APPENDIX – I

CHLORINE DOSAGE CALCULATIONS AND MEASUREMENTS

I-1. General

Tables I-1 and I-2 provide volumes in drops (dp), milliliters (mL), teaspoons (tsp), tablespoons (tbls), cups (cp), liters (L), and gallons (gal) of liquid bleach, dry calcium hypochlorite (HTH), and a concentrated calcium hypochlorite solution that, when added to the indicated volume of water, will provide the approximate chlorine dose indicated. The chlorine residual achieved using these values will be dependent on the chlorine demand exerted by the water that is chlorinated. If there is no chlorine demand, the residual should equal the dose. The greater the chlorine demand, the lower the residual will be. Note that for all chlorine residual concentrations in water, values in parts per million (ppm) are equivalent to values in milligrams per liter (mg/L) (for example, 10 ppm = 10 mg/L).

Table I-1. Rounded-up volumes of 5% liquid bleach that will provide approximately the indicated chlorine dose when added to the listed volume of water

Gallons to be Chlorinated	1 mg/L	2 mg/L	5 mg/L	10 mg/L	100 mg/L
5	6 dp	0.75 mL	1.9 mL	3.8 mL	8 tsp
10	0.75 mL	1.5 mL	3.8 mL	1.5 tsp	16 tsp
25	2 mL	3.8 mL	2 tsp	4 tsp	1 cp
36	3 mL	5.5 mL	2.75 tsp	2 tbls	1.25 cp
50	4 mL	1.5 tsp	4 tsp	3 tbls	1.75 cp
100	7.7 mL	3 tsp	3 tbls	5 tbls	3.25 cp
400	2 tbls	4.25 tsp	0.75 cp	1.5 cp	3 qt
500	3 tbls	0.33 cp	1 cp	1.75 cp	1 gal
1000	0.33 cp	0.67 cp	1.75 cp	3.25 cp	2 gal

Table I-2. Volumes of 70% available chlorine HTH (or solution concentrate*) that will provide approximately the indicated chlorine dose when added to the listed volume of water (more accurate volumes are shown in parentheses)

Gallons to be Chlorinated	1 mg/L	2 mg/L	5 mg/L	10 mg/L	100 mg/L
5	0.9 mL	1.7 mL	4.1 mL	8.3 mL	0.25 tsp
10	1.7 mL	3.3 mL	8.3 mL	16.6 mL	0.5 tsp
25	4.1 mL	8.3 mL	20.7 mL	41.4 mL	1.25 tsp
36	6 mL	11.9 mL	29.8 mL	0.9 mL	1.75 tsp
50	8.3 mL	16.6 mL	0.6 mL	0.25 tsp	2.5 tsp
100	16.6 mL	33 mL	0.25 tsp	0.5 tsp	5 tsp
400	0.92 mL	1.9 mL	1 tsp	2 tsp	19 tsp
500	1.3 mL	0.5 tsp	1.25 tsp	2.5 tsp	0.5 cp
1000	0.5 tsp	1 tsp	2.5 tsp	5 tsp	1 cp

*The shaded area of the table indicates the volume of a concentrated solution made from dissolving 1 teaspoon of HTH in a half canteen cup (1½ cups) of water.

I-2. Conversion factors

a. Table I-3 is useful in converting from one unit of measurement to another. It shows equivalent values for common units of measurement. Unit volumes increase from left to right and top to bottom. All volumes on the same horizontal line (row) are equal. So, looking at the "ounce" row, we can see that 1 oz, 444 dp, 30 mL, 6 tsp, and 2 tbls are all equal to each other. Continuing to the right on the same row indicates that 1 oz is also equal to 0.125 or 1/8th cp (see table I-4), 0.063 pints (pt), 0.031 quarts (qt), and so on across the table.

b. If you need to add 7 mL of bleach to a container of water, but you only have an eyedropper, you can see that each mL contains 15 dp, so 7 mL would be equivalent to 7 x 15, or 105 dp.

c. The values moving down a single column represent how many of the units at the top of the column make up one of the units on the left of the table. For example,

proceeding down the column with "**drop**" at the top, there are 15 dp in a mL, 74 dp in a tsp, 3550 dp in a cp, and a whopping 56,775 dp in a gal. Similarly, looking at the "**ounce**" column, there are only 0.002 oz in a dp, 0.5 oz in a tbls, and 32 oz in a qt.

Table I-3. Equivalent volumes

	drop	mL	tsp	tbls	ounce	Cup	pint	quart	liter	gal
drop	1	0.067	0.013	0.004	0.002					
mL	15	1	0.200	0.067	0.033	0.0042	0.0021	0.0011	0.0010	
tsp	74	5	1	0.333	0.167	0.021	0.010	0.005	0.005	0.001
tbls	222	15	3	1	0.500	0.063	0.031	0.016	0.015	0.004
ounce	444	30	6	2	1	0.125	0.063	0.031	0.030	0.008
cup	3550	237	48	16	8	1	0.500	0.250	0.240	0.063
pint	7100	473	96	32	16	2	1	0.500	0.480	0.125
quart	14200	946	192	64	32	4	2	1	0.960	0.25
liter	15000	1000	203	68	34	4.2	2.1	1.06	1	0.26
gal	56775	3785	768	256	128	16	8	4	3.785	1

I-3. Fractions and decimals

Table I-4 shows the equivalence between common fractions and decimals.

Table I-4. Common fractions and their decimal equivalents

Fraction	Decimal
1/16	0.0625
1/8	0.125
3/16	0.1875
1/4	0.25
5/16	0.3125
3/8	0.375
7/16	0.4375
1/2	0.500

Fraction	Decimal
9/16	0.5625
5/8	0.625
11/16	0.6875
3/4	0.75
13/16	0.8125
7/8	0.875
15/16	0.9375
16/16	1.0000

I-4. Chlorination formulas

a. If the volume and/or concentration you are working with are not in the tables above, use the following equations to calculate the volume of required bleach, HTH, or

concentrated calcium hypochlorite solution in mL; then use table I-3 to convert that volume to enable using the best measuring device you have available.

(1) For Liquid Bleach (~ 5% available chlorine):

$$\text{mL required} = \frac{\text{desired concentration in mg/L x number of gallons to be treated}}{13.2}$$

(2) For HTH (~70% available chlorine)

$$\text{mL required} = \frac{\text{desired concentration in mg/L x number of gallons to be treated}}{434.6}$$

(3) For a solution made from adding 1 level tsp HTH to half a canteen cup of water:

$$\text{mL required} = \frac{\text{desired concentration in mg/L x number of gallons to be treated}}{6.04}$$

For example: chlorinating 10 gallons of water with a dose of 5 mg/L (ppm), would require the following:

$\frac{5 \times 10}{13.2}$ = 3.8 mL of *bleach*

$\frac{5 \times 10}{434.6}$ = 0.115 mL of HTH, or

$\frac{5 \times 10}{6.04}$ = 8.3 mL of concentrated *hypochlorite solution* made from 1 level tsp HTH in half a canteen cup (1 ½ cups) of water.

b. If your measuring device is not as precise as the number you come up with, it is generally advisable to round the calculated number up to ensure you provide at least the dose you intended to provide. For water destined for drinking, it is always important to provide a 30-min contact time after adding the chlorine and mixing, then to test the water to ensure the desired residual has been achieved.