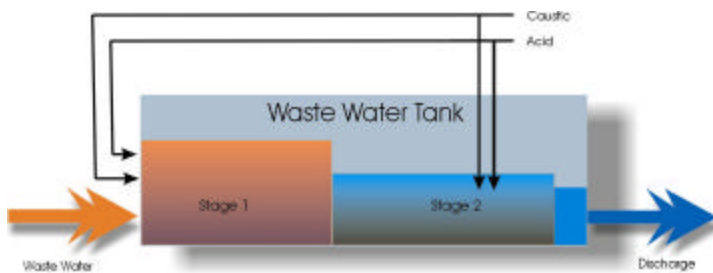
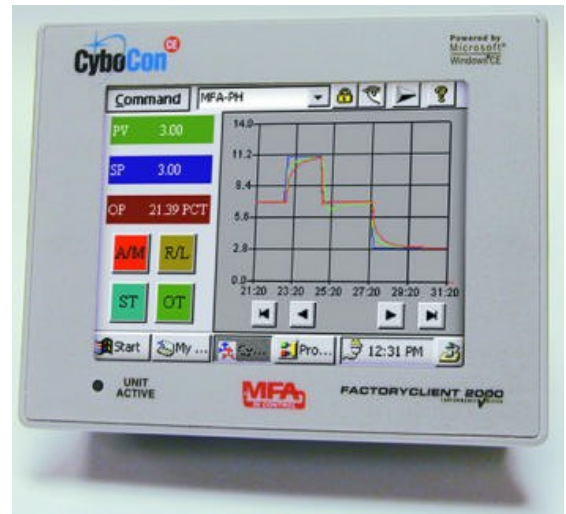


# Model-Free Adaptive Control on Wastewater Neutralization

<i>Use of MFA Control</i>	<i>Benefits</i>
Manipulates reagent flow intelligently and precisely.	Improves pH control by at least 50% reduction in variability.
Does not over-dose reagents.	Chemical (acid and caustic water) consumption is sharply reduced.
Enables automatic control of wastewater pH value within narrow ranges.	Complies with stringent EPA regulations on pharmaceutical companies and other industries.
Reduces rework and human errors.	Avoid fines for violations of EPA and local emission regulations
Improves efficiency & productivity.	Full investment is returned in months if not sooner.



*The CyboCon CE controller (right) brought the difficult-to-control pH of wastewater discharge into compliance with expected state regulations without requiring Chiron pharmaceutical to perform an expensive model-building exercise for advanced regulatory control.*



## **Case History: MFA pH Control for wastewater neutralization process at Chiron Pharmaceutical Plant**

For facilities facing strict wastewater treatment regulations, pH represents the classic control problem. Combine the non-linearity inherent in a pH curve with high pH/flow variability and long mixing delay times and you get a truly difficult control application.

The Chiron pharmaceutical plant in California not only faced this situation, but also foresaw that soon they would face stricter EPA regulations on pH in their discharge.

The wastewater system uses a dual-stage process with variable flow. The pH of the wastewater stream can vary greatly—from 2 to 11. Each stage uses a two-pulse control valve to add either a base (NaOH 14.0 pH @ 32% concentration) or an acid (sulfuric acid 1.50 pH @ 50% concentration). Multiple tanks hold the wastewater.

Chiron previously employed a PID-based controller in a PLC on its wastewater treatment system. This system required human intervention constantly due to ineffective control of the pH loop.

To improve pH control beyond traditional standards, the company decided to employ CyboCon CE, a Windows CE-based control instrument. CyboCon CE provides a simple, reliable, and affordable advanced control solution for pH control.

At its heart is CyboSoft's patented Model-Free Adaptive (MFA) control technology, which replaces PID with algorithms that adapt to variations inherent in the wastewater process. It compensates for disparate gain changes that characterize the pH titration curve.

The CyboCon CE MFA controller output is split at 50% to invert the acid and caustic portion of the signals. There-

fore, the controller can neutralize both acid and alkaline wastewater.

To avoid salt formation and violation of discharge codes, the old system had to set a dead band from 6.5 to 8. While the pH stayed inside this range, no reagent was added. If pH is outside the range, reagent is quickly added to force the pH back. This is a common practice for "bang-bang" pH control that will cause the pH loop to oscillate continuously resulting in waste of reagent chemicals.

After installing a CyboCon CE, the MFA controller setpoint was set to 7.5 and the dead band was changed to 7.4 to 7.6.

The pH control of this waste stream is maintained well within the desired range. Even within the severely constricted range, no salt formation is occurring. Tighter control has eliminated the potential for clean water violations, while reducing reagent consumption and clean out of the tanks.