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Athletic BUSINESS

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AWARDS

SALUTING THE BEST IN FUND RAISING AND PROMOTION

COMMON POOL PROBLEMS AND SOLUTIONS

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Do swimmers using your pool complain about eye irritation? Is your pool's plaster shell deteriorating or mineral stained? Is your pool water frequently cloudy? Knowing how to identify the causes of these problems and how to solve them will make your job more pleasant and may improve the appearance of your pool.

CHLORAMINES

Although pH imbalance, excessive turbidity or even reflective sunlight sunburning swimmers corneas are possible causes, most often swimmer eye irritation and the unpleasant "chlorine odor" associated with swimming pools is due to the presence of measurable chloramine levels.

Chloramines form when chlorine levels are maintained below the "breakpoint" and organic materials in the water are incompletely oxidized.

When chlorine is introduced into the water bacteria are destroyed. Regardless of what form of chlorine is used as the primary bactericide, the same chemical reaction takes place.when chlorine is added to water. Some chlorine is lost through dissipation into the air. Hypochlorous acid (HOCl), an effective oxidizer and sanitizer is formed and breaks down matter into inactive compounds. The amount of chlorine needed to destroy bacteria and organic matter already present in the water is called the chlorine demand. The chlorine left over is called the chlorine residual. Residual chlorine is maintained as a type of insurance policy to react with bacteria and organic matter that the operator anticipates will be introduced into the pool. The residual chlorine that is free or available to immediately attack contaminants is known as free available chlorine (FAC).

Hydrochloric acid (HCl) also forms as a by product of the chlorination process, and causes a drop in pH. Hydrochloric acid has a tendency to combine with ammonias (NH_3) and other nitrogen compounds introduced by swimmers, to form tightly combined molecules called combined available chlorine (CAC), or chloramines. Although they are present in the water as a

residual, they are not freely available and are undesirable. They will still kill bacteria, but at a rate approximately one hundred times slower that free available chlorine. They give off an unpleasant odor, and are a major cause of eye irritation, itchy skin, and mucous membrane irritation. Chloramines are removed through superchlorinating or shocking the water.

Superchlorination is an all or nothing reaction which occurs when a chemical breakpoint is reached. The purpose of doing this is threefold--to oxidize the organic material in the water, destroy the chloramines, and to kill algae. The concentration of chlorine in the water is increased to the point where bacteria and other organic matter are completely oxidized. Nitrogen and other wastes will "gas off". Superchlorination of pool water should be done periodically, at least once a week in pools, daily in commercial spas, or when the amount of CAC present in the water is greater than .3 ppm.

The amount of chlorine needed to reach the breakpoint can be mathematically calculated. Use a DPD (N-diethyl-p-phenylenediamine) colormetric or titration test kit to determine the amount of combined chlorines present in the water. If the CAC level is .3 ppm or greater, multiply the CAC by ten. Use this number and a standard chart to determine the amount of chlorine you must introduce into the pool water. You must also know the volume in gallons of water in the pool, the type of chlorine being used, and its percentage of available chlorine.

Amount of available chlorine necessary to raise the chlorine level
1 ppm per 10,000 gallons of pool water

1.5 cups	10%	sodium hypochlorite
1.3 cups	12%	sodium hypochlorite
1 cup	15%	sodium hypochlorite
2.25 ozs	60%	sodium dichloro-s-triazinetrione
2 ozs	65%	calcium hypochlorite
1.5 ozs	85%	trichloro-s-triazinetrione
1.3 ozs	100%	gas chlorine

Before superchlorinating, make sure the water is chemically balanced. Shocking a pool with unbalanced or oversaturated water, particularly with a high (basic) pH or high total alkalinity, will result in the formation of a carbonate precipitate which will cloud the water.

Although chlorine is not dangerous to humans in concentrations normally found in pool water, some health department regulations prohibit swimmers from using the pool when the chlorine concentration is raised. Because of this regulation, it is best to superchlorinate in the evening or during hours the pool is not in operation to allow chlorine levels to drop to "acceptable" levels. If it is necessary to superchlorinate during operating hours, add sodium thiosulfate to the water after superchlorinating to neutralize and bring down the chlorine present in the water.

Non chlorine oxidizers (potassium peroxymonosulfate) can be used instead of chlorine to shock or oxidize chloramines and other organic contaminants from the water. Unlike chlorine which must reach a "breakpoint" in order to cause total oxidation, any amount of potassium peroxymonosulfate added to water will oxidize some material. Non chlorine oxidizers will not raise chlorine to unacceptable levels, do not cause bleaching, and they don't effect water balance or pH. Oxidation can be performed while bathers are in the water. The product is especially recommended for pools with high bather load to water volume ratios, such as spas, where total dissolved solids and ammonia build-up as a rapid pace, and for indoor pools with poor ventilation.

PLASTER DETERIORATION

A majority of commercial pools in the U.S. are constructed of pneumatically applied shotcrete or gunnite finished with a plaster surface. Recently, severe plaster deterioration problems including mottling, spot etching, ghosting, bond failure, and staining, have plagued the industry. National Spa and Pool Institute sponsored Florida Marcite Committee and the California Plasterers Council are trying to determine what's causing the problems. Suspected causes which are being studied include improper troweling equipment, the application process, textural or composition defects in the marcite itself, improper water quality maintenance, climatic conditions, the cement to sand ratio of the mixture, the grade of calcium chloride used, method of filling the pool with water, and start-up procedures.

Because of the industry's inability to find a solution to the plaster deterioration problems, alternatives to plaster are increasing in popularity. Epoxy, chlorinated rubber and water based

paints can be applied. Aluminum or stainless steel inserts, or new PVC membranes can be installed. The surface can be tiled. But many operators are considering the application of fiberglass to cosmetically improve the appearance of their pools.

After proper surface preparation which includes sandblasting to remove old surface materials, tile repair and patching of cracks, a bonding coat is applied. Then depending on the application process used, either fiberglass mat is laid or chopped fiberglass is pneumatically sprayed on, and layers of fiberglass resin or gel coat are added. When compared to the alternatives, fiberglass is reasonably priced, long lasting--warrantees of up to fifteen years are common, easily patched or recoated, and simple to maintain. The smooth surface retains heat, doesn't leak, is stain resistant and inhibits algae growth. Potential drawbacks to the use of fiberglass are few, but do include: the appearance of cobalt stains caused when cobalt in the resin migrates to the surface and is oxidized by chlorine in the water, bond failure if the surface is not prepared properly, and delamination due to frequent freezing and thawing cycles .

MINERALS & STAINING

Minerals or dissolved metals in pool water are unwelcome because they impart color to pool water and stain pool surfaces. A test kit should be used to test for the presence of unoxidized minerals, but some dissolved metals can be identified by the color they bestow.

Stain Color	Dissolved Metal
Clear green	Iron
Greenish-blue	Copper
Brownish-black	Manganese
White	Calcium

Minerals (copper in particular) cause blond, gray or white haired swimmers' hair to turn green. Minerals are present in source water and many products added to the water. Metal staining occurs

as a result of electrolysis or through deterioration of pipes due to poor water balance, and is easier to prevent than to get rid of.

Superchlorination will oxidize dissolved minerals out of the water, eliminating potential problems.

Sequestering agents, or chelating agents, can be added to the water to help prevent mineral staining and calcification by reacting with metal ions in the water, surrounding them and keeping them in solution.

Mineral staining can also be reduced by installing magnetic water conditioners. These lightweight ceramic magnets give off an extremely concentrated magnetic force which alters the water's electrical charge by producing positively charged ions. The magnets can easily be installed in minutes by an operator over a pool recirculation line. Although some manufacturers' claims of usefulness as effective algicides, clarifiers or flocculants, and water balance stabilizers are exaggerated, magnetic water conditioners have no replacement parts, do not wear out, need no power to operate, have no known side effects, and are effective over time.

If preventive measures are not taken and mineral staining occurs, stains must be removed by acid washing.

PROCEDURE FOR ACID WASHING A PLASTER POOL

1. Visually inspect the pool. Look for discoloration, mineral staining, plaster etching or mottling, chipped tile, broken steps, and cracks.
2. Drain the pool.
3. Inspect the entire surface of the empty pool. Tap the walls and pool bottom looking for loose plaster or hollow spots.
4. Sand off any excessive calcium build-up. Make sure the pool is dry and you have taken all appropriate safety precautions for working with an electrical sander. Remember water and electricity do not mix well.
5. Rinse down the whole pool with water from a high pressure hose.
6. Mix water and TSP (tri sodium phosphate) in a plastic sprinkling can. Add about 1/4 cup of tile soap to the mixture.
7. Pour the TSP mixture from the deck down, a small area at a time. Scrub with an industrial pool deck brush to remove the oil residue that has built up over time. After completing the pool walls, scrub the pool bottom in a similar manner. Be careful not to slip.
8. Rinse the entire pool with fresh water.
9. Acid wash with a mild acid to water solution, usually in a 1 part acid to 4 parts water ratio. Scrub a small area at a time till the surface feels like fine sand paper. Keep the rinse water on at all times. Move the sump pump around to avoid leaving a pump "foot print" on the bottom.
10. "Acid wash aid" can be added to the acid and water solution to help cut down on fumes, but it doesn't really help much, makes the plaster harder to etch, and makes the pool extremely slippery.
11. After completing the acid wash, rinse the pool several times with fresh water.
12. Pour sodium carbonate (soda ash) down the main drain to help neutralize any acid still left in the drains and recirculation lines.
13. Repeat "Step 7" and neutralize the pool shell with TSP.
14. Rinse again with fresh water.

WARNING:

- Read the MSDS (Material Safety Data Sheets) for all chemicals to be used during the procedure, before beginning work.
- Wear protective clothing that covers all areas of exposed skin. Wear a full face shield and respirator with fresh acid cartridges, rubber boots and gloves.
- Make sure that the room or area is extremely well ventilated, that you are not working alone, and that both you and your partner are knowledgeable in first aid procedures for acid burns, and respiratory emergencies if one of you should be overcome by fumes.

CLOUDY WATER

Cloudy or white turbid water may result from any of several possible problems.

POSSIBLE CAUSES OF CLOUDY WATER

- insufficient turnover rate
- high total dissolved solids
- oversaturated water
- chemicals added to pool water too quickly or in too large a concentration
- high combined available chlorine levels
- diatomaceous earth passing through filter elements
- infrequent vacuuming
- filters not sized properly or not sufficient to meet user demand
- dirty filters or over extended filter runs
- excessively high cyanuric acid levels

Problems associated with poor water clarity can be improved through the use of flocculants. Flocculants, also known as clarifiers, are chemicals that promote the coagulation or combination of suspended debris in the water, so they can be more easily removed by the filter. Coagulated particles may also become heavy enough to settle to the pool bottom where they can be removed by vacuuming. Flocculants make small particles bigger, aid the filtration process and decrease water turbidity.

Flocculants such as aluminum sulfate (alum) commonly used in the past, are being replaced, due to problems associated with their use with cartridge or diatomaceous earth filters, by biodegradable polymer products which work both as clarifiers and as sequestering agents. The newer non alum flocculants were developed from chitin extracted from sea organisms, particularly crab or shrimp shells. They can be used with any type of pool filter, are non toxic, safe to handle, effective, non polluting, biodegradable, and can be used to treat drinking water, salt water and fresh water pools.

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BIO

Alison Osinski is currently in private practice as an aquatic consultant. Her firm, Aquatic Consulting Services, located in San Diego, California has as clients: health and fitness organizations, service agencies, architectural firms, aquatic sporting equipment manufacturers, attorneys, and municipal park and recreation and safety management departments. Dr. Osinski's specializations within the field of aquatics include: aquatic risk management, aquatic facility design and renovation, swimming pool chemistry, maintenance and operation; and lifeguard, boating and water safety training program development.

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Sue Schmidt, Editor
Athletic Business Publishing
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Dear Ms. Schmidt:

Attached is the manuscript you requested for publication in the May 1990 issue of **Athletic Business** magazine. The article "Common Pool Problems" is intended to help aquatic professions identify problems and suggest solutions to help rectify those problems.

Please let me know if I can be of assistance in the future. I hope to meet you at your December convention in Anaheim.

Thank you,

Alison Osinski, Ph.D.