Public Bathing Places

Pool Operator Training

Oklahoma State Department of Health

3/7/2018

What's new?

- New Presentation!
- Challenge Exam
- 3-year certificate
- Updating the Oklahoma Code within the next 2 years

Why are we here?

- Learn Pool Operator Responsibilities
- To become familiar with the Oklahoma Rules & Regulations
- Learn from other's Mistakes
- Instruct you how to do the job!

Top 5 Violations - 2016

1. Flow Meter/Flow Rate
2. Total Alkalinity between 80 – 200 ppm
3. Free Available Chlorine <1ppm; or Bromine <2ppm
4. Decks, Gutter, Pool Finish: Clean, Good Repair
5. Records kept: Required testing done; Inspection posted

Pool Operator Responsibilities

- The bathing place shall be maintained under the supervision and direction of a properly trained operator who shall be responsible for
  - Promoting good Sanitation & Safety
  - Proper Maintenance of the bathing place and all Physical & Mechanical equipment
  - Recording Keeping

O.A.C. 310:320-3-2(b)

Promoting Good Sanitation

- Perform required sampling & water maintenance
  - Chemical & operational parameters
  - Chemical analysis per regulation
  - Turbidity prior to opening pool
  - Balancing pool water
- Ensure animals are not allowed inside the pool enclosure

Ensuring Safety

- Enforce rules & regulations
- Exclude people under the influence of liquor or drugs
- Prevent tampering or playing with safety equipment
- Conduct 2 unannounced emergency drills annually
  - At least 1 involving a water rescue

Maintaining Equipment & Facilities

- Ensure gates/doors are locked when the bathing place is closed
- Ensure proper signs are placed
- Report to management any unsafe conditions or equipment which may be detrimental to safe operation
- Ensure showers are used and operating properly

Course Overview

- Area around the Pool/Spa
- Circulation & Disinfection
- Records & Test Kits
- Water Chemistry & Testing
- Bath House
- Accident & Incident Response
- Closing Pools
- Additional Information

Area around the Pool/Spa

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Fencing/Enclosure

- Outdoor Pools – such as Apartments, HOA, Hotel/Motel
  - Must have a Self Closing/Self Latching Gate
  - Must be at least 4 ft tall;
  - No more than a 4 inch gap
  - Does not Prevent Visual Observation
  - Is to prevent unattended small children from entering the pool

Fencing

- Outdoor Pools – such as City, YMCA, etc
  - Fencing must be 6 foot high woven wire fence
  - Gates must be locked when not open
  - Bathers shall NOT have access unless a lifeguard is present.
  - Does not Prevent Visual Observation
  - Are not required to have a SC/SL gate
    - So long as a lifeguard is present when the pool is open

Barriers

- Indoor Pools
  - Must be located in a room with doors
  - The doors must be LOCKED when the pool is not in use
  - Regardless of whether a fee is charged

Lifeguard Requirements

- 1 or more shall be pool side when the pool is open to the General Public and all pools with Diving boards/platforms higher than 1m
- Number of lifeguard on duty
  - Shall provide reasonable general supervision of the activities in the water
  - Enough to provide periodic rest periods
  - Recommended at least **1 lifeguard per 75 person**
- Lifeguard assigned to the pool shall not be subject to duties that distract their attention

Lifeguard Certification

- Must be at least 16 years old
- Current advanced life saving certificate must be displayed for each lifeguard
- Lifeguards
  - Shall be capable swimmers and in good physical conditions
  - Be competent in life saving methods
  - Be able to perform artificial respiration
  - Shall be able to command respect

Requirements for No Lifeguard

- For Pools NOT open to the General Public a sign stating -

"No Lifeguard or Attendant on Duty"

…must be posted!

Signs: Pool Rules

- 310:320-3-3 (a)
  - A cleansing shower, using warm water & soap, must be taken before entering the pool
  - Persons with open wounds, bandages, or any symptom of communicable disease shall be prevented from entering the pool
  - Swimming alone is prohibited
  - Children under 12 years of age must be accompanied by an adult responsible for that individual child at the pool side
  - Running & rough play are prohibited in and around the pool
  - "Cut-Off" should be hemmed
  - Excess body lotion should be removed prior to entering the water
  - Bathing load limit

Signs: Pool Rules

- Animals are not allowed inside the pool enclosure
  - 310:320-3-2(d)(1)(J)
- No Food, Drinks, Debris or foreign substances are thrown or carried into the pool
- No glass containers of any type may be used in or near the pool
  - 310:320-3-2(d)(2)(E)

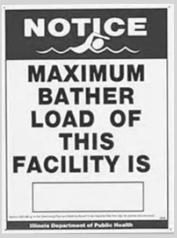
- What is missing from this sign?

Signs: Spa Rules

- "Persons who are pregnant, taking medication, or have any history of cardiovascular disease should consult a physician before entering hot water"
- "Drugs and alcohol are prohibited"

Signs: Bathing Load

- The bathing load for the pool, wading pool or spa should be posted and enforced



Signs: Diving

- Utilize "No Diving" Signs when needed

Life Saving Equipment

- Small Pool (<1600 sq ft)
  - 1 – 16ft straight pole w/ a shepherd's crook
  - 2 – ring buoys w/ ¼ in. rope
  - Some facilities may need to add extra Ring buoys or Shepherd's Crooks.
- Large Pool (>1600 sq ft)
  - 2– 16ft straight pole w/ a shepherd's crook
  - 4 – ring buoys w/ ¼ in. rope
  - Backboard

Life Saving Equipment

- Lifeline
  - Located at or near the break in grade between the shallow & Deep portions of the pool
  - Marked with Colored floats spread on 5 foot centers
  - The line should be at least ¾ in rope.
  - It is required that a 6 inch black stripe be painted on the floor below the lifeline
  - **MUST** remain in pool during **ALL** operational hours
- Telephone
  - For use to reach emergency assistance without the use of coinage **MUST** be accessible to the pool during **ALL** hours of operation!

Decks *

- Be constructed of concrete or other impervious material, have a slip-resistant finish, be easily cleanable and not allow standing water
- Should be kept clean and free of debris
  - To clean the deck, scrub with a bleach and water solution (20 parts water to one part bleach) to prevent mold, mildew & bacteria.
- Should be in good repair
  - No major cracks or sections missing
  - No grass growing thru

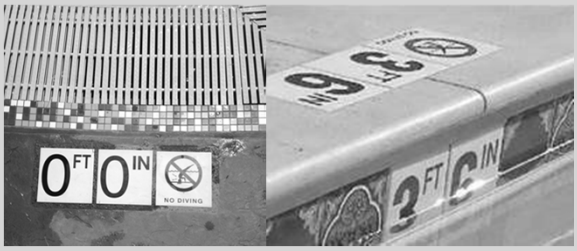
Pool Finish *

- The finish should be smooth, non-absorbent and durable
- Pool Finish should be white or light in color
- Pool should be kept clean

Depth Markers

- Are required to be at or above the water surface on the pool wall and on the edge of the deck next to the pool
- At the maximum, the minimum and the breaking point
- With a minimum of 3 markers per pool
- Numerals must be 4 inches in height
- Must be a contrasting color
- Replaced or repainted as needed

Depth Markers



Stair Stripes

- Are required on all stairs/seats
- Markings shall be located on the top and front facing part of the steps
- The stripes shall be at least 2 inches in width
- Must be of contrasting color
- Could be done with paint or tile
- Must be repaired or replaced as needed

Inlets

- In-wall or in-floor inlets return filtered, heated & chemically treated water to pool
- Inlets are important when directing the circulation pattern in the pool
  - Looking for equal distribution of the returned water
- Replace when broken or missing
  - If the inlets are not in place, you may end up with “dead” spots.

Main Drains

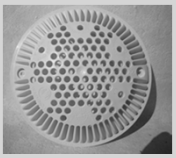
- Collects water from the bottom of pool
- Install proper covers that meet the ANSI/ASME A112.19.8-2007 standard (Virginia Graeme Baker) on every drain
- Refer to 310:315-7-14 (h) Outlets for detailed information

Main Drains

- Public Bathing Place Facility Standards
  - 310:315-7-14 (h) Outlets
    - A Safety Vacuum Release System (ANSI A112.19.17 or ASTM Standard F2387)
    - A suction-limiting vent system, must be tamper-resistant
    - A gravity drainage system that utilizes a collector tank
    - A automatic pump shut-off system
    - A device or system that disables the drain
    - An unblockable Suction outlets (ANSI A112.19.8-2007)

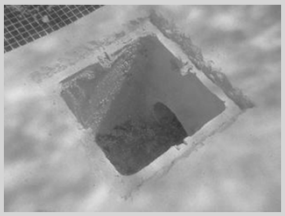
Main Drains

- Must be marked by a 2 inch dark colored stripe outlining the Main Drain
- Unless the Plate or Grating are a contrasting color

Main Drains

- Would you consider either one of these to be in violation?




Gutters *

- Water level should be maintained to ensure a constant overflow into the gutter when bathers are not present
- Should be kept clean and free of clogs
- Maintained in good repair

Surge or Balance Tanks

- Holds displaced water from pool overflow due to active swimmers or overcrowded conditions
- Helps Establish Hydraulic equilibrium
- Each swimmer will displace 20 gallons of water!

Skimmers

- Make sure you have a weir in place
- Double check your baskets
- Float valve for equalizer lines
- Check the equalizer line cover

Ladders, Handrails, & Coping

- Ladders must be properly installed
  - Most pools will have at least 1 ladder
  - Make sure the ladders are secured correctly
  - Make sure the bumpers are installed on the Ladder
- Handrails are necessary on stairs leading into the pool
  - Make sure the handrails are secured correctly
- Bullnose coping is recommended
  - It must be in good repair
  - Cannot extend more than 3 inches inside the pool wall

Diving Boards

- Pools with diving facilities shall be designed IAW standards set by FINA, NCAA, or U.S. Diving, Inc.
- Diving boards and platforms exceeding 3m in height should not open to general public
- Regularly inspect the bolts, treads and other parts for corrosion. Replace as needed
- Keep the diving board tread free of debris
- If replacing, contact the Health Department

Circulation & Disinfection

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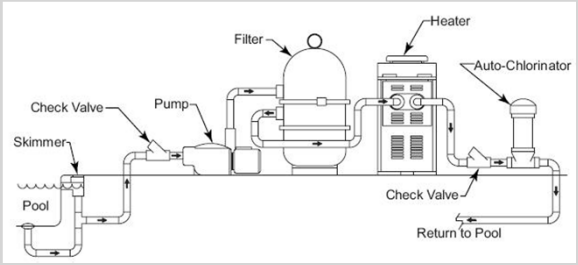
Basic Recirculation



Piping & Valves

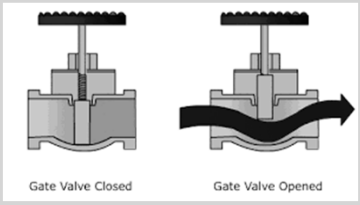
- Piping shall always be labeled
- Each suction line should have a separate valve
- Instructions for your facility should also be available

Valves

- CONTROL the flow
- Required on each skimmer/gutter and main drain line to adjust the flow between them
- Water flow from pool
  - 30% from main drain
  - 70% from skimmers and gutters

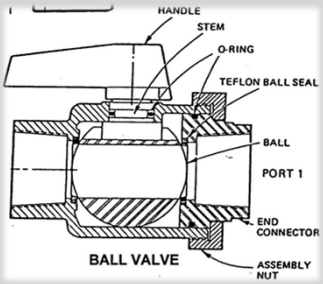
Gate Valves

- Vertical disc or wedge attached to a long threaded stem
- Larger pool systems



Ball Valves

- Typically used on spas and small pools
- Handles tend to break more easily than other types of valves

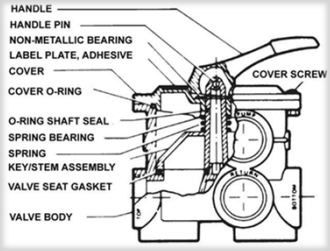


Butterfly Valves

- Disc mounted on a vertical or horizontal pivot

Multiport Valves

- Turn off pool
- Several settings
  - Filter
  - Rinse
  - Backwash
- Setting selects the different pipes to flush



Pumps

- Flow is measured in ***gallons per minute*** **(GPM)** and head pressure (resistance) is expressed in ***pounds per square inch*** **(PSI)**
- Must be operational at all times and be the proper size for your system
- The hair & lint strainer basket will collect large debris
  - It should be checked on a daily basis
  - You must have 2 baskets for each pump.

Filters

- Types of Filters
  - Rapid Rate Sand (Sand & Gravel)
  - High Rate Sand
  - Diatomaceous Earth (D.E.)
  - Cartridge

Rapid Rate Sand Filters

- Multiple large tanks
- Multiple layers of sand and gravel
- Vacuum or pressure systems
- Filtering rate is 3 GPM per square foot
- Each tank must be backwashed individually
- Flocculants may be added to pool water
  - A compound usually used with sand-type filters to form a thin, gelatinous layer to help pull out & clump particles from the water

High Rate Sand Filters

- One large tank or multiple tanks
  - Vertical or horizontal
- Single layer of sand
  - Single layer of pea gravel to protect laterals
- Always a pressure system
- Filtering rate is 15 GPM per square foot

High Rate Sand Filters

- Must be backwashed collectively
- Flocculants are NOT recommended
- Freeboard amount is ~50% of sand depth
- Must be NSF approved

Diatomaceous Earth (D.E.) Filters

- Single tank with multiple screens/leaves /septums (grids) to hold filter media (D.E.)
  - D.E. coats screens/leaves to provide filtering
- D.E. must be precoated or slurry (body) fed onto grids
- Vacuum or pressure systems
- Filter rate is 2.5 GPM per ft^2 of surface area
- May be backwashed or manually cleaned
  - Manually clean grids using TSP (trisodium phosphate) & water; allow to dry; dispose slurry as hazardous waste
  - Dispose waste water through adequately sized separation tank
- Must be NSF approved

Cartridge Filters

- Single or multiple pleated elements composed of synthetic fibrous material (usually polyester) attached to cylindrical core
- Normally used on pressure systems
- Filtering rate .375 GPM - 1.0 GPM per sq. ft.

Cartridge Filters

- Must be manually cleaned
  - Clean with TSP (trisodium phosphate) and water
  - Use 10 to 1 diluted solution of muriatic acid to remove scale (Caution: If acid is used first, it will set oils)
- Two separate sets of cartridges
- Must be NSF approved

Gauges & Meters

- Filter systems have 3 gauges:
  - Compound/Strainer gauge
  - Influent gauge
  - Effluent gauge
- Flow meters measure the speed the water moves through the system
  - Measured in Gallons per Minute (**GPM**)

Compound Gauges

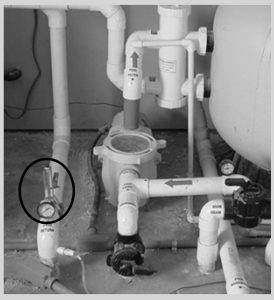
- Located on the pump
- Helps to identify whether or not the hair and lint strainer is clogged
  - or a possible problem from main pipe to strainer

Influent Gauges

- Indicates pressure exerted by pump to push water through filter
- "In" flowing water
- The influent pressure gauge is usually located on top of the filter

Effluent Gauges

- Located on piping after the filter
- Indicates pressure exerted by the pump to push water back to the pool after it exits the filter
- "Out" flowing water

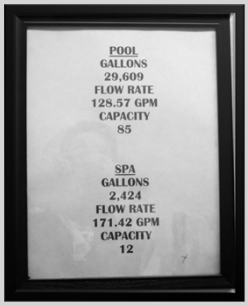


Sight Glasses

- Will help you determine when the filter has been properly backwashed
- Helps eliminate wasted water

Pool Volume & Flow Rate

- Must be posted in the Equipment area
- Must be legible



Flow Meters *

- Every public swimming pool filter system must have a Flow Meter
- Please install according to the Manufacturer's directions
- **Is it working**
- Are you meeting your turnover requirement?
  - Pool ?
  - Spa ?
  - Wading pool ?

Chemical Feeders

- What Type of Feeder do you use?
  - Erosion Feeder
  - Peristaltic or Diaphragm Pump
  - Gas
  - Electrolysis
- Is your system automatic or do you have to control it?

Chemical Feeders

- Feeds the chemicals automatically
  - Erosion Chlorine or Bromine Feeders
  - Peristaltic and diaphragm pumps feed liquid chlorine and pH adjusting chemicals
  - Gas chlorinators are vacuum operated design using venturi-operated injector
  - Must be NSF approved
- Automation/Controllers - monitor sanitizer and pH and direct chemical feeders to add chemicals as required
- Electrolysis (salt)

pH Controls

- Feeders for pH adjustment must be provided on all pools using gaseous chlorine
- pH controls can be used on systems utilizing other types of feeders but that is not required

Salt Systems

- Electrical charge splits the sodium into chlorine and other chemicals
  - No or Low Salt = NO CHLORINE
  - High Salt = NO CHLORINE
- Must use salt specified by system mfr.
  - Manufacturer will set the high & low
  - Common settings: 1,800ppm (low) & 3,200 (high)
- Salt generators must have a water control system
- ONLY reversing flow cells approved

Salt Cells

- Salt generator contains a "cell"
- Cell lasts about 3 years
- Must be cleaned frequently (weekly)
  - Frequent cleaning extends cell life
  - Follow manufacturer's directions
- High & low salt cutoffs = NO CHLORINE
  - Lights will be green but no Cl_2
- Cell size must be appropriate to size of pool

Salt Systems

Spas

- Spas will have a higher chemical demand due to:
  - High turnover rate
  - Higher water Temperatures (105F max)
  - Higher soil loads
  - High bather load
- Maintaining the chemical balance can be difficult

Spas

- Enforce rules & regs. through proper signs
- Water does not exceed 105°F
- Main drain is secure & clearly visible
- Test and keep records as per code
- Drain the spa after heavy use (especially if the tub is 2,000 gallons or less). The required schedule for draining is two (2) times a month if the spa is sparsely used
- Drain the spa & clean it whenever in doubt

Heated Facilities

- All indoor heated facilities are required to have 3 thermometers!
  - 2 on the filter system
  - 1 handheld in the pool
- Ambient Air Temperature must be maintained
  - A suitable thermometer must be deck side

Water Supplies

- Water for the Bath House, drinking fountain and the Public Pool must come from an Approved Source
  - The source must be approved by ODEQ
  - Must be approved prior to construction
- Backflow Prevention is a must!
- Hose bib connections must be provided
  - Utilizing a 50 foot hose
  - Must have an approved vacuum breaker at all hose connections

Water Supplies

- Pool Wastewater
  - Must go to a Sanitary Sewer
  - Used for Pool Make up Water after sedimentation & Filtration
  - Water may be used for irrigation after sedimentation

Vacuum Breakers

Back Washing

- Backwash necessary when:
  - Pressure gauge indicates a pressure difference of 8-10 psi between effluent and influent gauges
  - Flowrate is significantly reduced
- Valves for backwashing
  - Push-Pull valves
  - Multi-port valves
- Length of time to backwash:
  - Until water runs clear out waste line
  - About 2-3 minutes

Backwash Water

- Is this allowed?

Chemical Storage

- Store in original containers in a dry area
- Required to have on hand at least two-week supply of chemicals needed to maintain the proper chemical balance
- A sign stating “POOL CHEMICALS” shall be posted on the door leading into the chemical storage area
- Chemical storage should not be accessible to the general public

Would you consider this safe?

Records & Test Kits

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Daily Operational Form

- The Daily Operational Form is now available online
- It can be found at….

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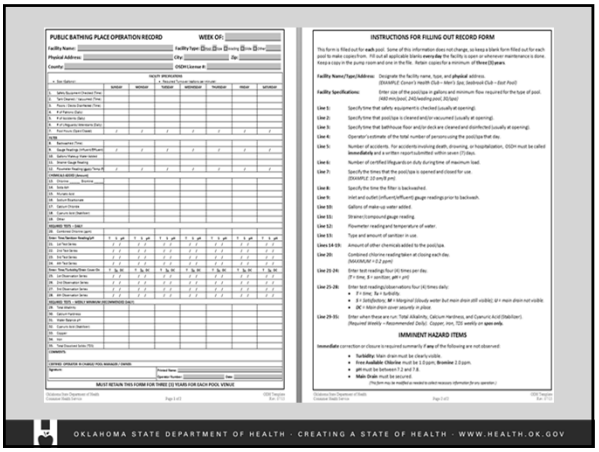

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Operation Records *

- To be Completed DAILY
- Properly Trained Pool Operator or designee must:
  - Maintain record forms
  - Sign record forms

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Operation Records

- General Pool Info
  - Gallons
  - Flow Rate Min/Max
  - Bathing Load
- Equipment Checklist
  - Backwash dates
  - Flow Readings
- Chemical Additions
- Test/Sample Results
- Observations

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Operation Records *

REQUIRED TESTS – DAILY

Enter: Time/Sanitizer Reading/pH	T	S	pH	T	S	pH	T	S	pH	T	S	pH	T	S	pH	T	S	pH	T	S	pH
20. Combined Chlorine (ppm)																					
21. 1st Test Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
22. 2nd Test Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
23. 3rd Test Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
24. 4th Test Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
Enter: Time/Turbidity/Drain Cover On	T	Tu	DC	T	Tu	DC	T	Tu	DC	T	Tu	DC	T	Tu	DC	T	Tu	DC	T	Tu	DC
25. 1st Observation Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
26. 2nd Observation Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
27. 3rd Observation Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	
28. 4th Observation Series	/	/		/	/		/	/		/	/		/	/		/	/		/	/	

Keep accessible and maintain for three (3) years!

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Test Kits

- Used multiple times a day
- Instructions clearly printed inside each kit (regardless of brand)

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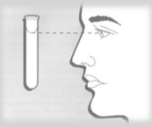
Test Kit Maintenance

- Store the test kit in a cool dark place
- Have the Color Standards checked once a year to ensure accurate & reliable test
- Replace test chemicals as needed
  - When low
  - When the chemicals expire
    - Some testing chemicals now have expiration dates on the bottles

Taking Samples – Filling w/Water

- Conduct tests BEFORE adding chemicals
- Always rinse the sample container/test chamber with pool water (before & after each test)
- Fill test chamber(s) until bottom of water curve is on the sample line level
  - Ensure test chamber is upright/level
- Follow instructions on inside of test kit



Taking Samples - Location

- Must take multiple samples in different places in pool
  - No dead spots
  - Test shallow and deep ends
- Depth of sample is 12-18 inches
- Do not take samples in front of inlets unless testing the chlorinator
- The whole tank/pool must be in compliance with sanitizer and pH

Taking Samples – Adding Reagents

- When inserting drops, hold reagent bottles straight up & down (ensures uniform size)

Taking Samples – Adding Reagents

- Add test solution slowly, swirling or gently inverting after each drop. NEVER shake
- Read all test results immediately, unless otherwise instructed
- After adding reagents to the vials, do NOT add this water back to the pool
  - Dispose of in a gutter or separate container

Taking Samples – Proper Handling

- Do not touch reagents, especially with dirty hands
- Do not interchange reagent caps & droppers
- For “FAS DPD”, “TA”, & “CH” continue to add & count drops until color change completed
- Clean all testing equipment with pool water after completing all samples

Reading Samples

- Use an outdoor light source or white background (paper ideal) to read the color

Water Chemistry & Testing

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Imminent Hazards

- Turbidity: Main drain must be clearly visible
- FAC: must be 1.0 ppm; Bromine: must be 2.0 ppm
- pH must be between 7.2-7.8
- Main Drain must be secured
- Any other condition, act or omission endangering health or safety

Turbidity

- You must be able to see the Main Drain or a six inch black disk on the bottom of the deepest part of the pool from the sidewalk
- If water Turbidity is Too High:
  - Chlorine level may be too low
  - Filtration system may be inoperative
  - Too turbid water may lead to drowning due to reduced visibility.

Types of Chlorine

- Unstabilized

(No Cyanuric Acid)

  - Calcium Hypochlorite (granular) – 65% available Chlorine
    - pH = 10.8 to 11.8
  - Sodium Hypochlorite (liquid) – 10 to 15% Available Chlorine
    - pH 13.0
  - Lithium Hypochlorite (Granular) – 35% Available Chlorine
    - pH 10.7
  - Gas – 100% available Chlorine
    - pH = <1.0

- Stabilized

(Contains Cyanuric Acid)

  - Sodium Dichlor – 55% available Chlorine
    - pH = 6.8 – 7.0
  - Trichlor – 90% available Chlorine
    - pH = 2.8 – 3.0

Water Contaminants

- Sanitation
  - The process of destroying organisms that are harmful to people
- Oxidation
  - The process of chemically removing organic debris from the water
- Algaecides
  - Algaecides control the growth of algae in pool or spa water

Chlorine sanitizes, oxidizes and controls algae growth.

Free Available Chlorine *

- A sanitizer must be continually active
  - Minimum: **1.0 ppm**
  - Ideal: **1.0 – 3.0 ppm**
- The chlorine residual is what ensures the sanitation of your water
- When any type of chlorine is added to water, it forms hypochlorous acid (HOCl) and hypochlorite ions (Ocl)
  - Together these two compounds are Free Available Chlorine (FAC)
    - We can measure FAC, TAC and CAC with a DPD test kit!

Combined Available Chlorine

- Chlorine in a pool or spa can become "Tied up" with contaminants forming Combined Available Chlorine (CAC or chloramines)
- Chloramines can:
  - Cause Body, Eye and Skin Irritants
  - Be Foul smelling
  - Cause algal growth
  - Cause bacteria growth
- Chloramines are a weak disinfectant (40 – 60 times less effective than FAC)

Superchlorination

- Process of eliminating CAC from water by adding a large dose of chlorine to reach "chlorine breakpoint"
- Breakpoint chlorination – point in a rising chlorine residual at which the concentration of available chlorine becomes great enough to completely oxidize ALL organic matter and ammonia compound in a pool
  - Weak disinfectant (40-60 times less effective than FAC)

Calculating Superchlorination

- Use the DPD Test Kit to test FAC and TAC to come up with the amount of chlorine required
  - TAC – FAC = CAC
  - Multiply CAC x 10
  - Total equals ppm of chlorine which must be added to reach breakpoint

Note: This test shall be done while the pool is NOT

Supplemental Treatments

- Potassium monopersulfate – non-chlorine shock
- Sodium chloride – electrolysis of salt
- Ozone – strong oxidizer and disinfectant generated onsite by UV light or elect. sparks
- Ionizer – use copper as algistat and/or silver bacteriostat

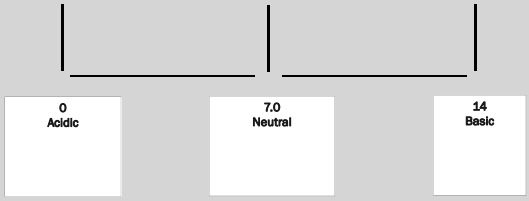
All supplemental treatments have advantages and disadvantages. In all cases, still required to maintain a chlorine residual in addition to the supplemental treatment.

Bromine *

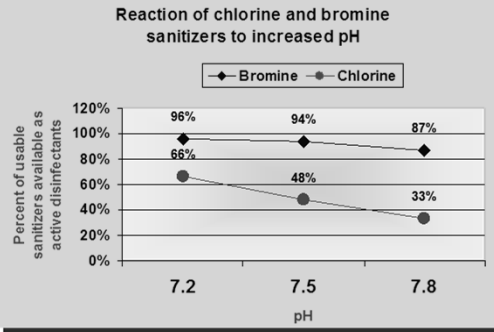
- Has a pH of 4.0 to 4.5
- Operating range is 2.0 – 4.0 ppm
- Bromine, like chlorine, combines with inorganic impurities to form combined bromines or bromamines
  - HOWEVER, combined bromine is still a semi effective sanitizer and does not smell
  - Because of this, bromine is popular for spas

pH

- pH is a value that determines how acidic (corrosive) or basic a solution is. pH is a temporary condition



pH



Importance of pH

- Vessel & equipment protection
- Swimmer comfort
- Sanitizer effectiveness

Importance of pH

- Low pH
  - Etched plaster
  - Corroded metals
  - Stained plaster
  - Eye & skin irritation
  - Destruction of total alkalinity
  - Chlorine unstable
- High pH
  - Scale formation
  - Cloudy water
  - Short filter runs
  - Eye & skin irritation
  - Poor chlorine efficiency

pH

- Ranges
  - Acceptable = 7.2 to 7.8 ppm
  - Ideal = 7.4 to 7.6 ppm
- Adjusting pH
  - To Raise: Use Soda Ash (sodium carbonate)
  - To Lower: Use Muriatic Acid (liquid) or Dry Acid (sodium bisulfate

Always test and adjust total alkalinity before testing and adjusting pH.

Total Alkalinity *

- Measure of resistance to change of pH (buffering capacity of the water). The correct total alkalinity helps maintain pH

Low Total Alkalinity	High Total Alkalinity
o Etched plaster	o pH hard to change
o Corroded metals	o Scale formation
o Stained plaster	o Poor chlorine efficiency
o Eye and skin irritation	o Eye and skin irritation
o Destruction of total alkalinity	o Cloudy water
o Chlorine unstable	

Total Alkalinity *

- Ranges (based on type of sanitizer used):
  - Acceptable = 80 ppm to 200 ppm
    - 80-100 ppm: sodium hypochlorite,calcium hypochlorite, or lithium hypochlorite
    - 100-120 ppm: gas, dichlor, trichlor, or bromine
- Adjusting Levels
  - To Raise: use sodium bicarbonate
  - To Lower: use muriatic acid (liquid) or dry acid (sodium bisulfate)

Calcium Hardness

- Measures the Calcium and Magnesium dissolved in water

Low Calcium Hardness	High Calcium Hardness
o Corrosive water	▪ Scale formation
o Water foaming	▪ Chemicals less effective
	▪ Cloudy water

Calcium Hardness

- Ranges
  - Acceptable = 50-500 ppm
    - Ideal – 200 to 400 ppm
    - Maximum = 500 ppm
- Adjusting Levels
  - To Raise: use calcium chloride (least soluble chemical)
  - To Lower: partially or completely drain pool and refill; spas should be completely drained and refilled

Note: Do NOT add calcium chloride the same day as soda ash or sodium bicarbonate as the water may turn cloudy.

Water Balance

- If pH, Total Alkalinity and calcium hardness are within recommended ranges,
- **AND** the water is correctly saturated with calcium carbonate,
- **THEN** there is no tendency to corrode or scale.

Water Gram Balance Wheel

- Must determine using the test kit:
  - pH
  - Total Alkalinity
  - Calcium Hardness
- Set the **Total Alkalinity** opposite the **Calcium Hardness** on the Wheel
- Hold Calcium Hardness against Total Alkalinity & set arrow to pH in window
- Read **Saturation index** opposite **Water Temperature**

Testing Your Knowledge: WaterGram Balance

Problem 1		Problem 2		Problem 3	
pH	8.0	pH	7.4	pH	7.2
Total Alk.	150	Total Alk.	100	Total Alk.	50
Cal. Hardness	500	Cal. Hardness	200	Cal. Hardness	90
Temperature	80ºF	Temperature	80ºF	Temperature	80ºF
Balanced:		Balanced:		Balanced:	
Over Saturated:		Over Saturated:		Over Saturated:	
Under Saturated:		Under Saturated:		Under Saturated:	

Testing Your Knowledge: WaterGram Balance

Over Saturated		Balanced		Under Saturated	
pH	8.0	pH	7.4	pH	7.2
Total Alk	150	Total Alk	100	Total Alk	50
Cal. Hardness	500	Cal. Hardness	200	Cal. Hardness	90
Temperature	76°F	Temperature	76°F	Temperature	76°F
SI =	+0.9	SI =	-0.2	SI =	-1.1

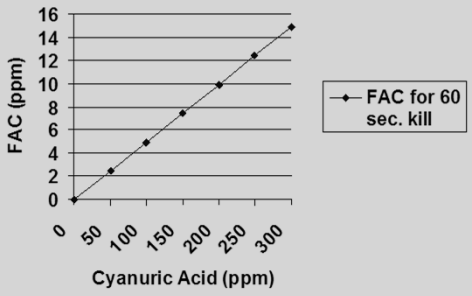
Cyanuric Acid (Stabilizer)

- Sunlight destroys/degrades chlorine rapidly (90% of residual in 2-3 hours)
- Cyanuric acid acts as sunscreen and cuts out up to 90% of burn-off
- Ranges:
  - Minimum = 30 ppm
  - Full range = 30 – 50 ppm (w/ a ORP/pH controller)
  - Ideal = 30 – 50 ppm

Cyanuric Acid (Stabilizer)

- Not used for indoor pools/spas or pools/spas using bromine
- As cyanuric acid levels increase, ORP levels decrease

Cyanuric Acid



Total Dissolved Solids

- Range
  - Acceptable = 300 - 1,500 ppm
- Adjusting Level
  - To Lower: partially or completely drain and refill pool
- A high TDS can result in
  - Salty-tasting water
  - Colored but Clean water
  - Algae despite a good sanitation level
  - Cloudy Water
  - Corrosion of Metal Parts
  - False Test Readings

Heavy Metals

- Copper
  - Ideal: None
  - High: 0.3 ppm
- Too High
  - Staining
  - Water may discolor
  - Chlorine dissipates rapidly
  - Filtering issues
  - May indicate pH too low
- Iron
  - Ideal 0.2 ppm
  - Range 0.2 - 0.3 ppm
- Too High
  - Staining
  - Water may discolor
  - Chlorine dissipates rapidly
  - Filtering issues

Heated Facilities

- Spa
  - Minimum: 90°F
  - Maximum: 105°F
- Indoor Swimming Pools
  - Minimum: 75°F
  - Maximum: 90°F
- Indoor Pool Air Temperature
  - Water Temperature +8°F Maximum
  - Water Temperature -2°F Minimum

Interference w/tests High Sanitizer Levels & Metals

- Taylor Test Kit – only accurate to 20-25 ppm FAC/Total Br
- DPD and TA test can be bleached by high sanitizer levels
- DPD is added ➔ pink ➔ clear, the reading is high
- Paper test strips
  - However, not reliable
  - Designed for personal (backyard) pools

Interference w/tests High Sanitizer Levels

- pH using Phenol Red – the indicator used in the pH test
  - Yellow < 6.8 pH
  - Red > 8.3 pH
  - Purple – too high
  - Bromine gives a "false high" pH, use a meter
  - High Cl/Br reading can bleach Phenol Red giving a false low pH

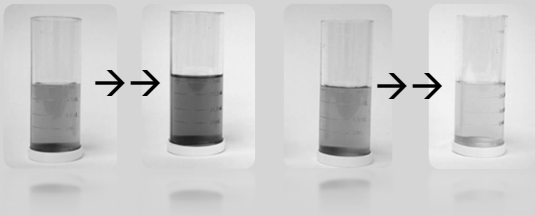
Taylor's Test Kit – pH Test

Left Block pH 7.5 (peach color)

Right Block high pH (purple color)

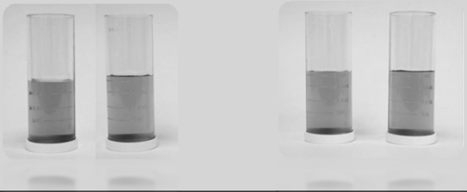
Interference w/tests High Sanitizer Levels

- Total Alkalinity Test
  - Green ➔ Pink
- High sanitizer levels
  - Teal ➔ Yellow



Interference w/tests High Metal levels

- Calcium Hardness test
  - Pink ➔ Slate Blue (end point)
- Metals will interfere w/ Calcium Hardness test
  - Doesn't turn slate blue



Order of Application

- Chemicals or sanitizers for water balance adjustments should be added in the following sequence:
  a) Free available chlorine (FAC)
  b) Total alkalinity
  c) pH
  d) Calcium Hardness
  e) Cyanuric Acid (outdoor pools only)

Order of Application

- Adding Chemicals:
  a) Add large amounts gradually in thirds over a two-hour period
  b) Add directly into the pool or spa when no swimmers are present and time is sufficient to permit even distribution of the chemicals
  c) Add granular chlorine or soda ash solution directly to the pool, but separately. Always mix chemicals into plastic containers that have been filled with water first

Chemical Standards

Chemical	Minimum	Ideal	Maximum
Free Chlorine (FAC)	1.0 ppm	1.0 - 3.0 ppm	5.0 ppm
Combined CL (CAC)	None	None	0.2 ppm
Bromine	2.0 ppm	3.0 ppm	4.0 ppm
PH	7.2	7.4 - 7.6	7.8
Total Alkalinity	80 ppm	80 - 120 ppm (Depends on type of sanitizer)	200 PPM
	Calcium hypochlorite and lithium hypochlorite	80 - 100 ppm	
	Gas, dichlor, trichlor and bromine compounds	100 - 120 ppm	
Cal. Hardness	50 ppm	125 ppm	500 ppm

Chemical Standards

Chemical	Minimum	Ideal	Maximum
TDS	300 ppm		1500 ppm
Iron & Copper (Heavy Metals)	None	None	0.3 ppm
Stabilizer (Cyanuric Acid)	30 ppm	30 - 50 ppm	100 ppm
Hot Water Fac. Temperature	90ºF		105ºF
Swimming Pools	75ºF		90ºF
Indoor Pool-Air Temp (-Hot Water Fac.)	Water Temp -2ºF		Water Temp +8ºF
Turbidity	Must be able to clearly see main drain from pool sidewalk.		

Table A

Amount of Chlorine Compound to Introduce 1 ppm Chlorine

	Volume of Water						
% Available Chlorine	400 gallons	1,000 gallons	5,000 gallons	10,000 gallons	20,000 gallons	50,000 gallons	100,000 gallons
5%	1.02 fl oz	2.56 fl oz	12.8 fl oz	1.60 pts	1.60 qts	1.00 gal	2.00 gal
10%	0.51 fl oz	1.28 fl oz	6.40 fl oz	12.8 fl oz	1.60 pts	2.00 qts	1.00 gal
12%	0.43 fl oz	1.07 fl oz	5.33 fl oz	10.7 fl oz	1.33 pts	1.67 qts	3.33 qts
35%	0.15 oz	0.38 oz	1.91 oz	3.82 oz	7.63 oz	1.19 lbs	2.38 lbs
60%	0.09 oz	0.22 oz	1.11 oz	2.23 oz	4.45 oz	11.1 oz	1.39 lbs
65%	0.08 oz	0.21 oz	1.03 oz	2.05 oz	4.11 oz	10.3 oz	1.28 lbs
90%	0.06 oz	0.15 oz	0.74 oz	1.48 oz	2.97 oz	7.42 oz	14.8 oz
100%	0.05 oz	0.13 oz	0.67 oz	1.34 oz	2.67 oz	6.68 oz	13.4 oz

Table B

30 ppm Shock Table for Algae Removal

	Volume of Water						
% Available Chlorine	400 gallons	1,000 gallons	5,000 gallons	10,000 gallons	20,000 gallons	50,000 gallons	100,000 gallons
5%	1.92 pts	2.40 qts	3.00 gal	6.00 gal	12.0 gal	30.0 gal	60.0 gal
10%	15.4 fl oz	1.20 qts	1.50 gal	3.00 gal	6.00 gal	15.0 gal	30.0 gal
12%	12.8 fl oz	1.0 qts	1.25 gal	2.50 gal	5.00 gal	12.5 gal	25.0 gal
35%	4.58 oz	11.4 oz	3.58 lbs	7.15 lbs	14.3 lbs	35.8 lbs	71.5 lbs
60%	2.67 oz	6.68 oz	2.09 lbs	4.17 lbs	8.35 lbs	20.9 lbs	41.7 lbs
65%	2.47 oz	6.17 oz	1.93 lbs	3.85 lbs	7.70 lbs	19.3 lbs	38.5 lbs
90%	1.78 oz	4.45 oz	1.39 lbs	2.78 lbs	5.56 lbs	13.9 lbs	27.8 lbs
100%	1.60 oz	4.01 oz	1.25 lbs	2.50 lbs	5.01 lbs	12.5 lbs	25.0 lbs

Formula for Amount of Chemicals

$$\text{Chemical amount} \times \frac{\text{tank volume}}{10{,}000\ \text{gal}} \times \text{needed change}$$

Previous Superchlorination Example:

$$2\ \text{oz} \times \frac{35{,}000\ \text{gallons}}{10{,}000\ \text{gallons}} \times 30\ \text{ppm} = 210\ \text{oz}$$

Formula for Amount of Chemicals

Parameter Chemical to use	Increments to Change 10,000 gal	Chemical Amount	pH Effect
Free Available Chlorine	**1 ppm**		
Calcium Hypochlorite (65%)		2 oz	UP
Sodium Hypochlorite (10%)		13 fl oz	UP

Bath House

Pool Operator Training

Oklahoma State Department of Health

Bath Houses

- Required for all Public Bathing Places open to the General Public
- Bathing places NOT open to the General Public are not required so long as all units include a bath and toilet and the facility is restricted to tenants and their guests
  - Motels
  - Apartment Complexes
  - Similar Establishments

Bath Houses

- Floors/Walls/ Ceilings
  - Smooth
  - Easily cleanable
- Supplies (filled)
  - Soap
  - TP
  - Paper towels
- Working toilets & showers
- Fixtures in good repair
- Hot Water
- Emergency exit sign

Drinking Fountains

Exits & Extinguishers

- Emergency Fire Exit, other than the entrance, shall be provided in the bathhouse and in the fencing or structure enclosing the pool area, and such exit shall be plainly marked
- A fire extinguisher should be positioned where they are easily accessible to respond to a fire in the equipment or chemical storage rooms

Electrical

- Ground Fault Interrupter (GFI) type outlets must be used within 15 feet of the pool, in the bathhouse and in the pump room
- No overhead wiring within 20' of pool enclosure
- All wiring must conform with the National Electrical Code of the National Underwriters Laboratories
- Bulbs protected

Ventilation

- Indoor pools, shower room, dressing rooms and toilets must be properly ventilated
- All interior rooms must be ventilated so that they do not remain excessively damp
- Restrooms are to be ventilated to the outside so that no odor nuisances may develop

Ventilation

- Ensure eight (8) complete air exchanges per hour
- Air Temperature will depend on the Water Temperature
  - Water temperature +8°F
  - Water Temperature - 2°F

Lighting

- Artificial Lighting must be provided to the pool, restrooms, etc.
- For night swimming
  - Designed in such a way as to allow the attendants or lifeguards to observe all parts of the pool
- Underwater lights
  - Recommended to provide at least 8 foot candle at any pool point
  - Spaced to provide light to all portions of the pool
- Emergency Lighting
  - Must be provided at all indoor bathing facilities, in accordance with the NFPA 101 Life Safety Code

Pool Lights

- All swimming pool light units are designed for easy maintenance
- They can be quickly removed from the light niche and generally have 8 to 10 feet of extra cord so that they can be brought up onto the deck for bulb replacement
- With all new style wet niche lights, the pool does not have to be partially drained to service the light

Pool Lights

- Because a pool light is water cooled ALWAYS:

- ❑ Shut off the circuit breaker prior to working on a pool light.
- ❑ Make sure the new bulb is the same style, voltage and wattage as the old bulb.
- ❑ Replace the old light gasket with a new light gasket. This must be done every time the light is opened up.
- ❑ Apply a thin coat of Teflon based lubricant on the sealing surfaces of the light gasket. If the unit is sealed by screws, lubricate those too.

Pool Lights

- Because a pool light is water cooled NEVER:

☒ Operate a pool light unless it is submerged. To do so could result in an explosion of the lens, a broken bulb and a damaged gasket.

Accident & Incident Response

Pool Operator Training

Oklahoma State Department of Health

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Incident Response

- **Immediate** notification of accidents requiring **hospitalization** or **drowning** to the local Health Department!
- Written follow-up of incident report to local health department within 7 days of incident

Incident Response Form

PUBLIC BATHING PLACE - INCIDENT REPORT FORM

Normal/Solid Discharge

- Contained, formed stool
  - Instruct patrons to exit pool
  - Close the pool until all steps in this guideline are completed
    - Remove the Feces from the pool
    - Add chlorine to the affected area
      - 1 oz of calcium hypochlorite OR
      - 4-5 ozs of sodium hypochlorite mixed in a small bucket of water
    - Record the incident on the Bathing Place Operation Record
    - Wait approximately 30 minutes to ensure chlorine and pH levels meet requirements

Watery Fecal Discharge or Vomit

- Greatest likelihood of carrying harmful pathogens. All steps must be followed when fecal matter detected in POOL:
  - Immediately instruct patrons to exit pool
  - Remove all visible fecal/vomit matter
  - Raise chlorine residual to a minimum of 20 ppm
  - Maintain a pH level at or near 7.5 for at least 12.75 hrs
  - Backwash filters
  - Lower the chlorine to 5 ppm using sodium thiosulphate

Watery Fecal Discharge or Vomit

- All steps must be followed when fecal matter detected in SPA / WADING POOL:
  - Immediately instruct patrons to exit pool
  - Drain the spa or wading pool
  - Brush the side & bottom with 100 ppm chlorine
  - Refill the spa or pool
  - Balance the water per code

Pool Disinfection Times

- How long does it take to disinfect the pool after a fecal incident?

Giardia Kill or Inactivation Time for a Formed Fecal Incident	
Free Chlorine Concentration (ppm)	Disinfection Time[3]
1.0	45 minutes
2.0	25–30 minutes
3.0	19 minutes

Use the formula below to calculate the time required to inactivate or kill Crypto[5]			
Concentration × time (CT) inactivation value	÷	Free chlorine concentration (parts per million [ppm])	Time (in minutes)
15,300	÷	20*	= 765 (or 12.75 hours)
15,300	÷	10	= 1,530 (or 25.5 hours)

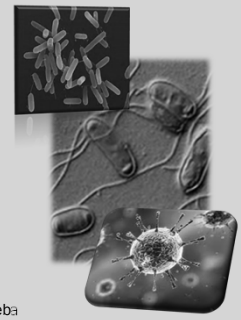
If the cyanuric acid concentration is more than 15 ppm, lower the concentration to 1–15 ppm by draining partially and adding fresh water without chlorine stabilizer before attempting to hyperchlorinate.

Recreational Water Illnesses (RWI)

- RWIs are disease causing organisms transmitted in water
  - Waterborne pathogens
- Transmitted by:
  - Ingestion (swallowing)
  - Inhalation (breathing)
  - Absorption (through the skin)
- Those at high risk include:
  - Children
  - Elderly
  - Immune deficient

Types of RWI

- Bacteria
  - Pseudomonas Aeruginosa
  - E. coli 0157:h7
  - Legionnaires or Pontiac Fever
- Viruses
  - Hepatitis A
  - Norovirus
- Protozoa
  - Cryptosporidium Parvum
- Amoeba
  - Nagleria fowleri – brain eating amoeba

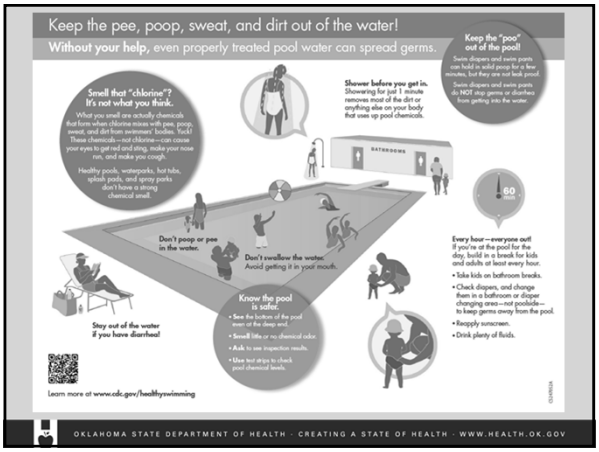


Prevent RWI

- An important preventative measure:
  Showering BEFORE entering the pool

How do you prevent this?

- Education, Education, Education
- Pool Operators should focus on preventing the discharge accident through education:
  - Educate parents to put swim diapers on children and teach them appropriate places to potty
  - Children should be taught especially NOT to drink pool water
  - Anyone with diarrhea in the past month should not go swimming
- Education may be done through signs, conversations, handouts or community newsletters



Closing Pools

Pool Operator Training

Oklahoma State Department of Health

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Winterization

- Draining
  - Drained and kept drained until put back into service
- Pools not drained or covered
  - Must be able to see the Main Drain from the Pool Deck
  - Chemicals must be maintained and balanced
    - Chlorine = 1-5 ppm; pH = 7.2-7.2; etc

Winterization

- Covering
  - Pool cover must be securely anchored to the deck with bolts or similar hardware
  - Must be able to support 1,000 pounds or more
  - Swimming in a partially covered pool is prohibited
  - If water is left in the pool, is should be drained below the tile and skimmer lines (18-24 inches)
  - Air should be blown out of the skimmer & Fill lines

Closing for Repairs

- Must be able to see the Main Drain clearly from the deck or it must be drained or covered
- If you are closing for major repairs
  - You will have to complete the application for a construction permit prior to starting the work
  - Please contact the State Office
- If you are closing for minor repairs:
  - Please contact your local inspector

Permanent Closure

- If you decided to Permanently Close your pool, please contact your local inspector
- We need to document that the pool has been filled-in

Questions

Contacts

State Central Office

- Consumer Health Service
  - Michael McClure (Western District permits)
  - Tabbatha Revas-French (Eastern District permits)
  - Richard Clark and Diana Graves-Foster (License & Admin)
  - ConsumerHealth@health.ok.gov
  - Main Office 405-271-5243

Local County Health Departments

- www.health.ok.gov
  - Page: "County Health Departments"
  - Select the County
- Local Sanitarian/Inspector
- Quadrant Supervisors

NE – Josh Daily
NW – Chad Newton
SW – Dan Brown
SE – Paul Gilbert
OK County – Troy Skow
Tulsa County - Debbie Watts

Test Time

Additional Information

Pool Operator Training

Oklahoma State Department of Health

Basic calculations

- Surface Areas
  Rectangle/square – Length x Width = Sq. Ft.
  Circle – 3.14 x Radius x Radius = Sq. Ft.
  Radius – Diameter ÷ 2
- Pool Volume
  Length x Width x Average Depth x 7.48 = Gallons
  Average Depth = Shallow + Deep ÷ 2

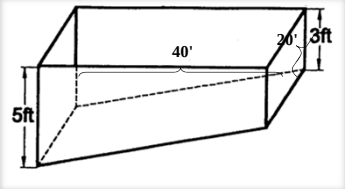
Basic calculations

- Turnover Rate
  – The amount of time needed to re-circulate the entire volume of the pool or spa 1 time. Measured in hours.

  Pool Volume ÷ Flow Rate ÷ 60 = Hours
- Flow Rate
  – The amount of water passing through the recirculation and filtration system at a given time. Measured in gallons per minute (GPM). Measured by a flow meter.

Pool Volume ÷ Required Turnover Rate (Hrs) ÷ 60 = (GPM)

Calculating Pool Volume - Square



L x W x H x gallon conversion
40' x 20' x ((5+3)/2) x 7.48 =
40' x 20' x 4' x 7.48 = **23,936 gallons**

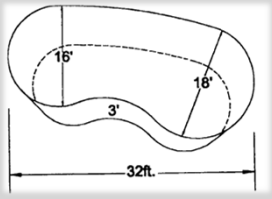
Calculating Pool Volume - Circle

Volume = L x W x H x 7.48
Area = πr^2
r = ½ d (diameter)

3.14 x $(24/2)^2$ x 3.5 x 7.48 =
452.16 x 3.5 x 7.48 = 11,837.5 gallon

Calculating Pool Volume - Kidney

1. Measure Surface Area
   – Measure widest part at both ends (A & B)
   – Measure length of pool
   – Multiply by 0.45
2. Volume
   (A+B) x L x 0.45 x H x 7.48



Surface area =
(16+18) x 32 x 0.45
489.6 x 3 x 7.48 =
10,987 gallons

Chemical Safety - Do's & Don't's

- When dealing with swimming pool and spa chemicals, certain precautions must be taken concerning their usage, storage and handling to avoid a potentially dangerous situation
- Always use common sense and keep safety in mind

Chemical Safety – DO!

- ☑ Always follow label directions.
- ☑ Store chemicals in a cool and dry place.
- ☑ Always use a separate, clean measuring cup for each chemical.
- ☑ Always keep containers tightly sealed.
- ☑ Always add chemicals to water - slowly. Never add water to chemicals.
- ☑ Keep chemicals out of reach of children.

Chemical Safety – DO!

- ☑ Always use caution when transporting chemicals.
- ☑ Always store pool chemicals separately from other chemicals (fertilizers, insecticides, cleaners, solvents, etc.).
- ☑ Always carry and store liquid (muriatic) acid or liquid chlorine bottles upright. The vented caps can cause leakage.
- ☑ Protect eyes and skin.

Chemical Safety – DON'T

- ☒ Mix chemicals of any kind together.
- ☒ Add more than one pint of muriatic acid per 10,000 gallons of pool water at any one time.
- ☒ Inhale fumes or allow chemicals to contact eyes, nose or mouth.
- ☒ Smoke around dry chlorine or any pool chemicals.
- ☒ Store incompatible pool chemicals together.

Chemical Safety – DON'T

- ☒ Add calcium chloride the same day as sodium bicarbonate.
- ☒ Add large amounts of chemicals at one time (add in thirds over extended period of time).
- ☒ Add chemicals to the pool with swimmers present.
- ☒ Add chelating/sequestering agents the same day as polymeric clarifiers.
- ☒ Add chlorine and bromine together.

The End

Pool Operator Training

Oklahoma State Department of Health

3/8/2018 179

WHAT DOES A SWIMMING POOL OPERATOR NEED TO KNOW?

1. **POOL VOLUME**

The volume of your pool is the most important number you need to know. The volume is the number of gallons of water in your pool.

a. The size of the pump, filter, chemical feeder, piping, heater, and other related pool equipment are all dependent on the pool volume.
b. The addition of pool chemicals is dependent on the pool volume.

Calculating your pool volume:
Measure the pool length and width in feet. Determine the average depth in feet.

For rectangular pools:	Length x Width x Average Depth x 7.48 = Pool Volume in gallons.
For round pools:	Diameter x Diameter x Average Depth x 5.87 = Pool Volume in gallons.
For other shape pools:	Surface Area x Average Depth x 7.48 = Pool Volume in gallons.

2. **POOL FLOW RATE**

The flow rate of your pool is also very important. The flow rate is the amount of water that flows through your pool in a set time period. It is measured in gallons per minute (gpm).

a. The size of most pool equipment is dependent on the flow rate also.
b. Water quality and clarity are dependent on flow rate.

Calculating your pool flow rate:
Pool Volume/Turnover Period/60=Flow Rate in gallons per minute.

Turnover Period for pools:	Required
Swimming Pools	8 hours or less
Wading Pools	1 hour or less
Spa Pools	0.5 hours or less

3. **BASIC POOL EQUIPMENT**

You must know the basic purpose for each component of your pool filtration system. Recirculation, filtration, disinfection, and other equipment are all used to maintain pool water quality and clarity.

1) Recirculation Equipment
   (1) The pump is the heart of the pool system causing water to flow at the proper rate.
   (2) Skimmers or gutters remove the contaminated pool water from the pool water surface.
   (3) Main drains remove water and settled debris from the pool bottom.
   (4) Piping conveys water to and from the pool.
   (5) Wall or floor inlets uniformly return clean water back to the pool.

2) Filtration Equipment
   (1) The filter removes dirt and other large particles from the pool water. There are 3 general types of filters.
      (a) Sand
      (b) Diatomaceous Earth (D.E.)
      (c) Cartridge
   (2) Dirt particles get captured in the spaces between sand, diatomite, or cartridge fibers. The filter needs to be periodically cleaned to remove the captured dirt.

3) Disinfection Equipment
   (1) The chemical feeder applies a controlled amount of disinfectant or sanitizer to the pool by either electrically operated pumps or by water erosion.
   (2) The disinfectant destroys bacteria, algae, and other matter, which easily pass through the filter.

4) Other Equipment
   (1) Valves are used to route and adjust the flow of water through the different parts of the piping and system.
   (2) The flow meter is used to monitor the actual flow rate in the system.
   (3) Pressure gauges are used primarily to monitor the cleanliness of the filter.
   (4) Compound Gauge

5) Minimum Safety Equipment Requirements for Small Pools
   (1) 2 – Ring buoys with 40 feet of rope
   (2) 1 – Shepherd's Crook on a 16 foot Straight Pole
   (3) Emergency 911 phone with the numbers posted
   (4) Life Line in the Pool (if required)
   (5) First Aid Kit

6) Minimum Safety Equipment Requirements for Large Pools (1600+ SQ FT)
   (1) 4 – Ring buoys with 40 feet of rope
   (2) 2– Shepherd's Crook on a 16 foot Straight Pole
   (3) Backboard
   (4) Emergency 911 phone with the numbers posted
   (5) Life Line in the Pool (if required)
   (6) First Aid Kit
   (7) Certified Lifeguard (if required)

4. **DISINFECTION**

Disinfection is the chemical process of destroying potentially harmful organisms not removed by filtration that could be found in your pool water. A disinfectant is needed at a low, but detectable levels to be effective. The effective level of disinfection is in the parts per million (ppm) range.

a. Minimum Free Available Disinfection Residuals

b.	Disinfectant	Range
c.	Total Bromine	2 – 4 ppm
d.	Free Chlorine	1 – 5 ppm
e.	Combined Chlorine	0 – 0.2 ppm

f. The chemicals used in disinfection are in liquid, granular, or tableted form.
g. The disinfectant chemical is required to be fed by a chemical feeder for normal pool disinfection.
h. The free available chlorine residual is measured by using a test kit that allows the comparison of a pool water sample color with the color of a kit standard with a known ppm level.
i. Test kit chemicals must be stored properly and be replaced annually.

5. **pH**

pH is the measure of how acid or alkaline your pool water is. This property of water is extremely important since it directly affects bather comfort and the effectiveness of any chemical added to the pool.

pH is required to be maintained between 7.2 and 7.8.

a. The best pH for any pool is 7.4 to 7.6.
b. A high pH greatly reduces chlorine effectiveness. A high pH has less effect of bromine effectiveness.
c. A low or high pH is irritating to swimmers.
d. A low pH is corrosive to pool and equipment surfaces.
e. A high pH can allow the formation of damaging scaling on pool and equipment surfaces.
f. All pool chemicals and fresh water will affect the pool pH in some way.

6. **SUPER CHLORINATION**

During conditions of high bather load and generally lower pH. chlorine and bromine readily combine with nitrogen in your swimming pool water instead of doing the work of disinfection.

a. The nitrogen is from swimmer's bodily waste products.
b. The compounds formed are called chloramines and cause unpleasant, chlorine-like odors and eye irritations.
c. Large doses of chlorine or other compounds are needed to remove chloramines.
d. A test kit is used to measure the total chlorine residual. If the difference between the total and the free residuals is greater than or equal to 0.3 ppm, these chloramines need to be removed.
e. A dosage of ten times the chloramine residual needs to be added to the pool at one time to remove the chloramine. A period of 6 or more hours is needed for the reaction to take place.
f. Normally, the excess chlorine residual will dissipate during this time period. However, if the chlorine residual is above about 5.0 ppm after reaction, a dechlorinating chemical may be used to bring the residual down to a more suitable level.

7. **POOL AREA**

The area within the pool enclosure must be maintained for the safety of you clients, HOA members and members of the general public.

a. The pool enclosure must be approved by the Oklahoma State Department of Health. The gates must be self-closing and latching. They must be locked with a "CLOSED" sign posted when the pool is closed. Opening in the fence cannot be more than 4 inches.
   i. For pools NOT open to the general (apartments or HOA pools) public the fence must be at least 4ft tall.
   ii. For pools open to the general public (YMCA or Municipal pools) the fence must be at least 6ft tall.

b. Specific SIGNS are required around the pool, spa or wading pool area.
   i. Bathing Load
   ii. Depth Markers & No Diving (when needed)
   iii. No Lifeguard on Duty (if needed)
   iv. 911 Phone with Emergency numbers listed
   v. Pool Rules
   vi. Pool Chemicals (on the door of the storage area)
   vii. Emergency Fire Exit signs posted

c. Bathhouse (if required)
   i. Must have Hot & Cold running water at showers and hand sinks
   ii. Soap and paper towels or other means to dry hands
   iii. Appropriate number of toilets, stocked with toilet paper for both men and women.
   iv. Adequate Ventilation to prevent buildup noxious odors.
   v. Drinking Fountain (required at all public bathing places)
   vi. Fire extinguishers.

For additional information please visit the Oklahoma State Department of Health website: https://www.ok.gov/health/Protective_Health/Consumer_Health_Service

The Occupational Licensing Division which administers the Public Bathing Place Program can be reached by calling (405) 271-5243 or sending an email to: ConsumerHealth@health.ok.gov.

SWIMMING POOL CHEMICALS

1. **DISINFECTION** Range: Free Chlorine 1 – 5 ppm or Total Bromine 2 – 4 ppm

Chemical	Form	% Available Chlorine	Solution pH	Approximate Dosage
Chlorine gas*	gas	100%	0-2	
Sodium Hypochlorite	Liquid	12%	13-14	
Calcium Hypochlorite	Granular or tablet	65%	12-13	**SEE**
Lithium Hypochlorite	Granular	35%	10.5	**Chemicals Used**

*Requires specific approval in writing

Chlorinated Cyanurates				
Dichloro	Granular	56%	6-7	
Trichloro	Tablets	90%	2-3	**Chart on**
Bromine	Tablets or Sticks	65% Br	6-7	**Page 9**

Superchlorination

Periodic superchlorination is highly recommended. Increase the free chlorine residual to 10 ppm for several hours and allow the level to fall to 3 ppm before allowing swimming again. This should be done at night or when the pool is not being used. Superchlorinate weekly to monthly or when necessary. Always correct the pH before and after this process.

The chart below shows the amounts of various chlorine compounds which can be used to introduce 10 ppm of chlorine to the pool.

Shock Treatment of Breakpoint Chlorination

Breakpoint chlorination is needed to remove unwanted combined chlorine or chloramines from pool water. Chloramines form when ammonia from swimmers combines with free chlorine in the pool. Chloramines are poor disinfectants and cause eye irritation, skin discomfort, and chlorine-like odors at a pool. To achieve breakpoint chlorination, the point at which free chlorine is reformed, a large dose of chlorine must be added to the pool. The dosage is 10 times the combined chlorine residual. For example, if the combined chlorine residual in the pool is 1 ppm, a 10 ppm dosage of 1 gallon of sodium hypochlorite per 12,000 gallons of pool water must be added to the pool to reach breakpoint. Any less than this dosage will be ineffective in removing any of the chloramines.

Neutralization of Disinfectant

To neutralize or eliminate a 1.0 ppm free chlorine residual:

Chemical	Add
Sodium bisulfate	1.46 ppm or 2.4 oz/10,000 gal
Sodium sulfite	1.77 ppm or 2.9 oz/10,000 gal
Sodium thiosulfate	0.70pm or 1.9 oz/10,000 gal

2. **pH CONTROL** Range: 7.2 – 7.8 Ideal: 7.4 – 7.6

Chemical	Form	Solution pH	Effective	Approximate Doseage
Acid				
Sodium bisulfate	Powder	1.5 (in water)	Lower pH	**SEE**
Muriatic acid	Liquid	1.0	Lower pH	**Chemicals Used**
Base				
Soda Ash (Sodium Carbonate)	Powder	11.0	Raise pH 0.3	**Chart on**
Baking Soda (Sodium Bicarbonate)	Powder	8.4	Raise pH (pH 8.4 max)	**Page 9**

Water has a major impact on the pool pH, and can raise or lower the pH depending on the pH of the make-up water and the amount of water being used.

Adding 1 ¼ lbs. of sodium bisulfate has the equivalent effect as adding 1 pint of muriatic acid.

3. **STABILIZER** Range: 20 – 100 ppm

Cyanuric acid is the stabilizer used to prevent the reduction of free chlorine residual by ultraviolet degradation (sunlight). A dosage of 1 ½ lb/5000 gallon of pool water is equal to 36 ppm. A 95% reduction of free chlorine residual occurs in about 4 hours on an 80-degree F. sunny day without stabilization. With a 30 ppm cyanuric acid level, less that 15% reduction of the residual occurs in 24 hours. Once added to the pool, cyanuric acid does not dissipate. It is removed from the pool only by splash out and backwash waste. Excessive amounts of cyanuric acid can interfere with the disinfection process and at concentrations above 100 ppm may cause "chlorine lock" and clouding of the pool. Cyanuric acid level is lowered by draining part of the water out of the pool and diluting the remaining water with fresh water.
There is little or no purpose for stabilization of an indoor pool since ultraviolet radiation does not penetrate glass or other enclosure materials. Stabilization has no effect on bromine disinfected pools. The cyanurate residual can only be lowered by water dilution.

4. **ALKALINITY CONTROL** Range: 80 – 200 ppm

Alkalinity is a measurement of the buffer capacity of the pool water. Buffer capacity acts as a “shock absorber” for the pH. A low alkalinity allows wild fluctuations of the pH with small additions of pH correction chemicals. A high alkalinity in effect prevents pH changes even with large additions of pH correction chemicals. A high alkalinity also will try to keep the pH at about 8.4.

Chemical	Form	Use	Approximate Dosage for Change
Baking Soda	Powder	Raise Alkalinity	**SEE**
Soda Ash	Powder	Raise Alkalinity	**Chemicals Used**
Muriatic acid	Liquid	Lower Alkalinity	**Chart on**
Sodium bisulfate	Powder	Lower Alkalinity	**Page 9**

5. **HARDNESS CONTROL** Range: 50 – 500 ppm

Hardness is the measurement of calcium and magnesium ions in the pool water. This measurement is so named because large amounts of these ions makes it “hard” for soap to make suds in water. Water seems to demand a certain amount of these ions to keep a proper balance. Soft water can contribute to the corrosion of pool walls, piping, and other equipment in contact with the pool water. Hard water can contribute to the formation of scale in piping and other pool surfaces, as well as some staining.

Chemical	Form	Use	Dosage
Calcium Chloride	Powder	Raise Hardness 11 ppm	See Charts on Page
Water	Liquid	Lower Hardness	As needed

6. ALGAE CONTROL AND ALGAECIDES

If adequate disinfectant residuals are maintained and periodic super chlorination is practiced, then algaecides are not normally needed. Many algaecides are simply relabeled disinfectants. Several types of separate algaecides are marketed but the companies still recommend adequate disinfection to prevent algae growth.

If an algaecide is to be used, follow the label directions carefully. Do not use too little or too much. Low levels are not effective and high levels are dangerous to swimmers.

Quaternary ammonium compounds are common algaecides in a liquid form and contain from 1 to 20% effective ingredient. The dosage varies around 1 gal/50,000 gallons for an initial treatment of an algae bloom, and 1 qt/50,000 gallons for routine preventative treatment.

These algaecides are not to be used in place of regular disinfectants as they are ineffective against many bacteria, causes foaming when used at moderate dosages, add to the combined chlorine residuals, are eye and mucous membrane irritants, and can react dangerously with soaps and detergents.

Copper based algaecides are another common form of algaecide. Copper triethanolamine, copper sulfate, copper citrate, copper gluconate, and cupric carbonate or malachite are common active ingredients.

Another active ingredient in algaecides include poly (oxyethylene (dimethyliminio) ethylene (dimethlyiminio) ethylene dichloride) (that’s all one name). This particular algaecide does not cause foaming, but is toxic to fish, so proper disposal is necessary. Simazine, colloidal silver, and sodium dimethyl dithlo carbonarte are other active ingredients in algaecides. Phenyl mercuric acetate was perhaps the most effective algaecide until it was banned because of mercury content.

7. **OTHER CHEMICALS**

Chemical	Use	Effect
Aluminum sulfate (alum)	Coagulant	Removes suspended solids and Cu, Fe, Ca, Mn
Copper ethylene diamine tetra acetate (EDTA)	Sequesterant	Removes Ca, Fe, Mg

THE 10K FORMULA

The formula below is similar to that found on product labels. The 10K FORMULA uses 10,000 gallons of water to determine the amount of chemical needed to adjust the chemical levels of Chlorine, Alkalinity, Calcium Hardness, etc. Manufacturers may use other amounts such as 3000 or 5000 gallons, etc.- ALWAYS READ the label directions before use.

The label for the calcium hypochlorite (65%) listed below would list dosage instructions similar to: "Add 2oz per 10,000 gallons, to increase the free chlorine residual by 1ppm." If your pool is not exactly 10,000 gallons, or you wish to raise your chlorine by one more than 1ppm, you would need to do a series of calculations summarized by the 10K formula.

$$\textbf{Chemical Amount*} \times \frac{\textbf{Pool Volume}}{\textbf{10,000 gal}} \times \frac{\textbf{Needed Change**}}{\textbf{Increment to Change 10,000gal**}} = \textbf{AMOUNT of CHEMICAL to TREAT WATER}$$

Chemical Amount is in ounces (oz.), pounds (lbs.), or fluid ounces (fl.oz.). The unit of measure in "CHEMICAL AMOUNT" will be the same unit of measure for your final answer. Use the table on page **9** (**C**hemical label, if available) to determine values for **"Chemical Amount"** (3rd column) and **"Increments to change"** (2nd column). **"Needed Change"** is the change to be made from the actual test reading to the ideal reading – i.e.

Total Alkalinity is 30ppm and should be 80ppm. Needed Change = 50ppm.

To Breakpoint chlorinate: TC – FAC = CC; (CC x 10) - FAC = Needed Change (from formula above).
(TC = Total Chlorine; FAC = Free Available Chlorine; CC = Combine Chlorines)

UNIT CONVERSION CHART

The Amount of Chemical to USE often requires conversion from smaller measures to larger ones.
Here is a handy conversion chart.

1 pound (lb)	=	16 dry ounces (oz)
1 gallon (gal)	=	128 fluid ounces (fl oz)
8 fl oz	=	1 cup
1 cubic foot (ft^3)	=	7.5 gal of water

*If converting Left to Right, Multiply. If converting Right to Left, Divide
Ex. 3 lb → ? oz; 3 x 16 = 48 oz
Ex. 500 fl oz → ? gal; 500 ÷ 128 = 3.9 gal

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RECREATIONAL WATERBORNE ILLNESS (RWI)

RWI are transmitted in the water form one person to the another by pathogens. The pathogens can be transmitted by drinking, breathing or contact with the pathogen on the skin. Bacteria, viruses and protozoa are generally the pathogens that make people sick. Bacteria and viruses are easiest to kill using sanitizers (Chlorine, Bromine, Ozone, and Ultraviolet Light). The Protozoans are harder to kill. According to CDC, approximately 85% of RWI are transmitted by the fecal-oral route. This is the reason why showering prior to entering the pool is necessary! CDC estimates the average adult may carry 0.14 grams of fecal matter on their bottom, which can hold more than enough pathogens to transmit disease.

In the event of a fecal incident, close the pool and advise patrons to shower thoroughly.

Remove any solid particles, and treat or drain the pool according to CDC recommendations for remediation.

Pathogens can be shed from the gut for several weeks after symptoms have disappeared.
Steps should be taken to prevent fecal matter from entering the pool:

- Require all patrons to shower before entering the pool
- Do not allow diapers to be changed near the pool- should be done either in the locker room or outside the pool area
- Encourage frequent potty breaks, especially for young children ("safety breaks")
- Exclude any bathers who have had diarrhea within the last (2) weeks

BIOFILMS- colonies of microorganisms that grow in or near the pool, on wet or damp surfaces (underside of skimmer lid), they secrete a slimy coating that chlorine and bromine cannot penetrate. They can harbor other organism and pathogens, protecting them from the chlorine, and secreting them into the pool over time. The best way to remove them is to dry them out completely, scrape them off, and then scrub the surface with a concentrated bleach solution.

ALGAE- single celled plants. Can cause turbid water, eat plaster, form biofilms, stain plaster, and secrete harmful toxins into the water. Shock affected areas, scrub any surfaces where they have colonized, filter out and backwash. Repeat as needed.

BACTERIA- most are easily killed by chlorine and bromine. *Legionella*, associated with moist, humid environments (not necessarily in the pool water itself, but the atmosphere) causes legionnaire's disease, a deadly type of pneumonia, and Pontiac fever. *Pseudomonas*, causes a very painful "hot tub rash," with puss filled blisters and follicles.

PROTOZOA (Parasites)- can be extremely chlorine resistant. If suspected, further steps must be taken to assure proper remediation/removal of viable pathogens. *Giardia*, causes severe diarrhea and gastrointestinal distress. *Cryptosporidium*, the most chlorine resistant pathogen for RWI's, can survive in a properly chlorinated pool for several days. Causes severe diarrhea and gastrointestinal distress, very dangerous for children and the elderly. Very easily spread outbreaks sometimes involve several thousand people infected.

CHEMICALS USED TO TREAT WATER

Chemical to Use	Increments To Change 10,000gal.**	Chemical Amount*	pH Effect
Chlorine (Free Available)	1 ppm		
Calcium Hypochlorite (65%)		2 oz	UP
Sodium Hypochlorite (10%)		13 fl oz	UP
Lithium Hypochlorite (35%)		10.5 oz	NA
Dichloro-s-triazinetrione (99%)*		2.5 oz	DOWN
Trichloro-s-triazanine trione (86-99%)*		1.5 oz	DOWN
Gas (100%)		1.3 oz	DOWN
Stabilizer – Raise (Increase) *have Cyanuric in tablet			
Cyanuric Acid – granular	5 ppm	6.5 oz	DOWN
Dichloro-s-triazinetrione	5 ppm	13.0 oz	DOWN
Neutralize Free Chlorine	1 ppm		
Sodium Thiosulfate		1 oz	UP
pH – Raise (Increase)	in 0.2increments		
Soda Ash		6 oz	UP
pH – Lower (Decrease)	in 0.2increments		
Muriatic Acid		24 oz	DOWN
Sodium Bisulfate		1.5 lbs	DOWN
Total Alkalinity – Raise (Increase)	10 ppm		
Sodium Bicarbonate		1.5 lbs	UP
Total Alkalinity – Lower (Decrease)	10 ppm		
Muriatic Acid		24 oz	DOWN
Sodium Bisulfate		1.5 lbs	DOWN
Calcium Hardness – Raise (Increase)*	10 ppm		
Calcium Chloride (100%)		1.0 lbs	UP
Calcium Chloride (77%)		1.25 lbs	UP

*The only way to Lower Calcium Hardness, Cyanuric Acid or Total Dissolved Solids is to drain water and replace with tap water.

APPROXIMATE DOSAGE CHARTS FOR POOL CHEMICALS

Superchlorination
(Amount Needed to Introduce 10 ppm)

Type of chlorine	GALLONS IN POOL						
	1,000	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
Sodium Hypo	10 oz.	1 3/4 qts.	3 1/4 qts.	1 1/4 gal.	1 2/3 gal.	2 gal.	4 gal.
Lithium Hypo	4 oz.	1 1/4 lbs.	2 1/3 lbs.	3 1/2 lbs.	4 3/4 lbs.	6 lbs.	12 lbs
Dichlor	2 1/4 oz.	11 oz.	1 1/3 lbs.	2 lbs.	2 2/3 lbs.	3 1/3 lbs.	6 3/4 lbs.
Calcium Hypo	2 oz.	10 oz.	1 1/4 lbs.	2 lbs.	2 1/2 lbs.	3 1/4 lbs.	6 1/2 lbs.

Raising pH with Soda Ash
(If pH is under 7.4, add this amount of soda ash, then retest)

	GALLONS IN POOL						
pH	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
7.2-7.4	2/3 oz.	3 oz.	6 oz.	9 oz.	12 oz.	1 lb.	2 lbs.
7.0-7.2	3/4 oz.	4 oz.	8 oz.	12 oz.	1 lb.	1 1/4 lbs.	2 1/2 lbs.
6.6-7.0	1 1/4 oz.	6 oz.	12 oz.	1 lb.	1 1/2 lbs.	2 lbs.	4 lbs.
Under 6.7	1 1/2 oz.	8 oz.	1 lb.	1 1/2 lbs.	2 lbs.	2 1/2 lbs	5 lbs

Lowering pH with Muriatic Acid
(If pH is over 7.6, add this amount of acid, then retest)

	GALLONS IN POOL						
pH	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
7.6-7.8	1 1/4 oz.	6 oz.	12 oz.	18 oz.	24 oz.	1 qt.	2 qts.
7.8-8.0	1 1/2 oz.	8 oz.	16 oz.	24 oz.	1 qt.	1 1/4 qts.	2 1/2 qts.
8.0-8.4	2 1/2 oz.	12 oz.	24 oz.	1 1/4 qts.	1 1/2 qts.	2 qts.	1 gal.
Over 8.4	3 oz.	16 oz.	1 qt.	1 1/4 qts.	2 qts.	2 1/2 qts.	1 1/4 gal.

Raising Alkalinity Using Sodium Bicarbonate

Increase	GALLONS IN POOL						
(ppm)	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
10	0.14 lbs	0.7 lbs.	1.4 lbs.	2.1 lbs.	2.8 lbs.	3.5 lbs.	7 lbs.
20	0.28 lbs.	1.4 lbs.	2.8 lbs.	4.2 lbs.	5.6 lbs.	7.0 lbs.	14 lbs.
30	0.42 lbs.	2.1 lbs.	4.2 lbs.	6.3 lbs.	8.4 lbs.	10.5 lbs.	21 lbs.
40	0.56 lbs.	2.8 lbs.	5.6 lbs.	8.4 lbs.	11.2 lbs.	14.0 lbs.	28 lbs.
50	0.70 lbs.	3.5 lbs.	7 lbs.	10.5 lbs	14.0 lbs.	17.5 lbs.	35 lbs.

Raising Alkalinity Using Soda Ash

Increase	GALLONS IN POOL						
(ppm)	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
10	0.09 lbs	0.44 lbs.	0.88 lbs.	1.32 lbs.	1.77 lbs.	2.21 lbs.	4.42 lbs.
20	0.18 lbs.	0.88 lbs.	1.77 lbs.	2.65 lbs.	3.53 lbs.	4.42 lbs.	8.83 lbs.
30	0.26 lbs.	1.32 lbs.	2.65 lbs.	3.97 lbs.	5.30 lbs.	6.62 lbs.	13.25 lbs.
40	0.35 lbs.	1.77 lbs.	3.53 lbs.	5.30 lbs.	7.07 lbs.	8.83 lbs.	17.66 lbs.
50	0.44 lbs.	2.21 lbs.	4.42 lbs.	6.62 lbs.	8.83 lbs.	11.04 lbs.	22.08 lbs.

Lowering Alkalinity Using Muriatic Acid

Decrease	GALLONS IN POOL						
(ppm)	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
10	2.56 oz.	0.8 pts.	0.8 qts.	1.2 qts.	1.6 qts.	2.0 qts.	1 gal.
20	5.12 oz.	1.60 pts.	1.6 qts.	2.4 qts.	3.2 qts.	1.0 gal.	2 gal.
30	7.68 oz.	1.2 qts.	2.4 qts.	3.6 qts.	1.2 gal.	1.5 gal.	3 gal.
40	10.24 oz.	1.6 qts.	3.2 qts.	1.2 gal.	1.6 gal.	2.0 gal.	4 gal.
50	12.80 oz.	2.0 qts.	1.0 gal.	1.5 gal.	2.0 gal.	2.5 gal.	5 gal.

Lowering Alkalinity Using Sodium Bisulfate

Decrease	**GALLONS IN POOL**						
(ppm)	**1,000**	**5,000**	**10,000**	**15,000**	**20,000**	**25,000**	**50,000**
10	0.21 lbs.	1.06 lbs.	2.13 lbs.	3.19 lbs.	4.25 lbs.	5.31 lbs.	10.63 lbs.
20	0.43 lbs.	2.13 lbs.	4.25 lbs.	6.38 lbs.	8.50 lbs.	10.63 lbs.	21.25 lbs.
30	0.64 lbs.	3.19 lbs.	6.38 lbs.	9.56 lbs.	12.75 lbs.	15.94 lbs.	31.88 lbs.
40	0.85 lbs.	4.25 lbs.	8.50 lbs.	12.75 lbs.	17.00 lbs.	21.25 lbs.	42.50 lbs.
50	1.06 lbs.	5.31 lbs.	10.63 lbs.	15.94 lbs.	21.25 lbs.	26.56 lbs.	53.13 lbs.

Chemical Standards

Chemical	Minimum	Ideal	Maximum
Free Chlorine (FAC)	1.0 ppm	1.0 - 3.0 ppm	5.0 ppm
Combined Chlorine (CAC)	None	None	0.2 ppm
Bromine	2.0 ppm	3.0 ppm	4.0 ppm
pH	7.2	7.5	7.8
Total Alkalinity	80 ppm	100 ppm	200 ppm
	Calcium hypochlorite and lithium hypochlorite	80 - 100 ppm	
	Gas, Dichlor, Trichlor and Bromine Compounds	100 - 120 ppm	
Calcium Hardness	50 ppm	125 ppm	500 ppm
TDS	300 ppm	…	1500 ppm
Copper/Iron (Heavy Metals)	None	None	0.3 ppm
Manganese	None	None	0.05 ppm
Stabilizer (Cyanuric Acid)	30 ppm	…	100 ppm
Hot Water Facilities-Water Temperature	90°F	…	105°F
Swimming Pool	75°F	…	90°F
Indoor Pool- Air Temp(excluding Hot Water Facilities)	Water Temp -2°F		Water Temp + 8°F
Turbidity	Must be able to clearly see Main Drain from Pool Sidewalk.		

CHEMISTRY QUICK START GUIDE

OVERVIEW

Before attempting to operate your new chlorine generator, salt must be added to your pool and your pool's water chemistry must be properly balanced. Properly balanced pool water is not only necessary for chlorine generation, but also to protect your pool equipment and users of the pool.

BECAUSE SOME CHEMICALS INFLUENCE MORE THAN ONE CHEMISTRY PARAMETER, IT IS IMPORTANT THAT YOU FOLLOW THE STEPS IN THE ORDER PRESENTED.

The following steps require the use of a reliable pool chemical test kit(s).

STEP 1: Calculate Pool Volume

Determine the total number of gallons of water in your pool using the formulas below. This calculation will be used frequently when adjusting pool chemical levels so take care when measuring. For non-standard shaped pools, it may be easier to break the pool up into "sections" to make the calculations. When done, add all the "sections" to determine the total volume of your pool.

	GALLONS (*pool size in feet*)	LITERS (*pool size in meters*)
Rectangular	Length x Width x Average Depth x 7.5	Length x Width x Average Depth x 1000
Round	Diameter x Diameter x Average Depth x 5.9	Diameter x Diameter x Average Depth x 785
Oval	Length x Width x Average Depth x 6.7	Length x Width x Average Depth x 893

STEP 2: Adjust Salt Level

IDEAL RANGE: Before adding salt, test your pool water for the current level of salt.

RECOMMENDED LEVEL: 2700 - 3400 ppm (3200 ppm ideal)

After testing salt, refer to Table 1 to determine how much salt must be added to achieve a level of 3200 parts per million (ppm).

Salt should be added directly to the pool with the pool pump on. Brush the salt around to speed up the dissolving process - do not allow the salt to pile up on the bottom of the pool. For new plaster pools, wait 10-14 days before adding salt to allow the plaster to cure. Run the filter pump for 24 hours with the suction coming from the main drain (use pool vac if there is no main drain) to allow the salt to evenly disperse throughout the pool.

Use common food quality salt usually available in 40-80 lb. bags labeled "Pool Salt" or "Coarse Solar Salt". Do not use rock salt, salt with yellow prussiate of soda, salt with anti-caking additives, or iodized salt.

STEP 3: Adjust Cyanuric Acid

Cyanuric Acid (Stabilizer) is very important to the performance of your chlorine generation system. It's a mild acid that helps prevent the breakdown of chlorine due to the sun's ultraviolet rays.

IDEAL LEVEL: 60 - 80 ppm outdoor pools
20 - 40 ppm covered pools
0 ppm indoor pools

Test your pool's Cyanuric Acid level using a pool test kit or bring a water sample to your local pool store.

Refer to Table 2 to determine the amount of Cyanuric Acid needed to raise the Cyanuric Acid to the desired level.

STEP 4: Adjust Total Alkalinity

Total Alkalinity (TA) is a measure of the total alkaline substances found in the pool water. The results of improper TA levels range from corrosion of metal pool parts, staining of the pool, burning eyes, cloudy water and reduced chlorine efficiency.

IDEAL LEVEL: 80 - 120 ppm

Test your pool's TA.

Refer to Table 3 to increase the pool's TA using Baking Soda (Sodium Bicarbonate 100%).

Refer to Table 4 to decrease the pool's TA using Muriatic Acid (Hydrochloric Acid 31.45%).

STEP 5: Adjust Total Hardness

Total Hardness is the measurement of the total amount of minerals that are found in your pool's water. Too much calcium hardness will cause scaling in your pool and too little will cause the pool water to become corrosive.

IDEAL LEVEL: 200 - 400 ppm

Test your pool's Total Hardness.

If low, add Calcium Chloride (77%) according to Table 5.

If Total Hardness is high, dilute or replace the pool water.

STEP 6: Adjust pH

pH is the measure of how acid/alkaline the pool water is. If pH is too low, the water can be corrosive to pool equipment. If pH is too high, then the chlorine becomes much less effective for sanitization.

IDEAL LEVEL: 7.2 - 7.8

Test your pool's pH.

To increase the pool's pH, add Soda Ash according to Table 6.

To decrease pool pH, add Muriatic Acid according to Table 7.

CHEMISTRY QUICK START GUIDE

Table 1

POUNDS and (Kg) OF SALT NEEDED FOR 3200 PPM

Current salt level ppm	Gallons and (Liters) of Pool/Spa water						
	12,000 (45,000)	14,000 (52,500)	16,000 (60,000)	18,000 (67,500)	20,000 (75,000)	22,000 (82,500)	24,000 (90,000)
0	320 (145)	373 (170)	427 (194)	480 (218)	533 (242)	587 (267)	640 (291)
200	300 (136)	350 (159)	400 (182)	450 (205)	500 (227)	550 (250)	600 (273)
400	280 (127)	327 (148)	373 (170)	420 (191)	467 (212)	513 (233)	560 (255)
600	260 (118)	303 (138)	347 (158)	390 (177)	433 (197)	477 (217)	520 (236)
800	240 (109)	280 (127)	320 (145)	360 (164)	400 (182)	440 (200)	480 (218)
1000	220 (100)	257 (117)	293 (133)	330 (150)	367 (167)	403 (183)	440 (200)
1200	200 (91)	233 (106)	267 (121)	300 (136)	333 (152)	367 (167)	400 (182)
1400	180 (82)	210 (95)	240 (109)	270 (123)	300 (136)	330 (150)	360 (164)
1600	160 (73)	187 (85)	213 (97)	240 (109)	267 (121)	293 (133)	320 (145)
1800	140 (64)	163 (74)	187 (85)	210 (95)	233 (106)	257 (117)	280 (127)
2000	120 (55)	140 (64)	160 (73)	180 (82)	200 (91)	220 (100)	240 (109)
2200	100 (45)	117 (53)	133 (61)	150 (68)	167 (76)	183 (83)	200 (91)
2400	80 (36)	93 (42)	107 (48)	120 (55)	133 (61)	147 (67)	160 (73)
2600	60 (27)	70 (32)	80 (36)	90 (41)	100 (45)	110 (50)	120 (55)
2800	40 (18)	47 (21)	53 (24)	60 (27)	67 (30)	73 (33)	80 (36)
3000	20 (9)	23 (11)	27 (12)	30 (14)	33 (15)	37 (17)	40 (18)
3200	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal	Ideal
above 3400	Dilute	Dilute	Dilute	Dilute	Dilute	Dilute	Dilute

Table 2

POUNDS and (Kg) OF STABILIZER (CYANURIC ACID) NEEDED FOR 80 PPM

Current Stabilizer level (ppm)	Gallons and (Liters) of Pool Water								
	8,000 (30,000)	10,000 (37,500)	12,000 (45,000)	14,000 (52,500)	16,000 (60,000)	18,000 (67,500)	20,000 (75,000)	22,000 (82,500)	24,000 (90,000)
0 ppm	5.3 (3.6)	6.7 (4.3)	8.0 (3.6)	9.4 (4.3)	10.7 (4.9)	12.0 (5.4)	13.4 (6.1)	14.7 (6.7)	16.0 (7.3)
10 ppm	4.7 (3.2)	5.8 (3.7)	7.0 (3.2)	8.2 (3.7)	9.4 (4.3)	10.5 (4.8)	11.7 (5.3)	12.9 (5.9)	14.0 (6.4)
20 ppm	4.0 (2.7)	5.0 (3.2)	6.0 (2.7)	7.0 (3.2)	8.0 (3.6)	9.0 (2.2)	10.0 (4.5)	11.0 (5.0)	12.0 (5.4)
30 ppm	3.3 (2.3)	4.2 (2.7)	5.0 (2.3)	5.9 (2.7)	6.7 (3.0)	7.5 (3.4)	8.4 (3.8)	9.2 (4.2)	10.0 (4.5)
40 ppm	2.7 (1.8)	3.3 (2.1)	4.0 (1.8)	4.7 (2.1)	5.4 (2.4)	6.0 (2.7)	6.7 (3.0)	7.4 (3.3)	8.0 (3.6)
50 ppm	2.0 (1.4)	2.5 (1.6)	3.0 (1.4)	3.5 (1.6)	4.0 (1.8)	4.5 (2.0)	5.0 (2.3)	5.5 (2.5)	6.0 (2.7)
60 ppm	1.3 (.91)	1.7 (1.1)	2.0 (.91)	2.3 (1.1)	2.7 (1.2)	3.0 (1.4)	3.3 (1.5)	3.7 (1.7)	4.0 (1.8)
70 ppm	0.7 (.45)	0.8 (.54)	1.0 (.45)	1.2 (.54)	1.4 (.64)	1.5 (.68)	1.7 (.77)	1.8 (.82)	2.0 (.91)
80 ppm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3

POUNDS and (Kg) OF BAKING SODA (SODIUM BICARBONATE 100%) NEEDED TO INCREASE TOTAL ALKALINITY TO THE RECOMMENDED RANGE

Desired Increase (ppm)	Gallons and (Liters) of Pool Water						
	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	0.1 (0)	0.1 (0.1)	0.7 (0.3)	1.4 (0.6)	2.1 (1)	2.8 (1.3)	3.5 (1.6)
20 ppm	0.1 (0.1)	0.3 (0.1)	1.4 (0.6)	2.8 (1.3)	4.2 (1.9)	5.6 (2.5)	7 (3.2)
30 ppm	0.2 (0.1)	0.4 (0.2)	2.1 (1)	4.2 (1.9)	6.3 (2.9)	8.4 (3.8)	10.5 (4.8)
40 ppm	0.2 (0.1)	0.6 (0.3)	2.8 (1.3)	5.6 (2.5)	8.4 (3.8)	11.2 (5.1)	14 (6.4)
50 ppm	0.3 (0.1)	0.7 (0.3)	3.5 (1.6)	7.0 (3.2)	10.5 (4.8)	14.0 (6.4)	17.5 (7.9)
60 ppm	0.3 (0.2)	0.8 (0.4)	4.2 (1.9)	8.4 (3.8)	12.6 (5.7)	16.8 (7.6)	21 (9.5)
70 ppm	0.4 (0.2)	1 (0.4)	4.9 (2.2)	9.8 (4.4)	14.7 (6.7)	19.6 (8.9)	24.5 (11.1)
80 ppm	0.4 (0.2)	1.1 (0.5)	5.6 (2.5)	11.2 (5.1)	16.8 (7.6)	22.4 (10.2)	28 (12.7)
90 ppm	0.5 (0.2)	1.3 (0.6)	6.3 (2.9)	12.6 (5.7)	18.9 (8.6)	25.2 (11.4)	31.5 (14.3)
100 ppm	0.6 (0.3)	1.4 (0.6)	7.0 (3.2)	14 (6.4)	21 (9.5)	28 (12.7)	35 (15.9)

Table 4

OUNCES and (L) OF MURIATIC ACID NEEDED TO DECREASE TOTAL ALKALINITY TO THE RECOMMENDED RANGE

Desired Decrease (ppm)	Gallons and (Liters) of Pool Water						
	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	1 (0)	2.5 (0.08)	13 (0.41)	26 (0.81)	39 (1.2)	52 (1.6)	65 (2)
20 ppm	2 (0.06)	5 (0.16)	26 (0.81)	52 (1.6)	78 (2.4)	105 (3.3)	131 (4)
30 ppm	3.2 (0.1)	8 (0.24)	39 (1.2)	78 (2.4)	105 (3.3)	157 (4.9)	196 (6)
40 ppm	4.2 (0.13)	10.5 (0.33)	52 (1.6)	105 (3.3)	157 (4.9)	208 (6.5)	260 (8.1)
50 ppm	5.2 (0.16)	13 (0.41)	65 (2)	131 (4)	196 (6)	260 (8.1)	325 (10.1)
60 ppm	6.2 (0.2)	15.5 (0.49)	78 (2.4)	157 (4.9)	235 (7.3)	314 (9.8)	390 (12.2)
70 ppm	7.2 (0.23)	18 (0.57)	91 (2.8)	183 (5.7)	275 (8.5)	366 (11.4)	457 (14.2)
80 ppm	8.4 (0.26)	21 (0.65)	105 (3.3)	208 (6.5)	312 (9.8)	416 (13)	520 (16.2)
90 ppm	9.4 (0.3)	23.5 (0.73)	118 (3.6)	235 (7.3)	353 (11)	470 (14.6)	588 (17.9)
100 ppm	10.4 (0.32)	26 (0.81)	131 (4.7)	260 (8.1)	390 (12.2)	520 (16.2)	651 (20.9)

Table 5

POUNDS and (Kg) OF CALCIUM CHLORIDE (77%) NEEDED TO INCREASE CALCIUM HARDNESS TO THE RECOMMENDED RANGE

Desired Increase (ppm)	Gallons and (Liters) of Pool Water						
	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
10 ppm	0 (0)	0.1 (0.1)	0.6 (0.3)	1.2 (.5)	1.8 (.8)	2.4 (1.1)	3 (1.4)
20 ppm	0.1 (0)	0.2 (0.1)	1.2 (0.5)	2.4 (1.1)	3.6 (1.6)	4.8 (2.2)	6 (2.7)
30 ppm	0.1 (0.1)	0.4 (0.2)	1.8 (0.8)	3.6 (1.6)	5.4 (2.5)	7.2 (3.3)	9 (4.1)
40 ppm	0.2 (0.1)	0.5 (0.2)	2.4 (1.1)	4.8 (2.2)	7.2 (3.3)	9.6 (4.4)	12 (5.5)
50 ppm	0.2 (0.1)	0.6 (0.3)	3.0 (1.4)	6.0 (2.7)	9 (4.1)	12.0 (5.5)	15 (6.8)
60 ppm	0.3 (0.1)	0.7 (0.3)	3.6 (1.6)	7.2 (3.3)	10.8 (4.9)	14.4 (6.5)	18 (8.2)
70 ppm	0.3 (0.2)	0.8 (0.4)	4.2 (1.9)	8.4 (3.8)	12.6 (5.7)	16.8 (7.6)	21 (9.5)
80 ppm	0.4 (0.2)	1 (0.4)	4.8 (2.2)	9.6 (4.4)	14.4 (6.5)	19.2 (8.7)	24 (10.9)
90 ppm	0.4 (0.2)	1.1 (0.5)	5.4 (2.4)	10.8 (4.9)	16.2 (7.3)	21.6 (9.8)	27 (12.2)
100 ppm	0.4 (0.2)	1.2 (0.5)	6.0 (2.7)	12 (5.4)	18 (9.5)	24 (10.9)	30 (13.6)

Table 6

OUNCES AND (GRAMS) OF SODA ASH (SODIUM CARBONATE) NEEDED TO RAISE pH TO THE RECOMMENDED RANGE

CURRENT pH	Gallons and (Liters) of Pool Water						
	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
7.0 - 7.2	0.25 (8.5)	0.75 (21.3)	4 (113)	8 (227)	12 (340)	16 (454)	20 (568)
6.7 - 7.0	0.5 (14)	1.25 (35.4)	6 (170)	12 (340)	16 (454)	24 (681)	32 (908)
under 6.7	0.6 (17)	1.5 (42.5)	8 (227)	16 (454)	24 (681)	32 (908)	40 (1100)

Table 7

OUNCES AND (GRAMS) OF MURIATIC ACID NEEDED TO LOWER pH TO THE RECOMMENDED RANGE

CURRENT pH	Gallons and (Liters) of Pool Water						
	400 (1,500)	1,000 (3,750)	5,000 (19,000)	10,000 (38,000)	15,000 (57,000)	20,000 (75,000)	25,000 (95,000)
7.8 - 8.0	0.6 (17)	1.5 (43)	8 (225)	16 (454)	24 (680)	32 (900)	40 (1125)
8.0 - 8.4	1.0 (28)	2.5 (70)	12 (340)	24 (680)	36 (1020)	48 (1360)	60 (1700)
over 8.4	1.2 (35)	3 (86)	16 (454)	32 (900)	48 (1350)	64 (1800)	80 (2250)

PUBLIC BATHING PLACE OPERATION RECORD WEEK OF:

Facility Name: _____ **Facility Type:** ☐Pool ☐Spa ☐Wading ☐Slide ☐Other_____

Physical Address: _____ **City:**_____ **Zip:** _____

County_____ **OSDH License #:** _____

FACILITY SPECIFICATIONS

- Size (Gallons):
- Required Turnover (gallons per minute):

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1. Safety Equipment Checked (Time)							
2. Tank Cleaned / Vacuumed (Time)							
3. Floors / Decks Disinfected (Time)							
4. # of Patrons (Daily)							
5. # of Accidents (Daily)							
6. # of Lifeguards/Attendants (Daily)							
7. Pool Hours (Open/Closed)	/	/	/	/	/	/	/
FILTER							
8. Backwashed (Time)							
9. Gauge Readings (Influent/Effluent)	/	/	/	/	/	/	/
10. Gallons Makeup Water Added							
11. Strainer Gauge Reading							
12. Flowmeter Reading (gpm)/Temp (F)	/	/	/	/	/	/	/
CHEMICALS ADDED (Amount)							
13. Chlorine: _____ Bromine: _____							
14. Soda Ash							
15. Muriatic Acid							
16. Sodium Bicarbonate							
17. Calcium Chloride							
18. Cyanuric Acid (Stabilizer)							
19. Other							
REQUIRED TESTS – DAILY							
20. Combined Chlorine (ppm)							
Enter: Time/Sanitizer Reading/pH	T S pH	T S pH	T S pH	T S pH	T S pH	T S pH	T S pH
21. 1st Test Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
22. 2nd Test Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
23. 3rd Test Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
24. 4th Test Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Enter: Time/Turbidity/Drain Cover On	T Tu DC	T Tu DC	T Tu DC	T Tu DC	T Tu DC	T Tu DC	T Tu DC
25. 1st Observation Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
26. 2nd Observation Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
27. 3rd Observation Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
28. 4th Observation Series	/ /	/ /	/ /	/ /	/ /	/ /	/ /
REQUIRED TESTS – WEEKLY MINIMUM (RECOMMENDED DAILY)							
29. Total Alkalinity							
30. Calcium Hardness							
31. Water Balance pH							
32. Cyanuric Acid (Stabilizer)							
33. Copper							
34. Iron							
35. Total Dissolved Solids (TDS)							

COMMENTS:

CERTIFIED OPERATOR IN CHARGE/ POOL MANAGER / OWNER:

Signature: _____

Printed Name: _____

Operator Number: _____ **Date:** _____

MUST RETAIN THIS FORM FOR THREE (3) YEARS FOR EACH POOL VENUE

INSTRUCTIONS FOR FILLING OUT RECORD FORM

This form is filled out for **each** pool. Some of this information does not change, so keep a blank form filled out for each pool to make copies from. Fill out all applicable blanks **every day** the facility is open or whenever maintenance is done. Keep a copy in the pump room and one in the file. Retain copies for a minimum of **three (3) years**.

Facility Name/Type/Address: Designate the facility name, type, and **physical** address.
(EXAMPLE: Conan's Health Club – Men's Spa; Seabrook Club – East Pool)

Facility Specifications: Enter size of the pool/spa in gallons and minimum flow required for the type of pool.
(480 min/pool, 240/wading pool, 30/spa)

Line 1: Specify time that safety equipment is checked (usually at opening).

Line 2: Specify time that pool/spa is cleaned and/or vacuumed (usually at opening).

Line 3: Specify time that bathhouse floor and/or deck are cleaned and disinfected (usually at opening).

Line 4: Operator's estimate of the total number of persons using the pool/spa that day.

Line 5: Number of accidents. For accidents involving death, drowning, or hospitalization, OSDH must be called **immediately** and a written report submitted within seven (7) days.

Line 6: Number of certified lifeguards on duty during time of maximum load.

Line 7: Specify the times that the pool/spa is opened and closed for use.
(EXAMPLE: 10 am/8 pm).

Line 8: Specify the time the filter is backwashed.

Line 9: Inlet and outlet (influent/effluent) gauge readings prior to backwash.

Line 10: Gallons of make-up water added.

Line 11: Strainer/compound gauge reading.

Line 12: Flowmeter reading and temperature of water.

Line 13: Type and amount of sanitizer in use.

Lines 14-19: Amount of other chemicals added to the pool/spa.

Line 20: Combined chlorine reading taken at closing each day.
(MAXIMUM = 0.2 ppm)

Line 21-24: Enter test readings four (4) times per day.
*(**T** = time, **S** = sanitizer, **pH** = pH)*

Line 25-28: Enter test readings/observations four (4) times daily:

- ***T** = time; **Tu** = turbidity.*
- ***S** = Satisfactory; **M** = Marginal (cloudy water but main drain still visible); **U** = main drain not visible.*
- ***DC** = Main drain cover securely in place.*

Line 29-35: Enter when these are run: Total Alkalinity, Calcium Hardness, and Cyanuric Acid (Stabilizer).
*(Required Weekly – Recommended Daily). Copper, Iron, TDS weekly on **spas only.***

IMMINENT HAZARD ITEMS

Immediate correction or closure is required summarily if **any** of the following are not observed:

- **Turbidity:** Main drain must be clearly visible.
- **Free Available Chlorine** must be 1.0 ppm; **Bromine** 2.0 ppm.
- **pH** must be between 7.2 and 7.8.
- **Main Drain** must be secured.

(This form may be modified as needed to collect necessary information for any operation.)

POOL

Public Swimming Pool Safety Checklist (Monthly)

Month/Year:	**License Number:**
Name of Facility:	
Street Address:	
City, State Zip:	
Name of Operator:	**Phone Number:**

Inspection Items:

Pool & Enclosure

- ☐ Fences-Openings < 4", Good Repair
- ☐ Doors & Gates-Self-Closes, Completely Latches, Good Condition
- ☐ Window/Sliding Glass Door-Open < 4"
- ☐ Deck Equipment—Good Condition
  - o Fasteners and Fittings not corroded
  - o Ladders-Handrail tight, Rungs tight
  - o Starting Blocks-Removed/Disabled
  - o Installed in >5' water depth
- ☐ Deck-Clean, Disinfected, Good Repair, No Puddles, No Carpet/Matting/Wood
- ☐ Skimmers/Gutters/Tile Line-Clean, Good Repair
- ☐ Lighting-Maintained, Adequate
- ☐ Safety Equipment-Provided, Good Repair
  - o First Aid Kit Stocked, Phone Working
  - o Rescue Tubes Provided and Used
- ☐ Test Kit-Clean, Stocked W/Fresh Reagents
  - o Stored in Cook, Dry Location

Recirculation Equipment

- ☐ Pumps/Filter/Disinfectant Feeders Maintained, Good Repair
- ☐ Gauges-Working, Accurate Readings within Parameters
- ☐ Piping-Good Repair, Marked, No leaks

Maintenance Comments:

Lifeguard Supervision:

Use the space below to note any items of interest noted during routine lifeguard supervision, such as: rescue tube use, scanning techniques, alertness, use of sun protection, distractions, rescue incidents, people skills, etc. These notes can be used later for individual coaching or in-service training. Documentation can show behaviors noted and modified for liability and supervision purposes. More complete documentation should be included as needed, in each employee's personnel files.

Date	Comment

Date	Comment

SPA

Public Spa Pool Safety Checklist (Monthly)

Month/Year:	**License Number:**
Name of Facility:	
Street Address:	
City, State Zip:	
Name of Operator:	**Phone Number:**

Inspection Items:

Pool & Enclosure

- ☐ Fences-Openings < 4", Good Repair
- ☐ Doors & Gates-Self-Closes, Completely Latches, Good Condition
- ☐ Window/Sliding Glass Door-Open < 4"
- ☐ Deck Equipment—Good Condition
  - o Fasteners and Fittings not corroded
  - o Stairs-Handrail tight
- ☐ Depth Marking—Easily Readable
- ☐ Deck-Clean, Disinfected, Good Repair, No Puddles, No Carpet/Matting/Wood
- ☐ Spa Basin—In Good Repair
- ☐ Skimmers/Gutters/Tile Line-Clean, Good Repair
- ☐ Lighting—Maintained, Adequate
- ☐ Safety Equipment-Provided, Good Repair
  - o First Aid Kit Stocked, Phone Working
- ☐ Test Kit-Clean, Stocked W/Fresh Reagents
  - o Stored in Cook, Dry Location
- ☐ Spa Temperature- <104°F. (Ideal 102°F, or less)
- ☐ Water Changed-at least monthly, best changed when ("# of bathers" = Volume (gal.) /3)

Recirculation Equipment

- ☐ Pumps/Filter/Disinfectant Feeders Maintained, Good Repair
- ☐ Gauges-Working, Accurate Readings within Parameters
- ☐ Piping-Good Repair, Marked, No leaks

Maintenance Comments:

Fecal Incident Response Recommendations for Aquatic Staff

What do you do when you find poop in the water?



Check for existing guidelines from your local or state regulatory agency before use. CDC recommendations do not replace existing state or local regulations or guidelines.

These recommendations are for responding to fecal incidents in chlorinated aquatic venues (for example, pools and water playgrounds).

Improper handling of chlorine-based disinfectants can cause injury. Follow proper occupational safety and health requirements when following these recommendations. For more pool chemical safety information, visit www.cdc.gov/healthywater/swimming/aquatics-professionals/preventing-pool-chemical-events.html.

CLOSURES: Fecal incidents are a concern and an inconvenience to both aquatic staff and patrons. Aquatic staff should carefully explain to patrons why the aquatic venue needs to be closed in response to a fecal incident. Explaining the reasons for closing the venue (for proper disinfection and protection of swimmer health) is likely to promote patron understanding and minimize their frustration. Closures allow chlorine to do its job—kill germs and help prevent recreational water illnesses (RWIs).

Hot tubs/spas, and some water playgrounds, can have much smaller amounts of water. In response to formed or diarrheal fecal incidents in small-volume venues, it might be more efficient to completely drain as much water as possible from the venue and associated plumbing; scrub and clean all accessible surfaces in contact with contaminated water; replace or clean filter media when appropriate, and refill with uncontaminated water from an approved source (for example, municipal water system).

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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What do I do about...

formed fecal matter (poop) in the water?

Formed fecal incidents pose a risk for spreading germs, including moderately chlorine tolerant *Giardia*. To disinfect the water following a formed fecal incident, aquatic staff should follow the steps below, which are based on killing or inactivating *Giardia*.

Step 1: Close the aquatic venue to swimmers. If you have multiple venues that use the same filtration system—all of the venues will have to be closed to swimmers. Do not allow anyone to enter the venue(s) until the disinfection process is completed.

Step 2: Remove as much of the fecal matter as possible (for example, using a net or bucket) and dispose of the fecal matter in a sanitary manner. Clean and disinfect the item used to remove the fecal matter (for example, after cleaning, leave the net or bucket immersed in the water during disinfection). **VACUUMING FECAL MATTER FROM THE WATER IS NOT RECOMMENDED.**

Step 3: Using unstabilized chlorine (for example, sodium hypochlorite), raise the water's free chlorine concentration to 2 parts per million (ppm), if less than 2 ppm. Maintain free chlorine concentration at 2 ppm and water at pH 7.5 or less for 25–30 minutes.[1] Other concentrations or closure times can be used (see table). State or local regulators may require higher free chlorine concentration in the presence of chlorine stabilizers,[2] which are known to slow the rate at which free chlorine inactivates or kills germs.

Step 4: Confirm that the filtration system is operating while the water reaches and is maintained at the proper free chlorine concentration and pH for disinfection.

Step 5: Allow swimmers back into the water only after the disinfection process has been completed and the free chlorine concentration and pH are within the 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 fecal matter or diarrhea and the free chlorine concentration and pH at the time or observation of the event. Before reopening the aquatic venue, record the procedures followed in response to the fecal incident (including the process used to adjust chlorine concentration and pH [if necessary], the free chlorine concentration and pH, and the disinfection time). You can download a Water Contamination Response Log at **http://www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html**

***Giardia* Kill or Inactivation Time for a Formed Fecal Incident**

Free Chlorine Concentration (ppm)	Disinfection Time[3]
1.0	45 minutes
2.0	25–30 minutes
3.0	19 minutes

1. Ideally, the water temperature should be 77°F (25°C) or higher during the disinfection process.
2. Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.
3. These closure times are based on 99.9% kill or inactivation of *Giardia* cysts by chlorine at pH 7.5 or less and temperature of 77°F (25°C) or higher. The closure times were derived from the U.S. Environmental Protection Agency (EPA) Disinfection Profiling and Benchmarking Guidance Manual. These closure times do not take into account "dead spots" and other areas of poor pool water mixing.

What do I do about...

diarrhea in the water when chlorine stabilizer[1] is NOT in the water?

A diarrheal incident is a high-risk event for contamination caused by *Cryptosporidium* (or "Crypto"), an extremely chlorine-tolerant parasite. Therefore, it is important that aquatic staff educate patrons not to swim when ill with diarrhea. To disinfect the water following a diarrheal incident, aquatic staff should hyperchlorinate, or raise the free chlorine concentration to a high concentration for a long period of time. If necessary, before attempting to hyperchlorinate, consult an aquatic professional to determine the feasibility, the most optimal and practical methods, and needed safety considerations.

Step 1: Close the aquatic venue to swimmers. If you have multiple venues that use the same filtration system—all of the venues will have to be closed to swimmers. Do not allow anyone to enter the venue(s) until the hyperchlorination process is completed.

Step 2: Remove as much of the fecal matter as possible (for example, using a net or bucket) and dispose of the fecal matter in a sanitary manner. Clean and disinfect the item used to remove the fecal matter (for example, after cleaning, leave the net or bucket immersed in the water during hyperchlorination).

VACUUMING FECAL MATTER FROM THE WATER IS NOT RECOMMENDED.

Step 3: Using unstabilized chlorine (for example, sodium hypochlorite), raise the water's free chlorine concentration (see Table below) and maintain water at pH 7.5 or less.[2]

Establish a fecal incident log.
Document each fecal incident by recording date and time of the event, whether it involved formed fecal matter or diarrhea and the free chlorine concentration and pH at the time or observation of the event. Before reopening the aquatic venue, record the procedures followed in response to the fecal incident (including the process used to adjust chlorine concentration and pH [if necessary], the free chlorine concentration and pH, and the hyperchlorination time). You can download a Water Contamination Response Log at **http://www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html**

Step 4: Achieve a concentration × time (CT) inactivation value of 15,300[3] to inactivate or kill Crypto. The CT inactivation value refers to the concentration of free chlorine in parts per million (ppm) multiplied by time in minutes at a specific pH and temperature.

Step 5: Confirm that the filtration system is operating while the water reaches and is maintained at the proper free chlorine concentration and pH for hyperchlorination.

Step 6: Backwash the filter thoroughly after reaching the CT inactivation value. Be sure to discharge directly to waste and according to state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.

Step 7[4]: Allow swimmers back into the water only after the required CT inactivation value has been achieved and the free chlorine concentration and pH are within the operating range allowed by the state or local regulatory authority.

Use the formula below to calculate the time required to inactivate or kill Crypto[5]

Concentration × time (CT) inactivation value	÷	Free chlorine concentration (parts per million [ppm])	Time (in minutes)
15,300	÷	20*	= 765 (or 12.75 hours)
15,300	÷	10	= 1,530 (or 25.5 hours)

1. Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.
2. Ideally, the water temperature should be 77°F (25°C) or higher during the hyperchlorination process.
3. Alternative options could include circulating the water through a secondary disinfection system (for example, ultraviolet light or ozone) to theoretically reduce the number of Crypto oocysts in the aquatic venue(s) below one oocyst/100 mL as outlined in the Model Aquatic Health Code (MAHC) standard 4.7.3.3.2.4 (current edition of the MAHC is available at www.cdc.gov/mahc/currentedition/index.html) or draining the aquatic venue(s).
4. CDC does not recommend testing the water for Crypto after hyperchlorination is completed. Although hyperchlorination destroys Crypto's infectivity, it does not necessarily destroy the structure of the parasite.
5. 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.

* Many conventional test kits cannot measure free chlorine concentrations 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 for use in a standard DPD test kit using chlorine-free water.

What do I do about...

diarrhea in the water when chlorine stabilizer[1] is in the water?

A diarrheal incident is a high-risk event for contamination caused by Cryptosporidium (or "Crypto"), an extremely chlorine-tolerant parasite. Therefore, it is important that aquatic staff educate patrons not to swim when ill with diarrhea. To disinfect the water following a diarrheal incident, aquatic staff should hyperchlorinate, or raise the free chlorine concentration to a high concentration for a long period of time. If necessary, before attempting to hyperchlorinate, consult an aquatic professional to determine the feasibility, the most optimal and practical methods, and needed safety considerations.

Step 1: Close the aquatic venue to swimmers. If you have multiple venues that use the same filtration system—all of the venues will have to be closed to swimmers. Do not allow anyone to enter the venue(s) until the hyperchlorination process is completed.

Step 2: Remove as much of the fecal matter as possible (for example, using a net or bucket) and dispose of the fecal matter in a sanitary manner. Clean and disinfect the item used to remove the fecal matter (for example, after cleaning, leave the net or bucket immersed in the water during hyperchlorination).

VACUUMING FECAL MATTER FROM THE WATER IS NOT RECOMMENDED.

Step 3: Using unstabilized chlorine (for example, sodium hypochlorite), raise the water's free chlorine concentration (see bullets below) and maintain water at pH 7.5 or less.[2]

Step 4: Hyperchlorinate.[3] Chlorine stabilizer slows the rate at which free chlorine inactivates or kills Crypto, and the more stabilizer there is in the water the longer it takes to kill Crypto.

If the cyanuric acid concentration is 1–15 parts per million (ppm)[4]

- Raise the free chlorine concentration to 20 ppm[5] and maintain it for 28 hours or
- Raise the free chlorine concentration to 30 ppm[5] and maintain it for 18 hours or
- Raise the free chlorine concentration to 40 ppm[5] and maintain it for 8.5 hours

If the cyanuric acid concentration is more than 15 ppm, lower the concentration to 1–15 ppm by draining partially and adding fresh water without chlorine stabilizer before attempting to hyperchlorinate.

Step 5: Confirm that the filtration system is operating while the water reaches and is maintained at the proper free chlorine concentration and pH for hyperchlorination.

Step 6: Backwash the filter thoroughly after hyperchlorination has been completed. Be sure to discharge directly to waste and according to state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.

Step 7[6]: Allow swimmers back into the water only after hyperchlorination has been completed and the free chlorine concentration and pH are within the 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 fecal matter or diarrhea and the free chlorine concentration and pH at the time or observation of the event. Before reopening the aquatic venue, record the procedures followed in response to the fecal incident (including the process used to adjust chlorine concentration and pH [if necessary], the free chlorine concentration and pH, and the hyperchlorination time). You can download a Water Contamination Response Log at **http://www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html**

1. Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.
2. Ideally, the water temperature should be 77°F (25°C) or higher during the hyperchlorination process.
3. Alternative options could include circulating the water through a secondary disinfection system (for example, ultraviolet light or ozone) to theoretically reduce the number of Crypto oocysts in the aquatic venue(s) below one oocyst/100 mL as outlined in the Model Aquatic Health Code (MAHC) standard 4.7.3.3.2.4 (current edition of the MAHC is available at www.cdc.gov/mahc/currentedition/index.html) or draining the aquatic venue(s).
4. Murphy JL, Haas CN, Arrowood MJ, Hlavsa MC, Beach MJ, Hill VR. Efficacy of chlorine dioxide tablets on inactivation of *Cryptosporidium* oocysts. Environ Sci Technol. 2014;48(10):5849–56.
5. Many conventional test kits cannot measure free chlorine concentrations 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 for use in a standard DPD test kit using chlorine-free water.
6. CDC does not recommend testing the water for Crypto after hyperchlorination is completed. Although hyperchlorination destroys Crypto's infectivity, it does not necessarily destroy the structure of the parasite.

Creating a State of Health

PROTECTIVE HEALTH SERVICES

Oklahoma State Department of Health
Consumer Health Service
PO Box 268815
OKC, OK 73126-8815
Telephone: (405) 271-5243
FAX: (405) 271-5286

PUBLIC BATHING PLACE - INCIDENT REPORT FORM

Please check the type of incident (mark all that apply): ☐ **Injury** ☐ **Contamination**

In the event of a **DROWNING or HOSPITALIZATION**, call your local county health department or Consumer Health **IMMEDIATELY** after the incident is handled with local medical authorities.
Outside of business hours M-F / 8-5, leave a message with local health (if available) or Consumer Health (405-271-5243).

INJURY INCIDENT

Injury Type: ☐ Drowning Resulting in Death ☐ Recovered Drowning ☐ Hospitalization ☐ Other:_____

Name of Person Injured:_____ Age:_____

Was the Injured Person a: ☐ Bather ☐ Observer

Parent/Guardian Name:_____

Contact Number:_____ &/or Email:_____

Address:_____

****

Actions Taken (mark all that apply):

☐ Contacted 911 or other ER #:_____ Who Called:_____ Time of Call:_____

☐ CPR Performed; Who Performed:_____ Time Started:_____

☐ Time of Emergency Medical Services Arrival:_____ or ☐ Patient Refused Assistance

Attach a Brief Summary of Incident (person(s) on duty/location/other witnesses and contact information; type of injury/reasons injury may have resulted).

CONTAMINATION INCIDENT

Contamination Type (mark all that apply): ☐ Fecal-Solid ☐ Fecal-Watery ☐ Vomit ☐ Blood ☐ Other:_____

Area(s) Contaminated (mark all that apply): ☐ Water* ☐ Deck ☐ Bathhouse ☐ Other:_____

*If separate pump systems, list pool contaminated:_____

****

Actions Taken (mark all that apply):

☐ Closed Facility: Time Closed:_____ Sanitizer levels at time of incident:_____

☐ Pool/Spa Treated: ☐ Chemical (type/amount):_____ ☐ Filter Cleaned

☐ Area Cleaned ☐ # of Complete Turnovers before Opening: #_____

☐ Measurements: pH:_____ CYA:_____ Temp:_____ Chlorine (ppm):_____

☐ Water Drained ☐ Facility Reopened: Time:_____ Date:_____

Attach a Brief Summary of Incident (person(s) on duty/location/other witnesses and contact information; etc.).

Certified Pool Operator Name:_____ Phone#: _____

CPO Signature: _____ Date: _____

Mail a copy of final report to local county health department within seven (7) days of incident.

Pool Operator Training – 2018

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