Volume-to-Weight Conversion Factors for Waste Handlers

Every other year, the Texas Commission on Environmental Quality must issue a report to the U.S. Environmental Protection Agency (EPA) summarizing hazardous-waste generation and management activities in Texas in a format specified by the EPA. The EPA requests that waste be reported in units of weight or that the density of the waste be reported also, so that volume units can be correctly converted to units of weight.

The information that follows is designed to help handlers who know the volume of a waste but not its weight.

This guide explains three methods by which a waste handler may determine the weight of a waste, other than weighing its entire volume.

Method 1

The handler knows the density and volume of the waste.

If a handler knows the density of a waste (i.e., its weight per unit volume), the handler can calculate the weight of the waste by using the following formula:

density × volume = weight

> **Example:** A handler knows that the density of a waste is 11.5 lbs per gallon. The handler also knows that there is 50 gallons of the waste. The weight of the waste can be calculated as follows:
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> *11.5 lbs/gal × 50 gal = 575 lbs*

Method 2

The handler knows the volume and weight of a representative sample of the waste.

The formula for using this method is:

(volume of original waste ÷ volume of sample) × weight of sample = weight of original waste

Follow these steps:

1. Obtain a representative sample of a known volume of the waste whose weight is being calculated.
2. Weigh the sample.
3. Calculate the number of such samples in the original waste by dividing the volume of the original waste by the volume of the sample.
4. Multiply the number obtained in step 3 by the weight of the sample to obtain the weight of the original waste.

> **Example:** A handler has 9,500 L of a liquid waste but does not know its specific gravity, and wants to determine how much the liquid weighs. Using Method 2, the generator may calculate the weight of the liquid waste as follows:
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> 1. Take a representative sample of a known volume of the liquid waste (for this example, assume a volume 2 L).
> 2. Obtain the weight of the sample taken in step 1 by weighing it (for this example, assume a weight of 3 kg).
> 3. Divide the volume of the original waste (9,500 L) by the volume of the sample (2 L) to obtain the result 4,750 (9,500 ÷ 2).
> 4. Calculate the weight of the original waste using the Method 2 formula: *(9,500 L ÷ 2 L) × 3 kg = 14,250 kg.* The weight of the original 9,500 L of liquid waste is 14,250 kg.

Method 3

The handler knows the specific gravity and volume of the waste.

The first requirement for using this method is that the handler knows the specific gravity (i.e., the ratio of the weight of the substance to the weight of an equal volume of water) of the waste whose weight is being calculated. The second requirement is that the units associated with the volume of the waste be the same as the weight of the volume of water used as a reference. This means, if the volume of the waste whose weight is being calculated is expressed in cubic yards, then the corresponding water weight reference must also be in cubic yards. For example, calculating the weight of 1 cubic meter of lead, while using the water reference weight of 1 cubic yard of water, is bad science. (*Note:* The specific gravity of your waste can generally be obtained from a material-safety data sheet, a publication available from the manufacturer, a materials handbook, or—on request—from your laboratory).

The formula for using this method is:

weight of water per unit volume × specific gravity × volume of waste = weight of waste

> **Example:** Lead has a specific gravity of 11.35 (i.e., a given volume of lead weighs 11.35 times as much as an equal volume of water). The weight of 1 cu ft of water is approximately 62.3 lbs. Given this information, the weight of 2 cu ft of lead would be calculated as follows:
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> *62.3 lbs./cu. ft. × 11.35 × 2 cu ft = 1,414.2 lbs*

Table 1 gives the weight of water for several commonly encountered units of volume. Table 2 may be helpful in converting from one unit of volume to another (e.g., from cubic feet to cubic meters).

TABLE 1
Common Units of Volume and Their Equivalent Weights of Water

1 cubic foot = 62.3 pounds
1 cubic yard = 1,682.1 pounds
1 cubic meter = 2,222.8 pounds
1 cubic centimeter = 0.00022 pounds
1 cubic inch = 0.0361 pounds
1 gallon = 8.34 pounds
1 liter = 2.205 pounds

TABLE 2
Other Helpful Conversion Factors

1 cubic foot = 0.037 cubic yards
1 cubic foot = 0.0283 cubic meters
1 cubic foot = 1,728 cubic inches
1 cubic foot = 28.32 liters
1 cubic foot = 28,318 cubic centimeters
1 ton (avoirdupois) = 2,000 pounds
1 gallon = 4 quarts
1 quart = 0.946 liters
1 gallon = 3.785 liters
1 liter = 1,000 milliliters
1 kilogram = 2.205 pounds