$$\text{lb of raw chemical per 100 gal} = \frac{\text{desired ppm}}{1205} \quad (1)$$

This provides the mass of actual chemical that must be dissolved per 100 gallons of water. For example, a 200 ppm concentration level of nitrogen as a fertilizer solution will require:

$$\frac{200 \text{ ppm}}{1205} = 0.17 \text{ lb. of N per 100 gal. of water .}$$

This is pounds of actual nitrogen required and not pounds of fertilizer mix as either a dry or liquid source.

Many chemicals are supplied as either a percentage by weight of a dry or liquid mixture. Therefore the mass of chemical mixture required will depend on the concentration of raw chemical in the mixture. Equation (2) can be used to determine the mass of chemical mixture required to provide the necessary level of raw chemical.

$$M(\text{mixture}) = \frac{(M_x)(100)}{\%X} \quad (2)$$

where M(mixture) = the required mass of chemical mixture (lb.),
M_x = the desired mass of chemical X (lb.), and
%X = the percentage of chemical X in the mixture.

If in the above example a 16-4-8 (N-P_2O_5-K_2O) dry fertilizer mix was used, then the required mass of fertilizer mix for 100 gallons of solution would be:

$$\frac{(0.17 \text{ pounds})(100)}{16\%} = 1.1 \text{ pounds .}$$

Therefore 1.1 pounds of 16-4-8 fertilizer source mix are required to supply 0.17 pounds of nitrogen.

Table 1 combines both Equations (1) and (2) to provide the mass of chemical mixture (for example, fertilizer mix) to add to 100 gallons of water to obtain a certain ppm level for the desired chemical. An example using Table 1 is included in the Appendix.

It is important to remember that the A-B-C analysis of a fertilizer label refers to the nitrogen (N), phosphorus oxide (P_2O_5), and potash (K_2O). Therefore only 44% of the B factor (P_2O_5) refers to actual phosphorous (P), and only 83% of the C factor (K_2O) refers to actual potassium (K). Equation (2) can be slightly rearranged to solve for M_x based on M(mixture), and used to determine the mass of actual P or K contained in a fertilizer mix. For example, in 50 pounds of 16-4-8 fertilizer the mass of P_2O_5 is

$$\frac{(50 \text{ pounds})(4\%)}{100} = 2.0 \text{ pounds of } P_2O_5 \text{ .}$$

Similarly, the mass of actual P would be

$$\frac{(2.0 \text{ pounds})(44\%)}{100} = 0.88 \text{ pounds of P.}$$

Therefore 50 pounds of a 16-4-8 fertilizer mixture contains only 0.88 pounds of actual P. The same procedure can be used to determine that the amount of actual K is 3.32 lbs.

When chemicals are supplied in liquid form, it is more convenient to measure volumes rather than masses or weights. This requires the specific density or specific weight (S_x) of the liquid mixture such as pounds of chemical per gallon of liquid. This property should be provided by the manufacturer or chemical supplier and can be used to simply convert from required lbs. to required gallons. For example a liquid fertilizer provided as a 4-0-8 solution has 4% nitrogen by weight. However, the amount of nitrogen is not known unless the specific weight of the chemical (fertilizer) solution is known, such as 9.6 lb. per gallon. As was previously mentioned, this value varies among chemical mixtures and should be on the chemical label, but may be obtained from the chemical supplier.

Concentration Injection Rates

The previous section described the procedure for mixing particular concentrations of a stock solution. However, many systems will have flowing water with a requirement to maintain a desired concentration of a chemical in that system. This