CLINTON COUNTY HEALTH DEPARTMENT
NEW! WATER SYSTEM DISINFECTION APPLICATION PACKET

• All PUBLIC WATER SYSTEMS MUST DISINFECT THEIR WATER SUPPLY!
• This Department recommends that a design professional; i.e., professional engineer or registered architect be engaged to prepare plans for installation of a water supply disinfection system. However, if an owner agrees to undertake all responsibility for the design and installation of relatively uncomplicated systems costing less than $5,000, a design professional may not be required if disinfection of a ground water source is the sole treatment and all acceptance conditions are met.
• You have 2 choices: (1) ULTRAVIOLET LIGHT or (2) CHLORINATION
• You must provide source water background information on Page 3 (yellow sheet)
• A 4-log inactivation of viruses is required by the Surface Water Treatment Rule. Under the Groundwater Rule, 4-log inactivation of viruses is required based upon raw water quality. The 4-log inactivation is calculated the same for both rules. Due to the new Groundwater Rule (12/1/2009), all NEW water systems using chlorine for disinfection must meet 4-log virus inactivation/removal.

Pros and Cons of UV Light versus Chlorination:

<table>
<thead>
<tr>
<th>UV LIGHT</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>No contact tanks required</td>
<td>May need pre-treatment of water</td>
</tr>
<tr>
<td>No chemicals to mix or handle</td>
<td>Not for use with an external distribution system</td>
</tr>
<tr>
<td>No disinfection by-products created</td>
<td>No residual disinfection provided</td>
</tr>
<tr>
<td>No effect on water taste or odor</td>
<td>Automatic solenoid shut-off valve required</td>
</tr>
<tr>
<td>Requires less space</td>
<td>Start-up costs may be expensive</td>
</tr>
<tr>
<td></td>
<td>Additional water sampling required prior to approval</td>
</tr>
<tr>
<td></td>
<td>Does not meet 99.99% removal/inactivation of viruses (as may be required by the Ground Water Rule)</td>
</tr>
<tr>
<td></td>
<td>When things go wrong – water shuts off!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHLORINATION</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides residual disinfection</td>
<td>Requires chemical handling and mixing</td>
</tr>
<tr>
<td>Inexpensive to operate</td>
<td>Contact tank(s) required</td>
</tr>
<tr>
<td>OK to use with external (underground) distribution system</td>
<td>Causes disinfection by-product formation</td>
</tr>
<tr>
<td>Usually no need for pre-treatment</td>
<td>May impart taste and odors to water</td>
</tr>
<tr>
<td></td>
<td>Requires DAILY chlorine measurement</td>
</tr>
</tbody>
</table>

CONSIDERATIONS:
If you choose ULTRAVIOLET LIGHT, you must have a raw water sample collected and tested by a certified laboratory for the parameters listed on Page 5. The results must be attached to this application for review. If the results indicate that pre-treatment is necessary, your proposal must also include additional information on the type of pre-treatment proposed. After completing the water tests, refer to Pages 5-9 (purple sheets).

If you choose CHLORINATION, at least 90% of all microbiological samples of raw water during the previous six months from the source(s) in question must not exceed 20 fecal coliform per 100 milliliters or 100 total coliform per 100 milliliters. If both fecal and total coliform analyses are performed, the fecal coliform results will take precedence. The treated water quality must meet the drinking water standards. The results must be attached to this application. After completing the water tests, refer to Pages 11-12 (light blue sheets).
CLINTON COUNTY HEALTH DEPARTMENT

Formal Request for Small Water System Disinfection Plan Approval

I request that the attached schematic for **Ultraviolet /Chlorine Disinfection** (circle one) and related information be accepted in lieu of plans prepared by a design professional. I certify that the aforementioned information is correct and accurate and the estimated cost of the project is less than $5,000. I agree to assume all responsibility for the disinfection system including hiring a design professional and replacement of the system if requested should the system fail to perform as required by Subpart 5-1 of the State Sanitary Code. I agree not to make changes to the proposed system without receiving prior approval from this office.

Facility Name__________________________________________________________
Facility Address (911 Address)__________________________________________
PWS ID# NY09 __ __ __ __ __
Owner Name (Print Clearly)______________________________________________
Owner Mailing Address__________________________________________________
Owner Telephone Number_________________________ email: ____________________
Owner Signature_________________________________________ Date______________

Applicant information (If different from Owner)
Applicant Name (Print Clearly)____________________________________________
Applicant Mailing Address________________________________________________
Applicant Telephone Number_________________________ email:_________________
Applicant Signature_________________________________________ Date______________

HEALTH DEPARTMENT USE ONLY:
Required Fee________ ($60.00 – single service connection; $120.00 – multiple service connections)
Date Fee Paid ___________ Receipt #_________________
Intake/Acceptance Recommended by_________________________ Date____________
Project Entered in eHIPS by________________________________ Date_____________
Engineering Review Accepted by________________________________ Date_____________
Plans Approved by (letter sent)________________________________ Date____________
Pre-Op Inspection by_________________________________________ Date_____________
Final *Letter of Approval by_________________________________ Date_____________

* Final approval of project requires field inspection by a CCHD Sanitarian or Engineer*

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1. Facility Name____________________________________ PWS ID#   NY09_______
Source Description_______________________________________________________________________
Well Casing Diameter______________   Total Well Depth_______________ Casing Depth______________
Static Water Level in Well___________ (feet below ground level).
Dynamic (pumping) Water Level in Well _______ Feet Below Ground Level.

*For all source types a groundwater under direct influence (GUDI) determination may be required.*

_____ Well Log Attached
_____  Plot Plan Attached (required – see Page 4)

2. Water Pump (may be in the well)
Manufacturer______________________________ Model____________________ Type________________
Pump Rating________________gpm at ______________ psi pressure.
Pressure switch setting:  **ON** at _____ psi.  **OFF** at _____ psi.

A minimum pressure of 20 psi is needed at user taps and fixtures.

3. Totalizing water meter location ____________, (daily records should be maintained when the water system is in use).

4. Pressure tank equipped with a pressure gauge.  Capacity in gallons ____________.

5. Raw water sampling tap location ____________________.

6. Treated water sampling tap location __________________.  (If chlorinating, free chlorine residual reading should be a minimum of 0.5 mg/L).
PLOT PLAN OF SITE

Place North arrow on the map.

Show all buildings, indicate height of building in stories; **Document the location and distance of the following features from each building and water supply source:**

- Septic or sewage system components
- Storm & sanitary sewers
- Parking lots (specify surface type)
- Other sources of microbial contamination (specify)
- Other sources of chemical contamination (specify)
- Streams or other surface water
- Drainage swales & ditches
- Property lines
- Manure piles
- Fuel storage
- Roads
- Waste lagoons
- Pool & beaches

If possible, document predominant slope of land at site showing surface features relative to water source and potential contamination sources.
UV LIGHT TESTING PARAMETERS***

Raw Water (before any treatment) quality data:
- Total Coliform
- Fecal Coliform
- Heterotrophic plate count
- And the following inorganic and physical constituents:

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UPPER GUIDANCE LEVELS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>0.3 mg/L</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.05 mg/L</td>
</tr>
<tr>
<td>Hardness (calcium)</td>
<td>120 mg/L</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>Non-detect</td>
</tr>
<tr>
<td>Turbidity</td>
<td>1 NTU</td>
</tr>
<tr>
<td>Color</td>
<td>15 APHA units</td>
</tr>
<tr>
<td>Suspended Solids</td>
<td>10 mg/L</td>
</tr>
<tr>
<td>UV Absorbance or UV Transmittance</td>
<td>0.155 cm-1 or 70% (lower limit)</td>
</tr>
</tbody>
</table>

* IF ANY of these levels are exceeded, then pre-treatment will be required and re-testing of the water will be required to show parameter is met after installation of pre-treatment equipment.

All testing must be conducted by a New York State Certified Laboratory

*** UV light disinfection system alone does NOT provide 4-log (99.99%) virus removal/inactivation****

**RESULTS OF ALL TESTING MUST BE SUBMITTED WITH THIS APPLICATION**
Applications must include sufficient information and/or meet the required criteria pertaining to all of the following guidelines listed below upon submittal to the Health Department.

- Does your system require 4-log (99.99%) removal/inactivation of viruses? UV light disinfection does NOT provide this. **As a result of the Groundwater Rule, should you be required to meet 4-log virus removal/inactivation you will be required to install additional treatment.**
- Does your water system provide water to more than one building? If yes, one UV unit is probably not acceptable for your water system. Please contact your inspector and discuss installing a continuous chlorination system. It may also be possible to install UV units in each building. If the answer is no, then proceed to the next item.
- A sketch or schematic of the water system showing all plumbing and treatment (meters, storage tanks, raw and finished water sampling taps, filters, softeners, disinfection, etc..) An example of an acceptable schematic is given (See Page 7)
- Manufacturer information sheets for the system components.
- Raw water results of satisfactory quality. If no, you need to choose another method of disinfection or install water treatment before the UV unit, so that water entering the unit does meet the parameters.
- A plot plan showing the location of the well, sewage disposal system, buildings, etc…
- A well log showing gallons per minute, depth of casing, soil conditions, capacity and type of pump.
- A signed and dated formal request (See Page 9).
- The proposed UV light must meet the design criteria below.

  - Ultraviolet radiation at a wavelength of 254 nm must be applied at a minimum dosage of 40,000 μW/cm² (same as 40 mW/cm²).
  - Maximum water depth in the chamber, measured from the tube surface to the chamber wall shall not exceed 3” unless the applicant can demonstrate the ability to achieve the requisite UV intensity transmitted through the proposed depth.
  - The ultraviolet tubes shall be:
    - Jacketed so that a proper operating tube temperature is maintained and;
    - The jacket shall be of quartz or high silica glass with similar optical characteristics.
  - Unit designed to permit mechanical cleaning of the water contact surface of the jacket without disassembly of the unit or be of such design that quick disassembly is possible for surface cleaning.
  - An automatic flow control valve, accurate within the expected pressure range, shall be installed to restrict flow to the maximum design flow of the treatment unit. The treatment unit shall be located before any storage tanks.
  - An accurately calibrated ultraviolet intensity meter, properly filtered to restrict its sensitivity to the disinfection spectrum, shall be installed in the wall of the disinfection chamber at the point of greatest water depth from the tube(s).
  - A flow diversion valve or automatic shut-off valve (solenoid valve) shall be installed which will permit flow into the potable water system only when at least the minimum ultraviolet dosage is applied. When power is not being supplied to the unit, the valve should be in a closed (fail safe) position which prevents the flow of water into the potable water system.
  - An automatic, audible alarm shall be installed to warn of malfunction or shutdown.
  - The unit shall be designed to protect the operator against electrical shock (GFI protection) or excessive radiation.
  - Installation of the unit shall be in a protected enclosure not subject to extremes in temperature.
  - A spare ultraviolet tube and other necessary equipment to affect prompt repair by qualified personnel properly instructed in the operation and maintenance of the equipment shall be provided on-site.
  - A copy of the bioassay results for the specified unit must be submitted. The bioassay shall have been performed by an independent laboratory for the manufacturer and be for the full operation range (i.e; 100-70%).

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CLINTON COUNTY HEALTH DEPARTMENT

ULTRAVIOLET DISINFECTION UNIT SCHEMATIC (GENERIC)

Facility Name________________________________________   PWS ID# NY____________________________

• Fill in manufacturers and model numbers for all components
• Enclose manufacturer’s specifications for ALL components of the UV system with this application
• UV light disinfection does NOT provide 4-log removal/inactivation of viruses. As a result of the Groundwater Rule, should you be required to meet 4-log virus removal/inactivation, you will be required to install additional treatment.

Manufacturer________________________________________    UV Model#_______________________________

NSF or Equivalent Approved____________________________   UV Intensity & Dosage_______________________

Flow Rate (mfg)______________________________________   Intensity Meter____________________________

Automatic Shut-off Valve_______________________________   Micron Filter Provided*____________________

Alarm: Audible___________ Visible________________________ Location to be Installed_____________________

Temperature relief valve  Y/N  Manufacturer _____________ Minimum system flow ______ gpm

Water Softener Needed: Yes / No

Manufacturer________________________________________   Model #__________________________________

Flow Restrictor_____________________ gpm

A partial schematic of an acceptable UV LIGHT installation is shown below. It may be used as a guide for the proposed installation of the above-noted facility. Please provide a complete water train schematic, showing ALL components of the water train such as softeners, filters or other treatment from well to distribution system (See Page 8). All information requested in this application must be completed and all construction must be in accordance with the accepted application.

* The 5 micron filter is required. **Temperature relief valve is required for low-flow situations

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UV LIGHT PROPOSED SCHEMATIC – Draw Below

Be sure to include the following in your drawing:

- Well
- Pressure Tank
- Raw Water Tap
- Pressure Switch
- Pressure Gauge
- Water Meter*
- Flow Restrictor
- Audible & Visible Alarm
- UV Light
- Water Softener
- Intensity Meter
- 5 Micron Filter
- Distribution System
- Automatic Solenoid Shut-off Valve

*Meters should be installed **horizontally** with at least 2 feet of pipe before and after.
OPERATOR'S RESPONSIBILITIES RECOGNIZED AND ACCEPTED

Ultraviolet Instructions for Water Supply Operation

Upon receiving approval for the proposed ultraviolet light disinfection unit schematic, installation of the unit is permitted. If changes are made during installation, you must contact the Health Department for prior approval. The checklist below is an obligatory testing schedule to maintain sufficient water quality standards. Records must be kept as part of an operational log to be maintained at the facility with relevant entries made for dates and types of maintenance as well as repairs, including annual bulb replacement and quartz sleeve cleaning.

- After installation, before serving water to the public, you must contact the Health Department to arrange for an inspection of the new ultraviolet unit.
- After the unit is installed correctly, the water must be analyzed for microbiological quality according to the following schedule:
  - One sample during the first week of installation DUE BY ________________
  - One sample at end of first month of operation DUE BY ________________
  - One routine sample quarterly or monthly of each operational year, depending upon your routine sampling schedule.

A. The owner must maintain a weekly operational log as designated by the Health Department.
B. Intensity meter readings must be in the proper range for disinfection at all times.
C. Bulb shall be changed at least annually and a spare bulb shall always be available at the facility.
D. Any interruption in treatment of a drinking water supply shall be reported immediately to this department. No change in source or method of treatment of a drinking water supply shall be made without first notifying and securing the approval of this office.
E. The operator/owner understands that UV light disinfection does NOT provide 4-log removal/inactivation of viruses. As a result of the Groundwater Rule (promulgated 12/2/1009), should this system be required to meet 4-log virus removal/inactivation, additional treatment will be required to be installed.

Send all completed operation reports to: Clinton County Health Department
133 Margaret Street
Plattsburgh, NY 12901

Direct any questions to: ____________________________ at (518) 565-4870.

I, ____________________________________________, ____________________________ am the designated (Print Name) (Title) water operator at ____________________________. I am authorized with absolute control of (Facility Name) all water system operation (record keeping, sampling and maintenance). To fulfill my responsibilities, I have read
and understood: (1) the above instructions and; (2) operation report instructions and blanks. I will record daily
activities and observations and test for bacteria as required by my sampling schedule, test for nitrate annually and
immediately report to CCHD any emergencies as defined on the operation report instruction sample.

__________________________________________      _______________________________
Signature of Water Operator                                                                                                                 Date

I, ____________________________________________ have given and explained the above
(CCHD Sanitarian) mentioned information.
Chlorination Schematic

Facility Name__________________________________ Facility PWS ID #________________________________

**Chlorine contact tank:** Capacity in gallons_________. This tank must be plumbed so the entire capacity is utilized (i.e., water enters at the bottom and exits at the top). A minimum of 30 minutes chlorine contact shall be provided. Multiply the pump rating on Page 3 by 30 to size the tank in gallons. If more than one source is used, the total of the pump ratings of all sources shall be multiplied by 30. **Example:** A 10 gpm pump requires a 300-gallon contact tank (i.e., 10 gpm x 30 minutes = 300 gallons).

**Chlorine solution tank:** Capacity in gallons_________. A 20 to 30 gallon plastic tank with cover manufactured for water treatment use is generally used. Venting of the tank to the outdoors is desirable.

**Hypochlorinator:** A positive displacement chemical metering pump equipped with an anti-siphon 4 in 1 valve. Manufacturer____________________________. Model_____________________________. Rating (gallons per day)________ at _________psi. The chlorinator must be electrically interconnected with the well pump so both start and stop simultaneously. Each well pump needs its own chlorinator unless the chlorinator is meter-driven.

A schematic of an acceptable chlorinator installation is shown below. It may be used as a guide for the proposed chlorination installation at the above-noted facility. *Please modify the schematic below to show YOUR system including any additional treatment such as softeners or filters.* All information requested in this application must be completed and all construction must be in accordance with the accepted application.

*Meters should be installed **horizontally** with at least 2 feet of pipe on either side. **See CT worksheet for estimating size.**
OPERATOR'S RESPONSIBILITIES RECOGNIZED AND ACCEPTED

Chlorination Instruction for Water Supply Operation

A. Free chlorine residuals should be checked and recorded at least once per day. A DPD type test kit must be used.
B. Free chlorine residual tests should be taken at the treated water sampling tap daily and at various cold water taps throughout the distribution system occasionally.
C. Free chlorine residual readings should be at least 0.5 mg/L at the treated water sampling tap and at least 0.2 mg/L throughout the distribution system.
D. Any interruption in treatment of a drinking water supply shall be reported immediately to this office. No change in the source or method of treatment of a drinking water supply shall be made without first notifying and securing approval of this office.
E. Note in the remarks column the sampling point (i.e., kitchen tap, Room 16 bathroom tap, main building outside tap, etc..) and any unusual circumstances (i.e., equipment failure, drinking water complaints, etc…).
F. Each chlorine solution tank should be calibrated for consistent solution strength. When refilling the solution tank, the ratio of disinfectant to water added shall remain the same (i.e., a 20-gallon tank requiring one pint of liquid chlorine to maintain a given concentration should have ½ pint of liquid chlorine added when 10 gallons of water are needed to refill the tank). The amount of liquid chlorine needed should be determined by measurement (i.e., markings on the outside of the tank or a measuring rod). Estimating the amount of disinfectant needed to refill the tank often results in extremely low or high readings.

Send completed operation reports to: CLINTON COUNTY HEALTH DEPARTMENT
133 MARGARET STREET
PLATTSBURGH, NY 12901

Direct any questions to___________________________________________________ at (518) 565-4870.

__________________________________________________________________________________________

I, _____________________________________________, ________________________________ am the
(Print Name)                                                                                                        (Title)
I am the designated water operator at ____________________________________________. I am authorized with
(Name of Facility) absolute control of all water system operation (record keeping, sampling and maintenance). To fulfill my
responsibilities, I have read and understand: (1) the above instructions and; (2) operation report instructions and
blanks. I will record daily activities and observations, test for bacteria as required by my sampling schedule, test
for nitrate annually and immediately report to CCHD any emergencies as defined on the operation report
instruction sample.

______________________________________________________________     _________________________
(Signature of Water Operator)                                                                                                                           (Date)

I_____________________________________________ have given and explained the above mentioned
(CCHD Sanitarian) information.
SUBMITTAL CHECK LIST (FOR UV AND CHLORINATION)

______ Signed application
______ Plot Plan of Site
______ Water Train Schematic
______ Water Test Parameter Sample Results (required for UV only)
______ Manufacturer’s Spec Sheets for all Components (tanks, cartridge filters, UV lights, solenoid valves, softeners, etc.)
______ Completed Water Source Information Form
______ Paid Fee
______ Capacity Development form completed (NCWS or CWS)
______ Task and Time Schedule/Construction Sequence

NEW WELLS

______ POC Sample Results (Table 9B)
______ SOC Sample Results (Table 9C)
______ PRI Sample Results (Table 8B)
______ Nitrate Sample Results
______ Nitrite Sample Results
______ Raw TC Sample Results

______________________________
______________________________
______________________________
______________________________
______ Pump Test (4hr.; 6hr.; 24hr.; 48hr.; 72hr.)
______ Well Driller’s log
______ GUDI testing needed ( less than 50 feet of casing/ within 200 feet of surface water?)

The attached DRAFT “Worksheet for Determining CT for 4-log Inactivation of Viruses” is for guidance purposes ONLY to assist you in designing your new chlorination system. The Clinton County Health Department (CCHD) has final authority over the size of the required chlorine contact tank. Use this worksheet to assist in designing and choosing your contact tank(s) for chlorination. This worksheet does not apply to UV light or other disinfection methods. UV light disinfection does NOT provide 4-log removal/inactivation of viruses. As a result of the Groundwater Rule, should you be required to meet 4-log virus removal/inactivation, you will be required to install additional treatment.

Any data you have (meter readings or other flow data, well pump specifications, pipe diameters, etc.) to determine actual and possible average daily flows and peak flows will provide a more accurate determination of the proper size contact tank you will need. 4-Log removal / inactivation of viruses means 99.99% of the viruses that could occur in your water are no longer able to cause illness to a person who drinks the water.

CT is the free chlorine residual concentration (mg/L) multiplied by the time the water is in contact with the chlorine (minutes). See attached worksheet for more information.

* * * * TAKE NOTE * * * *

We strongly recommend that you DO NOT purchase ANY system components until your plan has been approved by the Clinton County Health Department (CCHD) and you have received WRITTEN approval from the CCHD.

UV light disinfection does NOT provide 4-log removal/inactivation of viruses. As a result of the Groundwater Rule, should you be required to meet 4-log virus removal/inactivation, you will be required to install additional treatment.
WORKSHEET FOR DETERMINING CT FOR 4-LOG INACTIVATION OF VIRUSES

This worksheet is for estimation and guidance purposes only. Final tank size determination is up to the Clinton County Health Department.

A 4-log inactivation of viruses is required by the Surface Water Treatment Rule. Under the Groundwater Rule, 4-log inactivation of viruses is required based upon raw water quality. The 4-log inactivation is calculated the same for both rules.

Chlorine concentration should be measured downstream of all components and upstream of the first customer or at the first finished water tap.

To determine the contact time of a system, use the following two formulas:

Eq. 1  \[ CT (\text{mg/l} \times \text{min}) = \text{Concentration} (\text{mg/l}) \times \text{Time (min)} \]

Eq. 2  \[ \text{Time (min)} = \frac{\text{Volume of tank(s)} (\text{gal}) \times \text{baffling factor}}{\text{Peak flow (gal/min)}} \]

To determine the volume of the contact tank(s) needed, use the following formula:

Eq. 3  \[ \text{Volume of tank(s)} (\text{gal}) = \frac{CT (\text{mg/l} \times \text{min}) \times \text{peak flow (gal/min)}}{\text{Concentration (mg/l)} \times \text{baffling factor}} \]

Baffling factor based on tank configurations:

![Diagram showing baffling factors for different tank configurations](image)

NOTE: See Table 1 for baffling factor descriptions. Higher baffling factors may be assigned based on tank configurations (i.e., 0.7 for 3 tanks in series; 0.9 for 4 tanks in series). No credit is given to a tank with the same inlet and outlet (e.g., bladder pressure tank) See Table 2.

The water service line before the first customer or first finished water tap may be used for contact time. In this case, the baffling factor for the volume of water in the pipe will be 1.0. The volume of a pipe = \( \pi \times r^2 \times L \times 7.481 \text{ gal/ft}^3 \), where \( r \) = radius of pipe in feet and \( L \) = length of pipe in feet.
### Table 1

<table>
<thead>
<tr>
<th>Baffling Condition</th>
<th>Baffle factor</th>
<th>Baffling Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbaffled (mixed flow)</td>
<td>0.1</td>
<td>None, agitated basin, very low length to width ratio, high inlet and outlet velocities.</td>
</tr>
<tr>
<td>Poor</td>
<td>0.3</td>
<td>Single or multiple unbaffled inlets and outlets, no intra-basin baffles.</td>
</tr>
<tr>
<td>Average</td>
<td>0.5</td>
<td>Baffled inlet or outlet with some intra-basin baffles.</td>
</tr>
<tr>
<td>Superior</td>
<td>0.7</td>
<td>Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir.</td>
</tr>
<tr>
<td>Perfect</td>
<td>1.0</td>
<td>Very high length to width ratio (pipeline flow), perforated inlet, outlet and intra-basin baffles.</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Tanks in series</th>
<th>Tank Configuration</th>
<th>Baffling Factor</th>
<th>Total Volume</th>
<th>Number/Size of Tank(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fig 1.1</td>
<td>0.1</td>
<td>8650</td>
<td>1 – 8650 gal</td>
</tr>
<tr>
<td></td>
<td>Fig 1.2</td>
<td>0.3</td>
<td>2884</td>
<td>1 – 2884 gal</td>
</tr>
<tr>
<td>2</td>
<td>Fig 1.1</td>
<td>0.3</td>
<td>2884</td>
<td>2 – 1442 gal</td>
</tr>
<tr>
<td></td>
<td>Fig 1.3</td>
<td>0.5</td>
<td>1730</td>
<td>2 – 865 gal</td>
</tr>
<tr>
<td>3</td>
<td>Fig 1.1</td>
<td>0.5</td>
<td>1730</td>
<td>3 – 577 gal</td>
</tr>
<tr>
<td></td>
<td>Fig 1.2</td>
<td>0.7</td>
<td>1236</td>
<td>3 – 412 gal</td>
</tr>
<tr>
<td></td>
<td>Fig 1.2</td>
<td>0.9</td>
<td>962</td>
<td>4 – 241 gal</td>
</tr>
</tbody>
</table>

### Determination of Peak Flow

Determination of peak flow should be on a case-by-case basis. Whenever possible, actual water meter readings should be used to determine peak flow. Another option is to use a flow restrictor installed after the contact tank(s). For small, uncomplicated systems, where a water meter or flow restrictor cannot be used, it may be appropriate to use the well pump capacity as the peak flow or determine the practical limitation on peak flow based on pipe size (i.e., ¾” pipe will not realistically allow more than 7.5 gpm flow). However, complicating factors such as the location of hydropneumatic tank(s), distribution pumps, multiple water sources and complex distribution systems may necessitate an engineering evaluation to determine peak flow.

### Table 2A: CT (mg/l * min) values for inactivation of viruses by free chlorine, pH 6-9

<table>
<thead>
<tr>
<th>Log Inactivation</th>
<th>1°C (34F)</th>
<th>5°C (41F)</th>
<th>10°C (50F)</th>
<th>15°C (59F)</th>
<th>20°C (68F)</th>
<th>25°C (77F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5.8</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>8.7</td>
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<td>1.5</td>
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<tr>
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<td>8.0</td>
<td>6.0</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Notes: 1. For temperatures not shown use interpolation to determine CT.
2. Temperature is measured at the entry point, for seasonally varied temps, use “worse case” i.e. coldest temp.

### Example #1

Determine if the CT is adequate for 4-log virus inactivation at a groundwater system with the following characteristics:

- pH = 6.5
- Temperature = 5°C
- Cl₂ concentration at the 1st user = 0.8 mg/l
- Well pump capacity = 25 gal/min
- Contact tank(s) with configuration as noted below
- A hydropneumatic tank located after the contact tank(s)

From Table 2A we can see that the CT required for this system is 8.0 mg/l * min.
Configuration 1: One 120-gallon contact tank with a configuration similar to Fig. 1.2
Combine Eq. 1 and Eq. 2
\[
CT = \text{Concentration} \times (\text{volume of tank(s)} \times \text{baffling factor/peak flow})
\]
\[
CT = 0.8 \text{ mg/l} \times (120 \times 0.3 / 25 \text{ gal/min}) = 1.15 \text{ mg/l} \times \text{min}
\]
The available CT is not adequate.

Configuration 2: Two 120-gallon contact tanks with a configuration similar to Fig. 1.3
Combine Eq. 1 and Eq. 2
\[
CT = \text{Concentration} \times (\text{volume of tank(s)} \times \text{baffling factor/peak flow})
\]
\[
CT = 0.8 \text{ mg/l} \times (240 \text{ gal} \times 0.5 / 25 \text{ gal/min}) = 3.84 \text{ mg/l} \times \text{min}
\]
March 25, 2008

If a UV light is added to example #3, you only have to design for 3.5-log inactivation of viruses. UV disinfection (39 mj/cm² dose) is awarded 0.5-log inactivation of viruses according to Table 3 in the 12/7/2007 fact sheet. The CT required will only be 5, according to Table 2A. The equation will then read:

Using Eq. 3:
\[
\frac{CT \times \text{Peak flow}}{\text{Concentration} \times \text{Baffling Factor}}
\]
\[
(5 \text{ mg/l} \times \text{min} \times 10 \text{ gal/min}) / (0.2 \text{ mg/l} \times 0.3) = 834 \text{ gallons required for contact time (assuming one tank is used).}
\]

A substantial reduction in the size of the storage tank is needed when designing for 4-log inactivation of viruses instead of 0.5-log inactivation of Giardia.
System Diagram – include all pumps, tanks, treatment, hydropneumatic tanks, meters, etc...

**Water / System Characteristics**

Water Temperature:__________                                    Water pH:__________

Chlorine concentration at first tap/first customer:___________________________________________

Number / size of chlorine contact tanks:__________________________________________________

Total storage provided:_______________________________________________________________

Description of inlet and outlet on each contact tank:______________________________________
__________________________________________________________________________________

Baffling factor:_______________________

Average daily flow:___________________                                     Peak flow:_____________________

Well pump capacity:__________________

Does the system have a flow restrictor?   Y / N                If yes, size______________

Does the system have a UV light?            Y / N                If yes, size______________

Does the system have a raw water tap?   Y / N

Determine available CT from above information.

\[ CT_{ACT} \text{ (mg/l * min)} = \text{concentration (mg/l)} \times \text{volume of tank(s) (gal)} \times \text{baffling factor (from worksheet)} \]

\[ \text{Peak flow (gal/min)} \]

\[ \text{_____ (mg/l * min)} = \frac{(\text{mg/l})}{(\text{gal/min})} \times (\text{gal}) \times (\text{gal/min}) \]

**Table 2A: CT (mg/l * min) values for inactivation of viruses by free chlorine, pH 6-9**

<table>
<thead>
<tr>
<th>Log Inactivation</th>
<th>1°C</th>
<th>5°C</th>
<th>10°C</th>
<th>15°C</th>
<th>20°C</th>
<th>25°C</th>
</tr>
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<tr>
<td>2</td>
<td>5.8</td>
<td>4.0</td>
<td>3.0</td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
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<td>6.0</td>
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</tr>
</tbody>
</table>

If \( CT_{ACT} \)_____ > \( CT_{REQ} \)_____ there is sufficient contact time.

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Prepared by CNYRO Water Field Coordinators

DRAFT

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