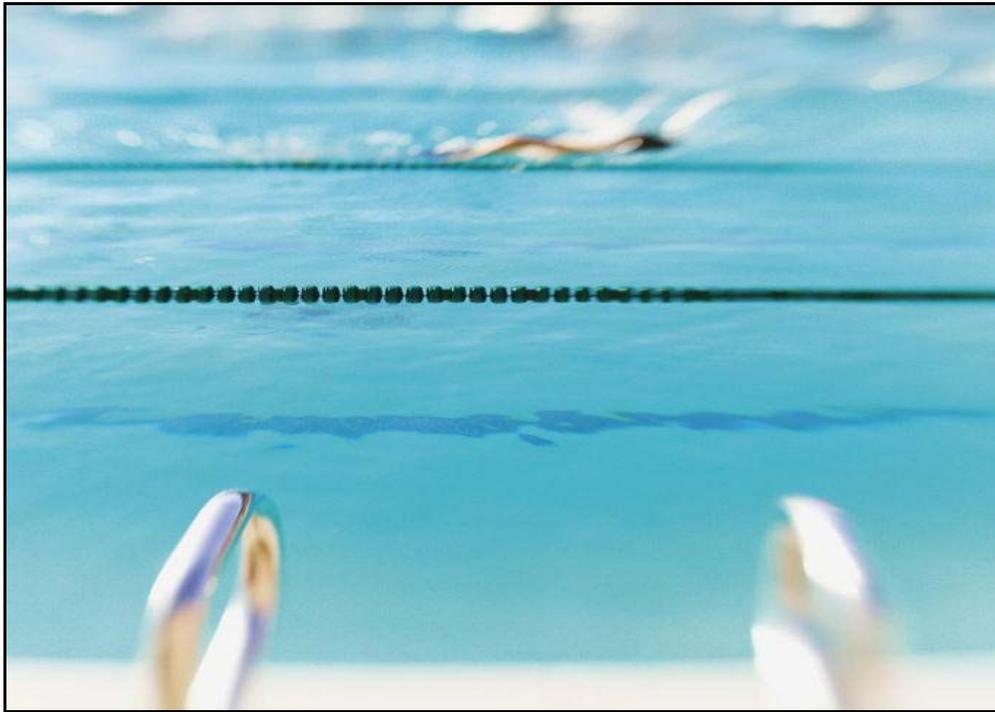


Swimming Pool Operator's Guide



San Luis Obispo County
Public Health Department
Environmental Health Services

Acknowledgements

National Swimming Pool Foundation
Centers for Disease Control
Consumers Product Safety Commission
National Drowning Prevention Alliance
American Red Cross
San Diego County Aquatic Council
Association of Pool & Spa Professionals
Independent Pool & Spa Service Association
Safe Kids
Department of Environmental Health, Pool Think Tank Members

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INTRODUCTION

The purpose of this guide is to provide public pool owners and operators with an understanding of how their pool is permitted, inspected and regulated by Environmental Health Services. It also provides general information about the proper operation and maintenance of a public pool.

San Luis Obispo County Environmental Health Services Swimming Pool Program is designed to eliminate illness, injury and death at public pools by reducing risk factor violations. The Swimming Pool Inspection process focuses on these “risk factor violations”.

The following **RISK FACTOR VIOLATIONS** have been identified as leading to injury, illness or death:

- Improper water chemistry
- Unsafe suction outlets
- Improper recirculation / disinfection system
- Improper chemical storage
- Safety hazards
- Unsecured pool enclosure
- Inadequate water clarity

The pool owner/operator can control these risk factor violations by taking the following **ACTIONS** or **INTERVENTIONS**:

- Designate a person responsible for the pool and bathers
- Train staff
- Educate bathers
- Keep maintenance, operation and training records and logs
- Review maintenance, operation and training records and logs

Supervision is the key to the success of these interventions and the safe operation of the facility. The pool must be under the supervision of a person who is fully capable and will assume responsibility for compliance with all requirements relating to pool operation, maintenance and safety. The California Health and Safety Code require that every pool have a responsible person to take appropriate action to correct hazardous conditions at the pool. Every pool should be monitored for unsafe conditions that could lead to injury, illness or death. These hazards could include something as common as broken glass in the water, to something as rare as a car crashing into the pool.

Environmental Health Services strives to develop partnerships with each pool owner/operator. By working together, we can provide safe, well-operated and well-maintained public pools for the enjoyment of everyone.

CHAPTER 1 THE INSPECTION REPORT

The Environmental Health Specialist (EHS) uses the Pool Inspection Report to record observations and violations found during an inspection. The Pool Inspection Report is a tool used to evaluate the safety and operation of your pool facility. At the end of an inspection, the EHS reviews the results of the inspection and explains any actions required to correct violations. You are encouraged to maintain a copy of the inspection report for your records.

The EHS works with the pool operator to gain voluntary compliance whenever possible. However, it is important to know that the violations listed on the Pool Inspection Report are violations of the California Health and Safety Code, California Code of Regulations, California Building Code and California Electrical Code. These violations require correction. Immediate health hazards observed must be corrected during the inspection or will result in closure.

The inspection report is divided into four general sections: Risk Factors, Maintenance & Operations, Measurements & Readings and Observations & Corrective Actions.

RISK FACTORS: This section covers water chemistry, entrapment, recirculation system, disinfection system, chemical storage, safety hazards, enclosures/security, water clarity and other unsafe conditions.

MAINTENANCE & OPERATIONS: This section covers items that are important in maintaining the pool, but are usually not an immediate threat to the safety of the bathers or staff.

MEASUREMENTS & READINGS: This section is used by the specialist to record chemical test results and readings taken from the equipment gauges and meters during an inspection.

OBSERVATIONS & CORRECTIVE ACTIONS: This section provides space for the specialist to note observations, clarify violations and explain corrective actions.

The **REVERSE** side of the inspection report lists the general requirements for each numbered item with applicable state and local codes.



Pool Inspection Report
County of San Diego, Department of Environmental Health
P.O. Box 12824, San Diego, CA 92112-2824
(619) 336-2222 (800) 253-9353 www.sdcdeh.org

Page of

Facility Name: _____ Date (MM/CCYY): / /

Site Address: _____ Permit No.:

Permit Holder: _____ Permit Type:

Mailing Address: _____ ID #:

City: _____ State: _____ Zip: _____ Census Tract: _____

Inspection Type: Routine Reinspection Complaint Environmental Other

Time Spent: hr min

In = In Compliance NIO = Not Observed NIA = Not Applicable OUT = Not In Compliance COB = Corroded Onsite

Location: _____

Pools on Permit: _____

RISK FACTORS				RISK FACTORS			
WATER CHEMISTRY				SAFETY HAZARDS			
In	1. Sanitizer (Chlorine / Bromine)	<input type="checkbox"/>	<input type="checkbox"/>	In	10. Dredging, Coating, Sides, Gutters & Covers	<input type="checkbox"/>	<input type="checkbox"/>
In	2. pH Level	<input type="checkbox"/>	<input type="checkbox"/>	In	11. Ladders	<input type="checkbox"/>	<input type="checkbox"/>
In	3a. Total Alkalinity	<input type="checkbox"/>	<input type="checkbox"/>	In	12. Filled Line, Cloth & Safety Markings Provided	<input type="checkbox"/>	<input type="checkbox"/>
In	3b. Cyanuric Acid Level	<input type="checkbox"/>	<input type="checkbox"/>	In	13. Side and Wave Pool Safety	<input type="checkbox"/>	<input type="checkbox"/>
ENTRAPMENT				ENCLOSURES / SECURITY			
In	4. Suction Outlet Covers / Fittings	<input type="checkbox"/>	<input type="checkbox"/>	In	15. Enclosure	<input type="checkbox"/>	<input type="checkbox"/>
In	5. Anti-entrapment Devices or Systems	<input type="checkbox"/>	<input type="checkbox"/>	In	16. Gates Self-Closing & Self-Latching	<input type="checkbox"/>	<input type="checkbox"/>
RECIRCULATION / FILTRATION / DISINFECTION				WATER CLARITY			
In	6. Minimum Turnover Provided	<input type="checkbox"/>	<input type="checkbox"/>	In	17. Gate with Keyless Egress	<input type="checkbox"/>	<input type="checkbox"/>
In	7. Proper Continuous Operation of Recirculation & Filtration System	<input type="checkbox"/>	<input type="checkbox"/>	In	18. Lifeguards Service	<input type="checkbox"/>	<input type="checkbox"/>
In	8. Proper Continuous Operation of Chemical Feeding	<input type="checkbox"/>	<input type="checkbox"/>	In	19. Main Drain Clearly Visible	<input type="checkbox"/>	<input type="checkbox"/>
CHEMICAL STORAGE				HEALTHFUL, SAFE & SANITARY			
In	9. Proper Chemical Storage	<input type="checkbox"/>	<input type="checkbox"/>	In	20. Pool in Healthy, Safe & Sanitary	<input type="checkbox"/>	<input type="checkbox"/>

MAINTENANCE & OPERATIONS				MAINTENANCE & OPERATIONS			
In	21. Pool Shell, Surface & Tiles Clean	<input type="checkbox"/>	<input type="checkbox"/>	In	27. Access for Inspection	<input type="checkbox"/>	<input type="checkbox"/>
In	22. Required Signs Posted & Good Repair	<input type="checkbox"/>	<input type="checkbox"/>	In	28. Adequate Recordkeeping	<input type="checkbox"/>	<input type="checkbox"/>
In	23. "WET FLOOR" Signage in Entrances, Fountains, Adequate, Clean & Good Repair	<input type="checkbox"/>	<input type="checkbox"/>	In	29. Adequate First Aid Materials	<input type="checkbox"/>	<input type="checkbox"/>
In	24. Gauges & Flow Meters Functioning	<input type="checkbox"/>	<input type="checkbox"/>	In	30. Pool Area Maintained and Free of Vermin	<input type="checkbox"/>	<input type="checkbox"/>
In	25. Equipment and Pressure Maintained	<input type="checkbox"/>	<input type="checkbox"/>	In	31. Heatmeter Checked	<input type="checkbox"/>	<input type="checkbox"/>
In	26. Responsible Person	<input type="checkbox"/>	<input type="checkbox"/>	In	32. Pool Shell Finish Maintained	<input type="checkbox"/>	<input type="checkbox"/>

Pool #	1	2	3
Free Chlorine (1.0 - 10 ppm) / Bromine (2.0 - 10 ppm)	mg/L	ppm	ppm
pH (7.2 - 8.0)			
Total Alkalinity (80 - 180 ppm)	ppm	ppm	ppm
Cyanuric Acid Level (Max. 100 ppm)	ppm	ppm	ppm
Flow Rate	gpm	gpm	gpm
Influent / Effluent Chlorine (checkweek if otherwise specify 10 sec)	psi	psi	psi

Inspection Result: Ordered Closed Approved to Reopen Yes No None Inactive Directed Substantial Compliance

Enforcement & Compliance: Plan Review Required No Valid Permit Hearing Scheduled

OBSERVATIONS & CORRECTIVE ACTIONS (see reverse for additional comments)

Received by (Print): _____

Specialist (Print): _____

Received by (Signature): _____

Specialist (Signature): _____

Phone: _____

Phone: _____

This report is an Official Notice of Violation. It is the responsibility of the owner/operator to make all corrections. See reverse for the general requirements and code sections for each violation listed. A reinspection fee may be charged if violations noted on this report are not corrected by the reinspection date.

DEHP-FH-381-NCR (Rev. 3/2010) DISTRIBUTION: WHITE-FILE YELLOW-OPERATOR PINK-SPECIALIST Reinspection Date (m/d/yyyy) _____

CHAPTER 2 WATER CHEMISTRY

Sanitizer

The **minimum** level for **unstabilized free chlorine** is **1.0 ppm** and **1.5 ppm** for **stabilized free chlorine**. When **bromine** is used as sanitizer, the minimum concentration required is **2.0 ppm**. The **maximum** level for both **free chlorine** and **bromine** is **10.0 ppm**. Sanitizer is responsible for killing pathogens that can cause illness. A **minimum** concentration of sanitizer must be maintained in the pool. If the sanitizer concentration is not in the approved range - **CLOSE** the pool and adjust the concentration to approved levels.

pH

The approved pH range is **7.2 - 8.0**. pH is the measure of acidity of the pool water. It is important in controlling water balance and effectiveness of sanitizer. If the pH is not in the approved range - **CLOSE** the pool and adjust the pH to the approved range.

Total Alkalinity

Maintain total alkalinity between **60 - 180 ppm**. Total alkalinity is a measure of the ability of pool water to resist changes in pH. Testing for total alkalinity is not required by current code, but is recommended as an aid in controlling pH levels.

Cyanuric Acid

Maintain cyanuric acid levels **at or below 100 ppm**. Cyanuric acid is a chemical that is commonly referred to as a “stabilizer”. When added to the pool water, it slows the degrading effect of sunlight on chlorine. In a pool exposed to sunlight the level of cyanuric acid should be kept between 30 - 50 ppm but must not exceed 100 ppm. As cyanuric acid levels in a pool increase, the sanitizing power of chlorine decreases.

See Appendix D “Water Chemistry & Testing” for more information about Water Chemistry.

WATER CHEMISTRY GUIDELINES				
Chemical	Pool Type	Ideal (ppm)	Minimum (ppm)	Maximum (ppm)
Free Chlorine	Pool & waterpark	2 - 3	1 *	10
	Spa & wader	3 - 5	1 *	10
Bromine	All	4 - 6	2	10
pH	All	7.4 - 7.6	7.2	8
Cyanuric Acid	All	30 - 50	0	100
Total Alkalinity	All	80 - 120	60	180
* If a pool uses <u>cyanuric acid</u> , the minimum chlorine concentration is <u>1.5 ppm</u>				

SAFETY TIP! Test pool water daily and record results on a log sheet. Be sure to test for Free Chlorine by using a DPD test kit.

CHAPTER 3 ENTRAPMENT

Suction Outlet Covers/Fittings

Entrapment accidents are one of the most preventable causes of injury and death in swimming pools. For that reason, it is important to closely inspect the suction system of your pool. All main drain covers must meet the “Virginia Graeme Baker Pool and Spa Safety Act” (VGB) anti-entrapment standards ASME/ANSI A112.19.8. Main drain covers must be in good repair and securely attached to the main drain housing. If the covers are broken, loose or missing - **CLOSE** the pool and replace the broken cover(s).



Bathers, especially young children, can become entrapped by powerful suction at unprotected pool or spa main drains or other suction ports in the pool. **See Appendix B “Suction Entrapment Prevention” for more information about anti-entrapment requirements.**

Anti-entrapment Devices or Systems

Pools and spas with single blockable drains or multiple drains less than 3 feet apart are required to provide an additional layer of anti-entrapment protection. This must be achieved by one of the following approved systems or devices: Safety Vacuum Release System (SVRS), a suction limiting system, a gravity drainage system or an automatic pump shut-off system. If the anti-entrapment device is broken or missing - **CLOSE** the pool and repair/replace the anti-entrapment device. **For more details on these systems or devices, see Appendix B “Suction Entrapment Prevention”.**

Safety Tip! Use your 12 foot reaching pole to check that the main drain covers are securely attached.



CHAPTER 4 RECIRCULATION / FILTRATION / DISINFECTION

Minimum Turnover Requirements

Each pool must meet a minimum required turnover time. The function of the recirculation system is to filter contaminants and sanitize the pool water. When it is not working correctly, the pool water can quickly become dirty and lack adequate germ killing disinfectant. The turnover time is determined by the size (volume) of the pool, the type of pool and the date it was constructed. Check the table below to find the minimum turnover time required for your pool.

Type of Pool	Built before January 1, 1982	Built after January 1, 1982
Swimming	8 hours	6 hours
Wader	2 hours	1 hour
Spa	1 hour	½ hour
Wave	N/A	2 hours
Spray pad	N/A	½ hour

$$\text{Turnover Rate (hrs)} = \text{Pool Volume (gal)} \div \text{Flow Rate (gal/min)} \div 60 \text{ (min/hr)}$$

Steps for determining the minimum turnover for your pool:

- Determine date the pool was constructed
- Calculate the volume of the pool (*See Appendix K “Formulas, Conversions & Calculations”*)
- Determine the flow rate by reading it from the flow meter

Proper Continuous Operation of Recirculation & Filtration System

The pool's recirculation or filtration system is required to be operating during the hours the pool is open and available to bathers. It is highly recommended that it operate an additional two (2) hours before and two (2) hours after the pool operating hours. This will allow the pool filter to clean and sanitize the water without bathers in the water. If the pool's recirculation/filtration system is not functioning - **CLOSE** the pool and don't allow bathers to use the pool until the system works correctly.



Perform daily maintenance on the recirculation/filtration system of the pool. The water level of the pool needs to be maintained at the mid-point of the skimmer for optimal filter performance. Check the filter influent and effluent gauges and backwash or clean if the difference is greater than 10 psi. Empty the skimmer baskets and make sure all components (weir flap, float valve, skimmer basket and skimmer cover) are in good repair and present. *See Appendix C “Recirculation / Filtration / Disinfection” for more information about these systems.*

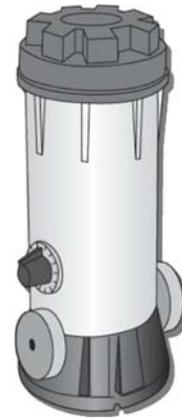
Proper Continuous Operation of Chemical Feeders

Chemical feeders (chlorinator, pH adjusting feeder and brominator) are required to be operating and in good repair during pool operating hours. As with the recirculation system, it is recommended that the chemical feeders also operate two (2) hours before and after the pool hours of operation. This will allow the chemical feeders to continue to sanitize and balance the water chemistry without additional contamination from bathers in the water. If the pool's automatic chemical feeder is not functioning - **CLOSE** the pool and repair the system.

Different forms of sanitizer have various pHs. Liquid chlorine has a high pH around 11, so the pH may need to be adjusted down between 7.2 and 7.8 with acid through an automatic chemical feeder. ***For more details on the chemical systems, see Appendix C "Recirculation / Filtration / Disinfection".***



Liquid Chlorine and Acid Feeders



Tablet Erosion Feeder – Chlorine or bromine is dissolved and injected into the pool water

SAFETY TIP! Due to safety concerns for bathers, do not use floating chlorinators or place sanitizer tablets in or underneath skimmer baskets. Place tablets only in approved feeders.

CHAPTER 5 CHEMICAL STORAGE

Proper Chemical Storage

Improper storage of chemicals could result in fire, explosion, or release of toxic fumes, due to accidental mixing of incompatible chemicals. Pool chemicals must be stored in a clean, dry, well-ventilated and secure area that is separated from other chemicals such as paint solvents, insecticides and fertilizers. Storing incompatible pool chemicals together must also be avoided due to the risk of severe chemical reactions. For example, chemicals with high pH (liquid chlorine) should not be stored with chemicals that have very low pH (chlorine tablets). If the chemicals are not properly stored - **CLOSE** the pool and correct the storage issue. For chemical emergencies, contact 9-1-1 and evacuate the area.

Reportable Quantities of Chemicals

The storage of any hazardous material in quantities equal to or greater than 55 gallons, 500 pounds or 200 cubic feet requires a Hazardous Materials Permit. This total includes empty chemical containers that may be on site. No Hazardous Material Inventory Permit is required if you have less than these quantities.

For Hazmat information please call (858) 505-6880.



SAFETY TIPS!

- Never store liquid chemicals above or beside chemicals in a solid, powder or tablet form.
- Read and follow storage instructions on container.
- Be prepared to safely clean up a pool chemical spill.

CHAPTER 6 SAFETY HAZARDS

Hazards can range from trip and fall hazards, cut and scrape hazards, electrical hazards or biological hazards.

Decking, Coping, Steps, Gutters & Covers

If the above areas of the pool are not maintained in good repair, accidents and injuries can occur in and around the pool. Cracked or damaged decking, coping, gutters or steps must be repaired or replaced. Ladders and handrails must be checked to ensure they are secure and undamaged.

DECKING is required to extend around the entire perimeter of the pool, be a minimum of 4 feet wide, constructed with concrete or like material, be slip resistant, non-abrasive, flush with the pool coping and unobstructed. This provides adequate space to walk around the pool and to perform a rescue if needed.

Wood decking and carpeting are not approved as decking surfaces.



SPA POOL DECK EXCEPTION - A spa pool must have a minimum of 4 feet of unobstructed decking around at least 50% of the spa. Half of the perimeter of a spa may be next to a wall, fence or guard rail if this portion of decking is one (1) foot or less in width.

EXISTING ENCLOSURE EXCEPTION - If a physical characteristic (building/stairs) of a site encroaches on the 4 foot deck around an existing pool, the enforcing agency may allow installation of an enclosure which reduces the pool deck to less than 4 feet in width.



COPING around the pool is usually a series of bull-nosed stones that slope away from the pool. This helps keep the pool clean by directing water on the deck away from the pool. Coping also functions as a handhold for bathers and must hang over the pool wall at least 1 inch, but not more than 2 inches. It is not to exceed 2 ½ inches in thickness.

LADDERS, HANDRAILS & STEPS are intended to provide bathers with support when entering or exiting the pool. It is essential that they are in good repair, securely fastened and steady. Loose or wobbling ladders or handrails can cause fall injuries; while steps with large cracks or chips can cause cuts or abrasions.



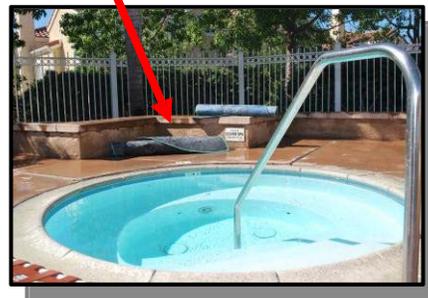
GUTTERS are found at large municipal and club pools or older pools built before 1960. Gutters serve two functions: trap debris and scum from the surface of the water and provide a handhold for bathers.



POOL & SPA COVERS

Covers on pools and spas provide real benefit if used correctly. They reduce heat loss and help conserve energy costs if your pool or spa is heated. They also reduce the amount of debris and contaminants blown into the pool. However, pool and spa covers also pose a risk of trapping a bather underneath the cover. Therefore, the pool or spa enclosure must be locked when the pool cover is in place and the cover must be removed and stored away from the pool when the pool is open to bathers.

All pool covers must be removed and stored at least 4 feet from the pool or spa when the pool is open and available to bathers.



Lighting

All pools that allow swimming after dark are required to provide lighting for both the pool and the surrounding deck area. Ensure pool lighting turns on after sunset to avoid injuries and accidents due to inadequate visibility around the deck and in the pool. If pool and/or deck lighting is not provided, the pool must post a sign stating “NO USE OF POOL ALLOWED AFTER DARK”.

POOL LIGHTING

All pools that allow use of the pool after dark must provide sufficient lighting so that all parts of the underwater area and swimming surface can be seen with no blind spots. Lighting must be approved by the Department of Environmental Health prior to installation and use. The pool lighting system must be equipped with a device that automatically turns on the pool lights from sunset to sunrise.



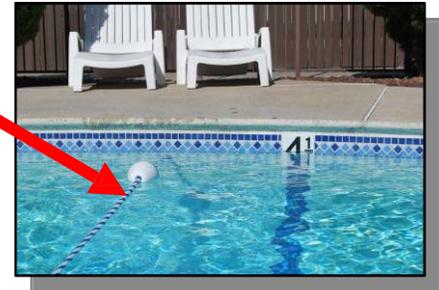
DECK LIGHTING

Pool decking must also be provided with sufficient lighting at all parts of the pool deck so that anyone walking on the deck can avoid any hazards. Deck lighting must be equipped with a device that automatically turns on the lights from sunset to sunrise.

Float Line, Depth and Safety Markings Provided

Depth markers, depth marking lines and float line provide bathers with information about how deep the pool is and where there are dramatic changes in depth. Depth markers, depth marking lines and float lines should be kept in good condition and replaced if they are damaged or missing.

FLOAT LINES WITH BUOYS are required for all pools with a break-in-slope, where the slope at the bottom of the pool gets steeper causing a dramatic change in depth across a short distance. The float rope is located on the shallow side of the break-in-slope, usually at the 4 ½ foot depth.



DEPTH MARKERS are required for all pools and spas and must be located at each end of the pool and at the deepest and shallowest depth of the pool.

- ✓ Numerals must be a minimum of 3 inches in height and of a contrasting color from the background.
- ✓ Marker must be made of durable material (tile, plastic or composite material).
- ✓ Marker must be on the vertical wall of the pool above the water line.
- ✓ If the pool is greater than 20 feet in width, the depth marker must also be placed on the edge of the deck next to the pool.



DEPTH MARKING LINES are only required for pools that have a maximum depth greater than 5 feet. It must be a 4 inch wide straight line of contrasting color across the bottom of the pool at the 4 ½ foot depth marker. If the pool is greater than 5 feet deep and also has a break-in-slope, it is required to provide both a depth marking line and float line with buoys.



Spa and Wave Pool Safety

Spa and wave pools present special safety concerns due to their unique features and have special equipment and signage requirements.



SPA POOLS

Although the warm water and water jets of spa pools can be very relaxing and enjoyable, they can also be dangerous for some bathers. Exposure to water temperatures well over normal body temperature can be unhealthy. In addition, the risk of suction entrapment is greater in spa pools due to the shallow depth and close proximity of bathers to jet and recirculation suction drains. For these reasons, all spa pools are allowed to maintain the water temperature at a maximum of 104° F and to provide an Emergency Shut-Off Switch that shuts off all jets and suction pumps to the spa. Spa pools are also required to post a SPA CAUTION sign that advises bathers of dangers related to spa use and a sign adjacent to the Emergency Shut-Off Switch to denote the switch's location.

WAVE POOLS

Wave pools are relatively new and offer a unique experience to bathers who want to enjoy wave action without going to the ocean. Wave pools generate waves at regulated intervals which changes the depth of the water dramatically in a short period of time. This change in depth, together with limited visibility of the bottom of the pool, poses risks to bathers that are not present at other pools. A system must sound with an audible signal that warns bathers when a wave is coming. USCG approved Type II OR III life vests must be made available for all non-swimmers and children less than 48 inches tall who use the wave pool.

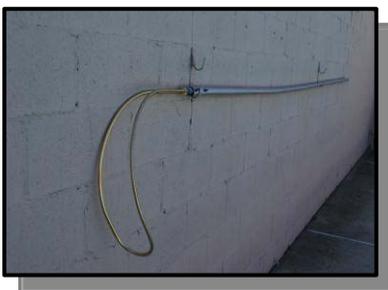


Lifesaving Equipment

All pools must provide the following lifesaving equipment. Ensure that equipment is located in clear view of bathers and is easily accessible in the event of a rescue.

LIFE RING WITH ROPE

All swimming pools are required to provide a life ring with an outside diameter of 17 inches and a rope attached that is long enough to span the widest part of the pool.



12 FOOT POLE WITH BODY HOOK

All pools must provide a 12 foot reaching pole with a body hook securely attached. The pole should be stored in a location that is clearly visible and is easily accessible to bathers. A shorter pole of adequate length to assist a bather in a spa is permitted if the spa is in an area not large enough to accommodate a 12 foot pole.

CHAPTER 7 ENCLOSURES / SECURITY

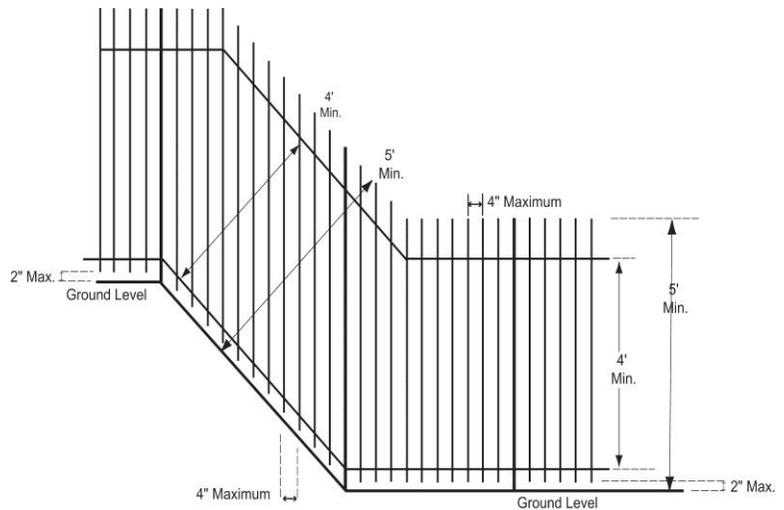
Enclosure

A well secured pool enclosure is vital to preventing childhood drowning. The fence or wall (surrounding the pool and decking area) and all gates or doors leading into the pool area are part of the enclosure. Enclosure requirements depend on when the pool enclosure was constructed. Pools constructed after July 1, 1994 are regulated by code sections found in the California Code of Regulations (CCR), Title 24, Chapter 31B, Sections 3118B - 3118B.4. If the enclosure is broken and children can access the pool - **CLOSE** the pool and repair the fencing.

Requirements for pool enclosures constructed or modified after July 1, 1994:

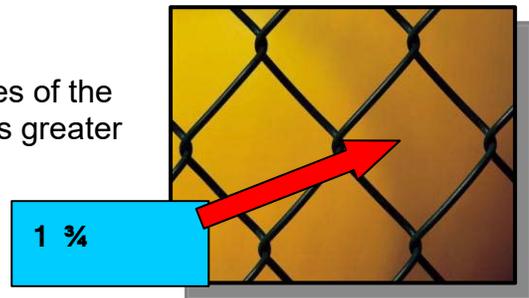
- Pools must be enclosed by a non-climbable wall or fence with a minimum height of 5 feet (60 inches) with no openings or gaps greater than 4 inches.

- The space between the bottom of the fence and the ground shall be no greater than 2 inches, unless the surface under the fence is a durable concrete like material in which case 4 inches is acceptable.



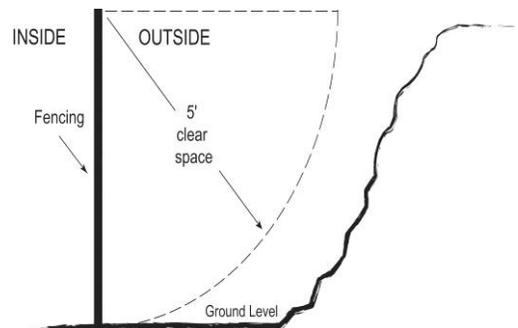
- Horizontal members must be a minimum of 48 inches apart to prevent climbing.

- Chain link fencing may be used if the open spaces of the links are not greater than 1 ¾ inches. Any spaces greater than 1 ¾ inches would be considered climbable.



- Buildings may be part of the enclosure if no doors, gates or windows from dwelling units open directly into the pool area.

- Climbable structures or natural features shall not be within a 5 foot radius, measured from the top of the outside of the enclosure.



Combination Fencing

Combination fencing consists of two or more materials stacked or integrated to form one solid fence. Commonly, this type of fence consists of a short masonry (block wall), one to two feet in height, with a wooden, metal, or chain link fence on top of the block. One of the components of the wall must be a minimum of four (4) feet in height and the fencing on top of the wall must be set to the outside of the wall to prevent climbing.



Requirements for pool enclosures constructed before July 1, 1994:

- Pool area shall be enclosed by a wall or fence with a minimum height of 4 feet (48 inches) with no opening or gaps greater than 4 inches.
- Buildings surrounding the pool may be part of the enclosure if there are gates and fencing at entrances to the apartment complex to restrict direct access to the pool area by non-residents.
- Buildings surrounding a courtyard, combined with fencing and gates at an apartment complex entrance, can create a swimming pool enclosure.



Modifying Existing Enclosures

Enclosures modified after July 1, 1994 must meet the July 1, 1994 enclosure requirements for fencing, gates and decking. Contact the DEH plan check unit before installing new fencing or decking, or making any major modifications to the existing fencing or decking.

Acceptable Construction Materials

Fencing and gates must be constructed out of a durable material such as wood, metal, masonry, plexiglass, or vinyl. Fencing and gates must be installed so they are stable and secure. **Vegetation such as bushes or shrubbery is considered to be non-durable and is not approved.**

SAFETY TIP! Routinely check all gates to make sure they are self-closing and self-latching. Also, check that the fencing is secure and in good condition with no gaps larger than 4 inches.

Self-Closing & Self-Latching Gates

Pool gates should be checked on a daily basis to ensure they are self-closing and self-latching. All gates must open out and away from the pool (if constructed after 1994), with the latch a minimum of 3 ½ feet (42 inches) above the ground. Test the gate by opening to a minimum of 12 inches and allow to close. If one or more of the pool gates is not self-closing and self-latching, or is in disrepair - **CLOSE** the pool and/or secure the problem gate(s) (chain or lock shut) until gate(s) is repaired.

Gates with Keyless Egress

All pool enclosures constructed after July 1, 1994 must have at least one gate or door through which a person can leave (egress) the enclosure without a key. Keyless egress gates or doors must be clearly marked with an “Emergency Exit” sign unless all gates and doors are keyless.

Lifeguard Service

DIRECT FEE

A facility charging a “direct fee” for the use of a pool (swimming, spa, wader, etc.) to the exclusion of any other service, facility or amenity, must provide lifeguard service. If there is no lifeguard on duty - **CLOSE** the pool until a lifeguard is placed on duty.

WAVE POOL

A lifeguard is required to be present.

LIFEGUARD QUALIFICATIONS

All lifeguards must have current certification from the American Red Cross (advanced lifesaving certificate), YMCA (senior lifesaving certificate) or have equivalent qualifications as determined by the California Department of Public Health. They must also have training in administering first aid, including cardiopulmonary resuscitation (CPR).

REQUIRED NUMBER OF LIFEGUARDS

This is dependent on a number of factors such as how many pools are in the enclosure, how large are the pools, what kinds of activities are occurring and how many bathers are in the pools. A general rule of thumb is to have enough lifeguards posted at different locations of the pool so that they are able to assist a bather in any part of the pool within 10 seconds. Lifeguards may not perform any other duties (e.g. conduct chemical water tests, teach swimming lessons, etc.) during the time they are responsible for guarding the pool.

CHAPTER 8 WATER CLARITY

Poor water clarity is an indication that the water may be unsafe for bathers. Cloudy or discolored water can mean the pool is contaminated or inadequately filtered. If the water clarity is so poor that the bottom of the pool is not visible, a potential drowning victim may not be seen until it is too late to rescue them. Check the water clarity of the pool on a daily basis. If the main drain cover is not visible through the water - **CLOSE** the pool and correct the water clarity.

MAIN DRAIN CLEARLY VISIBLE

The pool main drains must be clearly visible from the deck of the pool.

Poor water clarity is usually the result of contamination, algae bloom, poor filtration or chemical reactions with metals. Cloudy water can be caused by inadequate filtration, insufficient water circulation, insufficient flow rate or poor water chemistry.



Not clear



Clear

SAFETY TIP! Check daily to see if you can easily see the main drain covers from the deck. If the drain is not visible, close the pool until the water clarity

CHAPTER 9 MAINTENANCE & OPERATIONS

Pool Shell, Surface & Tiles Clean

Keeping the pool water surface clean of leaves and other floating debris is important in the daily maintenance of the pool. The surface should be skimmed daily or as needed depending on wind and weather conditions. Floating scum, sputum or other debris must not be allowed to accumulate on the water surface.

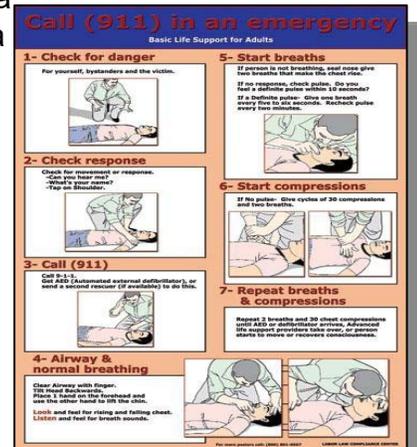
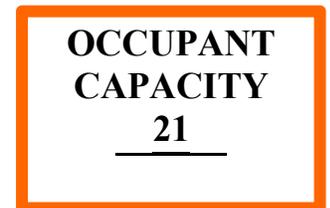
The pool shell (bottom, side walls and tile line) must be routinely brushed to eliminate algae and dirt buildup. This Action will help reduce the demand on the sanitizer concentration and the need for additional chemical treatments.



Required Signs Posted & Good Repair

All pools and spas are required to post these three (3) signs in plain view from all parts of the pool enclosure and maintain signs in good repair.

- **MAXIMUM OCCUPANT CAPACITY**
 - ✓ Signage must be in a minimum of 4 inch lettering
 - ✓ Post number of bathers allowed in the pool at one time
 - ✓ Pool Capacity = one bather for every 20 ft² of surface area
 - ✓ Spa Capacity = one bather for every 10 ft² of surface area
- **ARTIFICIAL RESPIRATION PROCEDURES**
 - ✓ Important that this sign is clearly visible and easily readable from all pools
 - ✓ Clear diagram of CPR and rescue breathing



- **EMERGENCY TELEPHONE # (9-1-1)**



Pools may require additional signage depending on the particular type, special features, activities or equipment used by the facility. The facility may need one or all of the following signs posted:

- **WARNING – NO LIFEGUARD ON DUTY**

- ✓ Signage must be in a minimum of 4 inch lettering
- ✓ Not required if facility does have a lifeguard on duty whenever pool is open for use



- **NO DIVING ALLOWED**

- ✓ Signage must be in a minimum of 4 inch lettering
- ✓ Only required if pool is less than 6 feet in depth



- **SHOWER BEFORE ENTERING POOL**

- **USE TOILET BEFORE ENTERING POOL**

- **SPA CAUTION**

- ✓ Must be posted near the entrance of spa pool
- ✓ Sign must contain the following language:



CAUTION

1. Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering a spa.
2. Unsupervised use by children under the age of 14 is prohibited.
3. Hot water immersion while under the influence of alcohol, narcotics, drugs, or medicines may lead to serious consequences and is not recommended.
4. Do not use alone.
5. Long exposure may result in nausea, dizziness or fainting.

- **SPA EMERGENCY SHUT-OFF SWITCH**

- ✓ Should be adjacent to emergency shut off switch



- **NO USE OF POOL AFTER DARK**

- ✓ Signage must be in a minimum of 4 inch lettering at each pool entrance
- ✓ Required for pools without sufficient lighting for use of pool after dark

- **EMERGENCY EXIT**

- ✓ Signage must be in a minimum of 4 inch lettering
- ✓ Facilities that have fencing/gates constructed after July 1994 must clearly label the gate that is equipped with keyless egress, unless all gates allow for exit without use of a key

- **DANGER: GASEOUS OXIDIZER CHLORINE**

- ✓ Signage must be in a minimum of 4 inch lettering
- ✓ Sign is required for pools with chlorine gas
- ✓ In addition, hazard ID symbol must be posted

- ✓ Signs must be posted on the exterior of the door of where the chlorine gas is being stored
- **LIFE VESTS ARE REQUIRED FOR ALL NON-SWIMMERS AND CHILDREN LESS THAN 42 INCHES TALL**
 - ✓ Required only for wave pools
- **ALL CHILDREN LESS THAN 42 INCHES TALL MUST BE ACCOMPANIED BY AN ADULT TO BE ADMITTED TO THE FACILITY**
 - ✓ Required only for wave pools
- **AN AUDIBLE WARNING SIGNAL WILL SOUND 15 SECONDS PRIOR TO THE NEXT WAVE**
 - ✓ Required only for wave pools
- **CAUTION: WATER IS RECIRCULATED. DO NOT DRINK**
 - ✓ Required only for Spray Grounds

The signs listed below are required to have lettering that is at least 4 inches high. All other required signs should be readable when standing in front of them.

- MAXIMUM OCCUPANT CAPACITY
- WARNING – NO LIFEGUARD ON DUTY
- NO DIVING ALLOWED
- NO USE AFTER DARK
- EMERGENCY EXIT
- DANGER: GASEOUS OXIDIZER CHLORINE

4 inches




Toilet Facilities, Showers and Drinking Fountains

Keep the pool's restrooms clean, stocked and in good repair. Dispensers must be stocked with soap, toilet paper and paper towels (or hand dryer). Hot and cold water (maximum of 110°F if from a mixed faucet) must be available at restroom hand sinks. Conduct daily monitoring of all locker/dressing rooms, restrooms and drinking fountains for cleanliness and maintenance.

Note: Facilities must provide restrooms for bathers if both living quarters and adjacent building with restrooms (cabana, clubhouse, recreation center) are more than 300 feet away.

Gauges and Flow Meters

Each pump is required to have a working influent gauge (on top of filter) and effluent gauge (after filter). If the pressure difference between the two gauges is greater than 10 psi, the pool filter needs to be backwashed or cleaned. The gauges should be positioned at the same height for accuracy of measurement.

Each pool is required to have a working flow meter. The flow meter measures the flow rate of the water through the recirculation system in gallons per minute. *Note: It should be positioned*

on a straight length of pipe with minimum distances of 10 times the pipe diameter before the flow meter and 4-5 times the pipe diameter after the flow meter.



Equipment Area

The area where the recirculation, filtration and disinfection systems are located must be clean, organized and accessible. This area must have adequate lighting for the safety of the staff. Do not store non-pool chemicals or equipment in the pump room. Label all pool piping as to directions of flow and to what pool it belongs to.

Responsible Person

Health and Safety Code requires that every pool must be under the supervision of a person that assumes responsibility for compliance of all pool operation, maintenance and safety of bathers.

The owner or permittee of the pool or an appointed agent can be the “responsible person”. He/she is not required to be at the pool during all hours of operation. However, he/she must assume responsibility for pool operation, maintenance requirements and the safety of bathers as required.

It is essential that the Environmental Health Services has accurate contact information. Without this information, Environmental Health cannot quickly inform you of issues related to your pool inspection, such as complaints, closures or other issues that require your attention.

Access Provided for Inspection

Routine inspections are unannounced and are conducted during reasonable hours. If your pool facility does not have staff at the pool during operating hours, ensure that this office has an entry method and current contact information for the pool operator or responsible manager.



Example: A lock box at the facility.

Adequate Record Keeping

All pool operators are required to keep daily records of the operation of each pool. Records should include readings of disinfectant residual and pH, as well as maintenance activities, such as cleaning of the filter and quantity of chemicals used to treat the pool. **Exception – Apartment or condo complexes with less than twenty-five (25) units are required to record information at least two times per week at intervals no greater than four days. This exception does not apply to hotels or motels.**

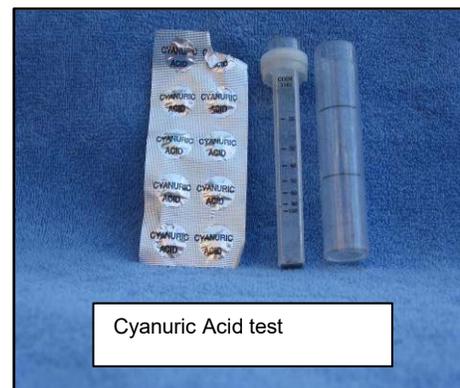
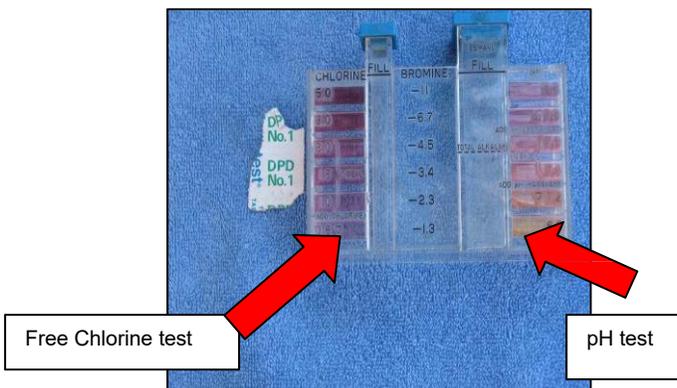
The records below should be kept for a minimum of one (1) year.

- ✓ Daily log of test results for disinfectant and pH
- ✓ Monthly record of cyanuric acid (stabilizer) if used
- ✓ Incident report of accidents requiring medical attention
- ✓ Fecal incidents and remedial treatment

Adequate Test Kit Available

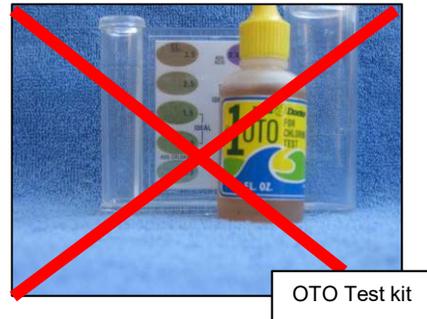
All pools are required to have available an approved test kit capable of measuring the **pH**, **disinfectant** concentration and **cyanuric acid** (stabilizer) concentration if used. Regular testing of the water is essential for maintaining safe and balanced water in the pool. Testing the water is the only way to determine whether chemical adjustments need to be made to keep the pH and disinfectant in the proper range. Although it is optional, Environmental Health recommends that the total alkalinity also be regularly tested. Total alkalinity has a dramatic impact on pH levels.

- **DISINFECTANT TEST** – Test kit must test for **free** chlorine or **free** bromine, **not** total chlorine or bromine.
- **pH** – Test kit must be capable of measuring a pH range between **6.8** and **8.2**.
- **CYANURIC ACID**–Test kit must be capable of measuring cyanuric acid concentration.
- **TOTAL ALKALINITY** – Test kit should be capable of measuring alkalinity.



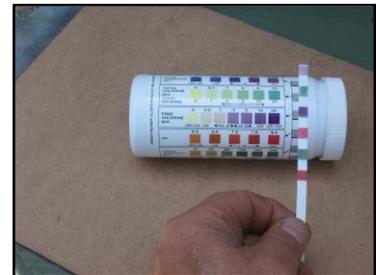
OTO vs DPD TEST KITS

When chlorine or bromine is used as the disinfectant, a test kit capable of measuring free chlorine or bromine residual is required. The reagent must be N,N-diethyl-p-phenylenediamine or (DPD #1), which turns pink in the presence of free chlorine or bromine. There are other test kits commonly sold at home improvement stores that use an Orthotolindine (OTO) reagent, but it is not approved because it measures TOTAL CHLORINE residual, not FREE CHLORINE. OTO turns yellow in the presence of total chlorine. There are numerous pool test kits available on the market, but the most important thing to consider is if the kit is capable of testing **free chlorine**.



TEST STRIPS are an acceptable alternative to test kits if free chlorine, pH and cyanuric acid tests are included on the strip.

See APPENDIX D “Water Chemistry & Testing” for guidelines on water testing and additional information regarding test kits.



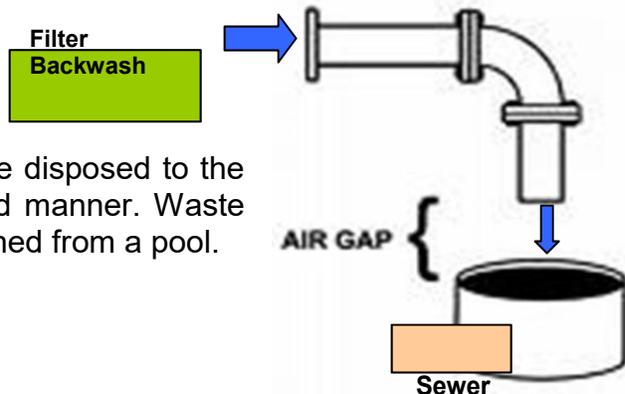
Pool Area Maintained and Free of Vermin & Animals

All parts of the pool and related pool facilities must be maintained clean, in good repair and free of litter and vermin. Animals should not be permitted in the pool or pool area with the exception of “service animals”.

See APPENDIX G “Pool Water Contamination & Response” for guidelines on treating water contamination due to animals.

Waste Water Disposal

All waste water generated by the pool must be disposed to the sewer with an air gap or other DEH approved manner. Waste water includes backwash water and water drained from a pool.

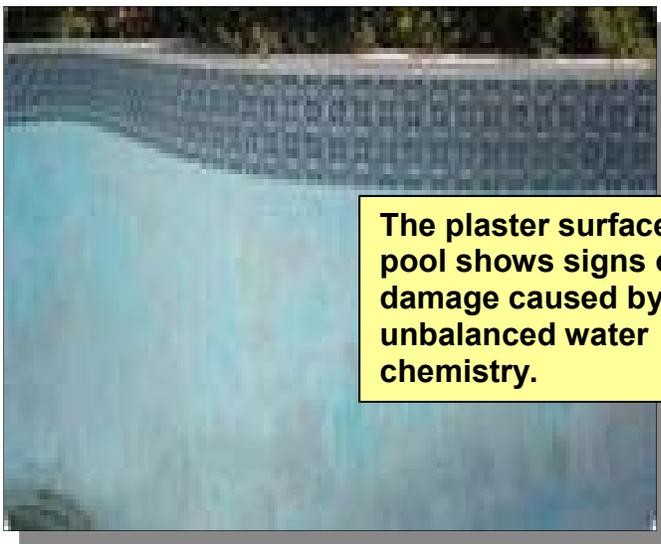


Pool Shell Finish Maintained

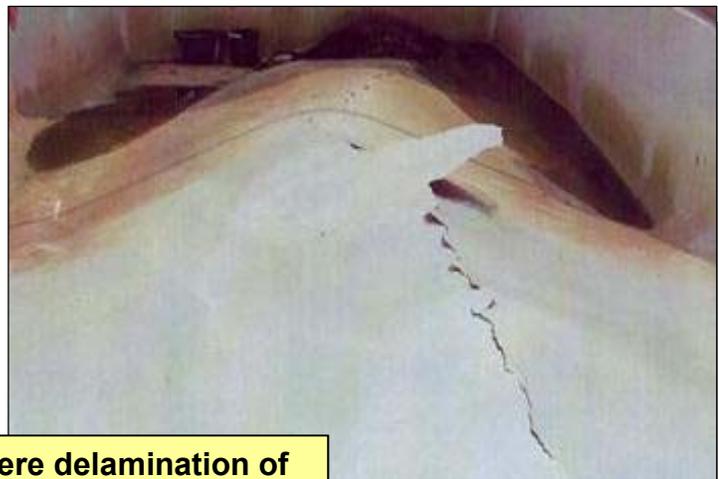
Whether it is made of plaster, tile or fiberglass, the pool shell (walls and bottom) surface must be maintained non-abrasive and non-slip. The finish color must be white except for tile lines, coping, handholds, edges of steps and other approved markings such as lane lines and depth marking lines. Spa pools may be a light (pastel) color if approved by Environmental Health Services.

Resurfacing A Pool Shell

It is time to resurface when the shell shows signs of damage that could cause cuts, scrapes or other injuries. Plaster surfaces that have cracks and chipping larger than one square foot require resurfacing. If a fiberglass pool shows any delamination, it must be resurfaced. Missing or cracked tiles must be repaired or replaced.



The plaster surface of this pool shows signs of damage caused by unbalanced water chemistry.



Severe delamination of fiberglass pool surface.

APPENDIX A Drowning Prevention

This section answers frequently asked questions about drowning and gives some drowning prevention tips. **See Appendix L “Contact Information” for web sites with additional information.**

How long does it take to drown?

Time is critical in a drowning situation. Injury or death occurs when the bather is unable to breathe, which causes the heart to stop beating, and eventually causes brain damage. Drowning can occur in as little as one minute.



Who is at greatest risk for drowning?

According to the National Swimming Pool Foundation (NSPF), children younger than five (5) years old are at the greatest risk for drowning. People under the influence of alcohol and drugs are also at a high risk.

Where have the most drowning incidents occurred?

Centers for Disease Control (CDC) estimates that 20% of all fatal drownings occur in pools and spas. In addition, 66% of nonfatal drownings also occur in pools and spas.



What can a pool operator do to prevent drownings?

There is no magic solution for preventing childhood drownings. Providing layers of protection are the most effective way to prevent drownings. Examples of layers of protection are non-climbable fences with self-closing and self-latching gates, constant supervision and other safety features like alarm systems or pool safety covers for when the pool is closed.

DROWNING PREVENTION MEASURES TO CONSIDER

- **Constant adult supervision of children is essential.**
- **Knowing how to swim is the best way to protect yourself from drowning, but swimming lessons do not prevent all drowning situations.**
- **Educate bathers about the risks associated with swimming.**
- **Check depth of water before entering.**
- **Do not rely on air-filled or foam toys (water wings, noodles or inner-tubes) as personal flotation devices to prevent drowning.**
- **Never swim alone.**
- **Never attempt to swim beyond your skill level.**
- **Have staff trained in CPR and the use of Automated External Defibrillators (AED).**
- **Trained lifeguards reduce the risk of drowning.**
- **Forbid bathers to use alcohol or drugs before, or while swimming.**
- **Ensure that main drain covers are securely in place and not damaged.**
- **Ensure that your fencing around the pool is in good repair with no gaps or openings greater than 4 inches. Gates must be self-closing and self-latching.**
- **Doors from clubhouses or buildings that enter into the pool area should be self-closing and self-latching.**
- **Only allow swimming when the water is clear enough to easily see the main drain at the bottom of the pool**



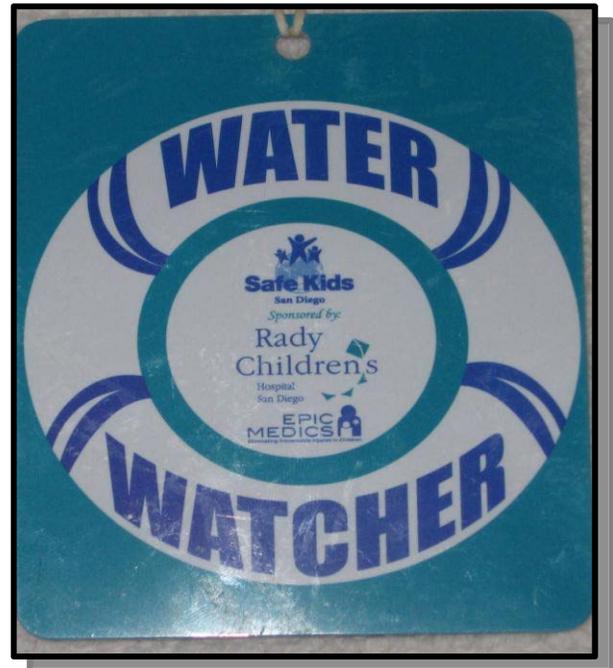
WATER WATCHER PROGRAM

What can apartment and condo complexes do to improve supervision at the pool? Encourage and promote a Water Watcher program.

What is the Water Watcher program? The program is based on the fact that a child can drown in the blink of an eye and that one way to prevent childhood drowning is to designate a person whose sole duty and responsibility is to watch the children in the water during the time they are wearing the Water Watcher tag.

What is the Water Watcher pledge? When an adult agrees to be a Water Watcher and wears a Water Watcher tag, they are pledging to do the following:

- While on duty I agree to maintain constant visual contact with the children who are in or near the water.



- I will remain by the water area until I give this tag to another adult who agrees to actively supervise the children.
- I will keep a phone near the water and will refrain from drinking or socializing while on duty.
- In a drowning emergency, I will:
 - Yell for HELP and remove the child from the water.
 - Call 911 or have another adult call.
 - Check the child's breathing and pulse.
 - Start rescue breaths and/or CPR as needed.

APPENDIX B Suction Entrapment Prevention

Suction entrapment is one of the most dangerous, but preventable risks associated with swimming pools and spas. This photo shows what can happen if anti-entrapment systems are not provided or properly maintained.

What is suction entrapment? Simply stated, it is when any part of a person's body or clothing becomes sucked into a main drain or other suction outlet of a pool. This can include a person's hair, skin, bathing suit or jewelry. Entrapment can result in major injury and even death.

How does suction entrapment happen? The recirculation systems of all swimming pools and spas work by pulling the water out of a pool and pushing the water through a filter. The filtered water is then returned to the pool. The suction required to draw the water out of the pool is incredibly strong and is focused at the main drain. If the pool is not equipped with approved anti-entrapment devices or systems, the pool can become a suction entrapment hazard.



What is the history of suction entrapment prevention regulations?

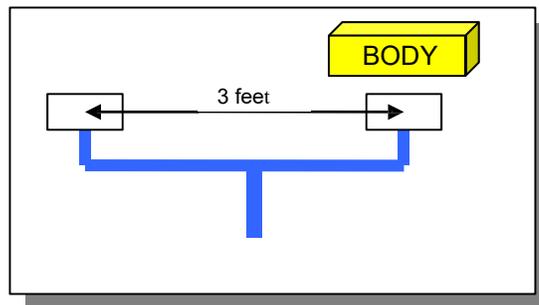
The state of California has recognized the risk of suction entrapment for more than 25 years. In 1982, the state required that all newly constructed pools must have a split main drain. Later, the state required that all wading pools retroactively install split main drains. Then in December of 2007, the Federal "Virginia Graeme Baker Pool and Spa Safety Act" (VGB) required all pools to install split main drains with anti-entrapment drain covers, or provide a secondary layer of protection if the pool has a single main drain or multiple drains less than 3 feet apart. In January of 2010, the state of California enacted AB1020 which required that all public pools meet all of the requirements of (VGB) by June 30, 2010 and that pool operators submit a compliance form to the local health department.

What is an anti-entrapment device or system? An anti-entrapment device or system is designed to prevent suction forces from holding a person, or their clothing, to a suction outlet (main drain). These devices or systems must be approved or certified as effective anti-entrapment devices or systems by a recognized certifying authority.

- The primary protection is an approved anti-entrapment drain cover over main drains that are separated a minimum of three (3) feet by a split "T".

DUAL DRAIN WITH SPLIT “T”

This system is specifically designed to prevent attachment of a bather to a drain. When a blockage (bather’s body) covers one of the drains the suction forces transfer to the other drain where there is less resistance, and never allows the full suction force of the pump to be at one drain at any one time.



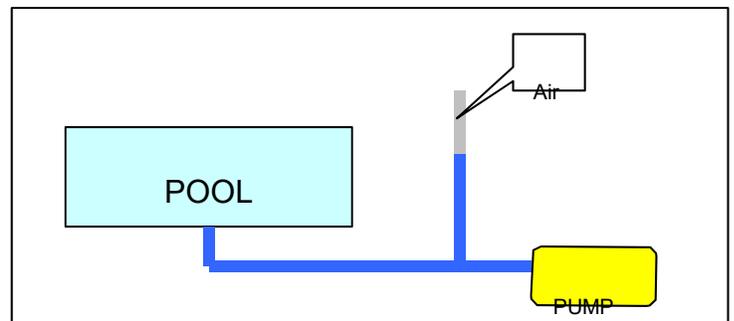
- Secondary layer of protection is required if the pool has a single blockable drain or has multiple drains less than 3 feet apart. Secondary layers of protection include:

SAFETY VACUUM RELEASE SYSTEM

This device is installed next to the suction pump and has a sensitive pressure gauge that detects any sudden pressure increase caused by a blockage in the system. When the blockage is detected, a piston in the device sends air into the suction line, which instantaneously disables the pump.

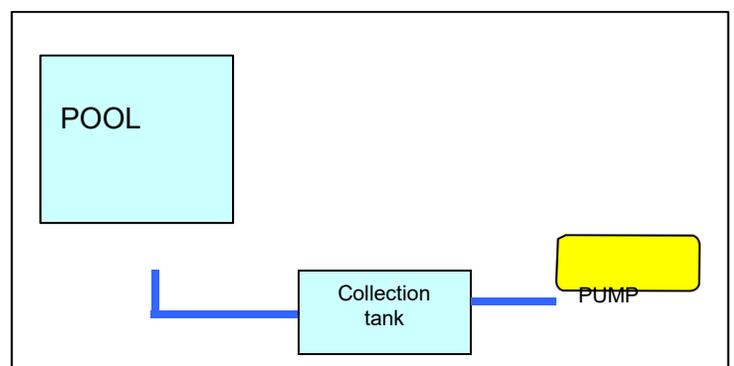
SUCTION LIMITING VENT SYSTEM

This system employs a vent pipe connected to the suction line and the atmosphere. The vent is filled with water when the system is not blocked. When the main drain is blocked, water from the vent pipe is sucked into the pump. The water is followed by air from the atmosphere, causing the pump to lose its prime and relieve the suction at the main drain.



GRAVITY DRAINAGE SYSTEM

This system uses a collection tank located between the pool and the recirculation pump. The pump draws water from the collection tank and directs it to the filter and back to the pool. The collection tank gets water from the pool’s main drain by atmospheric pressure and gravity, which removes the need for direct suction at the pool.



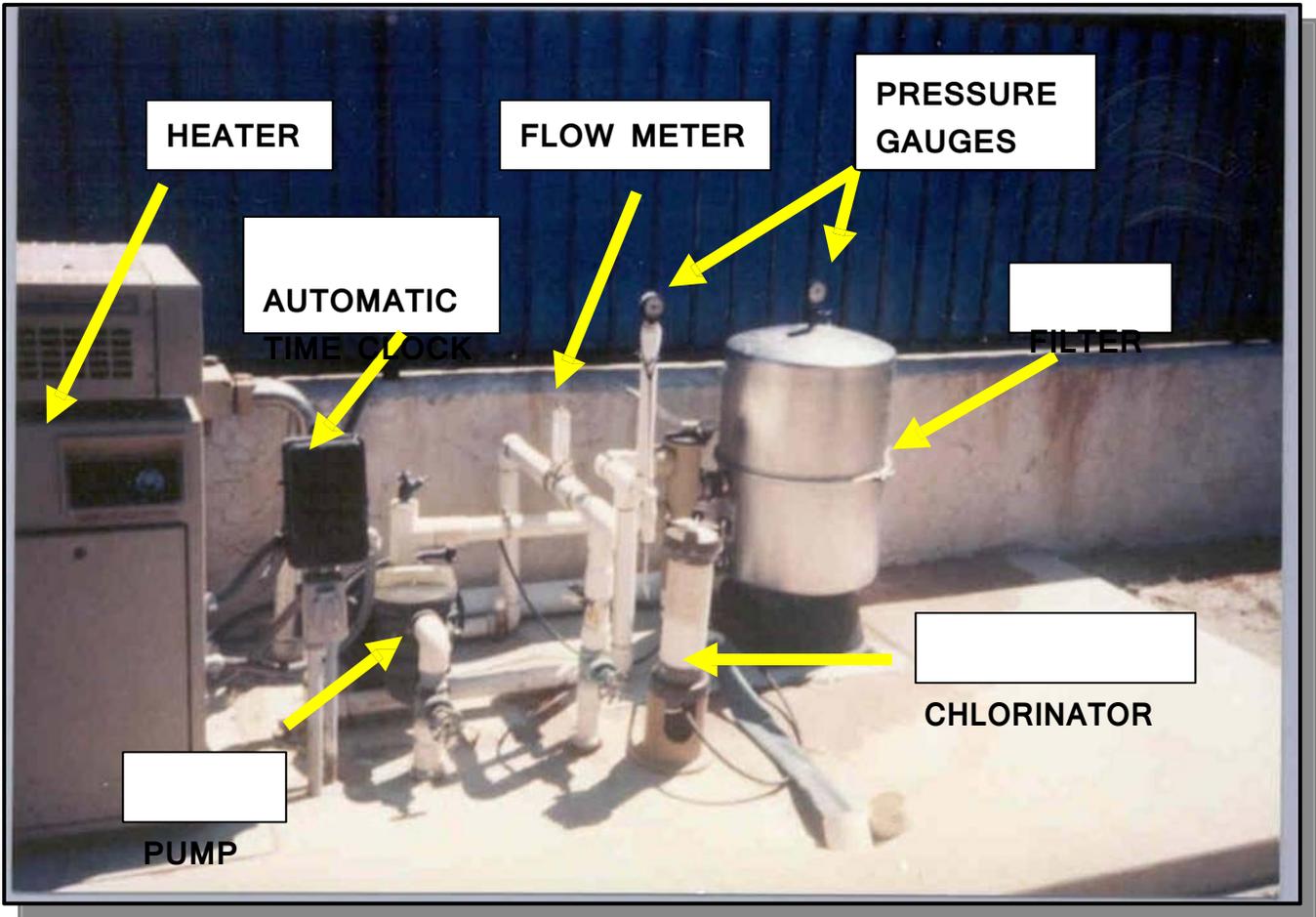
AUTOMATIC PUMP SHUT-OFF SYSTEM

This system detects a sudden increase in pressure, usually due to a blockage, and automatically shuts off the pump. This type of system is similar to the SVRS described above.

How can I tell if I am getting an approved anti-entrapment drain cover? The 2007 VGB law required all manufacturers and retailers to only sell approved anti-entrapment drain covers. These covers all meet the ASME/ANSI A112.19.8-2007 standard, as required by VGB. Ensure that the covers installed meet or exceed the total flow requirements of the pool pump(s).

APPENDIX C Recirculation / Filtration / Disinfection

A pool's recirculation and filtration system (see below) is responsible for moving the water through a disinfection cycle. The pump draws the water through the main drains and skimmers of the pool into the filter, where dirt and debris are removed. If the water is heated, it is passed through the heater next, and then to a sanitizer system where the water is disinfected and then returned back to the pool. The pool's recirculation, filtration and disinfection system must be operating and in good repair during the pool's hours of operation.



This section provides a brief and general description of the components of a recirculation, filtration and disinfection system of a 30,000 to 40,000 gallon swimming pool. It discusses the different types of filters and disinfection systems that are commonly used in San Luis Obispo County.

Contact Environmental Health Services when installing, modifying or replacing any recirculation equipment.

Pump

The pump's function is to move the pool water through the recirculation system (i.e. strainer, filter, heater, disinfection).



How does a pump work? The pump has a suction side and a pressure side. Suction is created by the centrifugal force generated by the spinning of an impeller, which is turned by an electrical motor. The suction draws water from the main drains and skimmers into the pump. After water passes by the impeller, it is pushed by pressure through piping to the filter, heater, disinfection system and back to the pool via the return inlets. For larger pools, return inlets may be located on the bottom of the pool, in addition to the side walls. This provides better distribution of water in large pools.

Are there different types of pumps, and if so, which one should I use? Yes, there are two types of pumps commonly used. The most common type is a self-priming pump, designed to prime itself if air gets into the system. Self-priming pumps are required if the pump is located above the pool's water level. The second type is referred to as a flooded suction pump. This pump requires priming if air gets into the system. These pumps are used when the pump is located below the pool's water level.

Does it matter what size pump I use? Yes, all pumps must be sized correctly. When your pump needs to be replaced it must be replaced with a pump sized properly for your pool. The pump must be certified by a nationally recognized institution, such as the National Sanitation Foundation (NSF). NSF certification is often void when only the pump motor is changed. Check with the manufacturer for proper replacement parts. You can contact Environmental Health Services with any questions.

What can happen if the pump is not the right size? If the pump is too small, it will not move enough water per minute. This will result in ineffective filtration and poor water quality. If the pump is too large, the water will move too fast through the filter, causing ineffective filtration. The increased friction may also cause damage to the filter and/or piping.

What about the new technology in pumps? Variable speed pumps are being required on residential pools to save on energy. Some of these pumps come with safety vacuum release systems (SVRS) built in. The use of these pumps on public and commercial pools present problems. The pump has to be set to maintain the required turnover rate during hours of use. The highest setting cannot exceed the design capacity of the pool plumbing. The DEH Plan Check Unit has additional requirements for the use of variable speed pumps. Contact the department prior to making any changes.

Filter

The filter is responsible for cleaning the pool water by trapping dirt and debris. The three basic types of filter media commonly used are sand, diatomaceous earth (D.E.) and cartridge filters.

Which filter media is best? Each type of filter media provides different benefits so it depends on the specific needs of the pool.

What are the characteristics of each type of filter media?

- **Sand filter** is the oldest type of filter and requires the least amount of routine maintenance. There are two types of sand filter systems:

- Rapid-rate is not commonly used today and is only found at older facilities. Rapid-rate uses a coarse grade of sand on top of a layer of gravel. Due to the relatively large filter media size, these filters are only capable of filtering particles larger than 50 microns.
- High-rate is a more modern system using a finer grade of sand capable of filtering particles larger than 25 microns.

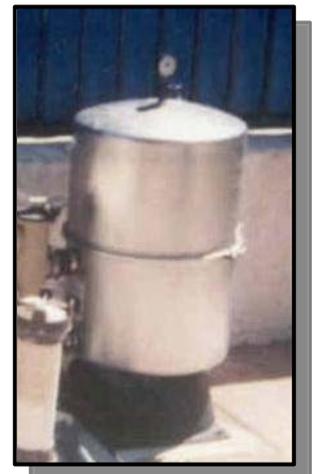


Both rapid-rate and high-rate sand filters are simple and inexpensive to maintain. Routine cleaning or backwashing only requires the turning of a valve to reverse the flow of water to dislodge dirt and debris trapped between the granules of sand. The tradeoff for less time and lower maintenance cost for routine maintenance is lower water quality and water clarity because a sand filter can only trap particles larger than 25 microns for high-rate and 50 microns for rapid-rate. Zeolite has been demonstrated as a material that may be used as a replacement for traditional silica sand. This material has been shown to filter down to 3 to 5 microns. Check with the manufacturer for existing sand filters.



- **Cartridge filter** is one of the newest forms of filtration. Cartridge filters use specially treated paper or polyester pleated in a cylinder similar in design to an air or oil filter. The pleating provides a larger surface area to trap dirt and particles. These filters provide better filtration and water quality and clarity, but do require more time and money for cleaning and maintenance. Cartridge filters usually need to be replaced every six to eight months. Cartridge filters are usually used on pools with smaller volumes like a spa or wading pool. They are also considered for pools in rural areas where there is no sewer for disposing of backwash fluids.

- **Diatomaceous Earth (D.E.) filters** provide the best filtration, water quality and water clarity due to their capability to filter particles between 2 to 6 microns. D.E. filter systems consist of a pressurized canister with 4 to 6 grids of cloth-like covers that provide filter surfaces on both sides and form the shape of a leaf. The covers are coated with a fine powder of diatomaceous earth (tiny skeletons of fossilized plankton). The water pressure in the filter constantly pushes the D.E. against the leaves forming a coating that provides an excellent filter. The downside to D.E. filters is that they require more time and money for cleaning and maintenance. Each time the filter needs to be backwashed (about once a week) a new coating of D.E. must be applied to the filter grids. To ensure effective filtration, the filter should be disassembled and the filter grids removed, cleaned and inspected for damage. This should be done every 2 to 3 months depending on pool bather load. The local sewer district may also require D.E. separators for these filters, especially if the pool exceeds 2000 square feet. Safer filter media such as Perlite may also be used in D.E. filters. Check with the manufacturer's standards.



- **Automatic regenerative media filters** are a new line of filters. These utilize what is known as “bump technology” to reuse the media (typically Perlite).

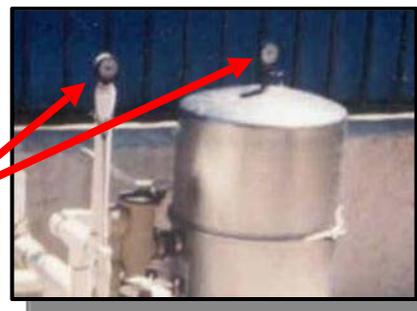
Meters & Gauges

Meters and gauges are often over-looked and under-utilized by the pool operator. These instruments provide important information about how effectively the pool recirculation and filtration equipment are operating. They tell the operator when it is time to backwash the filters and indicate whether the filter or plumbing is damaged.

- **Flow meters** measure the rate of water flow through the circulation system in gallons/minute. By knowing the flow rate, the operator can tell if the water is circulating fast enough to provide the minimum turnover. Ensure that the appropriate flow meter is installed at the proper location on a pipe to provide an accurate reading. For instance, a flow meter designed for 2 inch copper pipes won't give an accurate reading if used on 1 ½ inch PVC pipe. If the flow meter is installed too close to a 90 degree pipe joint, it will give an inaccurate reading. Follow manufacturer's instructions for proper installation of flow meters. Regular cleaning and maintenance of the flow meter is important to ensure accurate readings. San Diego County has “hard water” which over time can cause a calcium layer to form inside the flow meter, causing the flow meter to get stuck. Check the flow meter routinely.



- Pressure filters or vacuum filters have two pressure **gauges**: one to measure influent pressure (pressure inside the filter) and the other for effluent pressure (pressure outside the filter). As the filter operates, it traps dirt and debris, which increases the pressure inside the filter and reduces the pressure outside the filter. This difference in pressure tells the operator when the filter needs to be backwashed.



Heaters

The purpose of a heater is to heat the pool water and maintain it at a desired temperature. The temperature of the water is controlled by a thermostat which automatically turns the heater on or off depending on the heat demand.

What types of heating systems are available? There are several different heating systems available. The following are the most common on the market:

- **Gas Heaters**, which are most common, are used to heat small to medium sized swimming pools or spa pools. Gas heaters heat the pool water by burning either natural or propane gas as it passes through copper piping within the heater. A thermostat connected to a thermocouple controls a gas line valve that supplies additional gas when needed, and closes the gas valve when not needed.

- **Electric Heaters** use an electric coil to heat the water as it passes through the unit. A thermostat controls electrical circuits that provide more electricity as more heat is needed. These units are expensive to operate and take a long time to heat water, so they are primarily used to heat spa pools and not swimming pools.
- **Heat Exchangers** are generally used in large aquatic facilities or hotels that have large hot water systems for sinks and showers within the facility. The heat exchanger system works by allowing contact between a by-pass line from the hot water system of the facility and a by-pass line from the pool return line. The contact between the two by-pass lines allows heat to be exchanged. When additional heat is needed for the pool water, a small circulation pump is turned on by the pool water thermostat, which draws water from the facility's hot water system through the heat exchanger.
- **Heat Pumps** work using the thermodynamic principle that energy is required to change liquid into gas. Energy in the form of heat is released when a gas is changed back into a liquid. Heat pumps use a liquid with very low boiling point (Freon) and obtain the energy needed to heat the liquid by heat exchange from the surrounding air. As the liquid continues to heat, it turns to vapor. As the vapor cools, it releases energy in the form of heat.
- **Solar Heating** systems range from simple to complex. Simple systems, like a solar cover, can be used to absorb heat from the sun and transfer it to the pool's surface. Complex systems use solar panels to absorb heat from sunlight and transfer that energy back to the pool. Because solar systems alone may not be capable of heating the water to a desired temperature, they are sometimes used in conjunction with other heating systems. The heat gained by solar energy can greatly reduce the cost of other heating systems.

Disinfection Systems

The purpose of a disinfection system is to automatically supply an adequate quantity of disinfectant to inactivate microorganisms. The state Health and Safety code requires that all public pools be disinfected with a halogen that has a measurable residual. Although there are other halogens, only chlorine, bromine and iodine leave a measurable residual after they are added to the pool water. There are numerous types of chemical feeders and other disinfection systems available on the market today. Below is information about the most common feeders and systems.

- **Liquid Feeders** are generally used in larger pools. Liquid chlorine has a high pH (11 to 13). In order to maintain the proper pH range in the pool, the pH must be adjusted by addition of a chemical with a low pH, like Hydrochloric Acid (HCl). Therefore, liquid chlorine disinfection systems usually consist of a container of liquid chlorine and another container of HCl. The two chemicals are drawn out of their storage tanks by pumps, and feed into the pool return line by a small hose or tube. These chemicals should be fed into the pool return line downstream, or after the filter and heater, in order to reduce any possible chemical damage to the equipment.



- **Dry Feeders** are most popular in small swimming pools and spa pools. Chlorine or bromine in the tablet or granular form feed into the pool by a dry chemical feeder. These feeders are also referred to as “erosion feeders” because they feed the disinfectant into the pool by dissolving the tablet or granule into a liquid before the chemical is fed into the pool. The tablets or granules are stored in a cylinder shaped feeder with hoses attached to the influent and effluent side of the filter. The difference in partial pressure sucks water into the feeder and erodes the tablets/granules.



- **Gas Feeders** are used for both feeding gas chlorine into the pool as disinfectant, and also feeding carbon dioxide into the pool to lower pH when liquid chlorine is used. The risk of chlorine gas leaks during transportation or during handling has forced the industry to look for other ways to disinfect the pool. Therefore, gas feeders are now primarily used only to feed carbon dioxide to lower pH. ***If you use gas feeders, be sure that the gas tanks are securely fastened to the wall to prevent them from falling over when accidentally bumped or during an earthquake.***



- **Chlorine Generators** are relatively new systems and are becoming more popular nationwide. There are two systems available: in-line generators and brine-tank generators.
 - **In-line systems** work by adding salt to the pool water (about 3,000 ppm). The system uses the recirculation system to direct the salt water through an in-line cell that contains several electrolysis plates. The electrically charged plates convert sodium chloride (NaCl, a.k.a. salt) into free chlorine, which reverts back to salt once bound to particulates and is available to be oxidized again into free chlorine. Salt needs to be added to replace losses due to backwashing and splash out.
 - **Brine-tank systems** also produce free chlorine by electrolysis (electrically converting salt into free chlorine), but instead of using the pool and recirculation system, it produces free chlorine from salt brine that passes through an electrolytic cell and stores the free chlorine in a tank for distribution. These systems require a chemical controller to dispense the free chlorine.

Chemical Controllers

Chemical controllers are electronic systems with chemical sensing probes that automatically adjust the feeding of chemicals into the pool water. When the chemical sensors detect pH and disinfectant levels outside of pre-determined ranges, they automatically adjust pH and disinfection back within the proper range. When the controllers are connected to a computer, the pool’s water chemistry can be monitored from off-site locations. These systems provide excellent control of water chemistry by constantly measuring pH and disinfection levels. But routine maintenance of the system can increase initial costs. The



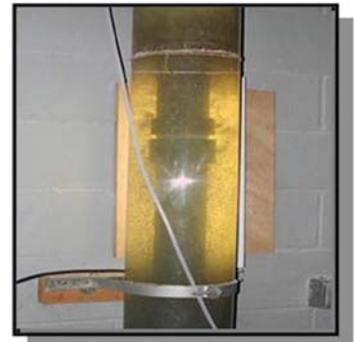
trade off to the increased cost is superior control of water chemistry, which leads to less risk to bather health and safety.

- **Chemical sensor probes** send information in the form of electrical signals to the controller to activate chemical feeders. Below are the different types of probes used with chemical controller systems.
 - **pH probes** detect changes in electrical potential of the water. These probes are affected by temperature and should be routinely calibrated to ensure accuracy.
 - **Oxidation-Reduction Potential (ORP) probes** measure the water's capability to oxidize (lose electrons) or reduce (add electrons) by measuring the electron activity. Since most disinfectants are oxidizers, they give positive ORP readings.
 - **Amperometric probes** are not commonly used in the United States. They measure the electrical current flow between the electrons in the probe, which gives a faster response than ORP, to changes in chlorine levels. These probes are currently more expensive than ORP probes.

Supplementary Disinfection Systems

These systems are not approved for use as primary disinfection systems in public pools because they do not leave the required measurable halogen residue in the pool water. With the approval of Environmental Health Services these systems may be used in conjunction with an approved disinfection system.

- **Ozone Generator** is an unstable molecule consisting of three oxygen atoms. It is so unstable, it cannot be stored or transported, but must be produced on-site. Ozone can be harmful to humans even in very low doses. Therefore, ozone generating equipment must be located in an approved location that has good, fresh air circulation. Ozone is considered a good disinfectant and oxidizer, but can only be used as a supplemental disinfectant since it leaves no residual in the water. These systems are recommended for use at facilities with high bather loads like water parks, splash pads and large pools.
- **Ultraviolet Radiation (UV)** is another supplemental disinfection system that can be installed and work in conjunction with a disinfection system that maintains a residual in the pool water. Pool water is disinfected as it passes by UV radiation that is generated by ultraviolet lamps. These UV systems must be connected to a control switch that shuts the system down if the pool recirculation is stopped for any reason. UV systems are required to supplement interactive water features such as splash pads.



APPENDIX D Water Chemistry & Testing

This section is intended to provide a brief overview of basic pool water chemistry and testing. It will cover disinfectants and their relationship to pH and water balance.

Disinfectant (Sanitizer)

State Health and Safety Code requires that public pools use a halogen disinfectant that has a measurable residual. Both chlorine and bromine are halogens and are stable enough in water to leave a measurable residual.

Chlorine

Three different forms of chlorine are observed when dealing with pool water: Free Chlorine (FC), Combined Chlorine (CC), and Total Chlorine (TC).

- **Free Chlorine** – FC is the active disinfectant in pool water. The forms of FC in water are hypochlorous acid (HOCl) and hypochlorite ion (OCl⁻). HOCl is the active killing form of chlorine, while OCl⁻ is a much less effective. The percentage of HOCl to OCl⁻ is dependant on the pH of the water. As pH decreases or becomes more acidic, the percentage of chlorine in the more effective HOCl form increases. **See chart on Active Chlorine vs. pH in this chapter.** Direct sunlight can quickly degrade the HOCl. This degrading effect of sunlight on chlorine can be reduced by adding a stabilizer (cyanuric acid).



- **Combined Chlorine** – CC forms when FC reacts with contaminants in the water such as ammonia in urine or sweat. CC, also called chloramines, is a very poor disinfectant. Chloramines can irritate bather's eyes and skin. The "chlorine smell" generally associated with pools is usually a buildup of CC in the water.



- **Total Chlorine** – TC is FC plus CC. Test kits that measure TC (OTO test kits) do not indicate how much FC or CC is present, but rather the sum of both.



When testing the disinfectant level in your pool, make sure to use a test kit capable of measuring FREE CHLORINE and/or BROMINE (DPD test kit) and not TOTAL CHLORINE (OTO test kit).

Bromine

Bromine is similar to chlorine, but has some advantages and disadvantages that need to be considered before using it as a disinfectant. Bromine produces hypobromous acid (HOBr) which is a good disinfectant, algaecide, and oxidizer. One advantage of using bromine is that when HOBr reacts with contaminants in the water, such as urine or sweat, it produces bromamines. Bromamines, unlike chloramines, are good disinfectants and do not irritate the eyes or skin. Like HOCl, the percentage of HOBr is dependant on the pH of the water. The lower the pH, the greater the percentage of HOBr is in the pool. One of the disadvantages of bromine is that it is quickly destroyed by sunlight exposure and cyanuric acid is ineffective from stopping this process. Therefore, bromine is best used in indoor pools with no sunlight exposure.

pH

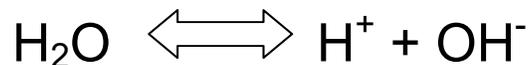
pH is a measurement based on the concentration of hydrogen ions in a solution. The mathematical expression of pH is:

$$\text{pH} = \text{the negative log of the hydrogen ion concentration}$$

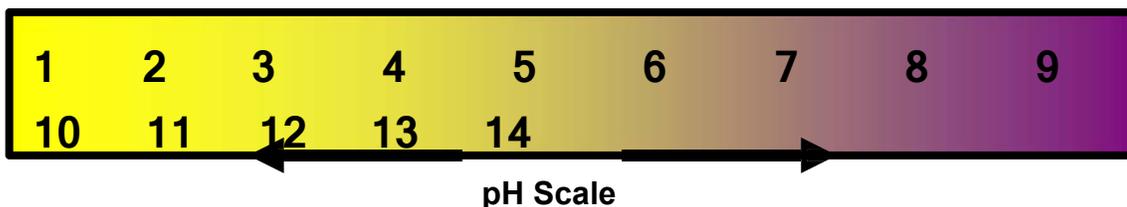
or

$$\text{pH} = -\log (\text{H}^+)$$

A water molecule is composed of two elements: 2 hydrogen atoms and 1 oxygen atom (H₂O). The water molecule is in equilibrium with two ions: hydrogen ion (H⁺) and hydroxyl ion (OH⁻).



Think of pH as a balance scale. As the number of hydrogen (H⁺) ions increases, the pH decreases (becomes more acidic). As the number of hydroxyl (OH⁻) ions increases, the pH increases (becomes more basic). When the number of hydrogen (H⁺) ions equals the number of hydroxyl (OH⁻) ions, the pH is neutral and is at 7.0 on the pH scale.



What should the pH of my pool be and why? The ideal range for pH is between 7.4 - 7.6 because this range allows chlorine or bromine to be effective at killing germs in the water, and also prevents skin or eye irritation. Keeping the pH in this range will also reduce maintenance costs by reducing corrosion of metal and calcium build-up on pool plaster and recirculation equipment.

What happens if the pH gets too high or too low?

- **When pH is too high:** If the pH is allowed to increase to more than 7.8, the water will irritate the bather's eyes and skin due to the increase in hydroxide ion (OH⁻) concentrations. This high concentration of OH⁻ also reduces the effectiveness of chlorine and bromine for killing germs. When the pH is 8.0 the chlorine is less than 25% effective at killing germs, and at 8.5 only 9% effective. If the pH is over 7.8 for a prolonged period of time, it will lead to calcium build-up on pool plaster, recirculation pipes, and equipment.
- **When pH is too low:** If the pH is allowed to drop below 7.2, the effectiveness of chlorine as a germ killing agent will increase, but eye and skin irritation of bathers may result. Low pH also reduces the life of the pool pump and heater by corroding (eating away) metal parts.

Active Chlorine vs. pH

% more Active HOCl	pH	% less Active OCl ⁻
97	6.0	3
91	6.5	9
76	7.0	24
66	7.2	34
50	7.5	50
33	7.8	67
24	8.0	76
9	8.5	91

This chart indicates the effect of change of pH on the % of activated chlorine.

Does sunlight affect the chlorine in the pool? Yes, ultra violet (UV) light in sunlight can destroy about 50% of the unstabilized chlorine in the water in under an hour.

Stabilizer (Cyanuric Acid)

What is chlorine stabilizer and why is it important? Free chlorine residual can last six times longer when stabilizer (cyanuric acid) is added to the water in the correct concentrations. Cyanuric acid is most effective between 30 - 50 ppm. State law requires that cyanuric acid not exceed 100 ppm. When cyanuric acid levels exceed 100 ppm, chlorine is less effective as both a disinfectant and algaecide. Because cyanuric acid does not break down or evaporate, each additional use will increase its concentration in the pool. The most common method of reducing cyanuric acid is to partially drain and then replace the pool water.

Should all pools use stabilizer? No, only outdoor pools in direct sunlight that use chlorine as a disinfectant get any benefit from using stabilizer. Indoor pools or pools that use bromine as a disinfectant should not add stabilizer. No pools have to use stabilizer. It is a method to try and prolong the lifespan of the chlorine sanitizer.

Water Balance

What does the term “water balance” mean and why is it important? The pool water is said to be in “balance” when the water is not too aggressive (acidic) or too scale forming (basic). The importance of maintaining “water balance” is to reduce corrosion of metal components of the recirculation/filtration system caused by acidic water. Conversely, it will also cause a reduction in scale formation on the pool plaster and plumbing system caused by the water being too basic. Disinfectants are most effective when the water is balanced.

How do I know if my water is balanced? The swimming pool industry has modified a version of the “Langelier Index”, developed by the water treatment industry and called it the “Saturation Index”. The saturation index measures five (5) factors in a formula to determine water balance: pH, water temperature, calcium, alkalinity and total dissolved solids.

Saturation Index = pH + Temperature factor + Calcium factor + Alkalinity factor – TDS factor

The factors for temperature, calcium, alkalinity and TDS are determined by comparing the results of chemical testing to a Saturation Index Chart (see below).

SATURATION INDEX

Temperature		Calcium Hardness		Total Alkalinity	
°F	Temp factor	ppm	Calcium factor	ppm	Alkalinity factor
32	0.0	25	1.0	25	1.4
37	0.1	50	1.3	50	1.7
46	0.2	75	1.5	75	1.9
53	0.3	100	1.6	100	2.0
60	0.4	125	1.7	125	2.1
66	0.5	150	1.8	150	2.2
76	0.6	200	1.9	200	2.3
84	0.7	250	2.0	250	2.4
94	0.8	300	2.1	300	2.5
105	0.9	400	2.2	400	2.6
		800	2.5	800	2.9

Total Dissolved Solids Factors (TDS)	
Less than 1000 ppm	Greater than 1000 ppm
12.1	12.2

You can determine if the pool water is balanced by using the Saturation Index Formula. If the result is between -0.3 and +0.3, the water is considered balanced. A result less than -0.3 is considered **corrosive**, and anything greater than +0.3 is considered **scaling**.

Examples of calculating the saturation index to determine if the water is balanced:

Example # 1

Pool water test results:

Temperature	76°F
pH	7.2
Calcium Hardness	100 ppm
Total Alkalinity	125 ppm
TDS	2,000 ppm

$$\begin{aligned} \text{SI} &= \text{pH} + \text{Tf} + \text{Cf} + \text{Af} - \text{TDSf} \\ \text{SI} &= 7.2 + 0.6 + 1.6 + 2.1 - 12.2 \\ \text{SI} &= -0.7 \end{aligned}$$

(Water is not balanced, it is corrosive)

Example # 2

Pool water test results:

Temperature	84°F
pH	8.0
Calcium Hardness	200 ppm
Total Alkalinity	150 ppm
TDS	2,800 ppm

$$\begin{aligned} \text{SI} &= \text{pH} + \text{Tf} + \text{Cf} + \text{Af} - \text{TDSf} \\ \text{SI} &= 8.0 + 0.7 + 1.9 + 2.2 - 12.2 \\ \text{SI} &= +0.6 \end{aligned}$$

(Water not balanced, it is scaling)

Example # 3

Pool water test results:

Temperature	84°F
pH	7.4
Calcium Hardness	250 ppm
Total Alkalinity	100 ppm
TDS	2,200 ppm

$$\begin{aligned} \text{SI} &= \text{pH} + \text{Tf} + \text{Cf} + \text{Af} - \text{TDSf} \\ \text{SI} &= 7.4 + 0.7 + 2.0 + 2.0 - 12.2 \\ \text{SI} &= -0.1 \end{aligned}$$

(Water is balanced)

Water Chemistry & Testing

This section will provide a brief glimpse of basic water tests that should be performed routinely to ensure your pool water is clear, clean and safe for swimmers.



How often should I test the water? It depends on the test you are performing. Daily testing of the disinfectant (chlorine) and pH levels is required, but if the bather load is high, it is recommended that both be tested at least twice a day. Large municipal pools are commonly tested hourly. Other tests such as cyanuric acid (stabilizer), total alkalinity and calcium hardness can be done less frequently; either weekly or monthly depending on weather conditions.

What level or concentration should I keep pH, disinfectants and stabilizers in my pool? The table below lists the minimum, maximum and ideal concentration or level for disinfectant, pH, stabilizer and total alkalinity.

Are there different methods of testing swimming pool water? Yes, there are four (4) basic methods for testing chemicals in pool water.

WATER CHEMISTRY GUIDELINES				
Chemical	Minimum	Ideal	Maximum	Pool Type
Free Chlorine	1.0 ppm *	2.0 - 3.0 ppm	10.0 ppm	Pool & Waterpark
	1.0 ppm *	3.0 - 5.0 ppm	10.0 ppm	Spa & Wader
Bromine	2.0 ppm	4.0 - 6.0 ppm	10.0 ppm	All types
pH	7.2	7.4 - 7.6	8.0	All types
Cyanuric Acid **	0 ppm	50 - 70 ppm	100 ppm	All types
Total Alkalinity ***	60 ppm	80 - 120 ppm	180 ppm	All types
<p>*If Cyanuric Acid (stabilizer) is used, the minimum chlorine concentration is 1.5 ppm **Cyanuric Acid (stabilizer) is not required to be used ***Total Alkalinity is an optional test</p>				

TESTING METHODS:



Colorimetric tests use a reagent which changes color depending on the concentration of the chemical being tested. The color is then compared to a standard to determine the concentration. Disinfectant and pH are usually tested using this method.

Titrimetric tests slowly combine a reagent with test water until a dramatic color change occurs. This method is used to measure disinfectant, total alkalinity and calcium hardness.



Turbidimetric tests measure the amount of suspended solids in the water. The sample becomes cloudier in proportion to the concentration of the chemical being tested. This test is used to measure the level of cyanuric acid (stabilizer) in the water.

Electronic tests use electric meters to measure differences in electrical properties such as conductivity, oxidation-reduction potential or light intensity to determine pH, total dissolved solids and disinfectant levels.



Each of these testing methods has advantages and disadvantages to consider when selecting the best method or combination of methods to use at your pool.

How can I be sure the test results are accurate?

For accurate results, be sure you do the following:

1. Carefully follow the instructions on the test kit.
2. Properly store the test kit.
 - a. Out of direct sunlight.
 - b. In a cool and dry location.
 - c. Away from chemical fumes.
3. Clean test kit sample tubes after testing.
4. Take water samples as directed in the test kit instructions.
 - a. Correct location is away from return outlets and skimmers.
 - b. Correct depth is usually 18 inches below the surface.
5. When performing the test(s), accurately measure the sample volumes and reagents added to the sample.
6. When reading the result, ensure you have adequate light. Avoid reading results under fluorescent lighting. Sunlight is the best light for reading test results.



How often should I conduct these tests? pH and disinfectants are affected by temperature, contamination, sunlight and water circulation. Therefore, how often you test is dependent on how many bathers are in the pool, the volume of the pool, water temperature and weather. For example, a small pool (spa) with the maximum number of bathers on a hot sunny day will need to have the pH and disinfectant levels tested several times a day. But, a medium sized pool with only few swimmers on a cool and cloudy day would only need to be tested once a day.

State Health & Safety Code requires that pH and disinfectant be tested and recorded on a daily log at least once a day.

Guide for Water Chemistry Test Frequency

Type of Pool	Number of Tests for Chlorine / Bromine	Number of Tests for pH	Number of Tests for Total Alkalinity (optional test not required)	Number of Tests for Cyanuric acid (only if stabilizer used)
	MIN #	MIN #	MIN #	MIN #
SPA	1 / day	1 / day	1 / week	1 / month
WADER	2 / day	2 / day	1 / week	1 / month
POOL (small) low to medium bath load	1 / day	1 / day	1 / week	1 / month
POOL (large) high bather load	2 / day	2 / day	1 / week	1 / month

APPENDIX E Routine Maintenance

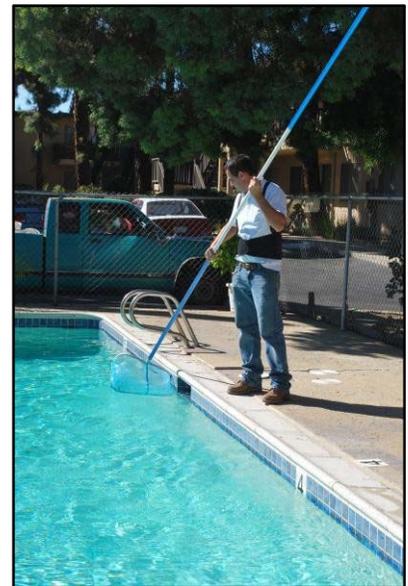
Recommended Daily, Weekly, Monthly, and Annual Maintenance for Pools

Routine maintenance is essential for economical and safe pool operations. Routine maintenance consists of chemical testing of pool water, cleaning and repair or replacement of equipment. The following maintenance schedule offers some guidelines on how often routine maintenance and testing should be done to ensure your pool facility is operating safely and efficiently.

Example Maintenance Schedule

Maintenance	Daily	Weekly	Monthly	Annually
Test pH and disinfectant (chlorine or bromine)	X			
Log test results	X			
Net debris from water surface	X			
Ensure recirculation system is operating	X			
Check gates are self closing and latching	X			
Check that main drain covers are secure and undamaged	X			
Empty skimmer baskets	X			
Super chlorinate (increase the chlorine level to 10 ppm)		X		
Check and record flow meter and pressure gauge readings		X		
Back wash filter if needed		X		
Check chemical feeders to make sure they have adequate supply of chemicals		X		
Brush tiles and pool side walls		X		
Check pool water level (add water if needed)		X		
Test cyanuric acid (stabilizer) if used			X	
Check perimeter of pool enclosure (fence & gates) for damage			X	
Check pool shell (plaster, tile, coping) for damage			X	
Check ladders and hand rails are secure			X	
Check pool safety signs to ensure they are readable				X
Check lifesaving equipment (life ring / reaching pole) for damage				X
Check pool lighting and spa emergency shut-off switch				X
Break down pool filter and inspect filter media				X
Check that health permit and staff training are up-to-date				X

Daily maintenance includes testing and recording of the water concentration of disinfectant (chlorine), pH, removing debris from the pool/skimmer, checking the enclosure gates and pool main drain covers to ensure they are in good repair.



Weekly maintenance consists of a broader range of maintenance. Super chlorination of the pool water (shocking the pool) this especially important during the height of the pool season when the bather load is highest. Checking and recording the readings of the flow meter and the filter pressure gauges will help determine when the filter is due to be backwashed. Chemical feeders should be checked weekly for chemical levels and proper operation. Weekly brushing of the pool tiles and sidewalls will reduce algae growth and improve water clarity. It is important to make sure the pool water level is kept at the midline of the skimmer opening to ensure optimum skimming and filtration.

Monthly maintenance involves the testing of chemicals that change slowly such as cyanuric acid (stabilizer), total alkalinity and calcium hardness. It is also important to conduct a close inspection of the entire pool enclosure including the fence/walls and all gates to make sure they are not damaged. Monthly inspection of the pool shell (plaster, tile and coping) for damage allows the operator to make minor repairs as needed instead of waiting for costly major repairs. Checking to make sure the pool ladder and hand rails are secure and stable will reduce the risk of injury to bathers getting in and out of the pool.



Annual maintenance is best conducted at the beginning of the swim season and involves the inspection of the recirculation, filtration, heating and disinfection systems to make sure they are working properly. If equipment needs to be replaced or repaired it can be done before the swim season begins. Some other things to inspect include the deck surface, pool safety signage and lifesaving equipment. This is also a good time to check that staff has the required training and that all necessary permits are valid.



APPENDIX F Common Reasons For Pool Closures

What are the most common reasons a pool or spa is closed by the Health Department? As a general rule, the pool/spa is closed when conditions exist that may cause illness or injury to bathers.

1. **Improper sanitizer level:** Proper levels of sanitizer (chlorine or bromine) kill pathogens (germs). State law requires a minimum of 1.0 ppm of unstabilized free chlorine or 1.5 ppm of stabilized free chlorine to be maintained while the pool/spa is open to bathers.
2. **Missing or damaged drain covers:** Drain covers protect bathers from entrapment hazards at suction ports.
3. **pH level outside acceptable range:** pH has a dramatic effect on water quality and the effectiveness of chlorine as a sanitizer (disinfectant). State law requires pH to be between 7.2 – 8.0.

County of San Diego
Department of Environmental Health
Food and Housing Division
(619) 338-2222

**POOL/SPA
CLOSED**

By order of the Department of
Environmental Health

This Facility is an Immediate Danger to the
Public Health and Safety and Shall Not Re-open
Without Written Consent From This Department
(California Code of Regulations Section 65545)

Facility Name: _____
Location of Facility: _____
Specialist: _____ Phone: _____

The Department of Environmental Health inspection on _____
found the following hazardous conditions.

Improper Sanitizer Levels Entrapment Hazards
 Safety/Electrical Hazards Unsafe Gates/Fencing
 Water Clarity Other: _____

Penalty for Unauthorized Removal of this Notice

DEH-FH-431 (Rev. 6/08)

4. **Unsecured pool enclosures:** All pool/spa facilities must be protected by an approved enclosure that is in good repair with self-closing and self-latching gates. The pool enclosure should prevent small children from entering the pool area without supervision.
5. **Recirculation system not operating during hours of operation:** A properly functioning recirculation system is essential for the removal of contaminants that collect in the pool water. If the system is not running, the pool water is not being filtered or sanitized.
6. **Poor water clarity:** Water clarity issues occur when proper sanitizer levels are not maintained and the filtration system is not operating effectively. As a general rule, if you can see the main drain from the pool deck, the water clarity is acceptable.
7. **Improper storage of chemicals:** The storage of flammables, fertilizers or other incompatible chemicals with pool chemicals can create risks of fire, explosion and personal injury to anyone in or around the chemical storage area.
8. **Hazardous conditions:** Dangerous conditions include broken glass on the deck or in the pool, electrical hazards (i.e. unsecured underwater pool lighting) or any other obvious conditions that pose a clear danger to the bathers.

What can a pool owner or operator do to prevent their pool from being CLOSED? The most obvious action is to have a knowledgeable and experienced person check the pool water chemistry and equipment daily to detect unsafe conditions. Pool conditions

can change dramatically in a matter of minutes or hours. It may be necessary to check the pool water several times a day if the pool is used heavily.

Steps to prevent the pool from being closed:

- Designate someone with proper training to test the pool water chemistry and monitor the recirculation system daily.
- Test the pool water chemistry as needed and record the results in a log.
- Take appropriate action if the minimum water chemistry standards are not observed after testing.
- Monitor the recirculation system to ensure it is operating properly during the hours of pool operation.

Is my pool maintenance service responsible for daily water testing and pool safety? Do not depend solely on a “pool maintenance service” to be responsible for the daily safety of your pool, unless your maintenance contract states they are assuming those responsibilities. If the apartment owner or manager decides to shift the responsibility of supervising the pool to a pool service, they need to contract for daily service or only make the pool available on the days the pool is serviced. Another solution is to designate a person to test the sanitizer level and pH, monitor the recirculation system daily and contact the pool service if conditions require action beyond the capability of the pool supervisor.

APPENDIX G Pool Water Contamination & Response Guidelines

There are two general ways to contaminate pools: biological and chemical. All water contamination should be recorded on a Water Contamination Response Log.

BIOLOGICAL CONTAMINATION

Pool water can be contaminated by feces, blood or vomit and should be responded to in similar ways.

FECAL INCIDENT

Fecal incidents are treated differently depending on whether the feces are solid (formed stool) or watery (diarrhea). The risk of illness is considerably greater if the fecal accident is watery (diarrhea) because diarrhea is a good indication that a person is sick. When a fecal incident is discovered, the pool must be CLOSED immediately. The duration of the closure and the action(s) taken by the operator can vary depending on the type of fecal incident. The Centers for Disease Control (CDC) recommends the following actions when a fecal incident occurs.

1. Solid Stool: The operator must CLOSE the pool, remove the stool, properly dispose of it and clean and sanitize the equipment used. The pool may be reopened when the free chlorine residual is adjusted to 2.0 ppm or greater for approximately 30 minutes with the pH ≤ 7.5 and when the water temperature is $\geq 77^{\circ}\text{F}$ (25°C).
2. Diarrhea: The operator must CLOSE the pool and remove as much of the feces as possible (do not vacuum). The pool must remain closed until the pool water and filtration system have been disinfected using the “15,300 minutes contact time” or equivalent procedure. This means the pool water must be in contact with 1.0 ppm of free chlorine for 15,300 minutes, which is equal to 255 hours or 10 ½ days. This contact time can be reduced dramatically by increasing the free chlorine concentration from 1.0 ppm to 10 or 20 ppm. Example: 15,300 minutes = 20 ppm Cl x 765 minutes or 12 ¾ hours. In addition to 15,300 minutes contact time or equivalent, the pool filters must be backwashed to the sewer after the hyperchlorination. The filter grids must also be removed, cleaned and sanitized after the hyperchlorination. After the pool has completed the 15,300 contact time procedure and properly cleaned and sanitized the filters, the pool may be reopened when the free chlorine residual is between 2.0 – 5.0 ppm and the pH is between 7.2 – 7.8.

Crypto Inactivation Time (15,300) for a Diarrheal Fecal Incident

Free Chlorine Level (ppm)	Disinfection Time*
10	1,530 minutes (25.5 hours)
20	765 minutes (12.75 hours)
40	383 minutes (6.5 hours)

*Inactivation of crypto using chlorine, at pH 7.5 with water temperature of 77°F or higher

Giardia Inactivation Time for Formed-Stool Fecal Incident

Free Chlorine Level (ppm)	Disinfection Time*
1.0	45 minutes
2.0	25 minutes
3.0	19 minutes

*These closure times are based on 99.9% inactivation of giardia cysts by chlorine at pH of 7.5 and water temperature of 77°F

Does stabilizer in the water affect how I treat the pool water?

When pools have more than 50 ppm of stabilizer (cyanuric acid) in the pool water, it presents a special concern because the cyanuric acid inhibits the killing action of chlorine resistant pathogens like cryptosporidium. Therefore, pools with stabilizer (50 ppm or more) must adjust the pH down to 6.5, increase the free chlorine to 40 ppm and maintain these concentrations of free chlorine and pH for 30 hours to achieve 99.9% inactivation of cryptosporidium.

If your pool water has 50 ppm or greater of stabilizer (cyanuric acid), the following additional contact time is required to ensure decontamination of the water.

Crypto Inactivation Time for a Diarrheal Fecal Incident (Cyanuric Acid > 50 ppm)

Free Chlorine (ppm)	Disinfection Time*
40	1800 minutes (30 hours)

*Inactivation of crypto using chlorine with pH 6.5 and water 77°F or greater

VOMIT INCIDENT

CDC recommends responding to vomiting as you would to a formed stool fecal incident. CLOSE the pool and attempt to remove as much of the vomit as possible. Then, adjust the free chlorine level to 2.0 ppm or greater with the pH below or equal to 7.5 for 30 minutes. This will inactivate any germs that may have been in the vomit. The pool may be reopened after the treatment is completed.

BLOOD INCIDENT

The CDC is not aware of any germs being transmitted to swimmers from blood spills in a pool. The CDC indicates that these germs do not survive long when diluted into a properly disinfected pool. If the pool is properly chlorinated, blood in the water does not warrant closing the pool for public health. Because swimmers may expect something to be done, the pool operator should test the chlorine and pH levels to ensure they meet the required minimums. If they do not, the pool should remain closed until the proper levels of chlorine and pH are achieved.

CHEMICAL CONTAMINATION

ACCIDENTAL CHEMICAL CONTAMINATION

Accidental chemical contamination can occur when there is an equipment malfunction involving automatic chemical feeders, such as a chlorine feeder or pH adjustment chemical feeder. Contamination can also occur if excessive levels of sanitizer or pH adjusting chemicals are added manually by pool maintenance staff.

The pool must be CLOSED and not reopened until the pool water chemistry is adjusted within acceptable levels and any malfunctioning equipment is repaired or replaced. Frequent testing of the pool water chemistry and routine maintenance of equipment will reduce the risk of accidental chemical contamination.

INTENTIONAL CHEMICAL CONTAMINATION

Intentional contamination can range from vandalism (e.g. pouring food coloring or laundry detergent into a spa or pool), to a terrorist act intended to cause injury or death.

Because contamination of a public pool can affect a large number of people, it is important to take all forms of contamination very seriously. The pool must be CLOSED immediately after the contamination is discovered. Depending on the situation and specifics of the contamination, it may be necessary to contact law enforcement, the fire department or Environmental Health Services to assess the danger and what action should be taken to decontaminate the pool. Do not reopen the pool until you have confirmed the contamination has been removed and the pool is safe to operate.

APPENDIX H Disaster & Emergency Response

Emergencies and natural disasters usually come at unexpected times, so being prepared in advance is critical for quick and efficient response. This section recommends how to prepare and respond to isolated emergencies like drowning or serious injury around the pool and disasters that impact the entire region, such as power outages, wild fires, earthquakes, thunder storms, lightning storms and flooding. Few, if any of these, incidents can be avoided, but the impact and severity of the emergency can be greatly reduced by being prepared before the emergency occurs.

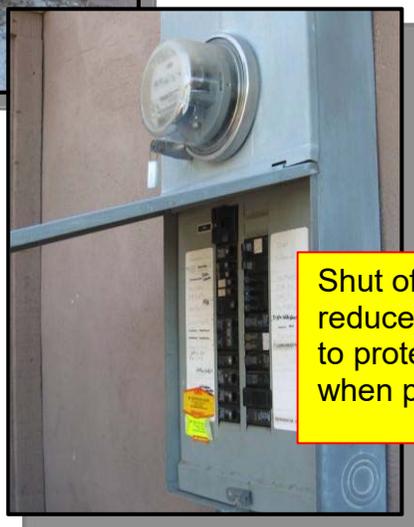
In most disasters or emergencies it is important to know how to shut off the utilities (gas, water and electrical). Make sure you know where and how to shut off the utilities.



Shut off gas at meter to prevent gas leak from broken gas line at the facility



Shut off water at the main to prevent contamination from damaged water main



Shut off electricity at main circuit box to reduce risk of fire or electrical shock and to protect equipment from power surge when power is restored

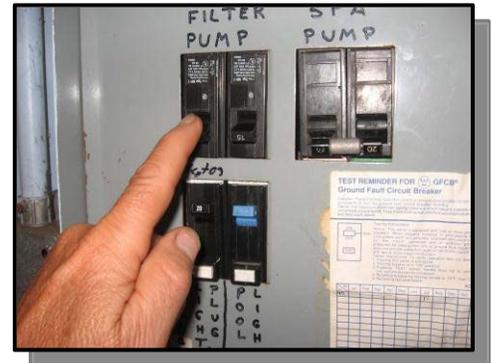
Power Outage

It is not uncommon for the electrical power to be lost due to downed power lines, blown transformer, fire or high winds. It is important to know what to do when this happens so that the operation of the swimming pool is safe. Here are some simple steps to take when there is a power outage.



Daylight Hours:

1. Close the pool in an orderly manner within 15 to 30 minutes of the power outage.
2. Turn the recirculation systems off and any other pool related electrical equipment. This will reduce the possibility of a power surge when the electrical power returns.
3. Leave one light or small appliance (radio) turned on so you know when the power is restored.
4. When power returns the following should be done:
 - a. Turn recirculation system on in stages if more than one pump is involved in the system.
 - b. Test the water chemistry to make sure that water quality standards are met.
 - c. Reset all timer clocks for pool lighting and recirculation systems and check that the emergency shut-off switch on the spa is working properly.
5. Reopen the pool to bathers only after you are satisfied that all pool equipment is operating properly and that the water quality meets minimum requirements.



Nighttime Hours:

1. Before a power outage happens, steps must be taken to provide some form of emergency lighting around the swimming pool. That lighting could be as simple as a flash light with extra batteries, some form of auxiliary battery powered lighting or an emergency generator.
2. Close the pool immediately and direct bathers out and away from the water.
3. Check the bottom of the pool with a flashlight to make sure all bathers are out of the water.
4. Check restrooms for anyone who may have fallen or become injured or disoriented in the dark.
5. Follow “daylight hours” guideline, steps 2-5.



Fire

Response to a fire depends on whether the fire started at your facility or if fire from the surrounding area is threatening your facility.

Fire on site: As with all disaster or emergency responses, the preparation and planning prior to the event is critical. Prior preparation should include:



1. Site map of facility showing:
 - Location of chemical storage (an inventory of the amount & type of chemicals stored).
 - Location of natural gas supply line and shut-off valve.
 - Location of emergency exits and assembly area.
 - Location of pool equipment area.
 - Location of restrooms, showers and locker area.
2. Evacuation plan for bathers and staff.

3. Contact the local fire department and have them review your map and evacuation plan.

Fire in the surrounding area: If the fire is in the area and threatening your facility you should implement your fire response plan. If smoke and ash from surrounding fires are impacting your pool, follow these clean-up guidelines.

Smoke & Ash Clean-Up

Pool Cleaning

- Clean the skimmer baskets of debris and skim the water surface with a pool net to remove floating debris.
- Brush sides and bottom of pool to loosen contaminants and vacuum the pool.
- Backwash and clean the filter. Discharged waste must go to a sanitary sewer.
- Check pH and adjust to between 7.2 and 8.0.
- Check disinfectant (chlorine) level and adjust to minimum of 2.0 ppm.
- Make sure the recirculation system is operating properly by checking the filter pressure and/or flow meter.
- Reopen pool to bathers only when the pH levels are between 7.2 and 8.0 and the free chlorine level is 2.0 ppm or higher.
- Due to the amount of smoke and ash in the air, these steps may need to be repeated after cleaning the filters.
- Alternatively, a swimming pool service company may be contracted to clean the pool. Check for business licenses and experience with servicing pools.

Deck Cleaning

Clean the pool deck and dispose of the debris with the rest of the solid waste. Do not hose down the deck to storm drains. You may spray lightly first to minimize dust and ashes from becoming airborne.

Draining Pools

Draining of community/public pools is not recommended. If you must drain the pool, contact your sewer agency for guidance. Discharge of pool water to the storm drain is not allowed.

Earthquake

Earthquakes are common in California so it is important to know how to prepare before an earthquake hits and what to do during and after the earthquake. Below are steps you should take to reduce the damage and injuries that may result from an earthquake.



BEFORE

1. Secure chemicals

- Fasten free standing storage shelves to wall
- Store liquid chemicals on lower shelves or
- In locked cabinets that are fastened to the wall
- Secure gas cylinders to wall



2. Know how to shut off utilities

- Gas
- Water
- Electricity

3. Know where the safest places are in each part of the facility

- Under door way
- Under sturdy tables

DURING

INDOORS

- Drop, cover and hold on
- Look for cover under doorways, tables or desks
- Move away from windows and exterior walls
- Stay inside until the shaking stops

OUTDOORS

- Get bathers out of the pool
- Move to open area away from power lines and trees

AFTER

- Check for injuries to bathers or staff
- Check for fires
- Check for gas leaks and shut off gas only if you suspect a leak
- Check for damage to electrical wiring. Shut off power if there is any damage or if there is a blackout in the area.
- Check for downed power lines
- Be prepared for AFTER SHOCKS

RECOVERY

- Check news reports for extent of damage
- Schedule to have gas turned back on if gas was shut off
- Turn electrical equipment back on in stages. Do not turn everything back on at once in order to prevent a power surge
- If water was shut off, turn water back on only after water provider advises you there is no risk of contamination

Severe Weather

For the most part, weather in San Luis Obispo County is mild, but occasionally San Luis Obispo is hit with severe weather and it is important to know what to do when it comes.

Thunderstorms & Lightning

Nationwide, lightning kills more people than tornadoes, floods or hurricanes, so it is critical to know a few simple precautions that can save lives during a lightning storm.



- Stay Alert
 - Monitor the weather
 - Know the signs of an oncoming thunder and lightning storm
 - towering clouds with a “cauliflower” shape
 - dark skies
 - distant rumbling of thunder
 - flash of lightning in the distance
- Seek Shelter
 - Get all bathers and staff out of the water and into a large enclosed building
 - Avoid patio tables with metal umbrellas or open patio covers
 - Stay away from metal fencing or light poles



High Winds

The primary danger with high winds is flying debris. High winds can also be responsible for downed power lines resulting in power outages.

During periods of high winds:

- Get bathers out of the pool and seek shelter inside a building or vehicle



- Patio furniture should be secured, especially umbrellas

After the winds subside:

- Skim the surface of the pool to remove leave and other debris
- Brush and vacuum the sides and bottom of the pool
- Test and adjust water chemistry before reopening the pool

Serious Injury or Drowning

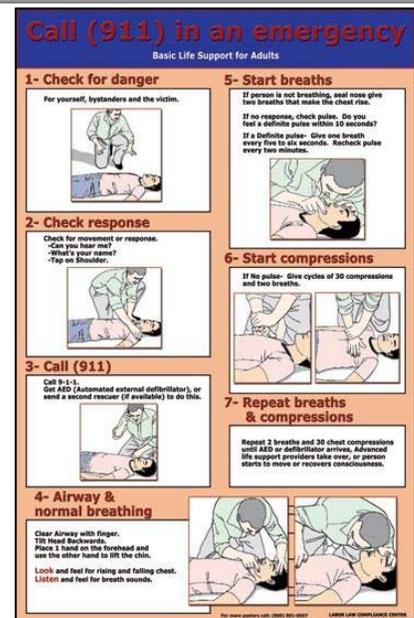
Every pool operator should be prepared for a drowning and/or serious injury that may occur. When a serious injury occurs, time is critical in saving the victim's life.

Once a serious incident occurs, the pool must be closed to all bathers as soon as possible so that full attention can be provided to the victim by emergency medical personnel.



Steps for serious injury response:

- Remove the victim from the water if there is no neck or back injury
- Move them to an area where immediate first aid can be started
- Call 911
- Provide CPR if the victim is not breathing
- Stop the bleeding if needed
- Direct staff or another bather to meet the ambulance at the facility entrance and direct them to the pool
- Keep the victim comfortable until emergency medical personnel arrive
- Complete an INCIDENT report



APPENDIX I Recreational Water Illness

What is a recreational water illness (RWI)? RWIs are illnesses associated with pathogens (germs) that are found in swimming pools, spas and other recreational waters that can make people sick. These include bacteria, viruses and parasites that live and grow in water. Most of these are killed by disinfectants (e.g. chlorine), but some are resistant to chlorine and must be eliminated by filtration or super-chlorination.

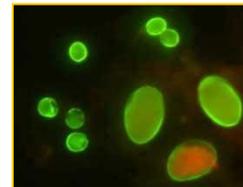
What causes recreational water illness? CDC reports that the most commonly reported RWIs are caused by the following:

- **Escherichia coli 0157:H7** is commonly referred to as E. coli. This bacterium is spread by the fecal oral pathway and is effectively controlled by maintaining 1.0 to 2.0 ppm of free chlorine.



- **Shigella** is a bacterium that is also spread by the fecal oral pathway and is effectively controlled by maintaining 1.0 to 2.0 ppm of free chlorine.

- **Giardia** is a protozoan parasite that forms a protective outer coating when conditions are not favorable for its growth. This protective coating makes giardia more resistant to chlorine. Giardia can be controlled by 1.0 to 2.0 ppm of free chlorine but needs a minimum of 45 minutes of contact time to kill.



- **Cryptosporidium** is commonly referred to as crypto and is a protozoan parasite that is spread by the fecal oral pathway. Similar to giardia, crypto also develops a protective coating but requires an even higher concentration of free chlorine and extended contact time to kill. When free chlorine is at 1.0 ppm, it takes 255 hours (10-11 days) of contact time to kill crypto.



For more information about recreational water illness (RWI), go to the CDC web page www.cdc.gov.

RWI Inactivation Time for Free Chlorinated Water

Pathogen (germ)	Free Chlorine Concentration	Required Contact Time
E. Coli 0157:H7	1.0 ppm	Less than one minute
Shigella	1.0 ppm	Less than one minute
Giardia	1.0 ppm	45 minutes
Cryptosporidium	1.0 ppm	15,300 minutes

CDC recommends these contact times based on water with a pH of 7.5

How do these pathogens get into the water and then to bathers? Most are carried into the water by bathers that are ill. They pass from the ill bather to the water when the bather has a fecal incident. Pathogens in the water then enter the body of the bather when the bather swallows the pool water.

How can RWI outbreaks be prevented? The Centers for Disease Control (CDC) recommends that you do the following to prevent RWI outbreaks:

1. Educate staff
2. Educate swimmers and parents
3. Maintain water quality and equipment
4. Evaluate filtration and disinfection systems
5. Develop disinfection guidelines
6. Evaluate hygiene facilities
7. Develop a bathroom break policy
8. Create special policies for large groups and young children
9. Post and distribute health information
10. Develop an outbreak/emergency response plan

CDC recommends the following for bathers and parents to protect themselves from RWI:

1. Don't swim when you are sick
2. Don't swallow the pool water
3. Practice good hygiene by taking a shower before entering the pool and washing hands after using the toilet or changing diapers
4. Take your child on bathroom breaks or check diapers often
5. Change diapers in a bathroom and not at pool side
6. Wash your child thoroughly (especially the rear end) with soap and water before entering the pool

For more information visit the CDC Healthy Swimming websites at: <http://www.cdc.gov/healthywater/swimming/rwi/>.

APPENDIX J Permits & Plan Check Requirements

Public Pool Permits: All public pools are required to have an annual operating permit. If the ownership of the pool facility changes, the new owner must apply for a new permit to operate. Permits are not transferable and therefore a new owner may not operate under the old permit even if it has not expired.

It is the responsibility of the facility owner to notify the Environmental Health Services when there is a change in management company, mailing address or contact information.

Plan Check Requirements for New Pools and Renovations: Anyone proposing to construct a new pool must obtain a plan check permit and submit construction plans for approval, prior to beginning construction. Renovation to any part of the existing facility, including, but not limited to, any changes to equipment, pool structure, decking, fencing or gates may require plan check.

Contact San Luis Obispo County Environmental Health Services whenever you are considering any changes to your facility. They can assist you in making the best choice and even save you money by keeping you from unknowingly purchasing or constructing something that is not approved for use.

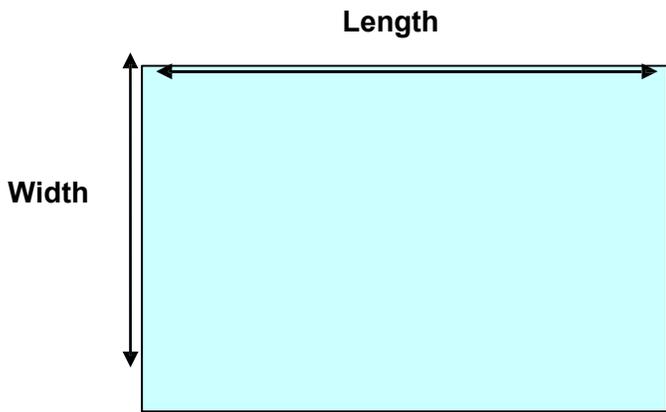
You may not be required to submit plans for equipment change if you are replacing like for like. For example, if you replace your recirculation pump with a pump of the same horse power, make and model, you don't need to submit plans. However, if you decide to change your pump to a different size, make or model, you must submit plans prior to installation of the pump. Plans and permits are not always required for renovations, but approval is required when making changes to the pool, enclosure, decking or equipment. Contact the plan check unit with any questions.

APPENDIX K Formulas, Conversions & Calculations

This section provides formulas and conversion tables to assist you in calculating surface area, volume, turn-over rates and determining amount of chemicals to add to adjust pool water chemistry.

Surface Area

Surface area involves length and width

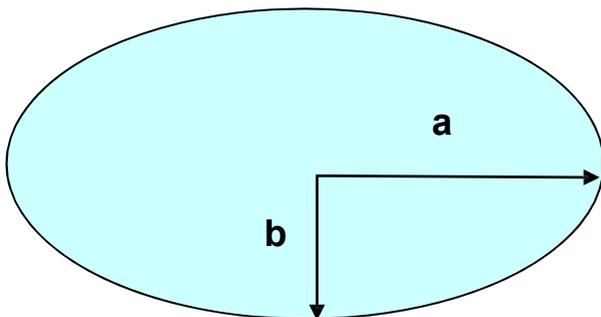
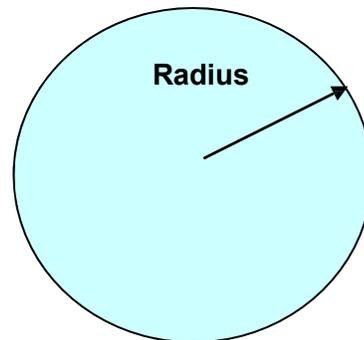


Rectangle

$$\text{Surface Area} = \text{Length} \times \text{Width}$$

Circle

$$\text{Surface Area} = 3.14 \times \text{radius} \times \text{radius}$$

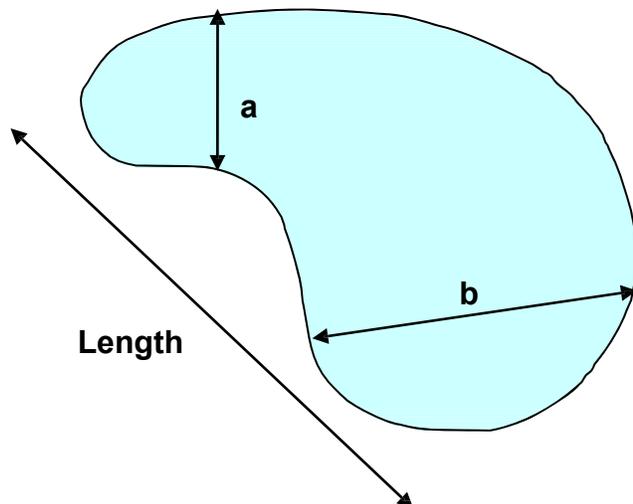


Oval

$$\text{Surface Area} = a \times b \times 3.14$$

Kidney

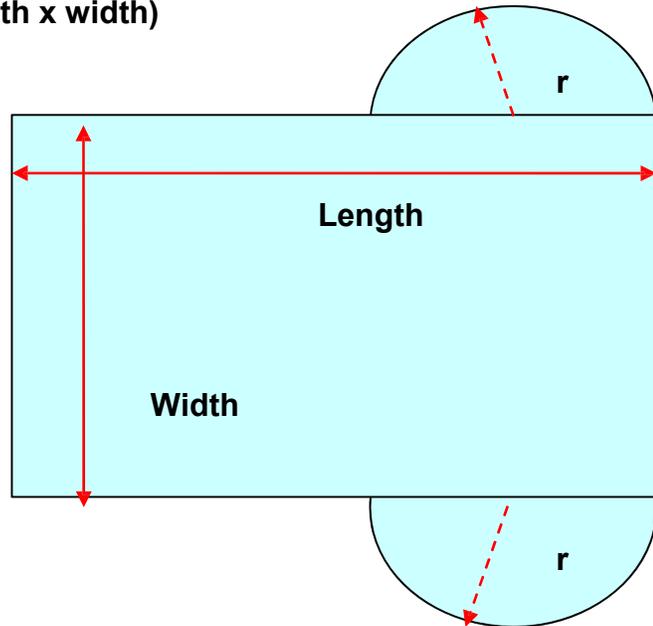
$$\text{Surface Area} = 0.45 \times (a + b) \times \text{length}$$



Some pools are a combination of common shapes requiring adding the sum of the shapes together to get the total surface area.

Combination

$$\text{Surface Area} = r \times r \times 3.14 + (\text{length} \times \text{width})$$



Volume

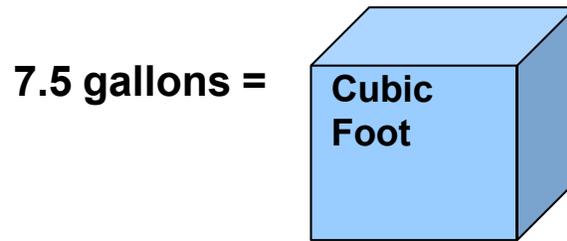
Calculating volume involves length, width and depth

$$\text{Volume} = \text{Surface Area} \times \text{Average Depth} \times 7.5$$

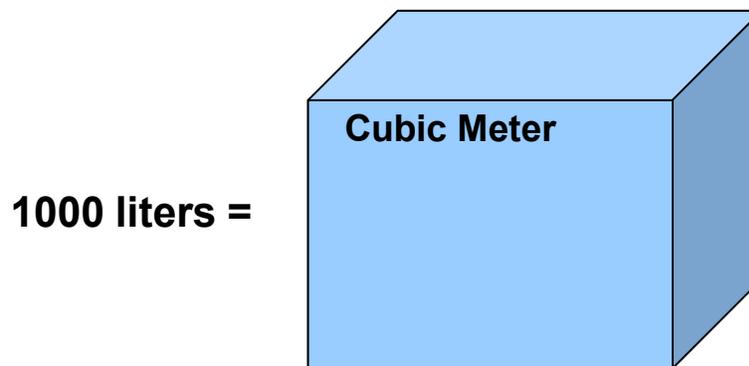
$$\text{Average Depth} = \frac{\text{Maximum depth} + \text{Minimum depth}}{2}$$



7.5 is a constant used when calculating volume in gallons because one cubic foot holds $7 \frac{1}{2}$ gallons of water



When using metric to calculate surface area and volume, the constant would be 1000 liters per cubic meter



Example #1: If a pool is 30 feet by 50 feet with a minimum depth of 3 feet and a maximum depth of 6 feet, the volume of the pool would be:

Surface Area = $30 \times 50 = 1500$ square feet

Ave. Depth = $(3 + 6) \div 2 = 4.5$ feet

Volume = $1500 \text{ sq. ft.} \times 4.5 \text{ ft.} \times 7.5 \text{ gal/cu. ft.} = 50,625$ gallons

Example #2: If a pool is 20 meters by 40 meters with a minimum depth of 1 meter and a maximum depth of 3 meters, the volume of the pool would be:

Surface Area = $20 \times 40 = 800$ square meters

Ave. Depth = $(1 + 3) \div 2 = 2$ meters

Volume = $800 \text{ sq. meters} \times 2 \text{ meters} \times 1000 \text{ liters/cu. meters} = 1,600,000$ liters

Turn-Over Rate

Time required for total volume of pool to pass through the filter

A pool's required turn-over rate depends on the type of pool and what year the pool was constructed. The table below indicates the turn-over rate required by the Health & Safety code.

Required Turn-Over Rates

Type of Pool	Built before January 1, 1982	Built after January 1, 1982
Swimming Pool	8 hours	6 hours
Wading Pool	2 hours	1 hour
Spa Pool	1 hour	½ hour

$$\text{Turn-Over Rate} = \text{Volume} \div \text{Flow Rate} \div 60 \text{ minutes / hour}$$

Example: If a spa pool was constructed after January 1, 1982 and has a total volume of 4,000 gallons the required turn-over rate is ½ hour.

Flow Rate

The rate water passes through the recirculation system

Generally, flow rate is measured in gallons per minute and is determined by reading the flow rate from the flow meter installed on the recirculation plumbing. The required flow rate can be calculated using the formula below.

$$\text{Flow Rate} = \text{Volume} \div \text{Turn-Over Rate} \div 60 \text{ minutes / hour}$$

Equivalent Volumes

Liquids

128 oz	1 Gallon	4 Quarts
32 oz	1 Quart	2 Pints
16 oz	1 Pint	2 Cups
8 oz	1 Cup	16 Tablespoons
½ oz	1 Tablespoon	3 Teaspoons

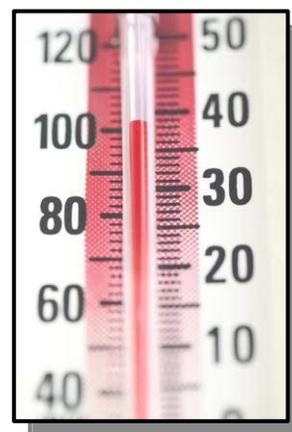
Conversions

Temperature

Fahrenheit (°F) and Centigrade (°C)

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 0.56$$

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 1.8) + 32$$



Metric

Liters to Gallons

$$\text{Liter} \times 0.264 = 1 \text{ Gallon}$$

Example: 12 liter \times 0.264 = 3.17 gallons

Meters to Feet

$$\text{Meter} \times 3.28 = 1 \text{ Foot}$$

Example: 5 meters \times 3.28 = 19 feet

APPENDIX L Contact Information

San Luis Obispo County Environmental Health Services is the local agency that regulates all public swimming and spa pools in the County of San Luis Obispo.

- Permitting
 - For questions about permits call **(805) 781-5544**
- Plan Check
 - For questions about pool plan check call **(805) 781-5544**
- Inspections
 - Contact your District Specialist or the office **(805) 781-5544**
- Complaints
 - To submit a complaint call **(805) 781-5544**
- Information & Public Record Requests
 - For general information or public record requests call **(805) 781-5544**
- Pool Information (click on the picture of the pool)
 - <http://www.slocounty.ca.gov/health/publichealth/ehs.htm>

GOVERNMENT AGENCIES

FEDERAL:

Consumer Product Safety Commission (CPSC) www.cpsc.org

Centers for Disease Control (CDC) www.cdc.gov

Environmental Protection Agency (EPA) www.epa.gov

STATE:

California Department of Public Health (DPH) www.cdph.ca.gov

COUNTY:

San Luis Obispo County Environmental Health Services
www.slocounty.ca.gov/ehs

POOL INDUSTRY ASSOCIATIONS

Association of Pool and Spa Professionals (APSP) www.apsp.org

- Pool and spa industry association
- Develops standards for regulations and equipment

National Swimming Pool Foundation (NSPF) www.NSPF.org

- Provides Certified Pool Operator (CPO) training
- Provides educational and operational materials for pool operators

Independent Pool & Spa Service Association (IPSSA) www.ipssa.com

- Provides pool maintenance & equipment repair

POOL SAFETY ORGANIZATIONS

Centers for Disease Control (CDC) www.cdc.gov

- Provides information about diseases including illnesses related to recreational water activities

Healthy Swimming www.healthyswimming.org

- Division of CDC dedicated to promoting healthy swimming
- Provides educational material and information on swimming safety and healthy swimming behaviors

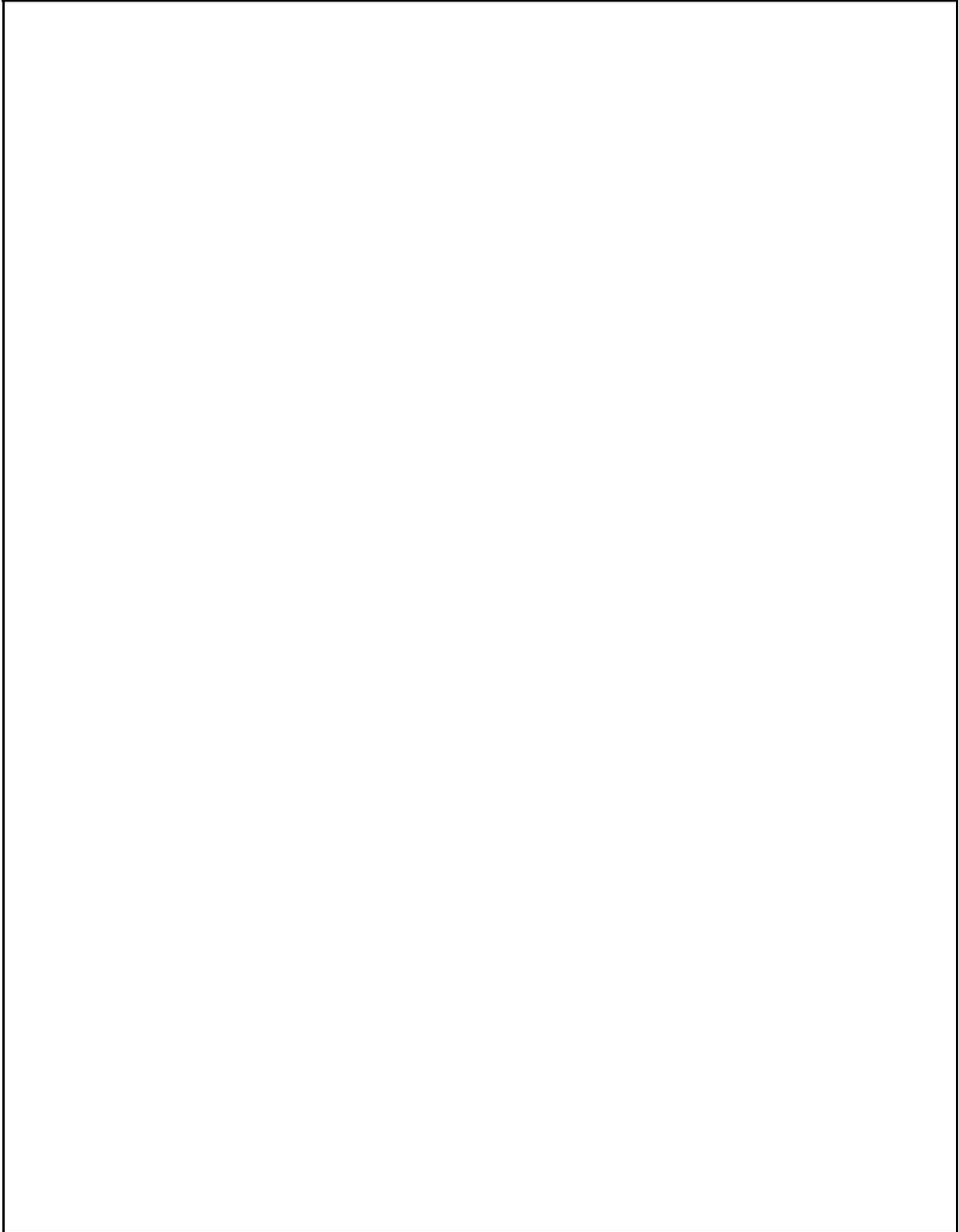
National Drowning Prevention Alliance (NDPA) www.NDPA.org

- Provides information on drowning prevention and safe water activities
- Provides referral for research on drowning prevention

Safe Kids www.safekids.org

- Provides information about child safety
- Works to promote child safety public policy and regulation

APPENDIX M FORMS AND APPLICATIONS





COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
 FOOD AND HOUSING DIVISION

SWIMMING POOL AND SPA SELF INSPECTION CHECKLIST

WATER QUALITY

- D** 1. Chlorine maintained at a minimum level of 15 ppm, but not to exceed 5 ppm.
- B** 2. pH maintained between 7.2 and 8.0.
- B** 3. Cyanuric acid maintained below 100 ppm.
- B** 4. Water clean and clear. Main drain(s) clearly visible.
- B** 5. Pool/Spa water test kit provided that measures free chlorine residual.
- O** 6. No algae in pool water on sides or bottom, or on tile.

SAFETY SIGNS AND LIFE SAVING EQUIPMENT

- D** 1. Signs posted in a conspicuous place and maintained in a legible manner:
 - a) "No Lifeguard" if pool is less than 6 feet in depth, and
 - b) "No Diving" if pool is less than 6 feet in depth, and
 - c) "Children Under the Age of 14 should not use pool without an adult in attendance."
- B** 2. Signs posted in a conspicuous place and maintained in a legible manner.
- B** 3. Lifting device with attached rope to span width of pool from poolside.
- B** 4. Body hook with attached 12ft. (min.) pole at poolside.
- B** 5. Depth markers clearly visible located at maximum, middle and minimum depth, and at the break in slope; on both sides; and at both ends.
- O** 6. Depth markers located on pool deck [if pool exceeds 20 feet in width).

FENCING/DECKING

- B** 1. Pool/Spa enclosed with approved fencing (min. 5ft. high, max. opening 4 in.).
- B** 2. Gates and doors are self-closing and self-latching.
- B** 3. An unobstructed 4ft. wide deck is provided around entire pool and around at least 50% of spa.
- B** 4. Pool/Spa deck and coping in good repair.

RECIRCULATION SYSTEM

- B** 1. Effluent and influent gauges installed and operating.
- B** 2. Flow meter installed and operating.
- B** 3. Approved automatic chlorinator in operation.
- B** 4. Property secured and anti-vortex covers provided for main drain(s), equalizer lines, and spa suction lines.
- D** 5. Skimmers and skimmer baskets clean and in good order.

PUBLIC RESTROOMS (if present)

- B** 1. Sinks, toilets, urinals, and showers clean and in good repair.
- B** 2. Floors, walls, and ceilings clean and in good repair.
- B** 3. Hot and cold water provided at all sinks (and showers if provided).
- B** 4. Soap and towels provided in approved dispensers at hand sinks.
- O** 5. Doors to restrooms are self-closing.
- O** 6. Screens in good repair and provided on all windows.

Daily Pool Check

../ Check and record pool chemistry daily

- Test the free chlorine and pH levels at least once per day and record the results in the log on the other side of this sheet.
- A DPD pool kit must be used to measure free chlorine concentrations.

../ Recommended chlorine levels:

Pool and water feature = 2.0 – 4.0 ppm

Spa and water = 3.0 – 5.0 ppm

- The maximum free chlorine level should never exceed 10.0 mg/L (10 ppm) outside the 1.0 and 10.0 ppm range.
- A minimum level of 1.5 mg/L is required when stabilizer is used.

../ Maintain a pH of 7.2 – 8.0

- A pH below 7.2 will irritate eyes and skin of all swimmers. It will also reduce the effectiveness of chlorine by 75% or more.
- A pH above 8.0 will irritate eyes and skin of all swimmers. It will also reduce the effectiveness of chlorine by 75% or more.

../ Other important chemical information

- Recommended total alkalinity is 80 – 120 ppm.
- Cyanuric acid maximum is 100 ppm.
- Recommended combined chlorine (CC) level maximum is 0.2 ppm for pools and 0.5 ppm for spas. If the level of CC is higher than the recommended concentration, retest and perform shock chlorination (DPC) to release any bound chlorine compounds.
- BPC-Alkaline Chlorine: Always use 10 Liters of BPC Alkaline Chlorine to raise the CC compound.

../ Remember if the chemical values do not meet approved concentration levels or if an immediate health hazard exists, **STOP THE POOL** until the issue has been corrected!



Facility Name _____
 Site Address _____
 Permit Holder _____
 Mailing Address _____
 City _____ State _____ Zip _____

Date (MM/DD/YY) []/[]/[]
 Permit # [] [] [] [] [] []
 Permit Type [F] [R] [] []
 ID # [] [] [] [] [] []
 # Pools on Permit _____
 Lockbox Location _____

Inspection Type: Routine Reinspection Complaint Environmental Other
 Time Spent: []

In = In Compliance NIO = Not Observed NIA = Not Applicable OUT = Not in Compliance COS = Corrected Onsite

RISK FACTORS				RISK FACTORS			
WATER CHEMISTRY				SAFETY HAZARDS			
In	1. Sanitizer (Chlorine / Bromine)	[]	[]	In	10. Decking, Coping, Steps, Gutters & Covers	[]	[]
In	2. pH Level	[]	[]	In NIO NIA	11. Lighting	[]	[]
In	2a. Total Alkalinity	[]	[]	In	12. Float Line, Depth & Safety Markings Provided	[]	[]
In	NIA 3. Cyanuric Acid Level	[]	[]	In	13. Spa and Wave Pool Safety	[]	[]
ENTRAPMENT				In	NIA 14. Lifesaving Equipment Adequate & Accessible	[]	[]
In	4. Suction Outlet Covers/ Fittings	[]	[]	ENCLOSURES / SECURITY			
In	NIA 5. Anti-entrapment Devices or Systems	[]	[]	In	15. Enclosure	[]	[]
RECIRCULATION / FILTRATION / DISINFECTION				In	16. Gates Self-Closing & Self-Latching	[]	[]
In NIO	6. Minimum Turnover Provided	[]	[]	In	NIA 17. Gate with Keyless Egress	[]	[]
In NIO	7. Proper Continuous Operation of Recirculation & Filtration System	[]	[]	In	NIA 18. Lifeguard Stand	[]	[]
In NIO	8. Proper Continuous Operation of Chemical Feeders	[]	[]	SAFETY & SANITARY			
CHEMICAL STORAGE				In	19. Safety & Sanitary	[]	[]
In NIO	9. Proper Chemical Storage	[]	[]	MAINTENANCE & OPERATIONS			
MAINTENANCE & OPERATIONS				In	20. Pool Shell Finish Maintained	[]	[]
In	21. Pool Shell, Surface & Tiles Clean	[]	[]	In	22. Required Signs Posted & Good Repair	[]	[]
In	22. Required Signs Posted & Good Repair	[]	[]	In	NIO NIA 23. Toilet Facilities, Showers & Drinking Fountains - Adequate, Clean & Good Repair	[]	[]
In NIO NIA	23. Toilet Facilities, Showers & Drinking Fountains - Adequate, Clean & Good Repair	[]	[]	In	NIO 24. Gauges & Flow Meters Functioning	[]	[]
In NIO	24. Gauges & Flow Meters Functioning	[]	[]	In	NIO 25. Equipment Area Properly Maintained	[]	[]
In NIO	25. Equipment Area Properly Maintained	[]	[]	In	NIO 26. Responsible Person	[]	[]
In NIO	26. Responsible Person	[]	[]	WASTEWATER DISPOSAL			
WASTEWATER DISPOSAL				In	27. Wastewater Disposal	[]	[]
WASTEWATER DISPOSAL				In	28. Pool Shell Finish Maintained	[]	[]

SAMPLE

Pool #	1	2	3
Pool Description or Location (pool/spa/wader)			
Free Chlorine (1.0 - 10 ppm) / Bromine (2.0 - 10 ppm)	High <input type="checkbox"/> Low <input type="checkbox"/> ppm	High <input type="checkbox"/> Low <input type="checkbox"/> ppm	High <input type="checkbox"/> Low <input type="checkbox"/> ppm
pH (7.2 - 8.0)			
Total Alkalinity (80 - 180 ppm)	ppm	ppm	ppm
Cyanuric Acid Level (Max. 100 ppm)	ppm	ppm	ppm
Flow Rate	gpm	gpm	gpm
Influent / Effluent Gauges (Backwash if difference exceeds 10 psi)	/ psi	/ psi	/ psi

Inspection Result: Ordered Closed Approved to Reopen Yes No None Inactive Directed Substantial Compliance
 Enforcement & Compliance: Plan Review Required No Valid Permit Hearing Scheduled

OBSERVATIONS & CORRECTIVE ACTIONS (see reverse for additional comments)

Received by (Print) _____ Received by (Signature) _____ Phone _____
 Specialist (Print) _____ Specialist (Signature) _____ Phone _____

This report is an Official Notice of Violation. It is the responsibility of the owner/operator to make all corrections. See reverse for the general requirements and code sections for each violation listed. A reinspection fee may be charged if violations noted on this report are not corrected by the reinspection date.

SUMMARY OF THE CORRESPONDING LAWS AND REGULATIONS FOR THE VIOLATIONS LISTED ON THE FRONT SIDE OF THIS FORM
 THIS SUMMARY PAGE LISTS EXCERPTS OF THE GENERAL REQUIREMENTS FOR EACH ITEM AND MAY NOT INCLUDE ALL APPLICABLE CODES. CODES CITED ARE FROM THE DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF PUBLIC SWIMMING POOLS UNLESS OTHERWISE NOTED. ADDITIONAL SECTIONS MAY BE CITED AS NEEDED.

WATER CHEMISTRY

1. Maintain a min. of 1.0 ppm free chlorine or 2.0 ppm bromine. For stabilized chlorine, maintain a minimum of 1.5 ppm free chlorine. Maintain a maximum of 10 ppm free chlorine/bromine. (65529)
2. Maintain the pH level between 7.2 and 8.0. (65529)
- 2a. Maintain the total alkalinity between 60 ppm and 160 ppm.
3. Reduce cyanuric acid level to a maximum of 100 ppm. (65529)

ENTRAPMENT

4. Protect suction outlets with approved covers that are properly secured and in good repair. (3134B.3, 116040, 116064)
5. Provide an approved anti-entrapment device or system. Provide an unblockable drain or an approved device to prevent physical entrapment by pool drain. (116040, 116064)

RECIRCULATION/ FILTRATION/DISINFECTION

6. Provide minimum required turnover rate. (3124B)
7. Recirculation & filtration
 - a. The recirculation system must be in operation whenever the pool is open for use. (65525)
 - b. Repair/replace the recirculation pump. (65525)
 - c. Repair/replace/backwash the filter. (65525, 3128B.3)
 - d. Adjust water level to the midpoint of skimmer. (3102)
 - e. Repair/replace broken/missing strainer basket, weir, and/or diverter valve assembly. (3134B)
8. Chemical feeders
 - a. Repair/replace automatic chlorinator. (3123B.1, 3132B)
 - b. Remove floating chlorinator or tablets from skimmer. (3133B)
 - c. Repair/replace chemical feeders. (3123B.1, 3132B)
9. Chemical storage
 - a. Maintain chemicals in a dry, secure area. (116040)
 - b. Store non-compatible chemicals separately. (116040)

SAFETY HAZARDS

10. Decking, coping, steps, gutters, and covers
 - a. Eliminate deck obstruction. (3113B.1)
 - b. Repair/replace deck. (3113B.1, 3113B.2)
 - c. Provide non-slip surface. (3113B.1, 3113B.2)
 - d. Replace broken/missing coping. (3111B.3)
 - e. Secure/replace handrails, ladder, step treads. (3110B.2, 3110B.5)
 - f. Replace missing/broken pool tiles. (3106B.3)
 - g. Repair overflow gutter. (3134B.2)
 - h. Properly store pool cover during hours of operation. (3113B.1, 116043)
11. Lighting
 - a. Provide adequate underwater lighting after dark with minimum of 4 inch high letters sign pool allowed after dark. (3119B.4, 3114B.3)
 - b. Provide adequate pool deck lighting after dark.
12. Safety markings
 - a. Repair/replace depth markers. (3109B.4)
 - b. Provide float line (rope with buoys) at break slope. (3108B.4)
13. Spa and Wave Pool safety
 - a. For spas, reduce water temperature to a maximum of 104°F. (3135B.2)
 - b. For spas, provide emergency shut-off switch in good repair adjacent to spa. (680-13) *Effective 1985
 - c. For wave pools, provide a system that sounds an audible signal that warns bathers that a wave is coming. (115952c)
 - d. For wave pools, provide a USCC approved Type II or III life vest to all non-swimmers and all children less than 48 inches tall when using wave pool. (115952a)
14. Lifesaving equipment
 - a. Provide life ring with rope of sufficient length to span the entire width of pool. (65539)
 - b. Provide 12-foot pole with body hook attached. (65539)

ENCLOSURES/SECURITY

15. Enclosure
 - a. All enclosures (fence, wall, or building) must be minimum 5 feet high with no opening greater than 4 inches. (3118B) Exception: enclosures constructed before July 1994 may be a minimum 4 feet high. (3118B.3)
16. Gates
 - a. Maintain self-closing gate to the pool area with self-latching hardware at least 42 inches above finished grade. (3118B.2)
 - b. Gates and doors shall open outward away from the pool. (3118B.2, 3118B.3) *Effective 7/1994
17. Gate with keyless egress
 - a. Provide at least one gate or door that allows user to exit pool enclosure without a key (3118B.2) *Effective 7/1994
18. Lifeguard service
 - a. Provide certified lifeguard service. (116028, 116045)
 - b. Provide lifeguard at wave pool. (115952d)

WATER CLARITY

19. Maintain pool water in clean, clear condition so main drain is clearly visible from pool deck. (65543, 65527)

HEALTHFUL, SAFE & SANITARY

20. Operate and maintain pool/spa in healthful, safe and sanitary condition, including, but not limited to, control of bacteriological, physical, chemical, and electrical hazards. (65545, 116060)

MAINTENANCE/OPERATIONS

21. Pool shell, surface, and tiles
 - a. Eliminate/control the algae. (65533)
 - b. Remove dirt, leaves, and debris from pool. (65533)
 - c. Clean the water tile lines. (65533)
22. Signs posted

Post the required signage that is clearly legible and located in a conspicuous place. Lettering on items a, b, c, h, and i must be a minimum of 4 inches high.

 - a. "Warning - No Lifeguard on Duty. Children under the age of 14 should not use pool without an adult in attendance". (65539)
 - b. "No Diving Allowed" (3119B.2)
 - c. "Maximum Occupant Capacity" (3119B.1)

Pool - one bather for every 20 sq. ft. of surface area
 Spa - one bather for every 10 sq. ft. of surface area
 - d. Artificial respiration procedures diagram (65539)
 - e. Emergency telephone number (9-1-1) (65539)
 - f. Spa Warning with the following language: (3119B.5)
 - Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering a spa
 - Unsupervised use by children under the age of 14 is prohibited
 - Hot water immersion while under the influence of alcohol, sedatives, drugs, or medicines may lead to unconsciousness and is not recommended

may result in nausea, dizziness, or

 - g. "Emergency Exit" (680-13)
 - h. "No swimming after dark" (3119B.4)
 - i. "No keyless egress for pools/ spas" (3119B.4)

July 1994 as "Emergency Exit".
 - j. "Warning - No children less than 48 inches tall when using a pool" (65539)
 - k. "Warning - Children less than 42 inches tall must be accompanied by an adult to be admitted to the facility." (115952g)
 - l. Provide sign advising bathers a warning audible signal will sound 15 seconds prior to the next wave. (115952g)

Spray grounds

 - n. Provide one or more signs indicating, "CAUTION: Water is recirculated. Do not drink". (CCDEH guidelines 10/2008)
23. Toilet facilities, showers, and drinking fountains
 - a. Clean and maintain toilet facilities, including restrooms, showers, dressing rooms, toilets, urinals, hand sinks. (65535)
 - b. Provide showers and hand sinks with hot and cold water by a mixing faucet with a maximum 110°F. (3115B.4)
 - c. Provide soap, paper towels/dryer, and toilet paper in dispensers. (65551)
 - d. Provide drinking fountain in good repair. (3116B)
24. Gauges & flow meters
 - a. Repair/replace effluent/intluent gauge(s). (3125B.2)
 - b. Repair/replace flow meter(s). (3125B.3)
25. Equipment area
 - a. Keep area clean, organized, and accessible. (3123B.3)
 - b. Label all piping and valves. (3125B.6)
26. Provide person who shall assume responsibility for operation, maintenance, and bather safety. (65521)
27. Provide access for inspection, including pool enclosure, equipment room, toilet facilities, and showers. (116055)
28. Maintain adequate records, including a daily log of pool operation, disinfection residual, pH, and maintenance procedures. For pools/spas in housing complexes with less than 25 units, twice weekly logs are permitted. Provide a monthly log for cyanuric acid. Maintain logs available upon request for at least one year. (65523, 116048)
29. Provide test kit capable of measuring free chlorine residual or other halogen residual. (65529)
30. Pool area maintenance
 - a. Maintain pool area clean, sanitary, and free of litter & vermin. (65535)
 - b. Provide hoses for regular deck cleaning. (65535)
 - c. Animals shall not be permitted in the pool/enclosure. (65533)
31. Dispose of wastewater properly. (3137B)
32. Pool shell finish
 - a. Provide pool shell finish that is smooth, durable, waterproof material, and in good repair. (3106B.2)
 - b. Provide pool shell that is white, except for spas, which may be pastel colored. (3106B.3)



Fecal Incident Response Log

Person Conducting Contamination Response						
Supervisor on Duty						
Date (mm/dd/yyyy) of Incident Response						
Time of Incident Response						
Water Feature or Area Contaminated						
Number of People in Water						
Type/Form of Contamination in Water: Fecal Incident (Formed Stool or Diarrhea), Vomit, Blood						
Time that Water Feature was Closed						
Stabilizer Used in Water Feature (Yes/No)						
	Water Quality Measurements					
	Level at Closure	1	2	3	4	Level Prior to Reopening
Free Residual Chlorine (1-4 are measurements spread evenly thru the closure time)						
pH (1-4 are measurements spread evenly thru the closure time)						
Date (mm/dd/yyyy) that Water Feature was Reopened						
Time that Water Feature was Reopened						
Total Contact Time (Time from when disinfectant reached desired level to when disinfectant levels were reduced prior to opening)						
Remediation Procedure(s) Used and Comments/Notes						

Glossary

Acid – A chemical compound that lowers pH by contributing hydrogen ions to the water. It is the opposite of a base.

Algae – Microscopic plants that enter the water by rain, wind, dust, storms or tap water. It can be a major maintenance concern for pool operators and affect sanitizer concentration. It is commonly grouped by colors of green, black and yellow.

Algicide (a.k.a. Algaecide) – Any chemical that kills algae.

Alkali – See Base.

Alkalinity – See Total Alkalinity.

Ammonia (NH₃) – A chemical compound of hydrogen and nitrogen that combines with free chlorine in pools to form inorganic chloramines (Combined Chlorine).

Automatic Feeders – A chemical feeder with valves that are controlled by electronic equipment to deliver needed chemicals. The electronic device (controller) receives signals from electrodes (probes) that monitor the water's chemistry.

Backwash – The process of cleaning a swimming pool filter by reversing the direction of the flow of water through the filter.

Backwash Rate – The rate of flow required for efficient filter cleaning. Typically measured as the volume of water (gallons) per minute per filter surface area.

Bacteria – Single-cell microorganisms that lack chlorophyll and reproduce by fission. Many are beneficial to human life, but some cause illness and disease.

Bactericide – Any chemical that kills bacteria.

Balanced Water – The correct ratio of hardness, alkalinity, temperature, dissolved

solids and pH that prevents the pool water from being either corrosive or scale forming.

Bather – Term used to describe the users of the pool facility whether they are swimming, floating or wading in the pool.

Barrier – See Enclosure.

Base (a.k.a. Alkaline) – A chemical that neutralizes acids, usually by providing hydroxyl ions. It is the opposite of an acid.

Bather Load – The number of bathers or users in the water at any given moment.

Break-in-Slope – A dramatic change in slope from shallow to deep water in the pool. This usually occurs at 4 ½ feet of depth.

Breakpoint Chlorination – The process of adding enough Free Chlorine to destroy the inorganic chloramines. Use at least ten times the Combined Chlorine (Total Chlorine – Free Chlorine) to achieve breakpoint chlorination.

Bromine – A disinfectant that is used to destroy microorganisms. It can also oxidize unwanted organic and nitrogenous waste.

Buffer – Chemicals that cause water to resist a change of pH. The amount of buffer in the water is measured by testing the total alkalinity.

Calcification – Formation of scale on pool walls or the surface of pool equipment due to the precipitation of calcium carbonate.

Calcium Carbonate (a.k.a. Scale) – A water-insoluble white solid that is the main component of scale.

Calcium Hardness – The calcium content in the water measured by testing for total hardness. The calcium level determines if the water is soft (too little) or hard (too much). Hard water can cause cloudiness and scale buildup. Soft water can damage equipment and the pool shell.

Carbon Dioxide – A gas that is used to lower pH in water.

Cartridge Filter – A filter that uses a replaceable and disposable porous element as the filter medium.

Cavitation – Formation of a partial vacuum when the pump volume exceeds the water supply.

Certified Pool Operator (CPO) - An individual who has successfully completed the class work and passed an examination administered by the National Swimming Pool Foundation (NSPF).

Chemical Feeder – A device that dispenses chemicals into water at a measured rate.

Chloramines (a.k.a. Combined Chlorine) – The chemical compound that forms when chlorine chemically bonds to ammonia from urine and perspiration, chloramine-treated source water or fertilizers. It can irritate the eyes and skin of bathers and has a strong odor of “chlorine” or “dirty clothes.”

Chlorinator – Any chemical feeder that is used to dispense chlorine (tablet, liquid or gas).

Chlorine – A disinfectant that is used to destroy microorganisms. It can also oxidize unwanted organic and nitrogenous waste. Extreme caution must be used when handling.

Circulation – The flow or movement of a volume of water through a pool and system piping, pump, filter, heater, feeders and other components.

Clarifier – A chemical that causes small particles to combine into larger particles that can be removed by a filter.

Combined Chlorine (a.k.a. CC, Combined Available Chlorine or Chloramine) – Undesirable compounds that are formed when Free Chlorine chemically bonds to ammonia or other nitrogenous compounds like urine or perspiration. It can irritate the eyes and skin of bathers and has a strong odor of “chlorine” or “dirty clothes.”

Coping – The deck edge around the pool just above the water surface; designed to direct deck water away from the pool and to create a handhold for bathers in the water.

Corona Discharge – A discharge of electricity that creates a bluish glow when the voltage gradient exceeds a critical value. A method used to generate ozone.

Cross Connection – An unprotected connection between a domestic water (potable) supply and a pool or other non-potable water where contamination of domestic water supply can occur.

Cyanuric Acid (a.k.a. Stabilizer or Conditioner) – A chemical that reduces the degrading effects of the ultraviolet rays of sunlight on Free Chlorine. Some tablet forms of chlorine contain cyanuric acid or it can be added as a supplement.

Deck – The area immediately surrounding a pool or spa for use by bathers to sit, stand or access the water.

Diatomaceous Earth (D.E.) – A white powder composed of fossilized skeletons of one-celled organisms called diatoms.

Diatomaceous Earth Filter (D.E. Filter) – A filter designed to use diatomaceous earth as a filter medium. It can either be used in a pressure or vacuum type filter system.

Dichlor (a.k.a. Dichloroisocyanuric acid) – A white solid disinfectant and oxidizer that releases chlorine and cyanuric acid when dissolved in water. It is available in tablet and granular form and has 60% available chlorine.

Disinfectant (a.k.a. Sanitizer) – An agent that kills microorganisms that might cause disease or illness.

DPD (a.k.a. Diethyl-p-phenylenediamine) – A reagent used in test kits or test strips to measure Free or Total Chlorine. The reagent turns pink in the presence of chlorine.

Effluent – Water flow out of a filter, pump or pool. Flow pressure is measured in pressure per square inch (psi).

Egress – A gate or door that allows for exiting the pool area without use of a key in case of an emergency.

Electrolysis – A chemical reaction caused by passing electrical current through a substance.

Enclosure – A barrier or system that controls access to a pool, spa or other recreational water body. Enclosure may include fencing, walls, gates/doors or surrounding buildings.

Erosion Feeder – A chemical feeder device in which sanitizer powder, tablets, sticks or briquettes are placed in a container. Pool water passes through, eroding and dissolving the chemical.

Filter – A mechanical device for separating suspended particles from water. There are three general types: sand, diatomaceous earth and cartridge.

Filter Medium – The component of the filter that performs the separation of solids from liquid including sand, paper, diatomaceous earth and zeolite.

Flocculant – A chemical that brings together fine particulate matter in water to form larger particles. It is used in the cleaning of sand filters.

Flow Meter – A device that measures the rate the water flows through the recirculation system.

Flow Rate – The velocity of the water that flows through the recirculation system. It is expressed in gallons per minute (gpm).

Free Chlorine (a.k.a. FC or Free Available Chlorine) – Chlorine that is not combined with nitrogen molecules and is available for disinfection. Free Chlorine is the sum of hypochlorous acid (HOCl) + hypochlorite ion (OCl⁻).

Gallons per Minute (gpm) – A measurement of the water flow rate.

Halogen – An element found in Group VIIA of the Periodic Table. Halogens are very chemically reactive, which make them excellent disinfectants and oxidizers. Chlorine and Bromine are both halogens.

Hose Bib – A valve with a threaded connection used to connect hose to potable water supply.

Hours of Operation – The time the pool is open and available to bathers.

Hydrochloric Acid (HCl a.k.a. Muriatic Acid) – A strong acid used to reduce the pH and total alkalinity. It is sometimes used to clean scale or “acid wash” surfaces.

Hypochlorite Ion (OCl⁻) – The form of Free Chlorine that is the less effective sanitizer. It is in dynamic equilibrium with hypochlorous acid (HOCl) and the concentration is dependent on the pH of the water.

Hypochlorous Acid (HOCl) – The form of Free Chlorine that is a more effective sanitizer due to its neutral charge. It is in dynamic equilibrium with hypochlorite ion (OCl⁻) and the concentration is dependent on the pH of the water.

Influent – Water flowing into a pool, pump, filter, chemical feeder or other equipment.

Lithium Hypochlorite (LiOCl) – A white granular solid disinfectant that contains 35% available chlorine.

Main Drain – Located at the deepest point of the pool, it draws water to the filter through the pump and also may be used to entirely drain the pool. Modern pools have split or dual main drains to reduce entrapment risk.

Makeup Water – Potable water that is used to fill or refill a pool or spa.

Molecule – A group of atoms bound together in a specific arrangement.

Muriatic Acid – See Hydrochloric Acid.

Occupant Capacity – The maximum number of bathers allowed in a swimming pool or spa pool at one time. The maximum allowable load for a spa pool is 1 bather for every 10 square feet of surface area. The maximum allowable load for a swimming pool is 1 bather for every 20 square feet of surface area.

OTO (a.k.a. Orthotolidine) – A test reagent that turns yellow in the presence of Total Chlorine or Total Bromine. It does not indicate the presence of Free Chlorine. OTO is not approved for use as a testing reagent and is a suspected carcinogen.

Oxidation – The process of changing the chemical structure of contaminants in the water by increasing the number of oxygen atoms or reducing the number of electrons in the contaminant.

Oxidation Reduction Potential (a.k.a. ORP) – A method of indirectly measuring the concentration of an oxidizer in the water. This information can be used to activate the chemical feeder to adjust the water chemistry.

Ozone (O₃) – A gaseous oxidizer and supplemental disinfectant that is generated on-site, and then dissolved in the water to oxidize contaminants and disinfect the water. Ozone is generated by UV light or a Corona-discharge generator.

Part per Million (ppm) – The amount of an item being measured in one million units.

Pathogen – A microorganism that causes disease or illness in humans.

pH – The negative logarithm of the hydrogen-ion concentration of a water solution. It measures how acidic or basic the water is on a scale of 0 to 14. A pH below 7.0 is considered acidic and above 7.0 is considered basic.

Phenol Red – An organic dye that is yellow at a pH of 6.8 and then turns progressively deeper red and purple in color as the pH increases to 8.4. It is the most common reagent used for testing pool pH.

Pounds per Square Inch (psi) – A unit of measure for pressure.

Pressure Differential – The difference in pressure between two points in a hydraulic system.

Protozoa – A single celled parasite that causes illness and release oocysts. The oocysts, which are resistant to disinfectants like chlorine, are passed from infected bather's feces to the pool water where other bathers can be infected by swallowing the pool water.

Public Pool – State law defines a public pool as any pool other than a private pool. A private pool is any constructed pool, permanent or portable, which is intended for non-commercial use as a swimming pool by not more than three owner families and their guest.

Recirculation System – A system consisting of piping, pumps and filters that allows water to be taken from the pool, filtered, treated and then returned to the pool.

Responsible Person – A person who is fully capable and responsible for compliance with all requirements relating to pool operation, maintenance and safety of bathers.

Sand Filter – A device that uses sand, or sand and gravel as the filter medium.

Sanitizer – See Disinfectant.

Saturation Index – Mathematical calculation based on water temperature, calcium hardness, total alkalinity, pH and dissolved solids to predict if the water has a tendency to be scale forming or corrosive. When the saturation index indicates that the water is neither scale forming nor corrosive, the water is said to be balanced.

Scale – Calcium carbonate deposits that can be found in filters, heaters and on pool walls.

Skimmer – A device other than an overflow trough for continuous removal of surface water and floating debris from pool. Water drawn through the skimmer goes to the filter.

Skimmer Weir – See Weir.

Sodium Hypochlorite (NaOH a.k.a. Bleach or Liquid Chlorine) – A liquid disinfectant and oxidizer that releases chlorine when added to water. It contains 10% to 15% available chlorine.

Sodium Carbonate (a.k.a. Soda Ash) – A white water soluble solid used to raise the pH and alkalinity of water.

Sodium Thiosulfate – A chemical used to remove chlorine from water. It is used to remove chlorine from test samples to ensure accurate pH readings. When used in large amounts, it can de-chlorinate swimming pools.

Split Drain System – Modern swimming, spa and wader pools are constructed with a split or dual main drains with “T” manifolds to reduce the possibility of suction entrapment.

Superchlorination (a.k.a. hyperchlorination) – The practice of adding large quantities of chlorine to kill algae and microorganisms, eliminate slime, destroy odors and maintain disinfectant residual.

Surface Area – a.) The amount of water exposed to the air in a pool, usually measured in square feet. b.) Amount of plaster exposed to the water, usually measured in square feet. c.) The area of filter medium available to filter water, usually measured in square feet.

Total Alkalinity – A measure of the ability of the water to maintain a desirable pH when acid is added to the water. Total alkalinity is measured in ppm.

Total Chlorine (a.k.a. TC or Total Available Chlorine) – The total of all Free Available Chlorine plus all Combined Chlorine in the water.

Total Dissolved Solids (TDS) – The amount of residue that would remain if all the water evaporated or was removed. TDS is usually expressed as ppm or mg/L.

Trichlor (a.k.a. Trichloroisocyanuric acid) – A disinfectant that releases chlorine and cyanuric acid when dissolved in the water. It is produced in granular and tablet form and provides 90% available chlorine.

Turbidity – A measure of the cloudiness of water due to the presence of small particles. Turbidity tests are used to measure the concentration of cyanuric acid.

Turnover Rate – The time required (in hours) it takes to circulate the amount of water equivalent to the volume of the pool or spa through the recirculation system.

Ultraviolet Light (UV) – Electromagnetic radiation with shorter wavelength than visible light from the sun or light artificially generated. UV is used as supplemental disinfectant.

Valve – A device used to control, resist or redirect the flow of water through the recirculation system. Includes backwash, multiport, gate and other types.

Water Watcher – Is a Safe Kids Childhood Drowning Prevention Program designed to designate a responsible adult whose sole duty while wearing the water watcher tag is to watch the children in and around the water.

Weir – The flap component of the skimmer that has the primary function of breaking the surface tension of the water to enhance suction through the skimmer inlet.

Zeolite – Filter media consisting of granular volcanic material. It is very porous and capable of filtering particles down to 5 microns and generally used in high rate sand filters.

NOTES: