# FACILITIES DEVELOPMENT

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IMPORTANT facts about owning, operating or using a pool/spa: Each area's water quality is different. If you try to treat water in the Midwest like a person treats a pool in Arizona or Florida, you will be in for an unpleasant surprise: IT WON"T work. Many areas have metal laden water with high nitrate content. Some also have a high sediment rate of suspended matter in the water. Be aware of what brand of chemicals are being used. The wrong brand in the wrong area can create a whole set of problems that is both time consuming and expensive to correct. Unfortunately the chemical manufacture will not alert you of what to look for.

There are 2 components to having CLEAR WATER. (1) Proper circulation (2) Proper chemicals
If the pump is not properly sized or the filter is not the proper size or type, green water or cloudy "murky" water may result. Many pools are designed (through "value engineering") with too small a pump and filter; some are up to 3 times too small for the pool. A professional pool company can size your filter to your pool. You may use chemicals with calcium as the inert ingredient, or you may need to learn about technical-grade sodium based chemicals and what buffers or binders they use. Every area of the country is different.

One of the 2 most important water tests you can do on a daily basis is pH: the RED indicator. If your pH is not between 7.3 and 7.6 none of the chemicals you put in the water, including chlorine, will work properly. To raise pH use soda ash; to lower pH use sodium bisulfate. Baking soda (sodium bicarbonate) will also raise pH or muriatic acid will lower pH in certain circumstances. Certain pH control chemicals can throw your total alkalinity out of balance and cause major problems.45 minutes after adjusting the pH, test the water to see what was accomplished. Re-treat if the readings haven't changed. Add pH-adjusting chemicals through the skimmer, gutter or through an in-line feeder.


Test kit indicators (the clear liquid with the yellow lid for chlorine and the red liquid with the red lid for pH) are not good for more than 12 months. Replacement bottles and complete test kits are sold at the local pool dealer. Test strips do not work well or read accurately, so stay with the liquid 5-part test kit. In addition to the daily chlorine and pH test, test regularly for available chlorine, total alkalinity and cynauric acid level. Most State Department of Public Health Swimming Pool Divisions require many more tests than just Chlorine and pH. All tests must be recorded and the pool logs kept on file.

The goal of pool water testing is to maintain a healthy, clean pool environment. Proper control of all the variables involved in pool chemistry is assured only by constantly monitoring the water, evaluating the findings, adding chemicals, and maintaining automatic chemical feeders to control proper water balance. There are many different types of test kits, some rated for residential pools and others for commercial applications. Electronic controllers that read, evaluate and mechanically adjust the pool water chemistry have simplified the testing and maintenance procedures associated with water chemistry balancing. However, in many instances unique water qualities make these inaccurate and inconsistent. Regardless of the system used, all applicators must follow basic rules when testing water. Disinterest, sloppy instrument handling, hurried procedures, bad reagents, poor choice of sampling location or inaccurate measurements will lead to problems.

The following rules apply to all commercial chemical testing:

1. Most states require that pool water be tested at least twice a day with the results recorded on a daily operational sheet. Test at times when the pool is used during normal peak periods of use.
2. Make certain that the sample is representative of the pool water. Select a sample location that contains well-mixed pool water. Obtain sample from at least 6" below the water's surface. Do not collect the sample from in front of an inlet or from a surge tank.
3. Follow test kit instructions. Water testing is a precise process that demands accuracy in measuring amounts of reagents involved and in observing time and temperature requirements.
4. Rinse all solution tubes and equipment thoroughly after each use, both inside and outside. Do not rinse droppers or reagent bottles or let the droppers touch pool water. Do not handle the equipment or reagents with dirty hands. Rinse off any reagents that get on the skin.
5. Properly box or case the equipment, and store in a cool, clean, dry place. Do not interchange parts such as solution tubes, bottle caps or droppers. Reckless or inexact methods of water testing lead to inaccurate results and possibly an unsafe condition for people using the facility. Water must be kept in a healthy, clean and clear condition at all times.

**Testing for Chlorine ( 2-3xdaily - minimum):** There are three types of chlorine test readings: free, combined and total. Free chlorine plus combined chlorine equals total chlorine. Only the free chlorine is effective in killing bacteria or algae. The combined chlorine is bound with other elements (contaminants) and needs further chlorine additions (oxidizer) to release it. Orthotolidine testing (OTO) reveals only the amount of total chlorine found in the pool water and does not distinguish between free available and combined chlorine levels. If the amount of combined chlorine reads higher than that of the free chlorine, problems are present. Ideally the free chlorine level should be kept around 1.8 to 2.5. Any reading over 2.5 may result in water and air problems. If using a UV system this reading may be decreased to 1.5 or less. Check with you state Dept. of Public Health Swimming Pool Division for their requirements.
**Note:** *Many State Department of Public Health swimming pool regulations allow higher than 3.0 ppm free chlorine. Some allow 5.0 and higher. This is not healthy for the pool users or the water/air quality. Many professional organizations are currently trying to get this changed. Unless there is a bacterial problem, free chlorine over 3.0 causes more problems than it can ever solve.*

**DPD Testing (daily minimum):** The quality and type of test kits vary. DPD testing kits are used to test for free available chlorine (F.A.C.), combined available chlorine (C.A.C.) commonly called chloramines and total available chlorine (T.A.C.). If there is a chloramine problem or pH problem swimmers will complain of red, irritated eyes and strong odors. This is a very serious health hazard and must be immediately addressed. Even though some regulations allow .05 ppm combined chlorine readings, anything over .02 ppm can cause water and air quality problems.
**Note:** *Liquid reagents have an 8 to 12 month shelf life. The accuracy of the test is likely to decrease if reagents are stored inaccurately or for long periods of time. Keep in a cool dry place out of the sunlight.*

**Testing pH (2-3xdaily):** The pH of water is usually tested by matching reagent colors against a colormetric standard. The reagent generally used for swimming pool water is phenol red, which has a pH range of 6.8 to 8.4 and a corresponding color range of yellow to red. There are 2 distinct types of phenol red: A "J" solution (residential) and a #4 solution (commercial). Knowing the pH of pool water is essential for properly controlling all the water chemistry parameters. Test pH at least daily, or 2 times a day when the disinfectant residual is checked. Confirm that the pH is within the desired 7.3 - 7.5 range. Take water samples from the pool for testing the pH, not from a pipe tap or in the equipment room. pH can be lowered with Sodium Bisulfate or Muriatic Acid. pH can be raised with soda ash or sodium bicarbonate.
**Note:** *Remember when dissolving chemicals, add chemicals to water; never add water to chemicals.*

Testing for Calcium Hardness Levels (monthly): Total hardness is the measure of calcium (Ca) and magnesium (Mg) in the water. Excessive hardness, the combination of calcium [Ca] and magnesium [Mg], causes calcium scale to build up on the walls and floor of plaster finished pools and spas and also on liners, tile and fiberglass. It also leaves scale build-up in heaters, heat exchangers and other filtration components. Recognize that it is not the magnesium that forms the scale, only the calcium forms scale. When the hardness level drops too low, the water becomes aggressive and will cause corrosion, pitting of plaster, and dissolving grout. Control of scaling or aggressive water requires the calcium hardness level to be kept above 200 ppm and below 400 ppm. Calcium chloride (CaCl) is used to increase the hardness level.

Testing for Total Alkalinity (monthly): Alkalinity in water represents the amount of bi-carbonates, carbonates, hydroxide and sometimes borates, silicates and phosphates. Total alkalinity is the resistance of water to changes in pH. The higher the total alkalinity, the more difficult it is to change the pH with soda ash or acid. Testing for total alkalinity is essential to make proper determinations of the saturation index as well as for bather comfort and ease of pH control. Total alkalinity (calcium carbonate) should be kept between 80-120 ppm for pools with inert liners, and

between 100 to 125 ppm for pools with plaster finished surfaces. Pools with source water with alkalinity over 200 cannot use CO2 for pH control.

Total Dissolved Solids (TDS) (monthly): Total dissolved solids (TDS) is the measurement of all materials dissolved in the water, i.e. calcium, dissolved organic and inorganic materials, carbonates, salts from chlorine residue, swimmer waste, soluble hair and body lotion, or anything in the pool that can be dissolved. The total dissolved solids (TDS) in a pool should not exceed 1,500 ppm. High TDS is common with spa water with high bather load, high chemical needs and a relatively small volume of water. TDS can only be corrected by dilution with water with low TDS or completely draining and refilling with fresh water. TDS levels require a special test kit.

Cyanuric Acid Testing (monthly): Cyanuric acid is commonly added to outdoor pools as a chlorine stabilizer or chlorine conditioner. The concentration of cyanuric acid must be monitored carefully to insure that the chlorine does not become over stabilized. Cyanuric acid products are not recommended for indoor pools and spas, since the need for chlorine protection from the sun is not a concern. However, many chemicals used in indoor pools and spas have small amounts of stabilizer (used as a binder or buffer in the manufacturer process) that can build up over time. The acceptable range of cyanuric acid is generally between 30-80 ppm. Tests are based on turbidity (cloudiness) or metal fallout. Cyanuric acid is also called stabilizer, conditioner and sun-screen. The only way to lower Cyanuric levels is to drain the pool or spa. Year round pools tend to have more challenges associated with iso-cyanurics than seasonal pool that drain their water and start fresh every year.

Copper Testing (monthly): Copper found in pool water contributes to staining of pool walls, water discoloration, and turns hair or nail cuticles of the pool users green or blue. Therefore, the recommended copper level is less than .02 ppm. If copper is present, maintaining a pH of 7.4 to 7.3 and a hardness of 350 ppm reduces the negative influences of copper.

Iron Testing (monthly): Dissolved iron is responsible for staining and color problems in pool water and on pool surfaces. The addition of chlorine in an adequate concentration helps to precipitate out the iron and allows the DE filter to remove it. Sand filters will usually just keep recirculating the iron until it either ends up on the bottom of the pool or goes back into suspension. Products that claim to “hold the iron in suspension” are expensive and do not work well.

**Test Strips for Water Chemistry Levels** (not allowed in most commercial applications): Test strips are available to determine chlorine and pH values as well as other parameters of water chemistry. These test strips are easy to use but they are only useful as general guidelines and in the presence of high metal concentration in the water or water over 84 degrees they are not reliable. Stick with the liquid test kits for reliability and accuracy.

Record Keeping: When performing water tests, keep a written record of the results. This information is helpful for understanding the dynamics of the pool’s system. Over time, you may notice trends and be able to anticipate water needs and keep a tighter control on water quality. This information is also required by the State Department of Public Health.

**Summary of Water Chemistry Testing**: To insure proper water quality and sanitizing levels of any swimming pool or spa pool, you must have a working knowledge of all parameters affecting water chemistry and must be familiar with water testing equipment. Testing equipment must be maintained in clean conditions, and fresh reagents used for achieving accurate results. You must record the results of testing activities.

**Temperature**: Water and air temperature should be monitored and recorded twice daily. There is an abundance of misinformation published about the relationship between air and water temperature. Do your homework and use common sense.

Water varying from 83-86 degrees Fahrenheit (28-30 degrees Celsius) is the most comfortable temperature for typical water fitness classes and general swimming. This allows the body to react and respond normally to the onset of exercise and the accompanying increase in body temperature. Cooling benefits are still felt and there is little risk of overheating. Program modifications will be required for water temperature outside the recommended range. Aquatic Fitness Professionals should know the water temperature and modify the program accordingly based upon the population and the program format. Water temperature below the recommended range requires modifications in programming. Participants may find it necessary to wear specialized clothing to maintain body heat. Water temperature above the recommended range also requires modifications in programming. The intensity and length of the main segment should be adjusted to prevent overheating. Encourage proper hydration and apparel. Specialized populations may require specific water temperatures for safe and effective programming. Some general guidelines are as follows:

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|---|---|---|
| Swim Team & Lap Swim | 78 – 82 F = 25.5 – 27.5 C | Slightly warmer may be workable |
| Resistance Training | 83 – 86 F = 28 – 30 C | |
| Therapy & Rehab | 91 – 95 F = 33 – 35 C | Can be as low as 87 F for many types of therapy |
| Multiple Sclerosis | 80 – 84 F = 26.5 – 29 C | Warmer water can cause adverse affects |
| Pregnancy | 78 – 84F = 25.5 – 29 C | Warmer water can cause adverse affects |
| Arthritis | 84 – 88 F = 29 – 31 C<br>86 – 90 F = 28 – 32 C | Arthritis Foundation minimum<br>ATRI low function program |
| Fibromyalgia | 86 – 96 F = 30 – 35.5 C | ATRI |
| Aerobic activity | 84 – 88 F = 29 – 31 C | Arthritis Foundation |
| Older adults - vertical | 83 – 86 F = 28 – 30 C<br>86 – 88 F = 30 – 31 C | Moderate to high intensity<br>Low intensity |
| Children, fitness | 83 – 86 F = 28 – 30 C | |
| Children's swim lessons | 84+ F = 29.+ C | Varies with age and class length |
| Obese | 80 – 86 F = 26.5 – 30 C | |

Filtration The water chemistry can be perfect but if the filtration or circulation is inadequate, there can still be problems. Proper filtration is 50% of the water clarity equation. There are 3 main types of filters:

Sand (40 microns)
Cartridge (15-20 microns)
DE (4 – 9 microns)

The smaller the size-number of microns the better the filtration. Assuming the pump is sized properly, DE is the most effective form of filtration. Filters must be cleaned on a maintenance schedule and media changed. Proper monitoring and maintenance is imperative. Many times water conditions warrant the use of more than one type of filter (e.g. sand filters can use cartridge filters as a scrubbing or polishing filter when installed after the filter/pump/heater and before water returns to the pool. A valved piping loop will allow the cartridge filter to be used when necessary.

Liquid chlorine has become a preferred method to treat pool water. Using cheap bleach from the store is not the same as using commercial liquid chlorine. Make sure the liquid chlorine being used has no stabilizers as a base or buffer. Read the label carefully and learn what the terms mean.

All chlorine's/bromine's are not the same, in fact, seldom are any 2 identical. Some use calcium, potassium or lithium for a base. Others use industrial or technical grade sodium. It is not the chlorine that makes one brand superior to another, but the base, the inert ingredients and the processing methods. Some of the chlorines on the market today are not suitable for pool use. So why are they sold? Possibly because people buy them and then buy the "corrective" chemicals to solve the problems they create. A large amount of the advertising for pool chemicals is false and the pool owner/manager is the one who suffers. Learn what chlorine will and won't do and stay with one brand that services the established needs.

The same advice holds true about algaecides, except there are even more products to choose from. Polymer based algaecides seem to work best and have no undue side effects. Again, watch out for the inert ingredients. Algaecides come in different concentrations, the more expensive bottle with the higher % of active ingredients may be the most economical to use in the long run. Also, there is no such thing as an "algaecide block" or an algaecide that you use once a month or less often. Stay away from products that promise easy answers.

Many times, green water is not caused by algae. It is usually caused by a chemical reaction that knocks the metals out of the water. Sometimes this can be the fault of the type/brand of chemicals used, other times the fault of the filter, then sometimes the problem can be more complex. Regardless of the cause, the problem cannot be solved by adding chlorine, bleach, muriatic acid, clarifiers, algaecides, shock or metal-out. These compound the problem and make it harder to correct. Get a water sample to the nearest reputable pool dealer so they can help correct the problem.

**"Shocking"** the pool can be best defined as "throwing money down the drain". The term "shock" has been misused more than any other in the pool industry. Procedures that are commonly called shocking are:

1. Adding an Oxidizer: (Potassium Peroxy Monosulphate; brand names Oxykleer or Oxybrite and others) to the water to convert the available chlorine to free chlorine
2. Breakpoint chlorination: raising the chlorine to 10.0 or above (superchlorination)
3. Hyperchlorination: raising the chlorine to 20.0
4. Adding chemicals to start your pool in the summer or close your pool for the winter.

Don't do any of these unless you are experienced with the process and know what is trying to be accomplished.

**Note*:** If chloramines are being formed in the water most Health Departments will advise Super or Hyper Chlorinating. This sometimes will work, but the pool will be closed down until the pool reaches a swimmable condition, usually 3.0 total chlorine count or less, then letting the water settle back down to 1.8. A more realistic approach is to find out why chloramines are being formed. It may be better to consider a type of filter that helps remove chloramines (DE or cartridge filters as compared to sand filters) or look into an UV (Ultra Violet) system that breaks down chloramines. The type or brand of chlorine being used also needs to be considered.

*Superchlorination — The Shocking Truth by Scott Webb May 10, 2011 ….. problems with chlorine shocking techniques. For a long time, in our attempt to get rid of chloramines, we've been trying to read chloramine level in a pool and then hitting it with 10x that amount of chlorine.*

*While it's true this process does a good job in eliminating inorganic chloramines, some legitimate scientists (Professor E. R. Blatchley and Dr. Jing Li at the Purdue University School of Engineering and Dr. Tom Tufano, senior R&D chemist, at DuPont) have pointed out that these high doses of chlorine are useless against organic chloramines, and worse, cause the formation of nasty, hazardous airborne chemicals which cause problems in the lungs of swimmers and especially children and people with asthma. Of course, this is much more of a concern with indoor than outdoor pools.*

*Still, we've been hearing more and more about the effects of these airborne chemicals in recent years in research studies, and I think, as a health and safety concern, this will become an ever larger issue in the years to come. There are two basic points here:*

*1) Complex organic chloramines are unaffected by chlorine shock treatments. They just sit there in the pool, and continue building up over time.*
*2) These large shock doses of chlorine react with organic contaminants to form a variety of characters we don't want hanging around our swimming pools.*

*The basic problem remains, however, how do we get rid of chloramines. Ozone is a great oxidizer of chloramines but it carries a price tag that many can't afford. Potassium Monopersulfate doesn't deal with organic chloramines either, although it doesn't seem to have the problems that chlorine does in producing unwanted by products.*

Never add chemicals to suspend the metals in the water or sequester the metals. Most of the metal inhibitive products do not work and they can actually stop the proper treatment for the water from working for up to a month. They are also very expensive, especially for large pools.

Stabilizing or sun screening the water can save some money over the summer season. Stabilizer is not necessary but it can make sodium based chlorines burn more effectively in the hot sunlight. Stabilizing is something not just done automatically every season because the chemical in stabilizer lasts for years in the water. If too much stabilizer is in the water nothing will take it out; the pool will have to be drained. Test the water for cynauric acid content to see how much stabilizer is needed. Do not stabilize indoor pools.

To make pool accessories (hoses, vacuum heads, nets, games) last as long as possible, store them out of the direct sunlight when not in use. The ultra-violet rays of the sun cause deterioration of anything made from plastic-type material. Protect filter hoses and filter housing from as much sun as possible. Most commercial accessories and pool covers/liners are made with ultra-violet inhibitors in the material. They cost only slightly more than the standard pool accessory but will last noticeably longer.

When the pump/filter is on a timer to save electricity by turning off at night, the pool will experience a higher chemical usage. After the water has been setting un-filtered for 3 hours the chemical life has been cut in half. More than 3 hours it has been cut by 2/3. So saving $2 in electricity may cost $5 in pool chemicals. Lack of proper circulation is the main cause of improper oxidation of chemicals. In addition, pool pumps will last longer if allowed to run continuously.

When adding make up (fresh) water to a pool, add the water directly to the piping before the filter if possible. Adding the water in the pool may cause chloramine problems.

Many times, pool owners/managers are their own worst enemies. They talk to friends who own pools and they say someone else tried this or uses that and it works great; so they try it. Don't do it! Very seldom will a person admit to trying something that failed. Many of the "miracle treatments" are urban legends from the manufacturers or re-sellers. People can try a gimmick chemical four or five times and one time it may seem to help but it may have been just a coincidence. Here is some good advice to follow:

1. If something works for you, don't change it. Also, don't expect it to work the same for someone else.
2. Do exactly what your pool professional recommends. If you don't have confidence in you pool pro, change the place you do business. When you have a pool problem, tell your pool pro everything you did. Don't leave out the fact that you added some discount store chemicals. Without all of the facts, the proper solution may not be reached.
3. There is more to taking care of water than adding chlorine and vacuuming. Learn as much as you can, and never assume you know all of the answers. Ask you pool pro for assistance.
4. Never, never listen to the advice of a friend. Don't add stuff to your water unless a pro has recommended it and tested your water first.
5. Keep track of what is spent so at the end of the season you know how much it cost to operate the pool. This is the only way you can prove to yourself that not only is a specific brand of chemicals better and easier to use, but it actually saves money when looking at the entire pool season.
6. For on line water technician courses contact www.aquaticpartners.com

**When swimming pools lose power** the pump-filter-heater stop working. The water just sits there and in 6 hours it can start stagnating. Not become stagnant but the process starts. Here are some things you can do to slow the process…..

- State codes do not allow people to enter a pool that is not circulating. CLOSE THE POOL TO ALL USERS
- The Chlorination-Chemical feeders will not work so you have to hand-feed the pool(s)
  - Only use a sodium base Di or Tri Chlor in powder form. Spread the powder around the edge of the pool as evenly as possible.
  - Use 4 oz. of powder per 10,000 gal of pool water at least once a day
  - Cover the pool if possible to help stop evaporation and retain some of the heat. This also will help preserve the air quality since the HVAC is also not working without electricity.
  - Check the Chlorine and pH readings 3 times a day
  - Using Sodium base chlorines may cause the pH to drop so have soda ash on had to add to the water to keep pH at 7.4 Spread the soda ash powder around the edges just like you did the Chlorine. Usually 2 oz. per 10,000 gal of pool water will raise pH but you will have to use your test kit (no strips) to see how much. The more powder chlorine you add the more soda ash you may have to adjust with.
  - DO NOT use any powder chlorine with Calcium content. (E.g. sock it or shock) The calcium will cloud the water and just lay on the bottom and could affect the pool interior.
  - DO NOT try to add clarifiers or any other chemicals – they will not help the water clear!
  - The water will not remain clear, it will become cloudy the very first day. This does not mean it is stagnant. As long as the Chlorine is between 1.5 and 2.0 and pH is 7.4 when the power comes back on the pool will clear up quickly (24 to 48 hours) once it is being filtered again.
  - If you cannot get sodium based powdered chlorine, Clorox not scented liquid bleach can be substituted. Generic bleach is also OK but only plain bleach – no scented. One gallon bleach per 80,000 gals pool water once a day should suffice but your test kit will decide the amount you need.
  - Test water 1 hour after adding chemicals – no sooner.
  - If the pool is covered for more than 8 hours you may get a false low pH reading. You will have to wait until the power comes back on and uncover the pool and let it circulate for 4 hours before you can get a true pH reading.

**Note!** *Many gimmick chemicals are introduced to the pool market each year. Before jumping in to anything new, do research. Most of these chemicals or treatment systems will damage pool equipment, cost more to use, and will not kill all types of dangerous bacteria. Resist the temptation to save a buck. If you feel uncomfortable about asking*

*people in your area you can call your local Department of Public Health, Swimming Pool Division, or call USA Swimming Facilities Division at 719-866-3522 (e-mail mnelson@usaswimming.org). Most of the gimmick chemicals have already been banned for commercial use in pools and spas.*
*Example: http://aem.asm.org/cgi/reprint/69/5/2505.pdf*

**DANGER, WARNING!** RWI (Recreational Water Illness): This illness always been around but now it is being is being detected sooner. Chlorine, bromine and other chemicals do not kill it as quickly as needed especially when pH and other water balance factors are not correct.
Some of the causes:

- Changing children's diapers poolside while exposing the baby to pool water without showering after a diaper change
- Not washing hands after using restroom and not showering (with soap) before entering pool
- Swimming with diarrhea
- Aquatic shoes being worn to bathroom and then back to pool
- High-pressure deck washing blowing bacteria into pool water
- Swimming after using the toilet without proper cleaning

Identifying the ENEMY:

- Cryptosporidiosis: Parasite is resistant to germicides and bactericides and can live in the pool water for up to a week; highly contagious; transmitted by swallowing water and people contact; causes dehydration, weight loss, stomach cramps, fever nausea and vomiting; no treatment.
- Escherichia coli (E-coli): Bacteria controlled by proper chlorination; transmitted by swallowing water; causes bloody diarrhea, abdominal cramps, and kidney failure; treated with antibiotics.
- Giardiasis: Parasite can last less than an hour in a properly chlorinated pool; the cooler the water the longer it can survive; transmitted by swallowing water; causes diarrhea, gas, stomach cramps, nausea and upset stomach; treated with prescription drugs.
- Hepatitis A: Virus is mildly resistant to germicides and bactericides and can live approximately 15 minutes in a properly chlorinated pool; transmitted by swallowing water; causes jaundice, fatigue, loss of appetite, diarrhea, fever, stomach pain; vaccine available but no treatment after the fact.
- Legionnaires' Disease / Pontiac Fever: Bacteria killed in less than a minute in a properly chlorinated pool;
- transmitted by inhaling mist from hot tubs or spray features; not contagious; causes fever, chills, cough, aches, fatigue, diarrhea, kidney malfunction; treatable if diagnosed in time.
- Naegleria Infection: Microbe that enters through nose and affects brain and spinal nerves; (rare) this ameba lives less than a minute in a properly chlorinated pool; causes meningoencephalitis; prescription drugs available if immediately diagnosed.
- Norovirus Gastroenteritis: Virus that has a mild resistance to germicides and bactericides and can live approximately 30 minutes in a properly chlorinated pool; transmitted by swallowing water; causes nausea, vomiting, diarrhea, stomach cramps, flu like symptoms; no treatment specified; people usually recover on their own in 48 hours.
- Pseudomonas Dermatitis: Bacteria controlled by proper chlorination; hot tubs and pools; transmitted by direct skin contact with/in water; causes itching, rash, blisters; not contagious; clears up on it's own in about 48 hours.
- Salmonellosis: Bacteria controlled by proper chlorination; transmitted by swallowing water; causes diarrhea, fever, cramps; antibiotics available for more serious cases.
- Shigellosis: bacteria controlled by proper chlorination; transmitted by swallowing water; causes diarrhea, fever, cramps; treated with antibiotics.

Prevention:

- Post signs warning of the risk of swallowing or putting pool water in mouth
- Enforce showering rules and proper standards for cleanliness
- Test water 3 times a day (or more) for proper chlorine and pH readings
- Make sure all filter systems have fresh media and are properly cleaned on a regular schedule
- Add an Ultra Violet system to water treatment
- Include educational material in all policy and procedure manuals and patron flyers

**Fresh Air – Fresh Water**

There are a dozen or more opinions on water and air quality and almost all of them have some good points. Over half of the calls to the Facilities Development Department's have to do with poor air quality. The information listed below may help you investigate and solve your specific problem.

First & Foremost: Air quality and water quality are dependent on each other. Air quality is affected by:

- The amount of fresh air that is being introduced into the building every hour. (A 90% change of air every 20-25 minutes works well.)
- The condition of the air handling equipment filters. (The filters should be cleaned or changed every 3 months. There are micro-filters that filter out more air-borne contaminates than the standard fiberglass or paper filters.)
- The type of air handling system. (Do you have a Desert-Air type system that is regularly serviced?)
- Routine maintenance on all pieces of air handling equipment. (Vents and louvers must be checked and lubed at least 4 times a year to make sure they are working properly. Motor belts and fuses also need to be checked.)

If the air smells like chlorine – something is wrong. That acrid smell we sometimes associate with chlorine is usually ammonia. In the swimming pool industry the cause of this odor is called chloramines. Chloramines (combined chlorine) occur when free chlorine combines with ammonia and other nitrogen compounds. This combining process can be accelerated by perspiration, urine, saliva, body oils, lotions and some shampoos/soaps, fertilizers, and industrial or household cleaners. The odor is created when water is not properly balanced. The odor intensifies when swimmers agitate the water, as in kicking or general warm-up swimming. The odor is worse at water level but can be extremely irritating at deck level or in the viewing area. Many times eye irritation is also experienced. Sometimes the water may be hazy, but not always. Many times, the water will appear perfectly clear and the water test for free chlorine and pH reads normal yet there is still a problem with odor and eye irritation.

This has become a widespread problem in indoor pools. People with asthma can find themselves hospitalized if exposed to this type of pool condition for even a short period of time. Outdoor pools have plenty of fresh air and sunshine (ultra violet light) so they are not as susceptible to the chloramines problem.

Chloramines formation can be accelerated by:

1. Improper showering before entering pool.
2. Urination in the pool. (This has become an epidemic )*
3. A high level of aerobic activity and sweating in the water. (People sweat in the water during exercise.)
4. Residues from ammonia based cleaning products that are used on decks or in shower rooms/lavatories.
5. Residues from fertilizers used on landscaping (nitrogen based) that get tracked into building.
6. Poor air circulation and lack of fresh air introduction into the pool building.
7. Over use of “shocking” the pool for maintenance purposes.
8. Improper use of certain brands of chemicals not suitable for local conditions.
9. Chloramines added artificially by the local water company, a common practice in many cities.

**(*)** We don’t swim in your toilet – please don’t pee in our pool. This was a popular sign displayed at many pools in the 1970’s and 80’s. What happened to that message? It needs to come back, stronger than ever with the advent of municipalities going to chloramination of drinking water rather than chlorination. To make a very long explanation short, it is not chlorine that makes the pool air smell bad, it is chloramines.

During the past year or so, alerts hit the internet claiming that sixty three percent of people surveyed were not aware they could get sick coming in contact with contaminated water. One in five people admit they failed to get out of the pool before having to urinate. “When it comes to peeing, a survey of 1,000 adults finds 78 percent are convinced their fellow swimmers are the guilty parties”. The survey has a margin of error of 3 percent. Only 35 percent say they shower before entering a pool. *Even though our main goal is to improve air quality we need to mention that not showering further contributes to the bacteria and other dirty stuff, like sweat, getting into the pool. That dirty pool water can lead to recreational water illnesses including diarrhea, respiratory illness, and ear and skin infections*. Just 36 percent of those surveyed say the quality of the pool water is something they think about when they go to the pool. And think about this: some kids actually drink from the pool. This is a very dangerous practice.

Why is the issue of peeing in the pool so important? What has come to the forefront recently is that peeing in the pool may be one of the main causes for “bad air quality” in indoor natatoriums. Since urine has a high ammonia content, a few people peeing in a 25 yard pool can tremendously affect the chloramine level. This directly affects the air quality in the pool room. Then we read on the web how bad chlorine is for people with asthma. This is a sensationalistic “the sky is falling” approach to a problem that can be helped. Stop peeing in the pool and start taking showers before going in the water and it will be surprising how fast air and water quality improves.

I recently was on deck at a USA Swimming Sectional Meet that had good air quality on the first day of meet then very questionable air quality on the second day, and unhealthy/dangerous air quality on the third day. My eyes started to water within 10 minutes of entering the pool room. At that same meet I personally heard many swimmers joking about peeing in the warm-down pool. One of the misconceptions amongst swimmers is that one person peeing will not affect a large pool. They do not realize the problem they are creating.

We talked about this increasingly serious situation at the September 2009 United States Aquatic Sports Convention during the annual coaches meeting. Over 150 coaches were in attendance. They were all asked to preach "get out and use the bathroom" to their swimmers both in practices and during meets. This is the first line of defense against this problem. After the meeting I heard all sorts of comments. One that stuck with me was: "If I let my kids out of practice to go to the bathroom, I'll never get any set done right!" My reply was simply: "How will you get sets done right without a swimming pool?"

That's where this is heading! Pools that have bad air quality are mandated to spend $30,000 or more to upgrade their water treatment equipment. Some pools (average rate of about 2 per week) respond by closing their pools doors permanently. Even upgraded water treatment systems with ultra-violet systems cannot adequately handle the problems occurring in the tank between filter cycles.

Let's debunk an urban legend: – there is no chemical to add to the water that turns the water red – blue (or some other color) when someone pees. If you can invent such a chemical please let us know so we can buy stock in your product.

Problems that have the simplest solutions seem to be the most challenging. Think about this: we know the causes of lung cancer, but people still smoke. We know a major cause of high chloramine levels in pools that cause air and water quality issues, but……

Here is what you can do:

- Sit your swimmers down (more than once) and impress upon them the importance of not peeing in the pool. Not a passing comment or casual mention of the fact or a joke, but real a statement that gets the swimmers' attention and gets the point across.

- Make sure there is signage in more than one prominent location (including locker rooms and lobbies) stressing the importance of not peeing in the pool. **BIG – BOLD – LETTERS**. Not cutesy signs – **WARNING SIGNS.**

- Help make every coach, athlete, parent, official and volunteer aware of the seriousness of this problem.

What can be done about the issue of chloramines? The answer can be divided into two parts:

1. short-term solution
2. prevention

Short-term solutions: If chloramines are detected the most common solution is to "shock" the water. This means super-chlorination (break-point chlorination) or raising the level of chlorine in the pool to 10 parts per million. Normally a dry chlorine powder or liquid chlorine is used to achieve super-chlorination. Recent studies show that many times this is not as effective as hyper-chlorination which is raising the level of chlorine to 20 parts per million. These methods may temporarily "burn out" chloramines but will also necessitate the pool being closed for a few days. More than the normal amount of fresh air will also have to be introduced during this process. Shocking the pool can create a whole new set of problems.

Some success has been realized with a non-chlorine shock additive. Adding an Oxidizer (Potassium Peroxy, Monosulphate = brand names Oxykleer or Oxybrite) to the water to convert the available chlorine to free chlorine can release the available chlorine to free chlorine. If this process is done in the evening, swimmers can usually be in the pool the next morning. Fresh air introduction is still important. There are some new enzyme chemicals that say they help chloramines, but no positive proven results have yet been reported.

Prevention: Often more than one thing needs to be changed to alleviate the problem. The most common preventative methods are:

- Change the air circulation system to include more fresh air introduction and better turnover or more efficient closed system circulation and dehumidification.
- Evaluate the type and brands of chemicals being used to treat the pool water for both chlorine and pH control
- Evaluate the pool filtration system to see if a filter that filters down to a more effective micron rating (like DE at 4 microns) would help.
- Install a high quality activated carbon filter on the line that supplies fresh water from the city. All water needs to go through this filter before it goes into the pool or the re-circulating system. The carbon filter will remove most of the chloramines add by the municipality.

- Check the labels on all cleaning products to make sure they do not contain ammonia or are not nitrogen enriched.
- Have you staff attempt to get the users of the pool to take showers before entering which is usually required by state health codes.
- Install a medium pressure Ultra Violet (UV) water treatment system that cuts down on the amount of chlorine you have to use and also "breaks down" chloramines. (See information at end of this article about UV)

When does the pool water need to be changed? That depends on:

1. The size of the pool
2. The water temperature
3. The bather load
4. The type and brand of chemicals used
5. The type of filter and the turnover rate

In general, the smaller the pool the more frequently the water has to be changed. Hot Tubs in the 300-600 gallon range need to be drained and refilled at least monthly. Many State Health Departments require that exact schedule. Many specialty pools, such as lessons pools or therapy pools in the 1,500 to 5,000 gallon range need to be drained every 3-4 months. The warmer the water and the higher the bather load the more frequent the water needs to be changed.

Larger pools, such as lap pools and competitive pools can actually go years before needing to be drained. Because of the large surface area of these pools exposed to evaporation, new water is constantly being added. In effect the water is always in a state of renewal. There are pools with perfect water that have not been drained for 4 years or more. Be aware that draining the pool may cause more problems than it solves because of chlorinated city water that will be used to refill pool.

Some things that can shorten the life of the water and necessitate early draining:

1. Improper chemicals with non-soluble buffers or binders and poorly designed "inert ingredients"
2. Poor quality filtration
3. Continually "shocking" pool to break up chloramines
4. Users not taking showers before entering pool
5. Chlorine generators using salt to produce chlorine

Every pool should have and enforce the RULE = "NO STREET SHOES ALLOWED ON POOL DECK"

When street shoes are worn on deck just some of the problems that are created are:

- Dirt is tracked on to deck and then wet feet walk through that dirt and track it into pool. If the pool has tile the grout in between the tiles will become discolored. If the deck is concrete, the concrete will trap the dirt and look dingy and dirty.
- Glass – the soles of most shoes have treads and many of them have chards of glass picked up from walking on the sidewalks and streets. Those tiny chards can end up on the pool deck and eventually in a bare foot. This causes problems.
- Cleaning Chemicals – most public places use ammonia based cleaners. The shoes walk through this all day and every day. The ammonia will come off on the wet pool deck and end up on swimmers feet and in the water. Even a miniscule amount of ammonia can wreak havoc with the pool water chemistry causing formation of chloramines.
- Nitrogen – almost every fertilizer uses nitrogen. When people walk across grass/lawns the chemicals stick to their shoes. The nitrogen compounds will come off on the wet pool deck and end up on swimmers feet and in the water. Even a miniscule amount of these chemicals can affect the pool water chemistry causing formation of chloramines

The solution is to have all staff wear shoes they only use on pool deck. All clients and pool users wear water shoes or sandals dedicated for pool room use only.

Problems cannot be ignored. Serious health and safety issues are involved. Everyone who works in an aquatic facility needs to be made aware of the importance of a clean and healthy environment.

**Indoor pools** are increasingly experiencing problems with "bad air". HVAC (Heating Ventilating & Air Conditioning) systems are designed to control air temperature. Some of them are designed to control humidity, and air flow with fresh air mix when necessary. They are not air scrubbers, therefore the air quality is directly affected by the water quality; bad water = bad air! Now days "bad air" seems to be coming from chloramines in the water – not chlorine – but chloramines. This is a chlorine compound that cannot burn off in the water. Chloramines are released during evaporation and when the water is agitated. They smell like ammonia and can cause serious respiratory problems both for swimmers, staff around the pool, and spectators in the stands.

**Many** municipal water companies are artificially adding chloramines in excess of 1.5 ppm (parts per million) to the city drinking water supply. In these instances, we highly recommend that pools look into installing an activated carbon filter for their makeup water. This will drastically reduce the amount of chloramines being added to the pool on a daily basis when fresh water is added.

Explanation: *Many major municipalities and surrounding areas have switched their drinking water disinfection from chlorine to chloramine. Chloramine, a chlorine-ammonia compound, is more stable in the water system than chlorine, and only slowly breaks down into chlorine and ammonia. While both methods, common nationwide, may sound ominous, there's little to worry about, except in special cases. Chloraminated water in dialysis (medical) fish tanks, and in certain business uses (swimming pools) will need to be specially filtered and treated. Chloraminated water can also cause rubber parts in plumbing, pumps, filters, and water heaters to degrade more quickly. Chloramine-resistant replacement parts may be available. Chloramine disinfection, however, professes to be preferable to chlorine for almost all uses: drinking, cooking, bathing, gardening, and pets. Your water's taste may improve, the carcinogens called trihalomethanes formed by chlorine will be reduced, and more pathogens will be removed due to chloramines' extra stability. As of January 1, the EPA has begun regulating chlorine, chloramines and byproduct levels in the drinking water of all communities, adding a nationwide level of oversight. Chlorine and chloramine levels are capped at 4 parts per million, but there is no cap set for ammonia. With some municipalities chloramine programs chloramine and chlorine levels are capped at 2 ppm and ammonia at 0.5 ppm. Others are well above this level. Chloramine and the small amount of ammonia produced in breakdown are neutralized in digestion, but chlorine can lead to eye and nose irritation, anemia, stomach discomfort, and damaged hair and skin. While the EPA's regulation, and chloramines' stability, should minimize all these symptoms, there are solutions if you're still worried or if you're one of the special cases mentioned above. Standard water filtration may not really reduce and definitely not eliminate chloramine and chlorine. While chlorine can be eliminated through boiling water or by letting it stand for a few days, neither method will eliminate chloramines. To eliminate chloramines in swimming pools, you will need a high quality granular activated carbon filter for source water (make-up water) and a dechloraminating system like "medium pressure" Ultra Violet.*

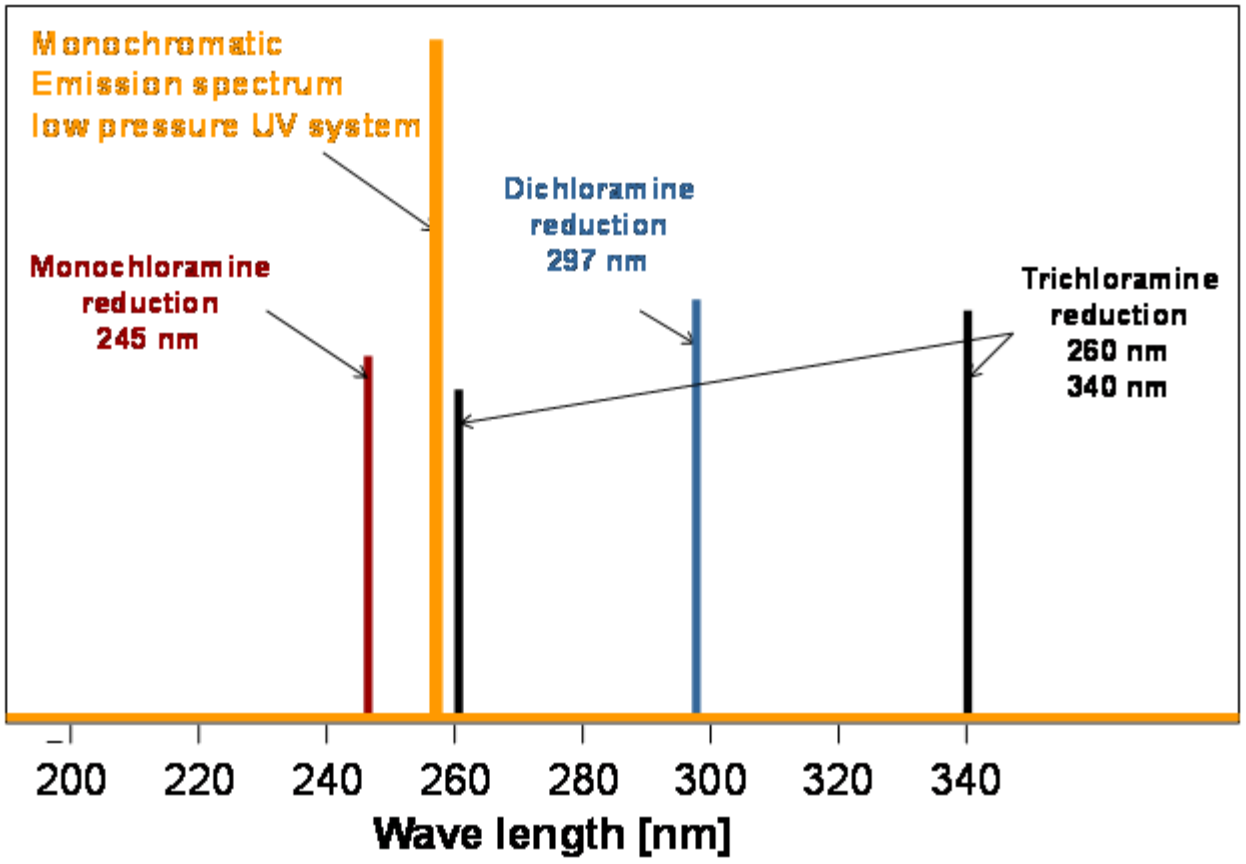
USA Swimming's Facility Development Department opinions on UV water treatment for chloramine destruction:

After attending the past 4 World Aquatic Health Conferences sponsored by NSPI and having a composite 60 plus years experience in the aquatic industry within the department, we are of the opinion that Medium Pressure UV may be the most effective system for broad spectrum chloramine destruction in indoor pools. We have reviewed well over 50 articles defining research and opinions comparing Low Pressure and Medium Pressure UV. There have been articles published in Aquatics International magazine, the NRPA newsletter, plus various other periodicals – a sampling attached. Until an unbiased independent research project is completed and we can review the protocols and conclusions, we can only strongly encourage you to do your own research as to which system fits your needs.

The most popular industry articles from the Medium Pressure contingent state that Low Pressure does not put out the wavelength to destroy di or trichloramines. According to the information, the Low Pressure system is only effective in eliminating monochlorimines and thus will control the other 2. In our opinion, this is not likely what will happen. Water in a pool (if balanced perfectly) will pass through the UV system approximately every 6 hours. That means that the water in the pool has plenty of time to develop monochloramines therefore creating the di's and tri's during the time in the pool with the bathers. This will happen - it's very natural. When this water passes through the UV, the mono's might be destroyed but it leaves behind the di's and tri's which get returned to the pool. Current best information states that the di's and tri's are the worst culprits of odor, corrosion, and irritation.

Any time we see information about Low Pressure UV they make the case that their system cannot eliminate di's and tri's but rather will control them by reducing the monochloramines. Both Low Pressure and Medium Pressure are effective at killing bacteria – we just have not seen a comparison of effectiveness. Back to our main concern which is chloramines - di's and tri's will be created in the water in the pool when the chlorine bonds with organic material (hydrogen or nitrogen). The water in the pool will have many hours to form these compounds before ever seeing the UV system again. This is probably the best evidence why we think the Medium Pressure may be better. The presentations we reviewed gives the wavelengths required to destroy all 3 chloramines - and a Low Pressure lamp can only produce the wavelength to reduce the monochloramines. The Medium Pressure lamps produce all 3 wavelengths required.

Our current position is - why take a chance on eliminating only the monos when we all know di's and tri's are present and cause issues for an indoor facility? It's also important to note that 3 of the 4 suppliers (Astral, Hanovia, and ETS) of UV systems have chosen Medium Pressure units.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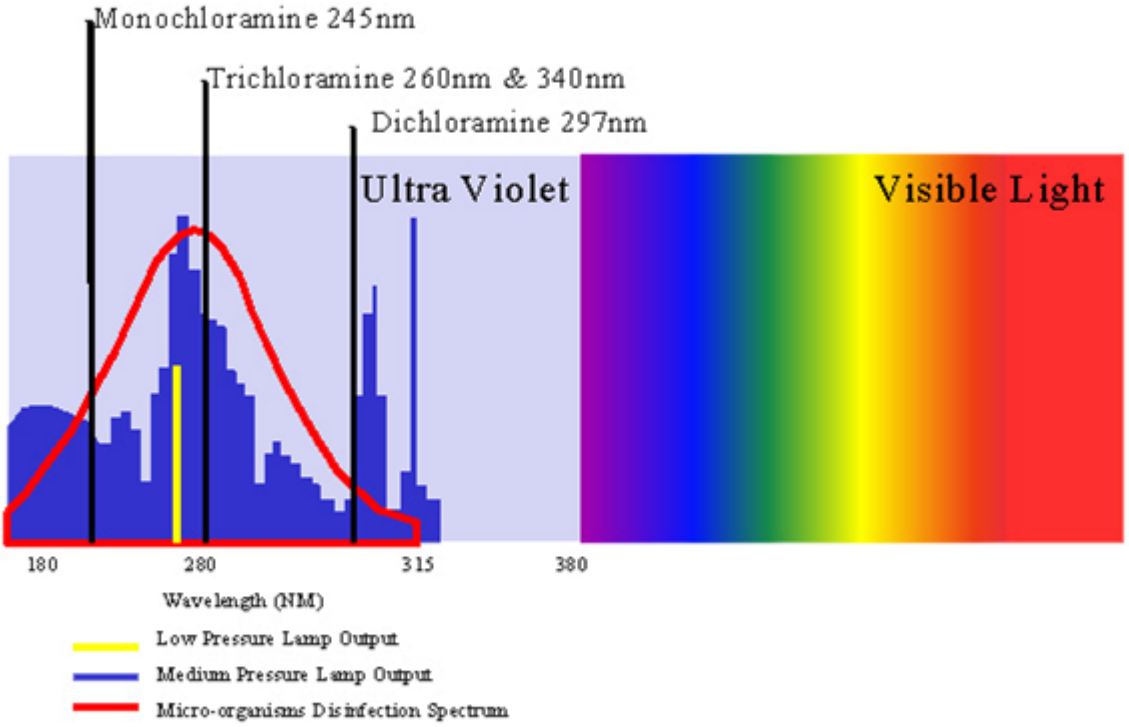



We have to use our best judgment when advising our members who are considering UV. We are not publishing articles to the general public – our research projects will not be completed until fall 2008. We stress that we are advising our members. We are open to reviewing any new information on this subject and are vigilant in our gathering of information. We do not recommend one manufacturer over another and even though we currently believe Medium Pressure may be the best solution to chloramine destruction, we encourage all of our clubs to do their own research on this controversial subject.

Water treatment is almost always the problem when the air is "bad". Improperly balanced chlorinated pools can cause asthma, according to research from several sources. "Results show that nitrogen trichloride (produced by high levels of available Chlorine) is a cause of occupational asthma in swimming pool workers like lifeguards and swim instructors," says Dr. K. Thickett of the Occupational Lung Diseases Unit at the Birmingham Heartlands Hospital. es.

The problem isn't the chlorine, but what chlorine turns into when combined with organics. The organics are contributed by bathers in the pool in the form of sweat, dander, urine and other organics. The chlorine reacts with the organics and produces nitrogen trichloride, aldehydes, halogenated hydrocarbons, chloroform, trihalomethanes and chloramines. If these sound like dangerous chemicals, they are.

**Solutions?** Dr. John Marshall, of the Pure Water Association, an American consumer group campaigning for safer drinking water, states: "It shows we should be paying more attention to the chemicals we put in our water and we should be looking for other alternatives to high levels of chlorination." There are options that are safe and non-toxic, such as treating water with ultra violet light. With medium pressure Ultra Violet systems there is a higher initial capital cost to the swimming pool compared to chlorine feeders. However, over the life of the pool Ultraviolet technologies reduce the on-going operating and maintenance costs. These costs can be significant. Chlorine is famous for destroying pool infrastructures, rusting out ventilation systems and destroying pool liners and coatings etc. UV poses no such problems. The UV pool will be much cleaner, which means dirt, grease, oils, organics and other materials will wind up in the filter system much faster than with highly chlorinated systems. If the filter and strainer maintenance is not stepped up accordingly, the pool recirculating system will slow down and the pool will actually look dirtier than with chlorine. However, proper maintenance of the filter system will solve this problem.

Part of the problem in adopting UV is that many engineers, architects, pool builders and designers are not familiar with the technology. Since engineering, architectural and other technical trainings have all been geared to chlorine, it takes re-education to now apply UV. Many people in these industries are reluctant to "shift gears" and take the time to educate themselves about the proper application of UV. Chlorine is a complex man-made chemical that found original use in the infamous mustard gas of the First World War. Chlorine is also an entrenched technology. It has been

widely used in North America and was first adopted at the turn of the century. It is still the reigning champion of disinfection and has many supporters in the chemical and swimming pool industries.

It is the organics that cause problems when combined with chlorine. By reducing the organic load, the Europeans keep the chloramines (the cancer causing substances) at a very low level. In European swimming pool systems, the same thought process prevails. In German DIN standards, for example, the strategy is to use a large “surge pool” that the public doesn’t even see to apply ozone or disinfection chemicals. The disinfection byproducts are then removed by various filtration processes prior to the water being returned to the pool with a slight dose of chlorine. Under these standards, swimming pool water is essentially treated to drinking water standards.

The North American model developed under much different circumstances than the European. In North America, chemicals were adopted wholeheartedly around the turn of the century as the answer to the larger, more expensive European models of water treatment. Engineers here found they could build water treatment plants and swimming pools at greatly reduced capital costs if they used what were then considered miraculous chemicals to treat water. And, for the most part, the systems did what they were designed to do and that was to kill micro-organisms that could lead to sickness and death. What they didn’t anticipate was that chemicals like chlorine would have very serious byproducts that become health hazards themselves.

In North America we are now stuck with swimming pools that in Europe would be considered surge tanks. The challenge is to evolve UV technology that can retrofit a large installed base of swimming pools in an economical manner. These systems are now starting to appear in the marketplace in increasing numbers and the success rate of positive results is amazing. Once pool owners add medium pressure UV, they realize that they no longer have to put up with red eye, rashes, unbreathable air and the health consequences of over chlorinated pools.

As the technology becomes more prevalent, expect to see more expertise at the local pool builder or pool maintenance companies. However, many of these companies rely on repeat sales of chemicals. These companies are likely to be highly resistant to UV systems as after-sales revenues will drop. However, for pool maintenance companies that are being paid to keep pools clean, UV is great. They should spend less time maintaining pools, the pools will be cleaner and the water more appealing. In the future, as UV prices drop slightly as more consumers become educated, demand for systems will definitely increase.

UV does not replace chlorine but allows the running of a lesser residual chlorine reading and allows the chlorine to be used 100% for disinfesting rather than go into combination with other elements. Your State department of Public Health will have a copy of your states regulations and limitations for using UV in commercial pool applications. Each state may have different codes and getting them to lower their required minimum chlorine levels can be very challenging.

What is ultraviolet or UV? Ultraviolet light is part of the light spectrum, which is classified into three wavelength ranges:

- UV-C, from 100 nanometers (nm) to 280 nm
- UV-B, from 280 nm to 315 nm
- UV-A, from 315 nm to 400 nm.

UV-C light is germicidal, i.e. it deactivates the DNA of bacteria, viruses and other pathogens and thus destroys their ability to multiply and cause disease. It also breaks down chloramines that develop in indoor swimming pool water.

Specifically, UV-C light causes damage to the nucleic acid of microorganisms by forming covalent bonds between certain adjacent bases in the DNA. The formation of such bonds prevents the DNA from being unzipped for replication, and the organism is unable to reproduce. In fact, when the organism tries to replicate, it dies.

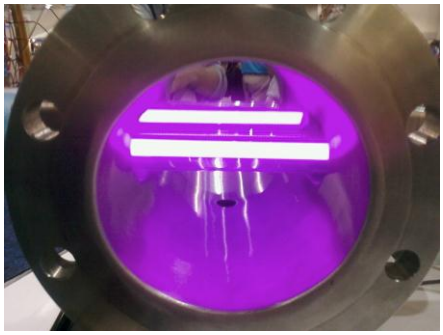
Ultraviolet technology is a non-chemical approach to assist disinfection. In this method of disinfection, nothing is added to the pool water except chlorine and pH control chemicals. This makes this process simple, inexpensive and requires very low maintenance. Ultraviolet purifiers utilize germicidal lamps that are designed and calculated to produce a certain dosage of ultraviolet (usually at least 16,000 microwatt seconds per square centimeter but many units actually have a much higher dosage.) The principle of design is based on a product of time and intensity; they must have a certain amount of both for a successful design.

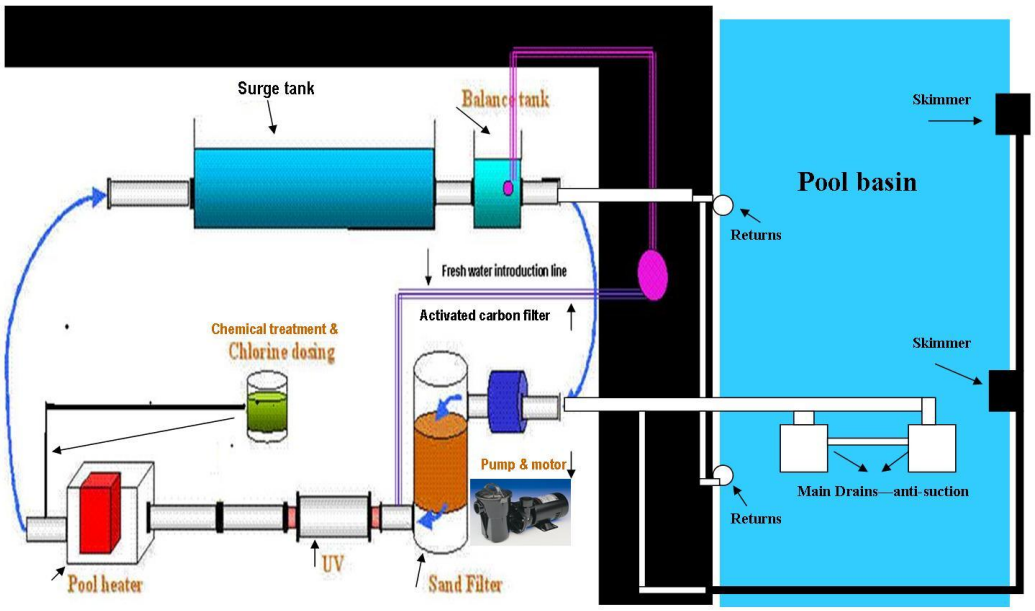
**How do ultraviolet purifiers work?** Short wave pressure mercury vapor tubes that produce ultraviolet wavelengths are installed in a water tight chamber. The UV system is installed after the pool filter and the return water to the pool is circulated 100% through the tube. Approximately 95% of the ultraviolet energy emitted is at the mercury resonance line of 254 nanometers. This wavelength is in the region of maximum germicidal effectiveness and is highly lethal to virus, bacteria and mold spores. Therefore, the water or air that passes through the chamber is exposed to the

germicidal UV light and the genetic material of the micro-organisms is deactivated, which prevents them from reproducing.

The CDC and others are currently conducting tests for the effectiveness of UV in killing germs and breaking down chloramines. There are still discussions whether low pressure UV is as effective and efficient as medium pressure. Bottom line is that the initial UV test results are good and many pools that have installed UV have seen a 100% turn around in their air and water quality almost immediately. The Facilities Department of USA Swimming strongly recommends that all indoor pools have UV installed.

The Facilities Development Department of USA Swimming has identified 3 preferred providers for UV systems. You can contact us for information about these manufacturers and distributors. We have also developed a 20 minute CD power point with audio called the **Safe-WAY** (**W**ater **A**ir & **Y**ou).
E-mail mnelson@usaswimming.org for information.





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| **POOL AREA - Daily procedures** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lights on | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Locker & Bath room check - toilet paper, towels, general cleanliness | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Benches & Chairs wiped off | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Uncover pool – check covers & rollers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check pools -clarity and bottom clean | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test water–pH +CL x2 and record AM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test water–pH +CL x2 and record PM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clocks on correct time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ck calendar for daily events /clients | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **POOL FILTER ROOM – Daily procd** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check pumps and filters for leaks or unusual noises | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check chemical containers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ck area of room for proper storage | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check for wet floor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **LAND AREA – Daily procedures** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lights on | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pick up rooms | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Access area check | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check supplies | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **POOL AREA – Daily routine** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Greet members by name and interact | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Encourage members | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Maintain safety of member and pool | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reports attendance and maintenance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Distribute information | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cover and uncover pools as needed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clean equip. spray with disinfectant | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Safety check on all equipment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Report comments or concerns – in writing - to supervisor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hosing of decks & floors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Weekly /Monthly** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pool cover cleaning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rust inhibitors for any metal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Clean metal – silicone | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check gutters for build up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check pool Vac equipment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check test kit for chemical testers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Disinfect decks and floors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check written reports | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Closing Procedures - Daily** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bathroom Ck - toilet paper, towels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Benches wipe off | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Check pools | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hook up Vac - cover pools | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Towels supply | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lights off | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lock area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |

**Welcome to the FILTER ROOM** literally the heart of the pool system. If the heart stops or malfunctions the pool does the same. You need to know the basic components of this room and not be intimidated by all of the mechanical stuff:


There are basically 5 parts to any filter room – from left upper corner clockwise:

- The heater
- The pump
- The filter
- The chemical treatment system
- and all of the valves and pipes

Since no 2 filter rooms are identical – most not even similar – you have to learn concept rather than try to memorize function. So here we go – ***pool circulation 101.***

The pool is full of water and it has to be treated both physically and chemically. This cannot be done in the same room as the pool therefore we have to transport the water out to a special room – treat it – then ship it back to the pool. This goes on 24/7 and should not be interrupted.

There are three ways to get the water from the pool to the filter room:

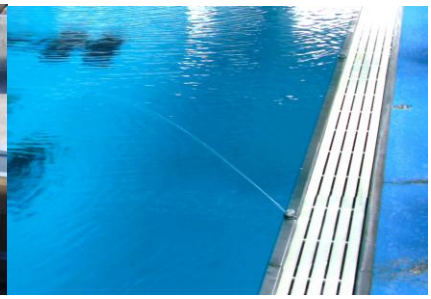
1. from the surface of the pool
2. from the bottom of the pool.
3. from a vacuum hose while cleaning the pool

#1 from the surface – this can be accomplished by port boxes or holes in the wall at the water level. These are called skimmers. They have baskets under the deck lid that trap hair and lint and large chunks of dirt. This protects piping from being clogged. Baskets have to be cleaned at least once a week.



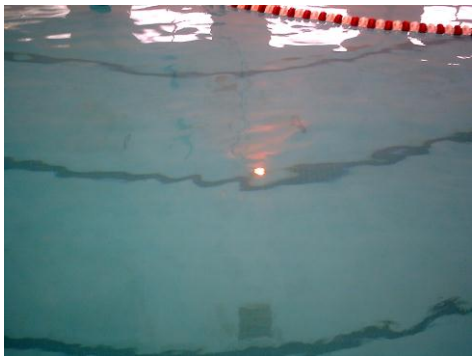
It can also be accomplished by a trough along the outer top edge of the pool around the total perimeter. These are called gutters.





Both skimmers and gutters take surface water from the pool and get it to the filter system by piping. The larger pools usually have gutters. There are many types of gutters – some get the water off the surface more effective and efficiently than others – but their primary function is the same. Get the water to the filters.
#2 from the bottom – always multiple drain boxes in the deepest part of the pool. These drains are connected to each other so no suction entrapment can occur. Usually more water is circulated through the bottom or "main drains" than through the gutters or skimmers. The amount of water coming from each can be controlled by adjusting valves in the filter room.





#3 from a vacuum hose – this can be attached to a special fitting in the wall or through the skimmer box. This method of circulation is used only when cleaning the pool. Valves are usually turned in the filter room to decrease water flow from the main drains or surface and increase suction through the vacuum line. The proper amount of water must be getting to the pump which is why other lines are not "shut off" only partially closed by valve settings.

Once the water is transported from the pool to the filter room, 3 major things happen.

1. It is filtered which physically removes suspended matter in the water
2. It is chemically treated – this kills bacteria and organisms that don't belong in pool water
3. It is heated

- Optional - It can be treated with UV to insure organisms are neutralized and organic chloramines are broken down

The transport mechanisms are PVC pipes. The transport power is supplied by a pool pump comprised of a hair strainer basket, an impeller housing, and a motor. The transport direction/path is controlled by valves.

There are different types of valves found in a filter room. The most commonly used is a ball valve.

Normally when the handle of the valve is pointed with the pipe as pictured above the valve is open. If the valve is at a 45 degree angle to the pipe it is partially open and is controlling water flow – probably for balancing purposes. If the valve handle is 90 degrees across the pipe – it is closed.

In this picture numbering the valves from left to right – the 1st and 3rd valve are closed – the second valve is open – the 4th (larger valve) is 90% open.

On larger pipes – usually over 4" diameter - a ¼ or ½ turn butterfly valve can be used. These come in a variety of sizes and styles. The #4 valve in the above picture is a butterfly valve.

Other types of valves in the filter room may be the common gate valve.


This usually turns the city (make up) fresh water supply off and on to fill the pool. Clockwise rotation of the handle closes the valve – counterclockwise rotation opens the valve and turns on the water. This is how the pool water level is controlled. Pool water level can be critical to proper operation of pool equipment.


There are also smaller valves that can bleed air from filters and control the flow of chemicals into PVC lines. The same rules apply about handle direction as related to off/on.

Some sand filters have multiport valves. They control the direction of the water through the filter and sometimes can change what pipes the water is directed through. These valves have multiple settings. For normal filtration, the valve needs to be set on FILTER as pictured below. Never move the valve handle while any pumps are on. All water pressure must be stopped. Other settings are …..

BACKWASH (for cleaning the filters)
RINSE (for repacking the sand after Backwashing but before going back to filtering)
CLOSED (all ports shut off)
RECIRCULATE (for by-passing the filter but still operating the pool – usually used for filter repairs)
WASTE (for draining the pool without the water going through the filter)


On larger pool you may find automatically operated valves.  These do not have handles and are controlled by air switches or computers.

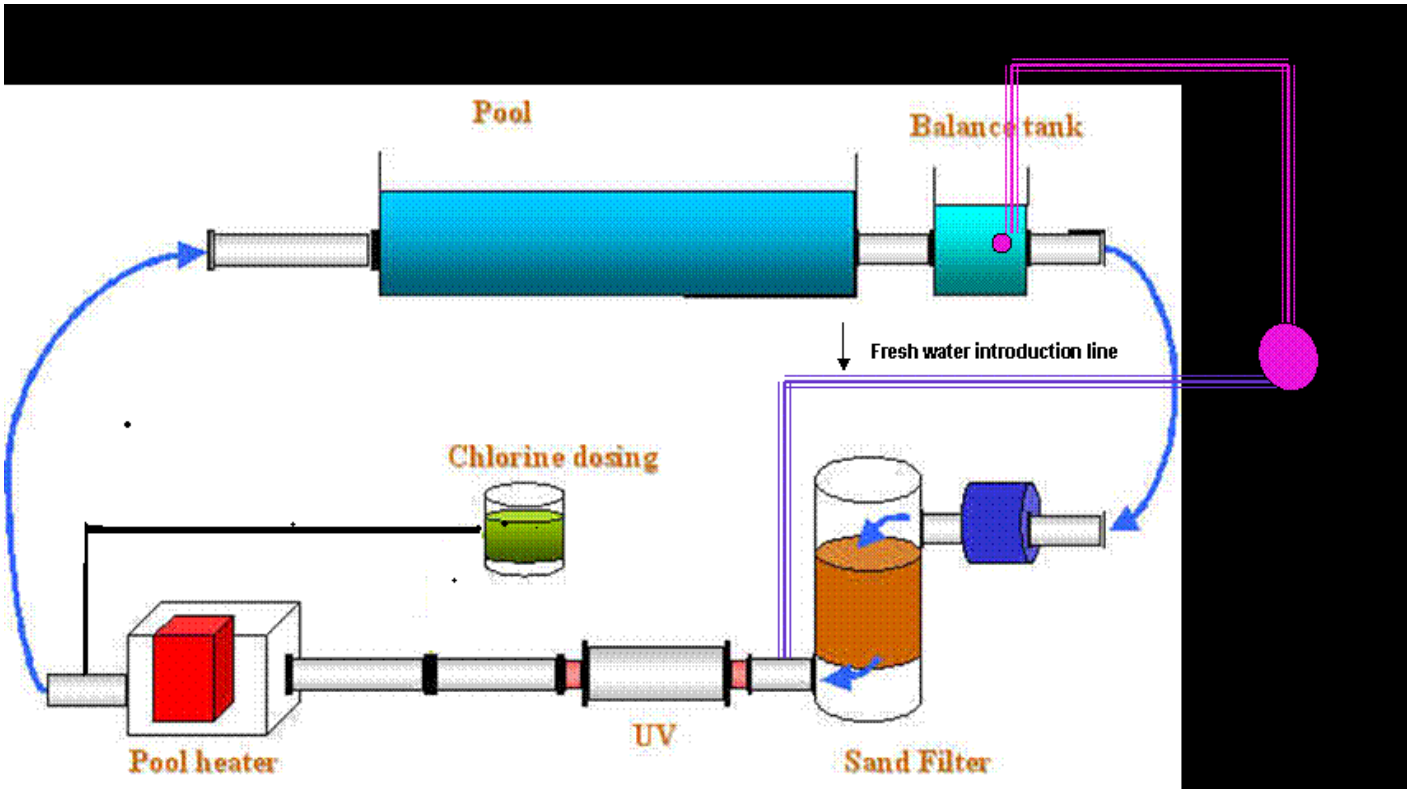
Since the gutters and skimmers have separate pipes from the main (bottom) drains, they will also have their own valves in the filter room.  A single pump can draw water from multiple lines and then feed the water through the hair strainer basket and trough more lines into a filter.

Once the water is filtered the water can be routed through a heater that is thermostatically controlled.  Large pools usually have gas heaters – small pools can have electric or gas.

After the heater the chemicals are introduced to the water.  There are many ways this can be done.  Most pools have automatic pumps controlling both chlorine and pH chemicals all controlled by a sensor unit that can adjust the pumps speed according to what the water needs.  These need to be cleaned and manually checked regularly.  These do not eliminate the necessity for testing water 3 times a day.



If Ultra Violet is used it needs to be after the filter but before the chemical introduction.




At the end of all of this treatment the water is returned to the pool through some sort of inlet system. Sometimes the inlets are in the pool wall – sometimes in the pool bottom – sometimes in the lower exterior part of the pool gutter. Point is that the water gets back to the pool so the pool level stays consistent and clean water is always being fed in to pool. The turnover rate or the amount of time it takes to filter and treat all of the pool water should be at least every 4-6 hours. Special use pools e.g. therapy pools or learn to swim pools can be designed with turnover rates as aggressive as every hour. Flow rates are controlled by pipe size, pump size, and filter size.

# *Water and Air Quality Checker – QUIZ*

1. **There are 2 components to having clear water. Proper _____ and Proper _____**
2. **Both _____ and _____ need to be tested 2-3 times a day.**
3. **The most effective and efficient pool filter is: Circle correct answer….. *Sand Cartridge DE***
4. **_____ quality and _____ quality are dependent on each other.**
5. **Name 3 of the 9 main things that can cause chloramines.**

   _____

   _____

   _____

6. **The best way to destroy all three types of chloramines is: _____ _____ ____**
7. **Chlorine kills _____**
8. **What are 2 of the 3 ways to get water from the pool to the filter room?**

   _____

   _____

9. **What does H V A C stand for? _____ _____ _____ _____**
10. **In the filter room does the filter or heater come first in the water treatment equipment layout?**

**Answer key:**

1. **Circulation and Chemicals**
2. **pH and Chlorine**
3. **DE**
4. **Air Water**
5. **3 of 9 listed below**

   Chloramines formation can be accelerated by:
   1. Improper showering before entering pool.
   2. Urination in the pool. (This has become an epidemic )*
   3. A high level of aerobic activity and sweating in the water. (People sweat in the water during exercise.)
   4. Residues from ammonia based cleaning products that are used on decks or in shower rooms/lavatories.
   5. Residues from fertilizers used on landscaping (nitrogen based) that get tracked into building.
   6. Poor air circulation and lack of fresh air introduction into the pool building.
   7. Over use of "shocking" the pool for maintenance purposes.
   8. Improper use of certain brands of chemicals not suitable for local conditions.
   9. Chloramines added artificially by the local water company, a common practice in many cities.
6. **Medium Pressure UV**
7. **Bacteria**
8. **There are three ways to get the water from the pool to the filter room:**
   1. from the surface of the pool – skimmers or gutters
   2. from the bottom of the pool - drains
   3. from a vacuum hose while cleaning the pool
9. **Heating Ventilation and Air Conditioning**
10. **The filter**