Nebraska Swimming Pool Operator Clinic

NEBRASKA

DEPT. OF ENVIRONMENT AND ENERGY

Clinic Outline

- **Healthy Swimming**
- **Rules and Regulations**
- **Circulation and Filtration**
- **Water Treatment**
- **Water Chemistry**
- **Water Testing Methods**
- **Spas**

Healthy Swimming

Chlorine Enemies

- Environmental
  - Street and work place dust, pollen, air pollutants, animals droppings
  - Insects, leaves, grass clippings
  - Sun/heat
    - For every 10° F above 80° F, twice as much chlorine is needed in the pool to maintain adequate free chlorine level (Sciencing.com, Scientific American)

Healthy Swimming

Chlorine Enemies

- Fecal residue
- Body grime and dead skin
- Body discharges
  - Mucous, saliva, sweat, urine
- Public bathers
- Body lotions and creams
- Personal care products
- **Shower WITH SOAP before entering the pool!**

Healthy Swimming

Watch bathers for:

- Sore or inflamed eyes
- Colds
- Nasal or ear discharge
- Boils, or other obvious skin or body infections, or wounds

- **EXCLUDE THEM FROM THE POOL**

Healthy Swimming

- Common waterborne germs can cause
  - Eye infection
    - Conjunctivitis (pinkeye)
  - Ear infections
  - Skin infections
  - Respiratory infections
  - Gastrointestinal


Medical exam prep

Healthy Swimming

Emergence of Waterborne Diseases

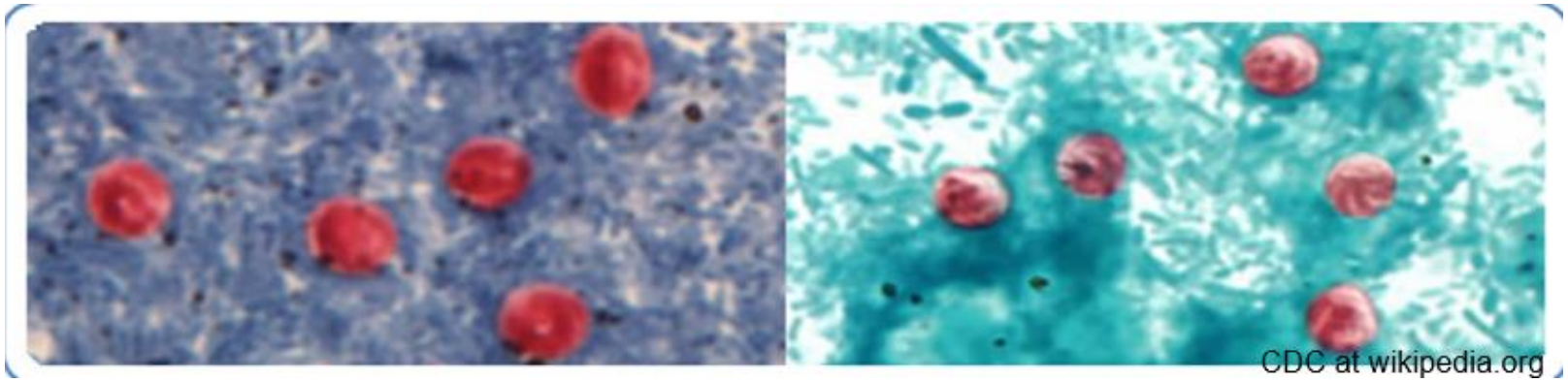
- Serious illness in healthy people
- Life threatening for high risk population
  - Elderly
  - People in poor health
  - Pregnant women
  - Young children

- MRSA – Methicillin Resistant Staphylococcus Aureus
- *Cryptosporidium*
- *Shigella*
- *E. coli*
- *Giardia*
- *Hepatitis A*
- *Legionella*

Healthy Swimming

Infectious Doses

	Healthy Adult	Toddler
• *Salmonella*	1000	100
• *Shigella* and *E. coli*	100	10
• *Cryptosporidium*	10	1



Healthy Swimming

Microbe Inactivation Time

With levels of 1 ppm chlorine at 7.5 pH

Microbe	**Time to Inactivate**
E. coli, bacteria	Less than 1 minute
Hepatitis A, virus	About 16 minutes
Cryptosporidium, parasite	15,300 minutes or 10.6 days

"Fecal Incident Response Recommendations for Pool Staff" www.cdc.gov/healthyswimming (June 22, 2018)

Healthy Swimming

Legionnaires Disease (type of Pneumonia)

- Caused by a germ called *Legionella*.
- *Legionella* is naturally found in water-especially warm water. Hot tubs or Spas that are not cleaned and properly disinfected, can become contaminated with *Legionella*.
- A person can get infected when they breathe in steam or mist from a contaminated hot tub/spa.
- Making sure the hot tub/spa has the proper disinfectant and pH levels are essential.

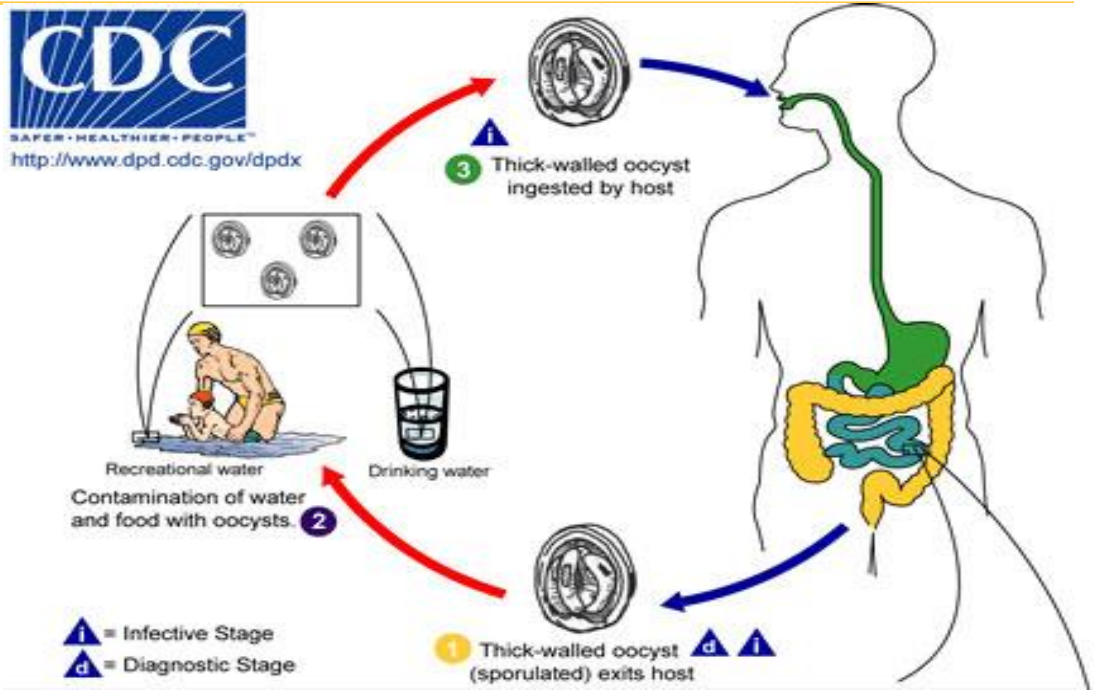
Webmd.com

Healthy Swimming

Cryptosporidium

Cryptosporidium is a parasite that causes diarrhea. This parasite has a tough outer shell that allows it to survive for a long time in the environment. It can survive for days, even in a properly disinfected pool or spa.

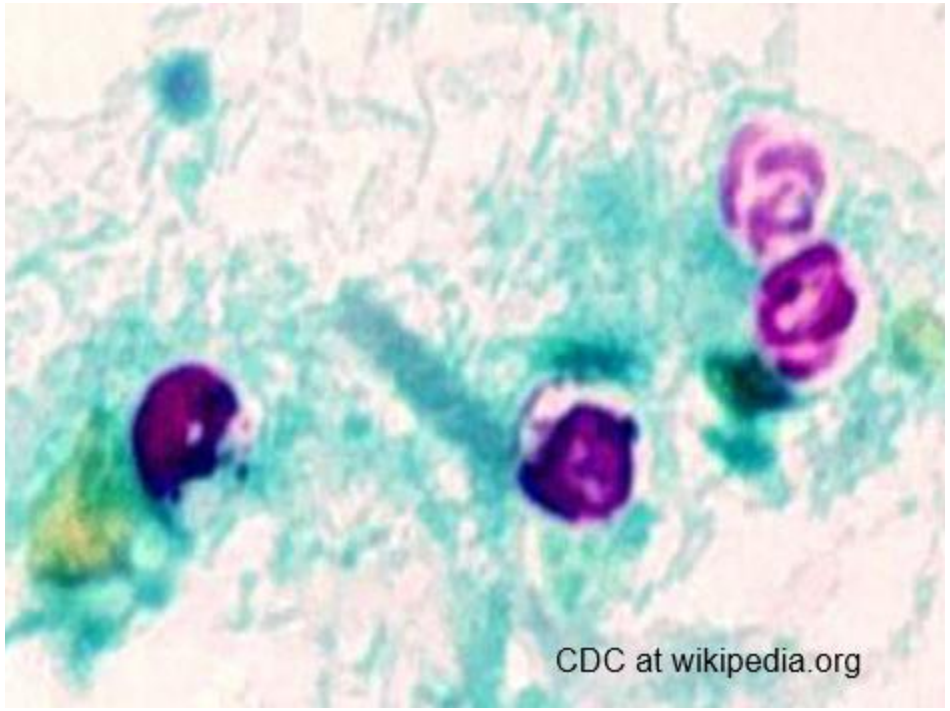
- *Cryptosporidium* is highly resistant to chlorine. Swallowing just a small amount of water infected with Crypto can make healthy kids and adults sick for weeks with diarrhea, nausea and vomiting. (CDC's Healthy Swimming Program)



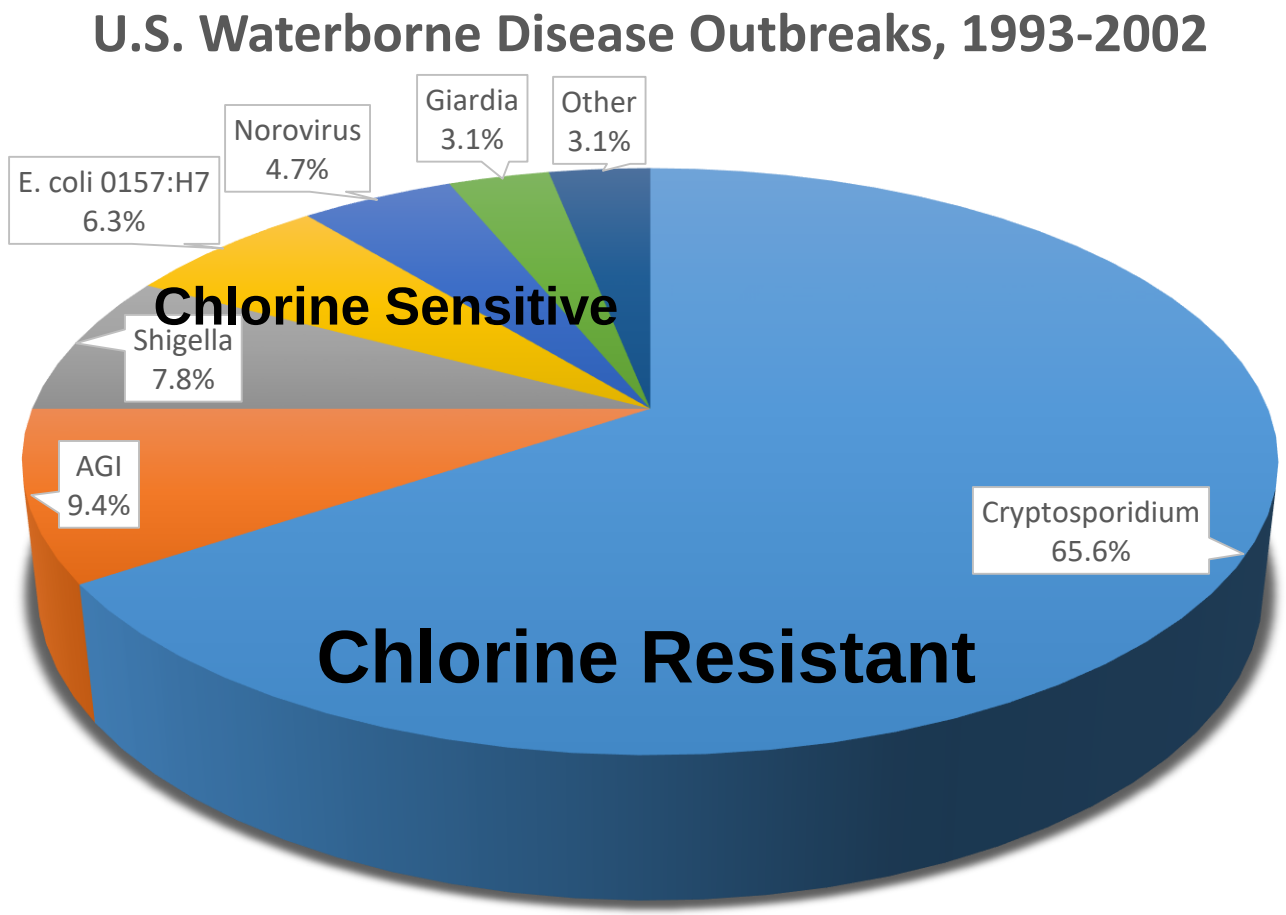
Healthy Swimming

Cryptosporidiosis Outbreaks

- Outbreaks of *Cryptosporidium* in the U.S. increased an average of 13% each year from 2009-2017
- For the same time period, the number of outbreaks of *Cryptosporidium* reached 444
- 35% of outbreaks linked to treated swimming water (CDC's Morbidity and Mortality Report)



Healthy Swimming



MMWR (2004) 50:1-15

Healthy Swimming

- According to a report from the Centers for Disease Control and Prevention, between 2000-2014, there were 493 disease outbreaks reported from public swimming pools and hot tubs.

- In all, more than 27,200 people in that 14 year period became ill after swimming in contaminated water.

- The study of the outbreaks was across 46 States. Eight people died.

Healthy Swimming

One diarrhea accident can release large amounts of contaminated material into a pool or spa….

AND MILLIONS OF DANGEROUS GERMS!

www.cdc.gov/healthyswimming

- Every pool or spa needs an established procedure when fecal accidents occur
- CDC Guidelines

Healthy Swimming

Non-stabilized Pool (no stabilizer present-example-calcium hypochlorite)

Fecal accident response (diarrheal stool)*

- Direct everyone to leave the pool, close pool
- Remove as much fecal material as possible
- Raise chlorine to 20 ppm and maintain pH 7.2-7.5
- Maintain chlorine at 20 ppm for 13 hours**
- Backwash filter
- Return chlorine to normal operating range before re-opening facility

* CDC recommendations (www.cdc.gov/healthyswimming)

** Or any combination of chlorine level and time to meet a CT of 15,300

CT = Concentration x time

Healthy Swimming

Stabilized Pool (contains cyanuric acid) >15 ppm

Fecal accident response (diarrheal stool)*

- Direct everyone to leave the pool, close pool
- Remove as much fecal material as possible
- Lower concentration to 1-15 ppm by draining partially and adding fresh water without chlorine stabilizer before attempting to hyperchlorinate
- Maintain pH of 7.5 or less
- Maintain chlorine:
  - 20 ppm for 28 hours or
  - 30 ppm for 18 hours or
  - 40 ppm for 8.5 hours
- Backwash filter
- Return chlorine to normal operating range before re-opening facility

* CDC recommendations (www.cdc.gov/healthyswimming)

Healthy Swimming

Stabilized Pool (contains cyanuric acid) 1-15 ppm

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* CDC recommendations (www.cdc.gov/healthyswimming)

Healthy Swimming

Fecal accident response (formed stool)*

Should you treat a formed fecal accident as if it contains *Cryptosporidium*?

NO!!

- Direct everyone to leave the pool. Pool is temporarily closed.
- Remove as much fecal material as possible. Do not vacuum.
- Ensure chlorine is at least 2 ppm and pH 7.2-7.5
- Maintain those levels for at least 25 minutes before re-opening.
- Document each fecal incident in your log book.

* CDC recommendations (www.cdc.gov/healthyswimming)

Healthy Swimming

How should you treat a vomit accident?

Same as a Formed Stool?

YES!!

Vomit accident response*

- Temporarily close. Everyone out of the pool
- Remove as much material as possible
- Ensure chlorine is at least 2 ppm and pH 7.2-7.5
- Maintain those levels for at least 25 minutes before re-opening

* CDC recommendations (www.cdc.gov/healthyswimming)

Healthy Swimming

Adding it all up

Chlorine resistant germs

+

Poor pool maintenance

+

Young people with diarrhea

+

Bathers swallowing pool water

=

Increased Risk of Outbreaks

Healthy Swimming

Sum of all the parts:

Eliminate/reduce risk

Don’t Drink the Pool Water!

Healthy Swimming

Surveillance data

State of the pools/spas:

Highest percentage of violation

Greatest risk of contamination:

Kiddie/Wading Pools

Healthy Swimming

Rules & Regulations

http://dee.ne.gov/NDEQProg.nsf/OnWeb/SP

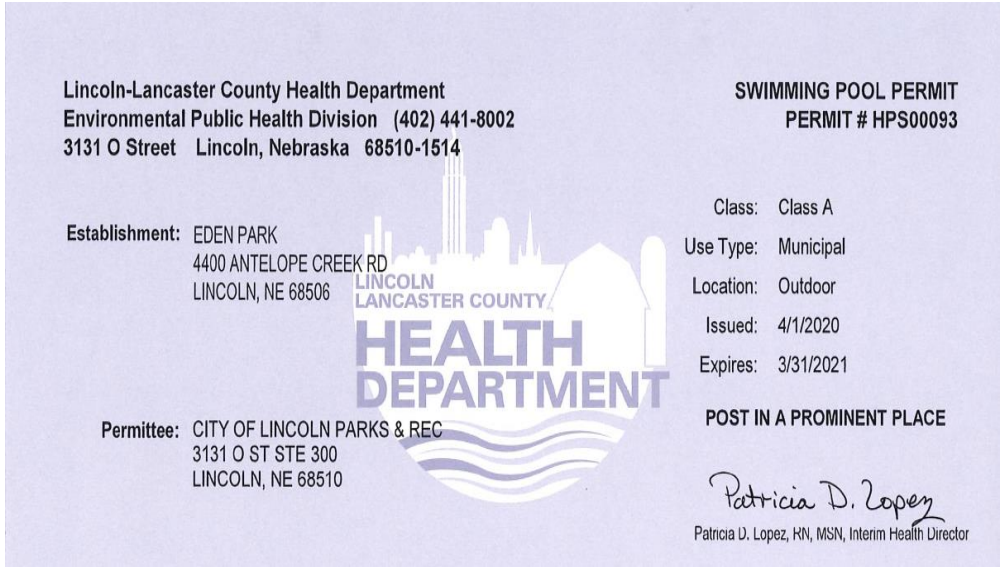
Title 178 Chapter 2, Design, Construction, Operation and Maintenance of Public Swimming Pools

The purpose is to prevent and reduce:

- Disease transmission
- Drowning or near-drowning
- Injuries

Rules & Regulations

- No public pool shall operate without a permit from NDEE
  - Local permits may also be required
- Permits are valid for one year



Lincoln-Lancaster County Health Department
Environmental Public Health Division (402) 441-8002
3131 O Street Lincoln, Nebraska 68510-1514

SWIMMING POOL PERMIT
PERMIT # HPS00093

Establishment: EDEN PARK
4400 ANTELOPE CREEK RD
LINCOLN, NE 68506

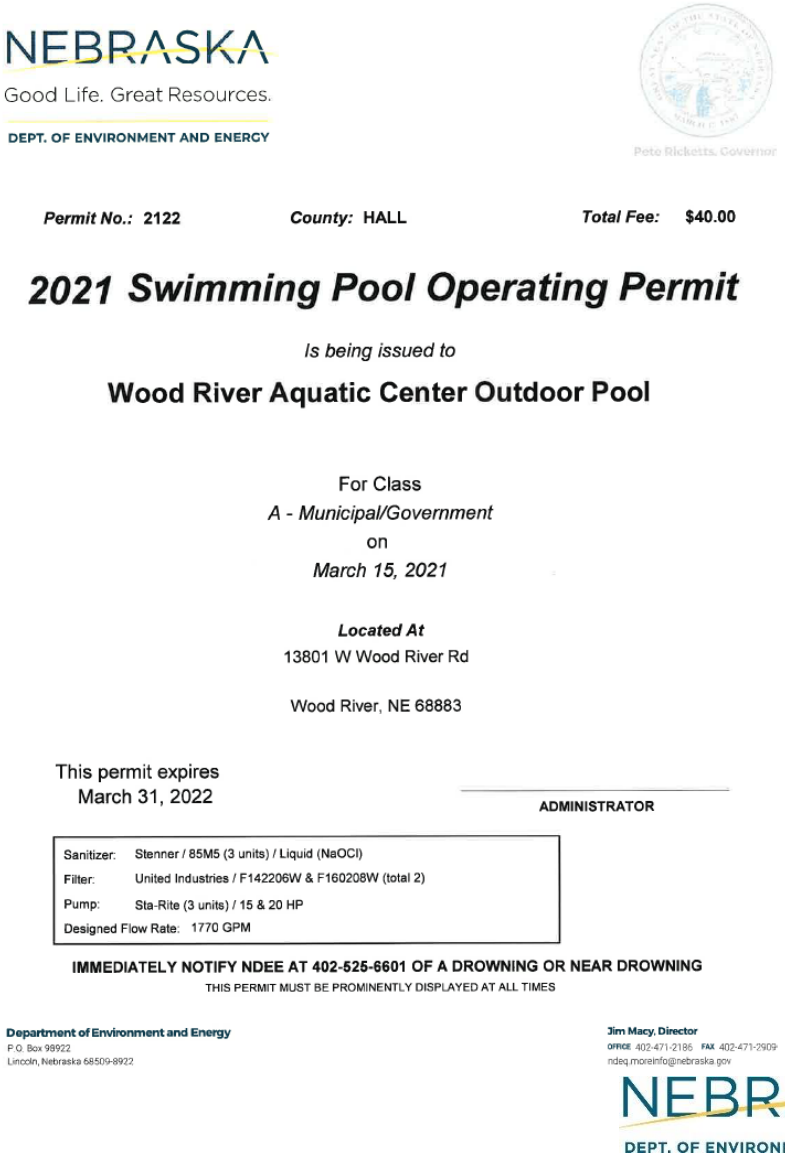
Class: Class A
Use Type: Municipal
Location: Outdoor
Issued: 4/1/2020
Expires: 3/31/2021

POST IN A PROMINENT PLACE

Permittee: CITY OF LINCOLN PARKS & REC
3131 O ST STE 300
LINCOLN, NE 68510

Patricia D. Lopez

Patricia D. Lopez, RN, MSN, Interim Health Director



NEBRASKA
Good Life. Great Resources.
DEPT. OF ENVIRONMENT AND ENERGY

Pete Ricketts, Governor

Permit No.: 2122 *County:* HALL *Total Fee:* $40.00

2021 Swimming Pool Operating Permit

Is being issued to

Wood River Aquatic Center Outdoor Pool

For Class
A - Municipal/Government
on
March 15, 2021

Located At
13801 W Wood River Rd

Wood River, NE 68883

This permit expires
March 31, 2022

ADMINISTRATOR

Sanitizer: Stenner / 85M5 (3 units) / Liquid (NaOCl)
Filter: United Industries / F142206W & F160208W (total 2)
Pump: Sta-Rite (3 units) / 15 & 20 HP
Designed Flow Rate: 1770 GPM

IMMEDIATELY NOTIFY NDEE AT 402-525-6601 OF A DROWNING OR NEAR DROWNING
THIS PERMIT MUST BE PROMINENTLY DISPLAYED AT ALL TIMES

Department of Environment and Energy
P.O. Box 99922
Lincoln, Nebraska 68509-8922

Jim Macy, Director
OFFICE 402-471-2186 FAX 402-471-2909
ndeq.moreinfo@nebraska.gov

NEBRASKA
DEPT. OF ENVIRONMENT AND ENERGY

Rules & Regulations

- **Class A:** Pools operated by political subdivisions, governmental agencies, municipalities, and any other pool operated for the purpose of public swimming
- **Class B:** Pools operated by hotels, motels, apartments, country clubs
- **Class C:** Spas
- **Class D:** Wading pools (stand alone) - not more than 24 inches deep and has has a separate recirculation system
- **Class E:** Spray parks - with separate recirculation system
- **Class F:** Health clubs, fitness centers, community fitness centers

Rules & Regulations

NDEE and **LLCHD** requires that all Class A pools to have a certified pool operator onsite whenever the pool is open.

NDEE requires Class B and F pools plus Class C (spas) to have a certified pool operator available within 60 minutes.

LLCHD requires that all pools (except Class A) have a certified pool operator available within 60 minutes.

DCHD requires all pools and spas to have a certified pool operator onsite whenever the pool or spa is open.

NDEE—Department of Environment and Energy

LLCHD—Lincoln/Lancaster County Health Department

DCHD—Douglas County Health Department

Rules & Regulations

Certified Pool Operator responsibilities

- Take online course and exam. Print certificate and keep on hand.
- Code compliance (must follow the rules!) Responsible for Title 178 Chapter 2
- Pool & user safety/supervising users
- Correctly operating disinfectant and recirculation systems---while following proper Labor law requirements
- Testing pool water (verify water quality)**

**LLCHD requires pool testers to be certified

Pinterest.com

Rules & Regulations

CPR & Pool Safety: It's Not Just For Lifeguards

- While certified lifeguards and swim teachers are required to learn CPR, they aren't the only ones who should be educated in pool safety.
- The large majority of America's pools – both public and private – are *not* supervised by lifeguards.
- This means the onus is on you and other supervising adults and teens to learn CPR.
- The CDC reminds us that, "seconds count," when it comes to saving a life, which is why it's so important to learn CPR. **Immediate, hands-on CPR performed by bystanders until EMTs or other emergency personnel arrive to the scene can make all the difference** when it comes to preventing an unintentional death by drowning. (*The Response Institute)*

Rules & Regulations

Emergency contact numbers all hours:

- NDEE – 402-525-6601
- Douglas County – 402-444-7000
- Lancaster County – 402-441-8000

Notify the Department IMMEDIATELY (day or night) in the event of a:

- Drowning - death occurs
- Near-drowning – "survival after suffocation caused by submersion in water" (medical-dictionary.com)
  - **An inspection will be done same day or within 1 business day of notification**

Notify the Department within 24 hours for accidents requiring hospitalization or medical treatment

Rules & Regulations

Class A Facilities:

- Must **conduct and document drills** in handling emergencies
- Within 30 days of season opening
- Within 30 days with new employees
- Pools operating year round or more than 6 months per year must conduct emergency drills at least once every 6 months

Rules & Regulations

Lifeguard qualifications

- Completed nationally recognized course for lifeguards
- CPR certification portion – **must be renewed annually**
- Lifeguard/CPR certifications must be **onsite, available and organized**

Check the following website for Federal child labor laws:

http://www.dol.gov/whd/regs/compliance/whdfs60.htm

Rules & Regulations

Lifeguard requirements

- The # required is determined by the # of swimmers and/or the surface area
  - One lifeguard per 100 bathers or 2,000 square feet of water surface area, whichever is the lesser number
  - Class B and F pools which elect to have a lifeguard on duty, must provide a lifeguard chair for each 2,000 square feet of water surface area
  - Sufficient lifeguards on duty to allow for periodic rest breaks
  - Lifeguards must be in position to view all areas of the pool he/she is responsible for watching
  - Distinguishing swimsuits or emblem must be worn

Pinterest.com

Rules & Regulations

Lifeguards

- Water slide requirements
  - Within 50 feet of discharge
  - 3 slide maximum
  - Guard only the slide area
- Lifeguard chairs must be properly located so that guard is not required to protect an area greater than 180 degrees

Rules & Regulations

Lifeguards are <u>not</u> required for

- Swim meets
- Swim classes

Spmasterswim.org

Rules & Regulations

Safety Equipment:

Class A pools ONLY

- Must have a backboard with three straps
- Rescue tube
  - Within arm's reach
  - 6 foot long strap/tow rope
  - <u>GOOD REPAIR - free of any damage</u>

Source: NDEE

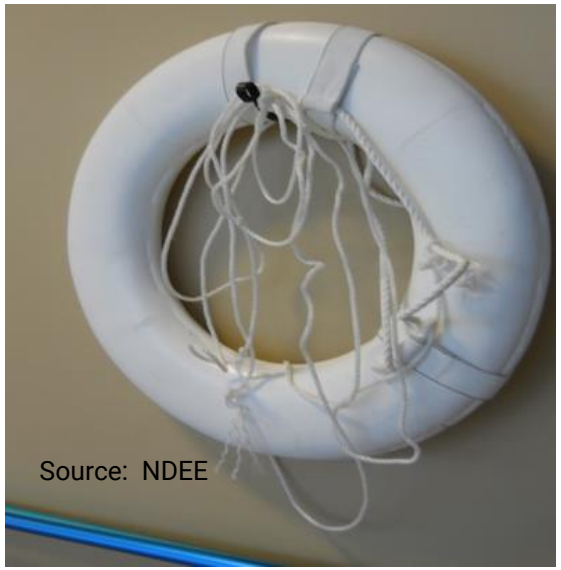
Swimoutlet.com

Rules & Regulations

Class B and F pools

- A rescue tube or ring buoy
- Shall be equipped with a rope as long as the width of the pool
- A shepherd's crook at least 12 feet long
- Lifesaving equipment must be mounted in conspicuous, accessible place. **In good repair and ready condition**

Poolweb Supplies



Source: NDEE

Rules & Regulations

Telephones:

An accessible working telephone with emergency numbers posted:

- 9 + number if needed
- Include name and address of facility

Source: NDEE

Rules & Regulations

First Aid Kit

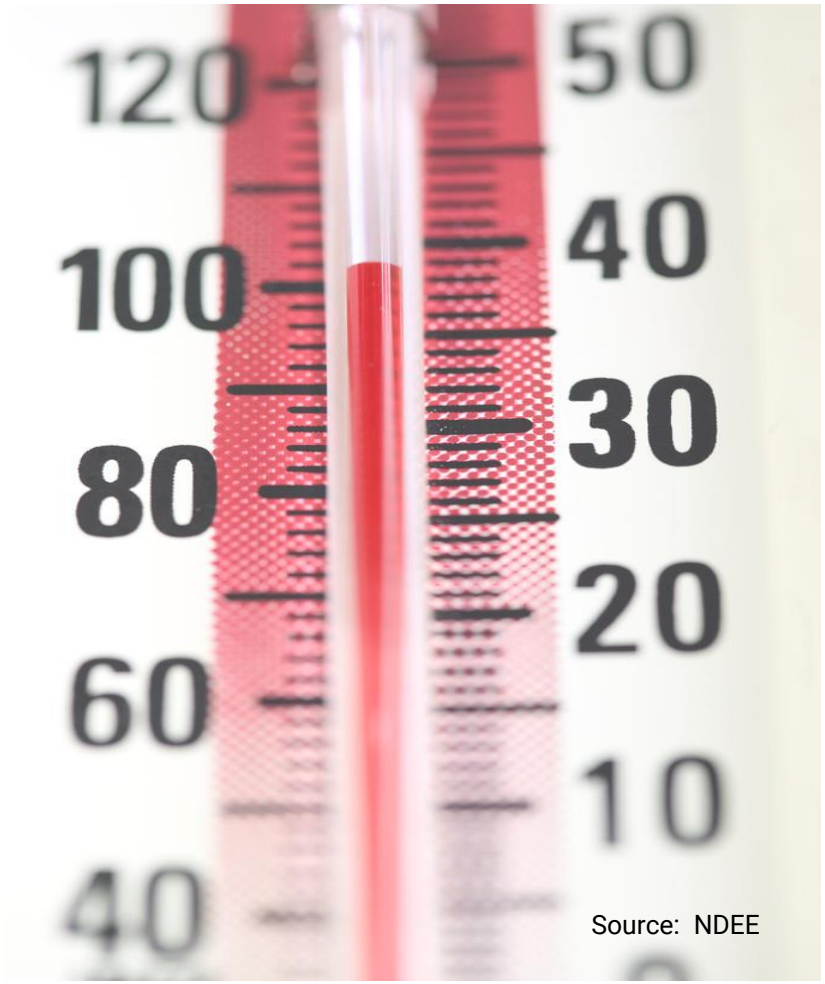
- Class A pools must have all items listed in regulations (Title 178 Chapter 2, 2-005.01 #7)
- All other pool classifications need a basic first aid kit

Source: NDEE

Rules & Regulations

A bathhouse is required for Class A pools:

- Disinfected daily
- Checked periodically
- Liquid soap (not bar soap) and paper towels provided
- Hot water between 90° F and 115° F
- 90° F to 105° F - single temp showers (showers with pull chains)



Source: NDEE

Rules & Regulations

- ALL pools must have ground fault circuit interrupts (GFCI) outlets
- Water, electricity and people in close proximity
- 23 deaths from 2002-2014 from electrocutions (Cpsc.gov)
- Raleigh, N.C. - 17 year old Lifeguard lost her life in 2016 after she was electrocuted. Electric company failed to replace faulty wiring (Newsobserver.com)

U.S. Consumer Product Safety Commission

Rules & Regulations

Indoor pools require:

- A **properly working** CO detector if a gas or propane heater is used
  - In the pool area
  - In the mechanical room

Outdoor Pools:

- A **properly working** CO detector is also required in any other enclosed mechanical room where there is a gas or propane fueled heater

Rules & Regulations

SANITIZER LEVELS FOR WATER QUALITY IN POOLS

- Pools shall be maintained at a MINIMUM of 2.0 ppm and MAXIMUM of 10.0 ppm free chlorine **
- Pools shall be maintained at a MINIMUM of 2.0 ppm and MAXIMUM of 18.0ppm bromine **

** IMMEDIATE closure items

Rules & Regulations

SANITIZER LEVELS FOR WATER QUALITY IN SPAS

- Spas shall be maintained at a MINIMUM of 3.0 ppm and MAXIMUM of 10.0 ppm free chlorine **
- Spas shall be maintained at a MINIMUM of 4.0 ppm and MAXIMUM of 18.0 ppm bromine **

** IMMEDIATE closure items

Rules & Regulations

Other Water Quality Levels:

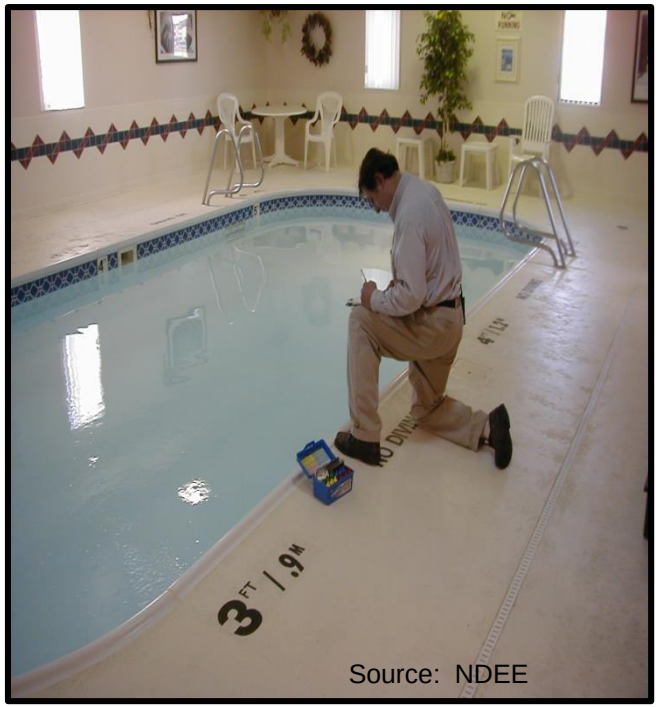
- pH shall be maintained between 7.2-7.8 **
- Combined chlorine shall not exceed 0.5 ppm **

  (if chlorine is used as the disinfectant)
- Cyanuric acid (if using stabilizer) exceeding maximum level of 90 ppm ** (50 ppm for LLCHD and DCHD)
- Total alkalinity shall be no less than 80 ppm

** IMMEDIATE closure items

Rules & Regulations

- Test the sanitizer and pH levels multiple times daily
  - **Verify/record levels before pool opening**
  - **Every 4 hours until closing**
- Test total alkalinity, combined chlorine and cyanuric acid (if using stabilizer) weekly
- Must be recorded on log sheet provided by NDEE
- Requirements for keeping log sheets may vary. Check with local health departments for requirements

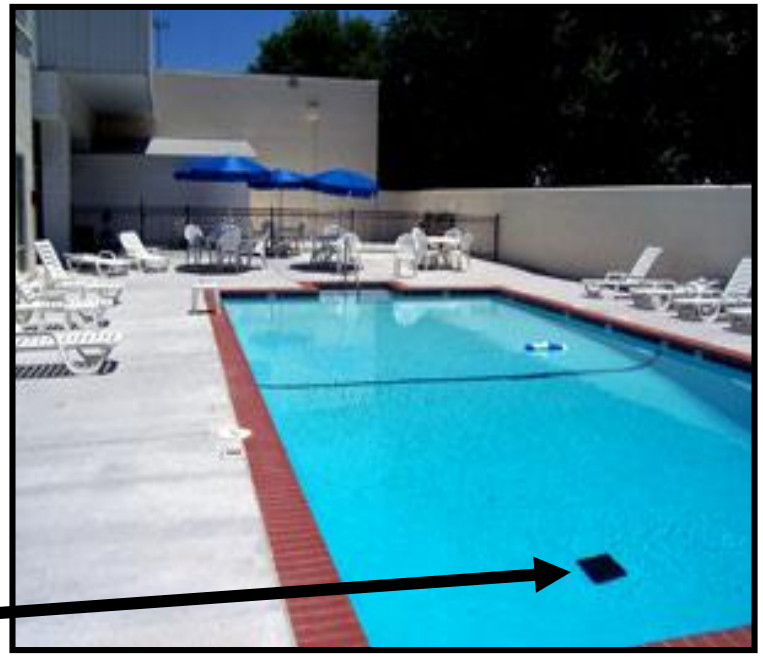


Source: NDEE

Rules & Regulations

Water Clarity

- Water must be free of floating and suspended materials
- Water must be sufficiently clear at all times so the main drain cover or grate is easily visible in the deepest portion of the pool/spa
- **If the drain/grate is not clearly visible, the whole pool/spa must be closed**



Source: NDEE

Rules & Regulations

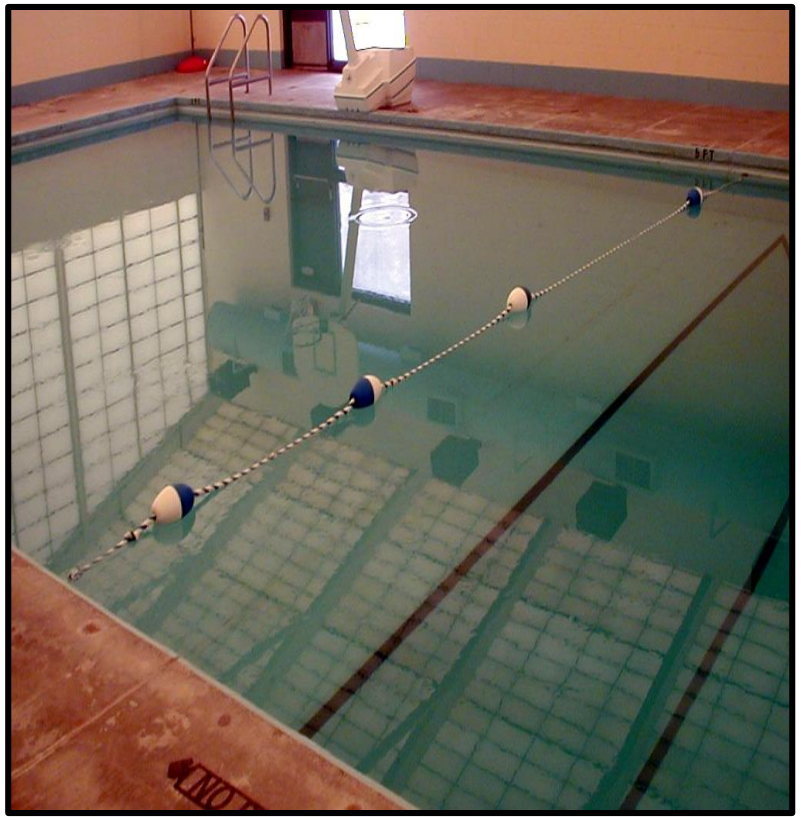
Pool Depth Boundaries

The boundary between the deep and shallow must be clearly marked by:

- A Line 4 inches wide on floor and up both sides of the pool walls

  AND ALSO

- A safety rope
  - Rope may be removed during lessons, swim meets and lap swim if group is supervised

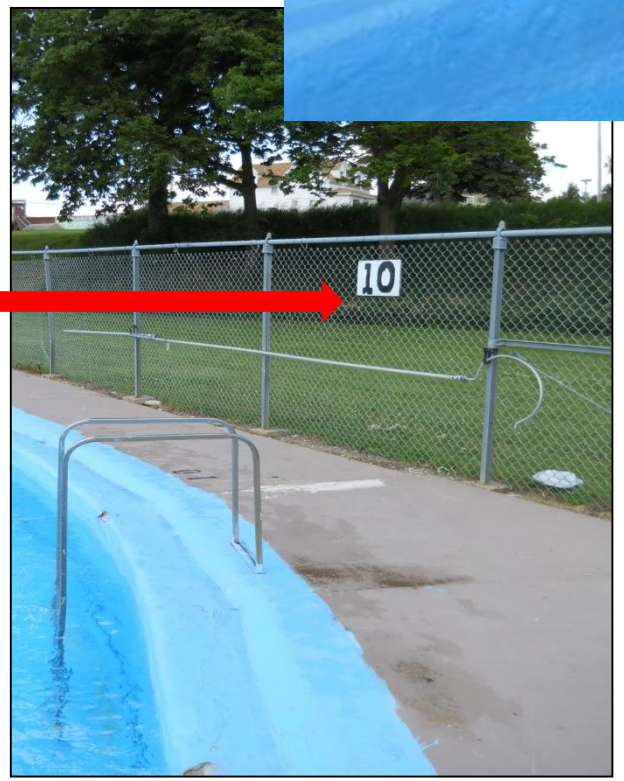


Source: NDEE

Rules & Regulations

Depth Markings

- Depth markers on tub walls and deck required every 25 feet
- Depth markers must be plainly visible while in the pool
- Pools with gutter systems may locate depth markers on interior walls or fence
- **4 INCH SIZE LETTERS/NUMBERS**

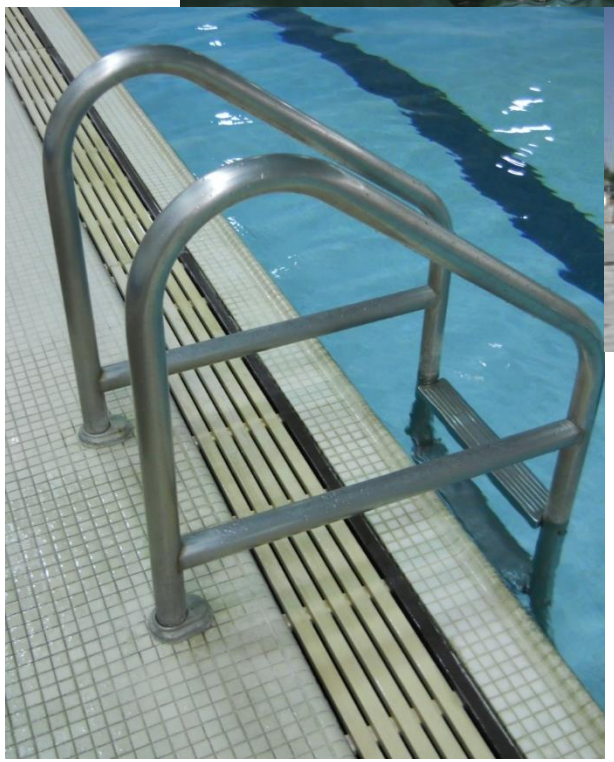


Source: NDEE

Rules & Regulations

Pool Fixtures/Condition

- Maintain the pool tub
  - Smooth tub surfaces
  - Cracks caulked
- Hand rails/ladders must be secure - do not pull out of pool deck
- Ladders equipped with slip-resistant treads - these require maintenance



Source: NDEE

Rules & Regulations

Pool Decking

- Pool deck must be in good repair with:
  - No crack over ¼-inch
  - No tripping hazards over ½-inch
  - No low spots for standing water
- Decks free of bags to allow room for emergency person to reach victim
- Facilities in poor repair may result in slips or falls which can often cause injury and subsequent lawsuits

Rules & Regulations

Facility Fencing/Enclosures

The pool shall be completely enclosed:

- Fence height of at least 6 feet in height
- No gaps/openings greater than 4 inches
- During hours of operation, unsupervised entrance areas/gates must not be locked but self-closing and self-latching
- ****Self-closing/self-latching gate****
- Recommended latch height at 48 inches

** IMMEDIATE closure item

Rules & Regulations

Pool/Spa Signage

- At Class B, C, D, E and F pools where Lifeguard service is not continuously provided, a warning sign must be placed in clear patron view that states: “WARNING—NO LIFEGUARD ON DUTY” in at least 4 inches letters and “CHILDREN UNDER THE AGE OF 16 MUST NOT USE THE POOL WITHOUT AN ADULT IN ATTENDANCE” in letters at least 2 inches
- Class C (spas) must also display signage that states: “NO ONE UNDER THE AGE OF 5 YEARS IS PERMITTED IN THE SPA”

Source: NDEE

Rules & Regulations

Signage **ALL POOLS**

- Pool Regulations/Rules sign must be conspicuously posted in the swimming pool areas
- “POOL REGULATIONS” must be in 4 inch letters
- Per State Regulations, the bullet points shown on this sign must be stated and displayed

Compliance Signs

Rules & Regulations

Signage **ALL POOLS**

- "Authorized Personnel Only" **must be displayed** on chemical storage rooms
- Storage rooms **must be locked at all times (when unoccupied)**

Source: NDEE

Rules & Regulations

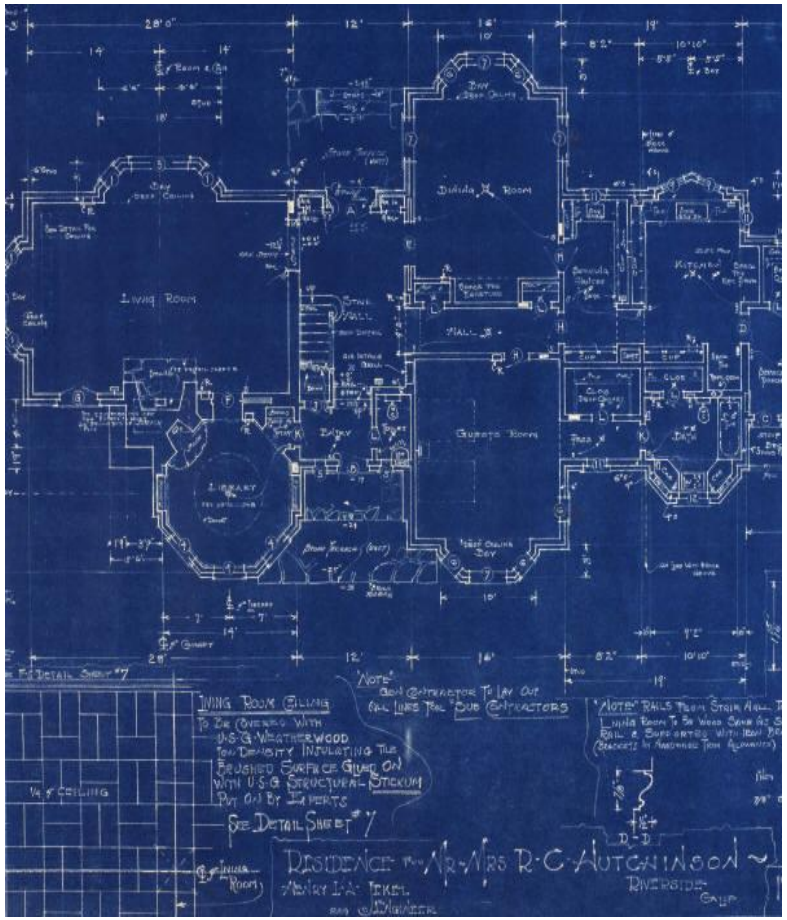
- No food or drinking permitted in the pool itself
  - Water is allowed in unbreakable containers
- Food and drink allowed in unbreakable containers in designated area only

Rules & Regulations

Pool Construction

Plans and specifications for new or reconstructed pools

- Must be prepared by a Nebraska licensed engineer or architect
- Submitted to Nebraska NDEE prior to construction
- Additional $1000 for as-built plans
- In-kind replacement does not apply to diving boards installed before June 8, 2004



Rules & Regulations

Pool Construction/ADA Standards

- Plans and specs MUST be submitted only if **structural modifications** to the pool are being made
    - Stairs, ramps, transfer walls/stairs
- NO plans and specs required for a lift, temporary stairs or ramps

Aquatrek2.com

Rules & Regulations

Pool Construction/ADA Requirements

ADA requires that facilities be readily accessible to, and usable by, individuals with disabilities.

www.ada.gov/pools_2010.htm

800-872-2253 ADA technical help line

Amica Medical Supply

Rules & Regulations

Reasons to close a pool:

1. Sanitizer is not within required range
2. Combined chlorine exceeds maximum level
3. pH is not within required range
4. Cyanuric acid exceeds maximum 90 ppm
5. Pool drain cover is not clearly visible
6. Accessible working phone with emergency numbers posted
7. Safety equipment is not available
8. Lifeguards are not present
9. Pool operator is not present or available
10. Weather conditions are threatening
11. A fecal accident has occurred
12. Excessive dirt, floating matter or objects in pool
13. Gate/door to pool is not self-closing and self-latching

Circulation & Filtration

- **Circulation** is a closed system in which water is removed and returned to the pool
  - Proper pool circulation is a key to maintaining a healthy pool environment

- **Filtration** is the physical removal of particles through a filtration media

Circulation & Filtration

Circulation requirements

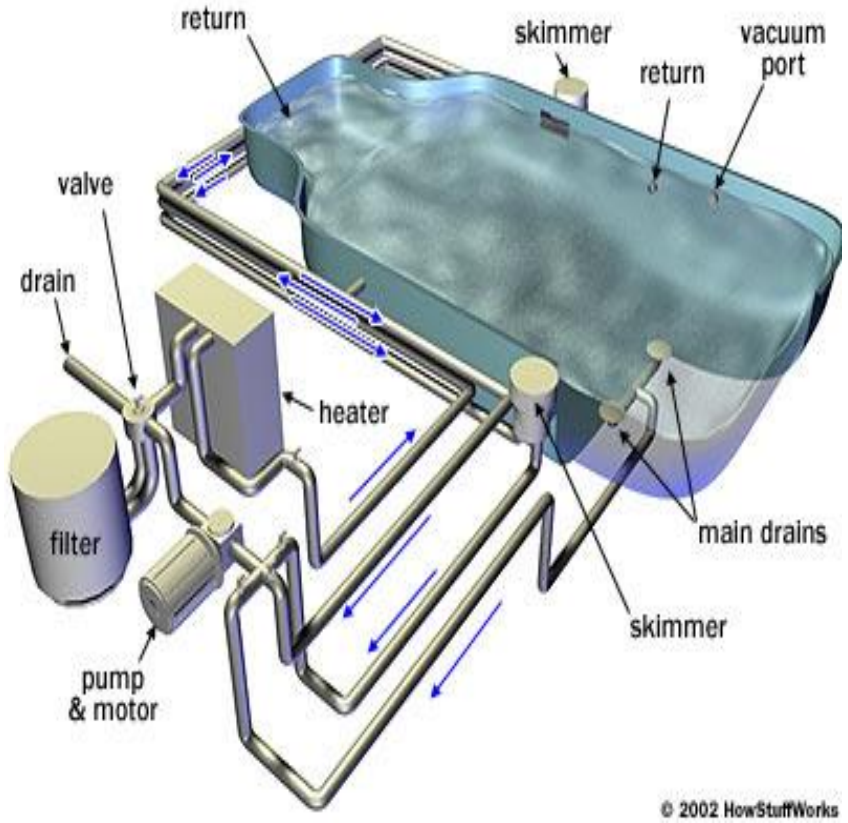
- Operate 24 hours a day
  - Effective sanitizer dilution
  - Proper sanitizer distribution

- The 3 C’s of Pool Care
  - Circulation
  - Chemicals
  - Cleaning (Swimuniversity.com)

Circulation & Filtration

Circulation

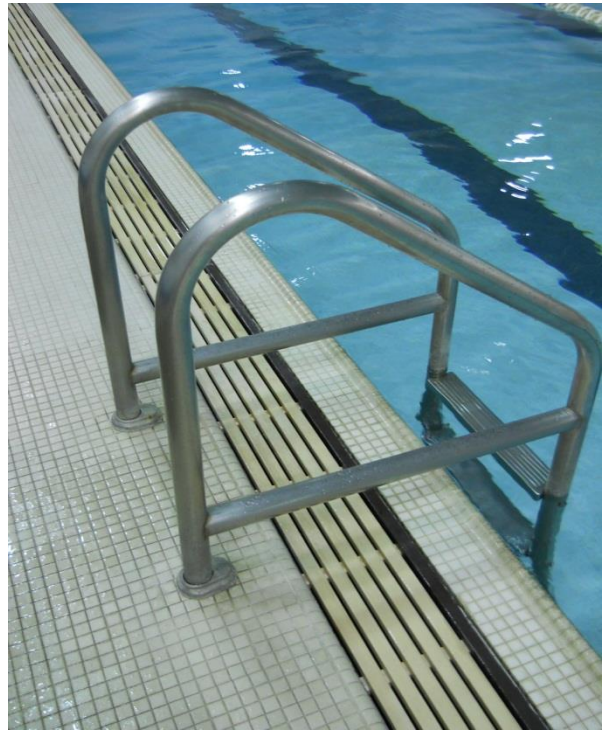
- Inlet placement and design
- Circulation pumps
- Pool shape and contour
- Piping and fittings
- Surface and main drain water removal
- Other systems such as heaters



Circulation & Filtration

Gutter systems

- An effective system aids both circulation and filtration
  - Maintain proper water levels
  - Removes debris
  - Regular cleaning

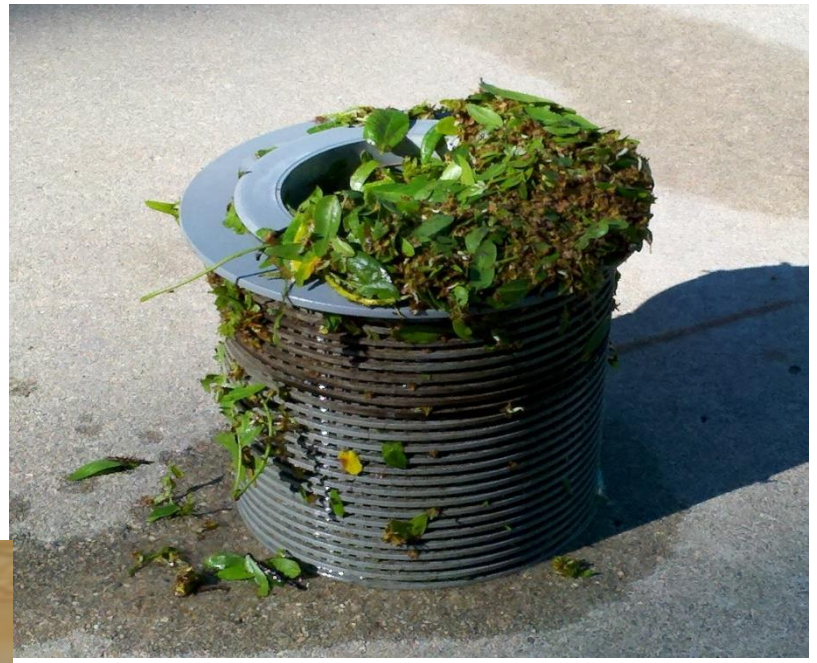


Source: NDEE

Circulation & Filtration

Skimmers

- Point source removal
- Maintain the water level - if too low, skimmer can bottom out and suck air into circulation system
- Removable basket to trap large solids - clogged baskets have negative impact
- CLEAN OUT STRAINERS OFTEN!!



Source: NDEE

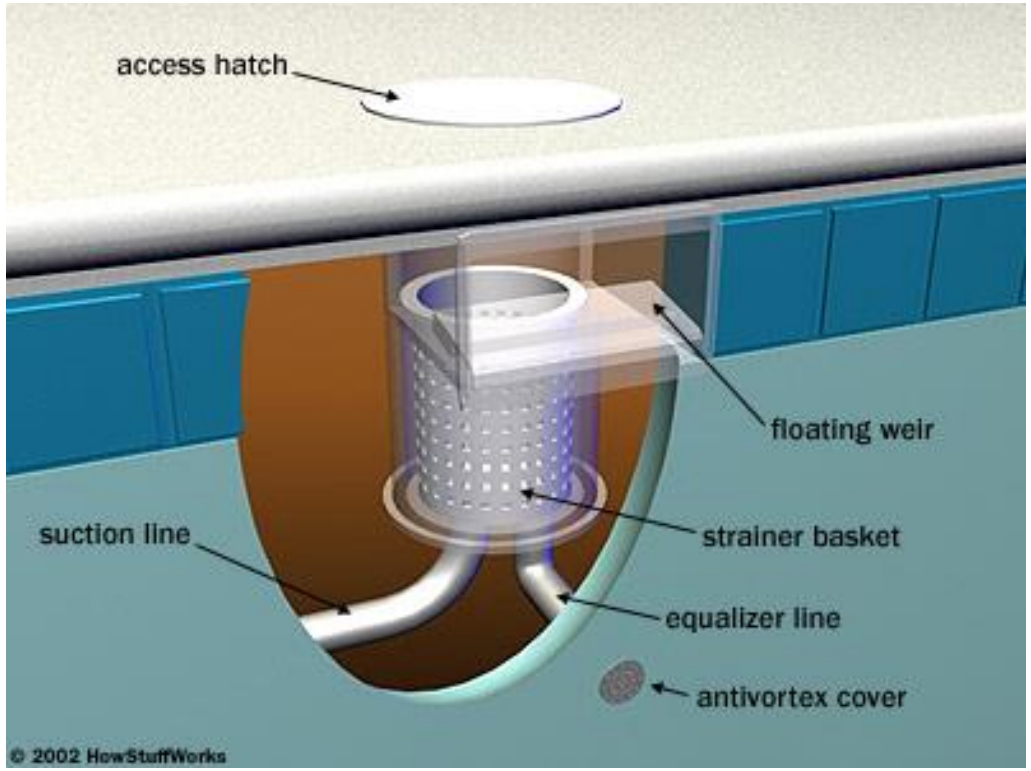
Circulation & Filtration

Skimmers

THEY ARE NOT CHLORINATORS!!

Do not add disinfectants directly into skimmer baskets

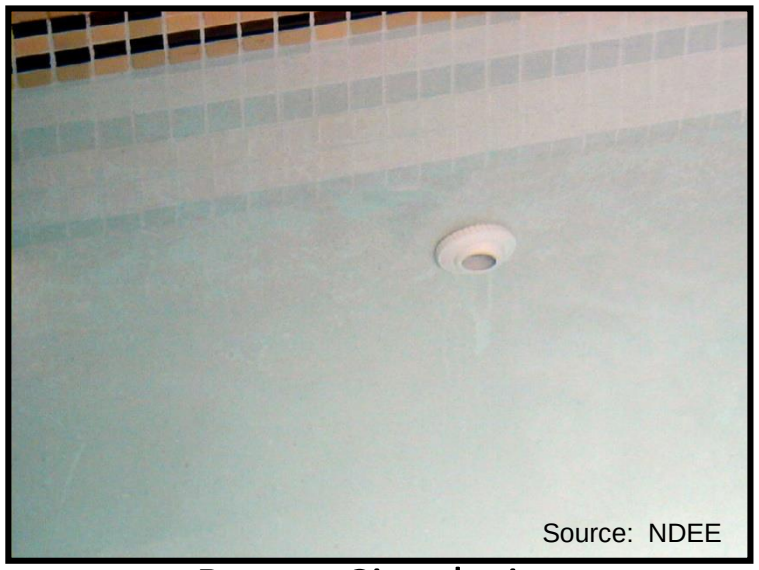
Easypoolcleaning.com



Circulation & Filtration

Pool Return Line Jets

- Return lines can be adjusted as needed
- Modified by changing direction of orifices
- Helps to manage pool “dead spots”



Better Circulation

Circulation & Filtration

Filtration room

1. Inlet Pipes
2. Hair Strainer
3. Pump/Impeller
4. Motor
5. Filters
6. Chemical Feeders (always last!)
7. Return Lines/Pipes

Circulation & Filtration

Pressurized Filtration system

- Pump located ahead of filter
- Closed tank
- Cleaning based on pressures involved
  - Watch pressure gauges
  - Reverse flow to clean (usually)

Sand Filter

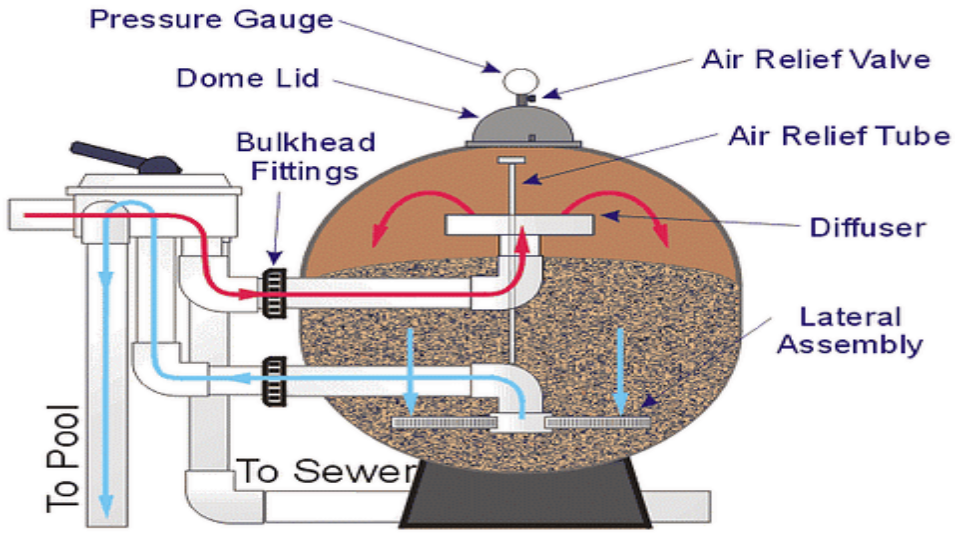
www.POOLCENTER.com

Circulation & Filtration

Pressurized System

- Cleaning based on pressures involved
  - Watch pressure gauges
  - Reverse flow to clean (usually)
  - Sight glass clear

IPTC Photo Metadata



Askthepoolguy.com

Circulation & Filtration

Suction (vacuum) Filtration System

- Pump located behind filter
- Open system
- Cleaning - physically removing the filter powder
  - Water pressure gauges
  - Inspect condition of cloth elements - D.E. Filtration

Magnified D.E. diatom

Circulation & Filtration

Filter Media types

- Sand
  - Gravity
  - Rapid sand
  - High rate sand
- Diatomaceous earth
- Cartridge (have back-up on hand)

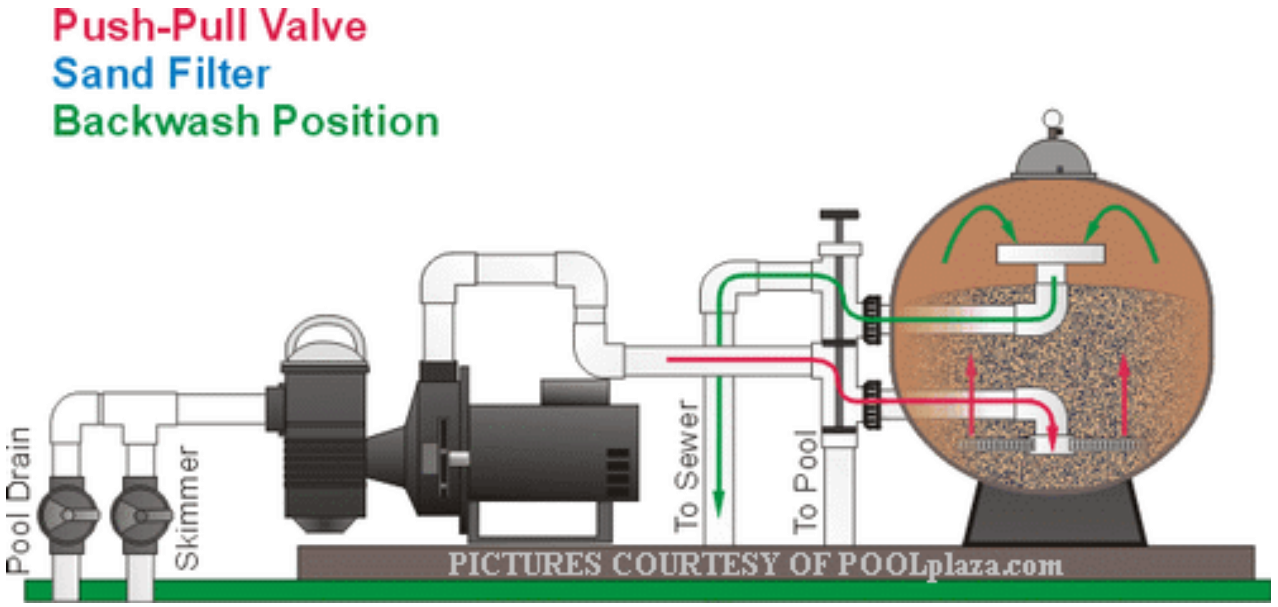
Pool matrix

Source: NDEE

Circulation & Filtration

Filter effectiveness

- Type of filter
- Surface area
- Velocity of water
- Condition of media
- Particulates in the water
- Clean pool regularly to ease demands on filters. Vacuum/clean strainers



Circulation & Filtration

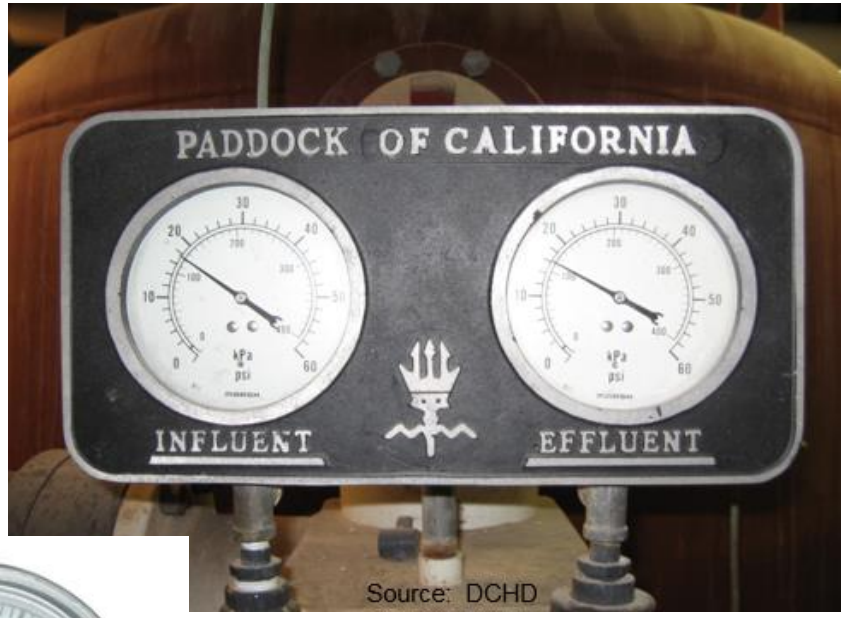
Flow Gauge (Required device)

- Measures the actual flow of water through the recirculation system in GPM
- Determines turnover rate
- 10-15% inaccuracy
- Check daily!!
- Flow meters must be installed, working and calibrated regularly

Circulation & Filtration

Filtration gauges

- **Must be operational!!**
- **Influent and Effluent gauge readings are great indicators of system effectiveness**



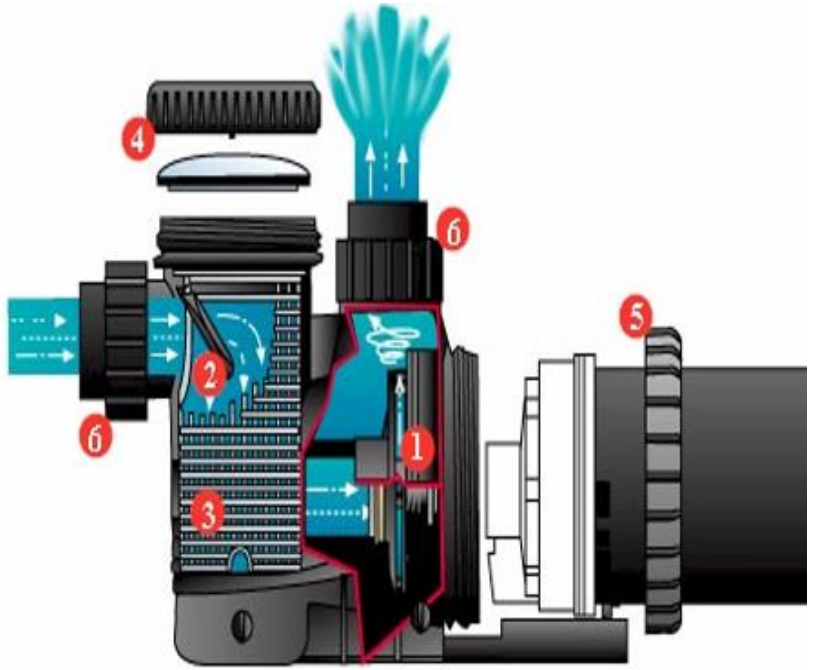
Circulation & Filtration

Flow Meters

If the flow rate fluctuates on the flow meter:

Check:

- The skimmer basket
- The pump impeller
- The filter gauges
- The filter media
- For obstructions in the piping or equipment



Circulation & Filtration

Turnover Rate

- Time it takes for pool's entire volume of water to be filtered
- Based on pool volume (L x W x [ave. depth] x 7.5 = total volume)
- Turnover rate equals:
  - Volume of pool divided by flow rate (from flow meter) divided by 60
  - 60,000 ÷ 300 gpm ÷ 60 = 3 hours 20 minutes

Circulation & Filtration

Turnover Rate

- If the turnover rate of a pool is too long, pollutant levels will start to build up.

- If the turnover time is too short, the water will be traveling too fast through the system and this will have a negative impact on the effectiveness of the filtration.

- Knowing the flow rate and turnover rate and checking them is vitally important to proper pool maintenance. (Stockwell Safety)

Circulation & Filtration

Whole System Required Volume Turnover Rates:

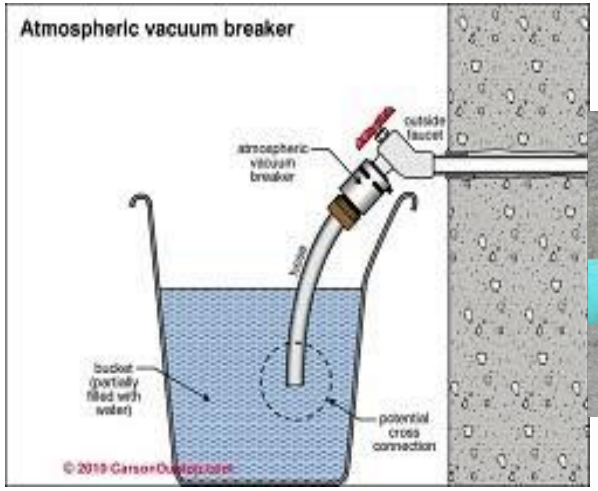
- Spray parks with no standing water
  - 30 minutes or less
- Pool areas ≤ 2 feet in water depth
  - 1 hour or less
- Pool areas greater than 2 feet but ≤ 3 feet in water depth
  - 2 hours or less
- Pool areas greater than 3 feet but ≤ 5 feet in water depth
  - 4 hours or less
- Pool areas > 5 feet in water depth
  - 6 hours or less

Circulation & Filtration

Water Source

Protect all potable water supplies with:

- An air gap
- A back-siphon device - device that only allows water to flow in one direction
- These are needed to prevent contaminated water from flowing back into public water supply

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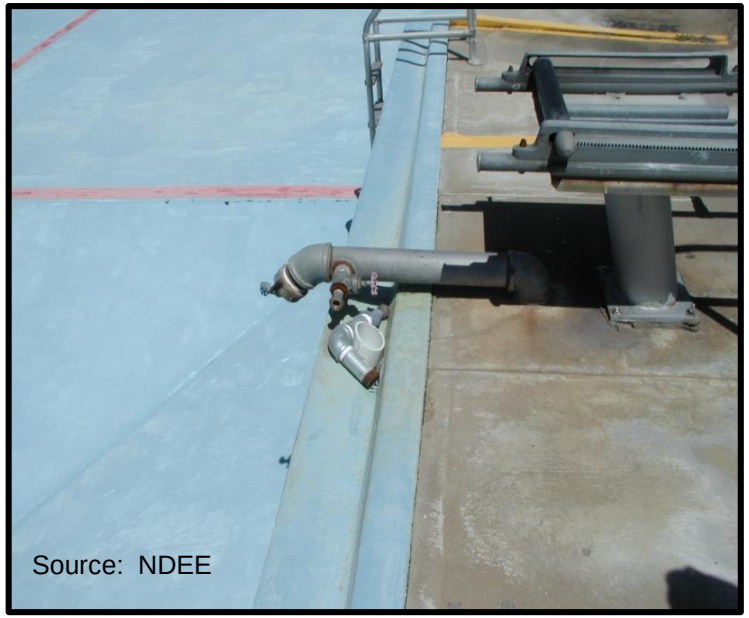

Source: NDEE

Circulation & Filtration

- **VGB Act Standards - Virginia Graeme Baker Act**
- Signed into Law 12-19-2007
- Graeme Baker - a 7 year old girl who died from “suction entrapment due to a faulty drain cover” (VGB Act)
- In 2007, there were 74 pool/spa circulation entrapments (Consumer Product Safety Commission)

Entrapment

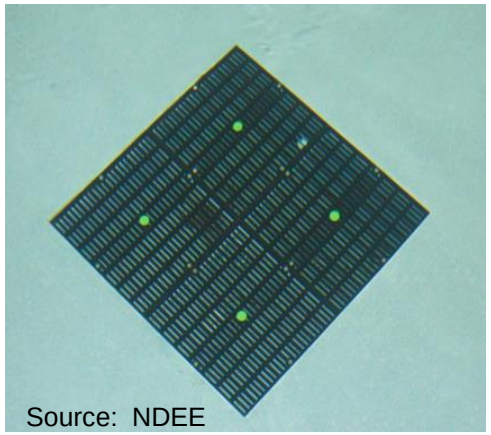
- Hair
- Jewelry
- Limb
- Whole body

Circulation & Filtration

VGB Act Standards

Drain covers:

- **MUST** be in place and secure
- Check drain cover expiration dates
    - Replace drain covers at date of expiration


Source: NDEE

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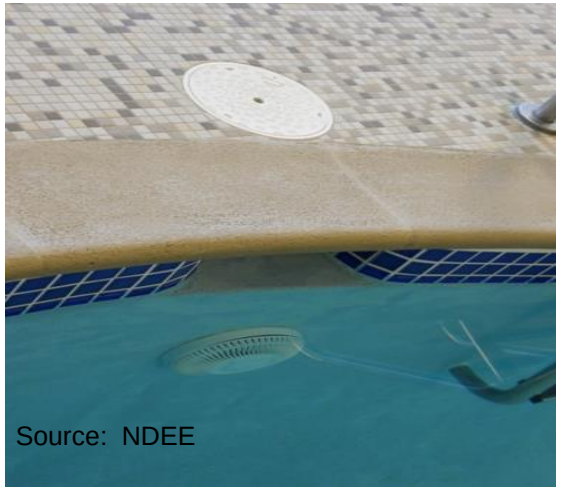

Source: NDEE

Circulation & Filtration

- All public pools and spas with a single main drain (24”x24”) or multiple drains less than 3 feet apart, must have an additional anti-entrapment device
- Most common - SVRS (Safety Vacuum Release System, Automatic Pump Shut-off System or Suction-Limiting Vent System)
- No pool or spa is safe if a drain cover is broken, missing or cracked. The pool/spa must be closed until repairs can be made (VGB Pool and Spa Safety Act)

Vacless

Circulation & Filtration

IF PROBLEMS/ISSUES ARISE:

- Refer to equipment manual
- Operate and maintain equipment according to manufacturer's instructions
- Contact equipment manufacturer
- Contact pool service provider
- Pump, filter and disinfectant feeder must be kept in proper working order

Water Treatment

Dichlor feeders

- Automatic system for fast dissolving sanitizers

Liquid feeders

- Sodium hypochlorite
- Not very stable - loses strength
- Very high pH - acid feeders included

Erosion feeders

- Trichlor application to pool
- Slow dissolving chlorine
- Operation affected by: solubility (low), water temperature, flow rate, amount of product in feeder

Source: NDEE

Water Treatment

Sanitizers facilitate oxidation of pool water

Sanitization

- Destroying (bacteria, fungi, protozoa, viruses…) harmful to human health in order to control communicable disease

Oxidation

- Chemically removing (perspiration, saliva, urine, body oils and wastes) from the water
  - The chemical cleaning of the pool water
  - Converts sweat, debris, urine and other organics into gases
  - Non-chlorine treatment for oxidation available

- Oxidation is important so that it frees up the sanitizers ability to bacteria and viruses.
- The terms shock, oxidation and superchlorination are used interchangeably

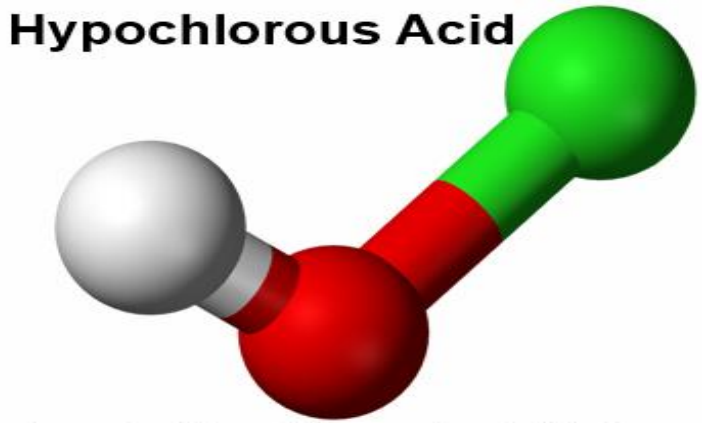
Water Treatment

- Primary sanitizers (residuals)
  - Chlorine
    - Granular, tablet, liquid, gas
  - Bromine
    - Granular, tablet, liquid
- Secondary/Supplemental sanitizers
  - Ozone
  - Ultraviolet light

Water Treatment

Chlorine is the most common sanitizer

- Effective at killing organisms which cause disease
- Strong oxidizer of perspiration, saliva, urine, body oils & waste
- **Disadvantage:** reacts with ammonia (component of sweat, urine and other organic substances to form chloramines causing “chlorine odor”

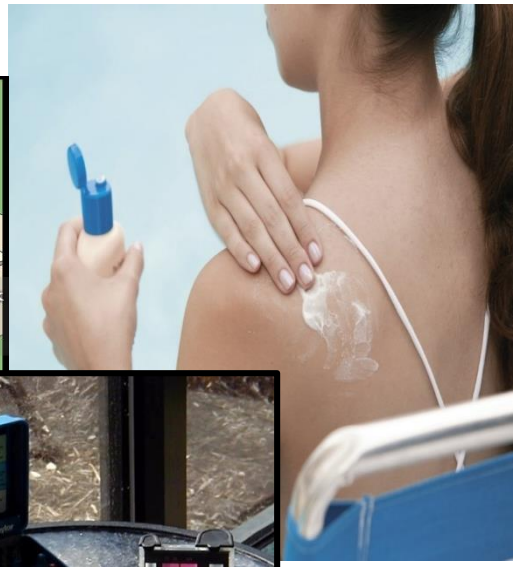


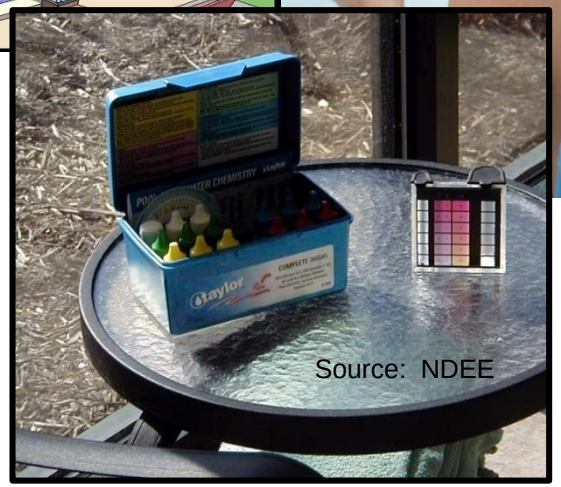
Source: Ben Mills and Ephemeronium at wikipedia.org

Water Treatment

Chloramines are formed when chlorine combines with the following:

- Organic waste
- Body waste (urine)
- Particulate matter
- Perspiration
- Oils and lotions
- Nitrates





Source: NDEE

Producing - COMBINED CHLORINE!

Use your test kit to check for combined chlorine shall not exceed 0.5 ppm

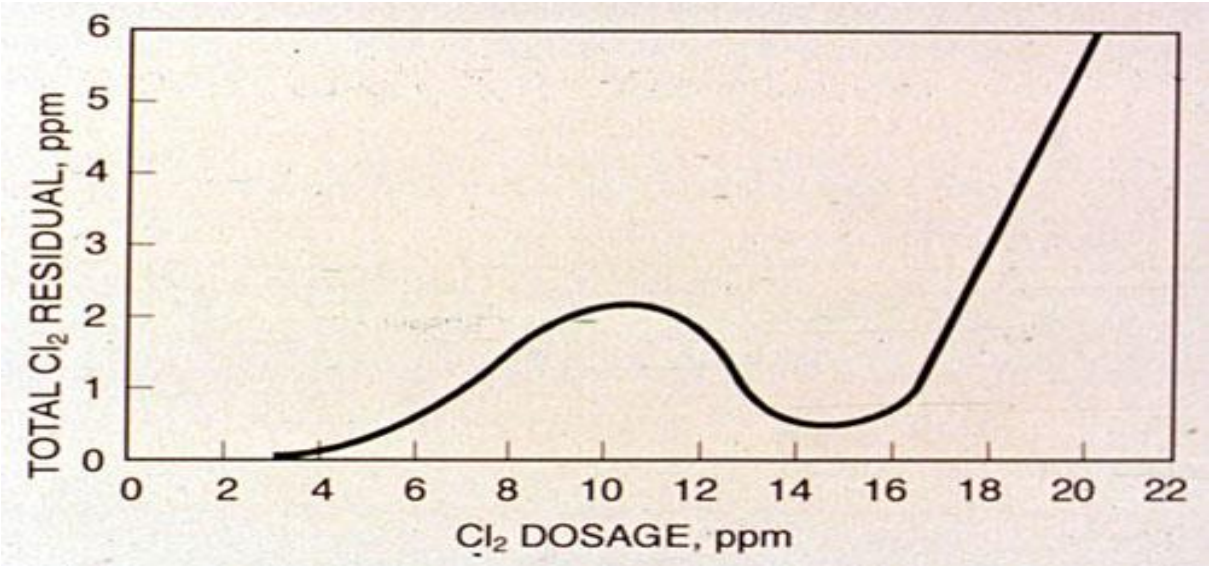
Water Treatment

Eliminate bad (combined) chlorine

Option 1

Breakpoint chlorination

- Dramatically increasing chlorine levels <u>over the breakpoint dose</u> for a short period of time completely oxidizes combined chlorine
- <u>Minimum</u> amount of chlorine needed to remove combined chlorine
- Adding less than the breakpoint dosage can create more combined chlorine



Water Treatment

Eliminate bad (combined) chlorine

Option 2

SHOCKING…SUPERCHLORINATION

Breakpoint = 10 X combined chlorine level

Example: water test indicates 0.8 combined chlorine

10 X 0.8 = 8.0 ppm

Solution: add 8 ppm MORE chlorine than what the pool is currently at.

Must add enough for the chlorine to reach the Breakpoint. If it does not, oxidation will not occur and matters could be made worse.

Water Treatment

Stabilized Chlorine / Stabilizer – Cyanuric Acid

- Protects chlorine from sun
- Maintain at 25-40 ppm*
- Lower by dilution
- For outdoor pools only

* LLCHD recommends not exceeding 30 ppm

NEVER MIX STABILIZED AND UNSTABILIZED FORMS OF CHLORINE!

- >15 ppm lowers chlorine efficacy
- >80 ppm may result in… CHLORINE LOCK
- If cyanuric acid exceeds the maximum 90 ppm **

** IMMEDIATE Closure Item

Water Treatment

Minimize combined chlorine by being proactive

- Require patrons to shower with soap before entering the pool
- Maintain a high free chlorine level (combined chlorine will not accumulate)

Outside Magazine

Water Treatment

Stabilized Chlorine - **OUTDOOR POOLS ONLY!!!!**

- New indoor pools
  - NOT ALLOWED
- Existing indoor pools
  - Must switch sanitizer type when existing stabilized chlorinator stops working

Water Chemistry

Chemistry of water

Water is a universal solvent

- Balanced
- Corrosive
- Scale forming

Water Chemistry

Proper water balance will:

- Optimize the sanitizer (chlorine/bromine)
- Extend the life of pool equipment
- Provide for bather comfort
- Improve filter runs
- Maintain clear water

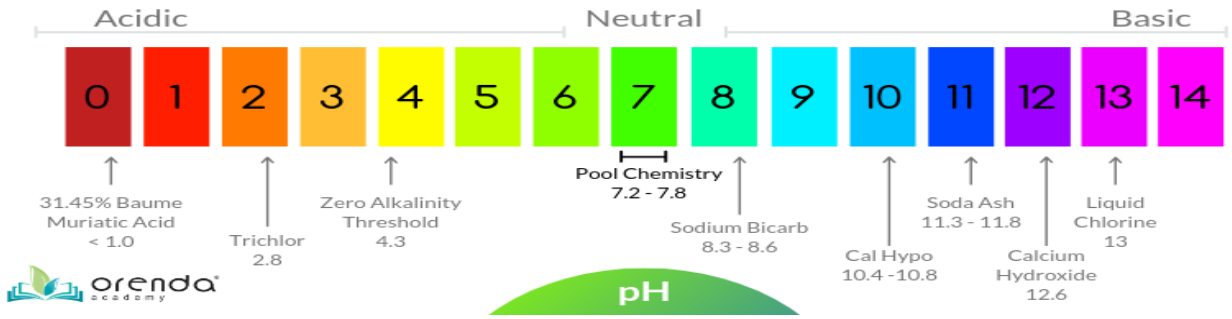
Pool water is sensitive with many factors and variables affecting it on a daily basis

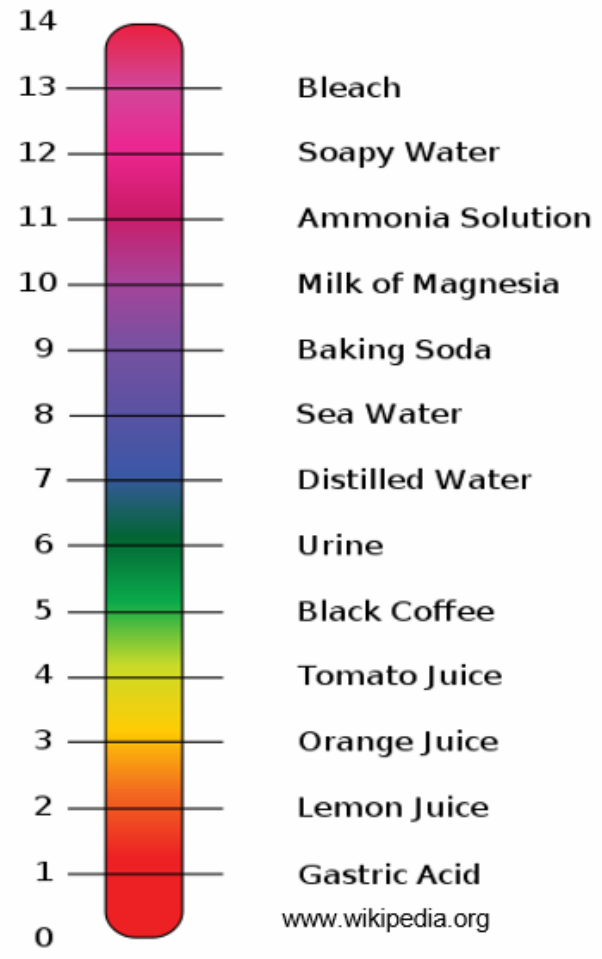
Water Chemistry

Balanced water is the correct ratio of:

- pH - measured on a scale of 0 to 14
- Total alkalinity - helps to buffer pH level
- Calcium hardness
- Temperature

All are dependent of and affect each other





Water Chemistry

Temperature

- Most chemicals dissolve better as temperatures increase
- Hardness (calcium carbonate) reacts the opposite

  As water temperature increases, the calcium carbonate precipitates out of the water and forms scaling

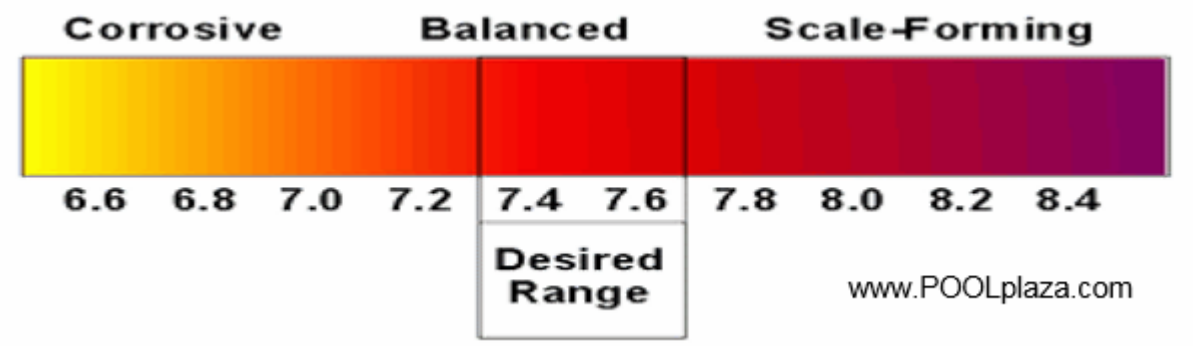
Temperature

- Ideal range for pools
  - 80º F - competition swimming
  - 78º F to 82º F - recreation

Water Chemistry

pH

- Has the greatest affect on pool water - foundation of water chemistry balance
- Measures how acidic or basic a solution is
- Distilled water has a pH of 7.0
- Human skin pH between 4.5-6.0
- A pH of 7.4-7.6 is ideal



Water Chemistry

What affects pH

- Chemicals used
- Swimmers
- Weather and environment
- Water source
- Algae

Source: Joe Sullivan at wikipedia.org

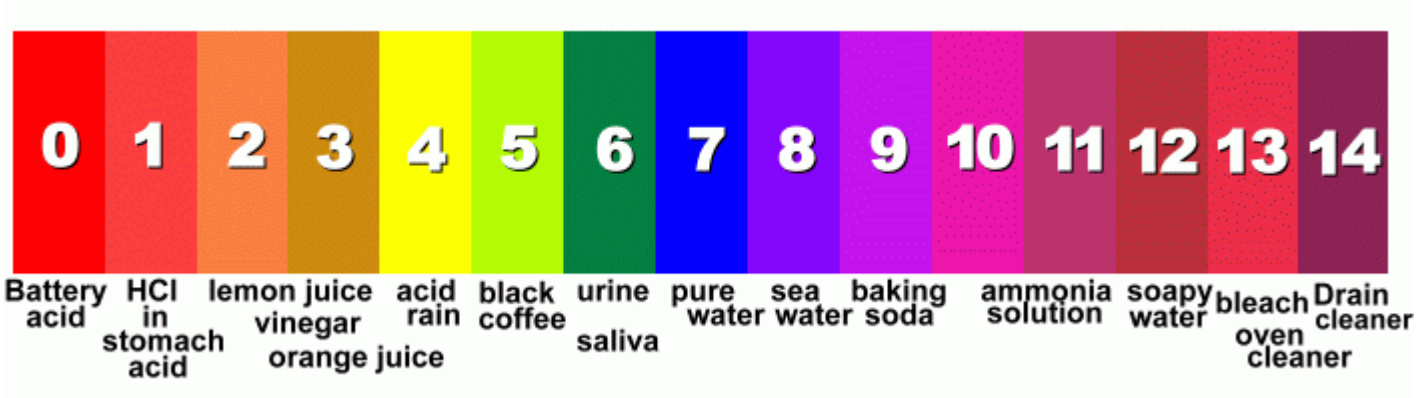
Source: de:Benutzer: Alex Anlicker at wikipedia.org

Aquafillpoolfill.com

Water Chemistry

High pH (7.9 or higher)

- Scale formation - build up on pool surfaces, waterlines and accessories
- Dull or cloudy pool water
- Burning eyes
- Filter runs are shorter
- Clogging of filter medium
- Chlorine is ineffective
    - Increased risk of disease



Water Chemistry

Low pH (7.1 or lower)

- Water becomes acidic
- Chlorine dissipates rapidly
- Eye irritation occurs
- Metal corrodes - pool accessories
- Dissolved metals leave stains
- Rapid loss of alkalinity
- Eroding of pool plaster and grouting

Water Chemistry

Raise pH - add a base product

- Sodium carbonate (soda ash)**

Follow label directions and adjust in small doses

** Adding too much too fast causes milky white water

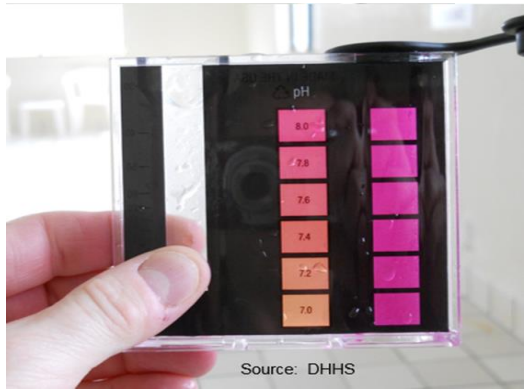
Duda Energy LLC

Water Chemistry

Lower pH - add an acidic product

- Muriatic acid
- Sodium bisulfate (dry acid)
- Lower pH can be a product of heavy precipitation (Acid rain) in outdoor pools
- Common cause of low pH is low alkalinity which should always be adjusted (with sodium bicarbonate - baking soda) before trying to increase the pH

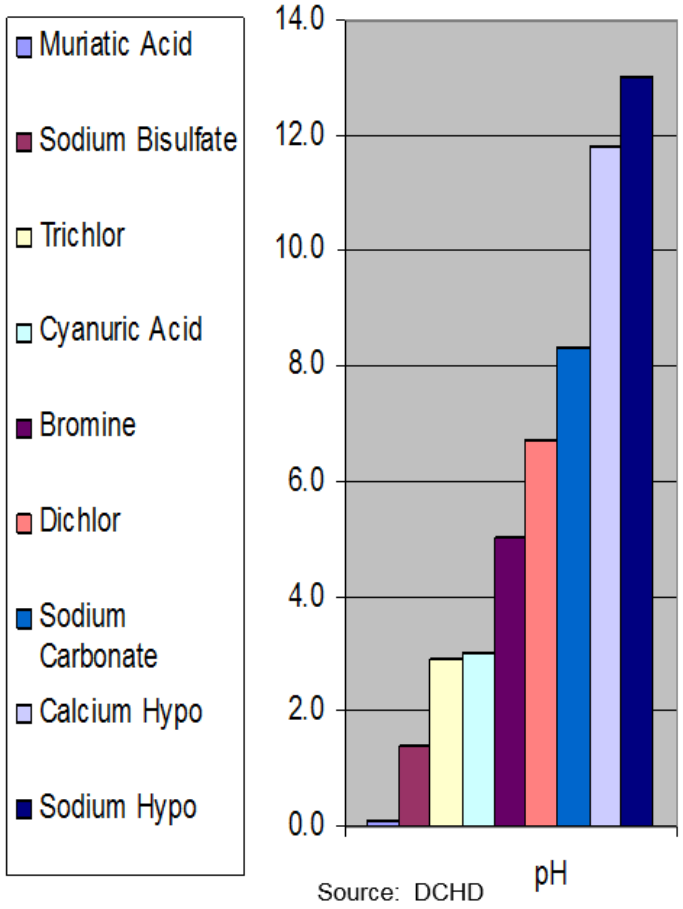
Brandli's.com



Water Chemistry

pH values of chemicals used are:

- Muriatic acid - 0.1
- Sodium bisulfate - 1.4
- ***Trichlor - 2.9*** - *contains stabilizer (CYA)*
- Cyanuric acid - 3.0
- Bromine - 5.0
- ***Dichlor - 6.7*** - *contains stabilizer (CYA)*
- Sodium carbonate - 8.3
- ***Calcium hypo - 11.8*** - *no stabilizer (CYA)*
- ***Sodium hypo - 13.0*** - *liquid chlorine-no CYA*



Water Chemistry

Chlorine & pH

Two products are formed when water and chlorine are mixed

- Hypochlorous acid - effective sanitizer
- Hypochlorite - less effective sanitizer

The amount of hypochlorous acid and hypochlorite produced is: **pH dependent**

Hypochlorous Acid	pH
66%	7.2
50%	7.5
33%	7.8
0%	over 8.0

Water Chemistry

Total Alkalinity

Total alkalinity is a measure of the water's ability to resist changes in pH

High alkalinity

- pH lock
- Cloudy water
- Scale

Low alkalinity

- Unstable
- Corrosive
- pH bounce

Water Chemistry

Total alkalinity

- Maintain at 80 ppm or higher for a stable pH
- To raise:
  - Add sodium bicarbonate*
    - Baking soda
- To lower:
  - Add an acid
    - Muriatic acid/Hydrochloric acid
    - Sodium bisulfate

Add slowly and make adjustments in small doses

ALWAYS follow manufacturer's recommendations!

Source: NDEE

Water Chemistry

Chemical Adjustments

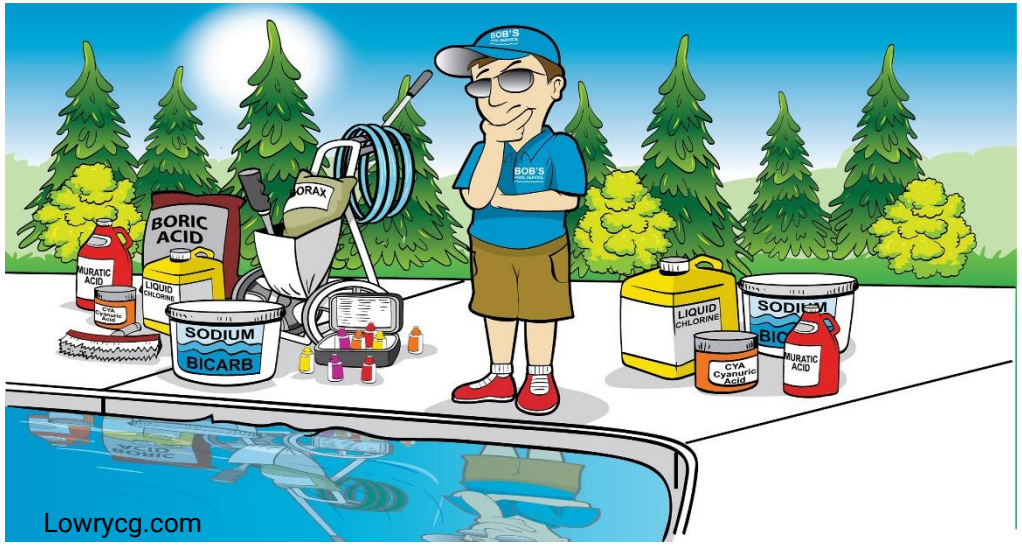
When adding large amounts of chemicals to make a chemical adjustment:

- Do so in smaller doses, if possible, over several days
- NEVER add chemicals when pool is occupied
- ***Follow manufacturer's guidelines***

Water Chemistry

Know the following when making chemical adjustments:

- How much of a change is needed
- Proper chemical to make change
- Pool volume



Sequence for testing/adjustments

- Adjust total alkalinity
- Adjust pH
- Add sanitizer to proper level

Water Testing Methods

Why test pool water?

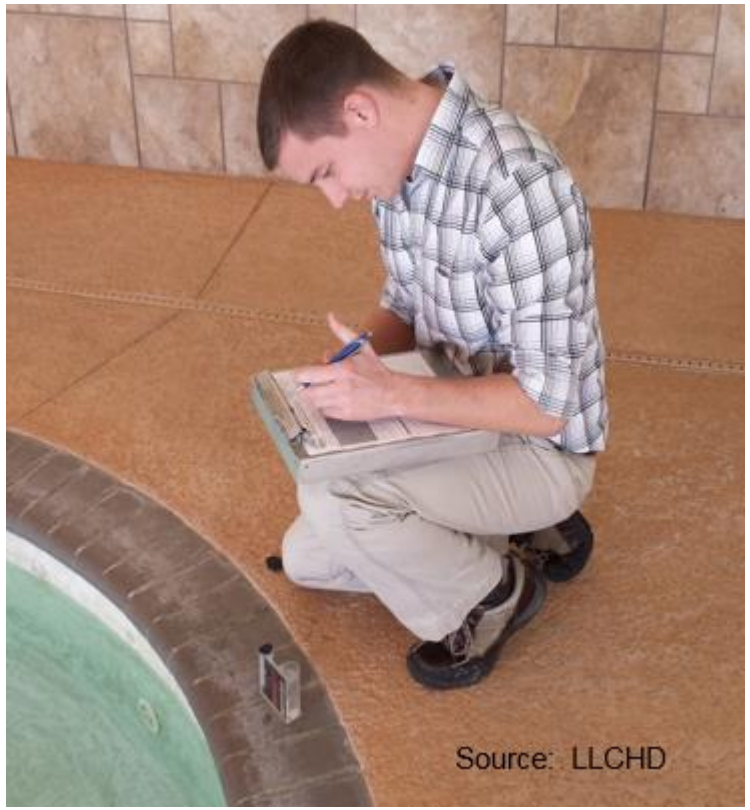
- Balanced water
- Good water clarity
  - Control algae growth
- Save money on chemical use and equipment maintenance
- Healthy environment for swimmers
  - Proper sanitation
  - Good water quality
- **Valuable tool during complaints and lawsuits**


Swimmingpool.com

Water Testing Methods

Required Testing Documentation

- Test sanitizer level and pH **before opening** and every 4 hours until close
- Test total alkalinity, combined chlorine and cyanuric acid at least once per week
- Must be **recorded** on log sheet form provided by NDEE
- These are mandatory requirements per State Regulations Title 178 Chapter 2



Water Testing Methods

Test kit must be accurate and reliable to measure:

- Free chlorine/bromine (FAS-DPD kit REQUIRED)
- Combined chlorine
- pH (7.0 - 8.0 range)
- Total alkalinity
- Cyanuric acid - if used

Source: NDEE

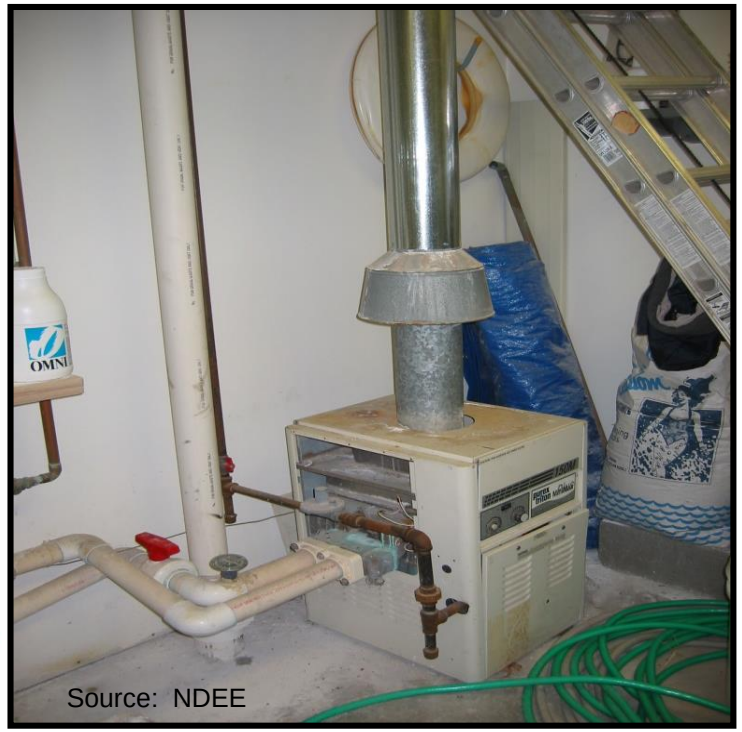

Pool and Spa Marketing

Water Testing Methods

Recommendation for accurate results

- Use fresh reagents - check expiration dates
- Do not store reagents in chemical storage areas
- Store reagents in cool, dark location

Taylor Technologies


Source: NDEE

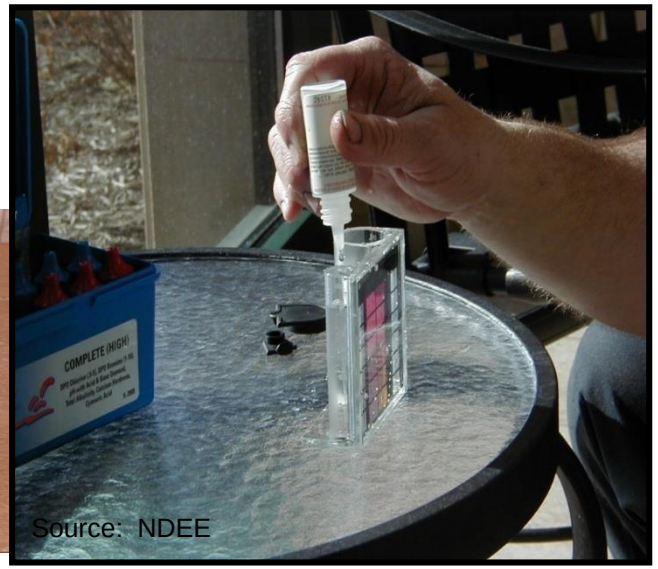
Water Testing Methods

Testing procedures

- Sample represents entire body of water
- Recommended to vary where sample is taken each time
- Collect sample 12-18 inches below water surface
  - Not in front of inlets

Proper procedures

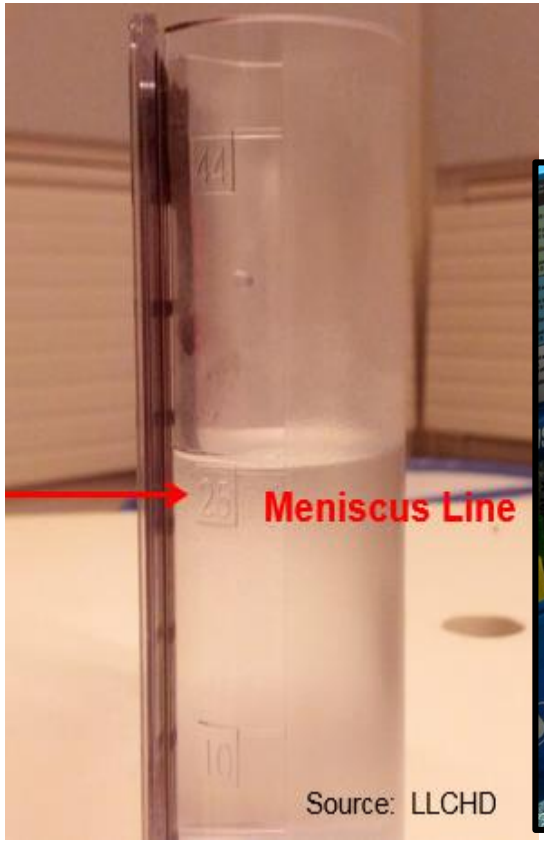
- Rinse comparator tubes three times
- Measure carefully
  - Pause and swirl between drops
- Hold reagent tubes vertical



Water Testing Methods

Testing procedures

- Swirl…Swirl…Swirl
- Do not shake the samples (may affect pH result)
- Use cell caps - for pH if applicable (fingers can contaminate the sample)
- Proper lighting will provide accurate readings
- Read results against light background
- Hold at eye level and measure from bottom of meniscus line



Water Testing Methods

How To Test - Free Chlorine (from Taylor test kit)

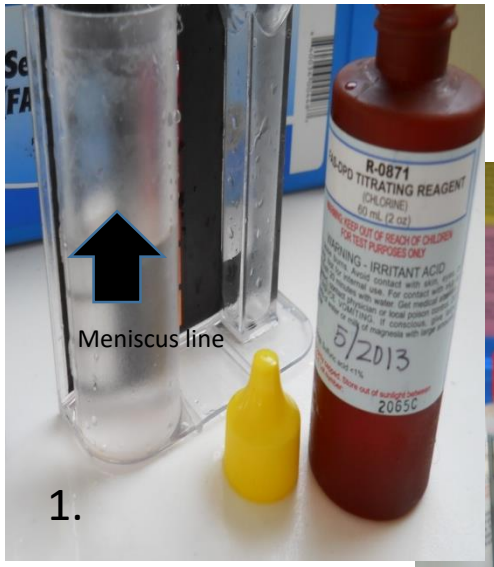
- Fill to either 10 ml or 25 ml line - make sure to measure sample to meniscus line.
- Add 2 dippers R-0870 DPD powder
- Add R-0871 DPD titrating reagent, (one drop at a time) count drops and swirl after each until color changes from pink to clear
- Multiply drops
  - 10 ml sample 1 drop = 0.5 ppm
  - 25 ml sample 1 drop = 0.2 ppm
- Example
  - @ 10 ml: 10 drops x 0.5 = 5 ppm chlorine
  - @ 25 ml: 10 drops x 0.2 = 2 ppm chlorine

Make sure reading is within compliance range and record on testing log

* Other test kits available, follow kit instructions - FAS-DPD kit required

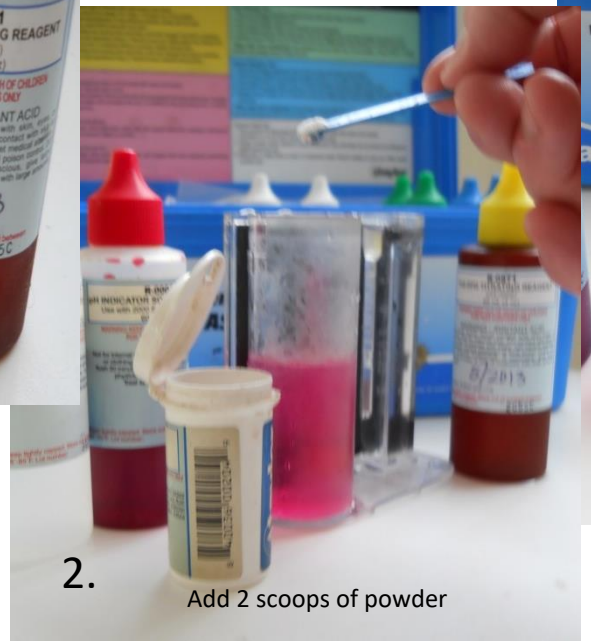
Water Testing Methods

Sequencing of Testing Steps for Free Chlorine



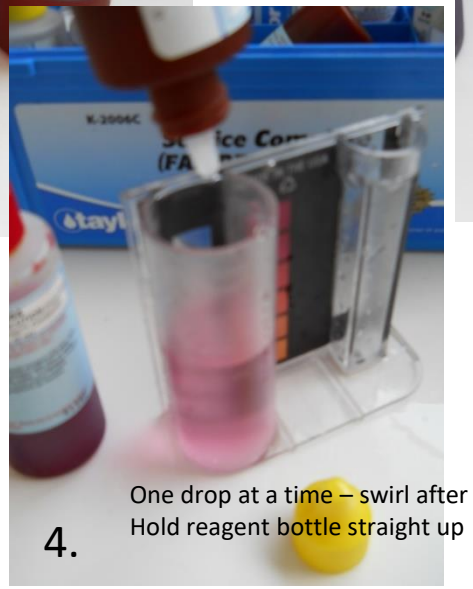
Meniscus line

1.



2. Add 2 scoops of powder

3.



4. One drop at a time – swirl after each drop
Hold reagent bottle straight up

5. Add drops until sample turns completely clear

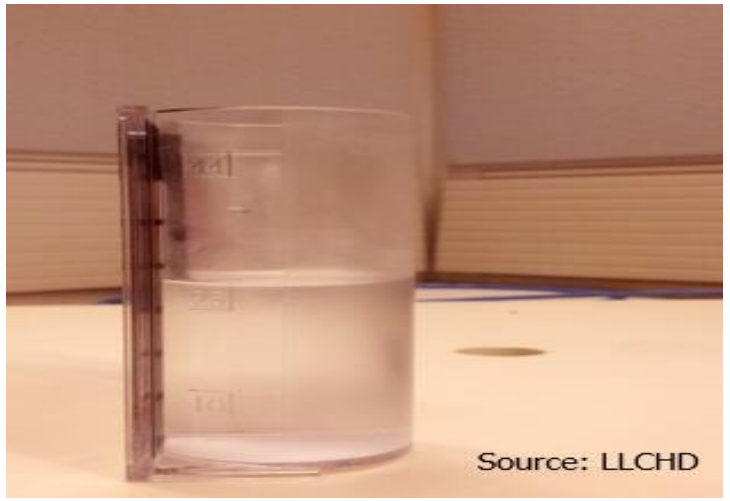
Source: NDEE

Water Testing Methods

How To Test - Free Chlorine

Water Testing Problem

- During chlorine test, sample quickly turns pink, but then during swirling sample goes clear



- Caused by very high levels of chlorine bleaching out the powder

Water Testing Methods

How To Test - Bromine (example from Taylor BROMINE test kit*)

- Same procedures as free chlorine…EXCEPT
- Multiply drops
  - 10 ml sample 1 drop = 1.25 ppm
  - 25 ml sample 1 drop = 0.5 ppm
- Example
  - @ 10 ml: 4 drops x 1.25 = 5 ppm bromine
  - @ 25 ml: 4 drops x 0.5 = 2 ppm bromine

* Other test kits available, follow kit instructions - FAS-DPD kit required

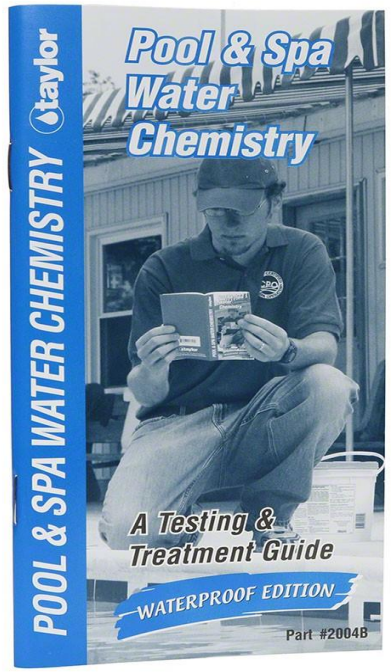
Water Testing Methods

How To Test- Bromine

Testing Bromine using a Chlorine test kit (and converting the result)

(directions from Taylor testing guide book)

- Same procedures as free chlorine…EXCEPT
- Multiply final result number by 2.25 ppm
- Example
  - @ 10 ml: Result of 5 ppm x 2.25 = 11.25 ppm bromine
  - @ 25 ml: Result of 2 ppm x 2.25 = 4.5 ppm bromine

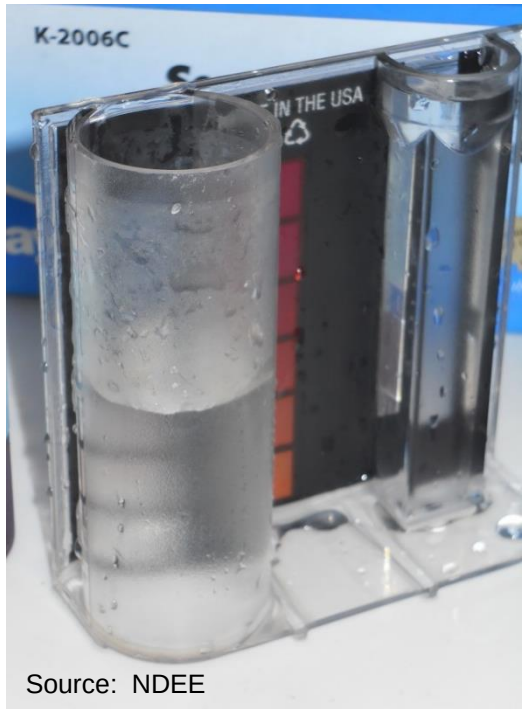


Water Testing Methods

How To - Combined Chlorine (example from Taylor test kit*)

- Immediately after the free chlorine test, with the same sample - **should be completely clear**
- Add 5 drops of R-0003 DPD reagent - if sample remains clear - Combined Chlorine is 0.00 ppm. If it changes back to any shade of pink - continue with remaining steps:
- Add R-0871 DPD titrating reagent, count drops and swirl after each until color changes from pink to clear
- Multiply drops
  - 10 ml sample 1 drop = 0.5 ppm
  - 25 ml sample 1 drop = 0.2 ppm
- Example
- @ 10 ml: 1 drop x 0.5 = 0.5 ppm chlorine
- @ 25 ml: 3 drops x 0.2 = 0.6 ppm chlorine (this result wou
- Other test kits available, follow kit instructions - FAS-DPD kit required

Taylor Technologies



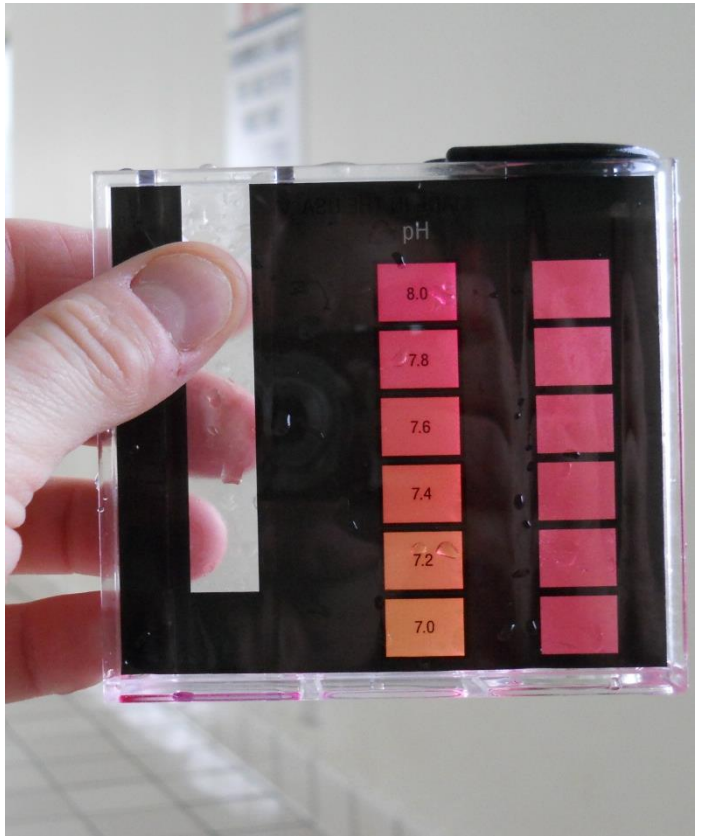
Source: NDEE

Water Testing Methods

How To Test- pH (example from Taylor test kit*)

- Fill to 44 ml line (meniscus)
- Add 5 drops R-0004 pH indicator solution. Secure the rubber cap.
- Invert 2 or 3 times to mix
- Match color with color comparator
- Result must be between 7.2 & 7.8

* Other test kits available, follow kit instructions



Source: NDEE

Water Testing Methods

How To Test - pH

Water Testing Problem

- Elevated chlorine, pH results might show a purple color instead of yellow to red
  - Caused by high chlorine interfering with phenol red reagent - R-004
  - Correct by adding one drop of sodium thiosulfate (chlorine neutralizer - R-007) to a completely new sample, then add the 5 drops of the pH reagent


Source: NDEE

Water Testing Methods

How To Test- Total Alkalinity (example from Taylor test kit*)

Taylor Technologies

- Fill to 25 ml line
- Add 2 drops R-0007 thiosulfate N/10, swirl
- Add 5 drops R-0008 total alkalinity indicator, swirl
- Add drops of R-0009 sulfuric acid, count and swirl each drop until color changes from green to deep red
- Multiply drops by 10
    - Example: 15 drops X 10 = 150 ppm Total Alkalinity

* Other test kits available, follow kit instructions

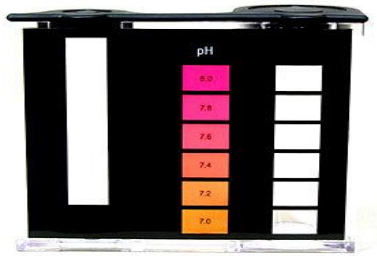
Water Testing Methods

How To Test - Cyanuric Acid (CYA) (example from Taylor test kit*)

- Fill CYA dispensing bottle to 7 ml line
- Add R-0013 cyanuric acid reagent to 14 ml, mix for 30 seconds
- Slowly add to small comparator tube until black dot disappears
- Match liquid level with comparator on the front
- State Regulation is maximum 90 ppm
- For LLCHD & DCHD the maximum is 50 ppm

* Other test kits available, follow kit instructions

Taylor Technologies



Taylor Technologies

Water Testing Methods

Instructions are in the lid of the test kit - color coded by test being performed

Guidebook (#2004B) amplifies these instructions and should be read to use this product properly.

POOL & SPA WATER TESTS
1. Read precautions on all labels.
2. Keep test kit out of reach of children.
3. Store test kit in cool, dark place.
4. Replace reagents once each year.
5. Do not dispose of solutions in pool or spa.
6. Rinse tubes before and after each test.
7. Obtain samples 18" (45 cm) below water surface.
8. Hold bottle vertically when dispensing.

Instr. #5138

Free & Combined Chlorine Test
1. Rinse and fill large comparator tube to desired mark with water to be tested.
NOTE: For 1 drop = 0.2 ppm, use 25 mL sample. For 1 drop = 0.5 ppm, use 10 mL sample.
2. Add 2 dippers R-0870. Swirl until dissolved. If free chlorine is present, sample will turn pink.
NOTE: If pink color disappears, add R-0870 until color turns pink.
3. Add R-0871 dropwise, swirling and counting after each drop, until color changes from pink to colorless.
4. Multiply drops in Step 3 by drop equivalence (Step 1). Record as parts per million (ppm) free chlorine (FC).
5. Add 5 drops R-0003. Swirl to mix. If combined chlorine is present, sample will turn pink.
6. Add R-0871 dropwise, swirling and counting after each drop, until color changes from pink to colorless.
7. Multiply drops in Step 6 by drop equivalence (Step 1). Record as ppm combined chlorine (CC).

pH Test
1. Rinse and fill large comparator tube to 44 mL mark with water to be tested.
2. Add 5 drops R-0004. Cap and invert to mix.
3. Match color with color standard. Record as pH units and save sample if pH needs adjustment. If sample color is between two values, pH is average of the two. To LOWER pH: See acid demand test. To RAISE pH: See base demand test.

Acid Demand Test
1. Use treated sample from pH test.
2. Add R-0005 dropwise. After each drop, count, mix, and compare with color standards until desired pH is matched. See treatment tables to continue.

Base Demand Test
1. Use treated sample from pH test.
2. Add R-0006 dropwise. After each drop, count, mix, and compare with color standards until desired pH is matched. See treatment table to continue.

Total Alkalinity Test
1. Rinse and fill large comparator tube to 25 mL mark with water to be tested.*
2. Add 2 drops R-0007. Swirl to mix.
3. Add 5 drops R-0008. Swirl to mix. Sample should turn green.
4. Add R-0009 dropwise. After each drop, count and swirl to mix until color changes from green to red.
5. Multiply drops in Step 4 by 10. Record as parts per million (ppm) total alkalinity as calcium carbonate.

**When high TA is anticipated,* this procedure may be used: Use 10 mL sample, 1 drop R-0007, 3 drops R-0008, and multiply drops in Step 4 by 25.

Calcium Hardness Test
1. Rinse and fill large comparator tube to 25 mL mark with water to be tested.*
2. Add 20 drops R-0010. Swirl to mix.
3. Add 5 drops R-0011L. Swirl to mix. If calcium hardness is present, sample will turn red.
4. Add R-0012 dropwise. After each drop, count and swirl to mix until color changes from red to blue.
5. Multiply drops in Step 4 by 10. Record as parts per million (ppm) calcium hardness as calcium carbonate.

**When high CH is anticipated,* this procedure may be used: Use 10 mL sample, 10 drops R-0010, 3 drops R-0011L, and multiply drops in Step 4 by 25.

Cyanuric Acid Test
1. Rinse and fill CYA dispensing bottle (#9191) to 7 mL mark with water to be tested.
2. Add R-0013 to 14 mL mark. Cap and mix for 30 seconds.
3. Slowly transfer cloudy solution to small comparator tube until black dot on bottom just disappears when viewed from top.
4. Read tube at liquid level on back of comparator block. Record reading as parts per million (ppm) cyanuric acid.

Sodium Chloride (Salt) Test
For 1 drop = 200 ppm
1. Rinse and fill sample tube (#9198) to 10 mL mark with water to be tested.
2. Add 1 drop R-0630. Swirl to mix. Sample should turn yellow.
3. Add R-0718 dropwise, swirling and counting after each drop, until color changes from yellow to a milky salmon (brick) red. Always hold bottle in vertical position.
NOTE: Do not add enough R-0718 to give a brown color. First change from yellow to a milky salmon (brick) red is the endpoint.
4. Multiply drops of R-0718 by 200. Record as parts per million (ppm) salt as sodium chloride.

taylor 12/14

Water Testing Methods

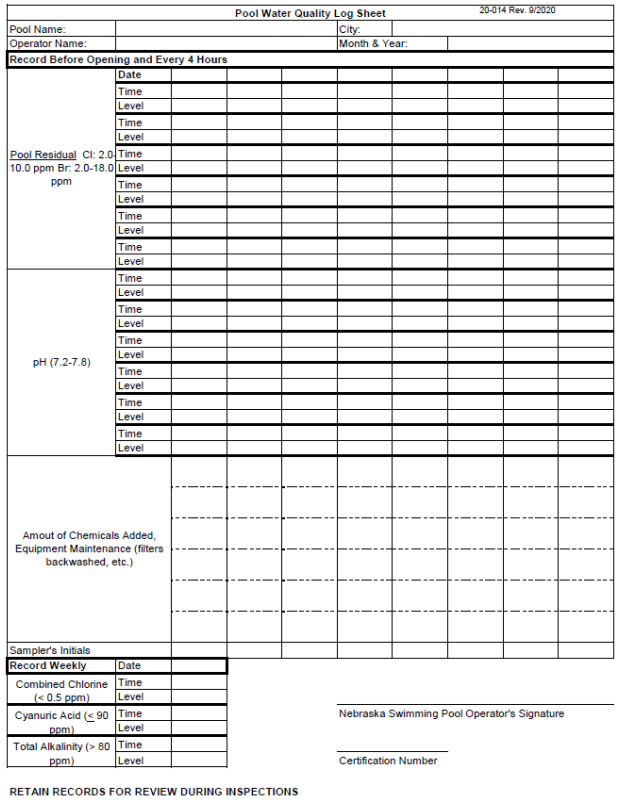
Results of Testing - Rules and Regulations

Pool log (provided by NDEE) is a record* of:

- Test results for all required water quality items
- Chemistry adjustments
- Equipment maintenance
- Daily patron loads

Keep current copy of pool operator card and pool tester certificate** **on-site**

- Retain records for review during inspections



Pool Water Quality Log Sheet — 20-014 Rev. 9/2020

Pool Name: | City:

Operator Name: | Month & Year:

Record Before Opening and Every 4 Hours

Pool Residual Cl: 2.0-10.0 ppm Br: 2.0-18.0 ppm	Date									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
pH (7.2-7.8)	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
	Time									
	Level									
Amout of Chemicals Added, Equipment Maintenance (filters backwashed, etc.)										
Sampler's Initials										

Record Weekly	Date	
Combined Chlorine (< 0.5 ppm)	Time	
	Level	
Cyanuric Acid (< 90 ppm)	Time	
	Level	
Total Alkalinity (> 80 ppm)	Time	
	Level	

Nebraska Swimming Pool Operator's Signature

Certification Number

RETAIN RECORDS FOR REVIEW DURING INSPECTIONS

* Check with local jurisdictions on record retention

** LLCHD requirement

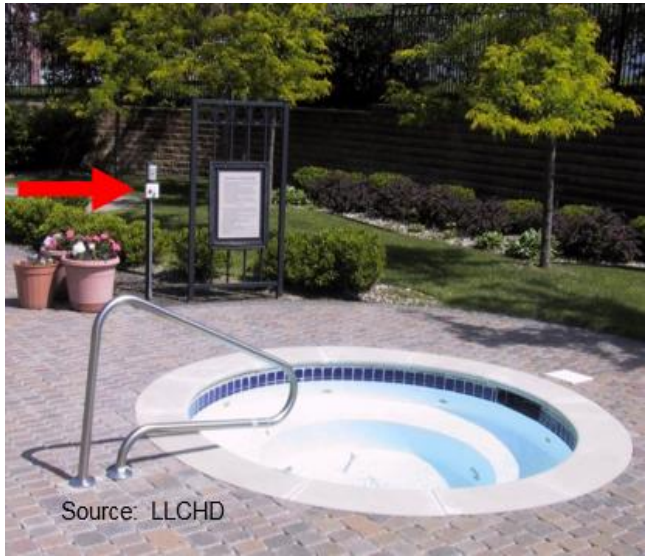
Spas

Spas are required to have:

Source: NDEE

- A timer for hydrotherapy pump and air blower
  - should be beyond arm's reach
- An emergency shut-off switch located near the spa in case entrapment should occur
- Must shutdown entire spa system

Source: NDEE


Source: LLCHD

Spas

Spas are required to have:

- A thermometer - make sure it does not contain glass
  - Record temperature
  - Assure temperature does not exceed 104^{o} F

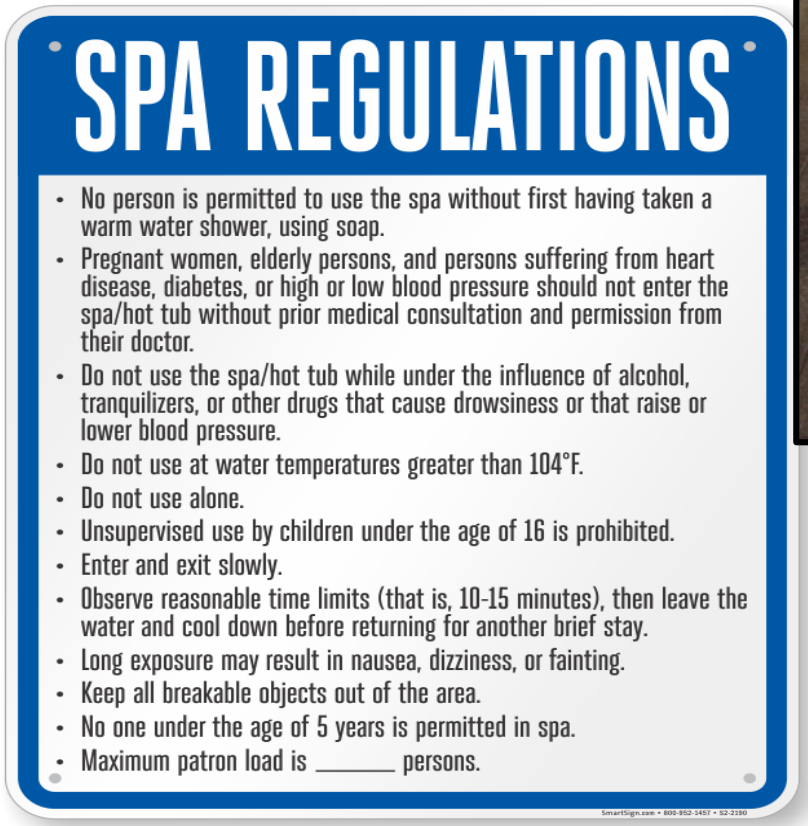
INYOpools.com

Spas

Spas are required to have:

- Depth markers
- Signage

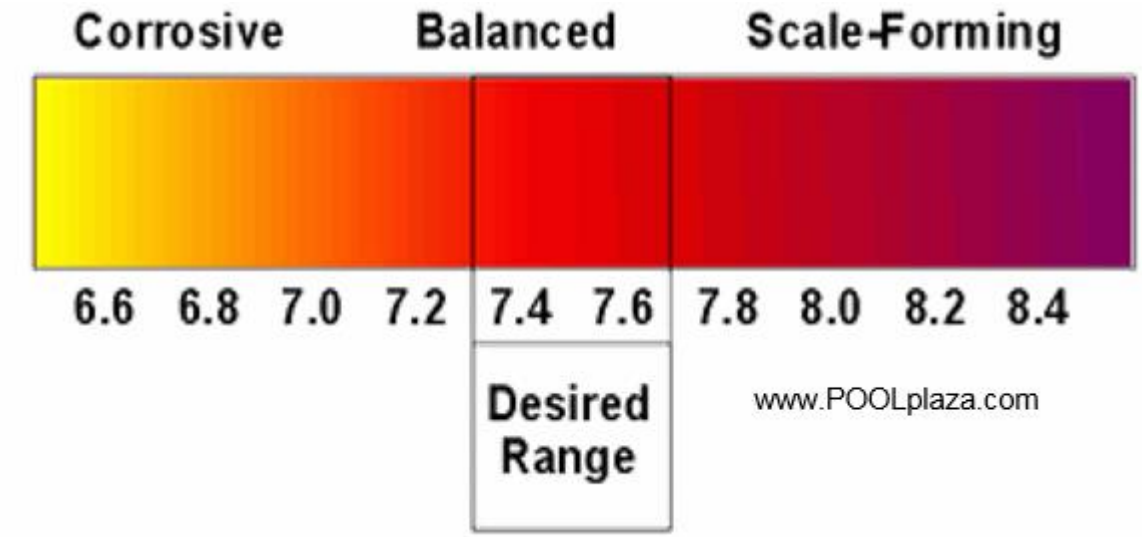
State of Nebraska regulation sign verbatim



Source: NDEE

Spas

- Air and hot water can cause pH to rise thus lowering the ability of the disinfectant to kill bacteria
- Smaller body of warmer water - more difficult to maintain water chemistry
- Frequent empty/refill affects pH - the actual pH level of water source



Spas

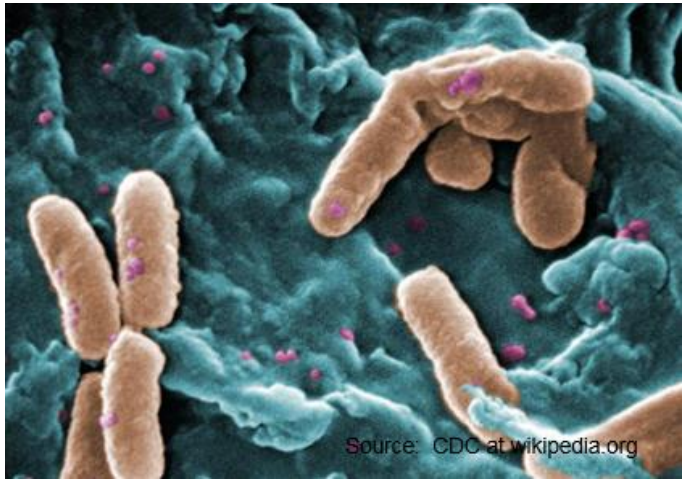
Spa problems

- Hyperthermia
- Entrapment
- Pseudomonas
- Dermatitis
- Glass bottles!

Source: NDEE

Spas

- Common spa “swimming” bacteria
  - *Pseudomonas aeruginosa*
  - Likes 98^{o} F - 105 ^{o} F water temperature
- Diseases caused by pseudomonas
  - Eye and ear infection “swimmers ear”
  - Skin and respiratory infection
  - Endocarditis - infects heart valves
  - Urinary and gastrointestinal infection
  - *Legionella* - bacteria causing a serious pneumonia-type illness called Legionnaires disease



Spas

Recirculation of spa water

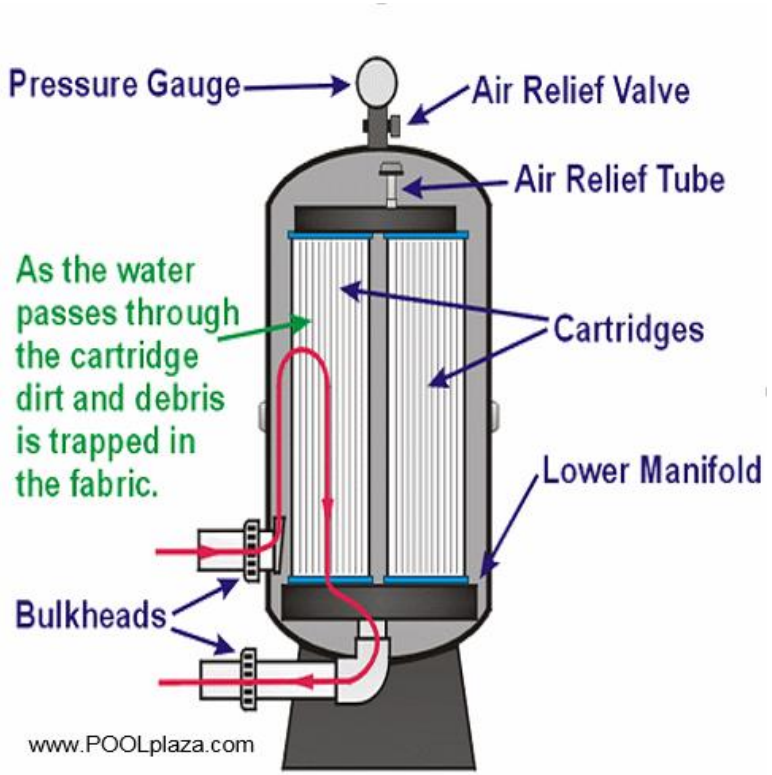
- 30 minutes turnover
- Filtered
- Sanitized
- Heated
- Returned to spa

- Air blower separate from water recirculation

Spas

- Water cleaned by cartridge or sand filter
  - Back-up 2nd cartridge is required

Pool matrix



Spas - Water Quality Review

Water Chemistry Requirements

- **MINIMUM** 3.0 ppm free chlorine
- **MAXIMUM** 10.0 ppm free chlorine
- **MINIMUM** 4.0 ppm bromine
- **MAXIMUM** 18.0 ppm bromine
- pH 7.2 to 7.8
- Combined Chlorine 0.0-0.5 ppm
- Alkalinity above 80 ppm
- Temperature not to exceed 104° F

Source: NDEE

Spa Closure

IF…

- Chlorine is not between 3 ppm - 10 ppm
- Bromine is not between 4 ppm - 18 ppm
- pH is not between 7.2 - 7.8
- Combined chlorine is above 0.5 ppm
- Cyanuric acid (if using stabilizer) exceeds maximum 90 ppm
- Cannot see main drain
- **CLOSE THE SPA!!**

Pool Closure

IF…

- Chlorine is not between 2 ppm - 10 ppm
- Bromine is not between 2 ppm - 18 ppm
- pH is not between 7.2 - 7.8
- Combined chlorine is above 0.5 ppm
- Cyanuric acid exceeds maximum 90 ppm
- Cannot see main drain
- **CLOSE THE POOL!!**

Swimming Pool Program

402-471-0903

http://dee.ne.gov/NDEQProg.nsf/OnWeb/SP