

UTAH DIVISION OF DRINKING WATER UV REACTOR MONITORING AND REPORTING PROTOCOL

(Last Update February 17, 2011)

This document provides clarifications and specifications on the UV monitoring and reporting requirements. *R309-215-15(19)(d)(iii)* states “*This monitoring must include UV intensity as measured by a UV sensor, flow rate, lamp status, and other parameters the Executive Secretary designates based on UV reactor operation. Systems must verify the calibration of UV sensors and must recalibrate sensors in accordance with a protocol the Executive Secretary approves.*” This Monitoring and Reporting Protocol also applies to other water systems using UV for disinfection inactivation credit. The Executive Secretary may reduce the requirements of monitoring and reporting on a case by case basis for the water systems that use UV as ancillary means of disinfection and do not claim credit for UV disinfection, or the water systems with UV facility of limited capacity.

1. UV Reactor Monitoring Requirements

(1) To obtain disinfection credit of UV disinfection, the water systems shall monitor the parameters used as part of the dose monitoring algorithm continuously, i.e. at least once per minute. For example, UV reactors validated using the Calculated Dose Approach must monitor the following parameters continuously for each UV reactor that is in use, including flow rate, UVT, UV intensity sensor reading, lamp status, number of lamp rows on, calculated or validated dose, power ballast setting, and off-specification time.

(2) Other parameters that are essential to operation and maintenance shall be monitored at the frequency recommended by the UV manufacturer or per EPA’s *2006 Final UVDGM*. Examples of these operational parameters:

- (a) Reactor status and run time
- (b) Water temperature
- (c) Lamp hours
- (d) Lamp sleeve cleaning records
- (e) Cumulative number of lamp on/off cycles
- (f) Calibration and verification of UV sensors
- (g) Calibration of on-line UVT analyzers
- (h) Date (or frequency) and type of maintenance/replacement of UV reactor components

2. Additional UV Reporting Requirements

(1) Compliance reporting for approved UV disinfection credit shall be submitted to the State as a part of the surface water treatment rule compliance report on a monthly basis. The recording frequency shall be at least every 4 hours. The minimum validated dose recording is the lowest validated dose reading within a period of 4 hours. The daily minimum validated dose is the lowest value among the four-hour minimum values for each day.

(2) As a minimum, the following parameters shall be included in the UV monthly compliance report:

- (a) Daily minimum and maximum flow rate
- (b) Daily minimum UVT
- (c) Daily minimum validated dose (This depends on the dose monitoring approach. Use UV intensity in case of UV Intensity Setpoint Approach)
- (d) Daily minimum ballast power setting
- (e) Daily production volume for off-specification events
- (f) Total production volume through UV system in a month
- (g) Total Production volume for off-specification events in a month
- (h) Total off-specification percentage (based on monthly volume)
- (i) Target pathogen (Cryptosporidium, Giardia, and virus)
- (j) Target log disinfection
- (k) Actual log disinfection
- (l) Date of monthly verification of duty UV sensor calibration and date of yearly calibration of Reference UV sensor
- (m) Total number of UV sensors per reactor
- (n) Number of UV sensors per reactor in service that were verified for calibration
- (o) Number of verified sensors that were within the acceptable range of tolerance

- (p) Reactor number and UV intensity sensor correction factor (if any UV intensity sensor does not meet the calibration criteria and remains in service in a particular reactor)
- (q) Date of weekly calibration of on-line UVT analyzers
- (r) Indication of whether or not the UV facility met the following criteria:
 - (i) Total log disinfection greater than target log disinfection
 - (ii) Flow rates less than the maximum validated flow rate
 - (iii) At or above validated minimum UVT (if using the calculated dose approach as monitoring strategy)
 - (iv) At or above validated power ballast minimum setting
 - (v) At or above the required dose or UV intensity
 - (vi) Within the 5% off specification limit of the total volume of treated water each month

(3) Off Specification Reporting.

The requirements of off specification reporting in this section are largely based on Section 6.4.1.3 of the *2006 Final UVDGM*.

- (a) The calculated off specification percentage is based on the volume of water treated through the UV system. The off specification percentage must be no more than 5% of the monthly total production. The off specification total volume should be calculated by totaling the off-specification time and associated volume released during those periods for each UV reactor (see Section 6.5.1 of the *2006 Final UVDGM*).
- (b) Five factors shall be considered contributing to off specification events:
 - (i) The UV facility operates outside of the validated limits, for example, validated dose is below required dose, flow rate greater than the maximum validated flow rate, UVT below minimum validated value, ballast setting below the validated power setting, etc.
 - (ii) A UV sensor is not in calibration. For example, any of the duty sensors did not meet the calibration criteria, the failed duty sensors were not replaced with calibrated duty sensors, or a UV sensor correction factor was not applied.

(iii) The UVT analyzer, which is part of the dose monitoring strategy, is found to be out of calibration and the remedial actions are not completed per the protocol prescribed in 6.4.1.2 of the 2006 *Final UVDGM*.

(iv) UV equipment and replaced components are not equivalent to or better than the equipment components validated. This UV equipment remains off specification until proper replacement takes place.

(v) Failure of flow meters or missing data necessary for dose calculation.

(4) UV Sensor Calibration and Reporting.

(a) The monthly compliance report shall contain:

(i) Total number of UV sensors per reactor

(ii) Number of UV sensors per reactor in service that were verified for calibration

(iii) Number of verified sensors that were within the acceptable range of tolerance.

(a) The water systems shall have adequate inventory of duty UV sensors to allow immediate replacement of a failed duty UV sensor.

(b) Re-calibrate or replace duty UV sensors if excessive drift or error occurs (i.e. greater than 20%).

(c) Reference UV sensor shall be calibrated at least once a year at a qualified facility (such as the manufacturer). The date of the most recent UV reference sensor calibration shall be included in the compliance report to the State.

(d) Duty sensors shall be verified for calibration at least monthly by verifying with at least two (2) reference sensors. All UV sensors in operation that month shall be verified for calibration. Date of the UV duty sensor verification shall be reported in the monthly report.

(e) The water systems shall follow the verification protocol of duty UV sensors specified in Section 6.3 of the EPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006 Final UVDGM). UV sensor correction factor shall

be included in the compliance report if a failed duty UV sensor is not replaced with a calibrated duty UV sensor. However, this approach shall not be used for long-term operation and the UV sensor problem should be resolved as quickly as possible.

(f) If a UV sensor correction factor (CF) is applied to allow a UV duty sensor that failed the UV sensor verification criteria to remain in service on an interim basis, the reactor number, the UV sensor number, and its UV sensor correction factor must be reported.

(5) UVT Analyzer Calibration and Reporting.

UVT analyzer calibration is required for the UV reactor validated based on the Calculated Dose Approach, because UVT is an integral part of the dose monitoring strategy.

(a) The online UVT analyzers should be calibrated at least weekly by comparing the on-line UVT measurement using a bench-top spectrophotometer.

(b) The UVT calibration frequency can be reduced to once a month if approved by the Executive Secretary when sufficient data (a minimum of a one-year period) indicate that the UVT analyzer is consistently within the allowable calibration error without adjustment for more than a month.