Isocyanuric Stabilization Benefactor or Bomb?

Another controversial subject in the world of pool water care is the much-discussed and little-understood business of cyanuric acid stabilization. Is it the real money saver and problem solver, as the ads say? Yes and no. In simple terms, sure, it is an excellent product if properly used in poorly-maintained or infrequently-serviced public pools. (Indeed, it is a necessity in almost all residential and motel pools.) But the answer might well be an emphatic NO somewhere else. There are a number of trade-offs which make cyanuric acid (CYA) a poor choice in many if not most high-use, well-cared-for, institutional swimming pools. Let's look at a few facts:

1. Isocyanurics do help chlorine "last longer" in the pool; that is, a residual shows up on the test kit for a longer period of time after administration of the product.

2. This "stabilization" of chlorine, however, degrades its "work value."

Let me explain the second item a little better. HOC1, the active chlorine compound in pool water, is inherently unstable. It is highly effective by virtue of the very fact that it is unstable. So what would you expect when chlorine is made more stable? A classic paradox exists, where effectiveness is traded for longevity. You don't get something for nothing!

From these three facts, an equal number of assumptions can be made:

1. The increased longevity of measurable chlorine residual might evoke a false sense of security, while the reduced effectiveness could place oxidation and disinfection potentials dangerously close to a point where problems begin to arise.
2. Higher residuals of chlorine should almost always be maintained to offset the reduced work value. (Target values two or three times "normal" might be wise.)

3. The expense of the initial cyanuric dosing plus make-up additions, along with the cost of maintaining the higher residuals of chlorine, surely will degrade the much wanted cost effectiveness. Indeed, there must be a break-even point beyond which we are spinning our (paddle) wheels.

All is not lost, however. There is, in fact, a point of diminishing returns with respect to the percentage of "stability" achieved for increasing values of stabilizer. It seems reasonable that if we stay below that figure, isocyanurics may well prove useful. But what is the number? To determine some practical guidelines, tests have been run by USFILTER in a controlled pool environment in Florida, then in Hawaii. This field work was followed by a detailed study in a laboratory atmosphere in California. Sensitive electronic instrumentation corroborated the findings: Oxidation Reduction Potential (ORP), the best means of evaluating chlorine's work value, falls off dramatically at a rapid and predictable rate which can be stated (and plotted) in terms of equivalent free chlorine.

Referring to Figure 1, we can see that at 5 ppm CYA, (pH 7.4, Chlorine residual 1.5), the equivalent chlorine effectiveness is more than 35% reduced; at 10 ppm it is about 65% reduced, at 20 ppm, chlorine equivalent effectiveness is down a startling 80%. Beyond 25 ppm CYA we can expect, in terms of oxidizing power, only 15% of what we'd have if the chlorine were unstabilized.

Aw c'mon, how can that be? We know of pools with twice that much CYA. The water's clear - and the health guy says the plate count is OK."

Well, remember what we are comparing: POTENTIAL to oxidize. If you don't need it all, you don't use it all. If the first .1 ppm can handle all the bugs, it does. If the next .1 or .2 ppm can handle all the organics, it does as well. What we've lost, however, is virtually all the "insurance residual." Just stir in another 100 kids, or a dead cat, and see what we've got! Just ask that well-taxed .3 ppm equivalent to handle half-a-part-per-million of ammonia. No way. You're paying the premiums on that insurance residual, so you might as well have the benefits....or most of them.

With all this detail on the fall-off of effectiveness, just where do we stand on staying power? We can't find our diminishing return point without knowing what increase in residual lifetime to expect. Look at Figure 2. (Data is from a tech bulletin of a major specialty chemical manufacturer.) This chart shows reasonable staying power achieved with only 5 ppm cyanuric in use. Over eighty percent of all the staying power achievable is found at a 10 ppm cyanuric while values much over 20 are clearly beyond the cost-effectiveness threshhold. These are not exactly the numbers you hear advertised.

One more surprise: In these laboratory tests, a rather amazing fact came to life. As effectiveness is lost, and the CYA reaches about 70 ppm, the ORP (Oxidation/Reduction Potential) curve levels off at about 12% of the original work value which resulted from the 1.5 ppm unstabilized chlorine. From that point upward, all reasonable levels of chlorine additions converge to approximately that value! In simple terms as cyanuric levels exceed about 70 ppm, 1 part-per-million will result in about a .2-part-per-million equivalent effectiveness; so would 2 parts per million chlorine dosage. So would 3. And so would 10 ppm! Values of cyanuric from that point upward make chlorine in any quantity a pretty bad investment.

Another interesting note: The "stabilization" gained is almost entirely in the presence of sunshine. CYA in indoor pools and spas is totally inappropriate.

The use of cyanuric-based dichloro and trichloro products, commonly used for spas, has convenience value only, since it costs more and works less. (Dichloro does dissolve handily in water and has little affect on pH). When using cyanuric-based chlorine products in spas, frequent (weekly) dumpings will keep CYA from building up.

Having investigated oxidation falloff and "staying power," what about disinfection — "bug-killing power"? We don't want anything alive in the pool but the swimmers, so this is quite often the variable of greatest concern. And this is where CYA gets its highest marks. In the twenty-two articles, technical treatises, and

FIG. 1 EFFECTS OF INCREASED CYANURIC STABILIZER IN SWIMMING POOLS

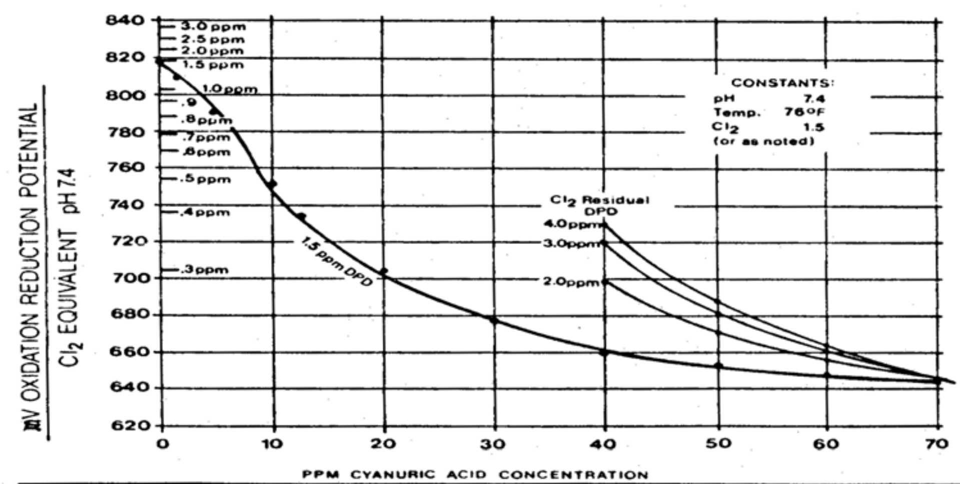
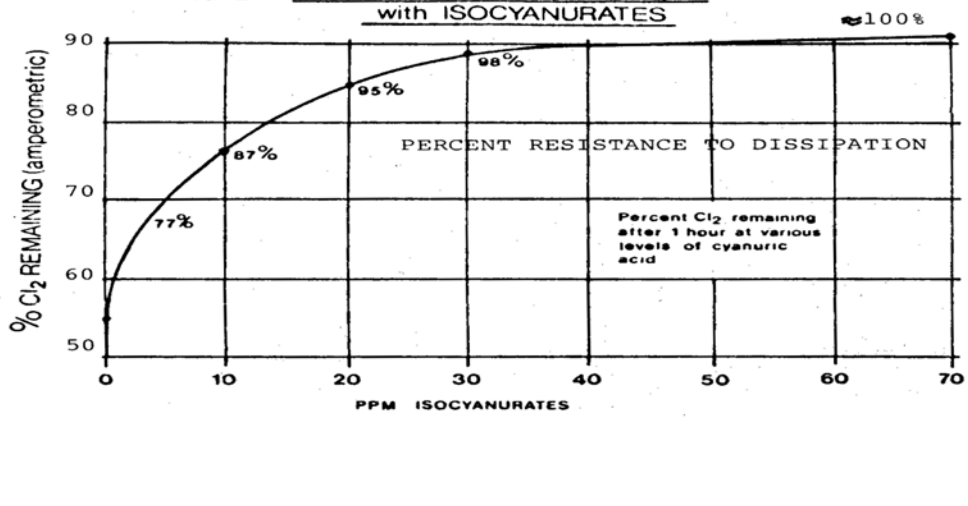


FIG. 2 CHLORINE "STAYING POWER" with ISOCYANURATES



papers on CYA referred to by this author, virtually all reported on the study of CYA with respect to disinfecting power of chlorine. (None addressed themselves to oxidation!). Much disagreement is found among the pro's and pH's regarding the oft-studied sanitation aspect (so much that a few state health departments do not allow CYA at all while others demand it in large public pools!). Some lab data in unstressed (non-pool) water showed Pseudorrinos Aeruginosa kill to take up to 100 times longer with, as compared to without, CYA (low residuals of chlorine), while other, less scientific but more true-to-life testing showed a few bacteria appear to die more quickly in the presence of CYA!

Although little agreement exists, one thing seems clear — the disinfectant fall-off is somewhat behind the oxidation loss. So pools, generally, remain safe from a health standpoint until ridiculous levels of CYA accumulate, not so uncommon, I fear. Therefore, as CYA increases, possibly from the use of dichloro– or trichloro-types of sanitizers, on top of initial "stabilization," chorine's power to oxidize continues to fall off more and more.

Resultant water conditions don't appear to change for the worse until the demand threshold exceeds the greatly limited "insurance" ORP.

Suppose you have a three-quarter-million-gallon outdoor pool and find yourself doing marathon cylinder changes trying to keep up with the chlorine demand. You've heard that cyanurics can double or triple the chlorine's life in your pool. What would be a reasonable course of action in this case?

Prepare yourself for a new responsibility —– that of testing and maintaining your CYA at reasonable and consistent levels. A procedure can be instituted to frequently check that level with an accurate (there aren't very many) CYA test kit. The pool should be dosed from 5 to 12 ppm cyanuric (in this case, 80 lbs. at a cost of approximately $200) in an automated pool or up to 20 ppm or so in a non-automated pool (near $400).

Then, knowing the chlorine effectiveness has been reduced, the old residual must be approximately tripled and maintained. In the example above, 2 ppm is not at all unreasonable, while upwards of 3 pm is recommended. (Some localities have required even 5 ppm.) You will realize a reduction in chlorine consumption over all, even maintaining higher residuals. Superchlorination may be needed slightly more often, especially to combat algae. This cost, and the cost of the initial dose of cyanuric acid and make-up doses, must be considered when computing overall savings.

The bottom line — the cost-effectiveness and ultimate suitability of cyanuric stabilization — can only be determined by you through your investigations or personal experience. Use the information in this article as just one of your sources.

A footnote: When you have heavily stabilized your pool, you are committed to at least some level of stabilization for years to come. Draining the pool — even multiple drainings and (heaven forbid) acid washings — cannot eliminate isocyanurates entirely from your freshly refilled pool. It has a way of impregnating plaster, filter elements and media, even scale or residue in heaters and pipes. One has difficulty returning to the fully-active low residual used prior to the initial stabilization attempt. Take heart, however, a few large-pool owners report that, after attempting CYA at substantial levels but giving up on the idea after a test season, they drained their pools, refilled, and subsequently experienced the most cost-effective year ever! It seems the trace of CYA that remained, unmeasurable on most test kits, accidentally worked out to be the best compromise for them.

Stranco Products
P.O. Box 389
Bradley, IL 60915 U.S.A.
866.766.5987 *tel*
815.932.8154 *tel*
815.932.1760 *fax*

Level 1, 6-10 Talavera Road
North Ryde, NSW 2113
Australia
+61.2.9850.2822 *tel*
+61.2.9850.2898 *fax*

Priory Works, Tonbridge
Kent, TN11 0QL
United Kingdom
+44.(0)1732.354888 *tel*
+44.(0)1732.354222 *fax*

http://www.strancoaquatics.com

ST-Isocyanuric-AT-0503