CALCULATING "THE CHLORINE DOSAGE" USING: 65% TO 70% CALCIUM HYPOCHLORITE (Ca (OCl)2)

This months Operators Notebook comes from three Water Distribution System Operators in the midwest and one in California. They all asked the about the same question: "WHY" do we have to divide the chlorine by the other values like the percentage of chlorine?" The answer will be shown in the following math example:

EXAMPLE: After completing a thorough cleaning, a new 3.8 MG water storage tank is to be disinfected by feeding and completely dissolving 65% available chlorine calcium hypochlorite granules into the water as it fills the storage tank. You must maintain a chlorine residual of at least 10 mg/L for 24 hours after the tank is filled for proper disinfection. (This is a math portion of Method 1 for disinfecting a water storage tank.) The laboratory says that the chlorine demand and chlorine loss over the 24 hour period of time will be about 2.7 mg/L. You elect to feed a dose of 12.7 mg/L chlorine (the "residual" you need plus the "demand" so that your dosage will be enough to meet the requirement). How many pounds of calcium hypochlorite granules will you use?
(Ans: 619.2 lbs calcium hypochlorite)

We first calculate the number of pounds of PURE chlorine we need, using the "pounds formula:"

(3.8 MG)(8.34 lbs/gal)(12.7 mg/L dosage) = 402.5 lbs PURE chlorine

We now have to correct for the amount of the impurities. That is why "we divide the number of pounds of pure chlorine by the percent of chlorine in the calcium hypochlorite." By doing this, we will have an answer that will take into account the substances that are NOT chlorine in the tablets, granules, etc.

There are two ways of doing this. The first is to set it up as a percentage problem and solve for the unknown, or you may do it by just remembering the "solving" for the unknown step as a memory exercise.

First way:

We use our method of "finding the percentage" of something. We take the "X whole pounds of calcium hypochlorite" with chlorine and other substances in it, and multiply that value by the percentage that we want, that we have, etc. of chlorine, and make that equal to the amount (lbs) of chlorine we require:

(X lbs Cal Hypo)(0.65 chlorine) = 402.5 lbs Pure Chlorine

We can now solve for the unknown pounds of calcium hypochlorite by dividing both sides of the equal sign by the "0.65" and then canceling:

$$\frac{(\text{X lbs Ca Hypo})\cancel{(0.65)}}{\cancel{0.65}} = \frac{\text{402.5 lbs Pure Chlorine}}{0.65}$$

This then gives us the following after we "clean it up," our answer:

$$\text{X lbs Ca Hypo} = \frac{\text{402.5 lbs pure Chlorine}}{0.65} = \text{619.2 lbs Ca Hypo}$$

We would use 619.2 lbs of calcium hypochlorite, that has 65% available chlorine in it!

We can further understand what we have done, and also check our work at the same time in the following. If we take "619.2 lbs of cal hypochlorite, and then multiply that by the percentage of availablke chlorine in it (the 65%) we should have as an asnwer, the "402.5 lbs of pure chlorine" that we need from the pounds formula. Here we go:

(619.2 lbs Cal Hypo)(0.65) = 402.5 lbs Pure Chlorine

It works!

Second way: just memorize that we pick it up at this step, where we divide the pounds of pure chlorine by the percent available chlorine. That's what most texts say to do... but they don't tell you where it came from!

$$\frac{(\text{X lbs Ca Hypo})\cancel{(0.65)}}{\cancel{0.65}} = \frac{\text{402.5 lbs pure Cl2}}{0.65} = \text{619.2 lbs Ca H}$$

Your turn! This one is for you to do!

PROBLEM: A new 1.8 MG water storage tank is to be disinfected by feeding and completely dissolving 65% available chlorine calcium hypochlorite granules into the water as it fills the storage tank. The laboratory says that the chlorine demand and chlorine loss will be about 3.5 mg/L. You elect to feed a chlorine dose of 13.5 mg/L. How many pounds of calcium hypochlorite (Ca (OCl)2.) will you use? (Ans: 307.2 lbs of calcium hypochlorite....... to get 200 lbs available chlorine)