



Aquatic Consulting Services

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Pool Tip #43: Langelier Saturation Index

Monitor the water balance in the pools (weekly) and spas and wading pools (daily) for mineral saturation control. Since water is the universal solvent, all things will inevitably dissolve in water until the water becomes saturated. Eventually, water will become oversaturated, and excess products will be lost by precipitation. Well balanced water will increase bather comfort and will dramatically extend the life expectancy of the pool and its components.

Water temperature, pH, total alkalinity, calcium hardness, and total dissolved solids act together to cause corrosiveness or calcification qualities of water. The Langelier Saturation Index formula and chart can be used to determine if pool water is balanced-- that is, neither aggressive nor oversaturated.

$$SI = pH + \text{alkalinity factor} + \text{calcium hardness factor} + \text{temperature factor} - \text{TDS factor}$$

Temperature		Calcium Hardness		TDS		Total Alkalinity	
Degree	Factor	PPM	Factor	PPM	Factor	PPM	Factor
66	0.5	75	1.5	<1000	12.1	50	1.7
77	0.6	100	1.6	>1000	12.2	75	1.9
84	0.7	150	1.8			100	2.0
94	0.8	200	1.9			150	2.2
105	0.9	300	2.1			200	2.3
		400	2.2			300	2.5
		800	2.5			400	2.6
		1000	2.6				

Saturation index equals pH plus the alkalinity factor, plus the calcium hardness factor plus the temperature factor minus the TDS factor.

Use your test kit and testing instruments to find each of the five values. Write down the actual pH value found. Then for the remaining four values, find the corresponding factor on the chart. Add or subtract the factors to or from the pH value. If an actual value is not found on the saturation index chart, do not interpolate -- there is no direct linear relationship between the values. Rather, move to the next higher value and use its factor.

If the sum obtained is zero, the water is balanced and chemical equilibrium has been achieved. A tolerance of plus or minus 0.3 is allowable for commercial swimming

pools. Negative values indicate corrosive water, while positive values indicate likely calcification and scale formation.

Corrosive or under saturated water is aggressive and will cause circulation pipes, heater elements, and other metal components of the pool to corrode. Pool wall surface materials will deteriorate. Plaster will soften and etch, metal staining will increase, and tiles will become loose and begin popping off the walls.

If the water is oversaturated, calcium carbonate will begin to settle out of the water. Water will become cloudy and take on a "milky" appearance. Scale will build up on solid surfaces, making the surfaces rough, and discoloring dark colored surfaces. Calcium carbonate scale will also build up on the interior surfaces of the pool recirculation pipes. Water flow will be restricted and pressure will increase. Sanitizer effectiveness will be reduced, and algae growth may increase.

If the saturation index formula indicates that the pool water is not balanced (not equal to zero, plus or minus 0.3), make the appropriate chemical corrections, starting with total alkalinity, then followed by pH, temperature, calcium hardness, and TDS.

Example:

pH	7.7
Total Alkalinity	140 ppm
Calcium Hardness	300 ppm
Water Temperature	104° F
TDS	850 ppm

$$SI = pH + af + cf + tf - TDSf$$

$$SI = 7.7 + 2.2 + 2.1 + .9 - 12.1 = +.8$$

The spa water is oversaturated.

The water could be balanced by adding sodium bisulfate to drop the total alkalinity to 100 ppm, and by reducing the pH level to 7.2 using muriatic acid or carbon dioxide.

Note: If cyanuric acid level are high, divide the cyanuric acid level by 3, then subtract this interference factor from the total alkalinity reading prior to calculating the saturation index.