ABSTRACT

Angela P. Ortiz Diaz. MSCE, Purdue University, May 2014. Variability in UV Disinfection of Municipal Wastewater. Major Professor: Ernest R. Blatchley III.

Variability in the performance of UV disinfection systems is hypothesized to be attributable to variability in the parameters that influence the overall performance. Predictability of process performance in UV disinfection systems should be possible, if variability in these input parameters can be defined. The objective of this project was to define variability in parameters that are known to affect the performance of UV disinfection systems so as to inform design and operation conditions for a large-scale UV disinfection system that was recently applied at the Belmont facility in Indianapolis, Indiana, and other systems. The present study focused on quantification of variability in several input parameters, including viable *E. coli* concentration in undisinfected secondary effluent, UV_{254} dose-response behavior of the target organism (*E. coli*), UV_{254} transmittance (UVT_{254}) of the water, total suspended solids (TSS), flow rate (Q), and precipitation. These data were subjected to correlation analysis to identify dependence among these parameters, and thus have a better understanding of the variability in the performance of this UV system.

In addition, measurements of the actual performance of the existing, full-scale UV disinfection system at the Belmont facility were conducted using Ambient Biodosimetry (AB). This method allowed for quantification of *E. coli* inactivation across the UV system over a range of operating conditions. The results of these experiments indicated that the system consistently exceeds treatment requirements, as defined by the Belmont NPDES permit, with a fraction of the existing hardware. This suggests that the existing system at Belmont may be over-designed, and that opportunities exist to improve the efficiency of the system's operation.

In the future, these data will be used in the development of a stochastic model that will predict performance variability. In turn, these model predictions will be used to inform the design and/or operation of UV wastewater disinfection systems.