

# FOOD WASTE SCOPING ANALYSIS

## U.S. ENVIRONMENTAL PROTECTION AGENCY

### OFFICE OF RESOURCE CONSERVATION AND RECOVERY

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#### I. INTRODUCTION

To support municipal solid waste (MSW) characterization efforts, EPA previously estimated MSW food waste generation using USDA ERS Loss-Adjusted Food Availability data. However, because the USDA data do not estimate diversion through food to animals and waste grease collection, the estimated food waste generation based on those data are not comparable to EPA's food waste generation estimate (after diversion). To help address this issue, the following areas have been researched:

- Estimate food waste captured for the animal feed market;
- Quantify fats, oils, and greases; and
- Estimate the ratio of preventable versus non-edible food waste in the United States.

#### II. ANIMAL FEED

Recovered food waste may be used as feed for livestock, poultry, and other animals. EPA's contractor conducted research to quantify the amount of post-consumer food waste being diverted as animal feed.

First, USDA representatives within the Animal and Plant Health Inspection Service were contacted in an effort to identify regulations that encourage or discourage feeding food waste to animals. Although food waste may be fed to other livestock species, it has most often been used as a source of feed for swine.<sup>1</sup> The 1980 Swine Health Protection Act is the primary federal regulation impacting food waste used for livestock feed and it applies to food waste containing meat, defined as:

*“all waste material derived in whole or in part from the meat of any animal (including fish and poultry) or other animal material, and other refuse of any character whatsoever that has been associated with any such material, resulting from the handling, preparation, cooking, or consumption of food, except that such term shall not include waste from ordinary household operations which is fed directly to swine on the same premises where such household is located.”*

The rule requires farmers to boil this waste before using it as feed and obtain a license before feeding it to their livestock. State laws vary, however, and in 25 states the feeding of waste containing meat to livestock is prohibited altogether: AL, AK, DE, GA, ID, IL, IN, IA, KS, KY, LA, MI, MS, NE, NY, ND, OR, SC, SD, TN, UT, VT, VA, WA, and WI. In the remaining states where feeding treated waste is allowed, the responsibility of licensing, monitoring, and enforcement may be carried out at the federal level, state level, or both, depending on the state.<sup>2</sup>

According to the supporting statement for the rule's most recently issued information collection request (ICR)<sup>3</sup>, there are over 2,100 total licenses for owner/operators of treatment facilities, herd owners, food establishments, or similar facilities. However, license-related data pertaining to these facilities is not publicly available. Furthermore, the USDA does not collect information about the amounts or types of waste, but typically just violations to the rule.<sup>2</sup> Even if this information were available, it would not be a

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<sup>1</sup> Feeding Food Wastes to Swine. Farms.com, February 02, 2011.

<http://www.farms.com/FarmsPages/ENews/NewsDetails/tabid/189/Default.aspx?NewsID=38537>

<sup>2</sup> January 22, 2014 email exchange from Barbara Porter-Spalding, USDA APHIS.

<sup>3</sup> Swine Health Protection Request for Extension of approval of an information collection (OMB Number: 0579-0065).

complete representation of the food waste being diverted as animal feed because it does not account for food waste not associated with meat, it excludes livestock other than swine, and it does not account for food waste being processed into commercial feed. It would also exclude any rule violators who do not have the required licenses; in 2013, 160 non-licensed facilities were found to be feeding food waste.<sup>4</sup>

From a North Carolina USDA representative, the contractor obtained limited data from 15 North Carolina swine facilities licensed to feed meat waste.<sup>5</sup> However, the data were not necessarily representative of all permitted facilities in the state, let alone throughout the U.S. In addition, the data only reflect meat waste being fed so they represent an incomplete picture of the amount of food waste being fed.

Because there is no central repository for quantitative data pertaining to food waste being used as animal feed, the contractor sought to identify possible data sources at a state level or smaller scale. The contractor contacted state-level contacts in North Carolina and Hawaii and reached out to several trade organizations, including the National Pork Board, the U.S. Poultry and Egg Association, United Egg Producers, the National Milk Producers Federation, the National Grocers Association, and the Food Marketing Institute. The contractor also reached out to grocery chains and a large commercial feed producer. Responses consistently indicated a lack of quantitative data regarding the amount of food waste being diverted to animal feed.

**Table 1. Food Waste to Animal Feed Contacts**

Organization	Description
USDA Animal and Plant Health Inspection Service	Federal Agency
National Milk Producers Federation	Farm industry group
National Pork Board	Farm industry group
U.S. Poultry and Egg Association	Farm industry group
United Egg Producers	Farm industry group
National Grocers Association	Food retail industry group
Kroger	Supermarket chain
Walmart	Supermarket chain
Cargill	Commercial feed producer
Food Marketing Institute	Food retail industry group

In addition to exploring Swine Health Protection Act license data, the contractor reviewed other USDA data including surveys conducted by the National Animal Health Monitoring System (NAHMS), available data in USDA's Economic Research Service (ERS) Feed Grains Database,<sup>6</sup> ERS Agricultural Resource Management Survey (ARMS) data,<sup>7</sup> and other reports identified in our research. These resources did not contain quantitative data pertaining to food waste as animal feed.

NAHMS reports included studies on dairy facility characteristics<sup>8</sup> and biosecurity practices,<sup>9</sup> beef cow-calf management practices,<sup>10</sup> and swine health and management practices. The dairy and beef reports contained no information about feed sources. The swine reports included some information related to feed sources, but only broad percentages were provided, and no quantities of food waste. For instance, the 2007 Small Enterprise Swine report<sup>11</sup> indicated that table food waste was fed to pigs in 23.4 percent of small operations, 15.1 percent of medium operations, and 13.8 percent of large operations (21.1 percent of

<sup>4</sup> National Pork Board Comments Regarding Notice of Request for Extension of Approval of an Information Collection; Swine health Protection. Docket ID: APHIS-2013-0053-0004.

<sup>5</sup> January 31, 2014 email exchange from Stephan Schaeffbauer, USDA-APHIS VS - North Carolina.

<sup>6</sup> <http://www.ers.usda.gov/data-products/feed-grains-database/documentation.aspx>

<sup>7</sup> <http://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices.aspx>

<sup>8</sup> "Facility Characteristics and Cow Comfort on U.S. Dairy Operations, 2007." USDA APHIS-VS-NAHMS. 2010.

[http://www.aphis.usda.gov/animal\\_health/nahms/dairy/downloads/dairy07/Dairy07\\_ir\\_Facilities.pdf](http://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy07/Dairy07_ir_Facilities.pdf)

<sup>9</sup> "Biosecurity Practices on U.S. Dairy Operations, 1991-2007." USDA APHIS-VS-NAHMS. 2010.

[http://www.aphis.usda.gov/animal\\_health/nahms/dairy/downloads/dairy07/Dairy07\\_ir\\_Biosecurity.pdf](http://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/dairy07/Dairy07_ir_Biosecurity.pdf)

<sup>10</sup> "Beef 2007-08 Part 1: Reference of Beef Cow calf Management Practices in the United States, 2007-08"

<sup>11</sup> "Reference of Management Practices on Small-Enterprise Swine Operations in the United States, 2007" USDA APHIS-VS-NAHMS. 2009. [http://www.aphis.usda.gov/animal\\_health/nahms/swine/downloads/swine2007/Swine07\\_dr\\_SmallSwine.pdf](http://www.aphis.usda.gov/animal_health/nahms/swine/downloads/swine2007/Swine07_dr_SmallSwine.pdf)

all operations). A 2006 report<sup>12</sup> noted that 13 percent of swine sites supplement their feed with bakery or food manufacturer byproducts, but this does not include table waste. According to one swine report,<sup>13</sup> less than 60 percent of swine sites keep records of feed intake amounts. Although the ERS Feed Grains Database contains some quantitative data concerning "miscellaneous by-product feeds" and "other byproduct feeds," these terms refer to the byproducts of milling processes for grain or sugar and do not include post-consumer food waste.<sup>14</sup> The ARMS data focused solely on crops.

An April 2013 report developed by the Food Waste Reduction Alliance (FWRA)<sup>15</sup> contained extrapolated survey data indicating that 2.1 billion pounds of food waste generated in the retail and wholesale sectors were diverted from landfills. In addition, the report indicated that 11 percent of the diverted food waste went to animal feed, implying that 231 million pounds of food waste were recycled as animal feed in 2011. Due to the lack of other available data, the contractor determined that this is the most reliable number for the total amount of food waste being recycled as animal feed.

The FWRA survey value (231 million pounds), applies specifically to the year 2011. In order to estimate this total over a time series of 10 years, the contractor planned to correlate the value with a parameter for which quantitative data are available over the same time series. Because the need for alternative feed sources would likely increase with the increasing corn or soy prices, we first attempted to link food waste as animal feed to the price of livestock feed. The contractor investigated the price of corn over the last 10 years and found that the annual percent change ranged from a 15 percent decrease to a 52 percent increase, with an average annual increase of 18 percent.<sup>16</sup> The variability in these prices from year to year made it difficult to develop a realistic growth or reduction factor for use in extrapolating food waste amounts on a year-to-year basis. Other factors contributing to annual fluctuations, such as increased awareness and trends toward zero-waste goals for both large and small companies are difficult to quantify.

The contractor developed a time series estimate of the quantity of food waste being fed to animals using the FWRA survey value and the amount of wholesale and retail food waste each year based on USDA ERS Loss-Adjusted Food Availability data. The 2011 FWRA value was 0.7 percent of the USDA ERS retail to consumer food loss values. Because of the lack of other data to extrapolate the values over the time series, the contractor assumed that 0.7 percent of the wholesale and retail food loss each year would become animal feed. The results of this analysis are presented in Table 2.

**Table 2. Amount of Food Waste used for Animal Feed**

<b>Year</b>	<b>Amount of Food Waste used for Animal Feed (million pounds)</b>
2000	214
2001	213
2002	217
2003	220
2004	223
2005	224
2006	226
2007	227

<sup>12</sup> "Part II: Reference of Swine Health and Health Management Practices in the United States, 2006" USDA APHIS-VS-NAHMS. 2007. [http://www.aphis.usda.gov/animal\\_health/nahms/swine/downloads/swine2006/Swine2006\\_dr\\_PartII.pdf](http://www.aphis.usda.gov/animal_health/nahms/swine/downloads/swine2006/Swine2006_dr_PartII.pdf)

<sup>13</sup> "Part I: Reference of Swine Health and Management Practices in the United States, 2006" USDA APHIS-VS-NAHMS. 2007. [http://www.aphis.usda.gov/animal\\_health/nahms/swine/downloads/swine2006/Swine2006\\_dr\\_PartI.pdf](http://www.aphis.usda.gov/animal_health/nahms/swine/downloads/swine2006/Swine2006_dr_PartI.pdf)

<sup>14</sup> January 28, 2014 email exchange from Tom Capehart, USDA Economic Research Service.

<sup>15</sup> Analysis of U.S. Food Waste Among Food Manufacturers, Retailers, and Wholesalers. Food Waste Reduction Alliance, 2013. [http://www.foodwastealliance.org/wp-content/uploads/2013/06/FWRA\\_BSR\\_Tier2\\_FINAL.pdf](http://www.foodwastealliance.org/wp-content/uploads/2013/06/FWRA_BSR_Tier2_FINAL.pdf)

<sup>16</sup> USDA World Agricultural Supply and Demand Estimates (WASDE) Reports. "U.S. Feed Grain and Corn Supply and Use" Tables. <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1194>

**Table 2. Amount of Food Waste used for Animal Feed**

<b>Year</b>	<b>Amount of Food Waste used for Animal Feed (million pounds)</b>
2008	228
2009	223
2010	231

### III. FATS, OILS, AND GREASE

The contractor quantified the amount of restaurant grease diverted from the municipal solid waste stream. This food waste composed of animal by-products, fats, and oils can be recycled into biofuels or rendered into saleable commodities such as high-protein meat, tallow, or grease, which are used in the production of animal feed, soap, paints and varnishes, cosmetics, explosives, toothpaste, pharmaceuticals, leather, textiles, lubricants, and other valuable products.<sup>17, 18</sup> While the contractor estimated diversion of restaurant grease in the Food Waste Loss Memorandum of May 2013, these estimates were not based on robust sources. Since previous investigations for these memoranda resulted in little information, the contractor continued the investigation for the amount of grease diverted from the solid waste stream by investigating a variety of industry groups as potential sources of data.

Table 3 shows the biofuel companies, waste oil recyclers, renderer and restaurant associations contacted. Waste oil recycling companies collect used fat, oil, and grease from restaurants and institutions for ultimate recycling into biofuel or yellow grease through rendering.

**Table 3. Waste Grease Contacts**

<b>Organization</b>	<b>Description</b>
National Restaurant Association	Restaurant industry group
National Renderers Association	Rendering industry group
Quest Recycling Services	Waste oil recycling company
Mendota Agri-Products/ Mahoney Environmental	Waste oil recycling company
Waste Oil Recyclers	Waste oil recycling company
The Energy Co-op	Previous owner of Black Gold Biofuels which recycled restaurant grease into fuel
Yokayo Biofuels	Biofuel company that recycles restaurant grease into fuel

While quantifications of waste grease are not readily available, the contractor was able to estimate the amount of waste grease diverted from the municipal solid waste stream with data provided by Yokayo Biofuels and the National Renderers Association (NRA):

- Yokayo Biofuels provided a restaurant grease generation rate of 1 gal/person/year (7.5 lbs/person/year).<sup>19</sup> This value is similar to the previously estimated restaurant grease diversion of 7.8 lbs/person/year used in the previous food loss scoping analysis. The value used in the scoping analysis was derived from an NRA estimate of collected restaurant grease in 2010. The number provided by Yokayo was from an unidentified EPA source.
- The NRA provided their 2011 Industry Profile which had both a quantification of the amount of grease collected by the rendering industry (Table 4) and an estimate of the total amount of waste grease produced by the restaurant industry as a whole.<sup>20</sup> Table 4 also includes an estimate of

<sup>17</sup> <http://www.calrecycle.ca.gov/Organics/Food/Rendering/>

<sup>18</sup> <http://www.nationalrenderers.org/about/process/>

<sup>19</sup> Personal correspondence with Yokayo Biofuels.

<sup>20</sup> A Profile of the North American Rendering Industry. Prepared for: The National Renderers Association. March 2011.

diversion in lbs/person/year which is comparable to the 7.8 lbs/person/year used in the previous food loss scoping analysis.

**Table 4. Restaurant Grease Collected for Rendering**

Year	Restaurant Grease Collected by Renderers	
	(billion lbs)	(lbs/person/year)
2005	2.643	8.94
2008	2.494	8.20
2010	2.408	7.78

The NRA developed an estimate of the total waste grease generation of restaurants using industry estimates of cooking oil use and the 2007 Economic Census Data reports of 211,313 fast food and 220,089 full service restaurants in the US. Using this estimate of 4.69 billion pounds of restaurant grease generation and the 2008 volume of restaurant grease collected by renderers, the NRA estimated that 53 percent of this waste is collected by renderers.

By applying this estimate of 53 percent to the NRA’s amount of restaurant grease collected by renderers as shown in Table 4 and extrapolating to the rest of the time series, the contractor was able to create the time series shown in Table 5. The 2010 value is similar to the previously estimated consumer waste grease value of 14.2 lbs/person/year used in the 2013 food loss scoping analysis.<sup>21</sup> The contractor did not identify any data sources to estimate how the remaining 47 percent of restaurant grease is disposed.

**Table 5. Total Restaurant Grease Generated Annually**

Year	Annual US Restaurant Grease Generation		Restaurant Grease Collected by Renderers	
	(billion lbs)	(lbs/person/year)	(billion lbs)	(lbs/person/year)
2000	5.468	19.379	2.898	10.271
2001	5.379	18.875	2.851	10.004
2002	5.290	18.391	2.804	9.747
2003	5.201	17.927	2.756	9.501
2004	5.112	17.458	2.709	9.253
2005	4.987	16.875	2.643	8.944
2006	4.934	16.535	2.615	8.763
2007	4.845	16.082	2.568	8.524
2008	4.706	15.474	2.494	8.201
2009	4.666	15.211	2.473	8.062
2010	4.543	14.688	2.408	7.785

#### IV. PREVENTABLE VERSUS NON-EDIBLE FOOD WASTE

The contractor estimated the ratio of preventable to non-edible food waste in the US. This value is represented by the “Consumer Loss: Nonedible” and “Consumer Loss: Other” categories in the USDA’s loss-adjusted food availability data spreadsheets.<sup>22</sup> The nonedible share of food is part that is not typically consumed, such as chicken bones or apple cores. The “other” consumer loss includes the remainder of the losses at the consumer level. This includes plate waste, spoilage, and cooking loss.

The amount of preventable food waste was consistently larger than that of non-edible food waste. In the case of dairy, fat, and sweetener, all consumer food waste would be classified as preventable. Table 6 shows the average ratio of non-edible to preventable food waste across all years of the USDA data (1970-2010). As the table demonstrates, for the fruit category, the ratio is almost 0.95. This value was calculated by dividing the non-edible consumer waste average (28.2 lbs/person/year) by the average preventable waste (29.8 lbs/person/year).

<sup>21</sup>2012 WA Task 11 Food Waste Loss and Donation Memorandum May 21, 2013

<sup>22</sup> 2012 WA Task 11 Combined MSW Food Waste Spreadsheet, May 2013.

**Table 6. Ratio of Non-edible to Preventable Consumer Food Waste**

Category	Average Ratio of Non-edible to Preventable Food Waste
Fruit	0.949
Vegetables	0.384
Meat	0.076
Grain	0.032
Dairy	NA
Fats and Oils (added)	NA
Sugar and sweeteners (added)	NA

NA: All food waste in this category is preventable.

The estimated ratios in Table 4 are for consumer level food waste only. A potential next step would be to estimate the preventable and non-edible food loss at the primary to retail and retail to consumer levels. These estimates could possibly developed by using the USDA loss-adjusted food availability spreadsheet for each category, and finding data or developing estimates using best professional judgment to determine the ratio of non-edible to preventable food waste. However, developing these estimates would require additional resources.

#### IV. SUMMARY

EPA's May 2013 Food Waste Loss and Donation Scoping Analysis compared the USDA national food loss data to the EPA food waste estimate.<sup>23</sup> This comparison is presented below, revised with the new estimates of grease and animal feed outlined in sections II and III in this scoping analysis.

**Table 7. USDA National Food Loss and EPA National Food Waste Comparison, 2010**

2010	USDA Food Loss <sup>(1)</sup>		EPA Food Waste <sup>(2)</sup>
	(lb/person/yr)	(1,000 tons)	(1,000 tons)
<b>MSW Food Loss to the Solid Waste System</b>			
Retail Loss	102.7	15,880	--
Consumer Loss <sup>(3)</sup>	217.2	33,590	--
<i>Subtotal MSW Food Loss</i>	<i>319.9</i>	<i>49,470</i>	<i>--</i>
<b>Food Loss Diversion</b>			
Food Donations <sup>(4)</sup>	-1.9	-290	--
Food to Animal Feed Retail <sup>(5)</sup>	0.75	-120	--
Food to Animal Feed Consumer	NA	NA	--
Food to Industrial Uses <sup>(6)</sup>	-6.2	-960	--
<i>Total MSW Food Loss to the Solid Waste System</i>	<i>311.8</i>	<i>48,100</i>	<i>35,740</i>
<b>MSW Food Loss to the Sewer System</b>			
Retail Loss to Sewer System	NA	NA	--
Consumer Loss to Sewer System	53.8	8,320	--
Liquid Product Loss <sup>(7)</sup>	135.4	20,930	--
<b>Non-MSW Food Loss</b>			
Consumer Waste Grease <sup>(3)</sup>	14.7	2,270	--
Waste Grease Diversion <sup>(8)</sup>	-7.8	-1,200	--
Industrial Processing Loss <sup>(9)</sup>	227	35,110	--
<b>Total Food Loss after Diversion</b>	<b>734.3</b>	<b>113,530</b>	<b>--</b>

(1) Contractor analysis of data from: U.S. Department of Agriculture. Economic Research Service Loss-Adjusted Food Availability Data. Downloaded March 2013. Includes field losses.

<sup>23</sup> U.S. EPA. *Municipal Solid Waste in the United States: 2011 Facts and Figures*.

- (2) U.S. EPA. *Municipal Solid Waste in the United States: 2011 Facts and Figures*. Does not include upstream diversion activities, food waste managed through the sewer system, or non-MSW food loss.
- (3) Consumer Waste Grease is primarily restaurant grease and is equivalent to USDA Other Consumer Loss for added fats and oils.
- (4) Food donations do not distinguish between solid and liquid product donations.
- (5) Retail level food loss to animal feed from Table 2 converted to 1,000 tons. Consumer food loss to animal feed is not available. USDA food loss data excludes food grown for animal feed from the primary weight level.
- (6) National Renderers Association. Spoiled and outdated meat and seafood products from grocery stores recovered for rendering estimated at 1.92 billion pounds in 2010.
- (7) Liquid Product loss from Retail, Consumer, and Industrial loss levels.
- (8) National Renderers Association, Collected yellow grease is estimated to be 2.4 billion pounds in 2010.
- (9) USDA industrial process food loss data are available for meat, fruit, and vegetables; other products are not available.