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Technical Bulletins

Understanding LSI :
The Langelier Saturation Index

The Langelier Saturation Index (LSI), also called the Langelier Stability Index, is a calculated number used to predict the calcium carbonate stability of water; that is, whether water will precipitate, dissolve, or be in equilibrium with calcium carbonate. Langelier developed a method for calculating the pH at which water is saturated in calcium carbonate. This pH is called the saturation pH, or pHS. The LSI is expressed as the difference between the actual system pH and the saturation pH: **LSI = pH – pHs.**

If the actual pH of the water is below the calculated saturation pH, the LSI is negative and the water has a very limited scaling potential. If the actual pH exceeds pHS, then the LSI is positive, and because the water is supersaturated with CaCO3, the water has a tendency to form scale. At increasing positive index values, the scaling potential increases.

Think of the LSI as a scale with a fulcrum

A perfect score on the LSI is zero (0.00). Zero is perfectly balanced water; saturated with the perfect amount of calcium carbonate, and has a stable pH. Being the universal solvent, if water is out of balance, it will naturally try to find its own balance and equilibrium, because it wants to be at 0.00 LSI. For instance, if there is not enough calcium, water will dissolve and extract it from the most readily available source.

LSI	Scale Potential
LSI < 0 (-) negative, less than zero	No scale potential. Water will dissolve CaCO3, The water tends to be corrosive
LSI = 0	Water is considered to be neutral. Neither scale-forming nor scale removing.
LSI > 0 (+) positive, greater than zero	Scale can form. CaCO3 recipitation may occur. The water tends to be scale forming.

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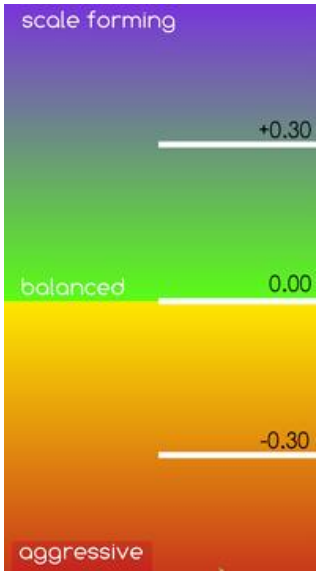

The LSI is basically a way to determine if water is corrosive (negative LSI) or scale-forming (positive LSI). LSI between -0.30 and +0.30 is the widely accepted range, while 0.00 is perfect equilibrium.

Water wants to be in equilibrium, and will find a way to get there. Under-saturation is corrosive, and over-saturation is scale-forming. Water can only hold so much calcium in solution. If water is in LSI equilibrium, neither etching nor scaling will happen. Water chemical professionals, our goal is to balance water up front (and maintain it) to LSI standards so that neither etching nor scaling occur.

Low LSI does not just etch plaster, it can corrode water treatment equipment too and plastics too. Water will stop at nothing to find equilibrium...so when it's hungry for calcium, it will aggressively look for it. When the water does not have a readily available source of calcium, corrosion and degradation can occur anywhere in the piping(or water equipments). Another important thing to remember: water cannot over-saturate itself. It will take only what it can hold, and nothing more.

How to calculate the LSI :

For calculating LSI, it is necessary to know the;

1. alkalinity (mg/l as CaCO3),
2. calcium hardness (mg/l Ca+2 as CaCO3),
3. the total dissolved solids (mg/l TDS),
4. the actual pH,
5. the temperature of the water (oC)

where:

pH is the measured water pH

pHs is the pH at saturation in calcite or calcium carbonate and is defined as:

pHs = (9.3 + A + B) – (C + D)