

**UNITED STATES ARMY  
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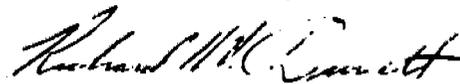
**ABERDEEN PROVING GROUND, MD 21010**

SPA AND HOT TUB GUIDELINES



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These guidelines were prepared by:

A handwritten signature in black ink, appearing to read "Richard W. Durrett". The signature is written in a cursive style with a large initial 'R'.

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DEPARTMENT OF THE ARMY  
 U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
 ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO  
 ATTENTION OF

HSHB-OI/WP

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SPA AND HOT TUB GUIDELINES

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I. INTRODUCTION. Epidemiologic evidence has shown that spas and hot tubs can be of significant public health concern if they are not properly operated and maintained. The following report has been prepared to provide the reader with basic information pertaining to recommended design, maintenance, and monitoring procedures and identification of potential public health hazards associated with these facilities. The data which follow are not meant to be used as a final standard for determining whether a spa or hot tub is to be approved for design, installation, or continued operation.

II. GENERAL DESCRIPTION. Spas and hot tubs are pools designed for recreational and therapeutic use and for physiological and psychological relaxation. They can also be called whirlpools, Jacuzzis®, hydro-therapy, or soaking tubs. These pools are not drained, cleaned and refilled after each use and may include, but are not limited to these types: hydrojet circulation, hot water, cold water, mineral baths, air induction systems or some combination of these. These facilities are closed water systems and may be designed with complete water circulation, filtration, heating and, in some cases, disinfectant and overflow systems integrated with the water circulation system. They can be constructed of wood, cement, tile, plastic or fiberglass. There are many sizes, brands and types, but they all require careful use, operation and maintenance.

III. RECOMMENDATIONS PERTAINING TO DESIGN AND CONSTRUCTION.

A. Structural Design. The structural design of spas and hot tubs should comply with local codes and should be in accordance with generally accepted good structural engineering practice.

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B. Electrical Requirements. The latest National Electrical Code, as published by the National Fire Protection Association, should be used for the wiring and grounding of all electrical equipment.

C. Heater Requirements. Spa and hot tub heaters should be tested by a recognized agency and designed for the purpose intended.

D. Circulation Systems. Circulation and filtration equipment and materials should comply with a suitable standard, such as the joint National Swimming Pool Institute-National Sanitation Foundation standards. Circulation equipment should provide a turnover rate for the entire water capacity at least once every 30 minutes. Filters should be designed to maintain water quality under anticipated operation conditions. Pumps and other component parts should provide safe operation and perform the functions for which they are intended.

E. Disinfectant and Chemical Feeders. A means of disinfecting the spa or hot tub should be employed which provides a disinfectant residual in the water. Chlorine or chlorine compounds are most frequently used for this purpose, but other bactericidal agents are acceptable if registered by the US Environmental Protection Agency. Adequate and appropriate procedures for introducing a disinfectant into the recirculation system should be used, and should be sufficient to maintain the appropriate disinfectant residual. Chemical feeding equipment, if required, should conform to a standard such as the joint National Swimming Pool Institute-National Sanitation Foundation Standard No. 50, Adequate Output Rate Chemical Feeding Equipment for Swimming Pools. Table 1 describes disinfectants and other chemical monitoring requirements.

F. Decks. Decks are those areas surrounding a spa or hot tub which are specifically constructed or installed for use by bathers. Deck work should be designed in accordance with approved engineering practices.

## IV. RECOMMENDATIONS FOR OPERATION.

A. Personnel. A specific person on each shift should be responsible for disinfection and water treatment operations. This person should be carefully trained in the performance of all routine operations as well as emergency procedures and leak control procedures. A specific person on each shift should also be made responsible for circulation and filter system operation, checks, maintenance, backwash, and cleaning. This person should be trained and capable of performing all routine cleanings and maintenance on the circulation and filter systems. At least one employee on duty should be trained in first-aid emergency procedures such as completion of the Standard First-Aid and Personal Safety Course as offered by the American Red Cross or an equivalent course.

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TABLE 1. CHEMICAL CHARACTERISTICS

	MINIMUM	IDEAL	MAXIMUM	COMMENTS
<b>DISINFECTANT LEVELS</b>				
Free chlorine (ppm*)	1.0	1.0-1.5	3.0	Note: Test the water hourly and maintain this range continually. Superchlorinate at the end of the use period.
Bromine (ppm)	0.8	1.5	3.0	Note: Local Preventive Medicine Activity must approve use.
Iodine (ppm)	1.0	1.5	5.0	Note: Local Preventive Medicine Activity must approve use. May discolor water. Ineffective against algae.
<b>CHEMICAL VALUES</b>				
pH check hourly	7.2	7.5	7.8	If pH is: TOO HIGH: Lower chlorine efficiency. Scale formation. Cloudy water. Increased chemical demand. Eye discomfort. TOO LOW: Rapid dissipation of chlorine. Plaster/concrete etching. Eye discomfort. Corrosion of metals.
Total alkalinity (ppm as CaCO <sub>3</sub> ) check hourly	60	100	200	If total alkalinity is:† TOO LOW: pH bounce. Corrosion tendency. TOO HIGH: Cloudy water. Increased scaling potential. pH maintained too high.

\* mg/L (ppm)

† Optimum alkalinity level is dictated by type of disinfectant used and feed rate.

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B. Maintenance. One of the primary goals of the spa/hot tub operator is to provide water which is clear, clean, and odor-free. The success of this goal depends on a daily program which achieves proper chemical balance, biological control, and physical operation. If water quality and conditions are not properly maintained, serious health hazards could result.

C. Chemical Balance. Because of the inherent design and operation of public hot tubs and spas, which feature high-water turnover rates, high temperatures, water agitation and high bather load, disinfectant residuals and safe pH are quickly lost during period of use. Therefore, in order to maintain a high degree of water quality, it is important that the operator have a test kit capable of measuring the free chlorine residual, combined chlorine, pH, and total alkalinity. Chlorine is the most commonly used disinfectant; however, bromine or iodine disinfectants may be used. Disinfectants other than chlorine must be approved by the local health authority. Regardless of the disinfectant system, appropriate test kits must be available and used.

D. Biological Control. High water temperature, the velocity and turbulence of the water, and heavy bather use all contribute to the organic contamination of spa/hot tub water. An effective sanitizing chemical residual must be maintained in the water at all times and shock treatments (burn-out or oxidation of the organic materials in spa and hot tub water) must be employed at end-of-day operations after heavy-use periods. Listed in Table 2 are the biological values of concern in the operation of a spa/hot tub. [The appropriate health authority may use the sampling techniques and safe water quality limitations for bacteriological content pertaining to swimming pools (see TB MED 575)].

TABLE 2. MICROBIOLOGICAL PARAMETERS

BIOLOGICAL VALUES	MINIMUM	IDEAL	MAXIMUM	COMMENTS
Algae		no visible algae		If algae are observed: Superchlorinate or shock treat pool. Supplement with brushing and vacuuming. Maintain adequate free chlorine residual. Use registered algicide according to label directions.
Bacteria	None	None	Refer to local health code or APHA standard	If bacteria count exceeds requirements: Superchlorinate pool and follow proper maintenance procedures. Maintain proper free chlorine residual.

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E. Physical Operation. Rapid turnover of water and a clean, efficient filter are the most important physical requirements for proper water quality in spas and hot tubs. Heavy bather use, turbulent and hot water, and increased concentrations of minerals and other solids make it imperative that spa and hot tub water be turned over quickly so that the filters may continuously remove insoluble debris from the water. It is recommended that hot tub and spa systems should be capable of a minimum turnover rate of two turnovers per hour and filters be cleaned daily (or at a cleaning schedule specified by the filter manufacturer and based on bather usage). Unlike swimming pools, spas and hot tubs must be emptied and cleaned frequently. The frequency of changing the water should be related directly to the length of time the spa/hot tub is in operation and to the number of people using it. If the spa or hot tub is outdoors, possible dust and vegetation fallout could influence frequency of cleaning. Because of the high temperatures at which spas and hot tubs are operated and because of the agitation and aeration of the water, excessive and rapid evaporation may also occur. The rate of evaporation is directly related to the length of time the aerator, the heater, and the filtration system are in operation. As the water evaporates, the concentration of dissolved solids rapidly increases in the water and eventually reaches the point where the water becomes cloudy and the chemicals begin to precipitate out of the water. When this occurs, the spa or hot tub must be emptied and refilled with fresh water. Depending on the usage, number of bathers, and the length of time the unit is in operation, water may be maintained for periods of several days to 2 months or more. Tables 3 and 4 are quick, easy reference guides that may be utilized by the spa/hot tub operator.

## V. RECOMMENDATIONS FOR MONITORING BY THE LOCAL HEALTH AUTHORITY.

A. General. The routine inspection of public hot tubs and spas is basically an inventory of operation and maintenance procedures. The detection of structural and equipment defects which exist because of poor operation and maintenance are also important goals of this type of visit by the health authority. The evaluation of water quality and general sanitation procedures practiced by the operator are of high importance. Structural and operational changes caused by changes in normal patron use of operational character are also matters of concern in the routine inspection.

B. Frequency of Inspection. New facilities or those which have not been inspected before by the local health authority should be inspected weekly until such time as health officials are satisfied that the operator is following proper sanitation procedures. At that point, a visit every 2 months as a minimum should be maintained. These suggested intervals are for the average spa/hot tub and less frequent or more frequent inspection might be in order for some facilities at the discretion of the health official.

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TABLE 3. OPERATOR'S GUIDE

	RECOMMENDATION	COMMENTS
<b>HOURLY CHECKS</b>		
Chlorine	1-3 ppm (1.5 ppm = Ideal)	Check chlorine level by DPD free chlorine method.
pH	7.2 - 7.8 (7.5 = Ideal)	Very high chlorine levels (>3 ppm) may cause incorrect pH reading
Total alkalinity (ppm as CaCO <sub>3</sub> )	60 - 200 ppm 100 ppm = Ideal)	Optimum alkalinity level is dictated by type of disinfectant used and feed rate.
Temperature	102°F maximum	Excessive water temperature is dangerous.
<b>DAILY TREATMENT, AS REQUIRED</b>		
Daily shock treatment chlorine (ppm)	5 ppm	Applied at the end of daily usage period. Hold this level for 1 to 4 hours to clarify the water, remove ammonia (combined chlorine) and to kill any algae present.
Additional super-chlorination (shock treatment) - chlorine (ppm)	10 ppm	When no bathers are present and as required to maintain clear water and the required chlorine residue.
Water replacement	As needed	Water replacement is necessary to dilute dissolved solids, to maintain water clarity and to do necessary routine maintenance.

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TABLE 4. Operational Problems

POTENTIAL OPERATIONAL PROBLEMS	DIAGNOSIS/TEST	ACTION/REMEDY
Odor (foul, locker-room smell)	Test free available chlorine	Superchlorinate following manufacturer's directions. Fresh, laundry-like smell should result.
Cloudiness	Check chlorine Check pH Check filter and circulation system	If low-superchlorinate. Adjust pH to 7.5. Backwash and clean if needed.
Foaming		If cloudiness persists, drain spa/tub and refill.
Stains	Check pH Check calcium hardness	Adjust pH to 7.5. Adjust to 150 ppm minimum.
Green or brown water	Test fill water for heavy metals	
Mineral deposits	Check pH	Adjust pH to 7.5. If not possible, drain and refill.

C. Time of Inspection. Inspections at times of least use and most use are as valuable in this field as they are in other fields of environmental health (e.g., restaurant inspection). Operational problems such as difficulty in maintaining disinfectant residuals and water clarity will necessitate review during high-use periods while problems of backwashing, structural soundness, and proper operation of support equipment might be helped by inspection during off-hours or when spas and hot tubs have been drained just prior to a refill.

D. Inspection Routine. The most efficient technique is one that will permit a thorough inspection in the least possible time by avoiding excessive retracing of steps. One suggested technique is to view the pool water and surroundings first, then proceed with an inspection of the support equipment and controls area, and finish with a review of the operator's records since the last inspection. Examples of items to check during the inspection:

1. Spa/Hot Tub Water. Spa and hot tub water should be clear and have the proper disinfectant residual and pH. Standard test kits (e.g., DPD test for chlorine residual) can be used for these measurements. Maximum water temperatures should be checked by thermometer with the thermostatic

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controls operational. Turnover time of 30 minutes or less under full flow operation should be checked as well as the proper operation of any automatic disinfectant feed equipment. Inspectors should look for the presence of oils, body lotions, and minerals not associated with chemicals used for water chemistry. Bacteriological content should also be sampled for at this time. In addition, a review of the operator's records on chemical balance should be made at this time.

2. Decks and Surroundings. Decks should be checked for slippery areas and protrusions. Such items as standing water, growth of algae or fungi, drainage, general cleanliness, sharp edges and protrusions, obstructions in the deck, inadequate handrails and areas of possible entanglement or entrapment of the bather's foot should be highlighted.

3. Spa/Hot Tub Shells. Spa/hot tub shells, including seats, steps, water outlets, deck copings and tub rims, should have no protrusions, extensions, means of entanglement, dangerous suction heads or other obstructions which can cause the bather to be trapped or injured.

4. Spa/Hot Tub Equipment. Check certifications of gas-fired or electric heaters as well as pump and filter capacities and operational flow rates.

### VI. GENERAL POTENTIAL PUBLIC HEALTH PROBLEMS.

A. Water Temperature. Water temperatures should be maintained in the 98° - 102°F range. A thermostatic control for the water temperature which insures that this limit will not be exceeded and is accessible only to the operator is essential. An accurate, shatterproof thermometer with one degree increments should be placed in the tub water during use to verify the thermostatic control setting and the water temperature. Water which is too hot can raise the body temperature high enough to cause heat stroke (the body's inability to regulate its internal temperature), and this can be fatal even to healthy adults. A temperature of 100°F is considered safe and comfortable for a healthy adult, although it may eventually raise the body temperature to the water temperature, and eventually become uncomfortable (like a fever). If an individual is planning a long rest in the tub, it is advisable to lower the water temperature closer to normal body temperature, about 99°F. Some people find even lower temperatures useful as an energizing experience. At higher temperatures, the soaking time should be reduced. At a water temperature of 102°F, the soaking time should be limited to a maximum of 20 minutes. Therefore, each facility should establish soaking time limits according to preferred water temperatures.

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### B. Special Precautions.

1. Pregnant women should limit their hot tub soaks to 10-15 minutes at a maximum water temperature of 102°F. Longer soaks can raise the body temperature high enough to cause fetal damage, particularly during the first 3 months of pregnancy (possibly resulting in a child with brain damage or deformity). Women in their child bearing ages may want to note this precaution in the event they may be pregnant and not know it.

2. Special caution is recommended for young children; their temperature rises faster than in adults. Childrens' small bodies cannot absorb as much heat, and their sweat glands are not fully developed.

C. Alcohol and Drugs. Most fatalities reported in the use of public spas and hot tubs have been attributed to the combination of high water temperature and the use of alcohol or drugs by the victims. Deaths in these cases have inevitably resulted from drowning after the victim has fallen asleep in the hot tub or spa. These individuals were either alone or in the company of another person who had been drinking or had taken medication and was similarly affected. The high temperature of the spas or hot tubs in combination with even a moderate level of alcohol in the blood stream tend to accelerate drowsiness. Consequently, careful monitoring of water temperatures and close supervision of patrons by the hot tub or spa operator as well as a strict prohibition against alcohol and drugs are fundamental for safety.

D. Health Conditions and Medications. Soaking in hot water causes changes in the circulatory system, such as enlargement of blood vessels near the skin. Therefore, people with a medical history of heart disease, circulatory problems, diabetes, or blood pressure problems should check with their physician before using hot tubs. Additionally, people taking medications causing drowsiness, such as tranquilizers, narcotics, anti-histamines, or anti-coagulants should not use hot tubs without asking their physician, due to the risk of drowning described above. Any drugs and substances which may affect your judgement or cause drowsiness or sluggishness should also be avoided while hot tubbing for the same reason. People with skin, ear or vaginal infections, open sores or wounds should not use hot tubs because of the possibility of spreading infection (because as mentioned, the hot water is an ideal breeding ground for some micro-organisms which cause infection.) Hot moist skin is also more easily infected. Questions have been raised as to whether the herpes virus can be spread through the water in a hot tub (this virus is responsible for a number of conditions, including genital herpes and cold sores). There is no medical evidence which suggests that the herpes virus can be transmitted in hot tub water. This virus is spread by direct contact (e.g., sexual contact for genital herpes).

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E. Personal Hygiene (Showering). All bathers should shower with soap and hot water thoroughly before and after using a spa or hot tub. Showering before hot tub use is important not only because it washes away many of the common skin bacteria, but also because it removes lotions, deodorants, creams, etc. If these lotions are introduced into the water, they can reduce the effectiveness of the disinfectant (chlorine), and lessen the ability of the facilities filter to work efficiently because the oils coat and clog the filter mesh. Soaps and lotions can also form foam and scum in the water (this includes sun tan lotions, bath oils and soaps, and shampoo). These oils also promote the growth of bacteria. Therefore, it is further recommended that bathers rinse well prior to entering the water. Many bacteria, algae and fungi are well adapted to survival in warm water. Spas and hot tubs appear especially prone to contamination because of the difficulty in maintaining adequate chlorination in the presence of high temperatures, turbulent flow, and a large amount of organic debris (MMWR ppm 27, 79). Therefore, showering after hot tub use will help to wash away harmful bacteria and other infectious agents that may come in contact with the skin during bathing.

F. Additional Safety Recommendations. Do not allow children to use a hot tub without supervision. Adults should also use caution - as a minimum safety precaution, one person using a tub should have someone within calling distance check the bather regularly. Ideally, a hot tub should never be used alone. Safe entry to and exit from spas and hot tubs are areas of concern. Slips, trips and falls on wet interior and deck surfaces could result in injury. Consequently, proper deck materials, good drainage, handholds, and the safe design of exterior and interior steps and ladders to avoid slips and entrapment, are important adjuncts to safety in a spa and hot tub facility.

## VII. REFERENCES.

A. Staying Happy and Health in Your Spa and Hot Tub, Seattle-King County Department of Public Health, copyright 1981.

B. Suggested Health and Safety Guidelines for Public Spas and Hot Tubs, US Department of Health and Human Services, April 1981.

C. "A Redwood Hot Tub Spa," Storm C. Goranson, P.E., R.S., Journal of Environmental Health, p 189-193, January/February 1979.

D. "Morbidity and Mortality," Center for Disease Control, Atlanta, GA. Rush Associated with Use of Whirlpools - Maine, 27 April 1979.

E. TB MED 575, Swimming Pools and Bathing Facilities.