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DEPARTMENT OF CHEMISTRY

TO: Mr. Jeff Laughlin, Driftaway Floatation Spas, 50 Mall Rd., Burlington, MA 01803
FROM: Dr. David K. Ryan, Professor of Chemistry
SUBJECT: Draft Statement on Flotation Spa Water Quality
DATE: June 20, 2006

Following our extensive discussions and my inspection of your Flotation Spas last month, I have reviewed the available water quality information and, by means of this report, can advise you on my findings and conclusions. I found your systems to be well constructed with both materials and operational characteristics conforming to industry standards for pools and spas. One feature of your spa that exceeds industry standards is the calculated turnover period of less than 5 min based on the 55 gal/min flow rate of the filtration system for a 200 gal spa.

Water quality in your systems will be analogous to any standard pool, spa or hot tub with only two exceptions and your routine procedures are more than adequate to provide excellent water quality and a safe environment for your clients. The two differences between your systems and a standard spa are the unusually high salt content provided by magnesium sulfate and the intermittent filtration requirement necessary to give clients the sensory deprivation experience. The high salt concentration works in your favor to prevent the growth of nearly all potentially harmful microorganisms. This effect is described in detail below. The intermittent filtration is not the norm for spas, however, the protections provided in your systems are quite capable handling the complete disinfection needs.

Three separate modes of disinfection are at work in your Flotation Spas to provide excellent water quality at all times. These three systems, two chemical and one mechanical, in combination with your standard operating procedures (SOPs) for maintenance and cleanliness will meet all your disinfection needs. The three modes of disinfection are briefly summarized as

follows:

- 1) Chemical disinfection** – The use of chemical disinfectants, such as chlorine, is standard practice for pools and spas and is the main line of defense against pathogenic organisms. The hypochlorite metered into your system by the chlorine feeder is a strong chemical oxidant that destroys microorganisms and sanitizes the water. Maintaining a chlorine residual is critical to the effectiveness of this means of disinfection and anything below 2 ppm is considered dangerous. A range of 2 to 6 ppm is often recommended and I would advise a target value of 5 ppm. If the residual drops below 2 ppm in any spa, that spa should be taken offline until appropriate treatment measures return the water quality to a safe level. Shocking the system with a high dose of chlorine is recommended for low excursions of the residual and as a routine procedure for spa water quality maintenance.
- 2) Filtration** – The use of a recirculating filtration system employing a cartridge or diatomaceous earth filter is the normal procedure for spas to remove particulate material, improve water clarity and aid in the removal of potentially pathogenic organisms. As mentioned above, your system has more than adequate filtration capacity and a very high flow rate of 55 gal/min. This provides a rapid turnover of the spa water calculated at less than 4 min. Ultimately the turnover rate is the most important specification of the system if we assume that standard cartridge filters, such as yours, provide a fairly similar degree of filtration. This comes about because a standard filtration system that only provides a flow of 10 gal/min will turnover the water in a 200 gal tank in 20 min. In one hour of continuous operation the tank water is turned over 3 times. Your system provides the equivalent turnover in only 11 minutes. So operating the tank intermittently can still provide necessary and effective filtration of the water.
- 3) High Salt Effect** – The presence of the very high salt concentration in your Flotation Spa also has the effect of killing microorganisms. This arises because of what is known as an osmotic pressure difference across the cell wall of the organism. Every cell has some level of dissolved salt inside often referred to as electrolytes. When a microorganism cell is introduced to a high salt medium like the spa, the water inside the

cell tends to flow out through the cell wall in an attempt to reduce the concentration difference between the inside and outside of the cell. A lower pressure develops inside the cell because of this osmotic effect and the cell collapses. A combination of dehydration (loss of water) and collapse of the cell wall destroys the microorganism typically rupturing the cell (cell lysis). The only organisms that could possibly live in this environment are halophylic or halotolerant bacteria that have adapted to high salt concentrations and are found in the environment at places like the Great Salt Lake or the Dead Sea. These organisms are not pathogenic and do not pose a threat to humans. In recent discussions Dr. Oscar Pancorbo, Director of the Massachusetts Department of Environmental Protection (DEP) Analytical Division and Station Chief of the Wall Experiment Station in Lawrence, MA, addressed the issue of microorganism viability in high salt environments. His opinion as a microbiologist and experience dealing with water quality issues daily for the Commonwealth of Massachusetts is that “no pathogenic organisms can survive salt concentrations above approximately 10 percent”. Clearly the greater than 50 percent salt concentration of your Flotation Spas creates an environment that is completely hostile to pathogenic microorganisms. Dr. Pancorbo mentioned that he is available by telephone for comment on this issue during normal business hours. His phone number is 978-682-5237 extension 314.

Regarding the matter of changing the water in the Flotation Spa on a regular basis, I would recommend changing the water every 6 to 12 months depending on usage. More frequent water changes are not required because the two main components of the system, magnesium sulfate and water, do not undergo any significant chemical transformations even over long periods of time. The issue is more one of aesthetics. Over time the water does build up dissolved species that are introduced by frequent use and result from the normal breakdown of the disinfection chemicals as they do their job. These species are largely inert and pose no threat to the users but, may ultimately impair the aesthetic quality of Flotation Spa.

In summary, I am very confident that your Flotation Spas are well protected with regard to their water quality. Threefold protection is provided by standard chemical disinfection with hypochlorite, high turnover filtration and the added effect of the high salt concentration all working together to provide a clean and safe environment for your clientele. Changing the water and magnesium sulfate every 6 to 12 months will also insure an aesthetically pleasing experience.