STATE OF CONNECTICUT DEPARTMENT OF PUBLIC HEALTH
DRINKING WATER SECTION
DISINFECTION "CT" APPLICATION FOR GROUNDWATER SOURCES USING CHLORINE

Instructions

This application is provided to assist a Public Water System (PWS) seeking approval from the Department of Public Health (DPH) for CT of an existing or proposed water treatment plant (WTP) which uses chlorine for disinfection of groundwater sources (i.e. wells). This application excludes groundwater sources which have been determined to be under the direct influence of surface water. The resulting goal of this application is to identify the minimum residual chlorine concentration (free chlorine residual) that a specific WTP must maintain for compliance. This application form must be submitted to the DPH along with a General Application Form.

A document entitled "TECHNICAL GUIDELINES FOR DETERMINING DISINFECTION "CT" WHEN USING CHLORINE FOR DISINFECTION OF GROUNDWATER SOURCES OF SUPPLY" (CT Guideline) is available on the DPH website http://www.ct.gov/dph/publicdrinkingwater for use as a reference in completing this application form and identifies applicable Regulations of Connecticut State Agencies (RCSA) or Connecticut General Statutes (CGS).

A separate form needs to be completed for each WTP. Additional supporting information as identified with an asterisk (*) in this application will need to be provided. Specific and applicable RCSA or CGS will be stated within brackets [ ]. If a new or replacement chlorination system is being installed at an existing or proposed PWS, and/or with a project which has multiple components (i.e. wells, tanks, pumps, other treatment, etc.) additional applications may need to be submitted. In general, check off and complete all items that apply. If the space provided in this application is not adequate, please provide the additional information in an attachment with reference to the specific application section and question that it is being provided for.

Footnotes are provided to assist a PWS in completing specific components of the application and close attention needs to be given to them. Two figures are also provided at the end of the application to help a PWS understand the basic terms in this application.

Section A. General Information

PWS Name: _____

PWSID #: CT_____

Please provide the contact information of the primary person who can answer <u>technical</u> questions regarding this project:

Name: _____

Title: _____

Company: _____

Address: _____

_____

_____

Phone Number: _____

Fax Number: _____

E-mail Address: _____

Section B. Identification of WTP and Well(s) Treated at WTP

Name of existing or proposed WTP: _____

Does the existing WTP currently use chlorination?: ☐ Yes ☐ No

If No or if a new WTP is being proposed to provide chlorination, submit a separate *"Chemical Feed System Project Application"* to the DPH

Identify Wells (numbers and/or names) supplying WTP: _____

Section C. Water pH Range

pH range of untreated well or blended well raw water which supplies WTP: _____

Does PWS adjust pH at this WTP? ☐ Yes ☐ No If yes, pH range of the treated water: _____

Section D. Water Temperature

If temperature is known and below 50°F (10°C), what is the coldest raw water temperature of well(s): _____

If not known, use a default temperature of 50°F (10°C).

Section E. Maximum Flow[a] (Q)

Maximum flow rate of well(s) (Q_W) [gallons per minute (gpm)]: _____

Maximum flow rate of booster pump(s) (Q_B) (gpm)]: _____

Method used for determining maximum flow rate: ☐ Meter readings; ☐ Other (describe): _____

_____

Footnote a: A PWS needs to assess what system components (pipes, tanks or other) are to be used to achieve CT in order to determine applicable maximum flow rate(s). Figures 1 and 2 are provided in this document to assist a PWS in making the determination of flow rates, and will also assist in the calculations within the following application sections. Figure 1 illustrates a WTP with only a well(s) which supplies water directly to a distribution system with or without pressure storage. Figure 2 illustrates a WTP with well(s), atmospheric storage tank(s) and with or without booster pump(s) to supply water directly to a distribution system.

Section F. Plans

*A plan sheet or drawing/schematic of an existing and/or proposed pipe arrangement showing: point of chlorine injection, tank(s), booster pump(s), sample line, sample tap and/or continuous chlorine analyzer used for taking residual chlorine concentration measurements, location of first customer/consumer (i.e. service line, tee/split in plumbing, etc.), should be submitted. Pipe diameters and corresponding lengths of pipe(s) used to achieve CT for first customer should also be identified.

Section G. Contact Time (T) Information/Calculations to First Customer

| 1. Pipe(s)[b]

 Includes all contact times from the point of chlorine injection up to a first customer[b]. **No** T will be given for a service line (see CT Guideline) | T_P = contact time (min.) in a specific pipe segment
 $T_P = [(0.785 \times D^2) \times L \times 7.48]/Q$
 $Q = Q_W$ or Q_B (from Section E) |

D = diameter of the pipe (feet – **NOT** inches)	L = length of pipe (feet)	Q = maximum flow (gpm)	T_P = (min)
		x BF[c]	

Total contact time in pipe segment(s) up to first customer = T_{TPF}

Footnote b: A PWS with a WTP supplying water to a distribution system with multiple and various sized mains may have to assess contact times in different directions to determine the location of the first customer. Do not assume that the first customer that receives treated water is the one located closest to the point of chlorine injection. Please refer to the DPH's CT Guideline where a definition for a first customer/consumer is provided.

Footnote c: For a PWS that plans to install a larger diameter pipe in series with existing pipes to increase CT, a baffle factor (BF) must be used since plug flow may not occur in the pipeline. Please refer to DPH's CT Guideline to determine appropriate BF.

Section G. Contact Time (T) Information/Calculations to First Customer (continued)

2. Tank(s)

Includes all contact times for pressure, hydropneumatic and/or atmospheric tanks, as well as filter vessels.

T_T = contact time (min) in a specific tank
$T_T = V/Q \times BF$
$Q = Q_W$ or Q_B (from Section E)

V = volume of water in tank (gallons)[d]	Q = maximum flow (gpm)	Baffle Factor (BF)[e]	T_T = (min)

Total contact time in tank(s) = T^{TT}

Footnote d: Volume of water in tank at lowest normal operating level - NOT the total/gross volume. Calculations supporting how the volume was determined should be provided.
- *For an Atmospheric Tank – Volume of water in tank at which level well(s) come on to re-fill tank (i.e. float switch, level probe, pressure sensor, etc.)*
- *For a Pressure or Hydropneumatic Tank – Volume of water in tank at which level well(s) or booster pump come on to re-fill tank (i.e. pressure switch, level probe, etc.)*

Footnote e: Refer to DPH's CT Guideline to determine appropriate BF.

3. Total Contact Time to First Customer = T_{TTF}

$T_{TTF} = T_{TPF}$ (from Section G.1. Pipe(s)) + T_{TT} (from Section G.2. Tank(s))
T_{TTF} = _____

Section H. CT Information/Calculations – Determining Minimum Compliance Residual Chlorine Concentration (Free Chlorine Residual) before or at the First Customer Necessary to Achieve CT

First Customer/Consumer CT = C x T

CT (mg-min/L) = Residual Chlorine Concentration [C (mg/L)] x Contact Time [T (min)] or C = CT/T

Minimum Residual Chlorine Concentration (mg/L) = C_{MIN}

$CT_F = C_{MIN} \times T_{TTF}$ (from Section G.3)

A PWS must select from the following two options to identify which regulation approval from the DPH is being sought.

☐ a. Per Section 19-13-B102(e)(7)(M) of the RCSA, a minimum required CT value of 2.0 mg-min/L which will maintain no less than 0.2 mg/L after ten minutes of contact time or equivalent shall be used before or at a first customer.

☐ b. Per the Ground Water Rule, a PWS must maintain a minimum CT value of 6.0 mg-min/L, which corresponds to a minimum residual chlorine concentration of no less than 0.20 mg/L after 30 minutes of contact time or equivalent before or at a first customer to achieve 4-log inactivation of viruses based on a water temperature of no less than 50°F (10°C) and pH range of 6.0 -9.0. If the well(s) water temperature is less than 50°F (10°C) per Section D, a corresponding CT value as identified in a Table provided in DPH's CT Guideline must be used.

C_{MIN} (mg/L)[f]	T_{TTF} [from Section G.3 (min)]	CT_F (mg-min/L)

Footnote f: A PWS must use a C_{MIN} of no less than 0.2 mg/L. The calculated C_{MIN} should be rounded up to the nearest 0.05 mg/L increment. The C_{MIN} identified will be the value which will be used to determine compliance at a system's approved sampling location.

Depending on the CT approval being sought as identified above, check off the applicable box below.
☐ a. Is the calculated CT_F value equal or greater than 2.0 mg-min/L? ☐ Yes ☐ No
☐ b. Is the calculated CT_F value equal or greater than 6.0 mg-min/L? ☐ Yes ☐ No
☐ c. Is the calculated CT_F value equal or greater than _____ mg-min/L? ☐ Yes ☐ No (Use a corresponding CT value as identified in a Table provided in DPH's CT Guideline when the water temperature of well(s) is less than 50°F (10°C)).
If yes, the treatment meets the minimum CT value and should be acceptable for approval.
If no, a PWS needs to increase C_{MIN} and/or T_{TTF}. Please refer to DPH's CT Guideline.

Section I. Identification of Compliance Sampling Location

A PWS must provide and identify a compliance sampling location where the residual chlorine concentration C_{MIN} is proposed to be monitored. A PWS will be required to maintain a residual chlorine concentration (i.e. free chlorine residual) at this sampling location equal or greater than the identified minimum residual chlorine concentration per Section H to achieve the required CT value. A sample line to a sample tap or continuous chlorine analyzer with a sample tap must be provided off of the water pipe or main carrying the chlorinated water after the point at which CT_F is achieved. Prior to 2012 the DPH allowed and approved sample lines to be used to achieve an equivalent CT_F, however this is no longer an option (see DPH CT Guideline).

1. What will be the WTP's compliance sampling location for monitoring residual chlorine concentration?

☐ Sample tap ☐ Continuous chlorine analyzer[g]

Footnote g: Under the Ground Water Rule a PWS serving greater than 3,300 people must continuously monitor the residual chlorine concentration of the treated water at a location approved by the DPH. Additionally, a sample tap needs to be installed right at the analyzer to allow for calibration of the analyzer and to allow for grab sampling in the event there is problem with the analyzer.

Section J. Compliance Testing for Residual Chlorine Concentration (Free Chlorine Residual) and Associated Components

Are tests for residual chlorine to be conducted by State Certified Laboratory?: ☐ Yes ☐ No

If yes, CT approved Lab: PH - _____

The DPH may grant an exemption from the use of laboratory when the analysis for the parameter is conducted by a DPH certified treatment operator using a test kit or continuous chlorine analyzer conforming to a test methodology approved by the DPH[h]. A list of methodologies approved by the DPH can be obtained upon request.

Is a test kit or analyzer to be used for compliance residual chlorine concentration monitoring?: ☐ Yes ☐ No

Footnote h: An analytical methods specified in 40 CFR 141.74(a)(2), as amended from time to time, must be used.

☐ Test kit - Manufacturer/Model No.: _____   Testing Methodology: _____

☐ Analyzer - Manufacturer/Model No.: _____   Testing Methodology: _____

DPH certified treatment plant operator who will use and maintain test kit and/or analyzer:

Name: _____   DPH Certification #: _____

* A treatment plant operator must be identified and documentation from the manufacturer of test kit or analyzer as to its testing methodology must be provided to DPH before an exemption can be considered.

Method to retain test results from analyzer: ☐ Written log ☐ Chart recorder ☐ SCADA

☐ Other: _____

If a continuous chlorine analyzer is to be provided, check all applicable alarms and alarm type to be provided.[i]

Alarms: ☐ low level ☐ high level

Alarm Type: ☐ audio ☐ visual ☐ dialer ☐ SCADA ☐ Other: _____

Footnote i: If a continuous chlorine analyzer is to be used, at least a low alarm with a means to alert the system's operator must be provided. Under the Ground Water Rule, a system serving fewer than 3,300 people and which uses a continuous chlorine analyzer without an alarm and means to alert a system's operator must daily visit the WTP/analyzer and write down the residual chlorine concentration which corresponds to a peak hour of water of use.
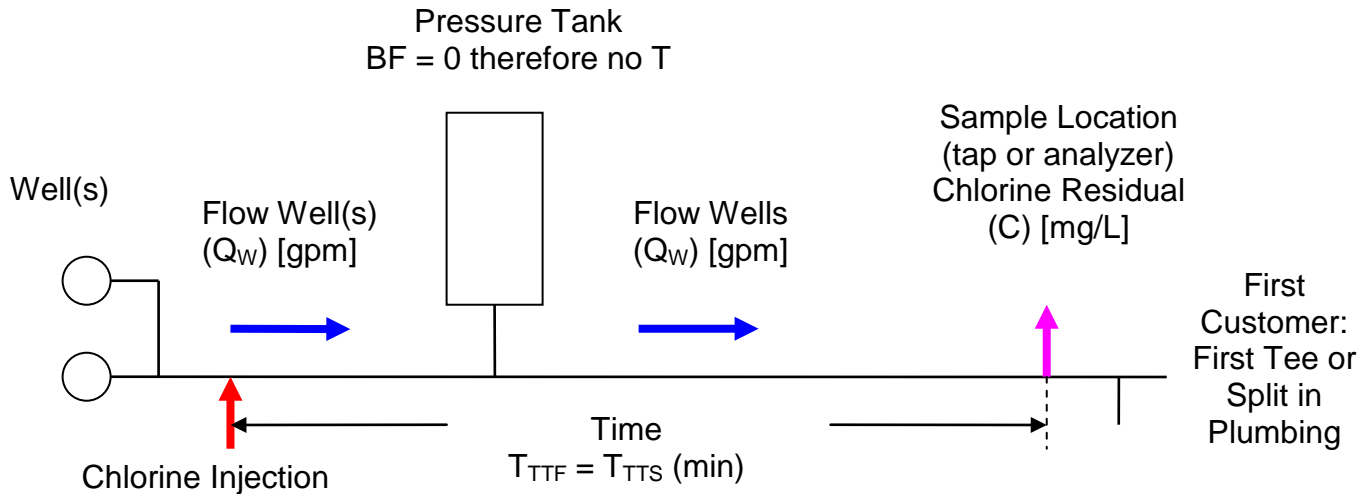
Section K. Certification

This application must be signed by the PWS administrative official, his/her authorized representative, or certified operator of the PWS.

I hereby certify that I have examined the information contained in this application as submitted to the DPH and have determined it to be accurate to the best of my knowledge:
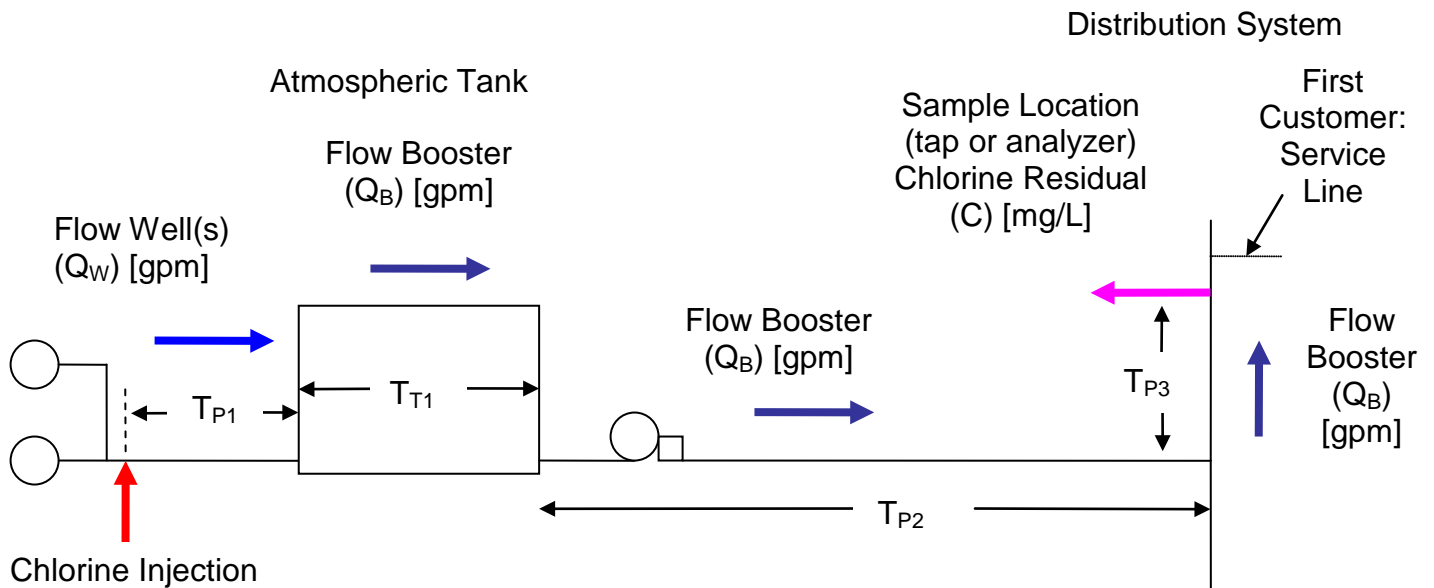
Signature:	Date Signed:
Name (Print):	Telephone #:
Title and Relationship to PWS:	

Figures

1. Flow (Q) and Pipe Contact Time (T) for PWS with plumbing system

Pressure Tank
BF = 0 therefore no T

Well(s)

Flow Well(s)
(Q_W) [gpm]

Flow Wells
(Q_W) [gpm]

Sample Location
(tap or analyzer)
Chlorine Residual
(C) [mg/L]

First Customer:
First Tee or Split in Plumbing

Chlorine Injection

Time
$T_{TTF} = T_{TTS}$ (min)

2. Flow (Q) and Pipe and Tank Contact Time (T) for PWS with distribution

Distribution System

Atmospheric Tank

Flow Booster
(Q_B) [gpm]

Sample Location
(tap or analyzer)
Chlorine Residual
(C) [mg/L]

First Customer:
Service Line

Flow Well(s)
(Q_W) [gpm]

Flow Booster
(Q_B) [gpm]

Flow Booster
(Q_B) [gpm]

T_{P1}

T_{T1}

T_{P3}

Chlorine Injection

T_{P2}

(Total Contact Time to First Customer) $T_{TTF} = T_{TPF}$ (pipes) + T_{TT} (tank)
$T_{TTF} = T_{P1} + T_{T1} + T_{P2} + T_{P3}$
No T is given for a service line. All T are in minutes.

These figures are for illustration only.