

PURPOSE: This document provides the requirements for ultraviolet (UV) disinfection for inactivation of *Cryptosporidium* at public water systems in the State of Louisiana. This policy serves to protect public health, safety, and welfare by establishing consistent procedures for approving all elements of the UV treatment unit (reactor) and ensuring that the UV treatment complies with all applicable rules and regulations of the Office of Public Health – Engineering Services Section. This policy is based on and references the federal Long Term 2 Enhanced Surface Water Treatment Rule (40 CFR 141.700-722) and the EPA 2006 Ultraviolet Disinfection Guidance Manual (2006 UVDGM¹).

I. General Requirements:

- A. Systems can receive *Cryptosporidium*, *Giardia lamblia*, and virus treatment credits for ultraviolet (UV) light reactors by achieving the corresponding UV dose values shown in 40 CFR §141.720(d)(1). Systems must validate and monitor UV reactors as described in 40 CFR §141.720(d)(2) and (3) to demonstrate that they are achieving a particular UV dose value for treatment credit.
- B. The treatment credits listed in UV Dose Table [see 40 CFR §141.720(d)(1)] are for UV light at a wavelength of 254 nm as produced by a low pressure mercury vapor lamp. The UV dose values in this table are applicable only to post-filter applications of UV in filtered systems and to unfiltered systems.
- C. Systems must use UV reactors that have undergone validation testing to determine the operating conditions under which the reactor delivers the required UV dose (*i.e.*, validated operating conditions). These operating conditions must include flow rate, UV intensity as measured by a UV sensor, and UV lamp status.
 1. When determining validated operating conditions, systems must account for the following factors: UV absorbance of the water; lamp fouling and aging; measurement uncertainty of on-line sensors; UV dose distributions arising from the velocity profiles through the reactor; failure of UV lamps or other critical system components; and inlet and outlet piping or channel configurations of the UV reactor.
 2. Validation testing must include the following: Full scale testing of a reactor that conforms uniformly to the UV reactors used by the system and inactivation of a test microorganism whose dose response characteristics have been quantified with a low pressure mercury vapor lamp.
 3. For a reactor validated offsite, the system must simply stay within the validated range of operating conditions and maintain the reactor.
- D. Systems must monitor their UV reactors to determine if the reactors are operating within validated conditions. This monitoring must include UV intensity as measured by a UV sensor, flow rate, lamp status, and other parameters designated below based on UV reactor operation. Systems must verify the calibration of UV sensors and must recalibrate sensors in accordance with a protocol the State approves.
- E. To receive treatment credit for UV disinfection, systems must treat at least **95 percent** of the water delivered to the public during each month by UV reactors operating within validated conditions for the required UV dose. Systems must demonstrate compliance with this condition by the monitoring the UV reactors.

¹2006 UVDGM - http://www.epa.gov/ogwdw/disinfection/lt2/pdfs/guide_lt2_uvguidance.pdf

II. Design Submittal Requirements:

Parameter	Requirement (items below must be included)
Plant Process design flows and treatment diagram	Refer to 2006 UVDGM, Sections 3.3 (Identifying Potential Locations for UV Facilities) and 3.4.3. (Design Flow Rate). Bypassing the UV unit is not allowed.
Water quality data of water entering the UV unit (post filtration)	6-12 months of UV transmittance (UVT), Turbidity, Calcium, Alkalinity, Manganese, Iron, Hardness, pH, Suspended Solids. Refer to 2006 UVDGM, Section 3.4.4. (Water Quality)
UV Reactor	<p>Items listed in Checklist 5.1 of the 2006 UVDGM (pages 5-45 & 5-46)</p> <ul style="list-style-type: none"> • UV Housing specifications - Stainless steel 304 or 316L • Lamp sleeve specifications - Type 214 clear fused quartz or equal • Wetted materials/coatings – certified by NSF Standards 61 • Alarms/signals for dose-monitoring parameters • Instantaneous flow measurement and control is required for each UV reactor
UV configuration diagram	One of the configurations in Section 3.6.2 of the 2006 UVDGM
Validation Testing and Report	Validation protocol, test facility, third party oversight certification, validated operating parameters and items listed in Checklists 5.2 through 5.5 of the 2006 UVDGM
Dose-monitoring Strategy/ Approach	Either “UV Intensity Setpoint” or “Calculated Dose” (see Section 3.5.2 of the 2006 UVDGM)
Disinfection Goal	Log inactivation credit
Monitoring equipment calibration	Flow, UVT, UV intensity, and influent water turbidity
Delivery of Required Design Dose	Online backup UV reactor or an operating scheme to provide required dose when a reactor fails, is taken out-of-service or operates off-specification (Section 3.4.1 of the 2006 UVDGM)
Lamp cleaning strategy	Chemical cleaning solutions must meet NSF/ANSI 60 Standard.
Power quality	Backup power and lamp start-up and restart times

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III. Monitoring, Recording and Reporting Requirements:

Dose-monitoring Approach (UV Intensity Setpoint or Calculated Dose)	<p>Must continuously monitor (every 5 minutes) and record the following parameters for each UV reactor and record (every 4 hours) per Table 6.7 (Section 6.4.1.4 of the 2006 UVDGM):</p> <ul style="list-style-type: none"> • UV Intensity Setpoint – UV intensity, flow rate and lamp status • Calculated Dose – Calculated dose, Validation factor, validated dose, flow rate, UVT, and lamp status
UV Sensor Calibration	Must be verified when being turned on and at least monthly (Section 6.4.1.1 of the 2006 UVDGM)
UVT Analyzer Calibration (for Calculated Dose Approach)	Must be verified when being turned on and at least weekly (Section 6.4.1.2 of the 2006 UVDGM)
Production Volume	Off-specification events (see below) and monthly total. Less than 5% of the volume treated by UV reactor on a monthly basis can be off specification.
Off-specification Alarms	Monitor and record at least every 5 minutes.
Off-specification Events	<ul style="list-style-type: none"> • Flow rate is greater than the validated range; • UVT is less than validated range (for Calculated Dose Approach); • UV intensity is less than validated setpoint (for UV Intensity Setpoint Approach); • Validated dose is less than required UV dose at a given flow rate (for Calculated Dose Approach); • Lamp status outside the validated range; • Duty UV sensor and/or on-line UVT analyzer is out of calibration; • Unequal component/reactors parts are used.
Recommended parameters to monitor	Recommend monitoring in accordance with Table 6.8 (Section 6.4.2 of the 2006 UVDGM).
Report by the treatment compliance date	Validation test results demonstrating operating conditions that achieve required UV dose.
Report within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date	Monthly report summarizing the percentage of water entering the distribution system that was not treated by UV reactors operating within validated conditions for the required dose as specified in 40 CFR §141.720(d).
Record maintenance	Systems must keep the results of treatment monitoring for 3 years.

¹2006 UVDGM - http://www.epa.gov/ogwdw/disinfection/lt2/pdfs/guide_lt2_uvguidance.pdf