



Ekster & Associates, Inc.

Machine Learning (ML) Based Control Systems

CLmaster™ — Frequently Asked Questions

What is CLmaster?

CLmaster is a machine-learning based real-time control system for chlorine disinfection. It controls the dosing of sodium hypochlorite and, for chloramination, aqueous ammonia, so that the disinfection target is met continuously as flow, ammonia and chlorine residual change. It sends its setpoints to the plant's SCADA system using the standard OPC protocol.

What does it control to?

The target is CT: the product of the total chlorine residual and the modal contact time. In California, Title 22 sets a CT of 450 mg·min/L for disinfected tertiary recycled water. CLmaster adjusts the chemical doses to hold CT at the target rather than above it.

Why is conventional chlorine dosing inefficient?

Chlorine dosing is usually controlled with fixed dosing tables, fixed chlorine-to-ammonia ratios or PID loops. These methods do not follow real-time changes in flow, chlorine decay, and ammonia or organic load, so operators dose conservatively to be certain of compliance. Conservative dosing means higher chemical use and more disinfection byproducts.

How is CLmaster different from an advisory system?

CLmaster is a closed-loop system: it adjusts the doses automatically. Advisory systems only recommend changes, which operators must then apply.

How does it account for delays in the process?

Chemical added now affects the measured residual only minutes later, after transport through pipes and filters. CLmaster uses the recent history of doses and residuals, not only the present reading, so that it accounts for chemical already in transit and avoids overcorrection.

How does it relate to DO/Nmaster?

At the Pomona Water Reclamation Plant of the Los Angeles County Sanitation Districts, machine-learning aeration control (Water Research Foundation Project 5148) made the effluent ammonia more stable. Stable ammonia allows the chloramination doses to be controlled more precisely. CLmaster builds on that result.

Can operators override it?

Yes. Operators can override CLmaster at any time. Dose limits and rate-of-change limits keep every adjustment within safe bounds, and if sensors fail the system returns control to the operators.

What happens if a chlorine or ammonia analyzer gives a wrong reading?

Every reading is checked before it is used. Faulty readings are detected and not acted on, and operators are alerted.

Does it need new equipment?

It uses chlorine and ammonia analyzers, flow measurement and the existing chemical feed pumps. These can be bought from any supplier. Ekster & Associates sells none of them, but provides recommended performance specifications.

What is CLmaster designed to achieve?

Lower sodium hypochlorite and aqueous ammonia use and fewer disinfection byproducts, while the CT target is met continuously.

How are the benefits for my plant estimated?

A free plant assessment estimates them. Send one year of operating data and chemical purchase records. You will receive a written estimate of savings in chemical use and dollars, the assumptions behind it, any changes required before installation, and a fixed price. If your plant is already operating efficiently, the estimate will say so.

Sources

- Ekster & Associates (2025). Automated Chloramination Control System for Enhanced Disinfection

Performance (system description).

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