Aquatic Consulting Services
1220 Rosecrans Street #915 • San Diego • California • 92106

Pool Tip #40: Cloudy Pool Water

When pool water appears cloudy or milky, and a fine white precipitate settles out after peak use periods, check the following items:

Turnover rate

Make sure that the normal flowrate is being maintained, and that an obstruction or pump impeller damage due to cavitation is not restricting the amount of water moving through the filters.

Filter Valves

Make sure that all valves are open or in the correct position to allow water to move through the filters.

Broken Laterals

Check the bottom of the swimming pool first thing in the morning before the water has been agitated and look for regular deposits of filter media near the return inlets. Isolate individual filter tanks from the bank to try to determine which laterals have broken. Remove the filter media and inspect the laterals at the bottom of the tank, and replace those which have broken.

Fines

If filters are not backwashed properly and for an adequate amount of time, fine particles start to work their way down into the filter bed. Eventually fines are carried into the laterals and back into the pool. On filter systems with automatic backwash valves, make sure that booster pumps are bringing the pressure up to 50 psi during the backwash process.

Channeling and Mudball Formation

Open the filter tank and observe, dig with a trowel or poke (being careful not to damage the filter tank or components) and look for: flatness of the media bed, channeling (holes), biofilms on the tank walls, media migration, and contamination caused by improper backwashing or improper chemical balance.

Perform a settling test to determine the make-up of the filter bed. Take a large glass jar (like a mayonnaise jar) and fill it with 2 cups of water. Add 1 cup of media from your filter. Add 1 teaspoon of dishwasher detergent or Calgon water softener. Replace the jar lid and shake. Allow the solution to settle overnight. The sample should settle into a layer of sand with water on top. If instead, it settles into layers with the sand on the bottom, silty material above the sand layer, and an organic layer on top, replace the filter media in the tanks.

Clean the sand media inside the filter tank by adding a commercial sand cleaning solution or sodium bisulfate. Mudballs and channels which form inside the sand should be destroyed.

Mudball formation is caused by calcium scale, organic debris, detergents, oils, and bather waste products. These oily products reduce sanitizer effectiveness, promote bacterial growth, and cloud water. In addition to forming scum lines at the water surface, they may also clog cartridge filters and diatomaceous earth filter elements, and contribute to mudball formation in sand filters causing reduced filter effectiveness.

The use of enzymes or absorbent foam products is recommended to help prevent these problems from occurring in the first place.

Enzymes are catalysts that start or speed up chemical reactions. Enzymes are protein-like substances that form naturally in animal and plant cells, but today, synthetic enzymes have been developed. Enzymes slowly, over several days, digest and destroy oils in pool water by converting them to carbon dioxide and water. A similar process is used to clean up oil spills that occur in the ocean. An initial dose of one to two ounces of enzyme per 1,000 gallons of pool water is recommended and then maintenance doses of about half that amount should be added to the pool on a weekly basis.

Absorbent foam products can also be used to physically remove oils from the water. Manufacturers of the products say the patented molecular structure and cell design of the foam allows it to absorb many times its own weight in oil. When the foam is saturated with oil, it turns a dark color, becomes heavy and sinks. The foam can be replaced, or for a period of time can be cleaned and reused by removing the absorbent foam from the pool skimmer, hair and lint strainer or filter tank, squeezing out the oils and replacing it in its hidden location.

Filters Not Properly Sized

Make sure that the filters are properly sized. If water is allowed to flow through the media at a rate higher than that recommended by the manufacturer and NSF International, debris will pass right through without being removed. To determine needed filter size, calculate the square footage of each filter tank (or look on the permanently affixed plate on the front of the filter). Take the flowrate in gallons per minute (gpm) and divide by the design flow rate for the particular tank using the same media. The total media square footage should exceed this number.

For example, a pool with a flowrate of 1,000 gpm, is being filtered with a bank of 4 horizontal high rate sand filters each with 13.5 square feet of #20 silica sand filter media for a total of 54 square feet of media. The design flow rate is a minimum 15 gpm/ft^2 (with 12 gpm/ft^2 recommended). One thousand gpm divided by 15 gpm/ft^2 equals 66.6 ft^2. The filters are considerably undersized, and water is likely to be cloudy during periods of heavy use.

High TDS

Use a TDS meter to determine the level of total dissolved solids. Regular dilution is recommended at a rate of 8 gallons per pool user per day. If TDS levels exceed 1,500 ppm and are causing problems with taste, clarity, ability to maintain ORP levels…, dilute significantly, or drain and refill the pool with fresh water.

Infrequent Vacuuming

Make sure the pool is routinely being vacuumed on a daily basis, first thing in the morning, or after a period of quiescence of at least 2 hours, to allow debris which is heavier than water to settle on the bottom of the pool. Check that portable or robotic pool vacuum filters are being disinfected and cleaned properly.

High Cyanuric Acid Levels

Do not use cyanuric acid or chlorinated isocyanurates in indoor pools, or in outdoor pools and spas with extremely high organic loading problems. If cyanurates are used to prevent loss of chlorine and dissipation into the air due to exposure to ultraviolet light, use in moderation. Keep cyanuric acid levels in the 10 ppm – 20 ppm range since 95% of the staying power benefit is achieved in that range, and the negative effects on pathogenic organism kill time, and depression of ORP are still within an acceptable range.

Unbalanced and Oversaturated Water

Since water is the universal solvent, all things will inevitably dissolve in water until the water becomes saturated. Eventually, water will become unbalanced or 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. 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.

SI = pH + alkalinity factor + calcium hardness factor + temperature factor – TDS factor.

Temperature		**Calcium Hardness**		**TDS**		**Total Alkalinity**	
degrees	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				

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, vinyl liners will become brittle, 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 surfaces (like colored tiles or black bottom pools). Calcium carbonate scale will also build up on the interior surfaces of the pool recirculation pipes causing a condition similar to "hardening of the arteries". 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, make the appropriate chemical corrections, starting with total alkalinity, then followed by pH, temperature, calcium hardness, and TDS.

Chemicals Added to the Water in too Great a Quantity In too Short a Period of Time

With the exception of chlorine, pool chemicals should be added to the pool gradually in small quantities over an extended period of time. Predissolve solid, granulated or powdered chemicals prior to their addition. Try to limit chemical additions to 10 ppm changes at a time.

Algae Bloom

Algae is a waterborne plant introduced into pools by swimmers, make-up water, rain, wind and windborne debris. Although algae in and of itself is not harmful to swimmers, it does cause problems when allowed to grow in a swimming pool. Algae gradually removes carbon dioxide from the water in order to manufacture food, and may cause a dramatic rise in pH. Pool water may become turbid, cloudy, or discolored. Pool surfaces can become slippery from a noticeable algae growth on the pool bottom or walls. Algae is a higher organism that may harbor pathogens or disease causing bacteria. Chlorine demand may be high as chlorine is used in an attempt to kill or control algae growth. Pools filled with algae may give off unpleasant odors.

To control algae growth, maintain adequate chlorine and ORP (oxidation reduction potential) levels, keep the water circulating continuously, make sure you have a uniform circulation pattern and absence of dead spots in the pool, superchlorinate regularly, and scrub or brush pool walls to prevent algae from adhering. If water is not continuously circulated, sanitized and oxidized, you may need to use commercially prepared algaecides or algaestats to keep algae growth under control. Some algaecides are more effective against a particular type of algae, and some are more appropriate for use in pools or in spas.

If you continue to have serious algae problems, you may want to monitor nitrate levels more closely, and try to determine the source of contamination. Nitrates stimulate plant growth, and when high levels of nitrates (greater than 25 ppm) are present in pool water, uncontrolled algae growth often occurs even though unaccountably large amounts of chlorine are being used. Nitrates are introduced into pools from: fill water in areas where fertilizer has worked its way down into the ground water, contaminated reservoirs or wells, rain, fertilizers or grass blown into the pool from the adjoining landscaping, human or animal urine or fecal matter, and bird droppings. Pools located in agriculture areas, screened pools, and pools that border large bodies of water often experience nitrate problems. To lower pool nitrate levels, try shocking the pool with chlorine to over 30 ppm, or partially drain and refill the pool with water which is not contaminated with nitrates.

Dead Spots

Perform a dye test of pool circulation patterns to make sure that all inlets are operating properly. Note the inlet pattern, any inlets that don't work, inlets where the water stream is weak, inlets pointed in the wrong direction, or inlets in need of adjustment.

Look for circulation "dead spots" or “weak spots” where the water does not change color, and record. If filtered, heated, chemically treated water is not being uniformly distributed to all areas of the pool, it is likely that algae will become established in the pool, and other water quality problems will develop.

Colloidal Particles

Colloids are particles smaller than 1 micron in size which are suspended in water. Colloids are small enough to pass through pool filters, too light to settle on the bottom of the pool, and make water murky or cloudy. Flocculants and clarifiers make colloidal (Koll-oyd-al) particles stick together or coagulate so that the particles become large enough to be filtered out or heavy enough to settle.

Although aluminum sulfate (alum) was the most common flocculant used in the past, today cellulose fiber or poly aluminum chloride are more common. The products are added directly to the filter bed and form a layer on top of or between the grains of sand media.

Clarifiers are biodegradable organic polymers usually made up of the natural polymer chitin often extracted from sea organisms. Positively charged repeating polymer links attract negatively charged colloidal particles. The electric charge is neutralized, and the polymer coils up into a large particle which can be filtered.

Excessively High Calcium Hardness Levels

If water is difficult to balance due to extremely high calcium hardness levels the use of sequestering or chelating agents is recommended.

Sequestering agents increase the ability of water to hold dissolved minerals or metals in solution. It is a preventative treatment. Sequestering agents keep minerals from: oxidizing and staining, causing scale build-up, precipitating (coming out of solution) calcium and magnesium salts when pH and water temperature rise, discoloring or clouding the water, attaching to and discoloring bathers’ hair.

Chelating agents (pronounced “key-lating”) remove metals or dissolved minerals from the water. They cure mineral staining problems. Organic water soluble molecules bond and react with metal ions to keep them from precipitating.

Heavy Bather Loads

To maintain clarity, keep the bather load to total filtered water (gallons/day) ratio at 1 bather : 1,400 gallons or less. The onset of turbidity is constant and related to the number of bathers, not just turnover time. If debris is added to the pool water faster than the filter can remove it, turbidity will increase. Debris is introduced into a pool through airborne dirt, dust, plant matter, and pollen; rain water, and bathers, but the greatest amount of debris is brought into the pool by bathers.

To determine maximum bather load:
Multiply flowrate (gpm) x 60 (minutes/hour) x 24 (hours/day) to get the total filtered gallons per day. Then, divide total filtered gallons per day by the constant 1,400 gallons to get the maximum number of bathers per day who can enter the pool before water clarity problems result.

To find the needed turnover time required at a given maximum bather load:
Multiple the actual number of bathers using the pool per day by the constant 1,400 to get total filtered gallons per day needed. Divide by 24 (hours/day), then divide by 60 (minutes/hour) to get the required flowrate in gpm. Divide the volume of the pool in gallons by the required flowrate to get the needed turnover time in minutes.