UNDERSTANDING BASIC POOL WATER CHEMISTRY

Water balance is simply the relationship between different chemical parameters. Your water is constantly changing; sunlight – wind – rain – bathers - dirt etc. that enters the pool water may affect water balance. Continuous filtration removes contaminants which keep water enjoyable but this is not water balance. A pool that is "balanced" has proper levels of pH, Total Alkalinity, and Calcium Hardness.

It may also be defined as water that is neither corrosive nor scaling. The concept is derived from the fact that water will dissolve and hold minerals until it becomes saturated and cannot hold any more water solution.

When water is considerably less saturated it is said to be in a corrosive or aggressive condition.

When water is over saturated and can no longer hold the minerals in solution it is in a scaling condition.

The cliché that "water seeks its own level" certainly applies here. Water which is under-saturated will attempt to saturate itself by dissolving everything in contact with in order to build up its content. Water which is over-saturated will attempt to throw of its content by precipitating minerals out of solution in form of scale.

pH

pH is a measure of how acidic or alkaline the water is. The pH scale ranges from 0 to 14, with 7.0 being neutral. Values below 7.0 are acidic (corrosive), and values above 7.0 are alkaline. If the pH is above 7.8 we are in a scaling condition. The Australian Standard 3633 defines the operating range as 7.0 to 7.8 and the recommended range of 7.2 to 7.6. (SPASA recommend 7.0 to 7.2 for fibreglass pools).

TOTAL ALKALINITY (T.A.)

A close cousin of pH, the level of alkalinity in the water is a measurement of all carbonates, Bi–carbonates, hydroxides, and all other alkaline substances found in pool water. pH is alkaline dependant; that is, alkalinity is defined as the ability of water to resist changes in pH. Also known as the buffering capacity of the water, alkalinity keeps the pH from "bouncing" all over the place. Low alkalinity is raised by the addition of a base (similar to pH); sodium bicarbonate is commonly used. High levels of alkalinity are lowered by the addition of an acid (similar to pH).Experts recommend "pooling" the acid in a small area of low current water for a greater affect on alkalinity. That is, adding an acid will lower both pH and alkalinity. Walking the acid around the pool in a highly distributed manner is said to have a greater effect lowering the pH than the alkalinity. Pooling the acid has the opposite effect.

CALCIUM HARDNESS

When we speak of scale, we are talking about calcium carbonate which has come out of solution and deposited itself on surfaces. It is a combination of carbonate ions, a part of total alkalinity and calcium, and a part of the Calcium Hardness level. The test for Calcium Hardness is a measure of how "hard" or "soft" the water is testing. Hard water can have high levels of calcium and magnesium. If these levels are too high the water becomes saturated and will throw off excess particles of solution which then seeks to deposit them on almost any surface inside the pool. This is calcium carbonate scale; a "white-ish," crystallized rough spot. If levels are too low the water is under-saturated, the water will become aggressive as it attempts to obtain the calcium it needs. Such "soft-water" will actually be corrosive to the pool and/or equipment.

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CALCIUM HARDNESS TESTS CANNOT USUALLY BE PERFORMED WITH THE STANDARD TEST KIT.

THE LANGELIER INDEX OR SATURATION INDEX.

The formulae for the Langelier Index or Langelier Scale were originally developed by Dr Wilfred Langelier as an accurate method of determining water balance.
The Langelier Saturation Index is often the recommended method of maintaining balanced water. I.e. non corrosive and scale forming.
There are four major factors considered for water balance, which affect the Saturation Index.

1. pH
2. Total Alkalinity
3. Calcium Hardness
4. Temperature

Three of the four factors are given numerical values which are then applied to the formula.

- Total Alkalinity referred to as AF (Alkalinity Factor)
- Calcium Hardness referred to as CF (Calcium Factor)
- Temperature referred to as TF (Temperature Factor)

The actual pH reading is used in the formulae and therefore is not given a value.

The formula for determining the Saturation Index, using the four factors is;

Ph + AF + CF + TF – (minus) 12.1 = Saturation Index (The required index is 0.0)

A minus figure is under saturated and corrosive. A positive figure is over saturated and the tendency to be scaling. The accepted limits for the index are -0.5 to +0.5

Temperature	Factor	Alkalinity	Factor	Calcium Hardness	Factor
0	0.0	5	0.7	5	0.3
3	0.1	25	1.4	25	1.0
8	0.2	50	1.7	50	1.3
12	0.3	75	1.9	75	1.5
16	0.4	100	2.0	100	1.6
19	0.5	150	2.2	150	1.8
24	0.6	200	2.3	200	1.9
29	0.7	300	2.5	300	2.1
34	0.8	400	2.6	400	2.2
41	0.9	800	2.9	800	2.5

Warning:
When gas heaters are used on salt chlorinated pools, care should be taken to ensure the production of chlorine is adjusted to suite either the spa or the pool, as internal components could be damaged by

excessive salt or chlorine levels. This is particularly important when operating for extended periods during heat-up.
Never store pool chemicals in the same room as Pool Heaters.
When physically adding chemicals to a pool (e.g. Acid) ensure that you dilute the chemical and add to pool opposite the skimmer box or follow manufactures instructions.
Pouring chemicals straight into a skimmer box can cause damage to pool pumps and heaters.

When testing pool water or adding chemicals it is advisable to use a reputable pool company, after all your patrons health is at risk or your plant and equipment could suffer serious damage if the water chemistry is not within the accepted guidelines.
If you have pool heating equipment ensure that the water analysis tests include the corrosiveness of the water (Langlier or Saturation Index).

If you have a gas pool heater, once you shut the pool pump down the gas heater has a water flow switch that shuts the heater down, trapping water in the heat exchanger. The heat that is still in the firebox of the heater, can overheat the water, this is usually not a problem until you remove the top of the pump etc which causes a suction affect drawing the water from the heater which softens and collapses the PVC water lines.
To avoid this situation, before vacuuming, backwashing or cleaning the pump strainer basket always turn off the power supply to your gas pool heater at least five minutes before shutting down the pool pump. This allows the water to keep circulating until the heat disperses from the heater fire box. Before turning on the heater ensure that the water is flowing in the system and all air locks have dissipated.

Regards – Ken Adams

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