“Chapter 2: Determining a Container's Volume” Video Transcript

Welcome to CalRecycle’s measurement presentation.

The volume of an RPPC is one factor for determining whether a product’s plastic packaging is an RPPC. Through this presentation, we are going to share some methods for measuring the volume of rigid plastic packaging containers.

More specifically, an RPPC with a volume capacity of eight ounces up to a maximum of five gallons could fall within the program.

If you are unsure of a particular product’s total packaging volume, you may consider contacting the container manufacturer to request the total volume capacity of the container, or contacting a package design engineer to obtain the container’s volume capacity.

If neither of these options are available, you may need to conduct the measurement yourself.

Regular shaped containers can easily be calculated using a standard formula. For example, the volume of a cube or rectangular prism can by calculated by multiplying the width times the length times the height.

Using this rectangular box as an example, the width is 2.25 inches, the length is 2.75 inches, and the height is 2.5 inches.

Two and one-quarter multiplied by 2.75 multiplied by 2.5 is equal to 15.47 cubic inches. Therefore, the volume of this box is 15.47 cubic inches. Now all you need to do is convert 15.47 cubic inches into ounces. Here is the formula for converting inches to ounces: 15.47 cubic inches divided by 1.8046875 equals 8.57 fluid ounces. Therefore, this container would meet the volume requirements of an RPPC.

As another example, a cylinder’s volume can by calculated by multiplying pi times the radius squared times the height. Using this cylindrical container as an example, pi is always 3.14 and the radius is 1.4 inches. The radius squared would be 1.4 times 1.4, or 1.96 inches, and the height is 2.5 inches. Therefore pi, or 3.14, times 1.96 times 2.5 is equal to 15.39 cubic inches. The volume of this container is 15.39 cubic inches.

Now convert 15.39 cubic inches into ounces. Using our formula, again: 15.39 cubic inches divided by 1.8046875 equals 8.53 fluid ounces. This container would meet the volume requirements of an RPPC.

For additional information on formulas to calculate regular shaped containers—such as cubes, rectangles, cylinders and other shapes—go to the RPPC website at: www.calrecycle.ca.gov/Plastics/RPPC/SelfDetermin without an “e” at the end. Once on this webpage, scroll to the bottom of the screen where you will find tools for “Determining a Container’s Volume or Equivalent Capacity.”

Effective product packaging is used to maximize sales. However, the total volume capacity of the packaging container may not be easy to measure. In cases where irregular shaped packaging is being used, and you need to conduct an evaluation on your own, several techniques are available.

The techniques include: the Rice Measurement Method, the Water Measurement Method, and the Volume Displacement or Water Dunk Test. Each of these methods can be used to determine the volume of a container. However, container determinations are almost always done for those containers that are questionably close to eight ounces.

The first method is the rice measurement method. We suggest using rice; however, any fine grain material, including sand, can be substituted.

As a regular shaped container, this rectangular box could easily be calculated by multiplying the width times the length times the height. However, for demonstration purposes, we will show you an alternative method for calculating this container's volume.

First, you will need to tape any gaps or small openings that may allow rice to slip through.

Next, using a standard kitchen measuring cup, measure eight ounces of rice and level off the top. One cup is equivalent to eight ounces volumetric capacity.

Finally, pour the rice into the empty container. Be sure to fill in all the crevices.

In this case, there is room for more rice. Using this method, the container has a volume greater than eight ounces. Given the product inside, it could be considered an RPPC covered by the program.

Smaller containers hold a variety of products. Using the rice measurement technique, we are going to determine if this irregular shaped container meets the minimum volumetric capacity requirement.

If necessary, tape any gaps or small openings that may allow rice to slip through.

Next, measure eight ounces of rice. Finally, pour the rice into the empty container and be sure to fill in all the crevices. In this case, we were not able to get all of the rice into the container. Using this method, the container has a volume less than eight ounces.

For irregular shaped containers that have several contours and indentations, the water measurement method might be preferred. This technique is slightly more accurate than the rice measurement technique. Using this technique helps to evaluate a container that is very close to eight ounces.

Using a standard kitchen measuring cup, measure eight ounces of water.

Next, pour the water into the empty container. Be sure to fill in all the spaces.

In this case, we have found that there is room for more water. Using this method, the container has a volume greater than eight ounces.

Again, using the water measurement technique, we are going to determine the volume of this small container.

Begin by measuring eight ounces of water.

Next, pour the water into the empty container and fill in all the spaces. In this case, we have found that there is not enough room for eight ounces of water. Using this method, the container has a volume less than eight ounces.

Another method that works well to measure the volume of irregular shaped containers is the Volume Displacement or Water Dunk Test.

For example, the volume of this irregular shaped container would be difficult to calculate using a standard formula. Therefore, the volume displacement test would work very well for this type of container.

First, fill the RPPC with sand to sufficiently weight the container so that it will sink into the water.

Next, tape any tiny openings that could allow water to seep from, or into, the container.

Now, pour any amount of water into a large measuring device, such as the one shown here. Just make sure the water level is enough to submerge the container without spilling over. For this demonstration, we're using forty ounces of water.

Lower the container into the water.

Finally, measure the amount of water that goes up. In our example, we placed forty ounces of water in the measuring device and the water level went up to approximately fifty-six ounces after adding the container. The amount of water that the container displaced is about sixteen ounces.

Therefore, the volume of this packaging container is about sixteen ounces. The methods that we have demonstrated provide the total capacity of the container, not the volume of the product. In summary, be sure to measure the total capacity of the packaging container.

We hope that this presentation has been helpful for better understanding a container's volume. For further information on conducting self-determination, please visit our website at: www.calrecycle.ca.gov/Plastics/RPPC/SelfDetermin, without an "e" at the end.