Monthly Manager Moments – Article #21

Pool Math #2: The 6th in our series on how pools work

Introduction – Last time we looked at how to calculate the capacity of a pool/spa in gallons, and how that determines the flow rate and turnover requirements. Generally, the smaller the pool and the heavier its use, the faster it must flow and turn over. The pool at EWU is required to turn over every 6 hours, at a flow rate of 792 GPM, whereas a heavily used spa must turn over every 10 minutes!

This article will look at how to calculate the chemical dosages for your pool, in case you're currently using the "by guess & by golly" method. First, you need the capacity of your pool, and within 10% accuracy. If it's not perfect, that's OK, but within 10% is necessary. Next, compare your pool to the million pound pool, which is 120,000 gallons. The million pound pool has standard dosages applied to it that you can now use against yours by applying a proportion to it.

Here's an example:

It takes 18 pounds of sodium bicarbonate (baking soda) to raise total alkalinity in the 120K pool 10 PPM. If you test the water and get 70 PPM, it's too low. Our target value is 100 PPPM. So, we need to raise it 30 PPM. To raise the 120K pool 30 PPM, set up one proportion:

$$\frac{18 \text{ lbs}}{10 \text{ PPM}} = \frac{X \text{ lbs}}{30 \text{ PPM}} = 54 \text{ pounds}$$

Now compare it to our pool. EWU pool is 285,000 gallons.

$$\frac{18 \text{ lbs}}{120K} = \frac{X \text{ lbs}}{285K} = \frac{42.75 \text{ lbs}}{10 \text{ PPM}}$$

Note: to solve a proportion, cross multiply and divide: 30 X 18 ÷ 10 = 54.

So, in the EWU pool, it takes 42.75 pounds to raise it 10 PPM. Remember that 18 pounds raised the 120K pool 10 PPM, so that's the unit that we carry over to the new ratio. Now we apply a second proportion to get the amount needed to raise the EWU pool 30 PPM.

$$\frac{42.75 \text{ lbs}}{10 \text{ PPM}} = \frac{x \text{ lbs}}{30 \text{ PPM}} = 128.25 \text{ pounds}$$

How do we know that this is correct? Look at the pool sizes. EWU pool at 285K is 2.375 times larger than the 120K pool. So, 54 X 2.375 = 128.25 pounds. Some operators prefer this "pool factor" method to the proportion method that I just showed you. It's really semantics though, since either method is essentially a proportion; comparing one set of values to another with like units.

What about other chemicals? Again, starting with the dosage for the 120K pool - Typically, pool operators also add calcium chloride (13 lbs/10 PPM), calcium hypochlorite (1.5 lbs/1 PPM), sodium hypochlorite (1 gallon/1 PPM), gas chlorine (1 lb/1 PPM). Other chemicals may be used as well, and are often listed for a certain amount per 10K gallons. No problem, just do the proportions again, using 10K instead of 120K for the starting ratios.

Summary for dosages - Keep in mind that the smaller your pool, the more careful you must be with dosages. It's common sense of course, but worth a reminder. If your pool is only 30,000 gallons (.25 of the million pound pool), you will definitely want to weigh the amount of baking soda that you're using in order to be pretty accurate (13.5 lbs). Here, just "throwing in a bag" would definitely not work!!

On the other hand, with the EWU pool being a rather large pool, I don't have to split hairs with weighing the amount of sodium bicarbonate I would put in to get 30 PPM rise in total alkalinity (TA). Also, I know that if I just put in three 50 lb bags (150 lbs, instead of 128 lbs) I might overshoot the 100 PPM target a tiny bit, but I'd not be over 110 PPM; which is still within the target range. Plus – In this pool TA is continually dropping, due to the gas chlorine making HCl and HOCl all the time. So, putting in 150 pounds is logical, and I would do that without hesitating.

One last thing to remember about dosages, and it's very important: ripple effect. Here's an example at this pool - If I put the 150 pounds of baking soda into my pool, which has a pH of 8.3, what will happen to my pH? Remember that the target value is only 7.3 (10X lower!), so that much baking soda will increase the pH significantly, at least for a while – enough that the controller's probes will certainly notice, and try to counter it. Now, two things will happen – the pH probe will turn on the acid feeder, and the ORP will go down from the higher pH being detected, so the chlorine feeder will also come on! The injection of three acids will neutralize the baking soda that I just spent money on and added to my pool! What do I do? Right before putting in the 150 pounds of bicarb, I turn the controller off by closing the valves to and from the flow cell. The pool will be just fine for a couple of hours with the controller off. After the baking soda has thoroughly mixed into the entire pool, the pH will be largely unchanged and the controller can be turned back on. Now, I've successfully increased the TA without just creating another problem! Another day in the life of an AFO (Aquatic Facility Operator)…

Happy dosing!

Greg Schmidt, AFO Instructor
EWU Aquatic Center Manager

Questions on dosing a pool? Email me at leos@ewu.edu.

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