# Do Californians Really Use 20 Billion Plastic Bags Per Year?

*How Bag Ban Proponents Exaggerate The Quantity of Plastic Carryout Bags Used*

*By Anthony van Leeuwen, 26 April 2013; Updated 23 July 2013*

How often have you heard Bag Ban Proponents say that California residents use 20 billion plastic carryout bags per year or 531 Bags Per Capita? Have you ever asked yourself the following questions:

- Where did this number come from?
- How is this number calculated?
- Is the number reasonable?
- Is there a more reasonable number?

## Quick Sanity Check

First, let's do a quick sanity check. At 531 Bags Per Capita, a family of four would use 4 x 531 or 2,124 bags per year or about 41 plastic carryout bags per week. This number is simply too large. A more appropriate number might be in the range of 15 to 20 bags per week. Especially, if the family does most of their shopping at the big box stores, like Costco and Sam's Club. So, the 20 billion number does NOT pass the quick sanity check.

## Where Does the Number Come From?

Many people will be surprised to learn that the 20 billion plastic carryout bag number comes straight from the landfill. Yes, you read that right, straight from the landfill. Garbage stinks, so does the 20 billion number! The California Integrated Waste Management Board (CIWMB), a now defunct state agency, published a report[1] titled "California 2008 Statewide Waste Characterization Study" wherein they identified the composition of material dumped in California's landfills by different material classes. The material class we are interested in is called "Plastic Grocery and Other Merchandise Bags." The weight of material in each class was determined by sampling and extrapolating the results to the weight of all material dumped in landfills during the reporting period. According to the waste characterization study samplings of waste were conducted at only 27 landfills and transfer stations representative of the different demographic, climatic, and geographic regions of the state. Sampling at 27 landfills or 10% of California's 278 landfills[2] makes the estimate questionable.

## How The Quantity Of Plastic Carryout Bags Are Calculated?

For California, the estimated weight of "Plastic Grocery and Other Merchandise Bags" in landfills is 123,405 tons.[3] The standard weight of each High Density Polyethylene (HDPE) bag is 5.5 grams or 0.01213 lbs. Dividing the total weight in the landfill by the weight per HDPE bag yields 20,347,073,372 plastic carryout bags and is calculated as follows:

$$Number\ of\ Plastic\ Bags = \frac{Landfill\ Weight\ in\ tons\ \times\ 2000\ lbs./_{ton}}{Weight\ of\ HDPE\ Plastic\ Bag}$$

$$Number\ of\ Plastic\ Bags = \frac{123{,}405\ tons\ \times 2000\ lbs./_{ton}}{0.01213\ lbs} = 20{,}347{,}073{,}372$$

Dividing the quantity of plastic carryout bags by California's 2012 population of 38,041,430[4] yields 535 Bags Per Capita shown as follows:

$$Bags\ Per\ Capita = \frac{Number\ of\ Plastic\ Bags}{Population} = \frac{20{,}347{,}073{,}372}{38{,}041{,}430} = 535\ Bags\ Per\ Capita$$

The quantity of 535 Bags Per Capita is similar to the 531 Bags Per Capita previously mentioned. Note that the 531 Bags Per Capita was calculated by dividing 20,000,000,000 by 37,688,804.[5] The latter number is the 2012 population of California from the California Department of Finance.

In the same manner the number of plastic bags and the bags per capita for the entire United States can be calculated using the weight in landfills of Plastic Packaging Bags and Sacks reported in the Environmental Protection Agency report titled "Municipal Solid Waste Generation, Recycling, and Disposal in the United States.[6] The estimated weight of Bags and Sacks is 770,000 tons[7] and which yields 126,958,000,000 plastic carryout bags when divided by the weight of an HDPE bag. Dividing the quantity of plastic carryout bags by the U.S. population of 313,914,040[8] yields 404 Bags Per Capita.

## Are The Quantities Calculated From Estimated Landfill Weights Accurate?

The "Plastic Grocery and Other Merchandise Bags" material class is defined in the Waste Characterization Study[9] as follows:

> *Plastic Grocery and Other Merchandise Bags means plastic shopping bags used to contain merchandise to transport from the place of purchase, given out by the store with the purchase.* ***This type includes dry cleaning bags intended for one-time use****. Does not include produce bags.*

In other words, the estimated weight of 123,405 tons for the "plastic grocery and other merchandise bags" material class is corrupted by the inclusion of the weight of dry cleaning bags!

Since the proportion of dry cleaning bags cannot be determined, there is no way to adjust the estimated weight to remove the effect of the dry cleaning bags. Since dry cleaning bags are not regulated in Single-Use Carryout Bag Ordinances, and since dry cleaning bags weigh more[10] than HDPE plastic carryout bags, the result of any calculation will result in an inflated number of plastic carryout bags.

Furthermore, the "plastic grocery and other merchandise bags" material class contains not only grocery store bags but also other plastic merchandise bags from other retailers. These bags are made not only from different plastic resins but also different sizes that have different weights. For example, Target's Low Density Polyethylene (LDPE) bag weighs 9.3 grams and HDPE bags from a variety of grocery stores and retailers can weigh between 4.0 and 6.5 grams each. The average weight of an HDPE bag is 5.5 grams. The average weight of plastic grocery and other merchandise bags in the landfill is unknown.

Therefore calculating the quantity of bags from landfill weights using the average weight of an HDPE bag will provide inflated and erroneous results.

The population of California is 38,041,430 and the population of the USA is 313,914,040. California reportedly uses 20,347,073,372 and the US reportedly uses 126,958,000,000. From this data we see that California has 12% of the nation's population and yet uses 16% of the nation's plastic carryout bags. Again this is an indication that the methodology of calculating the quantity of plastic carryout bags from landfill weights is flawed and does not provide reasonable results.

## How To Determine A Reasonable Number Of Plastic Carryout Bags

In 2006, the California legislature passed AB 2449. AB 2449 among other things, required grocery and retail stores subject to AB 2449, to report the total weight of plastic carryout bags purchased and the total weight of plastic carryout bags that were recycled on an annual basis. CalRecycle then compiled the data submitted and published it.

Calculating the quantity of plastic bags used by Californians from the weight of plastic carryout bags purchased by stores subject to AB 2449 is much more reliable because these are the same stores targeted by Single-Use Carryout Bag Ordinances and the bags would be of similar size and weight.

For 2008, the weight of bags purchased was 53,692 tons.[11] Dividing this number by the weight of an HDPE bag of 0.01213 lbs. yields 8,852,761,748 plastic carryout bags:

$$Number\ of\ Plastic\ Bags = \frac{Weight\ of\ Plastic\ Bags\ Purchased\ in\ tons\ \times\ {}^{2000\ lbs.}/_{ton}}{Weight\ of\ HDPE\ Plastic\ Bag}$$

$$Number\ of\ Plastic\ Bags = \frac{53{,}692\ tons\ \times\ {}^{2000\ lbs.}/_{ton}}{0.01213\ lbs.} = 8{,}852{,}761{,}748\ Plastic\ Bags$$

Dividing the quantity of plastic carryout bags by California's population of 38,041,430 yields 233 Bags Per Capita.

It should be noted that the 2008 data should be used to determine bag quantities because in 2007 the County of San Francisco adopted a ban on plastic carryout bags. Hence this is the best data available to calculate the total number of plastic carryout bags used by Californian's including the bags per capita.

If we use the 8.9 billion bag figure with 233 bags per capita, a family of four would use 932 bags per year or 18 bags per week. This number is more reasonable and corresponds more closely with reality.

Even if the number was bumped up to 10 billion plastic carryout bags per year, in order to ensure that all bags were accounted for by retailers not subject to AB 2449, the per capita quantity would compute to 263 bags. For a family of four this would mean 1052 bags per year or 20 bags per week. This number is more reasonable than the 20 billion bags estimated from landfill quantities.

## Corroborating the More Reasonable Number of Plastic Bags

Only one study exists that identifies carryout bag usage statistics based upon observations of shoppers before and after implementation of a bag ban. This study[12] was conducted by Team Marine, an environmental student group at Santa Monica High School. These high school students conducted observations of 50,400 grocery store patrons over a period of 19 months spanning from ten months prior to the Santa Monica Plastic Bag Ban to twelve months after. Team Marine subsequently published their report in March 2013 which included observations from before the ban, immediately after the ban and up to 1 year after the ban was implemented.

According to the Team Marine study, 69% of patrons used plastic carryout bags before the ban. Since shopping occurs on a per household basis, we divide the population by the average household size of 3 and then compute the number of households that use plastic bags as follows:

$$Households\ Using\ Plastic\ Bags = \frac{Population}{Average\ Household\ Size} \times Percent\ Using\ Plastic\ Bags$$

$$Households\ Using\ Plastic\ Bags = \frac{38{,}041{,}430}{3.00} \times 69\% = 8{,}749{,}529$$

Next, we assume that each household uses 20 plastic carryout bags per week for 52 weeks or 1040 plastic carryout bags per year and then compute the Pre Ban Quantity Of Plastic Bags used as follows:

$$Pre\ Ban\ Quantity\ of\ Plastic\ Bags = Households\ Using\ Plastic\ Bags * 1040\ bags\ per\ household$$

$$Pre\ Ban\ Quantity\ of\ Plastic\ Bags = 8{,}749{,}529 \times 1040 = 9{,}099{,}510{,}160$$

The Pre Ban Quantity of Plastic Bags is approximately 9,099,510,160 which corresponds very well with the 8,852,761,748 plastic carryout bags calculated from the weight of plastic bags purchased as reported by retailers. Hence the quantity of plastic bags used in California before the bag bans is probably closer to 9 billion than the 20 billion assumed by Bag Ban Proponents.

## Summary

The statement that Californians use 20 billion plastic carryout bags annually is clearly unreasonable. As stated, the origin of this number is calculated from the estimated weight of plastic bags in California's 278 landfills. The methodology of calculating plastic bag quantities using estimated weights in landfills is flawed and cannot produce reasonable results. Only the weight of plastic carryout bags purchased by California grocery and retail stores reported under AB 2449 can provide a reasonable ball park estimate for the total number of plastic carryout bags distributed by retailers in California. That number is approximately 9 billion plastic carryout bags.

The bottom line is that a quantity of 9 to 10 billion plastic carryout bags is closer to reality than the 20 billion asserted by many localities in their Environmental Impact Reports (EIRs) supporting Single-Use Carryout Bag Ordinances.

[1] California Integrated Waste Management Board, August 2009. "California 2008 Statewide Waste Characterization Study". Produced by: Cascadia Consulting Group. Available at: http://www.calrecycle.ca.gov/Publications/Documents/General%5C2009023.pdf
[2] US Environmental Protection Agency, "List of Municipal Solid Waste Landfills". Located at: http://www.epa.gov/osw/nonhaz/municipal/landfill/section3.pdf
[3] California Integrated Waste Management Board, August 2009. "California 2008 Statewide Waste Characterization Study". Produced by: Cascadia Consulting Group. Page 6. Available at: http://www.calrecycle.ca.gov/Publications/Documents/General%5C2009023.pdf
[4] United States Census Bureau, "California QuickFacts from the US Census Bureau – 2012 Population Estimate". Located at: http://quickfacts.census.gov/qfd/states/06000.html
[5] California Department of Finance, "E-1 Population Estimates for Cities, Counties, and the State — January 1, 2012 and 2013". Located at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/
[6] United States Environmental Protection Agency, December 2011. "Municipal Solid Waste Generation, Recycling, and Disposal in the United States Tables and Figures for 2010". Available at: http://www.epa.gov/osw/nonhaz/municipal/pubs/2010_MSW_Tables_and_Figures_508.pdf
[7] Ibid. Table 18, Page 20 of 58.
[8] United States Census Bureau, "USA QuickFacts from the US Census Bureau – 2012 Population Estimate". Located at: http://quickfacts.census.gov/qfd/states/00000.html
[9] California Integrated Waste Management Board, August 2009. "California 2008 Statewide Waste Characterization Study". Produced by: Cascadia Consulting Group. Available at: http://www.calrecycle.ca.gov/Publications/Documents/General%5C2009023.pdf
[10] The author weighed a dry cleaning bag at 36 grams or 6.54 times the weight of a HDPE Plastic Carryout Bag at 5.5 grams. Weights of dry cleaning bags from other establishments may vary.
[11] CalRecycle Website. "2008 Statewide Recycling Rate for Plastic Carryout Bags". Located at: http://www.calrecycle.ca.gov/Plastics/AtStore/AnnualRate/2008Rate.htm
[12] Team Marine, 8 May 2013. "The Effects of the Plastic Bag Ban on Consumer Bag Choice at Santa Monica Grocery Stores". Santa Monica High School. Located at: http://www.teammarine.org/wp-content/uploads/2013/05/Grocery-Store-Bag-Research_Press-Release-12-13.pdf