

# GWR Treatment Options

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Drinking Water Section



# What does 4-log Virus Treatment mean?

- 💧 For groundwater sources, 4-log treatment is the inactivation, removal, or inactivation and removal, of 99.99% of viruses from the water supply.
- 💧 It is a calculated value based on studies conducted on specific treatment technologies.



# What type of treatment?

- 💧 Inactivation (Chlorine, ozone, UV)
- 💧 Removal (Membrane technologies)
- 💧 Combination through alternative treatment technologies

# Why Install/Maintain 4-log Treatment?

- 💧 Systems that maintain 4-log virus treatment are exempt from monitoring requirements of the Ground Water Rule
- 💧 Installing 4-log treatment is one of the Corrective Action alternatives to address a significant deficiency or fecal contamination

# Why Install 4-log Treatment?

- 💧 Treatment typically will not be the first choice among the Corrective Action alternatives.

Why?

- 💧 Compliance monitoring
- 💧 Expense: operator, chemicals, lamps
- 💧 Maintenance
- 💧 “Band-aid”, chlorine will not reliably inactivate other pathogens like cryptosporidium



# When is 4-log Treatment the Appropriate CA Alternative?

- 💧 Lot constraints prevent regulation-compliant well location and no viable interconnection available
- 💧 Undetermined contamination source (i.e. no identified significant deficiencies)

# Treatment



Drinking Water Section





# Existing Treatment Systems

- 💧 GWSs that maintain 4-log inactivation and/or removal of viruses are exempt from the monitoring provisions of the GWR.
- 💧 If you believe that your system has this level of treatment, you must demonstrate to the DWS that the treatment meets this level.
- 💧 It is recommended that this be done before December and far enough in advance for DWS review and approval (i.e. now).





# Compliance Monitoring

- 💧 The water system must also maintain the treatment system at this level of treatment, and provide the DWS with documentation of this.
- 💧 DWS will provide forms/guidance that will outline this.
- 💧 Failure to do so will require the system to comply with triggered and assessment monitoring regulations.



💧 “I think my chlorination system will meet 4-log virus inactivation” ....

# Treatment, cont'd.

## Groundwater Public Water Systems that Utilize Chlorine, UV, or Ozone Treatment

On December 1, 2009, public water systems (PWSs) using groundwater sources will be required to comply with provisions of the [Ground Water Rule](#) (GWR). PWSs that use groundwater sources and use chlorination, ozonation or UV treatment systems may be affected differently by the monitoring provisions of the GWR.

PWSs that can substantiate that treatment of their groundwater sources is maintained to at least 4-log (99.99%) inactivation and/or removal of viruses will be exempt from the monitoring provisions of the GWR. PWSs that use chlorine, ozone or UV treatment that does not provide 4-log inactivation will likely be required to conduct additional monitoring to ensure that the treatment is not masking microbial pathogen contamination.

If you believe that the treatment system that is installed for your groundwater source(s) will provide 4-log treatment of viruses please submit written documentation to the Drinking Water Section (DWS). If the DWS concurs you will receive a written acknowledgement exempting your PWS from the monitoring provisions of the GWR, provided the compliance monitoring requirements of the GWR for your treatment system(s) are maintained.

The DWS's "[Technical Guidelines for Determining Disinfection "CT" When Using Chlorine for Chlorination of Groundwater Sources of Supply](#)" should be utilized as guidance in calculating and documenting the log removal of chlorination treatment system(s). The DWS believes a CT value of 6 is necessary under normal circumstances to achieve 4-log treatment of viruses. If you believe that 4-log treatment can be achieved with a lower CT at your PWS, you may provide evidence supporting that. For ozone systems, a minimum CT of 1.0 is necessary.

If you wish to submit data substantiating that a membrane filtration unit, UV disinfection system, or combination of treatment systems provides at least 4-logs of virus treatment, you must minimally provide the following as evidence:

- Validation of the log treatment indicated for a treatment unit. Acceptable validation methods include, but are not limited to, verification through industry, state or federal studies, including USEPA's ETV program or an actual in-situ validation conducted by the PWS.
- Verification that the UV dose can be reliably delivered with the site specific conditions of the system (if applicable), including water chemistry, flow rate changes, redundancy, backup power, etc.
- In the absence of DWS issued compliance monitoring requirements, a compliance monitoring plan that assures that the treatment unit(s) is/are being maintained to 4-log treatment of viruses.

Treatment systems installed in series can be approved provided that the sum total of treatment provides 4-log (e.g. UV+chlorine, membrane filtration+ UV, UV+UV+UV). There are currently no known single standalone UV units that will provide 4-log inactivation of viruses.

If you do not apply for and receive written approval from the DWS that your PWS achieves 4-log treatment prior to December 1, 2009, you will be required to comply with the monitoring provisions of the GWR until such time as DWS approval is granted.

Groundwater systems may wish to upgrade their existing treatment systems to provide 4-log treatment. An [application](#) for modifications or upgrades to treatment systems must be approved by the DWS prior to installation in accordance with Section 19-13-B102(d)(2) of the Regulations of Connecticut State Agencies.

If you have any questions, please contact Eric McPhee at [eric.mcphee@ct.gov](mailto:eric.mcphee@ct.gov) or 860.509.7333.

# Treatment

STATE OF CONNECTICUT DEPARTMENT OF PUBLIC HEALTH  
DRINKING WATER SECTION

**TECHNICAL GUIDELINES FOR DETERMINING DISINFECTION “CT” WHEN USING  
CHLORINE FOR CHLORINATION OF GROUNDWATER SOURCES OF SUPPLY**

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Effective Date: February 1, 2008

- 💧 Step 1: Determine existing/proposed CT from the point of injection to the first customer.
- 💧 CT: per Section 19-13-B102(a)(17) of the RCSA “means the product of the residual disinfectant concentration (C) in milligrams per liter (mg/l) determined before or at the first customer, and the corresponding disinfectant contact time (T) in minutes (i.e., “C” X “T”).” CT is typically expressed as mg-min/L (milligrams per minute per liter).
- 💧 Guidance is available on DWS website.

Microsoft Excel - GW CT Spreadsheet V8 EPA-1 [Read-Only]

File Edit View Insert Format Tools Data Window Help

S47

**Macros MUST be enabled in Microsoft Excel for CT Calculator to work**

## Welcome to the CT Calculator

**Intended Audience:** Public drinking water systems that use ground water and want to determine if the chemical disinfection their system uses provides 4-log inactivation of viruses.

**Information Needed to for a Complete Data Point**

- 1. Type of Disinfection (Free Chlorine, Chlorine Dioxide, Chloramines, or Ozone)**
- 2. For each data point being used the:**
  - Residual Disinfection Concentration
  - Water pH
  - Water Temperature in Celsius
  - Peak Flow in gallons per minute
- 3. For each data point being used either the:**
  - Volume in Gallons.
  - OR**
  - Total volume of water storage tank(s) for each GWTF.
  - Length (in feet) and diameter (in inches) for each GWTF that has a cylindrical pipe.

Review Instructions and Example

Access User's Guide - Walkthrough of Inputs

Background Information and System Specifications

Begin Data Entry

Credit / Instructions / Input Sheet / User's Guide /

Ready NUM

💧 [http://www.asdwa.org/\\_data/n\\_0001/resources/live/GW%20CT%20Spreadsheet%20V8%20EPA.xls](http://www.asdwa.org/_data/n_0001/resources/live/GW%20CT%20Spreadsheet%20V8%20EPA.xls)



# Treatment

- 💧 Step 2: Determine log inactivation based on CT-value
- 💧 What is the pH?
- 💧 What is the water temperature at the point of injection?

# Treatment

## EPA CT Value Table

**Table 4-4. CT Values for Inactivation of Viruses by Free Chlorine, pH 6.0-9.0**

Degrees C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Inactivation (log)																				
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
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
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

CT values provided in the tables are modified by linear interpolation between 5°C increments.



# Treatment

- 💧 Step 3: Is there adequate inactivation?
- 💧 If not: increase chlorine, increase contact time, or consider supplementing with an alternative treatment technology



# Compliance Monitoring

- 💧 For systems that provide 4-log removal treatment, routine compliance monitoring must be performed to ensure that the treatment is effective and public health is protected.

# Compliance Monitoring

- 💧 Step 4: Chlorine Compliance monitoring
  - 💧 >3,000 population – continuous monitoring at a location at least equivalent to 1<sup>st</sup> customer.
  - 💧 <3,000 population – continuous monitoring at a location equivalent to 1<sup>st</sup> customer or 1 grab sample/day at the time of peak hourly flow.



# Compliance Monitoring

- 💧 What is “equivalent to 1<sup>st</sup> customer”?
- 💧 What is “peak hour flow”?
- 💧 How do I compile and submit the data?



# Alternative Treatment

- 💧 Treatment systems installed in series can be approved provided that the sum total of treatment provides 4-log (e.g. UV+chlorine, membrane filtration+ UV, UV+UV+UV). There are currently no known single UV units that will provide 4-log inactivation of viruses.

# Examples:

- 💧 Combination of treatment technologies (UV and chlorine, UV and membrane, etc.)
- 💧 UV units in series
- 💧 Membranes units in series



# Review: Alternative Treatment

- If you wish to submit data substantiating that a membrane filtration unit, UV disinfection system, or combination of treatment systems provides at least 4-logs of virus treatment, you must minimally provide the following as evidence:
  - Validation of the log treatment indicated for a treatment unit. Acceptable validation methods include, but are not limited to, verification through industry, state or federal studies, including USEPA's ETV program, or an actual in-situ validation conducted by the PWS.
  - Verification that the UV dose can be reliably delivered with the site specific conditions of the system (if applicable), including water chemistry, flow rate changes, redundancy, backup power, etc.
  - In the absence of DWS issued compliance monitoring requirements, a compliance monitoring plan that assures that the treatment unit(s) is/are being maintained to 4-log treatment of viruses.





# What is ETV?

## September 2008 Drinking Water Systems Center

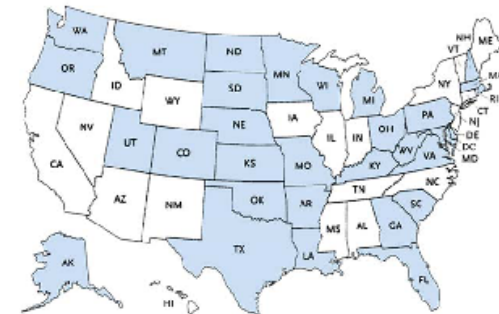
### Introduction

The NSF International (NSF) Drinking Water Systems (DWS) Center is one of several US EPA Environmental Technology Verification (ETV) centers dedicated to producing credible environmental performance data. The EPA Office of Research and Development (ORD) leads the ETV Program.

### DWS Center Key Features

The DWS Center's activities include development of verification protocols and test plans, independent testing and verification of equipment, conveying and supporting government/industry partnerships to obtain credible performance and cost data, and preparation of product-specific verification reports for broad dissemination. The DWS Center has targeted drinking water concerns such as arsenic reduction, microbiological contaminants, particulate removal, disinfection by-products, radionuclides, and other chemical contaminants. A stakeholder steering committee and technical panels help to advise the DWS Center on verification activities and direction.

The DWS Center currently has twenty-six test plans that outline testing procedures for various technologies. The Center has prioritized the following technology categories: low pressure membrane filtration, alternative membrane separation processes, adsorptive media and resins, coagulation and alternative filtration processes, UV & ozone disinfection and oxidation, ion exchange, air stripping, cartridge/bag filter processes, and on-site halogen generation systems. The DWS Center has also evaluated



residential Point-of Use (POU) devices, Point-of-Entry (POE) whole building systems, and mobile water treatment systems for their ability to remove chemical and biological agents of concern.

### EPA/ETV Report Recognition

In 2007 NSF survey of ASDWA members, thirty-five states reported they recognize NSF/EPA ETV reports for drinking water treatment systems, although mostly through policy (see map below). Utah is currently the only state with a formal reference to the ETV reports in their regulations. Massachusetts' water permit application mentions ETV and the State of Washington's water system design manual references ETV protocols for surface water treatment. Thirty-one states indicated they would allow for reduced pilot testing if the ETV report demonstrates adequate performance. Most stated that they would reduce the required pilot testing if source waters were similar to those in the ETV report.





# ETV

- 💧 Validates Treatment Technologies
- 💧 Establishes Validation Protocols
- 💧 Check website periodically

# Treatment

- 💧 Systems will be permitted to continue to use existing disinfection systems (chlorine, UV) that do not meet 4-log virus inactivation.

# Treatment

- 💧 PWSs that use chlorine, ozone or UV treatment that does not provide 4-log virus inactivation will likely be required to conduct additional monitoring to ensure that the treatment is not masking microbial pathogen contamination.

# Treatment

- 💧 Maintaining 4-log treatment does not remove the need to correct/maintain the infrastructure of the system.



# Treatment

- 💧 Don't forget...any treatment upgrades or installations must be approved by the DWS in advance (RCSA Section 19-13-B102(d)(2))
- 💧 General Application is available on our website.

**STATE OF CONNECTICUT DEPARTMENT OF PUBLIC HEALTH  
DRINKING WATER SECTION**

**PUBLIC WATER SYSTEM GENERAL APPLICATION FOR APPROVAL OR PERMIT**

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**Instructions**

Any regulated public water system (PWS) seeking an approval or permit (refer to list in Section C on following page) must submit this general application to the Department in addition to the applicable specific applications noted in Section C in order for the Department to initiate a review. This general application must be completed by either the administrative official or certified operator for the PWS. Sections A through E must be completed. Incomplete applications will be rejected. This general application form along with the applicable specific applications noted in Section C may be obtained from the DPH Drinking Water Section's web page by going to the DPH webpage at <http://www.ct.gov/dph> and clicking on the Drinking Water Section Link. Each phase of a multi-phase project requires a completed general application form.

Section A. Public Water System and Applicant Information	
PWS Name: _____	For new PWS indicate proposed name of PWS. A PWSID# will be assigned by the Department for a new PWS
Project Name: _____	
Project Address: _____	
PWSID Number: CT _____	PWS Type (select one): <input type="checkbox"/> Community <input type="checkbox"/> NTNC <input type="checkbox"/> TNC
Town: _____	DPH Project Number (if known): _____
Print Name of PWS Administrative Official or Certified Operator: _____	
Title: _____	
Address: _____	
_____	
_____	
Phone Number: _____	
Fax Number: _____	
E-mail Address: _____	
Signature of PWS Administrative Official or Certified Operator: _____ DATE _____	
Section B. Basis for Requesting Approval or Permit (select all that apply)	
<input type="checkbox"/> Formal Enforcement Action (Administrative Order, Consent Order, Notice of Violation (Civil Penalty))	
<input type="checkbox"/> Violation Identified in Sanitary Survey Report	
<input type="checkbox"/> Water Quality Exceedance (select all that apply): <input type="checkbox"/> MCL <input type="checkbox"/> Pb/Cu AL <input type="checkbox"/> Secondary MCL <input type="checkbox"/> Other: _____	
<input type="checkbox"/> Project Identified in Approved Water Supply Plan	
<input type="checkbox"/> Federal or State Grants or Loans <input type="checkbox"/> DWSRF <input type="checkbox"/> STEAP Funds <input type="checkbox"/> STAG Funds	
<input type="checkbox"/> Certificate of Public Convenience and Necessity (CPCN)	
<input type="checkbox"/> Proactive (system improvements or enhancements)	
<input type="checkbox"/> Other: _____	

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Rev 9/28/07



# Questions?