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TDS
FACT OR FICTION ?????

TDS - Total Dissolved Solids - may be the most misunderstood factor in the whole field of pool & spa water chemistry. It's misunderstood because no one knows exactly what effect it is going to have on any particular body of water.

When everything else seems to be all right, and the water still acts screwy, check the TDS.

* High TDS can result in corrosion of metal equipment and accessories, even though the water is balanced.
* High TDS can cause eye and skin irritation, even though the pH is right and there are no chloramines in the water.
* High TDS can permit an algae bloom, even with a 2-3 ppm chlorine residual.

But none of these symptoms will necessarily occur. It is the uncertain nature of problems caused by TDS that makes it such a headache to deal with.

As its name states, TDS is the sum total of all of the dissolved things in a given body of water. It's everything in the water that's not actually water. It includes hardness, alkalinity, cyanuric acid, chlorides, bromides, sulfates, silicates, and all manner of organic compounds.

Every time you add anything to the water, you are increasing its TDS. This includes not only sanitizing and pH adjusting chemicals, but also conditioner, algaecides, and tile and surface cleaners. It includes airborne pollutants and bather waste as well as dissolved minerals in the fill water.

At low levels, TDS does not present a problem. In fact, a certain amount of TDS is necessary for water balance. Hardness and Total Alkalinity are both part of TDS.

But at high levels - above 3,000 parts per million - you are welcoming problems. The National Spa & Pool Institute, in its standards for both swimming pools and spas, recommends an ideal TDS of between 1,000 and 2,000 ppm, with a maximum of 3,000 ppm.

No one knows exactly what mechanism is at work when you're dealing with high TDS water. One commonly held theory is that when you get a lot of dissolved substances in water, they interfere with the normal workings of sanitizers. They may do this by forming a chemical "shield" around bacteria, algae, and other substances normally attacked by chlorine or bromine. Or they may simply present "roadblocks" in the path of sanitizer molecules, preventing them from freely circulating.

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TDS buildup is inevitable. As we've explained, every time you add chemicals to water, you're increasing the TDS. When the water evaporates, it leaves behind all of the solids that had been dissolved in it.

Just how much are you increasing the TDS when you chemically treat pool or spa water? Well, for every pound of dry chemical that you add to a 15,000 gallon pool, you are increasing the TDS by about 8 ppm.

"Parts Per Million" is what scientists refer to as a "weight to weight" measurement. That is, if you know how much the water weighs, and you know how much the stuff you are adding to the water weighs, you can calculate how many parts per million you are adding to the water.

As it happens, one gallon of water weighs 8.34 pounds. So if you know how many gallons are in a pool or spa, and you multiply that number by 8.34, you will know how many pounds of water are in the pool or spa.

So, how many pounds of water are in a 450 gallon spa? The answer is 3,753 pounds (450 x 8.34 = 3,753). How about a 15,000 gallon pool? Well, 15,000 x 8.34 = 125,100. So, there are 125,100 pounds of water in a 15,000 gallon pool.

OK, so now you know how much the water weighs. Now, take 1 million and divide it by the total weight of that water, and you will find out how many parts per million are contained in each pound of water. For example, 1,000,000/125,100 (pounds of water in our 15,000 gallon pool) = 7.99. We'll call it 8. That is, every pound of material added to a 15,000 gallon pool will contribute about 8 parts per million.

How about a 450 gallon spa? Take 1,000,000, divide it by 3,753 (the weight of the water in the spa), and you get 266.45. We'll settle on 266. So for every pound of stuff that you add to a 450 gallon spa, you will be increasing the TDS by 266 parts per million.

Incidentally, if you wanted to design a pool that would contain almost exactly 1 million pounds of water, it would be a 120,000 gallon vessel. In that pool, every 1 pound of solids dissolved in the water would increase the TDS by 1 ppm.

Every sanitizing chemical, and every pH adjusting chemical used in the pool and spa industry will eventually contribute to the TDS in a pool or spa. Some will contribute more than others. Because sanitizing compounds often require the additional use of pH adjusting chemicals, the chemical maintenance regimen you choose can have a dramatic effect on the buildup of TDS.

TDS is fairly easy to calculate for dry chemicals. It's a bit more complicated for liquid solutions. If a research lab were going to test the solids content of a liquid, they would take a precise volume of the liquid and then slowly heat it until the liquid itself had evaporated. Then they would dry the remaining solids and weight them.

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The two most common liquid solutions used in our industry are muriatic acid and liquid chlorine (sodium hypochlorite). For your information, 1 gallon of muriatic acid will contribute 1.87 pounds of dissolved solids to the water. 1 gallon of liquid chlorine will contribute 2.2 pounds of dissolved solids.

You should also understand that every type of chlorine & sanitizer - including gas chlorine - eventually ends up contributing to TDS in the form of chloride. So every time you add a pound of dry chlorine compound, or infuse a pound of gas chlorine into a 15,000 gallon pool, you will wind up increasing the TDS by about 8 ppm.

Short of a detailed laboratory analysis, the most dependable method of TDS testing is through the use of a portable TDS meter. These meters actually measure the conductivity of the water - its ability to conduct an electrical charge, which happens to increase as the TDS increases.

Hand-held TDS meters - usually in the $50.00 - $150.00 range, generally operate by either placing some water in a sample cell or dipping the meter directly into the pool water and pushing a button, which causes a small electric current to pass between two electrodes immersed in the water and separated by a specific distance.

The meter measures the current passing between the electrodes and uses that to determine the water's conductivity The meter dial (or LCD readout) is calibrated to indicate TDS in parts per million.

The easiest way to reduce TDS is to drain and refill it with fresh water. This can also be done in stages, taking the water level down 1 or 2 feet at a time and refilling over a period of days or weeks.

Under normal circumstances, pool water can be expected to last anywhere from 3 to 5 years before it has to be completely changed. Your choice of chemical treatment can help to determine just how long it lasts.

Reprinted from Pool & Spa Service Industry News

Another Article

What Are Total Dissolved Solids?

1. "Dissolved solids" refer to any minerals, salts, metals, cations or anions dissolved in water. This includes anything present in water other than the pure water (H20) molecule and suspended solids. (Suspended solids are any particles/substances that are neither dissolved nor settled in the water, such as wood pulp.)

2. In general, the total dissolved solids concentration is the sum of the cations (positively charged) and anions (negatively charged) ions in the water.

3. Parts per Million (ppm) is the weight-to-weight ratio of any ion to water.

4. TDS is based on the electrical conductivity (EC) of water. Pure H20 has virtually zero conductivity. Conductivity is usually about 100 times the total cations or anions expressed as equivalents. TDS is calculated by converting the EC by a factor of 0.5 to 1.0 times the EC, depending upon the levels. Typically, the higher the level of EC, the higher the conversion factor to determine the TDS.

Where do Dissolved Solids come from?

1. Some dissolved solids come from organic sources such as leaves, silt, plankton, and industrial waste and sewage. Other sources come from runoff from urban areas, road salts used on street during the winter, and fertilizers and pesticides used on lawns and farms.
2. Dissolved solids also come from inorganic materials such as rocks and air that may contain calcium bicarbonate, nitrogen, iron phosphorous, sulfur, and other minerals. Many of these materials form salts, which are compounds that contain both a metal and a nonmetal. Salts usually dissolve in water forming ions. Ions are particles that have a positive or negative charge.
3. Water may also pick up metals such as lead or copper as they travel through pipes used to distribute water to consumers.
4. Note that the efficacy of water purifications systems in removing total dissolved solids will be reduced

over time, so it is highly recommended to monitor the quality of a filter or membrane and replace them when required.

Why Should You Measure the TDS level in your Water?

The EPA Secondary Regulations advise a maximum contamination level(MCL) of 500mg/liter (500 parts per million (ppm)) for TDS. Numerous water supplies exceed this level. When TDS levels exceed 1000mg/L it is generally considered unfit for human consumption. A high level of TDS is an indicator of potential concerns, and warrants further investigation. Most often, high levels of TDS are caused by the presence of potassium, chlorides and sodium. These ions have little or no short-term effects, but toxic ions (lead arsenic, cadmium, nitrate and others) may also be dissolved in the water.

Even the best water purification systems on the market require monitoring for TDS to ensure the filters and/or membranes are effectively removing unwanted particles and bacteria from your water.

How do you reduce or remove the TDS in your water?

Draining and filling with fresh water

By the use of the following filter and water purification systems:
1. Carbon Filtration
Charcoal, a form of carbon with a high surface area, adsorbs (or sticks to) many compounds, including some toxic compounds. Water is passed through activated charcoal to remove such contaminants.

2. Reverse Osmosis (R.O.)
Reverse osmosis works by forcing water under great pressure against a semi-permeable membrane that allows water molecules to pass through while excluding most contaminants. RO is the most thorough method of large-scale water purification available.

3. Distillation
Distillation involves boiling the water to produce water vapor. The water vapor then rises to a cooled surface where it can condense back into a liquid and be collected. Because the dissolved solids are not normally vaporized, they remain in the boiling solution.

4. Deionization (DI)
Water is passed between a positive electrode and a negative electrode. Ion selective membranes allow the positive ions to separate from the water toward the negative electrode and the negative ions toward the positive electrode. High purity de-ionized water results. The water is usually passed through a reverse osmosis unit first to remove nonionic organic contaminants.

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