

Guidance Document for Pool Operators

Development of Pool Operations Manual

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OPERATION GUIDANCE MANUAL WATER RECREATION POOL FACILITIES

This document is a guide to help pool operators review and check items for operating and maintaining their pool facilities. This is not to replace existing operation manuals, but serve as a guide for the items to include in development of such a manual. This guide will assist the operators in performing routine operation and troubleshooting of the water recreation facilities. Please understand this manual is not a complete compilation of all the facts necessary to properly maintain and operate a pool. It is designed to provide some useful checks on some key items that affect the health and safety considerations related to a pool. A bibliography of source reference manuals is provided in the appendix of this manual.

This guide evaluates pool facilities by reviewing the:

- Physical facility and its maintenance
- Safety equipment for the facility
- Water quality monitoring
- Supervision controls provided for bathers
- Factors related to the pool environment

This manual is organized in several different segments. The first section provides a brief narrative description of routine operations to be applied at a facility. Following this is a section of checklists for guiding the operator on some basic considerations. In the third section is a work sheet with some examples of basic factors to consider for determining some physical and operational characteristics of your individual pool.

When you have completed this section you will have a ready reference for chemical dosages necessary for your pools. Following this section is an appendix of some supportive materials.

SECTION I

OPERATIONAL MONITORING

DAILY OPERATIONAL CHECKS

Daily operational checks of the pool facility must be made to ensure safe and healthy swimming conditions for bathers. These checks not only include water quality monitoring, but inspection of the physical facilities and pool equipment. Daily attention must also be given to bather supervision and environmental conditions.

PHYSICAL FACILITIES

The pool facility, safety equipment, mechanical room and locker/restroom areas must be inspected at least once a day for safety and sanitation. If life-threatening safety hazards exist, e.g. missing main drain grates or broken faulty barriers, close the pool. Other physical facility parameters to review include:

- Observe pressure readings for filters and backwash as needed.
- Check water levels to ensure overflow system is at proper level.
- Check feeders to ensure adequate chemical levels are maintained.
- Hair and lint strainer is checked and cleaned as needed.
- Pool is vacuumed and brushed as needed.

WATER QUALITY CONDITIONS

Observe water clarity in the pool. If the main drain, bottom and sidewalls are not easily visible, close the pool until the clarity recovers. Monitor pH and disinfectant levels sufficiently during periods of use to ensure they are maintained within required levels and record the results on log sheets (see Appendix). It is recommended that a minimum of three tests per day for chlorine/bromine be taken for moderately used pools.

BATHER SUPERVISION

Lifeguarded Pools

Sufficient lifeguarding must be provided to ensure a 30-second response time to bathers. Include provisions for lifeguard rotation and/or rest periods. Define lifeguard stations per conditions at the pool.

Non-lifeguarded Pools

When the pool is used by children twelve years of age or under, a responsible adult eighteen years of age or older shall accompany the children and be at the pool or pool deck at all times the children use the facility. When used by persons thirteen through seventeen years of age a minimum of two people age thirteen or older must be at the pool facility. These rules must be

posted and enforced. Annual, seasonal, or on going (e.g. at a motel) written notification must be provided to responsible parties.

ENVIRONMENTAL CONDITIONS

If visibility problems arise due to fog, smoke, dust, etc., close the pool. If electrical storms arise, remove people from the pool until danger of the storm has passed. If an individual has brought an electrical device (e.g. radio, hairdryer, etc.) make sure it is not plugged in on the pool deck.

WEEKLY OPERATIONAL CHECKS

Weekly operational checks of the swimming pool/spa pool facility are needed to ensure that certain safety equipment is in working order and that certain water quality conditions are within proper bounds. Some operators close the facility to use for abbreviated periods to bathers on slow days to perform some of the water quality tasks.

PHYSICAL FACILITY

- Barriers are secure and gates are in good working order.
- Observe inlet and overflow system to ensure they are operative and in good repair.
- Ladders, steps, handrails and diving boards can become loose with use. Check their condition and tighten and secure as needed.
- Pool rule signs are necessary to properly inform users of their requirements for use. Ensure signs remain posted.
- Spa emergency shut off switches need to be tested to ensure they are operative to prevent entrapment hazards. This also applies to pools with a single main drain.
- Electrical lighting fixtures are operational and bulbs replaced as needed.
- Observe the pool for air bubbles, this is a sign of leaks in the lines. If necessary bleed air from the filter. Suction water lines or “O” rings on connections may need service.

WATER QUALITY

- Monitor and record levels of alkalinity, hardness, and cyanuric acid (if used).

BATHER SUPERVISION SAFETY

Lifeguarded Pools

- Take opportunity to observe staff and evaluate preventive lifeguarding practices of the guards.

Non-lifeguarded Pools

- Note problems with repeat offenders who are not complying with rules and take additional efforts to formally notify responsible adults of conditions for pool use.

ENVIRONMENTAL CONDITIONS

- Observe relative humidity and ventilation conditions at indoor pools. If humidity feels excessive, or water is forming on the walls, note indoor and out door weather conditions and check condition of ventilation system.

MONTHLY OPERATIONAL CHECKS

Monthly operational checks of the pool facility are set up for evaluating the working condition of the mechanical equipment, the physical surfaces, and staff performance. Monthly checks should be used to assure lifeguard training records are current, that the pool has run consistently to code the past month, that all equipment is functioning and repairs are scheduled in a timely manner. A good deal of preventive maintenance involves simple inspection procedures designed to detect pending troubles in time to allow corrective measures to be taken. Review your manufacturers recommendation for maintenance for all mechanical equipment.

PUMP ROOM

The monthly check of the pump room begins with checking the door locks, looking for corrosion, standing water, or other signs of deterioration due to lack of ventilation or water damage. Each piece of equipment should be evaluated as follows:

A. Filters

- **Caution:** Never open a filter before first bleeding off the air. The pressurized air in the filter can violently explode the shell when it is loosened.

Check for leaks from the vessel itself. **DE filter** septums should be checked for cracks, tears or breaks. In the DE filters look for bridging, which is, accumulation of filter media (DE) on adjacent filter element to such a thickness that a clear space between them becomes blocked. Remove this excess DE from the filter. **Cartridge filters** should be evaluated for cracks and breaks. Filters should be checked for damaged internal components. If cartridge filters have bypass valves, ensure these valves are permanently sealed closed. For **sand filters** – see quarterly checklist.

- B. **Chemical feeders** should be disassembled, cleaned, and flushed as recommended by the manufacturer. Check for tight connections and that the cleaner is free flowing. Check records for trends that may indicate problems. Test feeders for output.

C. **Pump and motor** Unless you are well equipped with proper tools and working knowledge it is probably best to leave repair to a professional. There are some things to do to prevent major repair including:

- Feel motor to ensure it is not excessively hot.
- Listen for unusual noises or clicking noises.
- Inspect terminal connections and pump for fraying wires.
- Check for water leaks. Ensure that pump is properly secured and well ventilated.
- There should be no standing water on the floor.
- Air bubbles at the pool inlets indicate pump seal problems.
- Check condition of hair strainer for breaks for air leaks.

SURFACES

Observe conditions of surfaces. Check all decks, coping, steps and pool surfaces for standing water and potential algae growth. Ensure non-slip surfaces are maintained. Look for cracks, breaks, and tripping hazards in the walking surfaces. Plans for repairs should be documented and arranged.

SPA

Ensure the bather load/usage is within state design limits. Make provisions to routinely drain spas. Use the following formula:

Spa volume ÷ 3 ÷ average number of users per day = Number of days between draining, cleaning and refilling
example: 900gal. ÷ 3 ÷ 20 users per day = 900 ÷ 3 = 300 300 ÷ 20 = 15 Drain, clean and refill every **15 days**.

LIFEGUARDED POOLS

All in-service training of staff should be updated and recorded. Document any audits, internal or external, and any changes made as a result.

RECORDS

Injury, illness and incident records should be up to date and documented. It should be verified that the Health Department was called within 2 days, for serious injury or serious illness as required by code.

QUARTERLY OPERATIONAL MONITORING

There are many items that need to be performed on an approximately quarterly basis to ensure proper maintenance of the pool facility.

There is a checklist covering some items that need to be reviewed to assess facility safety and operations and staff preparedness. Following is an overview of several important items.

PHYSICAL FACILITIES

Inspect the building that houses indoor pools. The moisture and corrosive chemicals used in pools can destroy building materials. Check the walls, roofs, fixtures and ceilings for damage, rot, rust, etc. Make any needed repairs in a timely manner – buildings have been known to collapse.

In addition, there have been problems with ventilation systems at time not providing enough fresh air makeup in buildings creating conditions where staff and bathers have upper respiratory ailments, headaches, and other conditions.

Inspect the ventilation system on indoor pools to ensure controls are working correctly. Ensure controls for airflow, temperature, and relative humidity are properly maintained.

SPA WATER TEMPERATURE

Soaking in hot water is enjoyable, but if excessive temperatures are not controlled, they can lead to a variety of health problems. Water that is too hot can raise the body temperature dangerously high and cause heat stroke or unconsciousness. Young children are more easily affected by hot water than adults and require close supervision. Children under 6 years old should not use the spa. Individuals with medical conditions including, heart disease, circulatory problems, blood pressure problems, or on certain medications should restrict their use as advised by their doctor. Alcohol also accelerates the rate at which persons may succumb to heat and become unconscious. Persons should not drink and use a spa pool.

There are concerns of potential damage to the unborn child with women who are pregnant. Women sitting in a hot tub with too hot of water may have their body temperatures increased which creates a condition similar to a fever. This has been considered as a probable cause of some serious birth defects among children including teratogenesis and spina bifida. It is recommended that women in the childbearing years not enter spas in excess of 102° Fahrenheit (F) and limit their stay to 15 minutes. The time that is most critical for potential damage to the child is during the first 4 to 8 weeks (so the mother may not even realize she is pregnant yet).

We **recommend** spa temperatures not exceed 102° F. to take into consideration the potential damage to unborn children. We **allow** temperatures to be provided up to a maximum of 104° F. It is important that proper notice of the conditions for use of the spa pool be posted.

Monitoring the water temperature in a spa pool is an important job. Spa water temperatures can fluctuate in relation to the particular thermostatic controls. Therefore, part of the quarterly checklist asks that the spa pool water temperature be monitored through one complete heating and cooling cycle to ensure that the maximum temperature of 104°F is never exceeded. A heating cycle runs from the time heater “clicks on”, “clicks off” then “clicks on” again. Remember at no time during this cycle should the water temperature be greater than 104°F.

LIFEGUARDED FACILITIES

Quarterly lifeguard audits should be held to practice skills and test the lifeguard staff’s capabilities. Audits should be documented and include testing of:

- Ability to meet 30-second response time.
- Rescuing a drowning victim (conscious and unconscious)
- Rescuing a victim of a potential neck or back injury.
- In gas chlorine pools, providing means to evacuate bathers and secure area.

NON-LIFEGUARDED FACILITIES

Copies of pool rules, especially the age restriction requirements must be sent out periodically to pool users. Responsible adults must be aware of pool rules and the limitations for pool use. CPR certified staff is highly recommended at all pools.

ANNUAL OPERATIONAL MONITORING

As the pool operator performs annual maintenance on their equipment and facility, there are several items that need to be included for health and safety. Although the checklist is intended to be used annually, you will find some items that may warrant more frequent review.

CHEMICAL HANDLING

Many swimming pool chemicals are exceedingly hazardous. Pool chemicals can react violently with each other or with water or other chemicals. Accidental mixing of chemicals can cause fires, explosions, and release of toxic gasses. Pool chemicals must be handled with care and stored correctly.

All chemicals at the pool facility must have a Material safety Data Sheet (MSDS) on file at the pool facility (OSHA and WISHA requirement). MSD sheets provide information on the potential hazards associated with a particular chemical and can be helpful in deciding how to work safely with chemicals. Each MSDS should provide specific information on a chemical’s potential reactivity hazards.

Safety equipment should be provided for handling potentially harmful pool chemicals. As a minimum eye protection (goggles) and hand protection (heavy rubber gloves) should be provided for use when handling chemicals. Also, it is necessary to provide a dedicated dispensing utensil scoop or measure for each chemical.

Chemical storage is an important consideration. The best storage arrangement starts by dedicating a room to pool chemicals only. This will reduce the number and kinds of chemicals that might accidentally mix with pool chemicals. A couple rules of thumb should be kept in mind when deciding where to locate chemicals.

- Store chemicals above floor level.
- Store acids away from bases.
- Store inorganic chlorine away from organic chlorine.

Finally, all swimming pool managers and operators should be aware of the E.P.A. requirements for reporting hazardous chemical inventories as required under SARA Title III. Contact your Local Emergency Planning Committee or the Washington State Emergency Response Commission (1-800-633-7585) for more information about your responsibilities under this law.

EMERGENCY PLANNING

Planning for potential emergencies can help save lives and prevent unnecessary injury or illness. As a minimum, pool operators should make contact with local rescue personnel each year. Evaluate how one would evacuate your facility in the event of an emergency. Also consider how you would react if a severe injury or near drowning or drowning occurred. Can emergency service personnel easily get into the facility? Can a person on a stretcher easily be removed from the facility?

RECORDS AND REPORTS

- If you have a non-lifeguarded pool facility, are you providing a copy (annually and/or ongoing) of the age restriction requirements to the responsible adults using the facility? If you have a flier, when was it last updated? Do you provide any information explaining the need for adult supervision and the severity of the problem of drownings, near drownings and severe injuries associated with pools?
- Have you evaluated the treatment reports of your facility over the past year? Have you determined the amounts of various chemicals needed for operation of the facility? Have you had recurring operational problems, but not coming to corrective solutions? Do you have a preventive maintenance program established for your equipment? Have you identified major items needing replacement over the next quarter, year, and five years?

- Are your records complete? Do they accurately reflect the conditions of the physical facility maintenance provided and water quality conditions maintained?
- Do you have copies of necessary reporting forms for water quality, injury or illness reports, and age restriction notification fliers for users?

TESTING EQUIPMENT

Testing equipment needs to be evaluated routinely to ensure both the reagents and the equipment being used is providing accurate readings. Reagents should be replaced with new chemicals at least annually. If you are a seasonal pool, be sure to purchase new reagents just before the start of the upcoming pool season. At least once during the year, check your testing equipment accuracy with a pool maintenance company that can provide accurate testing. As the test kits are subjected to a variety of environmental conditions with heat, sunlight, chemicals, etc., the reagent kits do lose their accuracy and need replacement.

POOL MARKINGS AND SIGNAGE

At least annually, the depth markings, marking lines in the pool, pool signage, and float ropes should be carefully reviewed and repaired or replaced as needed.

SPECIALTY CHECKS

CHLORINE GAS

There is need for emergency planning. Auditing capabilities of staff is to be done at least annually. Working closely with Emergency Services on an annual basis is advised. Information on emergency procedures for chlorine gas is in Appendix A.

- Provide commercial strength (twenty-six degrees Baume') ammonia vapor to detect chlorine gas leaks.
- Test chlorine exhaust fan to ensure proper operation.
- Test integral shut off switch from chlorine booster system with pool recirculation system to determine proper operation.

REPORTING TO STATE OR LOCAL HEALTH DEPARTMENT

- **DEATH, DROWNING, NEAR DROWNING, INJURY OR ILLNESS**
Whenever a death or serious injury or illness occurs which may be related to the pool facility, it is necessary to contact the state or local health jurisdiction within 48 hours. An injury reporting form is in the appendix. If additional forms are needed, please contact the state or local health agency.

SECTION II

OPERATING CHECKLISTS

DAILY OPERATIONAL CHECKLIST

S	M	T	W	T	F	S	WEEK OF:
PHYSICAL FACILITIES:							
							Gate & doors closed, self-closing, self-latching.
							Pool decks clean & free of slip/trip hazards.
							Main drain grates secure, not broken.
							Skimmers in good condition, water level adequate.
							Inlets secure, not broken.
							Pool vacuumed/brushed if needed.
SAFETY EQUIPMENT:							
							First aid kit stocked and accessible.
							Reaching/throwing devices accessible, functional.
							Emergency phone working and labeled.
							Float ropes secure.
MECHANICAL ROOM:							
							Pumps and filters operational.
							Chemical feeders filled and operational.
							Flowmeter working; record reading on log sheet.
							Hair strainer checked; clean as needed.
							Chemicals properly labeled and stored.
							Check filter pressure; backwash if needed.
SHOWER/LOCKER ROOMS:							
							Floors clean and non-slip.
							Sinks/showers functional and clean
							Soap, toilet paper, paper towels, etc. provided.
WATER QUALITY:							
							Test pool chemical levels; record on log sheet.
							Observe water clarity.
							Test spa water temperature; record on log sheet.
BATHER SUPERVISION							
							Lifeguarded pools - staff is available & overseeing pools during use, able to provide 30 second response time.
							Non-lifeguarded pools - children under 12 are not using pool w/o adult supervision. Kids 13-17 are not using pool alone.

WEEKLY OPERATIONAL CHECKLIST

WEEK OF:	
PHYSICAL FACILITIES:	
	Barriers are secure and in good repair.
	Ladders, steps, handrails, diving boards secure.
	Light fixtures working; bulbs replaced as needed.
SAFETY EQUIPMENT:	
	Pool rules signs posted and visible.
	Spa emergency pump shut-off switch working and labeled.
	Pool with single main drain emergency pump shut-off switch working and labeled.
WATER QUALITY:	
	Spa drained, scrubbed, refilled, and balanced (if heavily used).
	Monitor and record levels of alkalinity, hardness and cyanuric acid (if used).
	Test kit is clean & adequately stocked.
BATHER SUPERVISION:	
	Lifeguarded pools - observe staff & evaluate preventive lifeguard practices.
	Non-lifeguarded pools - evaluated repeat violations and take corrective action with adults
ENVIRONMENTAL CONDITIONS:	
	Indoor pools - check relative humidity & ventilation conditions.

MONTHLY OPERATION CHECKS

Date completed	Month of:
PHYSICAL FACILITY	
	FILTER - DE/Cartridge - Evaluate condition of internal components of filter. Sand - See quarterly operation checklist.
	CHEMICAL FEEDERS - Evaluate working condition.
	PUMP AND MOTOR - Observe and check condition
	SURFACES - Observe condition of walking steps and pool surfaces.
	SPA POOLS - In spa pools ensure pool water is drained, cleaned and refilled on a routine basis. In heavily used spas this may be a weekly task.
BATHER SUPERVISION	
	Lifeguarded pools - provide in-service training of staff and record training.
	Non-lifeguarded pools - review supervision requirements with staff to ensure compliance

QUARTERLY OPERATIONAL CHECKLIST

QUARTER:	
DATE COMPLETED	
PHYSICAL FACILITIES	
	Spa water does not exceed 104° F measured through one heating and cooling cycle.
	Sand filters - remove inspection lid after air has been released & observe sand for even conditions. If over 1" difference evaluate for potential break through. Also test sand for mud balls.
INDOOR POOLS	
	Ceiling and roof are in sound condition.
	Walls and support structure in sound condition.
BATHER SUPERVISION/SAFETY	
LIFEGUARDED FACILITIES:	
	Provide documentation of lifeguard audit (minimum of two per year).
	Lifeguard certifications are valid and on file.
	Guards able to meet 30-second response time.
	Guards demonstrate the proper use of backboard.
	Guards can handle a variety of rescue problems (seizure, heart attack, neck/back injury).
	Chlorine gas emergency drill.
NON-LIFEGUARDED FACILITIES:	
	Written notification given to pool users of limiting conditions for use. (i.e. age restrictions and supervision requirements)
	C.P.R. certified staff (recommended).

ANNUAL OPERATING CHECK

YEAR:	
DATE COMPLETED	PHYSICAL FACILITIES
	Proper safety gear is provided for chemical handling and emergencies.
	Material safety data sheets are provided for all chemicals at the facility.
	Chemicals properly stored.
	Pool test reagents fresh.
	Pool test kit in good condition (not stained and faded) and properly stored.
	Marking lines visible and in good condition.
	Depth markers easily readable.
	RECORDS AND REPORTS
	Non-lifeguarded pools - review message flier on supervision and update as needed
	Lifeguarded pools - review in service training for year and plan for following year.
	Ensure records are complete - water quality, lifeguard certificates, reporting of injury or illness to state or local health departments.
	Are more forms needed for water quality, injury reporting, etc. Contact state or local health departments for additional forms.

SECTION III

POOL DIMENSIONING AND CHARACTERISTICS

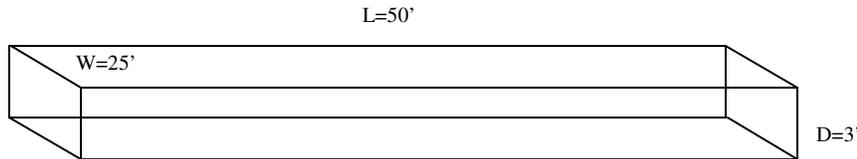
POOL AND SPA DIMENSIONING

Before beginning any chemical adjustments in the pool or spa, calculate the volume of water first. Accurate adjustments cannot be made unless the water volume is known. Calculating pool or spa volume is easy using some simple formulas and math.

For all calculations remember that: [V] = Volume
 [L] = Length of Pool
 [W] = Width of Pool
 [D] = Depth of water in the Pool

Also remember that your answer will be in cubic feet and 1 cubic foot contains 7.48 gallons of water.

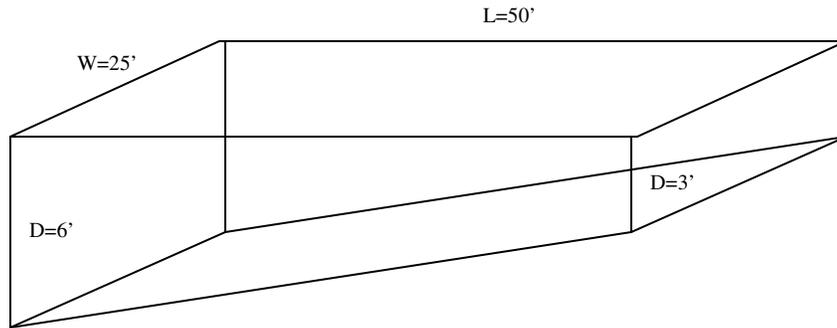
Example A. Constant Depth Pool: Lets start with a simple rectangular pool of the same depth. This pool is 50' long, 25' wide and 3' deep.



The formula to determine how many cubic feet is in the pool is:

Volume (V) = Length (L) x Width x Depth (D) or Volume = 50' x 25' x 3'
 Volume = 3750 cu. Ft. of water since one cubic foot contains 7.48 gallons of water
 3750 cu. Ft x 7.48 galls = 28,050 the volume of this pool is 28,050 gallons.

Example B. Variable Depth Pool: However most swimming pools are not just one depth, but usually have a deep end and a shallow end. We'll use the same 50'x25' pool as above, but suppose it is 3' deep at one end and gradually slopes to 6' at the other.



The formula is the same [Volume = L x W x D], however since the depth varies we must figure an **AVERAGE** depth for our pool. To do that add the two depths and divide by two, or $\frac{6' + 3'}{2} = 4.5'$

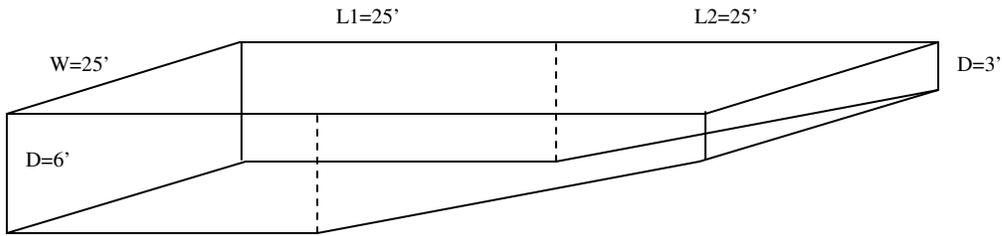
Volume (V) = Length (L) x Width (W) x Depth (D)

Volume = 50 x 25 x $\frac{6' + 3'}{2}$ = 5625 cu. ft. of water

since 1 cu. ft. contains 7.48 gallons then 5625 cu. ft. x 7.48 gals. = 42,075

Volume of this pool then is 42,075 gallons.

Example C. Variable Slope Pools: This pool is the same size, 25' x 50' but the bottom slopes from 3' at the shallow end to 6' at the middle. Then the rest of the pool is 6' deep.



Perhaps the easiest way to figure volume of this type of pool is to divide it into two pools that can be easily figured and add the results. Let's calculate the deep end as one pool 25' x 25' which is 6' deep (example A) and the shallow end of the pool as a 25' x 25' pool with a variable depth from 3' to 6' deep (example B).

Deep End

$$V=L \times W \times D$$

$$V=25' \times 25' \times 6'$$

$$V=4675$$

Shallow End

$$V=L \times W \times (\text{average}) D$$

$$V=25' \times 25' \times \frac{3' + 6'}{2}$$

$$V=2812$$

Volume of deep end = 4675 cu.ft.

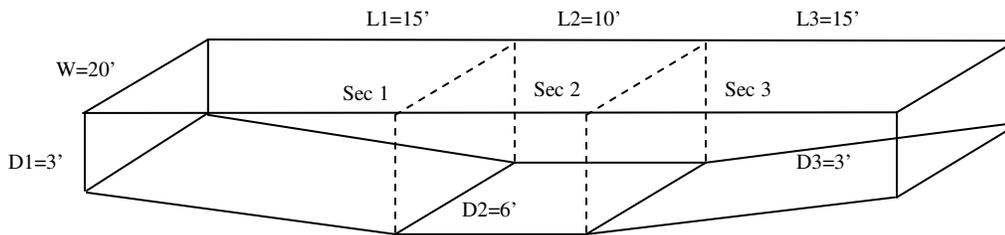
Volume of Shallow end = 2812 cu. Ft.

OR the total volume of the pool is 4675 + 2812 = 7487 cu.ft.

7487 x 7.48 gal. per cu.ft. = 56006

This pool then contains 56,006 gallons of water.

Example D. Multiple Depth Pools: The pool is 40' x 20' and is 6' deep in the middle and 3 ft. deep on the ends.

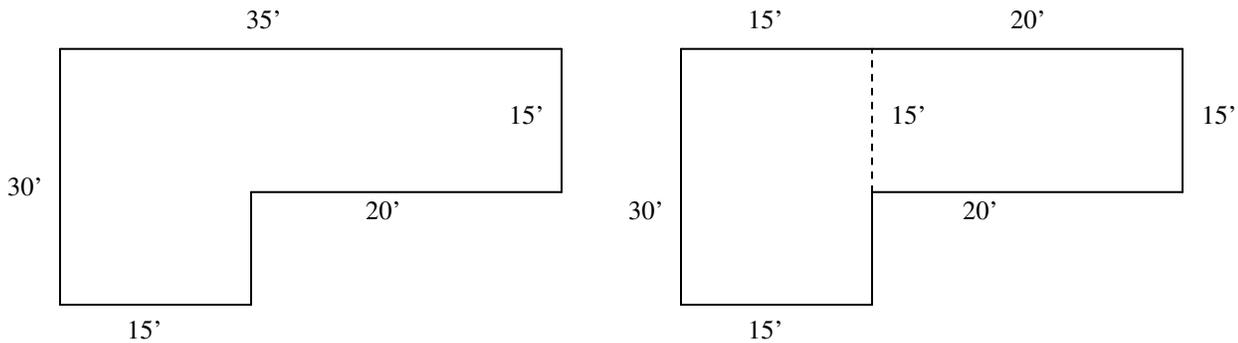


For pools with multiple depths simply divide the pool into sections. The deep or middle section is 10' x 20' x 6',

and the ends are 15' x 20' x $\frac{3' + 6'}{2}$. Therefore the volume of section 1 is 1350 cu. ft., volume of section 2 is

1200 cu. ft., and section 3 is 1350 cu. Ft., for a total of 3900 cu. Ft. or 29,172 gallons.

Example E L shaped and other Common Shapes of Pools: Calculating Volume of these pool types is done by dividing the pool into sections (dotted line) that can be easily worked with.



Example F. Round Pools: The formula for figuring the volume of a round pool or spa is

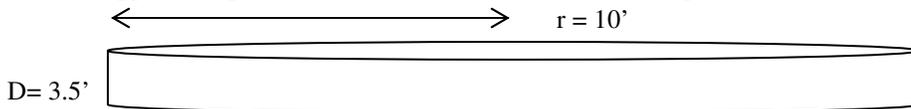
$$\text{Volume} = \pi (\pi) \times \text{radius } (r) \times \text{radius} \times \text{depth } (D)$$

where $\pi = 3.14$

r = radius or the distance from the middle of the pool to one edge

D = Depth of water

Also remember that your answer will be in cubic feet and that 1 cubic foot contains 7.48 gallons of water. So suppose our pool has a radius of 10' and the water is depth 3.5'

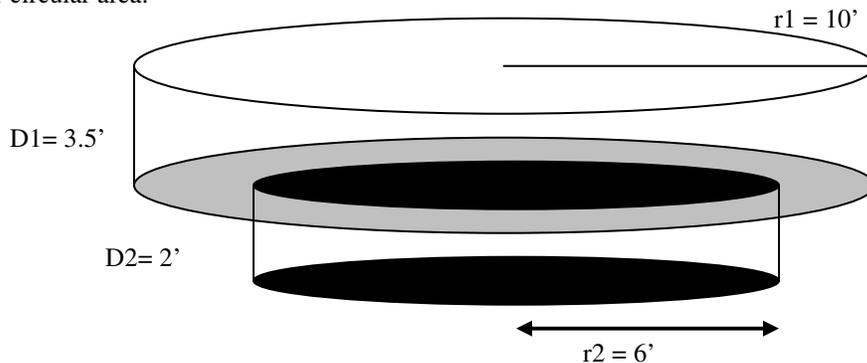


$$\begin{aligned} \text{Volume} &= \pi \times r \times r \times D \\ &= 3.14 \times 10 \times 10 \times 3.5 \\ &= 1099 \text{ cu. Ft.} \end{aligned}$$

and since one cubic foot contains 7.48 gallons, $1099 \text{ cu. Ft.} \times 7.48 \text{ gals.} = 8220 \text{ gallons}$

Volume of this pool then is 8,220 gallons

Example G. Round Pools with Seating: Pools or spas of this design can be divided into two sections, an upper and a lower circular area.



The upper section of this pool is the same as Example F. Just calculate the volume of the foot well or lower section and add the two volumes.

$$\begin{aligned} \text{Volume} &= \pi \times r \times r \times D = 3.14 \times 6 \times 6 \times 2 = 226 \text{ cu. Ft.} \\ \text{since one cubic foot contains 7.48 gallons, } &226 \text{ cu.ft.} \times 7.48 \text{ gals.} = 1691 \text{ gallons} \\ \text{add this to the upper section or } &8220 + 1691 = 9911 \text{ gallons of water in this pool.} \end{aligned}$$

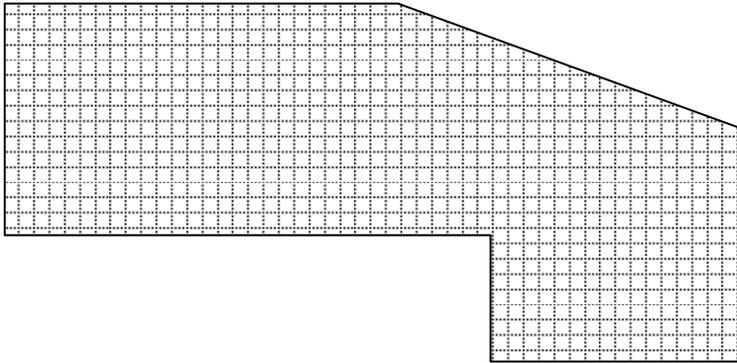
Volume of this pool is 9,911 gallons.

Example H. Irregularly Shaped Pools:

If your pool or spa is irregularly shaped try contacting:

- The Builder
- The Pool Manufacturer
- Your Equipment Supplier
- The Health District

It is also possible to calculate the volume by determining the surface area based upon a grid. Carefully draw the pool out on a graph paper; each square equals one square foot. Count the number of squares at each depth and calculate the volume.



POOL CHARACTERISTICS

The following information should be completed for each pool at your facility. This will enable you to accurately determine many important conditions for proper operation of your pool. If you need help in determining volume and dosages, we suggest you contact your local pool supply company.

Appendix A provides tips on testing water quality conditions.

Appendix B offers miscellaneous forms and further resources to aid you in maintaining your pool.

Dimensions: Length _____ Width _____ Depth Range _____ ‘ _____ “ to _____ ‘ _____ “

Pool volume: _____ gallons. (See Pool and Spa Dimensioning)

Determine minimum turnover rate:

Pool volume divided by 360 (for six hour turnover)	= _____ gpm. (swimming pool)
Pool volume divided by 180 (for three hour turnover)	= _____ gpm. (wading pool)
Pool volume divided by 30 (for 30 minute turnover)	= _____ gpm. (lightly loaded spa pool)
Pool volume divided by 20 (for 20 minute turnover)	= _____ gpm. (moderately loaded spa pool)
Pool volume divided by 10 (for 10 minute turnover)	= _____ gpm. (heavily loaded spa pool)

Flowmeter reading of actual turnover rate maintained with pool filter: clean _____ gpm; dirty _____ gpm.

Type of disinfectant used in pool facility. _____

Amount of disinfectant needed to provide one part per million in the pool is _____ (ounces, pounds).

Chemical(s) used to maintain pH within range is _____

Amount of chemical needed to increase pH by 0.1 unit. _____ (ounce or pound).

Chemical(s) used to maintain alkalinity _____

Amount of chemical needed to decrease or increase alkalinity by 10ppm. _____ (ounce or pound).

Chemical(s) used to maintain hardness _____.

Amount of chemical needed to decrease or increase hardness by 10 ppm. _____ (ounce or pound).

Goal levels for chemicals to be maintained in this pool are:

Primary disinfectant range. _____ to _____ ppm.
pH _____ to _____.
Alkalinity range _____ to _____ ppm.
Cyanuric acid range (if used) _____ to _____ ppm.
Hardness range _____ to _____ ppm.

APPENDIX A

CHEMICAL TESTING GUIDELINES

MAKING CHEMICAL ADJUSTMENTS THROUGH HAND FEEDINGS

Before beginning any chemical adjustments in the pool or spa, calculate the volume of water first. Accurate adjustments cannot be done unless the water volume is known.

Adding Chemicals:

1. Add large amounts *gradually* in thirds over a 2-hour period.
2. Add directly into the pool/spa when no swimmers are present and time is sufficient to permit even distribution of the chemical(s).
3. Add granular chlorine or soda ash solution directly to the pool/spa, but separately. Always mix chemicals into plastic containers that have been filled with water first.
4. Add chemicals evenly by walking the perimeter of the pool/spa.
5. Add chemicals frequently to prevent highs and lows in readings. Large reading fluctuations are hard on soft metals and produce a bounce effect on water treatment.
6. Add additional chemicals only following an adequate time that permits a second or third chemical reading.

THINGS TO REMEMBER

1. When adding chemicals to the pool or spa make sure no one is in the facility.
2. Do not add chemicals in the skimmers.
3. When using chlorine as the disinfectant, use only the chlorine designed for the type of feeder being used. (**Caution!** Granular chlorine placed in a feeder designed for tablets can result in an explosion.)
4. The greatest influence on pH in the water is often chlorine.
5. When stabilized chlorine is used cyanuric acid is also being continuously added.
6. Cartridge filters must be removed and cleaned, not backwashed.
7. Do not touch DPD tablets with your hands when conducting chlorine readings. Use lid on the sample tubes when shaking sample not your finger.
8. Flow meters periodically get dirty or clogged and require cleaning.
9. Dirty filters are not the only reason a pool or spa gets cloudy.
10. Clean pump strainer baskets and skimmer baskets regularly.
11. Do not use acid on D.E. filters before thoroughly washing with a strong detergent, the acid will set oil and grease making cleaning difficult.
12. Too high a pH can cause scaling. Too low a pH can cause corrosion.

EMERGENCY PROCEDURE FOR CHLORINE GAS LEAKS

DESCRIPTION OF LEAKAGE:

Liquid compressed chlorine (gas bottles) cannot be seen escaping into the air unless the leak is very large. It will have a greenish yellow color in high concentrations. It will have an irritating, bleach like odor and it is heavier than air. Chlorine forms a strong acid (hydrochloric acid) when it encounters water moisture. Inhaling it or getting it in the eyes causes immediate damage and distress. Chlorine will burn the wet or perspiring skin. Exposure to the chlorine gas can cause serious damage to the lungs and can stop a victim from breathing in a very short period of time. The chlorine bottles can begin leaking in warm conditions. If the temperature of the cylinder exceeds 158 degrees Fahrenheit there is a fuseable plug that will allow chlorine gas to escape to prevent bursting of the cylinder.

EMERGENCY PROCEDURE IF CHLORINE LEAK IS FOUND

1. If you are entering the chlorine room and notice the smell of chlorine gas, or are in the vicinity of the chlorine room and either smell or see chlorine vapors, consider that a chlorine leak is occurring.
2. Avoid contact with the chlorine liquid or vapors. Do not try to be a hero. Unless you have proper protective equipment, including self-contained breathing apparatus and are trained on its proper use, do not try to stop a leak on your own.
3. If the leak is small and no visible chlorine can be seen, put on self-contained breathing apparatus [preferably have two persons go to chlorine room with protective equipment] and turn off chlorine cylinder.
4. If the leak is severe [visible], initiate evacuation of the facility, moving the bathers and spectators up hill and up wind of the leak. As soon as the persons are moving to safety, have staff person contact emergency service agency with the following instructions:
 - a. Dial 911 or other predetermined emergency response number.
 - b. Note the name and address of the facility and note that you have a serious chlorine gas leak.
 - c. Ensure that all bathers, spectators, neighboring facilities and personnel are safely away from the area of the chlorine leak.
 - d. Continue to maintain the area until emergency service personnel arrive.
 - e. Prepare to give first aid to any injured bathers, spectators or staff.

FIRST AID FOR CHLORINE INJURIES

1. Move the victim to fresh air. If victim is conscious place them on their back with head elevated. Keep warm. Direct emergency service personnel to assess any victims and assist as needed.
2. If breathing stops, give artificial respiration. If knowledgeable on use of manual respirator, use this if possible. Chlorine on the skin of the victim can burn the mouth of the rescuer.
3. Burns may develop in the eyes or on the skin where moisture is present. Flush the area with clean water.

APPENDIX B

FORMS AND REFERENCES

Water Recreation Facility Injury Report Form

Reporting Requirement: The owner or operator **MUST** report any death, near drowning or serious injury to the Department within 48 hours (RCW 70.90 & WAC 246-260). A serious injury means someone has called for emergency aid (such as “911”) and/or the person needs immediate medical treatment at a clinic or emergency room and/or is admitted to a hospital.

Need Help? If help is needed in completing this form, call the Environmental Health Division at your local health jurisdiction or the state Department of Health at (360) 236-3073, or 236-3392 or 1(888) 586-9427.

Name of Facility: _____ Phone: (____) _____ - _____
Address of Facility: _____ County: _____
Name of Injured Person: _____ Phone: (____) _____ - _____
Address of Injured Person: _____

Date of Injury ____/____/____	Time of Day ____:____ AM PM (Circle One)	Race (Circle One) Asian/Pacific Black White Hispanic Native American Other
----------------------------------	--	--

Day of Week of Injury _____	Age of Person _____ Years	Sex (Circle One) Female Male
--------------------------------	------------------------------	--------------------------------------

Where did Injury Occur? (Circle One) <ul style="list-style-type: none">• In Pool or Spa• Deck/Walkway• Locker Room• Diving Board or Slide• Other (Specify) _____	When Injury is other than Drowning or Near Drowning (Circle One) <ul style="list-style-type: none">• Head• Neck• Back or Trunk• Arm/Leg, Finger/Toe _____	If Injury included Submersion, was it: (Circle One) <ul style="list-style-type: none">• Drowning (Fatal)• Near Drowning (Resuscitated/Non Fatal)• Other (Specify) _____
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Taken to Doctor? (Circle One) <ul style="list-style-type: none">• Emergency Service (Fire, Ambulance, Police, Etc)• Family, Friends or Others	Result of Injury? (Circle One) <ul style="list-style-type: none">• Died• Hospitalized• Treated & Released
--	--

Injury Description: (Provide a Short Statement Describing the Injury): _____

Water Quality Standards (Effective October 31, 2004)

Minimum and Maximum Levels of Disinfectant (ppm)

Swimming Pool	Minimum	Maximum (*)
Chlorine	1.5	10.0
Chlorine with Cyanurate Compound	2.0	10.0
Bromine	2.5	10.0

Spa & Wading Pool	Minimum	Maximum (*)
Chlorine	3.0	10.0
Chlorine with Cyanurate Compound	3.5	10.0
Bromine	4.0	10.0

* The maximum disinfectant level shall conform to manufacturers' recommendations.

Other Water Quality Constituents For both Pools and Spas

Chemical/Physical Constituent	Ranges
pH	7.2-8.0
Recommended Ranges for Alkalinity	
Plaster Pools	80-120 ppm
Painted, Vinyl, Fiberglass	100-150 ppm
Combined Chlorine	<50% of the free chlorine
Water Clarity	Main drain and pool bottom must be visible at all times
Turbidity	.5 T.U. Maximum
Cyanuric Acid	0-90 ppm
Temperature	104 °F Maximum (a pool thermometer must be provided when the water temperature exceeds 95 degrees Fahrenheit)

Pool Contamination Guidelines: Feces and Vomit

Pool and spa operators should be aware that fecal matter (stool) or vomitus in the pool poses a potential health risk for all pool users. If contamination should occur, the following is a general guide developed for pool operators by the Washington State Department of Health. When applying these disinfecting procedures, use unstabilized forms of chlorine (bleach or cal hypo) rather than stabilized forms of chlorine (dichlor or trichlor).

Step 1 – Evacuation.

Instruct bathers to exit the pool. Close the pool until all steps in this guideline are completed. Somewhat different guidelines are developed by CDC on their healthy swimming website, found at www.cdc.gov/healthyswimming which may also be applied.

Step 2 – Evaluation.

Determine (if possible) who contaminated the pool.

- a) **Go to Step 3 if all of these conditions are met:**
The stool or vomitus is intact, easily picked up, and illness is not suspected.
- b) **Got to Step 4 if one or more of these conditions is met:**
The stool is loose, the stool is not easily picked up, or illness is suspected when a victim is vomiting.

Step 3 – Removal and Disinfection Procedures for Conditions Listed in Step 2a.

- a) Remove as much of the feces or vomitus as possible. Use of leaf catchers or leaf lakes is helpful.
- b) Vacuum the remaining visible material.
- c) Small material that is floating on the surface and cannot be removed by use of leaf catchers or leaf rakes should be pushed toward the overflow or skimmers until all visible material is removed.
- d) Spot disinfect the area of contamination with a small quantity of available disinfectant.
 - Add one ounce of calcium hypochlorite (or 4 to 5 oz. of bleach) to a couple gallons of water applying the solution to affected area.
 - Brush the walls and bottom of the pool in the contaminated area.
- e) **Wait approximately 30 minutes** to ensure chlorine levels and pH levels meet the requirements outlined in the water recreation facility regulations, especially in the area where chemicals have been added.
- f) Backwash the filter. (Pool operators with vacuum DE [diatomaceous earth] filters may use the **Vacuum DE Filter Option** on the reverse page.)
- g) Reopen the pool.

Step 4 – Removal and Disinfection Procedures for Conditions Listed in Step 2b.

- a) Follow all the measures outlined in Steps 3 a, b, and c above.
- b) **Swimming pools;** raise the chlorine to a minimum maintained free chlorine residual of 10 PPM and let the water recirculate for a minimum of 25.5 hours. (Refer to the [High Chlorine Dosage Worksheet](#) on the reverse page if the pool cannot be closed for 24 hours.) **Spas and wading pools;** it is recommended that spas (and small wading pools) be drained, the sides and bottom cleaned, brushed with 100 ppm chlorine, refilled and balanced.
- c) Backwash the filter.
- d) Reopen the pool.

Step 5 – Recordkeeping.

When incidents of contamination occur document what you did to correct the situation. Maintain this record with your daily operating records. An **Incident Report** section is provided on the reverse side of this guide.

Blood

If an incident occurs resulting in minor cuts and scrapes to a bather, verify that disinfection levels met rules at the time of the incident.

If there is a serious injury resulting in significant blood loss in the pool, follow the procedures outlined in Steps 1, 3 d, e, and g, and 5.

Note: For incidents resulting in feces, vomitus, blood, or other bodily fluids on the pool deck or in the locker rooms, refer to Washington Department of Labor and Industries for proper bloodborne pathogens precautions and procedures.

HIGH CHLORINE DOSAGE WORKSHEET

L.E. 99-02

Use only after contamination of pool by feces or vomitus.
Complete the worksheet and keep it in your log book under the incident date.

CAUTION:

- ◆ You are using this worksheet because your pool has been contaminated by feces or vomitus AND the responsible person is ill or suspected to be ill, OR the stool or vomitus is loose or spread into a large area.
- ◆ Use this sheet only if the pool cannot be closed for 25.5 hours (see Step 4b on the other side of this guide).
- ◆ Be aware that you will be trying to reach a high chlorine residual. After determining the needed chlorine level, you should contact your swimming pool equipment supplier to ensure this level will not have a harmful effect on the pool or equipment.
- ◆ Do not use this procedure unless you are familiar with calculating and reaching high chlorine residuals.
- ◆ Do not use this procedure unless you understand how to use your chlorine test kit to accurately read high chlorine residuals.
- ◆ Do not use this procedure unless you can quickly lower high free chlorine residuals to less than 10 PPM.

Time and Concentration Calculation:

Use this chart to determine the amount of time you wish to keep the pool closed and the minimum concentration of chlorine necessary for that time to ensure bacteria from the incident are killed. Times different from the chart can be calculated by using the formula: $15,300 \div T = C$ or $15,300 \div \text{Time in minutes} = \text{the Concentration of chlorine in PPM}$.

TIME	6 HOURS	8 HOURS	10 HOURS	12 HOURS	16 HOURS	20 HOURS
CHLORINE	45 PPM	32 PPM	26 PPM	22 PPM	16 PPM	13 PPM

Amount of Chlorine Needed:

The amount of chlorine needed to achieve the PPM you have determined will depend on: 1) the volume of water in your pool and, 2) the concentration of the chlorine you are using. Read the product information with the chlorine you are using, or contact your pool equipment supplier. You might consider using chlorine made for shocking which would dissipate quickly. The pool cannot be opened until the free chlorine level is below 10 PPM.

Bromine pools: Use chlorine to obtain the high dosage.

VACUUM DE FILTER OPTION

Facilities that take a significant time to backwash may choose this option in lieu of Steps 3 f and g, (not suitable for Step 4 conditions):

- ◆ Increase the free available chlorine (FAC) in your filter tank to 20 PPM.
- ◆ Reopen the pool.
- ◆ Backwash your filter at the end of the day.

CONTAMINATION INCIDENT REPORT

Date of Incident: ___/___/____. Material in the pool was (check one): stool vomit. Material was intact spread into the pool. The person responsible: was ill was not ill was not found. Free chlorine level at the time of the incident: ___ PPM. The pool was not closed. The pool was closed for ___ hours and the free chlorine level was maintained at ___ PPM. The amount and type of chlorine added: _____ (lbs., ounces, quarts) of _____. The pool was closed at _____ AM/ PM on ___/___/____. The pool was reopened at _____ AM/ PM on ___/___/____. The free chlorine level at the time of opening was ___ PPM (pools with a free chlorine level above 6 PPM cannot be opened).

Signed: _____

WAC 246-260 First-Aid Kit Requirements for Pool Facilities

Standard 16 Unit Kit

	Units
Absorbent gauze 24"X72" (1 per package)	1
Adhesive bandages 1" (16 per package)	1
Bandage compresses 4" (1 per package)	2
Eye dressing (1 per package)	1
Scissors and tweezers	1
Triangular bandages 40" (1 per package)	2
Individualized antiseptic pads (3 per package)	1
Surgical gloves (2 pr. minimum, 4 recommended)	1
CPR mask (disposable or reusable type)	1
Adhesive gauze or elastic or self-adherent wrap roll material	1
Cold packs	1
First-aid cream or antibiotic ointment	1
1/2" or 1" rolls of tape (2 rolls per package)	1
Butterfly bandage	1
Knuckle or finger tip bandages	1
Body clean up parts	1
Additional units of required units	1

Pool Rules (Effective October 31, 2004)

All Pools

- Running and horseplay are prohibited
- Use by anyone with a communicable disease or anyone who has been ill with vomiting or diarrhea within the last two weeks is prohibited
- Consumption of food and drink in the pool is prohibited
- Use by anyone under the influence of alcohol or drugs is prohibited
- Cleansing shower is required before pool entry
- A protective covering must be worn over diapers
- Diapers must be changed at designated diaper changing areas
- Anyone with seizure, heart or circulatory problems should swim with a buddy
- Persons refusing to obey rules are subject to removal from the premises
- Direct patrons to the location of the nearest telephone and first-aid kit for emergency use
- Where diving boards are used, provide signs for proper use.

Pools w/o lifeguard or attendants

- If a child twelve years of age or less is using the pool, a responsible adult eighteen years of age or older must accompany the child and be at the pool or pool deck at all times the child uses the facility
- If an individual between thirteen years of age and seventeen years of age is using the pool, at least one other person must be at the pool facility.

Spa Pool Rules (Effective October 31, 2004)

All Spa Pools

- Running and horseplay are prohibited
- Use by anyone with a communicable disease or anyone who has been ill with vomiting or diarrhea within the two weeks is prohibited
- Consumption of food and drink in the pool is prohibited
- Cleansing shower is required before pool entry
- A protective covering must be worn over diapers
- Diapers must be changed at designated diaper changing areas
- Persons refusing to obey rules are subject to removal from the premises
- Children six years or younger should not use the spa
- Consult a physician prior to spa use if you are suffering from heart disease, diabetes or high blood pressure
- Women who are or might become pregnant should consult a physician before using the spa
- Soak time should be limited to 15 minutes
- Posting the maximum bather capacity of each spa pool
- Direct patrons to the location of the nearest telephone and first-aid kit for emergency use

Spa pools w/o lifeguards or attendants

- If a child twelve years of age or less is using the pool, a responsible adult eighteen years of age or older must accompany the child and be at the pool or pool deck at all times the child uses the facility

- If an individual between thirteen years of age and seventeen years of age is using the pool, at least one other person must be at the pool facility.

ADDITIONAL POOL REFERENCE MATERIALS

ADDITIONAL FORMS ON OUR WEBSITE:

http://www.co.cowlitz.wa.us/health/environmentalhealth/living_environment/recwatersafety.htm

PUBLICATIONS

ALERT: Lifeguarding in Action. 1993. Lifesaving Society, Royal Life Saving Society, Canada. 194 pp.

AMERICAN RED CROSS SAFETY TRAINING FOR SWIM COACHES. 1990. American Red Cross. 88 pp

CERTIFIED POOL-SPA OPERATOR HANDBOOK 2006. National Swimming Pool Foundation. 248 pp.

LIFEGUARD TRAINING 2000. American Red Cross

POOL OPERATORS MANUAL. 1999. Washington State Environmental Health Association & Washington State Public Health Association. 120 pp.

SWIMMING POOLS, A GUIDE TO THEIR PLANNING, DESIGN, AND OPERATION. 1987. Gabrielson, M. Human Kinetics Publishers, Inc. 315 pp.