Bacterial Hazards in Whirlpool Baths

Mark Guimond

Millions of whirlpool bathtub appliances have been sold over the past thirty years and millions more will be installed in the near future. Their use has expanded into condominiums, apartments, time-shares, mobile homes, boats, rehabilitation centers, hospitals, nursing homes, and throughout the lodging industry. Bathing in a whirlpool bath that has not been properly maintained exposes the bather to the residue of all the past users of that whirlpool bath. With every use of a whirlpool bath, bath residue (soap scum, dirt, body fluids, fecal matter) is circulated throughout the pump, multiple fittings, and the 15 to 30 feet of inaccessible piping that comprise a whirlpool bath's circulation system.

If not properly maintained, these baths can be a significant health hazard. This paper discusses health issues pertaining to unsanitary bathing environments and a procedure for effective cleaning is identified. The author suggests that home inspectors bring this concern to the attention of their clients.

ASHI Standards

The ASHI Standards of Practice specifically exclude spas from the inspection, "... except as to functional flow and functional drainage." [1] Whirlpool baths are not discussed. It is likely that there is confusion concerning these terms, and that the ASHI Standards of Practice will receive additional attention in this area. It would appear that the intent of the ASHI Standards of Practice is to exclude all portable hot tubs, and to exclude special air and water handling systems from hot tubs, whirlpools, and spas.

Spas versus Whirlpool Baths

Spas are used for recreation and are not used for bathing. The water in these devices is not drained after each use. Spa water is usually heated, and should always be chemically treated with products such as chlorine or muriatic acid to maintain a chemical balance. These chemicals (if properly administered) have the ability to kill bacteria.

Whirlpool baths are used for bathing. *[Fig. 1]* They are filled with untreated tap water and are drained after each use. Usually there is no separate heating system other than that used to provide domestic hot water at the tap.

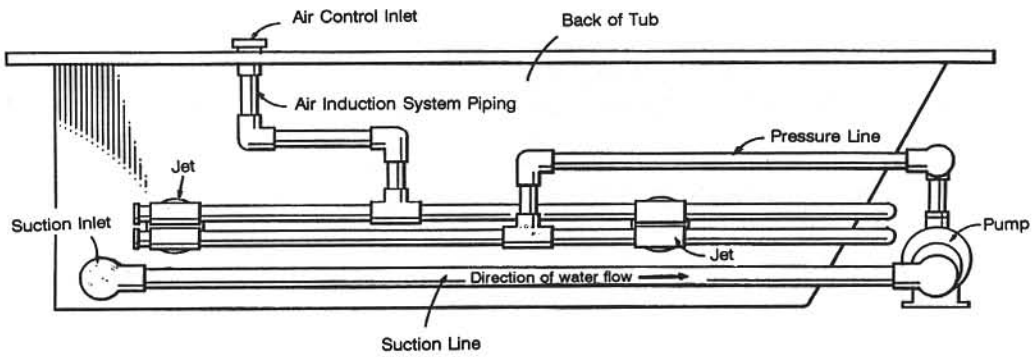

Fig. 1 - Typical Whirlpool Bath Circulation System

1 ASHI Standard 7.3.E.6, effective June 1, 1992.

A spa and a whirlpool bathtub appliance (whirlpool bath) have the same basic circulation system except that a spa contains a strainer basket and sometimes a filter. Both a spa and a whirlpool bath have a pressure system: a suction fitting that directs water from the tub through a pump and propels the water through piping back into the tub through a series of jets.

In addition to the piping used for the pressure system, the whirlpool bath also contains piping that channels air from the deck area of the tub into the whirlpool bath through a small orifice in each jet fitting. This air supply is sucked into the tub by the flow of the pressurized water as it is emitted from each jet and forms tiny air bubbles that create a tingling sensation. This air feature has little effect on the fluid dynamics of the water being propelled into the tub that creates the swirling action of the whirlpool bath.

Unsanitary Residues

Many published medical reports on the subject of "whirlpool" contamination refer to a spa or hot tub more often than to a whirlpool bathtub appliance. However, the health consequences associated with unsanitary circulation systems apply equally well, if not more so, to whirlpool bathtub appliances as they do to spas or hot tubs.

Bath residue such as hair, dirt, body oils, body fluids, fecal matter, etc., are emitted into the bath water and circulated throughout the multiple fittings, pump, and piping that comprise the circulation system.

Even though the tub is drained after each use, residue remains within the circulation system. [1] In addition to the retainage allowed by product testing, additional amounts of bath residue coat the piping with every use of the whirlpool bath and scale deposits form within the circulation system.

To complicate the situation, the air-line piping back-fills with residue whenever the whirlpool bath's pump is deactivated such as before and after using the bath. The design of the air system will permit the back-up of liquids into the air line piping, but cleaning agents cannot be effective unless they can be circulated through the air-line piping by the user of the whirlpool bath.

Due to the design of the air-line systems of whirlpool baths, the fact that whirlpool baths are used for bathing, and that they are not chemically treated, a whirlpool bathtub appliance may be as hazardous to a person's health as an improperly maintained spa.

The tub's air induction piping provides a route for air to be drawn from the deck area of the appliance into the tub via each individual jet fitting. A design defect may be attributed to the fact that bath water will backfill the air induction piping whenever the whirlpool bath's pump is deactivated and the tub is filled to its minimum operating capacity. Fresh water is contaminated prior to bathing and dirty water remaining after the bathtub is used will increase the problem.

Bacterial Infections

There is considerable medical evidence linking whirlpool systems to the source of bacterial infections.[2 3 4 5 6]

The most common problem associated with unsanitary whirlpool systems is the organism *Pseudomonas aeruginosa* or PA. The problems of PA colonized water systems are so widespread and commonplace that new outbreaks are not even medical news.

PA is an organism in our environment found almost any place where there is water, from sinks, flower pots, air conditioners, skin flora, and in 10% to 25% of human stool cultures, but whirlpool systems offer a particularly suitable environment. The warm, humid, and dark environment of the circulation system provides a breeding ground for infectious bacteria which feeds on user-donated matter. In water systems, the organism is able to attach to defects or scale depos-

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1 The strictest standards of the whirlpool bath industry allow for the retention within the circulation system of up to 1.5 fluid ounces of water for each jet or suction fitting in the whirlpool bath. A four jet system with one suction fitting can retain 7.5 ounces of bath residue. Many whirlpool bathtub appliances are installed with circulation systems that retain a great deal of residue (more than 1 gallon) because manufacturing standards are often ignored.

2 "Characteristics of Pseudomonas aeruginosa Isolated From Whirlpools and Bathers," Anita K. Highsmith, Phuong Nhan Le, Rima F. Khabbaz, MD, Van P. Munn, Infection Control, 1985 Vol 6 No 10 p.407-412.

3 "Fungi in Bathwater and Sludge of Bathroom Drainpipes," Kaxuko Nishimura, Makoto Miyaji, Hideaki Taguchi, Reiko Tanaka, Mycopathologia 97, 1987, p. 17-23.

4 "Hot Tub-Associated Dermatitis due to PA, Case Report and Review of the Literature," P.H. Chandrasekar, MD, K.V.I. Rolston, MD, D.W. Kannangara, MD, J.L. LeFrock, MD, S.A. Binnick, MD, Archives of Dermatology, Vol 120, Oct 1984

5 "PA Infections Associated with Hot Tubs and Other Environments," David W. Gregory, MD, William Schaffner, MD, New Challenges from Infectious Diseases, 0891-5520/87 p 638-648

6 "Hot Tub Folliculitis," Sue Anne Jenkerson, MSN, RNC, John Middaugh, MD, Alaska Medicine, April, May, June 1987 p. 51-53.

its and produce a layer of slime that prevents contact with a disinfectant. Many current whirlpool systems do not appear capable of preventing colonization of PA.

Most physicians are aware of the problems associated with PA. Estimates show that PA is responsible for approximately 9% of nosocomial infections (infections pertaining to a hospital or infirmary) and approximately 5% of community-acquired infections. PA is able to gain entrance into any follicular opening that is superhydrated (very wet, such as in a whirlpool bath). [1]

Potentially Serious Illnesses

The disastrous potential possessed by the PA organism is well known. In patients who are immunosuppressed, seemingly minimal skin infections with PA may develop into septicemia (blood poisoning), with resultant morbidity and mortality.

Urinary tract infection and *Pseudomonas* pneumonia have been documented from a whirlpool system. The reported overall mortality of PA pneumonia is approximately 70%.

PA bacteria not only can cause a nuisance rash but it also has the potential to inflict significant morbidity and perhaps mortality in an appropriate setting. [2]

When the tub is drained, a coating of oily bath residue remains within the circulation system plus pools of trapped water. The warm, dark, and humid environment of this system provides an ideal location for the growth of mold, mildew, microorganisms, and infectious bacteria that may result in ailments such as vaginal, kidney, bladder, yeast, and staph infections as well as herpes- and potentially lethal ailments such as PA pneumonia, PA endocarditis, Legionnaires' disease and tuberculosis.

Cleaning Problems vs the ASME/ANSI Standard

Since the activation of the whirlpool bath's pump will only clear the air induction piping of water and draw air into the tub, no cleaning solution can be circulated through this piping by simply adding it to a tub full of water and activating the whirlpool bathtub's pump.

The National Standard that governs the construction of whirlpool bathtub appliances and serves as a guide for users,

Fig. 2 - Whirlpool Tub Cleaning System

1 "Pseudomonas aeruginosa folliculitis ("Splash Rash")," William F. Sausker, MD, Clinics in Dermatology, July-September 1987, Vol 5 No 3.

2 "Pseudomonas aeruginosa folliculitis ("Splash Rash")"

manufacturers, architects, engineers, plumbing contractors, installers, and others, states that "The operating instructions shall have a warning in bold print that informs the user to flush the circulation system.[1] This same standard defines the circulation system as including the air induction system. Because the current design of a whirlpool bathtub's circulation system cannot permit the circulation of fluids through the air piping, the Standard's instructions[2] cannot be complied with by the consumer.

Some whirlpool bathtub manufacturers and distributors advertise that their whirlpool bathtubs drain 100% of the water from their circulation systems. They also recommend that their products' circulation systems can be maintained by being cleaned every 3 to 4 months with a small amount (4 tablespoons) of dish washing detergent. These claims are inaccurate. No whirlpool bathtub circulation system can fully drain.

The Standard, in Section 5, allows up to 1.5 fluid ounces of system retention for every jet or suction fitting contained in a whirlpool bathtub. This retention allowance permits over a cup of residue to remain within the circulation system of a 6 jet whirlpool bathtub, after it is fully drained, and this retention increases with the build-up of oily bath residue.

Research has demonstrated that whirlpool bathtub circulation systems can only be cleaned with the use of specialized equipment that will heat, convey, and concentrate cleaning solutions (detergents, descalers, and disinfectants) throughout the entire circulation system of a whirlpool bathtub appliance.

A single vendor, the Hydravac Corporation, has developed a cleaning process offering the only known method to effectively remove accumulations of bath residue from the circulation system.[3] *[Fig. 2, above.]*

This method is endorsed by the National Council for Whirlpool Bath Health & Safety. Until manufacturers design air induction systems that will permit cleaning solutions to be circulated throughout the entire circulation system, air induction systems should be terminated.

In addition to an annual Hydravac cleaning, a specially formulated maintenance product should be flushed through the whirlpool bath's circulation system after every use of the whirlpool bath in order to maintain a clean bathing environment.

Chemical Cleaners

Household products such as bleach, vinegar, automatic dish washing detergent, and baking soda have been analyzed for their effectiveness in cleaning whirlpool bath circulation systems. These "household remedies" are ineffective for the purpose of cleaning oily bath residue from the circulation systems of whirlpool bathtub appliances.

Consumer Warnings

There are dangers associated with using whirlpool bath equipment without regard to methods of disinfection. The intrinsic problem in the use of whirlpool systems is the potential for cross-infection if cleaning and disinfection procedures are ineffective.

The purchase and use of whirlpool baths, due to the potential for infection risks, should be discouraged in all settings—medical, commercial, and residential—unless the consumer is provided with an effective cleaning and maintenance procedure.

With the use of specialized cleaning equipment, the termination of air-line piping (unless a flushing valve is installed which permits the air-line system to be circulated with cleaning fluids), and the proper use of a specialized cleaning product to maintain sanitary conditions within the piping system, a whirlpool bath can be safe.

The National Council for Whirlpool Bath Health & Safety provides a brochure that is currently being used by home inspectors to provide the correct information to accurately disclose pertinent details related to the health and safety issues associated with whirlpool bathtub appliances.

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1 The "Standard" refers to ASME/ANSI A112.19.7M-1987,4.4.2C.

2 Ibid.

3 While the *Journal* does not promote individual products, editorial policy permits identification of key sources or sole suppliers of procedures or materials which may be of benefit to inspectors or inspection clients. References to the Hydravac Corporation are not an endorsement by the American Society of Home Inspectors. However at the time of publication of this paper this is the only known company providing this cleaning service in the US.

References

"Full Disclosure is Necessary for Whirlpool Bathtub Appliances," Tom Sullivan, private paper distributed at the ASHI 1993 San Antonio TX Conference, Hydravac™ Corporation, PO Box 543042, Dallas TX 75354-3042 1993, 214/744-2284

"Medical Overview Pertaining to Unsanitary Whirlpool Bath Circulation Systems," Tom Sullivan, Hydravac™ Corporation, PO Box 543042, Dallas TX 75354-3042 1993, 214/744-2284

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