Modeling Food Donation Benefits in EPA's Waste Reduction Model

Donation of food is a form of waste recovery that can be modeled using emission factors from EPA's Waste Reduction Model (WARM). Donating food to people in need or to animals in cases where the food would have otherwise been disposed prevents food from entering the waste stream and can reduce the need for other sources of food. These actions conserve resources and reduce pollution, including greenhouse gas (GHG) emissions that contribute to global warming. There are many existing formal and informal programs for food donation in the United States, including food pantries, food banks, and food rescue programs. These programs will collect food and redistribute it to those in need.

Modeling the Benefits of Food Donation Compared to Landfilling Using WARM Emission Factors

Users can estimate the GHG impacts of avoided landfilling through food donation by using the following approach in the online and Excel versions of WARM. This methodology allows users to conservatively estimate the downstream emissions benefits from donation but does not include any upstream impacts from source reduction. For more information, refer to the "Limitations" section at the end of this document.

Step 1: Adjusting for Food Losses

A portion of donated food is expected to be unfit for consumption due to spoilage during the donation process or because it contains an inedible portion of food (e.g., apple cores). Therefore, when modeling food donation in WARM, users should adjust for losses during donation by applying a loss rate factor based on the type of food donated. This will discount the amount of uneaten food that is expected to be landfilled regardless of whether or not it is donated. Table 1 shows representative loss rates for each food category in WARM. When users have detailed data on different waste materials donated, EPA recommends separately entering data for specific food material types (beef, poultry, grains, bread, fruits and vegetables, or dairy products) rather than the general "Food Waste" material types.

Table 1: Share of Food Lost during Donation[1]

Donated Material	Estimated Share of Donated Food Lost
Food Waste	20%
Food Waste (non-meat)	20%
Food Waste (meat only)	17%
Beef	20%
Poultry	15%
Grains	22%
Bread	20%
Fruits and Vegetables	18%
Dairy Products	23%

Use the following calculation estimate the amount of food received after losses:

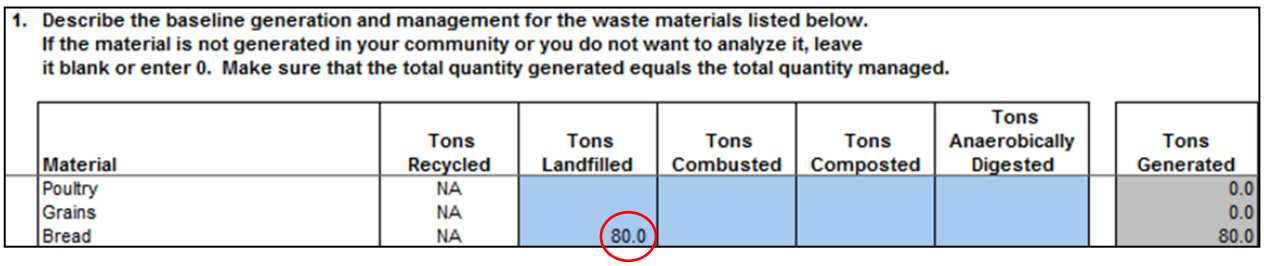
Food donated * (1 – loss rate) = Food received

For example, if 100 tons of bread was donated to a food bank over the course of a year, the adjusted value entered in WARM to estimate the impacts from donation would be:

*100 tons of bread donated * (1 – 20% loss rate) = 80 tons of bread entered in WARM*

Step 2: Model Donation Benefits Using WARM

1. Enter the tons of food received (after accounting for losses in Step 1) in the baseline scenario of the **Analysis Inputs** worksheet to model landfilling of the food had it not been donated. For the example shown below, donation of 80 tons of bread is modeled using the "Bread" category.



1. Describe the baseline generation and management for the waste materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Tons Generated
Poultry	NA					0.0
Grains	NA					0.0
Bread	NA	80.0				80.0

[1] Adapted from consumer food losses in the U.S. Department of Agriculture's "Food Availability (per Capita) Data System – 2010." U.S. Department of Agriculture Economic Research Service.

2. Next, add an alternate waste management scenario with identical tonnages in the landfilling column.

2. Describe the alternative management scenario for the waste materials generated in the baseline.
Any decrease in generation should be entered in the Source Reduction column.
Any increase in generation should be entered in the Source Reduction column as a negative value.
Make sure that the total quantity generated equals the total quantity managed.

Material	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested
Poultry		NA				
Grains		NA				
Bread		NA	80.0			

3. Next, continue to the **Summary Report (MTCO2E)** worksheet. The GHG emission avoided through donation are equivalent to the GHG emissions under **either** the baseline **or** the identical alternative waste management scenario, not the total change in GHG emissions. This represents amount of GHG emissions reduced by avoiding landfilling of unused food. For example, for the 80 tons of "Bread" shown below, donation avoids 43 metric tons of CO_2-equivalent ($MTCO_2E$) by diverting food waste from a landfill.

GHG Emissions from Baseline Waste Management ($MTCO_2E$): 43

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Total $MTCO_2E$
Bread	NA	80.0	-	-	-	43
						0
						0
						0

The impacts from donation estimated in both the Excel and online version of WARM will be a positive result under a landfilling baseline scenario, which means that donation results in avoided GHG emissions. Table 2 shows the GHG emissions savings from food donation instead of landfilling for each food material in WARM.

Table 2: Avoided Landfilling GHG Emissions per Short Ton of Food Donated

WARM Material Category	GHG Emissions (MTCO2E/Ton)
Food Waste	0.43
Food Waste (non-meat)	0.43
Food Waste (meat only)	0.45
Beef	0.43
Poultry	0.46
Grains	0.42
Bread	0.43
Fruits and Vegetables	0.44
Dairy Products	0.42

Notes:

1) Factors assume landfilling emissions from a national average mix of landfill gas control systems

2) Factors include loss rates from donation shown in Table 1

3) In this table, "food waste" refers to unused food that is still fit for consumption by humans or animals

Example Application

To illustrate the application of this approach, consider a bakery that donates 100 tons of bread to a food bank throughout the year. Had it not been donated, the bread would have been collected as part of the municipal solid waste stream and sent to a landfill. In order to calculate the GHG impacts of this donation:

1. Apply the loss rate for bread (20%) to the 100 tons donated to estimate that 80 tons of bread will no longer go to landfill due to donation.

2. Run WARM using a baseline scenario of landfilling 80 tons of "Bread" (in the Excel version of WARM) or "Food Waste (non-meat)" (in the online version of WARM) and an identical alternate scenario landfilling 80 tons of "Bread" or "Food Waste (non-meat)".

3. Under the national average landfill scenario in the Excel version of WARM, this calculation indicates that donating 100 tons of bread results in avoided landfilling emissions of 43 MTCO2E. Where more information is known about the landfill where waste would have been sent (e.g., geographic location, landfill gas control system, moisture conditions), users should select the relevant options in WARM to more accurately estimate avoided landfilling emissions.

Limitations

This section discusses the exclusion of source reduction in modeling emissions benefits of donation, and other limitations of the current approach to donation.

This Approach Does Not Account for Benefits of Source Reduction from Donating Food

Food donation can offset both downstream and upstream impacts from food production and waste management. From the downstream perspective, donating edible food avoids the majority[2] of disposal emissions from landfilling that would have otherwise occurred if the food had not been consumed. From the upstream perspective, the donated food may also offset demand for similar food that would have been consumed by people in need or animals receiving the donated food. Such a situation would avoid the upstream emissions from the similar food like a traditional source reduction scenario. However, there is a large degree of uncertainty associated with estimating GHG emissions avoided from donation, depending on the following assumptions:

1. **The type of food that is avoided in situations where donated food is consumed instead of food from another source.** For instance, if beef is donated, the beef could be replacing a less GHG-intensive food such as chicken or vegetables that would have otherwise been served. This scenario would result in less GHG savings than if beef were replacing beef. By comparison, donated vegetables replacing a beef meal would result in higher savings.

2. **Whether donated food is consumed instead of food from another source.** Many of those who consume donated food do not have a secure source for food. There is high level of uncertainty around how food-insecure people access food and nutrition, and the extent to which donated food will offset the generation of food from another source.

Due to these uncertainties, EPA currently recommends a conservative approach of modeling donation to account for just the avoided downstream impacts from waste disposal. EPA is also exploring options to account for potential avoided upstream impacts.

Other Limitations

The approach outlined in this guidance documents provides a conservative, baseline estimate of the avoided waste management impacts from food donation. However, this approach does not account for the following:

- Transportation, processing, and storage during the donation process before the donated food is consumed. This approach does not account for additional transportation and processing that may be needed to bring donated food to people or animals. Avoided transportation to landfills is included, as well as avoided GHG emissions from methane generation in landfills, which is the largest source of GHG emissions from landfilling food waste. EPA believes the effect of transportation and processing emissions from donated food is small; for example if transportation and processing emissions are similar to landfill transportation and processing they would be on the order of 7% of avoided landfilling benefits[3].

[2] As noted above, a small portion of donated food is expected to be inedible and will be sent for disposal.

[3] Assuming national average rates of landfill gas capture and energy recovery.

- Donations that offset composting and combustion of unused food have not been considered in this document. When estimating just the downstream impacts from donating food, avoiding food waste combustion or composting using the current GHG emission factors in WARM results in an increase in emissions when compared to donation because this approach does not account for upstream benefits from source reduction. Until more research is done on the upstream source reduction impacts of donated food, EPA does not recommend using WARM to estimate the GHG impacts from donating food that would have otherwise been composted or combusted.