NEW YORK STATE DEPARTMENT OF HEALTH OFFICE OF PUBLIC HEALTH CENTER FOR ENVIRONMENTAL HEALTH TECHNICAL REFERENCE	**ITEM NO:** PWS-186 **DATE:** 3/6/04 **SUBJECT:** Ultraviolet Light Disinfection Page 1 of 9

PURPOSE

To provide updated guidance on the use and acceptance of ultraviolet light disinfection for public water supplies. The major revision in this document from the 10/25/01 release is that ultraviolet disinfection units rated at 30 gpm or less must now be ANSI/NSF standard 055, listed under the Class A Disinfection Performance standard.

BACKGROUND

Over the past two decades Ultraviolet radiation (UV) applied at a 254 nm wavelength has been shown to be an effective disinfection process against bacteria. The Department has approved the use of this technology during that period for non-community water systems with properly protected groundwater sources. Research has documented that UV (using low and medium pressure lamps) is also effective for inactivating organisms found in surface water, such as giardia and cryptosporidium, if properly applied design criteria are used.

GENERAL

1. The UV disinfection process will now be considered as a primary disinfection process for an expanded range of public water supplies (PWS). These include community and non-community systems using groundwater sources as well as properly filtered surface water sources. In addition, the UV process can be considered for surface supplies that meet the filtration avoidance criteria enumerated in Subdivision of 5-1.30(c) of Subpart 5-1 of the State Sanitary Code.

2. Since no disinfection residual results from the UV process it will be necessary to supplement this disinfection process with post-chlorination to achieve a distribution residual for those systems with an external distribution system. (Please note that our existing guidance of allowing UV without post-chlorination at groundwater systems without an external distribution system, e.g., restaurants, Agriculture and Markets facilities, single building apartment complexes, etc. will continue.)

3. For simple design/installations for existing non-community systems utilizing a properly protected groundwater source with no external distribution network, the system owner may not need to engage the services of a licensed professional engineer (PE) or registered architect (RA) provided that the cost of the UV system is less than $5000. The reviewing Local Health Department (LHD) will have the discretion to accept the design. The decision by the LHD will

depend upon the availability of a PE on staff to accept and conduct a thorough design review and approval and LHD staff conducting a Completed Works inspection of the installation to verify that it was completed in accordance with approved plans/schematics at the time of the completed work inspection. A PE or RA must be utilized in situations when pre– or post- treatment is necessary due to source water quality conditions, where a surface source is employed, or where an external distribution system exists.

DESIGN SUBMITTALS AND APPROVAL

The UV disinfection installation proposal **must** address source and site conditions, raw water quality characteristics, other existing or proposed treatment processes and details on the proposed UV unit. Information required includes:

a) Source water type i.e., ground water or surface water, location, any available well log (if ground water) information and construction details.

b) Locations of, and distances to, potential sources of contamination.

c) Raw and filtered water quality data*****, including microbiological data (total coliform, fecal coliform, heterotrophic plate count), and the following inorganic and physical constituents:

PARAMETER	**DESIGN LIMIT**
Iron	0.3 mg/l
Manganese	0.05 mg/l
Hardness (calcium)	300 mg/l
Hydrogen Sulfide	1 mg/l
Turbidity	1 ntu
Color	15 APHA units
Suspended solids	10 mg/l
UV Absorbance	0.155 cm^{-1} **or**
UV Transmittance	70%

d) If any of the design limits for the water quality parameters included in c) are exceeded, a proposal for additional treatment to achieve acceptable levels must be included.

e) Applicants with surface sources or groundwater sources under the direct influence of surface water must provide filtration prior to the UV unit or meet filtration avoidance criteria.

*****The water quality parameters listed are for existing sources. New sources require more extensive testing i.e. full Part 5 analysis to demonstrate satisfactory quality, refer to the Environmental Health Manual Item PWS-131 for a definition of a full part 5 analysis.

The design must incorporate those criteria listed in Appendix A "Design Criteria for Ultraviolet Disinfection Units" (Appendix A is available separate from this Technical Reference for distribution to the public). In addition, for those installations being considered for surface sources, the number of units/lamps, intensities and dosage must be appropriately selected to insure 2 log crypto inactivation; an even higher inactivation capability may be required depending source water quality. Water quality parameters that could impair this intensity/dosage such as turbidity, naturally occurring UV absorption matter etc. must be factored into these decisions. Where necessary the design must incorporate appropriately selected and sized pre – and/or post-treatment. Appendix B – "Ultraviolet Disinfection Unit Review and Approval" is available separate from this Technical Reference as a useful handout that LHD's can provide to applicants, particularly for installations at small PWS's.

COMPLETED WORKS

Following installation, the supplier of water must submit total coliform sample results demonstrating satisfactory performance prior to providing water to the consumer. In addition, the LHD at the time of the completed work inspection must determine that the appropriate UV Dosage (minimum of 40 mJ/cm^2) is being achieved by checking that the intensity meter reading is at or above 70%. In addition, at least one total coliform sample must be collected during the first month of operation and at the prescribed monitoring frequency thereafter to ensure satisfactory performance. An operation log shall be maintained at the facility and entries shall be made for dates and types of maintenance and repair, including cleaning, bulb replacement, etc. At a minimum annual cleaning of the quartz sleeve and annual bulb replacement shall be required.

OPERATION REPORTS

A separate water systems operation report for UV disinfection will be available and will also include sampling information similar to the current water systems operation reports (DOH-360). A draft of the UV operations report is attached for use until the final report is released. UV operation reports should be submitted along with any microbiological sampling reports (monthly, quarterly, or otherwise; as required).

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APPENDIX A
DESIGN CRITERIA FOR ULTRAVIOLET DISINFECTION UNITS

1. Ultraviolet Disinfection units with a capacity of 30 gpm or less must be ANSI/NSF validated and listed with the National Sanitation Foundation under Standard ANSI/NSF Standard 055 Disinfection Performance Class A.

2. Ultraviolet radiation at a wavelength of 254 nm must be applied at a minimum dosage of 40,000 microwatt-seconds per square centimeter at all points throughout the water disinfection chamber.

3. Maximum water depth in the chamber, measured from the tube surface to the chamber wall shall not exceed three inches unless the applicant can demonstrate the ability to achieve the requisite UV intensity transmitted through the proposed depth.

a) The ultraviolet tubes shall be;

b) jacketed so that a proper operating tube temperature is maintained and;

c) the jacket shall be of quartz or high silica glass with similar optical characteristics.

4. The unit shall be 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.

5. 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.

6. 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 or tubes.

7. A flow diversion valve or automatic shut-off 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.

8. An automatic, audible alarm shall be installed to warn of malfunction or impending shutdown.

9. The unit shall be designed to protect the operator against electrical shock or excessive radiation.

10. Installation of the unit shall be in a protected enclosure not subject to extremes of temperature.

11. A spare ultraviolet tube and other necessary equipment to effect prompt repair by qualified personnel properly instructed in the operation and maintenance of the equipment shall be provided on site.

12. For units larger than 30 gpm, a copy of the bioassay results validating the units ability to deliver 40,000 miscrowatt-seconds per square centimeter 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 (e.g. 100%-70%).

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APPENDIX B
Ultraviolet Disinfection Unit Review and Approval

Installation of an ultraviolet (UV) light disinfection unit may be allowed for some public water supplies required to provide disinfection. Prior to installation, the unit must be approved by the local health department (LHD) having jurisdiction. Following, in order, are the steps to take:

1. A raw water sample must be collected and tested by a certified laboratory for the parameters listed below in item 1.a. The results must be sent to the LHD for review and acceptance. If the results indicate that pretreatment is necessary, the proposal must also include additional information on the type of pretreatment proposed.

a) Raw and filtered water quality data*****, including microbiological data (total coliform, fecal coliform, heterotrophic plate count), and the following inorganic and physical constituents:

PARAMETER	UPPER GUIDANCE LEVELS
Iron	0.3 mg/l
Manganese	0.05 mg/l
Hardness (calcium)	300 mg/l
Hydrogen Sulfide	1 mg/l
Turbidity	1 ntu
Color	15 APHA units
Suspended solids	10 mg/l
UV Absorbance	0.155 cm^{-1} **or**
UV transmittance	70%

2. The proposal submitted to the LHD for approval must include the following:

a) All the criteria detailed in the enclosed guideline, "Design Criteria for Ultraviolet Disinfection Units".

b) 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.). A schematic of an acceptable ultraviolet installation is attached.

c) Manufacturer information sheets for the system components.

*****The water quality parameters listed are for existing sources. New sources require more extensive testing i.e. full Part 5 analysis to demonstrate satisfactory quality, refer to the Environmental Health Manual Item PWS-131 for a definition of a full part 5 analysis.

d) A plot plan showing the location of the well, sewage disposal system, buildings, etc.

e) A well log showing gallons per minute, depth of casing, soil conditions, capacity and type of pump.

f) A signed and dated formal request (see page 8).

3. After receiving proposal approval, install the unit as approved. If any changes are anticipated during installation, contact your LHD for prior approval.

4. After installation, contact your LHD to arrange an inspection of the unit's installation.

5. After the unit has been installed correctly, the water should be analyzed for bacteriological quality according to the following schedule:

a. One sample the first week.

b. One sample monthly or quarterly as directed by the LHD. If you have any questions, please contact your LHD.

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ULTRAVIOLET DISINFECTION UNIT SCHEMATIC

Manufacturer _____ Model # _____

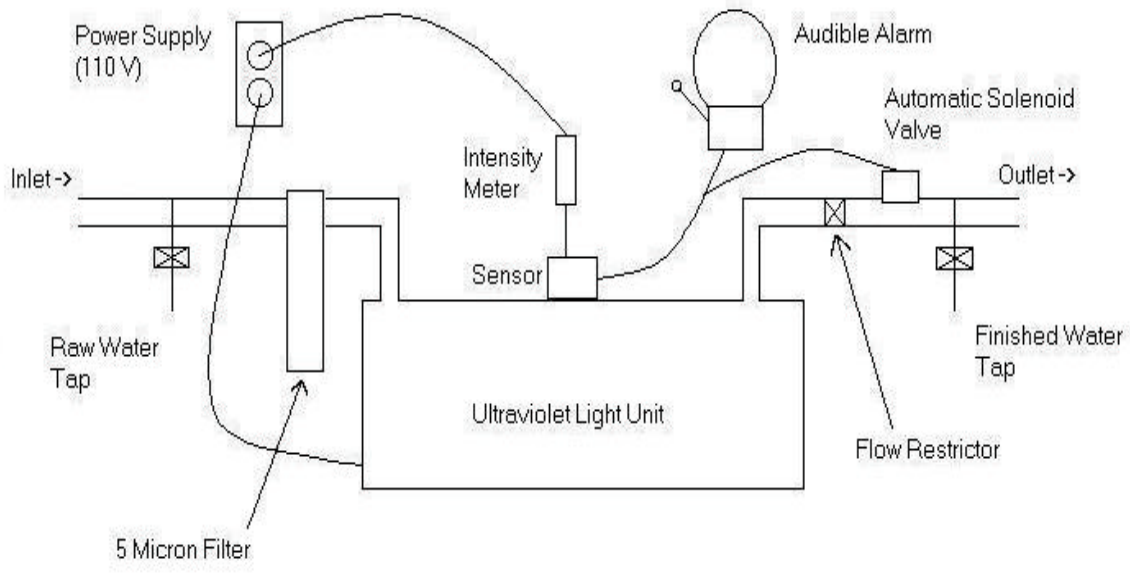
NSF or equivalent Approved _____ UV Intensity & Dosage _____

Flow Rate (mfg) _____ Intensity Meter _____

Automatic Shut Off Valve _____ Micron Filter Provided* _____

Alarm _____ Location to be Installed _____

* The 5 micron filter is recommended but not required.



FORMAL REQUEST

I request that this schematic for UlltraViolet Disinfection 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 then $5000. 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 _____

_____ _____
Owner/Applicant Signature Date

_____ _____
Owner/Applicant Name (clearly printed) Phone Number

Acceptance
Recommended by: _____ _____
NYS Health Department or LHD Staff Date

Accepted by: _____ _____
Permit Issuing Official Date
NYS Health Department or LHD Staff

Inspected by: _____ _____
NYS Health Department or LHD Staff Date

This formal request is available separate from this Technical Reference for distribution to the public