Pool Operator Prep Manual

FOR THOSE INDIVIDUALS PLANNING TO CERTIFY

Revised by Tropical Aquatics for Florida Pool Operator Certification

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You may also wish to down-load the
Math Tutorial for Pool Certification at
http://www.thepoolclass.com/support/math/

For more intense preparation, check out the
Support library at
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FORMULAS FOR POOL CALCULATIONS

L = length W = width V = volume D = depth

r = radius (half of the diameter of a circle)

π = (pi) 3.14 (a factor used in calculations with circles)

ppm = parts per million, or in Florida's code, mg/L an equivalent number

SURFACE AREA

Rectangular pool = L x W

Circular pool = r^2 x π or r x r x π

Right triangle = (L x W) ÷ 2

AVERAGE DEPTH (D_{Avg})

For constant slope: [D (shallow) + D (deep)] ÷ 2 = AVERAGE DEPTH

Note: For multi-depth pools calculate the volume in sections of constant slope and add them together.

CUBIC FEET OF VOLUME (surface area times average depth)

Rectangular pool V = L x W x $D_{Avg.}$

Circular pool V = r^2 x π x $D_{Avg.}$

POOL GALLONAGE IN CUBIC FEET (cubic foot of water = 7.5 gallons)

Rectangular pool gallons = L x W x D_{Avg} x 7.5

Circular pool gallons = r^2 x π x D_{Avg} x 7.5

FLOW RATE/TURNOVER RATES

SPAS: Required turnover every 30 minutes therefore required flow rate is:
Gallons ÷ 30 minutes = minimum (min) flow rate in gallons per minute (GPM)

POOLS: Required turnover at least every 6 hours (6 x 60 min = 360 min)
Gallons ÷ 360 minutes = min flow rate in GPM

HEALTH CLUB POOLS (less than 1,000 square feet):
Required turnover at least every 3 hours (3 x 60 min = 180 min)
Gallons ÷ 180 minutes = min flow rate in GPM

CHEMICAL ADJUSTMENT CALCULATIONS

You will need the dosage information for the chemical, i.e. the standard amount of a chemical needed to adjust a standard amount of water. This information is on the product label, or in the test kit guidebooks. The information is usually listed, for example, as “2 oz per 10,000 gallons of water to raise pH 1 ppm.” This amount needs to be converted (or calculated) to be specific for YOUR pool.

Except when doing breakpoint chlorination, chemical additions should be broken down into smaller amounts. The calculated amounts are approximate, and you will want to “sneak up” on the water chemistry value you are trying to reach. Add 1/3 of the amount calculated, allow to mix, retest, then add another 1/3, and so on. Better to work up to the right reading than to over-shoot the mark and have to adjust AGAIN back down.

You want to calculate how much chemical added to the volume of water in you pool will change the chemical value the desired amount.

NEEDED INFORMATION ABOUT YOUR POOL:

POOL VOLUME: amount of water in your pool

DESIRED CHANGE: amount of change (in ppm) that needs to take place in your pool, called **Change_{ppm}**

CHEMICAL DOSAGE INFORMATION: Taken from the chemical label or a table, called **Label_{ppm}**

AMOUNT OF CHEMICAL (**Label_{amt}**)= amount of chemical added to a:

GIVEN WATER VOLUME (LABEL VOLUME) produces a;

DESIRED CHANGE (**Change_{ppm}**) to the pool chemical parameters

So read the above 3 items as: 1.5 pounds of sodium bicarbonate (**Label_{amt}**) per 10,000 gallons (**LABEL VOLUME**) increase the Total Alkalinity 10 ppm (**Label_{ppm}**).

THE FORMULA (Terms are defined above):

SIZE FACTOR = ACTUAL POOL VOLUME ÷ LABEL VOLUME

CHANGE FACTOR = **Change_{ppm} ÷ Label_{ppm}**

CHEMICAL DOSAGE FOR YOUR POOL =

SIZE FACTOR x CHANGE FACTOR x AMOUNT OF CHEMICAL

Example 14,000 gallon pool, increase total alkalinity by 20 ppm

Chemical Dosage = [14,000 gal ÷ 10,000 gal] x [20ppm ÷ 10ppm] x 1.5 lbs. Sodium Bicarb.

Chemical Dosage = 1.4 (Size Factor) x 2 (Change Factor) x 1.5 lbs = 4.2 lbs of sodium bicarbonate is needed in a 14,000 gal. pool to raise the Total Alkalinity 20 ppm.

WATER CHEMISTRY

DEFINITIONS:

Sanitizer: A chemical product that will sanitize or disinfect water by destroying living organisms, bacteria and viruses in sufficient numbers (99.9 %) to prevent disease.

Sanitization: Sanitization or disinfection is the process of destroying living organizms, bacteria and viruses in sufficient numbers to prevent disease. Typically we measure the processes effectiveness by looking for a 3-log (99.9 %) or 4-log (99.99 %) reduction in the number of organisms. Sanitization does not necessarily mean the destruction of all organisms.

Oxidation: Oxidation is a burning out process to convert complex organic molecules to simple compounds and eventually to a harmless gas that can escape the pool (CO_2, elemental nitrogen and others. Dust, algae, human wastes, leaves and other materials, are examples of organic and nitrogen contaminants.

Halogen: Halogen is the term used to refer to any of five elements in group VII of the periodic chart. Of the five elements, we use chlorine and bromine for pool treatment.

HALOGENS

Group VII	Molecular Form	Physical State	Characteristics
Fluorine	**F_2**	**Gas**	Extremely reactive, Dangerous to handle.
Chlorine	**Cl_2**	**Gas**	Gas form dangerous, Good oxidizer, Most commonly used.
Bromine	**Br_2**	**Liquid**	2.25x heavier than Cl, Fair oxidizer.
Iodine	**I_2**	**Solid**	Stains, Difficult to handle, Poor oxidizer.
Astatine	**At_2**	**Solid**	Radioactive. Not Used.

Free Available Chlorine (FAC): FAC is the chlorine residual that does the sanitization and oxidation. The FAC is tested using DPD #1 and measures HOCl and OCl^-. HOCl is the active chlorine, and OCl^- is an inactive form of FAC. The ratio of HOCl / OCL^- is very dependent of the pH. At a pH of 7.2, about 2/3 of the FAC formed is in the form of HOCl. At a pH of 8.0, only about 1/3 of the FAC is HOCl with the rest as inactive OCl^-.

Combined Available Chlorine (CAC): CAC is the chlorine residual that is combined with nitrogen products such as ammonia (NH_3). The CAC is usually calculated by subtracting the FAC from the TAC. Ideally there should be no CAC in the water, or maintained as low as possible. It is very irritating at levels as low as 0.5 ppm. It is a very stable compound, but can be removed from the water by doing a "Breakpoint Chlorination"

Total Available Chlorine (TAC): TAC is the measure of FAC + CAC. It is measured by DPD #1 and DPD #3. The CAC level can be determined by subtracting the FAC (DPD #1) reading from the TAC (DPD #1 & DPD #3) reading.

Breakpoint Chlorination: Breakpoint chlorination is the process of adding sufficient chlorine to oxidize any combined chlorine and other nitrogen wastes to elemental nitrogen which gases off.

Parts per million (ppm): Ppm is a weight / weight measure equivalent to milligrams per liter (mg/l). It is equivalent to 1 pound of chemical in 1,000,000 pounds (~120,000 gallons of water)

Chlorine Sanitizers

Inorganic Chlorine Products

Chlorine Gas (Cl_2)(100% available Chorine): Chlorine gas is the most concentrated form of chlorine available. It is cheap and very effective. Unfortunately, Cl gas has been regulated almost entirely out of use for swimming pool sanitization. Chlorine gas is now a restricted pesticide, requiring special training and certification, special safety precautions and equipment, and it falls under the oversight of many national, state, and local jurisdictions. **If you presently use it, start working to switch to another sanitizer.**

Sodium Hypochlorite (NaOCl) (Liquid chlorine, bleach): Usually 10-12% available chlorine, bleach is 5.25 % available chlorine. Fairly cheap source of Cl, but will degrade over time and if stored improperly. Store in a cool, dark place. Household bleach and be used in an emergency (Do not use scented bleaches). Household bleach is half the strength and has more solids and possibly metals in it.

Calcium Hypochlorite ($Ca(OCl)_2$)(65 % available chlorine): Often referred to as "cal. hypo" or "HTH." Originally sold as a granulated powder for use as a shock, or dissolved and decanted (it forms a lot of sludge when dissolved., clear liquid has the CL.) as a liquid source of chlorine. In recent years it has also been manufactured in a "tablet" and "puck" form for use in erosion feeders designed specifically to feed cal. hypo. **DO NOT USE CALCIUM HYPOCHLORITE IN A TRICHLOR OR BROMINE EROSION FEEDER. IT WILL CAUSE AN EXPLOSION.** Some manufacturers are now placing blue specks in the calcium hypochlorite tabs and pucks. Cal. hypo stores well in a cool dry location. It can be a significant fire hazard if it gets wet, or is contaminates with other products. Do not dispose of this product in the trash. Use it in the pool, rinse and clean empty containers before placing out for trash pickup. Container disposal has been a large concern for solid waste haulers due to the fire hazard as well as toxic gas production. There may be new disposal regulations developed in the near future by the solid waste regulatory entities.

Lithium Hypochlorite (LiOCl)(35 % available chlorine): Available in a granulated powder product. Used for shocking. Product is clean dissolving and easy to use. Not used much in the pool industry because of the high cost**.** It can also be a fire hazard if stored improperly or contaminated.

Organic Chlorine Products

TriChlor (Trichloro-s-triazine Trione, Trichloroisocyanuric acid)(90 % Avail. Cl): Also known as "stabilized chlorine." And "erosion chlorine." Slow dissolving product manufactured in sticks, tablets and pucks. Made to use in a "trichlor" erosion feeder. Product comes with three Chlorine atoms attached to cyanuric acid (CYA). CYA is used as a "stabilizer " to protect the Cl from UV light degradation. CYA does not protect Cl indoors, in fact it can become a nuisance and interfere with disinfection and oxidation at higher levels. Fairly expensive.

DiChlor (Sodium Dichloro-s-triazine Trione, Sodium Dichloroisocyanuric acid)(62% avail. Cl): DiChlor has been used mainly in the laundry industry as "dry bleach." It use in swimming pools is mainly as a shock. It is fast dissolving, but adds considerable CYA to the pool, which may be undesirable. Can be a fire and Cl gas-producing hazard if wetted or contaminated.

SANITIZING WITH CHLORINE

Chlorine is the most popular and efficient sanitizer we have. If it is maintained at the required levels and the proper pH is maintained, it will kill most organisms in less than a minute. It is present in all of the sanitizing systems approved by the state for use in public pools and spas.

Whichever form of chlorine you choose to use, the reaction of the chlorine product with water will produce "**hypochlorous acid" (HOCl)**, and other by products. HOCl is the active sanitizer and oxidizer. You test HOCl as **Free Available Chlorine (FAC)**, using your test kit and DPD #1, if you have a color comparator kit, or your DPD powder and using the titrating solution if your have that type of test.

Sanitizing the Water

The HOCl will react with organisms in the water and kill them. We are particularly interested in killing those that could cause swimmer illness. Typically, little of the chlorine in the pool is needed to kill the microorganisms. With the exception of some protozoan organisms (*Cryptosporidium, Giardia, Cyclospora)*, most organisms will be killed by very low levels of chlorine in very short periods of time (seconds to 1-2 minutes).

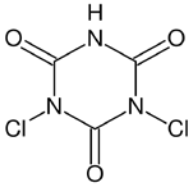
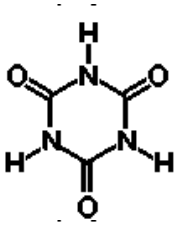
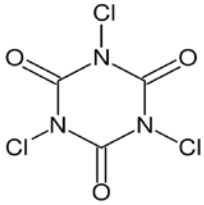
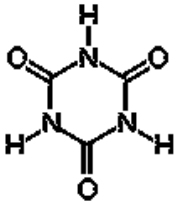
HOCl will react with the bacteria, viruses, protozoa, algae in the water and will kill or eliminate them. It also reacts with the oils and greases, leaves, dead bacteria, skin particles and other organic contaminants, to "**oxidize"** (breakdown or burn up the organic materials) and eliminate them from the water.

The oxidation process can be compared to burning a pile of leaves. They don't burn quickly and create lots of smoke. If we put a box over the pile of leaves, the box will fill with smoke, and because the fire cannot get fresh air, the fire will go out.

A similar burning process in the swimming pool, creating a gas-off product (nitrogen trichloride – a form of combined chlorine or chloramine) that is irritating like smoke causing red burning eyes, coughing, and nose and throat irritation. At most outdoor pools the smoke is blown away and with lots of fresh air, the oxidation can continue, so we find few problems with chloramines or combined chlorine. Indoor pools, like the pile of leaves with the box over the top, trap the "smoke" causing swimmer discomfort, and the lack of fresh air causes the oxidation to stop before everything is oxidized. Many times it is almost impossible to get rid of all the combined chlorine at an indoor pool.

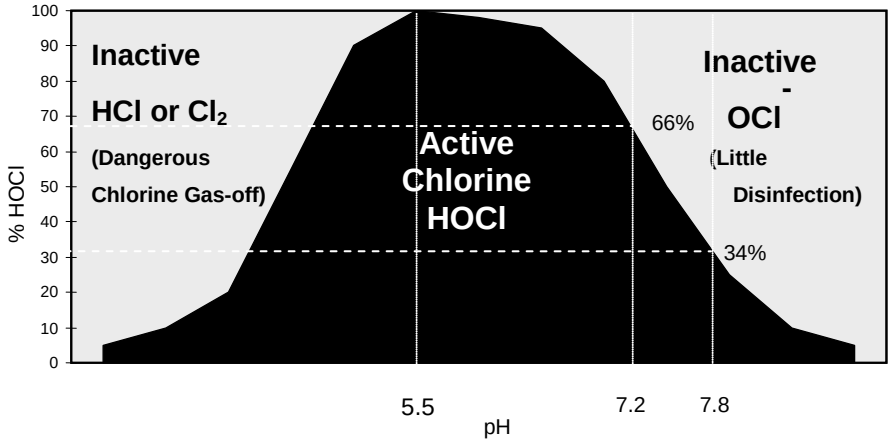
It is very important to get lots of fresh outside air into the pool area by opening windows and doors and adding fans to blow across the water.

Chlorine Products and Their Reaction When Added to Water (H_2O)

Chlorine Gas	Cl_2	+	H_2O	→	HOCl	+	HCl
Sodium Hypochlorite NaOH	NaOCl	+	H_2O	→	HOCl	+	
Lithium Hypochlorite	LiOCl	+	H_2O	→	HOCl	+	LiOH
Calcium Hypochlorite $Ca(OH)_2$	$Ca(OCl)_2$	+	H_2O	→	2HOCl	+	
Sodium DiChlor		+	H_2O	→	2HOCl	+	
TrI-Chlor		+	H_2O	→	3HOCl	+	

Hypochlorous Acid

The amount of hypochlorous acid (HOCl) formed in each reaction is dependent on the pH of the water. Low pH will form more HCl and Cl gas, pH at 5.5 forms almost totally HOCl and as the pH increases lower amounts of HOCl are formed and increasing amounts of OCl^- are formed. OCl^- is inactive as a disinfectant



% of HOCl Formed at Various pH Values

Combined Chlorine (Chloramines)

Combined chlorine is the reaction of “hypochlorous acid” (HOCl) with nitrogen containing compounds, particularly ammonia (NH_3). Depending on the chlorine concentration, the pH and the temperature the hypochlorous acid / ammonia mixture will form one of three compounds.

Monochloramine	NH_2Cl	
Dichloramine	$NHCl_2$	
Trichloramine	NCl_3	(Also known as Nitrogen trichloride)

With enough free chlorine and adequate ventilation to blow away the breakdown products that gas off the pool, the chlorine will break down the ammonia products until nitrogen is all that is left, which gases off the pool.

Unfortunately the process seldom goes perfectly. Often we get a lot of trichloramine (NCl_3) which is an oily substance that volitalizes out of the water into the air. Nitrogen trichloride is the cause of most of that “swimming pool” smell. It can be highly irritating and is the cause of the lung, eye and throat irritation people experience in poorly ventilated indoor pools.

To combat the buildup of chloramines the operator can use chlorine to breakpoint chlorinate the pool, use a non-chlorine oxidizer (potassium or sodium monopersulfate), use ozone, install medium-pressure UV light treatment, or increase the ventilation and air blowing across the pool. The last three treatments are costly methods of controlling chloramines, and are only practical on larger pools, although most pools can increase ventilation for short periods by using fans and opening outside doors or windows.

Breakpoint Chlorination:

Breakpoint chlorination is a calculated process. The amount of combined chlorine / chloramines in the pool must be known. If we take the amount of combined chlorine in ppm and multiply that by 10, we can determine how much new chlorine to add to the pool to reach breakpoint.

Example: You test the pool and find 2 ppm combined chlorine:

2 ppm x 10 = 20 ppm of new chlorine that must be added to the pool to reach breakpoint

Breakpoint Chlorination

To achieve breakpoint you must add an amount of new free chlorine equal to 10x the combined chlorine level

Water Balance

"Water Balance" is the process of maintaining the water in a state that is neither non-scaling nor corrosive. It is comfortable for the swimmers and easy on the pool equipment and pool surfaces.

To achieve this, the pool must be maintained at the "calcium saturation level." This means that the amount of calcium dissolved in the water is the maximum amount the water will hold without any precipitating out. We can calculate this using the **"Langelier Index"** found in this document.

You can think of water that is not saturated with calcium as "hungry," it will look for something to satisfy its hunger causing corrosion of the pool surfaces and eating away at the metal components of the recirculation system. If it is "overfed," the excess calcium is deposited as scale on surfaces and can cause cloudy water as the calcium comes out of solution.

To determine "calcium saturation," or "water balance," we look at the relation of 5 different measurements of the water. These factors are:

pH

Total Alkalinity (TA)

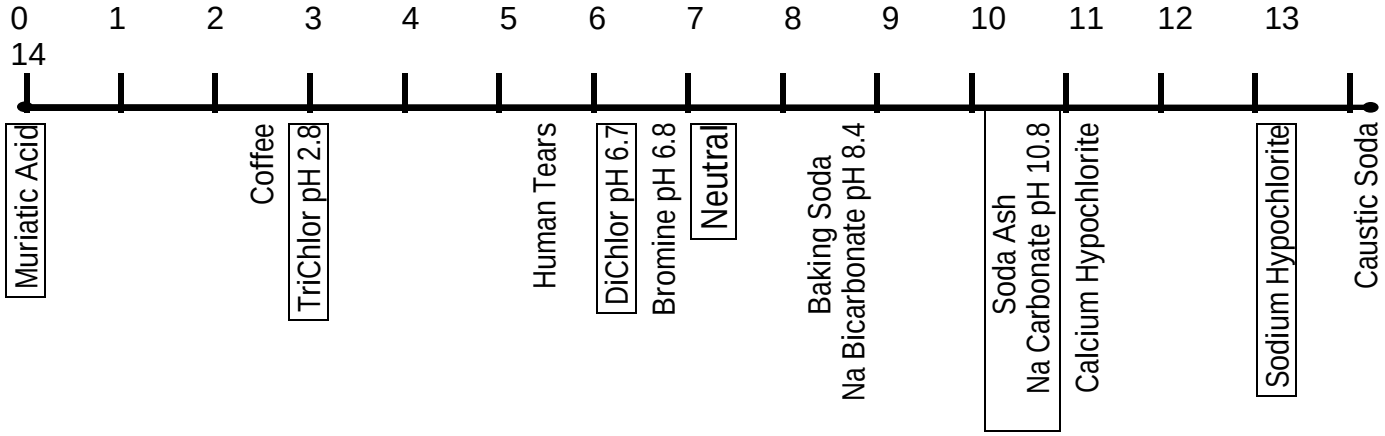
Calcium Hardness (CH)

Temperature of the Water

Total Dissolved Solids (TDS)

pH

pH is technically the "negative logarithm of the hydrogen ion (H^+) concentration." In simpler terms it is how "acidic" or "basic" a solution is. It is based on a scale from 0 to 14 where the lower the number the more acidic the solution.



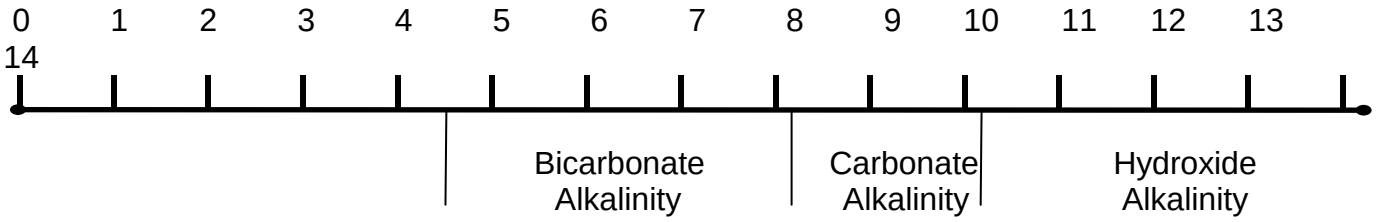
Lower pH:
Muriatic Acid
Sodium Bisulfate (Dry Acid)
Carbon Dioxide (CO_2)

Raise pH:
Caustic Soda
Soda Ash
Baking Soda

Total Alkalinity (TA)

Total alkalinity is the measure of how stable the pH is. It measures the pool water's buffering capacity to resist pH changes. Without control of the total alkalinity, the pH will rise and fall abruptly. The ability to resist this change in pH is due to the presence of bicarbonate and carbonate ions and other compounds.

Main Type of Total Alkalinity (Buffer) Compounds According to pH



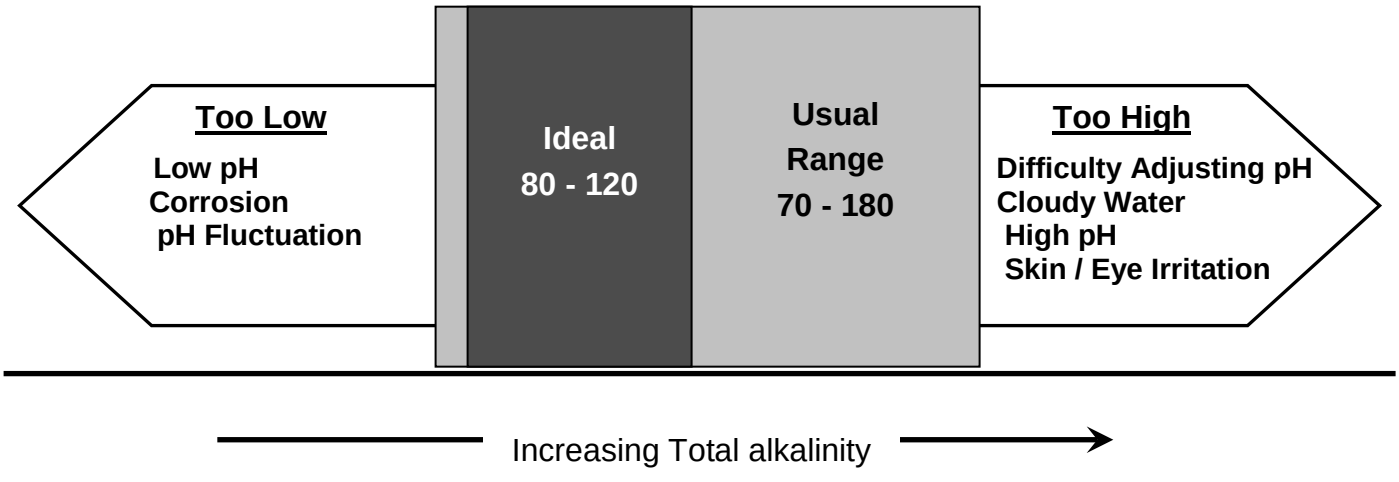
In general, total alkalinity should be kept between 80 ppm and 140 ppm but this will vary from region to region. The ideal reading for alkalinity will vary due to three variables: (1) type of pool, (2) type of sanitizer, and (3) type of shock.

When alkalinity is either too high or too low, water acts much like that with a low pH or high pH level.

A low total alkalinity makes it difficult to maintain a desired pH and can lead to corrosive water, which can damage equipment. Green water can also be another symptom of low total alkalinity. To increase the alkalinity level, add sodium bicarbonate, typically packaged as "Alkalinity Increaser", "Alkalinity Up", or "Alkalinity Plus". Always read the instructions on the label before adding any type of chemical, as manufacturers will recommend varying amounts to add per 10,000 gallons of water as well as the specific procedures.

High levels of total alkalinity can cause the pH to "get stuck" and is difficult to change. High Total alkalinity can also cause cloudy water and scale formation. To decrease the alkalinity level, sodium bisulfate or muriatic acid can be added to the pool water – these are the same chemicals used to lower pH. Always read the instructions on the label before adding any type of chemical, as manufacturers will recommend varying amounts to add per 10,000 gallons of water as well as the specific procedures.

Proper Range for Total Alkalinity



Calcium Hardness

Calcium hardness testing is a measure of the hardness minerals in the water. There are several, but the most important is calcium, and hardness, when tested with your pool test kit, is reported in equivalence to $CaCO_3$.

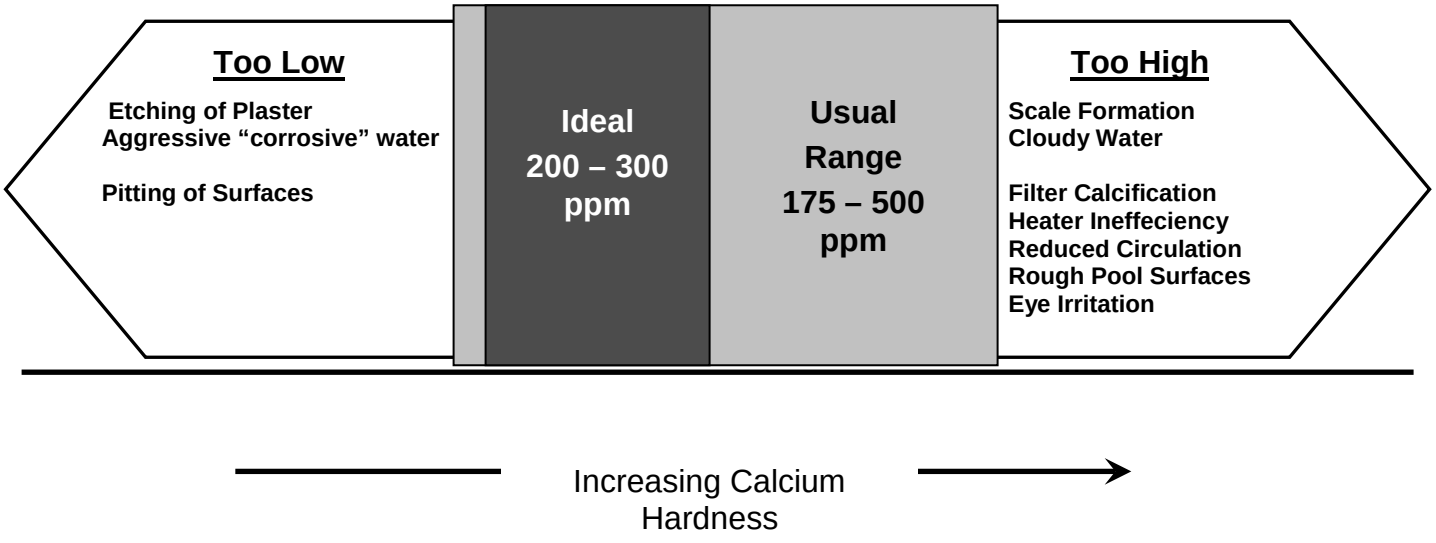
Potable water supplies in most of Oregon are in the range of 40 – 60 ppm calcium hardness. This is considered "very soft." There are a couple of areas in the state where hard water can be encountered; mainly in the Hermiston / Pendleton area. In this area some of the potable water is considered very hard with several hundred ppm calcium hardness, depending on the source.

Soft water is good for washing or when soap is used, as the soap does not form a sticky layer of soap & minerals on the water's surface, hence "hard water." In soft water the soap foams well and clothes usually stay whiter.

In pools, we are concerned with maintaining the pool surfaces and equipment. We are attempting to maintain water that is saturated with calcium to prevent the corrosion of the surfaces and equipment. However, we don't want so much calcium that is will not all stay dissolved in the water, "scaling" out on pool surfaces and inside equipment and piping. Scaling can make the surfaces rough and actually plug piping with calcium scale. Watch your pool heater.

To maintain calcium saturation we must consider the calcium level as well as pH, total alkalinity, temperature and total dissolved solids.

Proper Range for Calcium Hardness



Total Dissolved Solids (TDS)

Total dissolved solids (TDS) are a measure of all the stuff dissolved in the water that would be left in a sample if the water was removed. Sort of like the stuff left when a teapot has been reheated and the water evaporated.

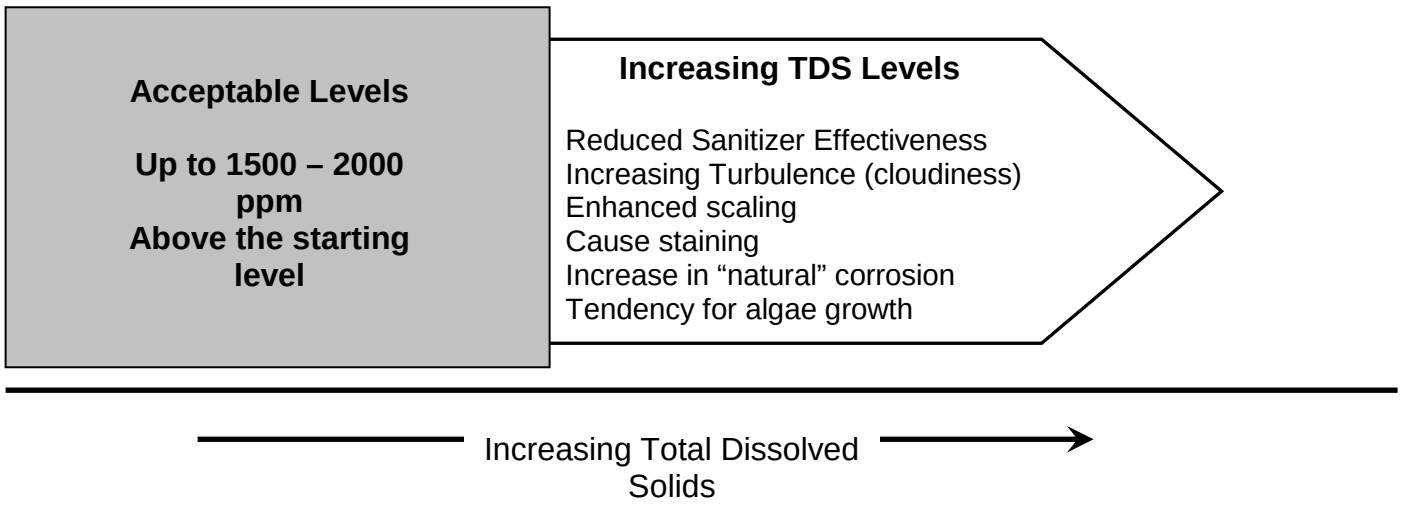
The solids are made up of minerals, organic materials, oils, and other material in the water. Most anything that is added to the water contributes to the total dissolved solids, especially the swimmers.

Potable water usually has about 100 ppm (TDS). As the water ages the TDS climbs until we can think of the water as crowded with dissolved material. This condition makes it hard to disinfect and control the water quality in the pool. Usually we will drain the pool and replace the water when the TDS becomes this high by either draining all the water, or diluting the pool with repeated partial drain and refills.

With salt water pools, the pools start off with TDS levels close to 3500 ppm. We would begin to dilute and drain these pools once the TDS climbed about 1500 ppm over what it was to begin with.

TDS is tested by using a conductivity meter. Pure distilled or completely deionized water will not conduct electricity. As minerals and things are dissolved in the water the water will conduct electricity better and better. The conductivity meter will measure this and relate it to the TDS levels.

Total Dissolved Solids



Temperature

Temperature is a real concern when dealing with calcium saturation because calcium carbonate, the most common form of calcium, is more soluble in colder water. This is contrary to what we find with most other materials we can dissolve in water.

The concern is the warmer the water the lower the calcium hardness needs to be to be at saturation, so spas do not need as high a level of calcium. The other concern is where the pool is winterized during the colder weather. If the calcium isn't adjusted for the cold water temperatures, the pool basin can suffer from the corrosive water

For most of us, we have little control over the temperature. The public likes swimming in water of a certain temperature depending on the activity. We cannot cater to each group without greatly increasing the heating costs. Most operators find a median temperature and leave it there when the pool is open for swimming.

Common temperature preferences:

Polar Bear Club – usually 45 – 60^{o} F
Serious Lap Swimmers – about 78^{o}F
Recreational Swimmers – about 82 – 84^{o}F
Classes (children) – about 86 – 90^{o}F
Older Exercisers – about 86 – 95^{o}F
Spa Users – (Hotter is better) Do not exceed 104^{o}F Recommend 102^{o}F

Our regulations only regulate spa temperatures. At this time the rules allow a maximum 104^{o}F. Over the years we have found that this temperature can be harmful to some people. It is our strong recommendation that spas be maintained at no more than 102^{o}F. At some point the rules will be updated with this temperature.

The lower temperature is much safer for pregnant women, older users, persons using the spa while intoxicated (not recommended) and for small children (not recommended). Studies have shown that most people cannot sit in a 104^{o}F spa for more than 15 minutes without risking the chance of overheating. Most people can sit in a spa at 102^{o}F for much longer periods of time without health effects.

The Langelier Index

The Langelier index is one of several methods of calculating calcium saturation in your pool. Your pool test kit has a device to also test for calcium saturation. Another of the other popular methods of calculating the saturation is the “Rysnar Index”

All the indexes use the pH, total alkalinity, calcium hardness, temperature and total dissolved solid levels in your pool. The relation of these allows us to determine the calcium saturation.

The langelier index, used here, is one the health departments will most often use.

The calculation uses the pH of the water as is, and adds factors off the table below for total alkalinity, calcium hardness and temperature. Total dissolved solids do not change the calculation much, and are often used as a constant of -12.1. If the TDS is over 1000 ppm the constant can be changed to -12.2.

The formula for calculating the calcium saturations is:

Saturation Index = pH + TF + CF + AF – 12.1

Where:

pH = pH **CF = Calcium Factor**

TF = Temperature Factor **AF = Alkalinty Factor**

Temperature	
°F	= TF
32	0.0
37	0.1
46	0.2
53	0.3
60	0.4
66	0.5
76	0.6
84	0.7
94	0.8
105	0.9
Too	Hot

Calcium Hardness	
ppm	= CF
5	0.3
25	1.0
50	1.3
75	1.5
100	1.6
150	1.8
200	1.9
300	2.1
400	2.2
800	2.5
1000	2.6

Total Alkalinity	
ppm	= AF
5	0.7
25	1.4
50	1.7
75	1.9
100	2.0
150	2.2
200	2.3
300	2.5
400	2.6
800	2.9
1000	3.0

Values between +0.5 and -0.5 are consider balanced

Negative values are corrosive

Positive values are scale forming

Chemical Dosages

Using the formula found on page two of this packet, you can use the following dosages to figure out how much chemical you will need to make changes to you water chemistry. Remember, "breakpoint chlorination" requires that the entire calculated amount be added at once. All other chemical parameters should be adjusted slowly by breaking up the dosage calculated into smaller additions to add to the pool, allowing mixing between additions.

Chemical Dosages

Product	Amount per	Gallons	= Amount of Change	Effect on pH
Raising Chlorine Residuals				
Gas Chlorine (Cl_2)	1 lb.	12,000 gal.	12 ppm	
Sodium Hypochlorite (10 % liquid chlorine)	1 gal.	12,000 gal.	12 ppm	
Calcium Hypochlorite	1.5 lbs.	12,000 gal.	12 ppm	
Lithium Hypochlorite	3.25 lbs.	12.000 gal	12 ppm	
TriChlor (Stabilized Chlorine)	Not used for hand dosing the pool. Use only in an appropriate feeder.			
DiChlor	Not recommended for hand dosing the pool.			
Lowering Chlorine Residuals				
Sodium Thiosulfate	1 lb.	10,000 gal	10 ppm	
Raising Total Alkalinity				
Sodium Bicarbonate (Baking Soda)	15 lbs	10,000 gal	10 ppm	
Raising Calcium Hardness				
Calcium Chloride (Flaked or Pellets)	11 lbs	10,000 gal.	10 ppm	
Lowering Total Alkalinity				
Muriatic Acid or Dry Acid (Sodium Bisulfate)	The best way to adjust is to add dilute acid evenly around the pool. The initial effect will be a decrease in pH, but as the water gets agitated or aerated, the total alkalinity will decrease. Add small amounts daily until the desired level is reached.			
Lowering Calcium Hardness				
Drain some water and refill with fresh water with lower calcium hardness				
Lowering Cyanuric Acid Levels				
Drain some water and refill with fresh water.				

FLORIDA DEPARTMENT OF HEALTH

STATE OF FLORIDA
DEPARTMENT OF HEALTH
MONTHLY SWIMMING POOL REPORT

STATE PERMIT #_____ **DATE**_____

NAME OF POOL_____ ADDRESS _____

Days of month	Chlorine residual			pH			Filter Gauge Reading			POOL VOLUME IN GALLONS_____			
	9 AM	1 PM	4 PM	9 AM	1 PM	4 PM	Vacuum in/Hg	Pressure: Influent PSI	Pressure: Effluent PSI	Flow GPM	Pool Vacuumed	No. Patrons	Remarks Enter items such as: Total alkalinity, hardness, cyanuric acid, equipment breakdown, excessive pool water loss, filter backwash, water clarity
1													
2													
3													
4													
5													
6													
7													
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Diseases and Sanitation

There are a variety of diseases that are of concern in swimming pools and spas. Many of the more serious are gastrointestinal in nature causing diarrhea, vomiting, abdominal pain, fever and malaise. Diseases can also be spread by, and infect the nose, eyes, ears, genitals, skin and wounds.

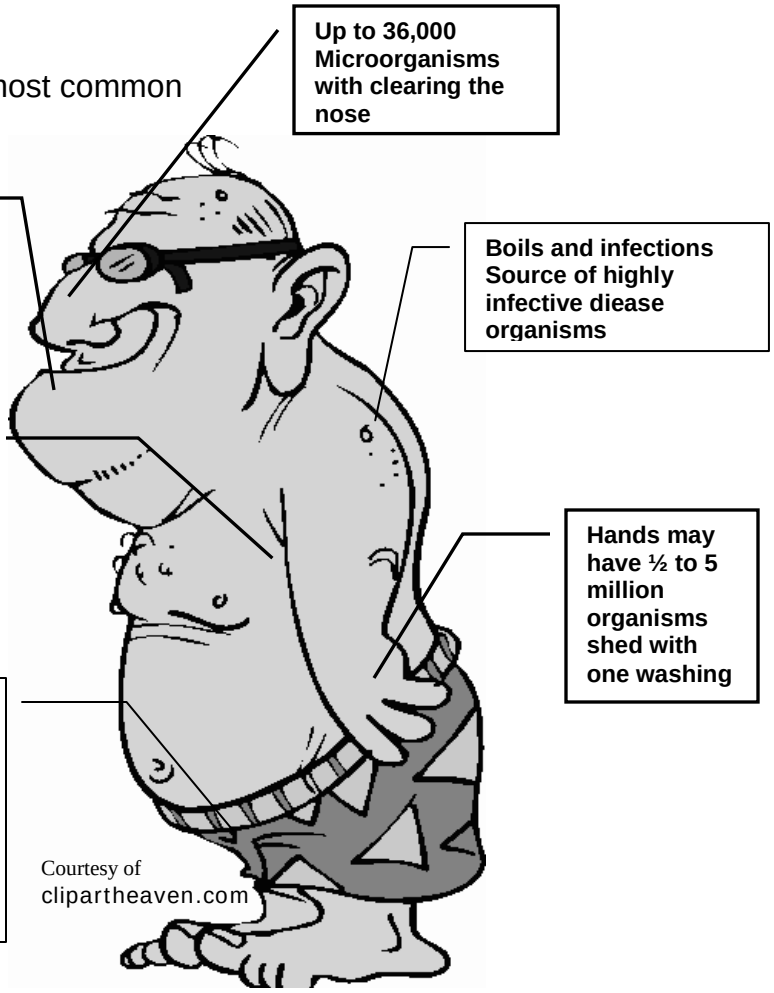
Intestinal Diseases – Shigellosis, E. Coli, Giardiasis, Cryposporidiosis, Cylosporidia and others can be spread by swallowing the disease organisms after they have been excreted by the carrier. Most microorganisms are very susceptible to chlorine disinfection, though some have shown remarkable resistance. Most important is to avoid swimming if you have had diarrhea within the last two weeks. Thorough showering can also help.

Respiratory Diseases – Colds, Strep throat, Pseudomonas, and Legionellosis can be readily transmitted by persons having these diseases. Prolonged contact with the water can remove protective coatings in the respiratory tract making a person more susceptible to infection

Eye, ear, and skin infections – Athlete's foot, granuloma, impetigo and pinkeye are some of the more common infections that can be transmitted from one person to another. In addition to the pool water, transmission can occur because of dirty floors, seats, counters swim suits, towels, rough surfaces and combs.

Pseudomonas Auriginosa – is one of the most common skin infections with transmission usually occurring in spas. The organism can be easily passed between bathers because of the large amount of chlorine used up when several people are in a small volume of water like a spa. Showering is a good preventative measure for preventing transmission. Pseudomonas can causes serious respiratory eye, and ear infections.

Aids and Herpes Viruses – These Viruses are not usually associated with transmission in public pools during normal swimming activities. They are sexually transmitted.



Diseases and Sanitation (con't)

As the pool operator, you can affect the behavior of the swimmers using your pool. One of the most important pieces of prevention is educating the users of your pool as to what is expected from them as far as personal hygiene. If you expect showering, you will usually get better compliance than if you ignore it.

Some pools have used signs, newsletters, educated their lifeguards and staff and used them for public education, and other methods of public education. Our staff and local health department staff are occasionally available as speakers at public meeting of users or pool operators to pass on hygiene and disease prevention information.

Education Highlights:

1. **Do Not Come To The Pool If Ill**. If a swimmer has a contagious illness, or have had diarrhea within the last two weeks they should not come swimming. This is especially true for small children.

2. **Take a Shower.** Proper showering can reduce the bacterial and soil loading on the pool by as much as 50%. Proper showering is a nude shower using soap.

3. **Make sure your children take bathroom breaks.** An hourly break is usually a good idea to prevent accidents in the pool.

4. **Change diapers in the designated changing area.** Changing diapers on the pool deck or on tables or chairs spreads microorganisms over large areas in the pool area where others will come in contact with it. (yukkk) !

5. **Make sure pool staff know how to properly handle fecal accidents.** In addition to helping prevent the spread of disease organisms, proper handling will help satisfy your customers that you take contamination of the pools seriously.

6. **Don't slather up with suntan oils and moisturizers just before going in the pool.** Most suntan oils and moisturizers will wash off quickly in the pool, causing a tremendous load for the disinfectant to deal with. The best approach is to shower immediately after leaving the pool and then applying the suntan oil or moisturizer. They are more effective that way. Perfumes and aftershaves will also wash off and can be smelled and tasted in the water.

7. **Discourage street shoes and clothes in the pool area.** Shoes particularly can sometimes track large amounts of dirt and contamination into the pool area. Best if they are left outside the pool area if there is a secure area.

Operators that have been proactive and consistent in educating and enforcing these concepts actually have good compliance. It takes effort on the part of you and your staff, but the reduced risk of disease transmission can be significant. It also helps make people think about proper hygiene and safety when they are using other pools and other recreational bodies of water.

Diseases and Sanitation (con't)

What can you do to make sure your pool is sanitary?

1. **Maintain sanitizer residuals.** Test the water whenever you are open for operation. One test a day is insufficient. Use the rules as your guide. Consistent and adequate sanitizer levels will really help make your pool safe.

2. **Make sure the recirculation equipment is operating properly.** Inadequate filtration and water circulation can be a real problem. Maintaining clear water helps remove disease organisms, and clarity is an important safety concern. DO NOT operate you pool if you cannot clearly see the main drain.

3. **Clean the decks daily.** At many pools a daily rinse with potable water is sufficient for normal operation. At least once per week, the deck should be scrubbing with a stiff bristled broom and disinfectant. Outdoors allowing the deck to dry completely in the sun is a very good way to keep it disinfected. Cleaning with a disinfectant will remove oils and dirt. The best disinfectant is chlorine. Make sure whatever you use is food grade and compatible with the pool water chemistry. Floor cleaning machines are not always appropriate for cleaning as they can spread dirt and disease organisms.

4. **Clean and disinfect the locker rooms daily.** Allowing them to dry out is very important. Consider using fans or increasing ventilation if drying is a problem. Again, most locker rooms can be scrubbed using a bristle broom and sanitizer. Be sure garbage cans are emptied and that you use a liner to keep them clean. Scrub toilets, urinals and sinks daily. The best locker room can be cleaned and rinsed using a hose. All surfaces are waterproof, drained, and easily rinsed.

5. **Check locker rooms periodically during the day.** Often busy pools run out of soap, paper towels, and other hygiene supplies. Sometimes things back up or vandalism occurs causing the locker room to need immediate cleaning. Stay on top of these problems. A clean, well-maintained locker room is a good advertisement for your facility.

6. **Keep records of your efforts.** When things happen, having records of when areas were cleaned or locker rooms were checked can be important. Water testing results should be available to the public upon request. There should not be any reason your do not want to show off your exemplary operation.

Be proud of your facility and what you do. Encourage your staff to feel the same. Remember this is <u>your</u> facility and it reflects on your sense of pride and workmanship. Keeping a top notch facility is usually the best way to make a safe and healthy facility. Operating a pool is a complicated and demanding job and doing it well is worth feeling good about.

Care of Seasonal Pools

Closing a pool, preparing it for winter conditions, and opening it again in the spring requires special techniques. Methods of seasonal care may vary according to the winter conditions and past experiences. The two greatest concerns are freezing and hydrostatic pressure. The first can crack pool fittings and piping; the second can cause the pool to rise out of the ground (float), damaging recirculation lines and systems and often damaging the pool basin beyond repair.

A successful winterizing program prevents rust, moisture accumulation, and general deterioration resulting from nonuse. Rodents and insect can enter a closed facility if care is not taken to prevent their entry. Vandalism is one of the pool operator's greatest concerns and any winterizing schedule must include adequate security plans.

Protecting the Pool:

The pool basin is the largest exposed area to be winterized and protected against vandalism. An empty pool's surface, whether painted or tile, is subject to weather conditions if left exposed. In addition an empty pool is susceptible to floating if the groundwater gets high enough. Most pools should be winterized with water in them, unless provisions have been made to remove excess groundwater under the pool. A pool that is covered and filled will be protected best from the elements.

Pool Blankets:

Since the pool is protected best by covering it, many pool operators use pool blankets. These blankets are designed not only to conserve energy, but also to protect the pool from winter problems. They need to be secured in the corners and along the sides to prevent the wind from lifting them and blowing them off.

Pool blankets should never be considered as safety devices. A person or animal that falls into the pool will quickly become entangled in the blanket. Eliminating pool access to unauthorized persons is still required for control. A very good second layer of protection against someone or something getting in the pool would be a security cover that can be attached around the edges to the deck and locked on so they cannot be removed by unauthorized persons.

Pool Recirculation and Chemistry:

A pool placed on a recirculating schedule for 4 hours out of 24 is recommended. A covered pool will need minimal chemicals to maintain its balance. Deterioration costs of an emptied pool can easily justify a covered and recirculated pool.

Pool Expansion;

The danger of the pool basin being damaged from expansion due to freezing is minimal. The same cannot be said for the piping, fittings associated with the pool. Freezing can often be avoided, even during extremely low temperatures if the pool is covered and recirculated 24 hours a day.

In areas with long periods of freezing temperatures the piping system is commonly drained and capped, then treated with a non-toxic antifreeze solution. If this is done, it is a good idea to remove the pump and store it in a warm location. Winter is an excellent time to service the pump so it is in top notch condition in the spring.

Filtration

Definitions

Biologically Clean water - Water that is free from harmful bacteria

Physically Clean Water - Water that is free of particulate matter; suspended particles which make the water turbid (cloudy)

Flowrate / Recirculation Rate - The rate of water- flow through the recirculation system, usually expressed in gallons per minute (gpm)

Turnover Time - The amount of time required to move a volume of water, equivalent to the pool volume, through the recirculation system

Pools:
Turnover time (hrs.) = Pool volume (gal.)/(60 X flowrate (gpm))

Spas:
Turnover time (min.) = Volume(gal.)/ Flowrate

Gage & Bidwell Chart

Number of times a volume of water equivalent to the pool volume is filtered	Percent of dirt removed by cumulative filter runs (after reaching equilibrium)
1	42%
2	84%
3	95%
4	98%
5	99%

Turnover Rates

Public Pools:	5 - 6 hrs
Heavy Loads:	3 - 5 hrs
Spas:	20 - 30 min
Heavy Loads	10 min or less

* A filter is more efficient as it becomes dirty
* 25 microns = 1/100th of an inch

	SAND	DIATOMACEOUS EARTH	CARTRIDGE
Initial Cost	Medium	High	Low
Filter Media Replacement Cost	No Cost	Average	Very High
Clarity	(25 - 100 microns)	Excellent (4 - 6 microns)	Very Good (10 -25 microns)
Backwash Necessary	Yes	Yes	No
Flow (gpm / minute / sq. foot)	Rapid Rate 1 -3 gpm	1 - 2 gpm	0.375 gpm
	High Rate 4 - 20 gpm		

Sand Filtration

Sand filtration is the oldest of the different types of filtration. It has developed thru several stages and types of filters.

Gravity sand – Is the earliest type of sand filter. The sand was deposited in a tank in graduated sizes from fine sand to pea gravel to larger sizes of gravel. The water during the cleaning of the filter would distribute the sand so the finest particles were towards the top of the tank. Filtration occurred as water was introduced on top of the sand and allowed to flow through the sand with the aid of gravity. Flow through the sand was about a maximum of 1.5 gpm./ sq. ft. of filter surface area. Filters were very large.

Rapid rate sand – Was fast campared to the gravity. The water was pulled or pushed through the sand and gravel. At 2 – 4 gpm / sq. ft.. these were much faster and required less than half the surface area needed for the gravity sand. Still very large. Filtration occurs at the surface of the sand.

High rate sand – Was developed during WWII when clean drinking water needed to be provided to the troops but large tanks were impractical to move around. Today's high rate sand filter has a sand bed made up of typically #20 silica filter sand. This sand has jagged edges, so does not pack down tightly allowing the water to run through easily, but trapping the dirt. These filters use about the top 6 inches of the sand for filtration. Almost all filters now days are high rate sand filters. Flow rates vary from 5 – 20 gpm / sq.ft. of filter surface area

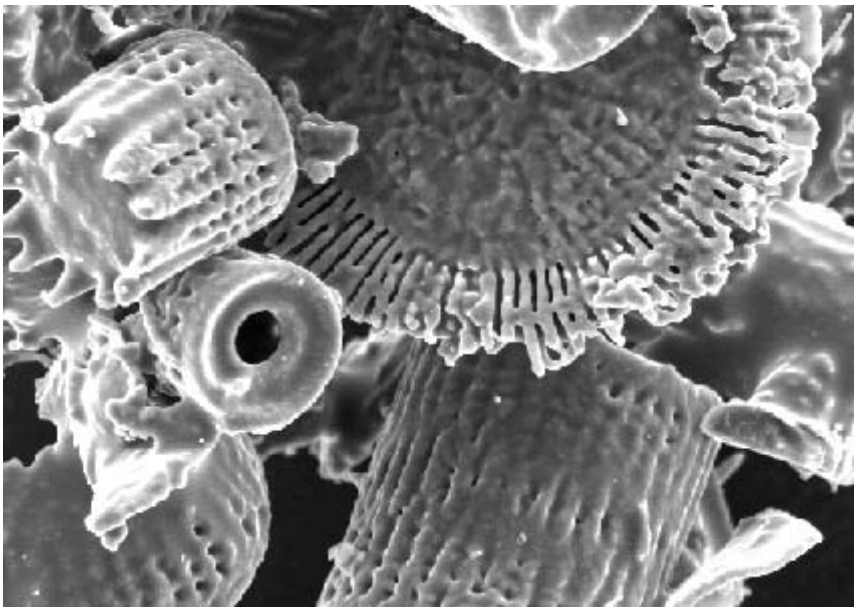
Backwashing – Is the process of cleaning a sand filter. The water flow is reversed through the filter at a rate of about 12 -15 gpm / sq.ft. of filter surface. This flow is enough to lift the sand particles and allow the dirt to be washed out, but not so much the sand is washed out as well.

How long will the sand last? There are still some gravity sand and rapid rate sand filters still using their original sand after many, many years. However, the high rate sand filter seems to require occasional sand replacement. Usually the sand becomes coated with oils and greases that trap dirt onto the sand particle. If the sand is thoroughly cleaned routinely, the sand can last for years. As a usual rule though, most pools need to change their sand about every 5 years with regular care.

Diatomaceous Earth (D.E.)

Diatomaceous earth filtration is a type a filtration with "replaceable media," as compared to "permanent media" that is not replace like sand and cartridge filtration. With DE filtration, once the DE as collected enough dirt, we will backwash or clean the filter and remove all the dirty DE. We replace it with clean DE which is coated onto a filter bag, and the filter run begins again.

Diatomaceous earth is the silica-based skeletons of one-celled organisms called "diatoms" (see the picture). The organisms lived in warm shallow seas and when they died, huge layers of them were left behind when the seas dried up. They look like little sieves, and the water flows right through the skeleton. The holes in the skeleton are small enough the most dirt and bacteria will not flow through them and are trapped.



Greatly Magnified Diatoms

DE filters are used to filter fruit juices and beer products. DE is also an EPA registered insecticide, a frequent ingredient in toothpaste and scouring powder and has many other uses.

DE is a fine, white, floury powder when dry. It can be a health hazard if the dust is inhaled. It should not be handled dry.

Diatomaceous Earth (D.E.) Filtration

DE filters use diatomaceous earth to filter out the particulate matter in the water. DE provides the best filtration of the three types of filters addressed in this booklet. A good filter run will filter out particles as small as 2 microns. This makes the DE filter effective at removing cryptosporidium oocysts, one of the pool operator's more difficult to handle disease-causing organisms.

To work, a DE filter has what are called "septums." These are support structures that come in a variety of shapes and sizes which are covered with a "sock" or fabric which traps and holds the DE during the filtration run. The picture at the right shows a set of septums for a round DE filter. The DE coats the outside of the septums and the water passes through it into the inside of the septum and then into the piping to go back to the pool. These filters will work using either pressure or vacuum. We probably see more vacuum DE filters than any other type of vacuum filter.

The flow rate for the DE filter is between about 1 – 2 gpm / sq. ft. While this is much slower than High rate sand, because of the septum design and spacing, filters of equivalent capacity take up fairly similar amounts of space.

To clean this filter, the water flow is reverses and the DE is released to go to waste, or the filter tank is drained and the septums are hosed off to remove the DE. The dirty DE is disposed of and new DE is used for the new filter cycle.

About once a year, the septums are cleaned with a good degreasing solution to remove any oil buildup and sometimes then acid washed to remove any mineral buildup. They are checked to make sure there are no broken septum supports or holes in the "socks"

Cartridge Filters

Cartridge Filters are pressure type filters that have a filter cartridge that fits inside the filter housing. This filter is removable for cleaning and is not cleaned in place, except that some very large cartridges may need to be hosed down in place to remove a portion of the dirt to allow them to be lifted out of the filter.

One of the main advantages of a cartridge filter is that the cleaning of the filter takes less water than what is normally used for sand or DE filter cleaning or backwashing. One disadvantage of the cartridges is that they are quite expensive and have to be replaced about every 2 – 5 years depending on the pool conditions.

The cartridges are usually a spun polyester fiber. The cartridges are constructed with an accordion pleat and look much like the air cleaner in your car. Because of the folding, a great deal of surface area can be packed into a fairly small amount of space.

The flow capacity of the cartridge filter for a cartridge filter with a capacity approximately that of sand fits inside the same size filter vessel. By slowing down the flow even further, the cartridge filter can reach an effectiveness approaching that of the DE filter for particle removal, and very long filter runs have been achieved between cleanings.

To clean a cartridge filter, the filter tank is disassembled and the cartridge removed. Typically a clean cartridge is kept to immediately replace the dirty cartridge and the filter is quickly back in operation.

The filter is hosed off to remove the dirt buildup. Sometimes a soft brush is used to help loosen the dirt. After the dirt is removed the cartridge should be soaked in a degreasing solution for several hours to overnight and then thoroughly rinsed. Occasionally this is followed by an acid wash in an acid solution. The filter is then thoroughly rinsed. Soaking in a disinfectant solution can remove the last dirt and grease and help disinfect the filter. Every filter should be allow to air dry until completely dry to make sure the filter is completely disinfected and ready to return to filtration duty.

ORP – The Measurement of Oxidation Reduction Potential

INTRODUCTION

ORP stands for “Oxidation-Reduction Potential.” In some parts of the world, it is also known as “Redox Potential.” ORP measures the relative tendency of different substances to lose or gain electrons. In pools, it is a measurement showing a disinfectant’s potential to oxidize contaminants.

When chemists first used the term, the word "oxidation" meant "to combine with oxygen." We can see examples of oxidation all the time in our daily lives. Oxidation can occur at different speeds. When we see a piece of iron rusting, or a slice of apple turning brown, we are looking at examples of relatively slow oxidation. When we look at a fire, we are witnessing an example of rapid oxidation. We now know that oxidation involves an exchange of electrons between two atoms. The atom that loses an electron in the process is said to be "oxidized." The one that gains an electron is said to be "reduced." The “reduced” atom no longer has an electrochemical potential, and the “oxidized” atom loses its attraction to the rest of its parent molecule. Chemicals like chlorine, bromine, and ozone are all oxidizers. It is their ability to oxidize - to "steal" electrons from other substances - that makes them good disinfectants, because in altering the chemical makeup of unwanted plants and animals, they kill them. Then they "burn up" the remains, leaving a few harmless chemicals as the by-product.

ORP is the only practical method we have to electronically monitor sanitizer effectiveness. The World Health Organization (WHO) has determined that an electrochemical potential (ORP) of 650 mV will disinfect drinking water. Because much of the “work” of the disinfectant is to oxidize materials as well, a minimum standard of 750 mV is used. This does not correlate to any particular part per million (ppm) measure, as there are many factors which effect the ORP reading.

ORP MEASUREMENT

Of all the factors involved in chemical maintenance; two, disinfectant residual and pH, are measured and adjusted most often. These are measured by a pool controller using the measurements from two different electrode probes inserted into the water stream.

When measuring ORP, an inert metal electrode is used to acquire the electrochemical potential of electrons. Platinum and gold are the most common ORP electrode materials. The actual potential is measured between the metal electrode and a reference electrode. This measurement is the actual ability of the water and its components to oxidize; like a battery charged with stored disinfection and oxidation energy. Newer probes, with more highly refined electrodes, have a better ability to measure small changes in the ORP. These

newer electrodes are used for High Resolution Redox (HRR) controllers. ORP and HRR essentially measure the same thing.

The oxidation potential for a pool should be maintained at 750 mV or higher.

pH DEPENDENCE

Chlorine ORP measurement is very pH dependent. As the pH of the solution rises, the ORP potential will decline. As we know, chlorine forms variable amounts of Hypochlorous Acid (HOCl - the active disinfectant) and Hypochlorite ions (OCl^- - inactive chlorine) depending on the pH. ORP is measures only the active chlorine (HOCl), other oxidizing disinfectants are measured similarly.

ORP ELECTRODE CONTAMINATION AND CLEANING

Generally, an ORP electrode will rapidly measure the ORP of the water. The speed and accuracy is dependent on the condition of the electrode. The electrode will collect grease that can be cleaned off with a common mild household degreaser. Spray it on, wait and rinse. Occasionally the electrode can collect some calcium deposits which can be removed from a platinum electrode with a mild solution of hydrochloric (muriatic) acid. Always degrease before acid cleaning. Cleaning the metal electrode with an abrasive material is not recommended. After chemical cleaning, the ORP electrode may exhibit unstable readings until it has stabilized. This stabilization may take overnight.

ORP ELECTRODE CALIBRATION

Since ORP is a characteristic measure of redox equilibrium, the ORP electrode should not require standardization or calibration. The measured potential is absolute. However, it is desirable to check instruments for proper operations and contamination.

Unfortunately, at this time, most state pool rules do not recognize ORP or HRR. Because of this, you will have to monitor both the ORP values, and the disinfectant ppm residuals required in the code. It is fairly easy to use both by adjusting the pH up or down slightlyuntil the ppm reading falls within the code requirements.

NOTES

Important background info...

WHAT ARE RECREATIONAL WATER ILLNESSES (RWIs)?

What is the first thing that pops into your head when you think about water safety? Drowning? Slipping? Lightning? All good answers, and all are very important. But, did you know that germs can contaminate swimming water? These germs cause RWIs that have made many people sick.

RWIs are caused by germs such as “Crypto” (KRIP-toe), short for *Cryptosporidium*, *Giardia* (gee-ARE-dee-uh), *E. coli* 0157:H7, and *Shigella* (Shi-GEL-uh).

HOW ARE RWIs SPREAD?

RWIs are spread by swallowing pool water that has been contaminated with fecal matter. How? If someone has diarrhea, that person can easily contaminate the pool. Think about it. Pool water is shared by every swimmer. Really, it’s communal bathing water. It’s not sterile. It’s not drinking water.

The good news is that germs causing RWIs are killed by chlorine. However, chlorine doesn’t work right away. It takes time to kill germs and some germs like Crypto can live in pools for days. Even the best maintained pools can spread illness.

SHOULD ALL FECAL INCIDENTS BE TREATED THE SAME?

No. A diarrheal fecal incident is a higher-risk event than a formed-stool incident. With most diarrheal illnesses, the number of infectious germs found in each bowel movement decreases as the diarrhea stops and the person’s bowel movements return to normal. Therefore, a formed stool is probably less of a risk than a diarrheal incident that you may not see.

A formed stool may contain no germs, a few, or many that can cause illness. You won’t know. The germs that may be present are less likely to be released into the pool because they are mostly contained within the stool. However, formed stool also protects germs inside from being exposed to the chlorine in the pool, so prompt removal is necessary.

Germ Inactivation Time for Chlorinated Water*

Germ	Time
E. coli O157:H7 Bacterium	Less than 1 minute
Hepatitis A Virus	About 16 minutes
Giardia Parasite	About 45 minutes
Crypto Parasite	About 15,300 minutes or 10.6 days†

SHOULD YOU TREAT A FORMED FECAL INCIDENT AS IF IT CONTAINS CRYPTO?

No. In 1999, pool staff volunteers from across the country collected almost 300 samples from fecal incidents that occurred at water parks and pools.¶ CDC then tested these samples for Crypto and *Giardia*. None of the sampled feces tested positive for Crypto, but *Giardia* was found in 4.4% of the samples collected. These results suggest that formed fecal incidents pose only a very small Crypto threat but should be treated as a risk for spreading other germs (such as *Giardia*). Remember a diarrheal fecal incident is considered to be a higher-risk event than a formed-stool fecal incident.

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* 1 parts per million (ppm) or mg/L free chlorine at pH 7.5 or less and a temperature of 77°F (25°C) or higher.

† Shields JM, Hill VR, Arrowood MJ, Beach MJ. Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. J Water Health 2008;6(4):513–20.

¶ CDC. Prevalence of Parasites in Fecal Material from Chlorinated Swimming Pools — United States, 1999. MMWR 2001;50(20):410–2.

What do I do about...

formed stool in the pool?

Formed stools can act as a container for germs. If the fecal matter is solid, removing the feces from the pool without breaking it apart will limit the degree of pool contamination. In addition, RWIs are more likely to be spread when someone who is ill with diarrhea has a fecal incident in the pool.

1. **For both formed-stool and diarrheal fecal incidents,** close the pool to swimmers. If you have multiple pools that use the same filtration system — all pools will have to be closed to swimmers. Do not allow anyone to enter the pool(s) until the disinfection process is completed.
2. **For both formed-stool and diarrheal fecal incidents,** remove as much of the fecal material as possible (for example, using a net or bucket) and dispose of it in a sanitary manner. Clean and disinfect the item used to remove the fecal material (for example, after cleaning, leave the net or bucket immersed in the pool during disinfection).

VACUUMING STOOL FROM THE POOL IS NOT RECOMMENDED.

3. Raise the free chlorine to 2 parts per million (ppm), if less than 2 ppm, and ensure pH 7.5 or less and a temperature of 77°F (25°C) or higher. This chlorine concentration was selected to keep the pool closure time to approximately 30 minutes. Other concentrations or closure times can be used as long as the contact time (CT) inactivation value* is achieved (see next page).
4. Maintain free chlorine concentration at 2 ppm and pH 7.5 or less for at least 25 minutes before reopening the pool. State or local regulators may require higher free chlorine levels in the presence of chlorine stabilizers,[†] which are known to slow disinfection. Ensure that the filtration system is operating while the pool reaches and maintains the proper free chlorine concentration during the disinfection process.

diarrhea in the pool?

Those who swim when ill with diarrhea place other swimmers at significant risk for getting sick. Diarrheal incidents are much more likely than formed stool to contain germs. Therefore, it is important that all pool managers stress to patrons that swimming when ill with diarrhea is an unhealthy swimming behavior.

3. If necessary, before attempting the hyperchlorination of any pool, consult an aquatics professional to determine the feasibility, the most optimal and practical methods, and needed safety considerations.
4. Raise the free chlorine concentration to 20 ppm[¶,§] and maintain pH 7.5 or less and a temperature at 77°F (25°C) or higher. The free chlorine and pH should remain at these levels for at least 12.75 hours to achieve the CT inactivation value of 15,300.** **Crypto CT inactivation values are based on killing 99.9% of Crypto. This level of Crypto inactivation cannot be reached in the presence of 50 ppm chlorine stabilizer, even after 24 hours at 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C).[† †] Extrapolation of these data suggest it would take approximately 30 hours to kill 99.9% of Crypto in the presence of 50 ppm or less cyanuric acid, 40 ppm free chlorine, pH 6.5, and a temperat**
5. Confirm that the filtration system is operating while the water reaches, and is maintained, at the proper chlorine level for disinfection.
6. Backwash the filter after reaching the CT inactivation value. Be sure the effluent is discharged directly to waste and in accordance with state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.
7. Allow swimmers back into the water only after the required CT inactivation value has been achieved and the free chlorine and pH levels have been returned to the normal operating range allowed by the state or local regulatory authority.

Establish a fecal incident log. Document each fecal incident by recording date and time of the event, whether it involved formed stool or diarrhea, and the free chlorine and pH levels at the time or observation of the event. Before reopening the pool, record the free chlorine and pH levels, the procedures followed in response to the fecal incident (including the process used to increase chlorine levels if necessary), and the contact time.

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* CT inactivation value refers to concentration (C) of free chlorine in ppm (or mg/L) multiplied by time (T) in minutes at a specific pH and temperature.

† Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.

¶ Many conventional test kits cannot measure free chlorine levels this high. Use chlorine test strips that can measure free chlorine in a range that includes 20–40 ppm (such as those used in the food industry) or make dilutions with chlorine-free water when using a standard DPD test kit.

§ If pool operators want to use a different free chlorine concentration or inactivation time, they need to ensure that CT inactivation values always remain the same (see next page for examples of how to accomplish this).

** Shields JM, Hill VR, Arrowood MJ, Beach MJ. Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. J Water Health 2008;6(4):513–20.

† † Shields JM, Arrowood MJ, Hill VR, Beach MJ. The effect of cyanuric acid on the chlorine inactivation of *Cryptosporidium parvum*. J Water Health 2008; 7(1): 109–114.

NOTES

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INFECTIOUS DISEASES IN CHILDREN®

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Prevention of recreational water illnesses

Is chlorination enough to ensure healthy swimming?

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Special to INFECTIOUS DISEASES IN CHILDREN

In June of 1998, the Georgia Division of Public Health investigated a cluster of diarrheal illnesses reported by a day care facility. The investigation identified 26 people infected with *Escherichia coli* O157:H7; seven of these people developed hemolytic uremic syndrome and one died. The source of exposure was traced to a water park that ill people had visited prior to the onset of illness. The investigation revealed inadequate levels of chlorine disinfectant in a suspect "kiddie" pool during the critical exposure time period. Poor maintenance of disinfectant levels at the water park was believed by investigators to have contributed to the transmission of disease.

In August of 2001, the Illinois Department of Public Health was notified of a cluster of diarrheal illnesses in people who had recently attended a water park. The investigation identified 358 case-patients infected with the parasite *Cryptosporidium*. A case-control study showed that case-patients were more likely than age-matched controls to have attended and swum at the water park, to have had pool water in their mouth and to have swallowed it. Samples of pool water were found to contain *Cryptosporidium*. Maintenance records at the water park revealed adequate chlorine levels during the suspected period of transmission. There were routine checks for, and adjustment of, both chlorine and pH levels. Daily fecal accidents were reported as confirmed by a fecal accident log and staff recollection. Despite adequate facility maintenance and compliance with standard treatment guidelines for disinfected venues, transmission of disease occurred. Critical to this occurrence was the chlorine-resistant nature of the *Cryptosporidium* parasite.

These two outbreak scenarios raise important issues regarding to chlorination and healthy swimming. Aren't all disinfected swimming venues maintained well? Doesn't chlorination kill everything so that pool water is sterile? These outbreaks help to dispel these societal myths about swimming pools. Swimming pool water safety has traditionally focused on the issues of preventive measures for drowning, injuries and lightning strikes. However, as these examples demonstrate, swimming pools and other disinfected recreational venues may also serve as settings for infectious disease transmission. Water safety programs should also include knowledge and preventive measures for recreational water illnesses.

Health care providers may help to teach parents of ill children and patients about healthy swimming habits. These simple and practical messages (posted by the CDC at www.healthyswimming.org) include the following:

- Don't swim when you have diarrhea.
- Don't swallow pool water.
- Shower with soap and water before swimming.
- Wash your hands with soap and water after using a toilet or after changing diapers.
- Take your children on bathroom breaks or check diapers often.
- Change diapers in a bathroom and not at poolside.
- Wash your child thoroughly with soap and water before swimming.

Source: www.healthyswimming.org

Recreational water illnesses

Recreational water illnesses (RWI) refer to a spectrum of illnesses acquired from swallowing, breathing or coming into contact with contaminated water in recreational water venues. Recreational water venues include treated or disinfected venues such as swimming pools, water parks and hot tubs. They also include untreated or naturally occurring bodies of water, such as lakes, rivers and the ocean.

The spectrum of RWIs includes ear, eye, gastrointestinal, neurologic, respiratory and skin infections. This article will focus on diarrheal illnesses, which account for most illness reported from recreational water venues. Waterborne diarrheal pathogens include viruses (noroviruses), bacteria (*E. coli*, *Shigella*) and parasites (*Cryptosporidium*, *Giardia*). People most susceptible to gastrointestinal RWIs are the young, the elderly, the pregnant and the immuno-

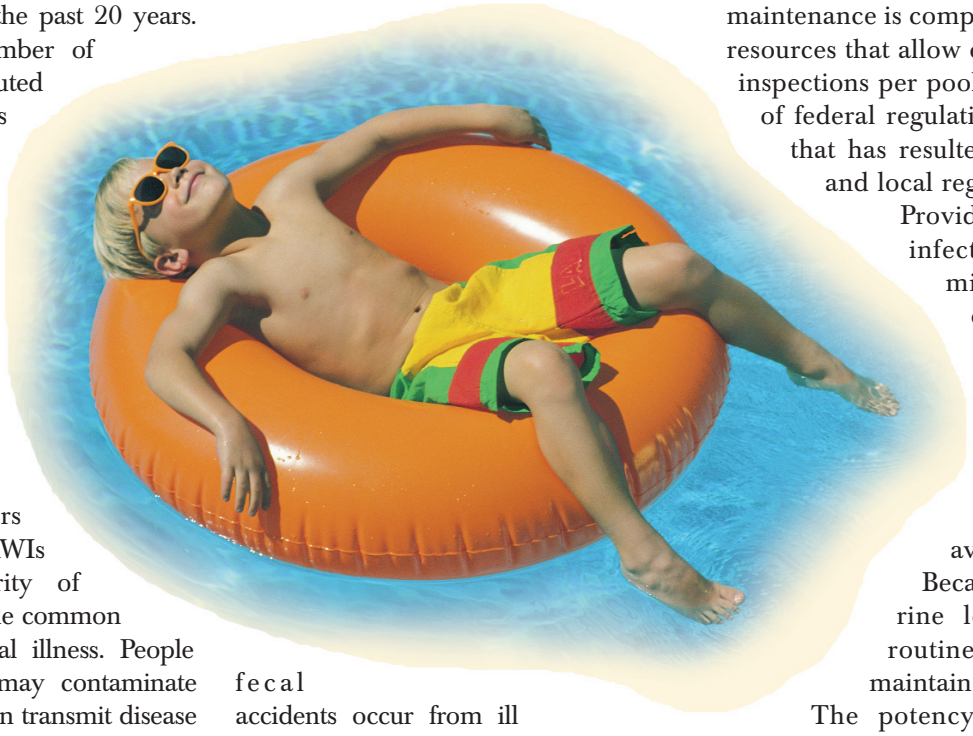
compromised. Illness in this last population may be the most severe and life-threatening, as seen with the significant morbidity associated with *Cryptosporidium* infections in the immunocompromised.

Ongoing surveillance by the CDC and state health departments has shown increasing trends of RWI outbreaks of diarrheal illness over the past 20 years. For instance, the number of RWI outbreaks attributed to *Cryptosporidium* has increased tenfold from 1990 to 2000; in the past two years, 80% of these diarrheal illness outbreaks in recreational water venues have been due to the chlorine-resistant nature of *Cryptosporidium*.

Contributing factors to the emergence of RWIs include the popularity of swimming as well as the common occurrence of diarrheal illness. People who swim when ill may contaminate venues, which may then transmit disease to healthy swimmers.

Contamination of swimming venues

There may be several routes of contamination for swimming venues. Natural water venues may be contaminated by infected animals defecating in watershed areas or by point source contamination (eg, sewage outflows). For disinfected and natural water venues, contamination may also occur from patrons. A high bather density that includes toddler and diaper-aged children engaging in activities of communal bathing and water sharing increases the likelihood of water contamination. Fecal accidents, improper cleansing after bowel movement and feces from swimmers' bodies may all add up to several pounds of feces a day in the average water park. If



fecal accidents occur from ill swimmers with infectious diarrhea, the release of waterborne pathogens creates a health risk to other swimmers. Because waterborne pathogens such as *Cryptosporidium* and *Giardia* have such low infectious doses, consumption of only small volumes of water may be required for disease transmission to occur.

The presence of a highly resistant outer shell allows *Cryptosporidium* to survive in the environment for long periods as well as to withstand rapid chlorine inactivation.

Chlorination of disinfected venues

Advancements in technology over the last century have resulted in disinfection methods and environmental improvements that help to ensure the cleanliness of recreational water venues. Despite this, RWI outbreaks have emerged over the past two decades. Chlorination and other disinfectants are the first line of defense against disease transmission in disinfected recreational water venues. As the first outbreak demonstrates, inadequate facility maintenance may result in transmission of chlorine-sensitive pathogens.

The state of pool maintenance in the United States is demonstrated by surveillance data from more than 22,000 swimming pool inspections performed during the summer of 2002. Fifty-four percent of inspections had one or more violations (range: one to 12 violations). Eight percent of inspections resulted in immediate pool closure. Assurance of adequate pool maintenance is complicated by limited resources that allow only a few annual inspections per pool as well as a lack of federal regulation and oversight that has resulted in varied state and local regulations.

Providing adequate disinfection for swimming venues has other challenges. Urine, sunlight, aeration and organic matter all serve to deplete the levels of free available chlorine. Because of this, chlorine levels should be routinely measured to maintain adequate levels.

The potency of chlorine to inactivate pathogens is intimately tied to pH levels. As the pH goes up, the ability of chlorine to effectively disinfect decreases. Therefore, checking for and maintaining appropriate pH levels is critical to ensure effective disinfection.

Chlorine-resistant waterborne pathogens

Even the best-maintained pools may transmit disease. The second outbreak discussed demonstrates how RWI transmission may occur despite adequate facility maintenance. Key to this are the characteristics of environmental stability and chlorine resistance found in several waterborne pathogens, such as *Cryptosporidium* and *Giardia*.

Chlorine typically kills most waterborne pathogens in less than an hour. *Cryptosporidium*, found throughout the United States and the world, provides the greatest challenge as a RWI pathogen. The presence of a highly resistant outer shell allows it to survive in the environment for long periods as

well as to withstand rapid chlorine inactivation. Its small size also challenges conventional filtration systems. *Cryptosporidium* can survive for days in swimming pools. For example, the inactivation time for typical pool water (1 ppm [1 mg/L] chlorine, pH 7.5, 77° F) is less than one minute for *E. coli* vs. 9,600 minutes (6.7 days) for *Cryptosporidium*. The good news is that chlorine will eventually kill all waterborne pathogens. The bad news is that you do not always know which pathogens, if any, are present in the water after a fecal accident.

Strategies for healthy swimming

RWI transmission occurs in inadequately chlorinated recreational water venues. It may also occur in adequately maintained venues when chlorine-resistant pathogens are involved. Because of the complex nature of RWI transmission, it is essential to incorporate a multidisciplinary approach in prevention and control strategies.

Human behavior plays a pivotal role in RWI transmission. Swimmers who are symptomatic with diarrhea may contaminate swimming venues; this poses health risks for healthy co-swimmers. Healthy swimming messages should be disseminated to general public, especially in patients with diarrhea, parents of diapered and toddler-aged children. In addition, high-risk groups such as the young, the elderly, the pregnant and the immunosuppressed should also be advised about healthy swimming habits.

Health care providers may help to teach parents of ill children and patients about healthy swimming habits. These simple and practical messages (posted by the CDC at www.healthyswimming.org) include the following:

- Don't swim when you have diarrhea.
- Don't swallow pool water.
- Shower with soap and water before swimming, and be particularly meticulous about washing the crotch area.
- Wash your hands with soap and water after using a toilet or after changing diapers.
- Take your children on bathroom breaks or check diapers often.
- Change diapers in a bathroom and not at poolside.
- Wash your child thoroughly with soap and water before swimming.

It may be judicious to recommend that patients ill with infectious diarrhea refrain from swimming for the two weeks after cessation of diarrhea, particularly if they are infected with *Cryptosporidium* or *Giardia*: these may be excreted for several weeks even after symptom resolution. These same prevention measures apply to people traveling domestically and/or internationally.

Recreational water venues provide opportunities for people to increase their level of physical activity and enjoy their leisure time. The message is to continue enjoying swimming, but only after adopting healthy swimming habits that will prevent disease transmission for oneself, one's family, fellow swimmers and others. **IDC**

For more information:

Gilbert L, Blake P. Outbreak of *Escherichia coli* O157:H7 infections associated with a water park. *Georgia Epidemiol Rep*. 1998;14(7):1-6.

Lee SH, Levy DA, Craun GF, et al. Surveillance for waterborne-disease outbreaks – United States, 1999-2000. *MMWR Surveill Summ*. 2002;51(8):1-47. Can be accessed online at: www.cdc.gov/mmwr/preview/mmwrhtml/ss5108a1.htm.

CDC. Surveillance data from swimming pool inspections - selected states and counties, United States, May-September 2002. *MMWR*. 2003;52(22):513-516. Can be accessed online at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5222a1.htm.

The CDC has swimming safety information at www.healthyswimming.org.

Safety Checklist for Manufactured Safety Vacuum Release System (SVRS)

(All answers should be **Yes,** if any answers are **No**, then corrective action should be taken immediately because there is a significant increase in risk of entrapment/evisceration)

☐ Daily pool maintenance log including any and all maintenance and testing of SVRS
☐ Manual(s) for installation, owner, operation and troubleshooting is onsite
☐ All required marking on the device:
manufacturer's name or trademark,
model #,
serial #,
date coding,
lot ID,
a contact phone number, and
statement about application limitations
☐ All required information in the manual; the same as items listed above plus:
the application type (lift suction, submerged suction or all),
statement that device conforms to ASME* or ASTM** standard, and
statement that the device is designed to prevent entrapment but not evisceration (prolapse).
☐ Each suction fitting (drain cover) is ASME A112.19.8 compliant
☐ Device is installed to manufacturer's specifications
☐ Device installed by an individual that meets the qualifications established by manufacturer
☐ One device installed for each circulating pump plumbed directly to the suction outlet
☐ No Check valve in suction piping protected by the device
☐ No hydrostatic valve in the suction piping protected by the device
☐ Device is calibrated after onsite installation to manufacturer's specifications
☐ Ball, butterfly or sliding gate valve installed within two feet upstream of device, or a test mat is used to cover suction outlet to simulate entrapment event during test
☐ Device is tested 3 times to simulate entrapment event
☐ Mechanical devices shall latch or lock out in vented safe position after test of high vacuum occurrence
☐ Non-mechanical devices have built in tamper proof features
☐ Device shall cause release of vacuum within 4.5 seconds after onset of high vacuum
☐ The vacuum shall decay to less than the level present within the system before the test event within 4.5 seconds of test occurrence
☐ Device is tested to simulate entrapment event by qualified individual monthly, or as often as manufacturer specifies.

Name of Person (Printed and signed) that conduct safety check Date

*ASME - American Society of Mechanical Engineers, A112.19.17-Manufactured Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub, and Wading Pool Suction Systems; A112.19.8-Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs.
** ASTM - American Society of Testing and Materials, F2387 Standard Specification for for Manufactured Safety Vacuum Release Systems (SVRS) for Swimming Pools, Spas and Hot Tubs. V2 5/31/11

CODE DIFFERENCES ADVISORY TEMPLATE

Please be Advised (*Version 8/14/12)*

The _____Building Department has reviewed and approved your public pool plans for construction criteria in accordance with only the Florida Building Code, Section 424.1.

Be advised that the Florida Department of Health (FDOH) code, Chapter 64E-9, Florida Administrative Code, currently has several differences with FBC 424.1 (newly named 454.1), and these additional construction requirements must be provided before FDOH will issue the required operating permit. You will need to comply with all of the following that are applicable to these specialty pools to be granted an operation permit by the FDOH:

Non-equivalent Design criteria

Note the two sentences about an electrical interlock for Ozone use. 64E-9.007(16)(d)4.
424.1.6.5.16.4.4 The injection point for ozone generating equipment shall be located in the pool return line after the filtration and heating equipment, prior to the halogen injection point, and as far as possible from the nearest pool return inlet with a minimum distance of 4 feet (1219 mm). Injection methods shall include a mixer, contact chamber, or other means of efficiently mixing the ozone with the recirculated water. The injection and mixing equipment shall not prevent the attainment of the required turnover rate of the recirculation system. Ozone generating equipment shall be equipped with a check valve between the generator and the injection point. Ozone generating equipment shall be equipped with an air flow meter and a means to control the flow. The generator shall be electrically interlocked with the recirculation pump to prevent the feeding of ozone when the recirculation pump is not operating. A flow sensor controller can also be used to turn off the feeder when flow is sensed.

For Wading pools, note this prohibition. 64E-9.009(6)
424.1.7.6 Vacuuming. Wading pools with 200 square feet or more of pool water surface area shall have provisions for vacuuming through the skimmer, a portable vacuum system or an alternative approved method that does not involve a direct suction port in the pool.

For Plunge pools, number 2 should be replaced with the number 3. 64E-9.011(2)(c)1.
424.1.9.2.3.1 Pump reservoir volume. The minimum reservoir volume shall be equal to ~~2~~ 3 minutes of the combined flow rate in gallons per minute of all filter and slide pumps.

For Zero depth entry pools, number 5 should be replaced with the number 7. 64E-9.011(6)(c)
424.1.9.6.3 The pool deck may slope toward the pool for no more than ~~5~~ 7 feet (~~1524~~ 2133mm), as measured from the overflow system grate outward.

For Interactive water fountains, number 2 should be replaced with the number 3.
64E-9.011(8)(a)
424.1.9.8.1 Waters discharged from all fountain or spray features shall not pond on the feature floor but shall flow by gravity through a main drain fitting to a below or collection system which discharges to a collector tank. The minimum size of the collector tank shall be equal to the volume of ~~2~~ 3 minutes of the combined flow of all feature pumps and the filter pump. Smaller tanks may be utilized if hydraulically justified by the design engineer.

Note too that changes that do not rise to the level of a Modification are listed at both 424.1.10.1 and in 64E-9.005(2), yet jurisdiction for only new construction and modification permits are transferred to Building Officials in the 2012 House Bill 1263. Modifications include changes to the pool shape, to the pool deck and to the recirculation, disinfection and filtration systems. New decking is not a modification if installed in conformance with 424.1.3.1.1 and deck markings are upgraded. Replacement of identical pool equipment in-kind is maintenance. Resurfacing of the pool is not a modification, but a list of items that must be corrected at that time is found in Chapter 64E-9.005(2) & 424.1.10.1-9 . The Department of Health will inspect the pool after resurfacing for compliance with 64E-9, FAC. Installation of a new pool

CODE DIFFERENCES ADVISORY TEMPLATE

shell is considered new construction.

An application for a DOH initial operating permit on form DH 918, an appropriate fee, and one copy of the building department permit and a set of building department approved pool plans are needed by the CHD upon construction completion to conduct the initial operating permit inspection. 514.031(1), FS.

Important: On August 7 2012, the Florida Building Commission approved the 15 "glitch" changes that DOH proposed to the public swimming pool building code, formerly known as section 424.1 and now 454.1. These changes were effective immediately for the state's building code and the Building Officials now have authority to require these construction related items identical to DOH when they review a new pool construction or a modification and when they conduct their inspections. They will be available soon on the FBC webpage: www.floridabuilding.org

Please contact the Florida Department of Health, Environmental Health Pool Program Office, Tallahassee, at (850) 245-4240 or your local county health department pool program staff for additional information. DOH forms and other useful information can be found on their Public Pool program webpage: www.myfloridaeh.com/water/swim/index.html

~~(4) The board shall adopt rules to administer this part.~~

Section 102. Section 466.00775, Florida Statutes, is repealed.

Section 103. Subsection (4) of section 514.011, Florida Statutes, is amended to read:

514.011 Definitions.—As used in this chapter:

(4) "Public bathing place" means a body of water, natural or modified by humans, for swimming, diving, and recreational bathing~~, together with adjacent shoreline or land area, buildings, equipment, and appurtenances pertaining thereto,~~ used by consent of the owner or owners and held out to the public by any person or public body, irrespective of whether a fee is charged for the use thereof. The bathing water areas of public bathing places include, but are not limited to, lakes, ponds, rivers, streams, artificial impoundments, and waters along the coastal and intracoastal beaches and shores of the state.

Section 104. Section 514.021, Florida Statutes, is amended to read:

514.021 Department authorization.—

(1) The department may adopt and enforce rules~~, which may include definitions of terms,~~ to protect the health, safety, or welfare of persons by setting sanitation and safety standards for ~~using~~ public swimming pools and public bathing places. The department shall review and revise such rules as necessary, but not less than biennially. Sanitation and safety standards shall ~~include, but not~~ be limited to~~,~~ matters relating to ~~structure; appurtenances; operation;~~ source of water supply; microbiological ~~bacteriological~~, chemical, and physical quality of water in the pool or bathing area; method of water purification, treatment, and disinfection; lifesaving apparatus; and measures to ensure safety of bathers~~; and measures to ensure the personal cleanliness of bathers~~.

(2) The department may not establish by rule any regulation governing the design, alteration, modification, or repair of public swimming pools and bathing places which has no impact on sanitation and safety ~~the health, safety, and welfare~~ of persons using public swimming pools and bathing places. Further, the department may not adopt by rule any regulation governing the construction, erection, or demolition of public swimming pools and bathing places. It is the intent of the Legislature to preempt those functions to the Florida Building Commission through adoption and maintenance of the Florida Building Code. The department shall provide technical assistance to the commission in updating the construction standards of the Florida Building Code which govern public swimming pools ~~and bathing places~~. ~~Further, the department is authorized to conduct plan reviews, to issue approvals, and to enforce the special-occupancy provisions of the Florida Building Code which apply to public swimming pools and bathing places in conducting any inspections authorized by this~~

~~chapter.~~ This subsection does not abrogate the authority of the department to adopt and enforce appropriate sanitary regulations and requirements as authorized in subsection (1).

Section 105. Section 514.023, Florida Statutes, is amended to read:

514.023 Sampling of beach waters and public bathing places; health advisories.—

(1) As used in this section, the term "beach waters" means the waters along the coastal and intracoastal beaches and shores of the state, and includes salt water and brackish water.

(2) The department may adopt and enforce rules to protect the health, safety, and welfare of persons using the beach waters and public bathing places of the state. The rules must establish health standards and prescribe procedures and timeframes for bacteriological sampling of beach waters and public bathing places.

(3) The department may issue health advisories if the quality of beach waters or a public bathing place fails to meet standards established by the department. The issuance of health advisories related to the results of bacteriological sampling of beach waters is preempted to the state.

(4) When the department issues a health advisory against swimming in beach waters or a public bathing place on the basis of finding elevated levels of fecal coliform, Escherichia coli, or enterococci bacteria in a water sample, the department shall concurrently notify the municipality or county in which the affected beach waters are located, whichever has jurisdiction, and the local office of the Department of Environmental Protection, of the advisory. The local office of the Department of Environmental Protection shall promptly investigate wastewater treatment facilities within 1 mile of the affected beach waters or public bathing place to determine if a facility experienced an incident that may have contributed to the contamination and provide the results of the investigation in writing or by electronic means to the municipality or county, as applicable.

~~(5) Contingent upon legislative appropriation to the department in the amount of $600,000 nonrecurring, the department will perform a 3-year study to determine the water quality at beaches throughout the state. The study will be performed in all counties that have public-access saltwater and brackish water beaches.~~

Section 106. Section 514.025, Florida Statutes, is amended to read:

514.025 Assignment of authority to county health departments.—

(1) The department shall assign to county health departments that are staffed with qualified engineering personnel the functions of reviewing applications and plans for the construction, development, or modification of public swimming pools or bathing places; of conducting inspections ~~for and~~

~~issuance of initial operating permits~~; and of issuing all permits. If the county health department determines that qualified staff are not available ~~is not assigned the functions of application and plan review and the issuance of initial operating permits~~, the department shall be responsible for such functions. ~~The department shall make the determination concerning the qualifications of county health department personnel to perform these functions and may make and enforce such rules pertaining thereto as it shall deem proper.~~

(2) ~~After the initial operating permit is issued, the~~ County health departments are responsible ~~shall assume full responsibility~~ for routine surveillance of water quality in all public swimming pools and bathing places, including ~~responsibility for a minimum of two~~ routine inspections ~~annually~~, complaint investigations, enforcement procedures, and ~~reissuance of operating permits, and renewal of~~ operating permits.

(3) The department may assign the responsibilities and functions specified in this section to any multicounty independent special district created by the Legislature to perform multiple functions, to include municipal services and improvements, to the same extent and under the same conditions as provided in subsections (1) and (2), upon request of the special district.

Section 107. Section 514.03, Florida Statutes, is amended to read:

514.03 ~~Construction plans~~ Approval necessary to construct, develop, or modify public swimming pools or public bathing places.~~—It is unlawful for any person or public body to construct, develop, or modify any public swimming pool or bathing place, other than coastal or intracoastal beaches, without a valid construction plans approval from the department. This section does not preempt the authority of~~ Local governments or local enforcement districts may determine ~~to conduct plan reviews and inspections of public swimming pools and bathing places for~~ compliance with the general construction standards of the Florida Building Code, pursuant to s. 553.80. Local governments or local enforcement districts may conduct plan reviews and inspections of public swimming pools and public bathing places for this purpose.

~~(1) Any person or public body desiring to construct, develop, or modify any public swimming pool or bathing place shall file an application for a construction plans approval with the department on application forms provided by the department and shall accompany such application with:~~

~~(a) Engineering drawings, specifications, descriptions, and detailed maps of the structure, its appurtenances, and its intended operation.~~

~~(b) A description of the source or sources of water supply and amount and quality of water available and intended to be used.~~

~~(c) A description of the method and manner of water purification, treatment, disinfection, and heating.~~

~~(d) Other applicable information deemed necessary by the department to fulfill the requirements of this chapter.~~

~~(2) If the proposed construction of, development of, or modification of a public swimming pool or bathing place meets standards of public health and safety as defined in this chapter and rules adopted hereunder, the department shall grant the application for the construction plans approval within 30 days after receipt of a complete submittal. If engineering plans submitted are in substantial compliance with the standards aforementioned, the department may approve the plans with provisions for corrective action to be completed prior to issuance of the operating permit.~~

~~(3) If the proposed construction, development, or modification of a public swimming pool or bathing place fails to meet standards of public health and safety as defined in this chapter and rules adopted hereunder, the department shall deny the application for construction plans approval pursuant to the provisions of chapter 120. Such denial shall be issued in writing within 30 days and shall list the circumstances for denial. Upon correction of such circumstances, an applicant previously denied permission to construct, develop, or modify a public swimming pool or bathing place may reapply for construction plans approval.~~

~~(4) An approval of construction plans issued by the department under this section becomes void 1 year after the date the approval was issued if the construction is not commenced within 1 year after the date of issuance.~~

Section 108. Section 514.031, Florida Statutes, is amended to read:

514.031 Permit necessary to operate public swimming pool ~~or bathing place~~.—

(1) It is unlawful for any person or public body to operate or continue to operate any public swimming pool ~~or bathing place~~ without a valid permit from the department, such permit to be obtained in the following manner:

(a) Any person or public body desiring to operate any public swimming pool ~~or bathing place~~ shall file an application for a permit with the department, on application forms provided by the department, and shall accompany such application with:

~~1. Descriptions of the structure, its appurtenances, and its operation.~~

1.~~2.~~ Description of the source or sources of water supply, and the amount and quality of water available and intended to be used.

2.~~3.~~ Method and manner of water purification, treatment, disinfection, and heating.

3.~~4.~~ Safety equipment and standards to be used.

~~5. Measures to ensure personal cleanliness of bathers.~~

4.~~6.~~ Any other pertinent information deemed necessary by the department ~~to fulfill the requirements of this chapter~~.

(b) If the department determines that the public swimming pool ~~or bathing place~~ is or may reasonably be expected to be operated in compliance with this chapter and the rules adopted hereunder, the department shall grant the application for permit.

(c) If the department determines that the public swimming pool ~~or bathing place~~ does not meet the provisions outlined in this chapter or the rules adopted hereunder, the department shall deny the application for a permit pursuant to the provisions of chapter 120. Such denial shall be in writing and shall list the circumstances for the denial. Upon correction of such circumstances, an applicant previously denied permission to operate a public swimming pool or bathing place may reapply for a permit.

(2) Operating permits shall not be required for coastal or intracoastal beaches.

(3) Operating permits may be transferred ~~shall not be transferable~~ from one name or owner to another. When the ownership or name of an existing public swimming pool ~~or bathing place~~ is changed and such establishment is operating at the time of the change with a valid permit from the department, the new owner of the establishment shall apply to the department, upon forms provided by the department, within 30 days after such a change~~, for a reissuance of the existing permit~~.

(4) Each such operating permit shall be renewed annually and the permit must be posted in a conspicuous place.

(5) An owner or operator of a public swimming pool, including, but not limited to, a spa, wading, or special purpose pool, to which admittance is obtained by membership for a fee shall post in a prominent location within the facility the most recent pool inspection report issued by the department pertaining to the health and safety conditions of such facility. The report shall be legible and readily accessible to members or potential members. The department shall adopt rules to enforce this subsection. A portable pool may not be used as a public pool.

Section 109. Section 514.033, Florida Statutes, is amended to read:

514.033 Creation of fee schedules authorized.—

(1) The department is authorized to establish a schedule of fees to be charged by the department or by any authorized county health department as detailed in s. 514.025 ~~for the review of applications and plans to construct, develop, or modify a public swimming pool or bathing place, for the issuance~~

~~of permits to operate such establishments, and for the review of variance applications for public swimming pools and bathing places~~. Fees assessed under this chapter shall be in an amount sufficient to meet the cost of carrying out the provisions of this chapter.

(2) The fee schedule shall be: for original construction or development plan approval, not less than $275 and not more than $500; for modification of original construction, not less than $100 and not more than $150; for an initial operating permit, not less than $125 and not more than $250; and for review of variance applications, not less than $240 and not more than $400. The department shall assess the minimum fees provided in this subsection until a fee schedule is promulgated by rule of the department.

(3) Fees shall be ~~Any person or public body operating a public swimming pool or bathing place shall pay to the department an annual operating permit fee~~ based on pool ~~or bathing place~~ aggregate gallonage, which shall be: up to and including 25,000 gallons, not less than $75 and not more than $125; and in excess of 25,000 gallons, not less than $160 and not more than $265, except for a pool inspected pursuant to s. 514.0115(2)(b) for which the annual fee shall be $50.

(4) Fees collected by the department in accordance with this chapter shall be deposited into the Grants and Donations Trust Fund or ~~Public Swimming Pool and Bathing Place Trust Fund for the payment of costs incurred in the administration of this chapter. Fees collected by county health departments performing functions pursuant to s. 514.025 shall be deposited into~~ the County Health Department Trust Fund. Any fee collected under this chapter is nonrefundable.

(5) The department may not charge any fees for services provided under this chapter other than those fees authorized in this section. However, the department shall prorate the initial annual fee for an operating permit on a half-year basis.

Section 110. Subsections (4) and (5) of section 514.05, Florida Statutes, are amended to read:

514.05 Denial, suspension, or revocation of permit; administrative fines.

(4) All amounts collected pursuant to this section shall be deposited into the Grants and Donations Trust Fund ~~Public Swimming Pool and Bathing Place Trust Fund~~ or into the County Health Department Trust Fund, whichever is applicable.

(5) Under conditions specified by rule, the department may close a public pool that is not in compliance with this chapter or the rules adopted under this chapter.

Section 111. Section 514.06, Florida Statutes, is amended to read:

514.06 Injunction to restrain violations.—Any public swimming pool or public bathing place presenting a significant risk to public health by failing to meet sanitation and safety standards established pursuant to ~~constructed, developed, operated, or maintained contrary to the provisions of~~ this chapter is declared to be a public nuisance, dangerous to health or safety. Such nuisances may be abated or enjoined in an action brought by the county health department or the department.

Section 112. Subsections (1) and (2) of section 633.115, Florida Statutes, are amended to read:

633.115 Fire and Emergency Incident Information Reporting Program; duties; fire reports.—

(1)(a) The Fire and Emergency Incident Information Reporting Program is created within the Division of State Fire Marshal. The program shall:

1. Establish and maintain an electronic communication system capable of transmitting fire and emergency incident information to and between fire protection agencies.

2. Initiate a Fire and Emergency Incident Information Reporting System that shall be responsible for:

a. Receiving fire and emergency incident information from fire protection agencies.

b. Preparing and disseminating annual reports to the Governor, the President of the Senate, the Speaker of the House of Representatives, fire protection agencies, and, upon request, the public. Each report shall include, but not be limited to, the information listed in the National Fire Incident Reporting System.

c. Upon request, providing other states and federal agencies with fire and emergency incident data of this state.

3. Adopt rules to effectively and efficiently implement, administer, manage, maintain, and use the Fire and Emergency Incident Information Reporting Program. The rules shall be considered minimum requirements and shall not preclude a fire protection agency from implementing its own requirements which shall not conflict with the rules of the Division of State Fire Marshal.

4. By rule, establish procedures and a format for each fire protection agency to voluntarily monitor its records and submit reports to the program.

5. Establish an electronic information database which is accessible and searchable by fire protection agencies.

(b) The Division of State Fire Marshal shall consult with the Division of Forestry of the Department of Agriculture and Consumer Services and the

Date_____

County_____ Date Received_____ Log#_____

Project_____

Engineer_____ Original____ Revision____ Modification____

Reviewed By_____ SP-_____File #_____

Date Re-Submittal Received:_____ Date of 2nd Review:_____

Items needing correction or clarification are marked by an "X" beside the appropriate section number of the Florida Administrative Code citation (2009 64E-9, FAC, or 2010 FBC 424.1). We have left the 64E-9 requirements in this checklist because they are critical for public health and therefore the pool will be checked for these items by the County Health Department at the first operating permit inspection after the Building Official's approval of the construction.

Reviewer: Note that section 424.1.8.1 requires that "Spa pools shall meet the requirement of Sections 424.1.1 through 424.1.6.5, unless specifically indicated otherwise." Use the additional "Spa pool" checklist for spa pools. This checklist can be used for Wading pools and there is an additional Wading pool detail checklist.
From: www.myfloridaeh.com/water/swim/index.html

Florida Building Code or Florida Administrative Code Section | SwP | Spa/WaP | #sets plans _____disk____

Section	SwP	Spa/WaP	
64E-9.005(1)(a)3.	____	___/___	Plans review fees received as required by Section 64E-9.015.
64E-9.005(1)(a)	____	___/___	Six one-piece applications for approval of swimming pool plans received.
64E-9.005(1)(a)	____	___/___	Six sets of signed and sealed engineering plans received (proper size).
64E-9.005(1)(a)2.	____	___/___	A 4" x 6" blank space exists on lower right hand corner of plans sheets; site plan is included.
64E-9.005(1)(a)2.	____	___/___	An equipment list and specifications with manufacturer and/or distributor names, model numbers, and catalog numbers included on plans.
424.1.2.1(a)	____	___/___	Pool constructed of impervious structurally rigid material, light in color, with a smooth, non-toxic, slip-resistant finish.
424.1.2.3.2	____	___/___	Pool shell free of **designs** which interfere with detection of human(s) in distress, algae, sediment, or other objects in pool.
424.1.6.5.3.2.5	____	___/___	A min. 4" **tile line** (6" for skimmer pools) is at the water line, max. 12" if dark tile. Gutter pools may use 2" tile line along pool wall edge of gutter lip. (tiles are min. 1" on all sides)
424.1.2.1 (b)	____	___/___	If 1" tiles are used in pool, adhesive is certified for shear strength (250 psi) & underwater use.
424.1.2.3.3 &.4	____	___/___	**Lap lanes** and targets on non-competition pools to meet code. (2-6" wide markings)
424.1.1	____	___/___	The filtration system is sized for at least 1 gpm per living unit for transient or 3/4 gpm per living unit for non-transient. (For multiple pools: cumulative total GPM, excluding spas, wading pools and interactive water features)
424.1.1	____	___/___	Conventional pool filtration system **turnover** period is not less than 3 hours unless otherwise required. (For sizing purposes only.)
424.1.2.2.2	____	___/___	All pool walls (except steps and spa coves) have minimum 15' clearance perpendicular to a tangent to the wall. (Interior step protrusion does not exceed 6')
424.1.2.2.2	____	___/___	Corners shall be a minimum 90 degree angle.
424.1.2.2.2	____	___/___	Protruding corners to have at least 2" radius continued through top of gutter edge. Coping does not overhang into the pool more than 1-1/2".
424.1.2.3.1 1.	____	___/___	Pool water depth is at least 3' in shallow area.
424.1.2.3.1 1.	____	___/___	Pool water depth is at least 4' in deep area.
424.1.2.2.2	____	___/___	The upper part of pool walls (areas of 5' or less depth) are within 5° of vertical for a minimum depth of 2½' and the radius joining this upper section to the floor does not exceed 2½'.

424.1.2.2.2	____	___/___	The upper part of pool walls in areas over 5' deep are within 5° of vertical for a minimum depth equal to the pool depth minus 2½' and the radius joining this upper section to the floor does not exceed 2½'.
424.1.2.3.1 2.	____	___/___	Minimum 4" permanent contrasting **depth markings**, followed by the full or abbreviated words "FEET" or "INCHES", properly located on both sides of the pool at shallow end, slope break, deep end wall, and deep point. Horizontal surfaces are slip resistant.
424.1.2.3.1 2.	____	___/___	Depth markers shall indicate actual depth within 3 inches.
424.1.2.3.1 2.	____	___/___	Symmetrical pool designs with deep point at center have dual markings indicating depth at wall and at the deep point, followed by FEET or INCHES.
424.1.2.3.1 3.	____	___/___	Maximum perimeter distance between depth markings is 25'.
424.1.2.3.1 3.	____	___/___	Depth markings are visible from inside the pool and from the deck.
424.1.2.3.1 4.	____	___/___	When curb is provided, depth markings are located on inside and outside riser. (Top of curb may be substituted for outside riser location.)
424.1.2.3.1 4.	____	___/___	When no curb is provided, depth markings are located at or above water level on inside vertical wall and on the deck (within 2' of water edge).
424.1.2.3.1 4.	____	___/___	When open type gutters are used, depth markers are located on the back of the gutter wall.
424.1.2.3.1 5.	____	___/___	When deck level perimeter overflow systems are used, additional depth markers are on adjacent fencing or walls, large enough to be recognizable from inside the pool. Depth markers on deck are within 3' of water. Or, depth markers may be at top of pool wall just under water level.
424.1.2.3.1 6.	____	___/___	In areas not part of an approved diving bowl, tile "NO DIVING" markings are on the curb top or deck within 2' of water edge on each side of pool with a maximum distance between markings of 25'.
424.1.2.3.1 6.	____	___/___	The "NO DIVING" markings are at least 4" high and contrasting; or a 6” tile with min. 4” red international “No Diving” symbol.
424.1.2.3.1 7.	____	___/___	All markings installed on horizontal surfaces have a slip-resistant finish.
424.1.2.3.1 7.	____	___/___	All markings are tile (unless pool is fiberglass, thermoplastic or stainless steel).
424.1.2.2.3.2	____	___/___	Slope break (where applicable) has 5' depth or greater.
424.1.2.2.3.2	____	___/___	Slope break (if applicable) has 2-6" wide dark contrasting tile marking across bottom and up sides at the transition point.
424.1.2.2.3.2	____	___/___	Slope break (if applicable) has safety line mounted with recessed cup anchors 2' before contrasting marking, toward shallow end.
424.1.2.2.3.2	____	___/___	Safety line (if applicable) has visible floats at maximum 7' intervals.
424.1.2.2.3	____	___/___	Pool <u>does not</u> have double level floor.
424.1.2.2.3.1	____	___/___	The pool floor slope in areas of 5' depth or less does not exceed 1' in 10'.
424.1.2.2.3.1	____	___/___	The pool floor slope in areas of greater than 5' depth does not exceed 1' in 3'.
424.1.2.2.3.2	____	___/___	The transition from a pool floor slope of 1' in 10' to a greater floor slope has a slope break and safety line.
424.1.2.2.3.1	____	___/___	The pool floor slope is at least 1' in 40'.
424.1.2.2.1	____	___/___	**Diving** areas meet minimum requirements of the FINA Handbook 2005-2009.
424.1.2.5	____	___/___	Adequate number of **steps, swimouts**, recessed treads and/or ladders provided (Every 75' of pool perimeter, minimum of 2) including both ends (plus deep point, if not at one end). If deep end >30' wide, both sides have means of access.
424.1.2.5.3	____	___/___	Pool steps have not less than 24" tread length(s), 10" tread width(s) nor more than 10" tread riser(s). Max. tread width is 48”.
424.1.2.5.3	____	___/___	Intermediate step treads and risers are uniform in width and height (within ½”).
424.1.2.5.3	____	___/___	Dark, contrasting, slip resistant tiles are provided for intersection of tread and riser for entire length of each step. (3/4” -2” on tread, 2” on riser, or slip resistant bullnose)
424.1.2.5.3	____	___/___	Step and bench seat edge markings on vinyl liner and fiberglass pools are permanent, permanently secured, dark, non-fading and slip resistant.
424.1.2.5.4	_____	___/___	**Swimouts** extend 18" to 24" back from the pool wall and are 4' to 5' wide.
424.1.2.5.4	____	___/___	Unless stairs are provided, the swimout is a maximum of 12" below the deck.

424.1.2.5.4	____	___/___	Swimout is located in an area of the pool with a depth exceeding 5'.
424.1.2.5.4	____	___/___	If pool is on skimmers, a wall inlet is provided within the swimout.
424.1.2.5.4	____	___/___	A dark, contrasting colored, slip resistant tile band is located along the intersection of the pool wall and the swimout, extending 2" on horizontal and vertical surfaces. Bullnose tile may be used with ¾" on horizontal surface.
424.1.2.5.5	____	___/___	Handrail(s) for the stairs are correct length to mount in deck and bottom step (figure four mounted in deck and extended over bottom step).
424.1.2.5.5	____	___/___	**Handrails** shall extend between 28" and 40" above the step or deck.
424.1.2.5.6	____	___/___	If provided, lifts to accommodate handicapped persons have a four foot wide deck behind the lift mount.
424.1.2.5.1	____	___/___	**Ladder(s**) are cross-braced, corrosion resistant, are the correct length to mount in pool deck, extend 28" to 40" above deck, and extend over into pool.
424.1.2.5.1	____	___/___	Ladder treads are slip-resistant and the clearance between the ladder and pool wall is 3 to 6". Ladder bottom braces have end caps. Top rung is at or below water level on open gutter pools and max. 12" below deck/curb top on all others.
424.1.2.5.2	____	___/___	Step treads installed into pool wall shall be flush with pool wall and have minimum 5" tread width, minimum 10" length, & a maximum vertical distance of 12" between steps.
424.1.2.5.2	____	___/___	Step treads installed into pool wall have a grabrail at each side of the steps and each grabrail is mounted in the deck and extends 28" to 40" above the deck.
424.1.2.6	____	___/___	**Underwater bench seats** are 14" to 18" wide and have a 2" wide dark contrasting slip resistant tile marking along the horizontal and vertical surface. Slip resistant bullnose tile may be used with ¾" on horizontal surface.
424.1.2.6	____	___/___	Underwater bench seats are in areas less than five feet deep.
424.1.2.6	____	___/___	Benches do not protrude into the 15' clearance requirement.
424.1.3.1.3 &.2	____	___/___	**Pool deck** has unobstructed area with minimum 4' width around perimeter of pool, handrail & ladder anchors, diving boards/towers, and slides. Pits and crevices more than 3/16" deep not allowed.
424.1.3.1.1	____	___/___	Pool deck constructed of impervious material with slip-resistant finish.
424.1.3.1.2	____	___/___	Pool deck is not below maximum 10" from the curb top when curb is provided.
424.1.3.1.2	____	___/___	Indoor and outdoor pool deck has a minimum 2% and maximum 4% uniform slope away from pool or to deck drains.
424.1.3.1.4	____	___/___	Traffic barriers provided to prevent obstruction of deck by vehicles (where applicable).
424.1.3.1.5	____	___/___	Hose bibb with vacuum breaker is provided to wash deck with potable water.
424.1.3.1.5	____	___/___	Walkways between the pool and sanitary facilities are constructed of concrete or other non-absorbent materials for the first 15' of walkway and have a slip-resistant finish.
424.1.2.6	____	___/___	Pool water area has no obstruction.
424.1.2.6	____	___/___	Structures located inside pool perimeter are additional part of the recirculation system and are not located less than 15' from any pool wall and are not located within the diving bowl area.
424.1.3.1.8	____	___/___	The vertical clearance above the pool deck is at least 7'.
424.1.3.1.6	____	___/___	Obstructions of the perimeter of the pool do not exceed 10% of total pool perimeter, and are protected by a barrier or designed to discourage patron access.
424.1.3.1.6	____	___/___	Obstructions of the perimeter of the pool have a wet deck area behind or through the obstruction and within 15'of the water edge. Approved slides have the near edge of walk within 35' of water.
424.1.3.2	_____	___/___	**Bridge** or obstruction over pool is at least 8' above pool bottom and at least 4' above water surface.
424.1.3.2	____	___/___	Minimum 42" high handrails are provided along each side of the bridge.
424.1.3.2	____	___/___	Bridge or walkway footing surface is constructed of concrete or other non-absorbent material having a smooth slip-resistant finish.
424.1.6.5.3.1	____	___/___	Pool has perimeter overflow gutter or recessed automatic surface skimmers (where allowed).

424.1.6.5.3.1	____	___/___	Overflow gutter lip is level(max. ¼" between high & low) and bottom of gutter is level or slopes to gutter drains.
424.1.6.5.3.1	____	___/___	The gutter drain spacing does not exceed 10' for 2" drains or 15' for 2½" drains.
424.1.6.5.3.1	____	___/___	Gutters may be eliminated for no more than 15' of pool perimeter (or max.10% of perimeter). In such areas, handholds shall be installed within 9 inches of water surface.
424.1.6.5.3.1.3	____	___/___	Gutter lip has min. 2" of tile on pool wall (except if stainless steel). (tiles are min. 1" on all sides)
424.1.6.5.3.1.1	____	___/___	Recessed gutter is at least 4" deep and 4" wide with no part of the gutter trough visible from a point directly above.
424.1.6.5.3.1.1	____	___/___	Open type gutter is at least 6" deep and 12" wide with a 2" (± ¼") slope from the lip to the gutter drain level (may be 1" at steps if gutter used as tread) and back wall is smooth glazed tile.
424.1.6.5.3.1.1	___	__/__	Back of gutter drain is within ¾" of back vertical wall of gutter wall where gutter is deepest, and flush or recessed no more than 3/8".
424.1.6.5.3	____	___/___	Gutter drain system is capable of handling 100% of the recirculation flow and shall discharge into the collector tank.
424.1.6.5.3.2	____	___/___	**Skimmer** pool water surface area does not exceed 1000 ft.² (excluding offset stairs & swimout) and does not exceed maximum width of 20' (when measured perpendicular to a tangent to the wall).
424.1.6.5.1	____	___/___	Skimmers have NSF approval.
424.1.6.5.3.2.1	____	___/___	Skimmer system designed to carry 60% of pool total design flow rate with each skimmer carrying at least 30 gpm.
424.1.6.5.3.2.1	____	___/___	Number of skimmers is based upon 1 for every 400 ft.² or fraction thereof of pool water surface area.
424.1.6.5.3.2.2	____	___/___	Skimmers are located to take advantage of prevailing wind direction and to minimize interference from adjacent inlets or skimmers.
424.1.6.5.3.2.2	____	___/___	Skimmers do not protrude into pool area.
424.1.6.5.3.2.2	____	___/___	Pools with skimmers have handhold in deck or curb construction which is not more than 9" above midpoint of skimmer.
424.1.6.5.3.2.3	____	___/___	Skimmer installation may be installed with spring loaded vertical check equalizer valve and 2" min. diameter equalizer line, installed at least 12 " below normal water level protected by an ASME/ANSI A112.19.8-2007 compliant grate, when skimmer system is connected to pump suction. No float valves allowed.
424.1.6.5.3.2.4	____	___/___	A wall inlet fitting is directly across from each skimmer.
424.1.6.5.11	____	___/___	**Pool makeup water** supply is from an approved potable water system or meets those requirements with bacteriological/chemical reports to county health department.
424.1.6.5.11	____	___/___	Pool makeup water supply has air break or approved backflow prevention device.
424.1.6.1.4& 424.1.3.1.5	____	___/___	Hose bibbs have vacuum breakers.
424.1.6.5.2	____	___/___	The **recirculation/filtration** equipment is designed to provide at least 4 turnovers of the pool volume per day. Health or fitness centers shall provide 8 turnovers per day unless pool is 1000 ft² or larger.
424.1.6.5.3	____	___/___	The design pattern of recirculation flow of pool with overflow gutters is 100% through main drain piping and 100% through gutter system piping.
424.1.6.5.3	____	___/___	The design pattern of recirculation flow for pool with skimmers is 100% through main drain and 60% through skimmer system piping.
424.1.6.10.5	____	___/___	A collector tank with an effective capacity of at least 1 minute of the design flow is provided.
424.1.6.5.11	____	___/___	An automatic water makeup control and a manual pool fillspout are provided to discharge into the collector tank with an air gap.
424.1.6.5.4	____	___/___	The recirculation pump is sized at the proper T.D.H. according to the type of filter system.
424.1.6.5.4	____	___/___	The recirculation pump (when mounted above the water level of the pool) is specified as self-priming.

64E-9.007(17)	____	___/___	**Waterfalls or features**: Return piping is capable of handling additional feature flow when feature turned off. Feature requiring more than 20% of flow rate has additional pump that drafts from a suitable collector tank. Feature water is not counted toward designed turnover rate. Water from the features returns to the pool.
64E-9.007(17)	____	___/___	Spray features mounted in deck are flush with pool deck.
424.1.6.5.9.6	____	___/___	The number of inlets handle the recirculation flow with a maximum flow of 20 gpm per inlet.
424.1.6.5.9	____	___/___	Wall return inlets are directionally adjustable and do not protrude into the pool. Wall inlets are a min. of 12” below normal water level unless otherwise justified.
424.1.6.5.9.1	____	___/___	Pools 30' or less wide, with wall inlets only, have maximum spacing of 20' between inlets based on pool perimeter.
424.1.6.5.9.2	____	___/___	Pools 30' or less wide, with floor inlets only, have inlets located such that they are not over 20' apart nor over 10' from adjacent walls.
424.1.6.5.9.3	____	___/___	Pools 30' or less wide with combination floor and wall inlets meet requirements of either 424.1.6.5.9.1 or .2.
424.1.6.5.9.4	____	___/___	Pools greater that 30’ wide have floor inlets only or a combination of floor and wall inlets.
424.1.6.5.9.4	____	___/___	Pools greater than 30' wide, with floor inlets only, have inlets located such that they are not over 20' apart or 10' from adjacent walls.
424.1.6.5.9.5	____	___/___	Pools greater than 30' wide with combination floor and wall inlets have wall inlets not over 20' apart (based on pool perimeter) and floor inlets are provided for the water area beyond 15' perpendicular distance from all walls. (Floor inlets are located not over 20' apart and 25' from adjacent walls.)
424.1.6.5.9	____	___/___	Floor return inlets have a means of flow adjustment.
424.1.6.5.9	____	___/___	Floor inlets do not protrude above pool floor and do not have sharp edges or protrusions. For vinyl liner & fiberglass pools, floor inlets are not more than 3/8” above floor.
424.1.6.5.10	____	___/___	The **main drain grate(s)** are located at the deepest point in the pool and are flat, flush, and not readily breakable or removable by bathers.
424.1.6.5.10.1	____	___/___	The depth at the deepest point/main drain grate does not deviate more than 3" from side wall depth indicated by depth markers at the location. (unless dual marking used)
424.1.6.5.10.2	____	___/___	The open area of the main drain grate(s) is such that the flow velocity at the grate(s) does not exceed 1½' per second at the design flow rate of the recirculation pump.
424.1.6.5.10.3	____	___/___	Pool over 30' wide in deep end has multiple main drain grates, equally spaced from the pool side walls and each other.
424.1.6.5.10.4	____	___/___	Hydrostatic relief devices have been provided if high ground water exists at site.
424.1.6.5.4	____	___/___	If the recirculation pump takes suction prior to filtration, the pump is specified with hair and lint strainer.
424.1.6.5.12	____	___/___	A portable or plumbed vacuuming system is provided which allows vacuuming the pool with a hose not more than 50' in length. Recirculation pump over 3 hp is not used for vacuuming.
424.1.6.5.12	____	___/___	Vacuum cleaning system pump is provided with hair and lint strainer.
424.1.6.5.12	____	___/___	A vacuum fitting with spring-loaded safety cover, is flush mounted no more than 15” below water level. (12” acceptable in FBC, 15” max. per 64E-9.007(12).
424.1.6.5.12	____	___/___	Bag type cleaners that operate as ejectors on potable water supply pressure are protected by a vacuum breaker.
424.1.6.5.13	____	___/___	A flowmeter capable of reading at least 1½ times the design flow rate is properly located with proper clearances upstream and downstream. (Located in the pump discharge line for sand filter systems and in the pool return line for other filter systems.)
424.1.6.5.14	____	___/___	If heater is provided, a fixed thermometer is mounted in the pool recirculation line downstream of the heater outlet line connection.
424.1.6.5.14	____	___/___	Sufficient valves and piping are provided to allow isolation or removal of the pool heater.
424.1.6.5.14	____	___/___	Heater bypass valve is designed for proportioning flow (gate valve is unacceptable).
424.1.6.5.14	____	___/___	Material used in solar and other heaters are non-toxic and acceptable for potable water use.

424.1.6.5.6	____	___/___	**Plastic pipe** has NSF-pw seal of approval and is completely specified.
424.1.6.5.6	____	___/___	Plastic pipe exposed to sunlight is coated for UV protection.
424.1.6.5.7	____	___/___	Return line, main drain line, and surface overflow system lines each have proportioning valves.
424.1.6.5.8	____	___/___	All pressure piping is sized such that the flow velocity does not exceed 10' per second at the design flow rate. (Exception for precoat lines when higher velocity is needed for agitation purposes.)
424.1.6.5.8	____	___/___	All suction piping is sized such that the flow velocity does not exceed 6' per second at the design flow rate. (Exception is vacuum filter header assembly where velocity may be up to 10' per second.)
424.1.6.5.8	____	___/___	Main drain systems and surface overflow systems which discharge to collector tanks are sized such that the flow velocity does not exceed 3' per second at the design pattern of recirculation flow.
424.1.6.5.15	____	___/___	Each waste line has a unique air gap and is not connected to other lines. Method of water & DE powder disposal is acceptable.
424.1.6.5.5.1	____	___/___	**Sand filters**: The filter is sized such that the filtration rate does not exceed 3 gpm/ft² for rapid sand filter or 15 gpm/ft² for high rate sand filters (or 20 if so rated by NSF).
424.1.6.5.1	____	___/___	Sand filters meet the requirements of NSF/ANSI Standard 50 - 2007.
64E-9.007(8)	____	___/___	Sand filters: The recirculation pump(s) and piping is designed to be capable of backwashing.
424.1.6.5.4	____	___/___	Sand filters: The recirculation pump provides a min. T.D.H. of 60' for filtration unless hydraulically justified by the design engineer.
424.1.6.5.5.2.1	____	___/___	Sand filters: Pressure filters have influent and effluent pressure gauges with minimum 2" face diameter(s) and scale(s) of 0-60 psi and a sight glass in the backwash line.
424.1.6.5.5.2.1	____	___/___	Sand filters: The pressure filter tanks have air relief valves.
424.1.6.5.5.2.2	____	___/___	Sand filters: Vacuum filter has 2", or larger, diameter vacuum gauge in suction line with 0-30" (mercury) scale.
64E-9.007(8)	____	___/___	Sand filters: Piping system permits filtering to pool, vacuuming to filter, vacuuming to waste, backwashing individual filters, complete drainage of the system, and space to allow maintenance.
424.1.6.5.5.1	____	___/___	**D.E. Type filters**: The filter is sized such that the filtration rate does not exceed 2 gpm/ft².
424.1.6.5.5.2.3	____	___/___	If diatomaceous earth type filters are used, separation devices are provided and properly sized for the waste water system.
424.1.6.5.1	____	___/___	D.E. type filters: Components and materials have been tested and approved using NSF/ANSI Standard 50-2007.
424.1.6.5.5.2.3	____	___/___	D.E. type filters: Pressure filter(s) have precoat pot or collector tank for precoating purposes.
64E-9.007(8)	____	___/___	D.E. type filters: Pressure filter(s) have piping to backwash to waste by reverse flow procedure and filter can be completely drained.
64E-9.007(5)(c)	____	___/___	Custom design filter meets the requirements of 64E-9.007(5)(c).
424.1.6.5.5.3	____	___/___	D.E. type filters: The filter area is determined on the basis of effective filtering surfaces with no allowance given for areas of impaired filtration.
424.1.6.5.5.3	____	___/___	D.E. type filters: Filter septa have a minimum 1" clear spacing between elements (up to 4 ft² effective area per septum) and the minimum spacing between elements is 1/8" larger for each additional square foot or fraction thereof of septum area over 4 ft².
424.1.6.5.4	____	___/___	D.E. type filters: The recirculation pump provides 60' T.D.H. for pressure systems and 50' T.D.H. for vacuum systems.
424.1.6.5.5.2.1	____	___/___	D.E. type filters: Pressure filter(s) are equipped with air relief valves, influent/effluent pressure gauges (2" minimum face diameter), and a sight glass in the waste line.

424.1.6.5.5.2.2	____	___/___	D.E. type filters: Vacuum filter has vacuum gauge with minimum face diameter of 2", reading 0-30" of mercury located on suction line.
424.1.6.5.5.3	____	___/___	D.E. type filters: Vacuum filter tank has coved intersections between the wall and the floor and the tank floor slopes to the filter tank drain.
64E-9.007(8)	____	___/___	D.E. type filters: The system allows filtering to pool, precoat recirculation to filter, vacuuming to waste, vacuuming to filter, backwashing (pressure filter) to waste, and complete drainage of filter tank.
424.1.6.5.5.1	____	___/___	**Cartridge filters**: The filter complies with the maximum filtration rate of 0.375 gpm/ft² for pleated type cartridges.
424.1.6.5.1	____	___/___	Cartridge filters: The filter model has met the requirements of NSF/ANSI Standard 50-2007.
424.1.6.5.4	____	___/___	Cartridge filters: The recirculation pump is selected to give 60' T.D.H.
424.1.6.5.5.2.1	____	___/___	Cartridge filters: Pressure type filter(s) are self-purging or have air relief valves and have influent/effluent pressure gauges with minimum 2" face diameters and reading 0-60 psi.
424.1.6.5.5.2.2	____	___/___	Cartridge filters: Vacuum filter has vacuum gauge with 2" minimum face diameter (0-30" mercury reading) located on the suction line.
64E-9.007(8)	____	___/___	Cartridge filters: Filter system is capable of filtering to pool, vacuuming to waste, vacuuming to filter, and complete drainage of the filter tank with space for maintenance.
64E-9.007(5)(c)	____	___/___	Cartridge filters: The filter cartridges are permanently marked with the manufacturer's name, pore size, and filter area on one end cap.
424.1.6.5.16.2	____	___/___	**Hypohalogenation**: The feeder has adjustable feed rate from zero to full range and meets the requirements of NSF/ANSI Standard 50-2007.
424.1.6.5.16.2	____	___/___	Hypohalogenation: The feeder is capable of feeding a dosage of 6 ppm to the minimum required turnover flow rate (if solution type feeders, a 5% calcium hypochlorite or 10% sodium hypochlorite solution).
424.1.6.5.16.2	____	___/___	Hypohalogenation: An electrical feeder, when used, has electrical interlock with the recirculation pump. A flow sensor controller may be used.
424.1.6.5.16.2	____	___/___	Hypohalogenation: Solution crock has a volume equal to at least 50% of the maximum daily feed capacity of the chlorine solution feeder.
424.1.6.5.16.2	____	___/___	Hypohalogenation: Solution crock is marked to indicate contents.
424.1.6.5.16.2	____	___/___	**Erosion type feeder** shall have a flowmeter and flow adjustment valve.
424.1.6.5.16.3	____	___/___	**pH adjustment feeder**: A positive displacement type feeder adjustable from zero to full range & meets NSF/ANSI Standard 50-2007 is provided.
424.1.6.5.16.3	____	___/___	pH adjustment feeder: An electrical feeder has electrical interlock with the recirculation pump.
424.1.6.5.16.3	____	___/___	pH adjustment feeder: The solution crock volume is at least 50% of the maximum daily capacity of the feeder and is marked to indicate the contents.
64E-9.004(11)	____	___/___	A **test kit** is provided and is capable of testing for free active halogens, total or combined available chlorine, total alkalinity, calcium hardness & pH.
64E-9.004(11)(a)	____	___/___	If a cyanurate type feeder is used, a cyanuric acid test kit is provided.
64E-9.004(11)(a)	____	___/___	If a salt solution in the pool water is necessary for a chlorine generator, a sodium chloride test kit is provided.
424.1.5.1	____	___/___	An **equipment room** or enclosure is provided which is protected from unauthorized entrance and from the weather on 3 sides and overhead. Equipment designated by manufacturer for outdoor use may be located in a 4' min. fenced equipment area with self-closing, self-latching gate with locking device.
424.1.3.1.9			A gate through the pool fence from the pool area to the equipment area is provided within 10 feet of the equipment area is provided

424.1.5.3 ____ ___/___ The equipment room floor is constructed of concrete or other nonabsorbent material having a smooth slip-resistant finish and uniformly sloped to prevent standing water.

424.1.5.4 ____ ___/___ The equipment room has forced draft, or adequate cross ventilation, and positive floor drainage with sump pump if needed.

424.1.5.4 ____ ___/___ Below grade equipment rooms have a stairway with forced draft ventilation or fully louvered door and powered intake within 6" of floor. Ship's ladder may be specified by design engineer.

424.1.5.5 ____ ___/___ The equipment room access is at least 3' x 6'.

424.1.5.9 ____ ___/___ The equipment room is provided with a hose bibb with vacuum breaker.

424.1.5.6 ____ ___/___ The equipment room size and layout provides clearances for all equipment as prescribed by the manufacturer to allow normal maintenance and removal.

424.1.5.6 ____ ___/___ The equipment room with a fixed ceiling has a minimum height of 7'.

424.1.5.7 ____ ___/___ The equipment room is lighted to provide a minimum 30 fc of illumination at floor level.

64E-9.006(2)(e) ____ ___/___ Collector tank or filter tank (vacuum system) is not accessible to unauthorized individuals.

424.1.4.2 ____ ___/___ Lighting: Artificial lighting is provided when natural lighting is not adequate or when night swimming will be allowed.

424.1.4.2.1 ____ ___/___ Outdoor pool lighting: If night swimming is to be allowed, lighting will provide at least 3 fc of illumination at the water and wet deck level.

424.1.4.2.1 ____ ___/___ Outdoor pool lighting: If night swimming is to be allowed, underwater lighting will provide at least 1/2 watt per square foot of pool water surface area. (Except where above water lighting is at least 15 fc of illumination.)

424.1.4.2.2 ____ ___/___ Indoor pool lighting: If natural illumination is inadequate, or night swimming is to be allowed, lighting shall provide at least 10 fc of illumination at the water and wet deck level.

424.1.4.2.2 ____ ___/___ Indoor pool lighting: If natural illumination is inadequate or night swimming is to be allowed, underwater lighting will provide 0.8 watt per square foot of water surface area. (Except where above water level lighting is at least 15 fc of illumination.)

424.1.4.2.3 ____ ___/___ **Lighting:** The underwater lighting utilizes transformers and low voltage circuits (15 volts maximum) with each underwater light grounded. (When dependent upon submersion for safe operation, lights have protection from overheating when not submerged.)

424.1.4.2.3 ____ ___/___ Lighting: The underwater incandescent lamp size does not exceed 300 watts and is located at least 18" below normal water level. (center line of skimmer, or top lip of gutter)

424.1.4.2.4 ____ ___/___ Lighting: The plans do not show overhead service wiring within 10' horizontally of the pool walls or deck appurtenances; or clearances meet NEC standards.

424.1.4.1 ____ ___/___ The electrical equipment wiring and installation will conform to the Chapter 27, of the Florida Building Code, Building.

424.1.1 ____ ___/___ **Bathing load**: If the pool is not a spa pool, the bathing load is computed on the basis of 1 person per each 5 gpm of water recirculated.

424.1.1 ____ ___/___ If the pool is a spa, the bathing load is computed on the basis of 1 person per each 10 ft² of water surface area.

64E-9.008(7) ____ ___/___ The bathing load will be posted at the pool as required in the bathing rules.

424.1.6.1 ____ ___/___ If bathing load is less than 40, Separate sanitary **facilities for each sex** are provided, entrances Are labeled for men or women, and entry doors are within 200' walking distance of the nearest water's edge for each pool.

424.1.6.1.1 ____ ___/___ Fixtures are provided as indicated on the following chart: (suitable for deck area up to 3x pool surface)

Men's Restroom			
Size	Urinals	WC	Lavatory
0-2500 ft²	1	1	1
2501-5000 ft²	2	1	1
5001-7500 ft²	2	2	2
7501-10,000 ft²	3	2	3

Women's Restroom		
Size	WC	Lavatory
0-2500 ft²	1	1
2501-5000 ft²	5	1
5001-7500 ft²	6	2
7501-10,000 ft²	8	3

424.1.6.1.1	____	___/___	Supplemental family-style restrooms may be used to meet requirements.
424.1.6.1	____	___/___	Unisex restrooms: may be used if bathing load is 20 or less (1), or 40 or less (2). Each has a water closet, a urinal, a lavatory and a diaper changing table.
424.1.6.1	____	___/___	Pools greater than 10,000 ft² have one additional fixture set for each 7,500 ft² or major fraction thereof above 10,000 ft², and meet 3:2 female/male ratio requirements. Lavatory counts are equal.
424.1.6.2	____	___/___	Sanitary facilities for outdoor pool have outside access door. If in adjacent building, doors are within 50' of the exterior door.
424.1.6.1 exception	____	___/___	Sanitary facilities are not required if all units served by the pool are within a 200' horizontal radius from the nearest pool water edge, are not over 3 stories high, unless served by elevator, and have private sanitary facilities.
424.1.6.1.3	____	___/___	Sanitary facilities' floors are to be constructed of concrete or other impervious material and have a smooth, slip-resistant finish.
424.1.6.1.3	____	___/___	Sanitary facilities' floors are sloped for positive drainage to drains.
424.1.6.1.3	____	___/___	Intersections between floors and walls are coved if either floor or wall isn't waterproof material.
424.1.6.1.3	____	___/___	Sanitary facilities: There are no foot baths, carpet or duck boards on the floor.
424.1.6.1.4	____	___/___	A hose bibb with vacuum breaker is in or within 25' each restroom for ease of cleaning.
424.1.6.1.2	____	___/___	Sanitary facilities: Where separate non-private sanitary facilities are provided and are not visible from any portion of the pool deck, signs are posted showing directions to the facilities. Signs are legible from the pool deck, with letters at least 1" high.
424.1.6.1.1	____	___/___	One diaper changing table is provided at each restroom unless all pools restricted to adult use.
424.1.6.2	____	___/___	If the pool is outdoors, a **rinse shower** is provided on the pool deck and is located within 20' of the pool water edge.
64E-9.008(2)	____	___/___	If the pool length is 50' or less, at least 1 **shepherd's hook** with one-piece pole (minimum 16' long) and 1 lifesaving ring (minimum 18" in diameter) with sufficient rope attached to reach all parts of the pool from the deck are provided, mounted in a conspicuous place.
64E-9.008(2)	____	___/___	If the pool length is greater than 50' there are multiple shepherd's hooks with one-piece poles (min. 16' long) and multiple lifesaving rings (min. 18" diameter) with sufficient ropes attached to reach all parts of the pool from the deck, mounted along each of the longer sides of the pool.
64E-9.006(1)(e)	____	___/___	There are no protrusions, extensions, means of entanglement, or other obstructions on the pool floor or pool walls.
64E-9.008(4)	____	___/___	If solar blanket or pool cover is specified, it is either secured around entire pool perimeter and can support a live load of an adult person, or the pool area can be made inaccessible to unauthorized persons when cover is in use.
424.1.3.1.9	____	___/___	Pool is surrounded by min. 48" high fence with self-closing, self-latching, lockable gates opening away from pool. Latch is 54" above bottom of gate or min. 3" below the top of the gate on the pool side. Fence does not allow passage of 4" diameter sphere. Locks, if self-locking, may be 34 - 48" above floor or ground.
424.1.3.1.9	____	___/____	Access through the fence from dwelling units is via minimum 48" self-closing, self-latching, lockable gate. Doored access from public rooms need not be through gates.
424.1.3.1.9	____	___/___	Other substantial barriers may be considered by the department.
424.1.3.1.9	____	___/___	Screened pool enclosures are hardened on the bottom 3 feet.
424.1.5.8	____	___/___	Provision is made for storage of chemicals in well-ventilated area: 64E-9.008(5) adds: under roof and protected from access by unauthorized persons.
64E-9.008(6)	____	___/___	Swimming pool slide is installed in accordance with the manufacturer's specification.
424.1.6.5.11	____	___/___	Over the rim fill spout prohibited.
64E-9.008(7)	____	___/___	The following **rules** will be posted at or near poolside and will be legible from pool deck: 1. No food or beverages in pool or on wet deck. 2. No glass or animals within fenced pool area (or 50' from unfenced pool). 3. Bathing Load:____persons.

4. Pool Hours: ____A.M. to ____P.M.
5. Shower before entering pool.
6. Do not swallow the pool water.

64E-9.008(7)	____	___/___	The lettering for the pool rules sign is at least 1" high.
64E-9.008(7)	____	___/___	Pool over 200 ft² without an approved diving bowl configuration has "NO DIVING" included on the pool rules in lettering at least 4" high.
424.1.3.1.7	____	___/___	There is no provision for drink or food serving facilities within 12’ of the water’s edge.