Zen Bathworks Water Sanitation

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Sanitation Education

Introduction

In any hot tub, clean, balanced water is vital for your health and safety. Too little sanitation and you could come down with some nasty rashes or illnesses caused by bacteria or other waterborne pathogens; too much sanitation, and you could end up with different sorts of rashes, damaged hair, and bleached swimwear. When you have a cedar tub, clean, balanced water is **also vital to the health and safety of the cedar wood!** Many of the water treatment products used in the spa industry are harsh on cedar, and some of them can cause severe damage. Let's take a deeper look at the most common sanitizing agent, which is also the one we recommend, and how it interacts with your cedar tub.

Chlorine

Chlorine was the first water treatment method discovered by humanity that could cheaply and efficiently sanitize large amounts of water. In less than 150 years, chlorine sanitation has prevented incalculable hundreds of thousands of deaths and illnesses caused by waterborne pathogens. While the harsh smell and

feel associated with chlorine has prompted the development of other supplemental sanitization products that can greatly reduce the amount of chlorine needed, the fact remains that some small amount of either chlorine or bromine plays an important role in every certified sanitation system.

When chlorine attacks contaminants, it binds to them and forms chemical compounds called chloramines. It's actually the chloramines building up over time that are responsible for most of the nasty smell and itchy feel we associate with 'chlorine'. Since we want to avoid that, we need a way to break up the chloramines. We do this by oxidation - adding powerful oxygen atoms that tear apart the chloramine molecules. **This process is called 'shock' treatment.** There are lots of different oxidizing products out there, and believe it or not one of the simplest and most common ones is a big dose of…more chlorine. Yes, chlorine is both a sanitizer and an oxidizer! It's not uncommon in the plastic spa world to use chlorine as a sanitizing agent, and more chlorine as the oxidizing shock agent, and do everything with different doses of the same product.

That's not great for our cedar tubs though. Unfortunately, chlorine can't tell the difference between wood and contaminants, and therefore any chlorine that doesn't attack contaminants winds up attacking the organic molecules in the wood. The chlorine product we supply is Spa 56 by Leisure Time, and it is a **sodium dichlor chlorinating granules** product. Chlorine comes in many forms: sodium dichlor is much gentler than some of the alternatives and is what you want to use in your cedar tub. Using the wrong type of chlorine, or using far too much sodium dichlor, can attack the wood very quickly. It bleaches and loosens the wood fibers, giving the wood a whitish, hairy appearance that has to be sanded down once the tub is drained and dried.

Even correct doses of sodium dichlor are harsh on the wood and will shorten the service life of the tub. We don't want that, so what can we do? Enter the supplemental sanitation systems.

But first, a quick note about Bromine. Bromine is a chemical similar to chlorine that is a little less unpleasant to humans than chlorine, and therefore is a popular substitute for some spas. It's **not** suitable for cedar tubs though! Excess chlorine evaporates, which helps us keep it in the sweet spot of being enough to clean the water, but not too much to damage the tub. Excess bromine does not evaporate and instead builds up in the wood itself, which makes it nearly impossible to prevent premature wood deterioration. With cedar tubs, it's best to **just say no to bromine**!

Oxidizing Supplemental Sanitation Systems

Ozone

You may remember from chemistry class that atmospheric oxygen is two oxygen atoms, O_2. Ozone is O_3, but that extra oxygen atom is an unwelcome third wheel. In other words, ozone is "unstable" and looking for a way to shed the extra oxygen atom and become once again a stable O_2 molecule. When another molecule passes by, the third oxygen atom breaks away from the ozone molecule and attaches itself to the other molecule. Depending on what the other molecule is, it might be neutralized or torn apart completely, but either way, if it was part of a contaminant in our hot tub water, it's no longer of concern! Ozone is extremely powerful. It can deal handily with bacteria and other pathogens, algae, lotion, makeup, chloramines, sweat, etc., and does it all in a matter of minutes.

How do we get ozone to work for us? Well, ozone can be generated from atmospheric oxygen in one of two ways: exposure to certain wavelengths of UV light, or exposure to an electrical arc. Both types have been used in hot tub sanitation, but the second option generates more ozone for the cost and is becoming the default - the industry terminology is 'Corona Discharge', often shortened to 'CD'.

Ozone is a gas, so we have to mix it into the water somehow. The most prevalent system is a venturi manifold that works like a simple carburetor, except in reverse: instead of using the flow of air through a special nozzle called a 'venturi' to draw in liquid fuel, ozonator manifolds use the flow of liquid water through a venturi to draw in ozone-enriched air. This produces very fine bubbles - often described as champagne bubbles - any time the pump is running. Note that the presence of bubbles does NOT mean that the ozonator is producing ozone. The ozonator is only activated during the control system's "filtration" cycle, which is set from the topside touchpad. The rest of the time, the champagne bubbles are just air.

What about drawbacks? Well, if excessive amounts of ozone wind up in the tub itself, the ozone can bleach the inside of the cover, and sometimes the wood itself especially above the waterline. This can be managed to an extent by calibrating the venturi correctly, and by adjusting the length of the filtration cycle.

The second drawback with ozone is that it can be difficult to tell if it's on or not. Ozone does have a distinctive fresh, slightly metallic smell that can be detected when lifting the cover after the filtration cycle. Many people describe this scent to be similar to the one detected when there's lightning nearby and it's about to rain. Keeping a careful eye on total chlorine levels can also help identify an ozonator failure, since chloramines will start building up without the ozonator.

Whether an ozonator uses UV bulbs or CD chips, both will eventually wear out and need to be replaced. CD chips tend to last longer - typically around 2 - 3 years depending on usage - and are easier to replace.

Hydrogen Peroxide

You may come across references to hydrogen peroxide water treatment. Like ozone, hydrogen peroxide (H_2O_2) is an unstable molecule with an extra oxygen atom that wants to break off and attack something. Where ozone breaks down into oxygen, hydrogen peroxide breaks down into water. Although hydrogen peroxide does a great job at cleaning water, it's not commonly used because it's highly volatile stuff. This isn't your drugstore 3% solution for cleaning cuts - pool sanitation hydrogen peroxide is more like 35% and is capable of giving careless users severe chemical burns. While hydrogen peroxide itself is not flammable, it adds a tremendous amount of oxygen to anything that *is* flammable and thus poses an indirect fire hazard if improperly stored. We can't recommend it for those safety reasons, but it is very effective and compatible with cedar.

AOP

Ozone is great, but it can be made even better. When ozonated water is passed under certain wavelengths of ultraviolet light, the extra oxygen molecule in the ozone combines with some of the hydrogen atoms in the water to form Hydroxyl Radicals - 'OH, one oxygen and one hydrogen. And boy are they fierce! Anything ozone can kill in minutes, these little molecules can kill in milliseconds. Because they work so fast, they break down in the pipes and never come in contact with the cover or the wood. These high-tech systems go by the abbreviation AOP, short for "Advanced Oxidation Process", and they are capable of producing the most beautiful, clear, clean water you've ever seen, with just the tiniest amount of chlorine to keep it that way between AOP cycles.

What's the catch? Well, cutting edge technology tends to be expensive, and AOP is no exception. Good ozone systems can be found for a few hundred dollars, but AOP starts at a few thousand.

Other Supplemental Sanitation Systems

UV-C

We've all seen the sunscreen ads about how we need to protect ourselves from harmful UV rays: UV-C sanitation uses similar, but even more powerful UV rays to work zapping bacteria, algae, and other biological contaminants! The radiation doesn't kill them immediately, but it does scramble their DNA, which makes it impossible for them to reproduce. Since bacteria reproduce every 4 to 20 minutes, that makes a huge impact!

UV-C systems are somewhat effective at breaking down chloramines, but are less effective than the oxidizing systems. The exact effectiveness can vary; it is possible to completely remove all chlorine and chloramines with UV light, but such systems use different wavelengths and much more intensity than typical pool or spa biological sanitizers. It may still be necessary to use chemical shocks more often than with oxidizing systems.

The special UV lightbulbs have to be replaced at fairly regular intervals, even if they are producing light, to make sure that the correct wavelengths are being produced. This task must be done carefully, because the UV light is dangerous if you are exposed to an illuminated bulb, and there are dangerous chemicals inside the bulb if it is accidentally broken. That said, in between bulb changes the UV system is maintenance-free.

Ionization

First off, what's an ion? An ion is a particle with an electrical charge, either positive or negative. If a negatively charged ion meets a positively charged ion, they will stick together just like the north and south poles of a magnet. We'll come back to that in a moment.

Silver has antibacterial properties. This was discovered at least thousands of years ago - the ancient Greeks already knew about it and used silver jars to help stave off bacteria. Zinc is likewise effective against some forms of bacteria. Meanwhile, copper is effective against algae growth.

Rather than make a hot tub out of silver, modern technology lets us make tiny, charged ions out of these three metals by applying low voltage electricity to special bars made of a mix of the three metals. Now, it turns out that bacteria have a net negative electrical charge - each bacteria is essentially a living, negative ion! So if we produce metal ions with a positive charge, they will stick to the bacteria or algae like magnets and kill them! The ions are completely harmless to humans and cedar tubs, and unlike chlorine or ozone, they don't evaporate. They will just circulate around the tub waiting to protect it from bacteria or algae. There is no by-product, no smell, no residue…just super-clear, inviting water.

NOTE: not all ionizers come with all three metals! There are cheaper ionizers out there that only come with copper-zinc, or even copper-only. They are still partly effective against a narrower range of algae, but they are NOT the same as the silver-copper-zinc ionizers such as the ClearBlue ionizer that we endorse.

Ionizers are quite affordable, and low-maintenance. There are test strips to measure the amount of ions, and occasionally adjustments need to be made on the controller to keep the ions in the recommended range. The mineral cell (metal bars) need to be replaced every so often.

Ionizers work slowly. They must be used in conjunction with a small amount of chlorine (and optionally, with an oxidizing system) that will keep the bacteria or algae population from growing out of control faster than the

ionizer can remove them. Ionizers also have no effect on non-biological contaminants (sweat, sunscreen, lotion, etc), which the chlorine will take care of.

Ionizers have no effect on chloramines either. If using an ionizer, you will need to either use a chlorine or non-chlorine shock treatment, or install an oxidizing sanitation system in addition to the ionizer. Ozone and ions together can produce excellent water quality at a reasonable price point.

Recommended Sanitation Procedure

Dichlor Granules

We'll start with how to use the chlorine. Even though we send supplemental sanitizers with all of our electric or gas heat tubs, understanding the basics of chlorine is foundational. The exact amounts of chlorine required will change depending on your tub's water volume and what supplemental system you are using, if any, but the following process will still be applicable.

Because the excess chlorine eats at the cedar, your chlorine levels will drop to zero much more quickly than they would in a plastic spa. You will not be able to get a reading of stable free chlorine levels in between soaks no matter how much you add, and if you try you will end up damaging the wood. For this reason, we do not recommend systems that generate a constant flow of chlorine (e.g. salt chlorine generators) or products that dispense a constant supply of chlorine (e.g. chlorine floating tabs).

Add your chlorine 30 minutes to 24 hours BEFORE soaking. Allowing at least 30 minutes gives the chlorine enough time to kill any bacteria that may be present. After 24 hours, most of the chlorine will have evaporated, and enough time will have passed that bacteria could be growing again. Note that if you use the tub daily, you can add chlorine immediately after soaking, if your next soak is less than 24 hours away.

If you are using Spa 56 dichlor only, add enough chlorine to reach 2-3 ppm (parts per million). (Refer to manufacturer's instructions for other dichlor products.) If you have a supplemental system (e.g. an ionizer), see below for the appropriate reduced chlorine level. Since parts per million (ppm) is not a convenient measurement system, refer to Table 1 for an approximate number of tablespoons for our tub sizes.

After 5 minutes, the chlorine will have dissolved into the water, and you can use a test strip to make sure the chlorine is in the recommended range. If you added a little too much, up to 5 ppm is safe to enter, or turning the jets on and waiting a bit longer will help evaporate some of that excess chlorine. If you have less than 2 ppm, add more chlorine and test again after 5 more minutes. IMPORTANT: 5 minutes is the only time you will be able to get an accurate reading with the test strips.

If the same few people are using the tub several times per week, this amount of chlorine will be plenty. If you have a few extra guests over, add another dose of chlorine AFTER everyone is out of the tub to help with the extra bather load.

If you will not be using the tub for a while, it is advisable to turn down the temperature and add chlorine once per week, or drain the tub.

NOTE: Dry chemicals are dosed in ounces by WEIGHT; however, dichlor is close to 1 oz of weight per 1 oz of volume											
Tub	**Gal.**	**oz**	**tbsp**	**Tub**	**Gal.**	**oz**	**tbsp**	**Tub**	**Gal.**	**oz**	**tbsp**
Reference	500	0.5	1.0	5' Round 42"	400	0.4	0.8	7' Ellipse 48"	720	0.7	1.4
				5' Round 48"	460	0.5	0.9	7' Round 29"	530	0.5	1.1
4' Ellipse 29"	125	0.1	0.3	6' Ellipse 29"	300	0.3	0.6	7' Round 36"	680	0.7	1.4
4' Ellipse 36"	160	0.2	0.3	6' Ellipse 36"	375	0.4	0.8	7' Round 42"	810	0.8	1.6
4' Ellipse 42"	190	0.2	0.4	6' Ellipse 42"	450	0.5	0.9	7' Round 48"	940	0.9	1.9
4' Round 29"	165	0.2	0.3	6' Ellipse 48"	525	0.5	1.1	8' Ellipse 29"	535	0.5	1.1
4' Round 36"	210	0.2	0.4	6' Round 29"	390	0.4	0.8	8' Ellipse 36"	690	0.7	1.4
4' Round 42"	250	0.3	0.5	6' Round 36"	495	0.5	1.0	8' Ellipse 42"	820	0.8	1.6
5' Ellipse 29"	200	0.2	0.4	6' Round 42"	590	0.6	1.2	8' Ellipse 48"	950	1.0	1.9
5' Ellipse 36"	255	0.3	0.5	6' Round 48"	685	0.7	1.4	8' Round 29"	700	0.7	1.4
5' Ellipse 42"	305	0.3	0.6	7' Ellipse 29"	410	0.4	0.8	8' Round 36"	900	0.9	1.8
5' Round 29"	260	0.3	0.5	7' Ellipse 36"	520	0.5	1.0	8' Round 42"	1075	1.1	2.2
5' Round 36"	330	0.3	0.7	7' Ellipse 42"	620	0.6	1.2	8' Round 48"	1250	1.3	2.5

Maintenance Shocking

About every 2 - 4 weeks, you will need to shock the tub to deal with the chloramines. You can use Spa 56 to shock, by adding twice the usual amount. Or you can use non-chlorine shock products, as long as they are compatible with chlorine, by following the manufacturer's instructions. REMEMBER: Either use a sodium dichlor product like Spa 56 or a non-chlorine shock that's compatible with chlorine. DO NOT use other chlorine shock products on cedar tubs!

Conditional 'Shocking'

Any time your water equilibrium is disrupted, it can be a good idea to super-sanitize your tub. Technically speaking, we're not shocking chloramines, but since the process is the same as a dichlor shock, it's common for people to refer to this super-sanitation as 'shocking' as well. Times you will want to super-sanitize include:

- After refilling the tub
- After heavy bather loads (more people, longer soaking,)
- Before using if the tub has not been used for a while
- Anytime there is indication that bacteria or algae may be present (water cloudiness, green or brown residue on the walls)

Ozonator

If using an ozonator, we recommend that you add your chlorine to between 1 - 2 ppm.

Maintenance shocking for chloramines can be greatly reduced, and may not be necessary at all. It is still advisable to shock the tub in high-sanitation-load circumstances as listed above.

Ionizer

The effectiveness of ionizers varies according to the makeup of the mineral cells. Our preferred brand, ClearBlue, recommends 0.5 - 1 ppm chlorine. The ClearBlue ionizer includes copper test strips that directly measure the copper ions, and indirectly measure the silver and zinc ions since all are produced proportionally. Use the ClearBlue instructions to bring your copper levels to between 0.2 and 0.4 ppm, and then check the copper levels every two weeks after that.

As the ionizer has no effect on chloramines, and is slow to respond to changes in water chemistry, you will need to follow the shocking instructions as written above in the dichlor section.

Filter Cleaning and Changes

Properly cleaning your filters is important for your water quality. No matter what sanitation system you use, your filter plays an important role in the cleanliness of your tub water. Made from pleated paper, the filter captures particles of debris out of the water. While individual bacteria and algae are small enough to pass through the filter, the filter does capture a percentage of them and plays a role in your sanitation as well. Optional clarifier products such as Leisure Time Bright & Clear can help increase the filter's effectiveness.

Your filter needs to be rinsed with clean water regularly. Use a water stream, such as a hose nozzle set to 'jet' or a kitchen sink sprayer, to spray between each pleat at an angle, to flush the dirt out of the pleat from top to bottom. DO NOT use a pressure washer, or you will destroy your filter. When your tub is new, rinse your filter every two weeks. After you have cared for your tub for a while, you can rinse your filter as-needed, approximately every 3 or 4 weeks. But remember, there's no such thing as cleaning your filter too often and it's much easier to clean a slightly soiled filter than a very soiled filter. You will likely spend less total time cleaning frequently than infrequently. When in doubt, give it a washout.

Filter cartridges perform more effectively if you allow them to dry in between cleanings. This is why we supply a spare filter cartridge. You should rinse the filter immediately after removing it from service, then let it air dry, then rinse it again before putting it back into service.

At longer intervals (about 3 months or 30-40 uses, but this varies depending on amount of lotions and skin oils present) the filter needs to be cleaned more thoroughly and degreased. To do so, soak the dirty filter in a cleaning solution for at least 2 hours. Overnight is fine if you prefer. If your filter doesn't have too much greasy buildup, you can use a 50:50 mix of hot water and white vinegar. If you need more cleaning power, there are specially formulated spa filter degreaser products widely available that are just right for the job. Do not use household cleaning products - they may be too harsh and wear out your filter prematurely, and they may introduce detergent residues into your tub water that you will then have to remove. Once cleaned and rinsed, set this filter aside to dry in a clean and dry location where it will be ready for the next filter swap.

If you take good care of your filters and your tub water, your filters should last 1-2 years each. If you are rotating your filters every 3 months as we recommend, that means you will have to buy 2 new filters every 2-4 years. Regular, gentle cleaning and good water sanitation practices will maximize their service life.

If you are ever in doubt about whether or not to replace a filter cartridge, just replace it. In the grand scheme of things it is inexpensive insurance.

Water Changes and Physical Scrubbing

Water Changes

While chlorine, ozonators, ionizers, and filters are integral parts to keeping your hot tubbing experience healthy and enjoyable, do not overlook the importance of water changes and physical scrubbing of your hot tub's interior. When your tub is new, dark pigments from the wood, called tannins, will color the water brown. Coffee and tea also have similar tannins, which is why when you add hot water it turns coffee or tea colored. It's not at all harmful to soak in the tannin water, but to some a coffee-colored hot tub just isn't as inviting as a clear one. Also, it is increased organic matter that will require more chlorine to maintain sanitation effectiveness. Therefore, we recommend changing the water every 1 - 2 weeks, if possible, during the break-in period with a new tub. Most of the tannins will come out in the first few water changes, and in most cases they will be gone in about 4 to 6 months with these frequent water changes.

After that, your water change schedule depends on how you use and care for your tub. We recommend draining, scrubbing, and refilling every 30 - 40 hot tub uses, or every 4 months, whichever happens first. If you use only dichlor as your sanitation method, you will need to change the water regularly due to inevitable chemical buildups. If ever in doubt, change the water.

Also whenever taking your tub out of service, remember stagnant water, even in small amounts such as in the pockets of your plumbing (bottom of pump, filter, heater, etc.), is breeding grounds for bacteria, algae etc. If your tub is not running, drain and ventilate all parts of your hot tub system, including the system components and plumbing. Always super-chlorinate your tub after refilling.

Tub Scrubbing

Scrubbing should be done with a medium bristle brush. Scrubbing with warm water may be sufficient; if your tub needs more you can use a small amount of dish soap, or half a **teaspoon** (not tablespoon!) of Spa 56 per gallon of water in your scrubbing bucket.

Other Notes

If you follow the Zen Bathworks sanitation regimen, water from your tub is safe for watering lawns or other landscape plants. We do not recommend using it for plants intended for human consumption.

Hot tub sanitation has many variables. We've covered most of them above, but there are a few others to consider. One is the temperature of the water. The warmer it is kept on average, in general the better bacteria will reproduce. Due to the high water temperature, 4 people in a hot tub is the equivalent bather load of 300 people in a pool! How clean the bathers are when they enter is another impactful variable. Therefore, please understand these are general guidelines. You will need to fine-tune within the parameters given to best suit your personal situation. For example, if you have a supplemental sanitizer that allows for very low chlorine levels, you have low intensity usage (meaning only a few people, usually the same people, and not a lot of lotions, makeups, etc. added) and you routinely follow other instructions we've given, you may be able to extend your water change intervals. On the other hand, if you love hosting hot tub parties, you will probably need to err to the conservative side of our recommendations. Over time you will likely develop a familiarity with your results and be able to fine tune things to best fit your circumstances. If this is your first hot tub and this all seems a little overwhelming, we understand. But rest assured, it isn't that bad once you get into the routine, and the relaxation that comes from worry free hot tubbing is totally worth it!

Sanitation Procedure Quick Reference Guide

NOTE: Be sure you have read and understood the full length “Recommended Sanitation Procedure” we have provided. This is for quick reference only.

Dichlor Only

1. Test pH and adjust as necessary
2. Add _____ tablespoons of Spa 56 or equiv for my tub (1x dose indicated in Table 1)
3. Test chlorine levels after 5 minutes: range is 2-3 ppm
4. Add at least 30 minutes and not more than 24 hours BEFORE soaking
5. Maintenance shock every 2 - 4 weeks with _____ tablespoons for my tub (2x dose indicated in Table 1)
6. Shock after filling, after heavy use, after period of no use, or if contamination from algae or bacteria is suspected
7. Rotate your filter cartridge for a clean one about every 10th to 15th tub use.
8. Drain and refill your tub about every 2 - 4 months. Before refilling, scrub all interior surfaces with a medium brush, rinse and fully drain the tub, then refill with fresh water.

Ozonator with Dichlor

1. Test pH and adjust as necessary
2. Add _____ tablespoons of Spa 56 or equiv for my tub (1/2 of dose indicated in Table 1)
3. Test chlorine levels after 5 minutes: range is 1-2 ppm
4. Add between 24 hours and 30 minutes BEFORE soaking
5. Maintenance shock should not be necessary, and is an indicator that the ozonator is not set correctly or is not working
6. Shock after filling, after heavy use, after period of no use, or if contamination from algae or bacteria is suspected
7. Rotate your filter cartridge for a clean one about every 10th to 15th tub use.
8. Drain and refill your tub about every 2 - 4 months. Before refilling, scrub all interior surfaces with a medium brush, rinse and fully drain the tub, then refill with fresh water

Ionizer (ClearBlue) with Dichlor

1. Test pH and adjust as necessary
2. Check that copper levels are between 0.2 and 0.8 ppm
    a. *IMPORTANT: if copper levels are below range, use Dichlor-Only sanitation instructions until ion levels have risen to at least 0.2 ppm*
3. Add _____ tablespoons of Spa 56 or equiv for my tub (1/4 of dose indicated in Table 1)
4. Test chlorine levels after 5 minutes: range is .5-1 ppm
5. Add dichlor between 24 hours and 30 minutes BEFORE soaking
6. Maintenance shock every 2 - 4 weeks with _____ tablespoons for my tub (1x dose indicated in Table 1)
7. Shock after filling, after heavy use, after period of no use, or if contamination from algae or bacteria is suspected
8. Rotate your filter cartridge for a clean one about every 10th to 15th tub use.
9. Drain and refill your tub about every 2 - 4 months. Before refilling, scrub all interior surfaces with a medium brush, rinse and fully drain the tub, then refill with fresh water