DESIGN PERSPECTIVE

Monochloramine Versus Total Chlorine: What Your Residual Reading Isn't Telling You

A single total chlorine number can describe a perfectly healthy residual or one that is already failing. The difference lives in the species — and the number can't tell you which one you have.

Travis Silveri, Sales Director, Halogen Systems, Inc.



The Halogen Systems MP-Total resolves free chlorine, total chlorine, and monochloramine on one in-pipe sensor with the D20™ controller — a membrane-free, reagent-free amperometric measurement at 1 ppb resolution.

"2.5 ppm total chlorine" feels like a complete answer. In a chloraminated system, it isn't. That value could be almost entirely monochloramine doing exactly what you want, or it could be an increasingly unhealthy mix of dichloramine and organic chloramine that reads as residual but no longer protects the system. Total chlorine cannot distinguish between those two situations. Direct monochloramine measurement can.

What is the difference between total chlorine and monochloramine?

Total chlorine is the sum of every combined chlorine species in the water, while monochloramine is the single species that actually delivers stable secondary disinfection. When you chloraminate, chlorine and ammonia react to form monochloramine — the species you want. But the same reaction can also produce dichloramine and trichloramine, and chlorine can bind to organic

nitrogen to form organic chloramines. Every one of those counts toward the total chlorine reading. Only monochloramine provides the persistent, low-taste-and-odor residual chloramination is chosen for.

Why can a healthy-looking total chlorine reading still be a problem?

A total chlorine value can sit right on target while a growing share of it is dichloramine or organic chloramine — combined chlorine that registers as residual but does little useful disinfection. This is the trap in relying on a total-only measurement. The number stays reassuring while the composition beneath it drifts. Dichloramine brings the swimming-pool taste and odor customers complain about; organic chloramines are weak disinfectants that inflate the residual figure without backing it up. A system can look compliant on paper and still be losing the protective margin the reading implies.

> ***"The total chlorine number can stay reassuring while the composition beneath it quietly drifts to the wrong species."***

What role does the chlorine-to-ammonia ratio play?

Monochloramine forms cleanly only within a fairly narrow chlorine-to-ammonia weight ratio — generally in the range of 4.5:1 to 5:1 as Cl_2 to ammonia-nitrogen — and drifting outside that window either produces the wrong species or leaves free ammonia behind. Push the ratio too low on chlorine and you leave excess free ammonia in the water, which is the fuel that feeds nitrification downstream. Push it too high and you drive dichloramine formation and edge toward breakpoint, with the taste, odor, and residual instability that follow. Holding the ratio is a balancing act — and you cannot balance what you can only see as a lumped total. Watching monochloramine and free ammonia directly is what makes the ratio controllable rather than assumed.

How is monochloramine measured directly?

Direct monochloramine measurement requires a sensor that resolves the monochloramine species itself, rather than inferring it from a total-chlorine colorimetric reaction. The traditional DPD approach can approximate chloramine fractions through sequential reagent steps, but it is a grab-based, operator-dependent bench procedure — slow to run, easy to bias, and impossible to sustain continuously across a distribution system. An in-pipe amperometric sensor reads monochloramine continuously in the live process water, giving operators a real-time speciated value instead of a periodic total.

How do the two measurements compare?

The distinction is not academic — it changes what an operator can actually see and act on:

	Total chlorine (DPD)	Direct monochloramine
What it reports	All combined species, lumped	Monochloramine as a value
Ratio control	Inferred, indirect	Directly observable
Early nitrification signal	Late — after decline	Visible in the trend
Reagents	Required	None
Continuous?	No — grab-based	Yes — in-pipe, real time

Free chlorine, total chlorine, and monochloramine on one sensor

This is the gap the Halogen Systems MP-Total was built to close. It measures free chlorine, total chlorine, and monochloramine — along with pH, ORP, conductivity, and temperature — on a single in-pipe probe, using a membrane-free, reagent-free amperometric design with 1 ppb resolution. Instead of trusting one total number to describe a chemistry it can't actually resolve, operators see the species that determines whether the residual is healthy, and the free ammonia that determines where it is headed.

To compare the MP-Total and MP5A sensors, review installation options, and request specifications, visit halogensys.com.

Frequently asked questions

Is total chlorine the same as monochloramine? No. Total chlorine is the sum of all combined chlorine species; monochloramine is the specific species that provides stable secondary disinfection in a chloraminated system.

What is the ideal chlorine-to-ammonia ratio for chloramination? Most systems target roughly 4.5:1 to 5:1 by weight as chlorine to ammonia-nitrogen, which favors clean monochloramine formation while limiting leftover free ammonia and dichloramine.

Why is dichloramine a problem? Dichloramine drives the characteristic swimming-pool taste and odor and signals that the chlorine-to-ammonia ratio has drifted away from clean monochloramine formation.

Can a DPD test distinguish monochloramine from total chlorine? DPD can approximate chloramine fractions through sequential reagent steps, but it is a manual, grab-based, operator-dependent method — not a continuous, distribution-wide measurement.

What monochloramine concentration should a chloraminated system maintain? Targets are system- and regulation-specific, but the goal is a stable monochloramine residual held through the distribution system, with minimal free ammonia and negligible di- or trichloramine.