Cyanuric Acid Chemistry

onBalance – Que Hales, Doug Latta and Kim Skinner

What is it? – Cyanuric acid slows down the loss rate of chlorine in pool water – the rate at which UV light from the sun pulls chlorine out of a pool (photolytic decompsition!) Called variously cyanuric acid, CyA, isocyanurate, conditioner, stabilizer.

Why do we care? – Stabilized chlorine will last days in a pool, where unstabilized chlorine may be gone in hours. The primary responsibility of chemical maintenance in swimming pools and spas is bather health, the the primary way to protect bathers is chlorine

How is it packaged/sold? – White, odorless, solids (powder or granule), liquid suspension, half of a trichlor tablet.

Safety – Classified as "essentially non-toxic," can be "slightly hazardous" to skin and eyes on contact, can be "slightly hazardous" if enough is breathed or swallowed, not listed as a known carcinogen (see MSDS). PPE (personal protective equipment) recommended = safety glasses, gloves, dust mask (but nobody does this…) First Aid primarily consists of lots of water flushing, and seeking medical care if reactions, symptoms (skin irritation, coughing, eye irritation, etc.) persist. Spill cleanup consists primarily in recovering usable product, disposing of what you can, and lots of water flushing for the rest.

How does it work? – Cyanuric acid has a ring structure with three hydrogen (H) molecules attached. More hydrogen means lower pH, so this is an acidic product. When dissolved in water that contains NO chlorine, 2/3 of the cyanuric acid stays acidic (keeping all three hydrogens) and 1/3 is base (by dropping one hydrogen). When dissolved in water that DOES contain chlorine, the hydrogen jumps off and chlorine replaces it. Fully stabilized chlorine has the same chemical formula as trichlor. Dichlor has two chlorines and one sodium. So essentially, cyanuric acid works by containing "receptor sites" that can hold hydrogen, chlorine, sodium, etc. When chlorine is unattached, the sun can/will knock it out. When chlorine is holding onto cyanuric acid, it is protected from the sun

How do I test for it? – Cyanuric, dissolved in water, will combine with melamine to form a white insoluble precipitate. The cloudier the precipitation, the higher the amount of cyanuric acid in the sample. Test cells are calibrated to convert visible turbidity (cloudiness) to parts per million (ppm).
Added CyA may not be measurable for 2 to 3 days, until fully dissolved. Re-test pH, TA and CyA on next visit – CyA should go up, pH may go down, TA should stay relatively the same. Testing may be less frequent than other parameters (chlorine, pH, etc.) because cyanuric acid rises and falls much slower…

How much should I add? – Five pounds of cyanuric acid in a 20,000 gallon pool will give you about 30 ppm CyA.

APSP recommended level:
Minimum – 20 ppm (in outdoor pools)
Ideal – 30–50 ppm
Maximum – 100 or 150 ppm (it changes…)

How much should I add? – Coast to the right level. Remember, pool chemical levels do not "stay put" – they drift. For pools start-ups when using unstabilized chlorine (gas, bleach, cal-hypo) you could adjust the CyA to 50-100 according to your preference and the type of pool, and then watch it drift down. Add as needed. For pools start-ups when using stabilized chlorine (trichlor tablets, dichlor) you could adjust the CyA to 20-30 and then watch it drift up. Drain when needed.

The ideal amount of CyA is also based on how much chlorine you wish to maintain in the pool. Our calculations indicate that the ratio of chlorine to cyanuric acid is about 1:16, meaning that it takes roughly about:

30 ppm of cyanuric acid to stabilize 2 ppm of chlorine
50 ppm of cyanuric acid to stabilize 3 ppm of chlorine
65 ppm of cyanuric acid to stabilize 4 ppm of chlorine

That means that if you have 50 ppm CyA and 4 ppm chlorine, 3 ppm is stabilized and the unstabilized 1 ppm will soon disappear…

What if it is out-of-range? – Too much – Slows down the kill-rate of chlorine (very important in commercial, not as important in residential pools), Replaces more bicarbonate alkalinity with cyanurate (makes water more aggressive). Too little – Chlorine goes bye-bye. Just right – Life is good.

Cyanuric Acid and "Chlorine Lock" – There is a specific number of attachment locations – where the hydrogen (H) resides. Once they are all full of chlorine instead of hydrogen, they can't grab any MORE! Any additional chlorine – unstabilized - simply degrades in sunlight, so there is no such thing as "chlorine lock."

Manipulating CyA – How do I make it go "up?" One pound of CyA in 20,000 gallons makes about 6 ppm in the pool , or use trichlor or dichlor. How do I make it go "down?" Switch to bleach, dilute (partial or full water replacement), enzyme? (brand new on the market and so we do not yet have an opinion on it… we are testing it so watch our website – www.poolhelp.com – in about a month)

What is the "right way" to add it? – Can pre-dissolve, distribute and brush, can feed through net or bag, can add through skimmer if possible and safe. Relatively insoluble – straight CyA may require days to completely go into solution: Clean filter before adding and then do not backwash for three days – filter pressure may slightly rise while the powder dissolves. Do not allow solid, undissolved cyanuric acid to sit on plaster – especially uncured plaster (pool surfaces less than 30 days old) or colored plaster.

Does it get "used up?" – Cyanuric acid is not "used up" in the process of stabilizing chlorine – it repeatedly grabs and releases, but stays in the water in its useful form. Cyanuric acid can be lost when water is lost from the pool – by backwashing, swimmer splash-out and drag-out, leaks, etc.

Cyanuric Acid – TA Subtraction – Cyanurate is a form of "alkalinity." In swimming pool saturation chemistry calculations (LSI), or Water Balance, "alkalinity" should only include bicarbonate. When reporting "Total Alkalinity," use both… just as it reads in your test kit. When doing LSI calculations, do the subtraction: Bicarbonate alkalinity = Tested alkalinity level – (1/3 tested CyA level)