APPLICATION NOTE

REDUCING ENERGY CONSUMPTION OF UV DISINFECTION BY MEASURING %UVT

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Adding a %UVT Sensor can pay for itself in as little as one month

With operating budgets shrinking, smart wastewater operators reduce energy consumption throughout their plants, and one of the most overlooked areas is the ultraviolet (UV) disinfection system, which will consume between 14 and 23% of a wastewater plant's power budget. The best strategy to reduce the energy consumption of the disinfection system is to modulate the UV dose based upon three factors: flow, lamp power, and a water quality measurement known as percent ultraviolet transmittance (%UVT), also called 'dose pacing'. The City of Grand Rapids, Michigan implemented dose pacing several years ago, and comparing data from January 1, 2010 to October 16, 2010, found that a dose pacing strategy reduced energy costs by 65% when compared to a flow-paced strategy.

The Grand Rapids Wastewater Treatment Plant provides wastewater collection and treatment for the City of Grand Rapids and ten surrounding communities totaling approximately 265,000 customers within a 125-square-mile geographical area. The wastewater plant has a design capacity of 61 MGD and currently has an average daily flow of 48 MGD. The municipality has two distinct treatment plants at this location: the North Plant, a conventional activated sludge plant; and the South Plant, an A/O process for biological phosphorus removal. Both plants have separate secondary treatment processes and dedicated channels in the UV disinfection system. A TrojanUV 4000plus system disinfects the water in both channels using medium pressure lamps, four banks of lamps per channel for a total of eight banks of bulbs.

The ultraviolet light from the disinfection system does not actually kill microorganisms, but instead damages the DNA within the cell. When the microorganism attempts to reproduce, the damaged DNA does not allow the repro-duction to continue, and therefore the microorganism is considered "sterile". Optimizing a UV disinfection system means dosing just enough UV light to damage the DNA in the cells, this requires compensating for flow, lamp intensity, and the changes in water quality which can block or absorb the UV light.

The Hach UVAS plus sc %UVT sensor determines the water quality by measuring the absorbance of a 254nm ultraviolet wavelength passed through a 50mm path length. Both particles and dissolved organics will absorb this wavelength of ultraviolet light, and as the concentrations change, the %UVT measurement changes, and the dose of UV light required to inactivate the microorganisms will need to change too.

Grand Rapids has two Hach UVAS plus sc sensors installed, because the water quality can change independently in each channel. Both sensors are connected to a Hach common controller, and the %UVT measurement is output from the controller to the TrojanUV 4000plus system via 4-20 milliamp signals. Without a %UVT sensor, wastewater plants mainly operate their UV disinfection systems by varying the UV dose in proportion to flow, and assume a static %UVT. Most commonly, the two options are a static 60%UVT, or a worst-case measured scenario %UVT. Table 1 and Table 2 below outline the consequences of these two strategies compared to the actual data at Grand Rapids.

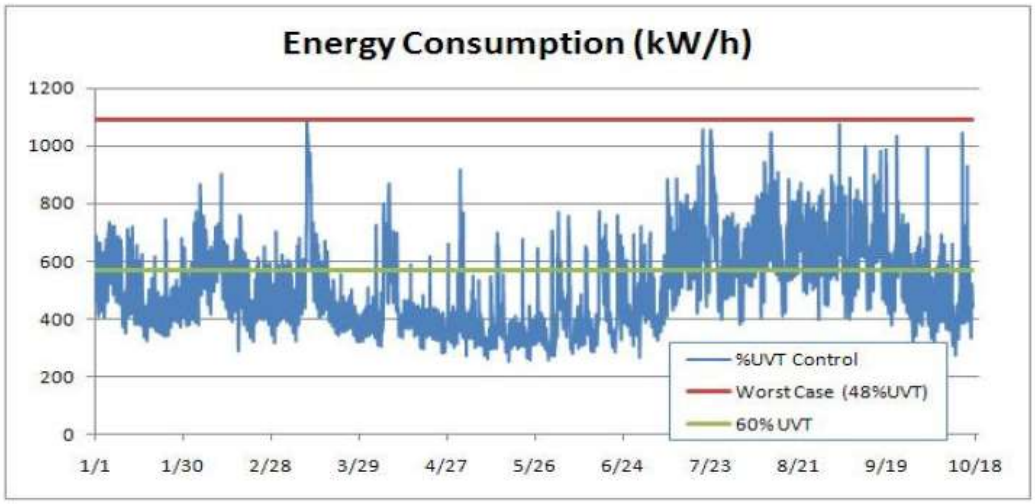
Table 1: Comparison of a fixed 60% UVT

	60% UVT	Dose Paced
Hours	6,918	6,918
kW	567.97	Variable
Total kWh	3,929,216	2,605,422
Cost @ $0.06/kWh	235,753	156,325
$/MG Treated	19.49	12.92
$ Difference		**79,428**
% Savings		**34%**
ROI (months)		**3.8**

Table 2: Comparison of a Worst Case Scenario

	Worst Case	Dose Paced
Hours	6,918	6,918
kW	1,090.94	Variable
Total kWh	7,547,109	2,605,422
Cost @ $0.06/kWh	452,827	156,325
$/MG Treated	37.44	12.92
$ Difference		**296,501**
% Savings		**66%**
ROI (months)		**1.0**

The chart below represents the same data in a time scale format. Any area below the red or green lines indicates actual energy and cost savings by using the %UVT measurement for dose pacing.



Controlling UV disinfection systems with a dose paced strategy can result in significant energy and cost savings to the municipality, all while ensuring effluent Coliform limits are met. Upgrading a specific system from flow paced to dose paced can be a simple endeavor for systems which are able to modulate the ultraviolet dose, generating a fast return on investment.

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