

## **What experience does ControlSoft bring to the control of Water Treatment or Wastewater Treatment problems?**

### **Project for One of the Largest City Water Departments in the U.S.**

#### Problems before MANTRA

- Residual chlorine control to a setpoint of 2 ppm.
- Long retention time required, resulting in transportation delay (deadtime).
- Water flow fluctuations.
- Multiple chlorine injection points.
- Original variation 0.5 - 5.0 ppm.
- Need to overdose chlorine to keep residual at 0.5 or higher at all times.

#### Scope of the Project

- Over 35 chlorination stations on a WAN.
- Central data collection on Westinghouse DCS.

#### Solution provided by MANTRA

- Chlorine control to a setpoint of 1.5 ppm.
- Model-based control with model-based feedforward compensation.
- MANTRA Coordinated Controller achieves variation of 0.2 ppm around setpoint.

#### Benefits of MANTRA

- Consistent chlorine content in drinking water.
- Lower usage of chlorine (by more than 25%).
- Substantial savings in chlorine costs.

## **Project for 90-Million-Gallons-Per-Day Water Supply Facility**

### Problems before MANTRA

- Chlorine discharge residual fluctuated because of seasonal water demands.
- Manual adjustments by operators.
- Transportation delays.
- Low sampling rates.
- Flow-proportional control enhanced oscillations.

### Scope of the Project

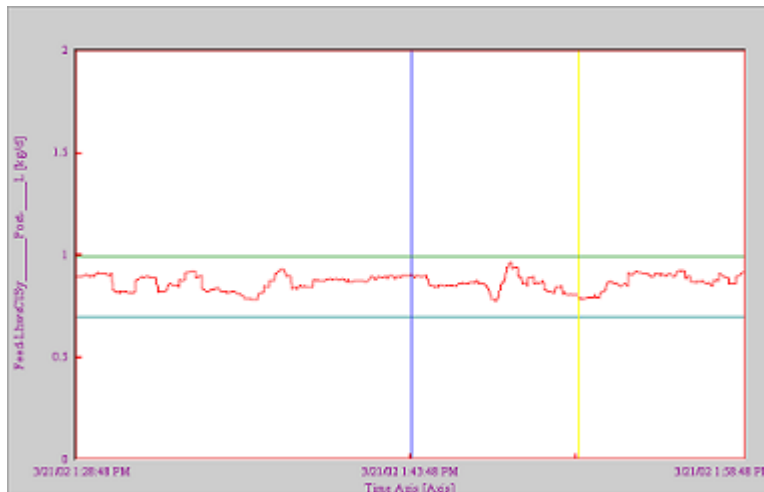
- Review the existing chlorination control schemes.
- Recommend additional instrumentation to improve chlorination control.
- Design an advanced control strategy for better chlorination control.
- Implement and commission the project.

### Solution and Benefits of MANTRA

- Model-based control with model-based feedforward compensation.
- Maintains the chlorine discharge residual constantly within +/- 0.1 ppm of the desired setpoint.

### Results

- MANTRA advanced chlorination control maintains the chlorine discharge residual constantly within plus or minus 0.1 ppm of desired setpoint.



### Testimonial

When asked to compare the previous control system to the MANTRA solution, the plant operator says: *"They are as different as night and day."*

## **For Large City Wastewater Treatment Plant**

### Problems before MANTRA

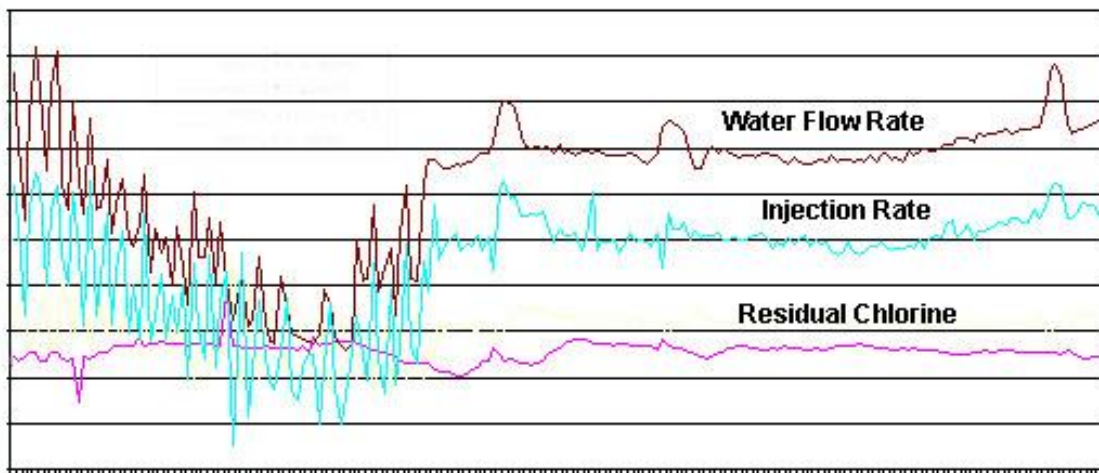
- Large chlorine contact basins with significant deadtime between injection and measurement.
- A combination of operator manual and automatic control was used to maintain chlorine levels.
- Original wide variation of 1.25 mg/l to 2.5 mg/l
- Water flow fluctuations.

### Solution provided by MANTRA

- Lower chlorine control setpoint.
- Model-based control with model-based feedforward compensation.
- Fully automated control.

### Results

- MANTRA Coordinated Controller achieves variation of 1.0 – 1.5 mg/l.



**Actual Plant Trend Data Over Twenty-Four Hours**

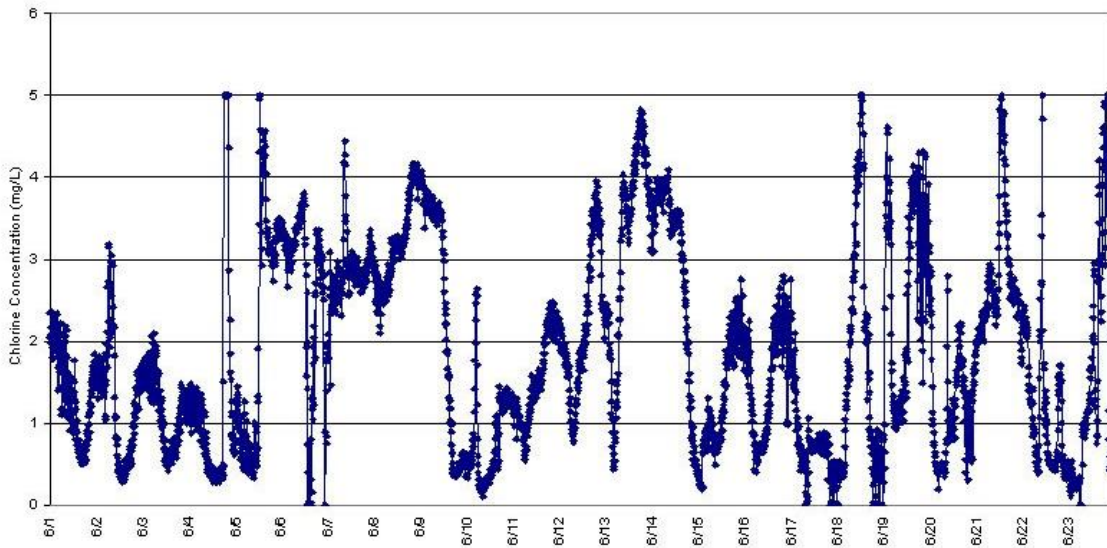
### Benefits

- Much tighter control, reduced chlorine variation by 60%, resulting in a lower residual setpoint.
- Reduced long-term chemical usage.
- Successfully alleviated faulty sensor readings.
- The control system is easier to use and to maintain.

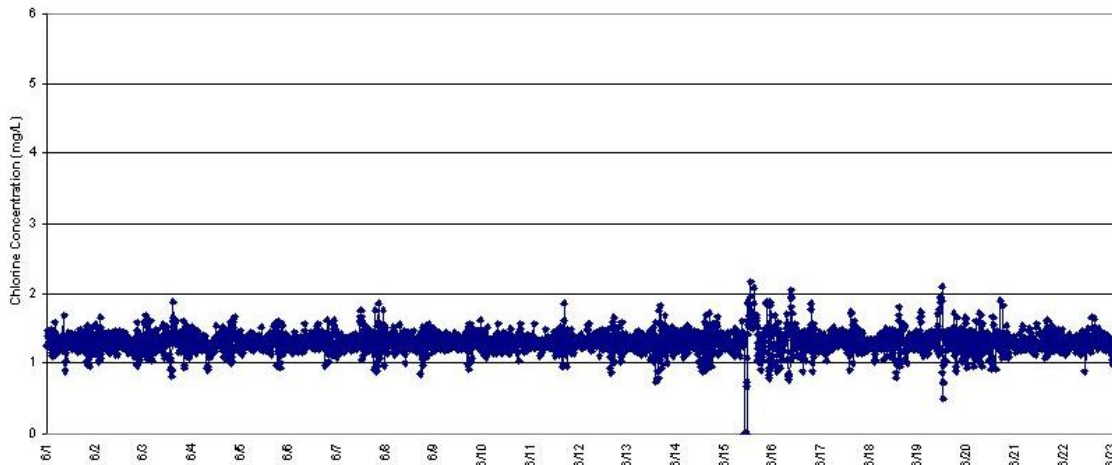
### Testimonial

*"The operator, at a minimum, needed to make two adjustments during the day to compensate for the daily flow pattern. On a typical day, no operator intervention is required. The operator was able to lower the chlorine setpoint, no longer needing to run at a higher setpoint for 'margin' against fast increases in flow."*

### **Residual Chlorine Comparison**



**Results without MANTRA model predictive control over 23 days**



**Results with MANTRA model predictive control over 23 days**