT" concept where "C" is the measured concentration of the chemical disinfectant residual and "T" is the contact time between the point of application of the disinfectant and the point where the disinfection residual is measured. The point where the residual is measured must be before or at the first customer or first connection providing water to the public. T, the contact time of the disinfectant in minutes, is determined by dividing the total volume of system components (pipe, storage tank), in gallons, by flow, in gallons per minute (gpm), of the system. Once C is measured and T is determined from the flow and size of the system components, the product C x T (CT) is compared to EPA developed tables of CT values that are required to achieve inactivation of viruses.

If your system disinfects with gaseous or liquid chlorine, use the formulas and table on Form GWR A to determine the CT (Concentration of free chlorine ($C_{mg/L}$) X contact time ($T_{minutes}$) that is achieved for your groundwater. The CT required to meet 4-log will depend on your groundwater source's temperature, the free chlorine residual concentration in your water at the first customer and the amount of time that the water spends in contact with chlorine before the first customer. Under the GWR, if a system can achieve a CT at least equal to or greater than the CT needed for 4-log inactivation of viruses, the PWS is not required to meet the triggered monitoring requirements of the rule. However, such a system must comply with GWR treatment and compliance monitoring requirements.

Note: 4-log treatment of viruses can be achieved through a combination of disinfection and membrane filtration or other state approved treatment processes. If your PWS provides 4-log treatment, you must submit supporting documentation (in addition to completing the form) prepared by a Professional Engineer. Please call your regional contact for more information on the approval process and future monitoring requirements.

DWP Use Only: Date Received __/__/__ Action Taken: _____

I. PWS Information

PWS Name:	City/Town:	PWS ID:
PWS Address:		COM, NTNC, or TNC (circle one)
Contact Person:		Date Submitted:___/___/_____
Phone Number:	Email:	

1. Do you use chlorine gas, sodium hypochlorite, calcium hypochlorite, or chlorine dioxide? _____
   Note: Contact your regional office if you use chlorine dioxide.
2. Is your pH always within the range 6.0 to 9.0? _____ If no, what is the range? _____
3. Does your system have a tank prior to the first customer? _____ If yes, is it a hydropneumatic tank? _____
   Note: A baffling factor of 0.1 will be applied to all tanks unless the tank has baffles to reduce short circuiting.
4. Does your system have a flow meter? _____ If no, how is flow recorded?_____
5. How and where is chlorine residual measured?_____
6. What is the range of chlorine doses applied in mg/L? _____

II. Calculate CT – PWSs with multiple wells and/or chlorination points must perform this calculation for each disinfected point of entry and attach a schematic.

1. System's free chlorine residual, C = ____ mg/L (at first customer's service connection)
2. What is the Pipe Length$_{feet,}$ of each pipe from the point of chemical application to residual measurement? L_1 = ____feet; L_2 = _____feet; L_3 = _____feet
3. What is the Pipe Diameter$_{inches}$, of each length of pipe? D_1 = ____ inches; D_2 = ___inches; D_3 = _____inches
4. Calculate the Pipe Volume$_{gallons}$ for each length of pipe: $V = L \times 3.14 \times (D/2)^2 \times (7.48_{gal/cu.ft.}/144_{sq.in./sq.\ ft.})$; V_1 = _____ gallons; V_2 = _____ gallons; V_3 = ___ gallons
5. Total Pipe Volume: Add each volume in item #4: V_{pipe} = _____ gallons
6. Tank Volume, V_{tank} x (0.1) baffling factor = _____ gallons
7. Total Volume, V_{total}: $V_{pipe} + V_{tank}$ = _____ gallons
8. Peak Flow Rate, F = ____ gallons/minute (maximum pump rate or flow rate at peak hour – circle one)
9. Shortest amount of time water is coming into contact with chlorine, (T = V/F)

   Time = T = $V_{total,\ gallons}$/Peak Flow Rate$_{gallons\ per\ minute}$: T = _____ minutes

10. Calculate Total CT (multiply line 1 by line 9), C x T = _____ min-mg/L

III. Determine Log Inactivation

1. In the table below, circle the PWS's coldest source water temperature, t = ____ degrees F/C°
2. In the table below, circle the CT value that is associated with the temperature and 4-log.
3. In the table below, circle the CT that is closest to the CT in item 10 above and at the same temperature.
4. Compare the two circled CT values. If your system's CT is equal to or larger than the CT at 4-log, then your system probably provides 4-log inactivation. If it is smaller, the log inactivation is probably less than 4-log unless you have additional approved treatment.
5. What is the estimated log inactivation achieved by chlorination at your system (associated CT in item 3)? _____

CT Values for Inactivation of Viruses by Free Chlorine, pH 6.0 – 9.0

Temperature																									
°C	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
°F	**34**	**36**	**37**	**39**	**41**	**43**	**45**	**46**	**48**	**50**	**52**	**54**	**55**	**57**	**59**	**61**	**63**	**64**	**66**	**68**	**70**	**72**	**73**	**75**	**77**
Log Inactivation																									
2	**5.8**	**5.3**	**4.9**	**4.4**	**4.0**	**3.8**	**3.6**	**3.4**	**3.2**	**3.0**	**2.8**	**2.6**	**2.4**	**2.2**	**2.0**	**1.8**	**1.6**	**1.4**	**1.2**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
3	**8.7**	**8.0**	**7.3**	**6.7**	**6.0**	**5.6**	**5.2**	**4.8**	**4.4**	**4.0**	**3.8**	**3.6**	**3.4**	**3.2**	**3.0**	**2.8**	**2.6**	**2.4**	**2.2**	**2.0**	**1.8**	**1.6**	**1.4**	**1.2**	**1.0**
4	**11.6**	**10.7**	**9.8**	**8.9**	**8.0**	**7.6**	**7.2**	**6.8**	**6.4**	**6.0**	**5.6**	**5.2**	**4.8**	**4.4**	**4.0**	**3.8**	**3.6**	**3.4**	**3.2**	**3.0**	**2.8**	**2.6**	**2.4**	**2.2**	**2.0**

IV. Next Steps: Certification – Sign & Return to your MassDEP Regional Office: DWP/GWR

I certify under penalty of law that I am the person authorized to fill out this form, and the information contained herein is true, accurate and complete to the best of my knowledge and belief.

Print Name: _____ Title: _____ Phone #: _____

Signature: _____ Date: __/__/__ Email: _____