



TO: Guy Bertelli, Accents in Water, Inc.
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RE: UV inactivation response of microbial blooms in ACCENTS IN WATER features

OVERVIEW: Full-scale experiments have shown that ACCENTS IN WATER features remove airborne particulate matter that may serve as a substrate for bacteria in an operating water feature. Once entrained in the water feature’s flow, bacteria and organic carbon can be recirculated through the feature’s reservoir using a submersible pump which contains an in-line, low pressure ultraviolet lamp. Using the EPA Ultraviolet Disinfection Guidance Manual¹, the inactivation potential of different types of bacteria retained by ACCENTS IN WATER feature was previously assessed by modeling. We report here, the inactivation potential of this UV equipment against actual microbial blooms, which were purposely induced by operating 12’ x 8’ stainless steel water feature in a high-exposure environment with its UV disengaged, and with no SANIGARD pre-treatment.

METHOD: The ultraviolet inactivation kinetics of many different pathogenic microorganisms have been derived from studies under near optimal conditions: where water is clean, has low turbidity, and high UV transmittance. We purposely challenged a UV unit in an operating ACCENTS IN WATER feature under a conservative engineering condition where water quality conditions had degraded turbidity to levels greater than 5 NTU, total organic carbon (TOC) levels greater than 5 mg/L, and heterotrophic colony forming units exceeded 10⁷ CFU/mL. These conditions were a purposeful result of 4 months of continuous operation during which the unit was not cleaned. We report here, the response of a bacterial enrichment when suspended in these feature’s water through the maximum flow rate recommended for normal operation of the low pressure mercury lamps used in ACCENTS IN WATER features

INACTIVATION RESPONSE: Using the conservative operational scenario outlined above, the effects of UV doses delivered by *Pondmaster* units installed in the larger ACCENTS IN WATER features are summarized below at the maximum flow rate they deliver.

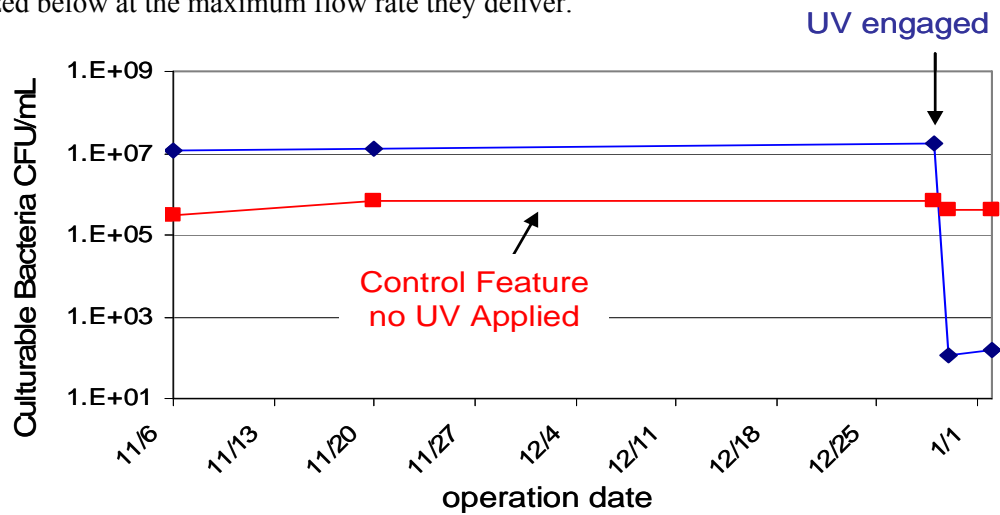


Figure 1. UV induced inactivation of bacteria enriched in an untreated 12 x 8 stainless water feature following 4 months of undisturbed operations (—♦—); and parallel unit operated under identical conditions during the same time period, but not subject to UV (—■—).

RESULTS SUMMARY. The relatively high levels of culturable planktonic bacteria that were purposely allowed to build up in the water features were markedly impacted by the initiation of UV irradiation delivered by a Pondmaster plug flow unit. Even under the poor water quality conditions of the recirculating water (> 5 NTU turbidity), the concentrations of culturable microbes experienced a 5-log reduction in response to UV exposure, and did not experience any significant recovery on the order of days. These results are consistent with efforts to analytically model the inactivation of waterborne microbes under both clean and conservative conditions. While maintenance protocols are designed to prevent water quality condition from degrading to those observed here, these results suggest that the design of the UV irradiation system is effective and appropriate for the water features' configuration and the indoor environments in which they are intended to operate.

¹ Ultraviolet Disinfection Guidance Manual, United States Environmental Protection Agency 815-D-03-007