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Final Report

Portland Metropolitan Industrial Food Waste Study Report

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Prepared by:
Martin Lott
Strategic Energy Group
&
Research Into Action

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Abstract

This study estimates that 105,000 tons of industrial food waste is generated in the Portland metropolitan region each year. This finding is the product of 27 Portland-area interviews and employment-based projections for 105 food processing firms. The majority of this waste is post-processing and generated by a small number of large fruit & vegetable processors. By volume, most is disposed as animal feed, compost, or mixed with large volumes of water in municipal wastewater systems. Unprocessed, or *Raw Ingredient Waste*, on the other hand, constitutes 20% of area food waste and is disposed separately as animal feed or compost. Food processors are generally open to participating in further studies, despite rarely being motivated by environmental concerns or waste disposal costs.

1. Introduction

In 2008, the US EPA estimated that food waste is the third largest waste stream after paper and yard waste. Nationally, 31 million tons are thrown into landfills or incinerators, while the amount disposed through wastewater systems is unknown.

The Portland metropolitan region, consisting of Multnomah, Clackamas, and Washington Counties in Oregon, disposes of over 270,000 tons of food waste and non-recyclable paper per year from residential and commercial sources through a number of channels. Diverting this material from direct landfill disposal would have environmental benefits through avoided greenhouse gas emissions associated with the decomposition of this material in landfills and from the conversion of this material into valuable products such as methane for power generation and compost for land application.

While a significant amount is known about residential and commercial food waste generation and disposal, little is known about the industrial sector's food waste types, quantities and management practices. To address this gap in information, Energy Trust and Metro have funded this study to begin to document the magnitude, type and availability of industrial food waste generated within the Portland metropolitan area.

2. Background

Over the past two years there has been a growing interest in making more beneficial use of food waste from the commercial, residential and industrial sectors. This interest has been driven by regulatory support for the development of renewable energy and programs aimed at diverting the organic fraction of municipal solid waste from landfills.

Prior to this study, anecdotal evidence suggested the volume of food waste from the industrial sector in the Metro region might support the establishment or expansion of composting facilities in the region as well as represent a key feedstock to support the development of biogas plants for the generation of renewable electrical energy.

The size and importance of the food processing industry supports this focused study. The Metro Regional Government estimated the Portland region is home to over 105 food processors out of the 530 reported for all of Oregon by the Northwest Food Processors Association (NWFPA). Furthermore, the NWFPA attributes 23,000 jobs and $6.1 billion in state revenue through this third largest Oregon industry. The food processing industry also holds the mantle of the second largest consumer of regional electrical energy, after the pulp and paper industry.

The potential environmental and business benefits of documenting industrial food waste include:

1. Documenting a key feedstock to support the development of composting facilities that provide benefits that include reduction in greenhouse gas emissions, returning nutrients to the soil and reducing the need for chemical fertilizers and water use.
2. Documenting a key feedstock to support the development of biogas plants that could produce renewable energy through the expansion of existing facilities at wastewater treatment plants or new plants sited at food processors or agricultural businesses.
3. Reduce disposal costs for area food processors.

3. Scope

The accepted definition of food waste used in this study is *any food substance, raw or cooked, which is discarded, or intended or required to be discarded. Food wastes are the organic residues generated by the handling, storage, sale, preparation, cooking, and serving of foods*[1]. This study considers only the food wastes generated at industrial-scale food processors, and does not consider commercial (e.g. restaurant & grocery) and residential food waste.

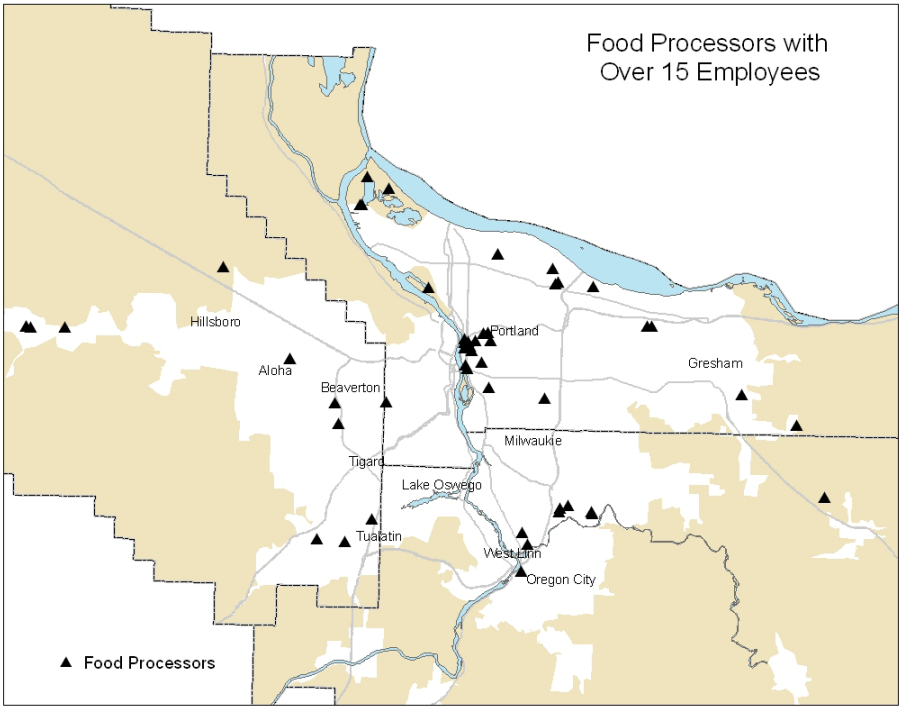
[1] Estimating and Addressing America's Food Losses. Kantor, Linda Scott. USDA. 1997

Objective – Conduct a field study to determine the following:

1. The volume of food waste
2. The category of food waste (e.g. packaging, raw food, processed waste, oils, water, etc.)
3. Current methods of disposal (e.g. sewer, municipal landfill, animal feed, composting, etc.)
4. Cost of disposal and considered alternatives
5. If there is onsite treatment
6. Waste volume forecast over five years
7. Other waste and sustainability practices
8. Past efforts to study onsite power generation or alternate food waste disposal methods
9. Interest in receiving assessment of food waste energy potential scoping results
10. Value to the company in fostering sustainable business practices for their customers and their own goals
11. Interest in onsite power generation vs. supporting a community digester and generation approach

Target Market: Industrial food processors with more than 15 employees (see Figure 1)
Geographic Area: Portland-metro region (Washington, Clackamas, and Multnomah counties)
Excluded: Breweries, wineries, warehouses, and distribution centers

Figure 1 – Map of Targeted Food Processors in Portland Metro Area



4. Methodology

Literature Review: A literature review was conducted in preparation for the field study and analysis.

Population Sample: The Portland Metro Regional Government provided a confidential list of 105 area food processors. Of these, approximately 54 were identified as study targets. Only food processors with at least 15 employees were considered as it was assumed that employment would indicate waste volume. Contact information was provided through existing relationships, be they through the study contractors, Energy Trust of Oregon, Northwest Food Processors Association, Dunn & Bradstreet databases, or, as a last resort, through cold calls. During the calling process, seven of the 54 contacts were identified as duplicates, out of business, not applicable, or otherwise ineligible. At the conclusion of the study, 27 food processors were interviewed.

Field study: The market strategy segmented the target population of food processors into three groups:

1. Northwest Food Processors Association members;
2. Energy Trust of Oregon past program participants; and
3. Other food processors.

Communications were tailored to leverage past relationship wherever possible. This was done in an attempt to maximize participation. Telephone interviews were scheduled after each participant was mailed an introduction letter and given the opportunity to enter into a nondisclosure agreement.

Telephone interviews were the primary method of collecting field data and were conducted between November 2009 and January 2010. The interviewers used a survey instrument designed to cover the study's objectives and standardize responses. The telephone interviews were then supplemented by written requests for waste tracking data and selected site walkthroughs.

The survey instrument assumed that industrial food waste can be divided into four main categories:

1. Raw Ingredient Waste – waste produced before processing
2. Processed Food Waste – waste produced after processing
3. Fat, Oils, and Grease (FOG)
4. Wastewater – water indirectly involved in food processing (e.g. rinse water)

Once the field work was complete, it was apparent that FOG was a subset of Processed Food Waste, and two additional subcategories were required:

1. Solid Waste, and
2. Watery waste
3. Fat, Oil, and Grease (FOG)

Quality assurance for the telephone surveys was maintained by performing a series of in-person surveys during plant walkthroughs. Data previously collected in the telephone interviews were confirmed and additional qualitative data was collected. Additional quality control was conducted on the data itself to ensure the study objectives were being met or to identify the need for different market tactics.

Meta Analysis: During the course of the study it was determined that Oregon Department of Environmental Quality (DEQ) maintains solid and wastewater data on permitted facilities. Of the target population, approximately half are permitted by DEQ. The data provided by DEQ provided an independent point of comparison to the self-reported data garnered in the telephone interviews, thereby providing a better assessment of the quality of all data collected.

5. Analysis

The analysis is based on the data collected from interviews, site walkthroughs, and DEQ wastewater records. These data provide direct insights into waste types, volumes, and other operational activities. Indirect insights are inferred through cross tabulation comparisons of observations.

Respondents were asked if they had conducted a waste stream evaluation in the past two years, as a broad indicator of their propensity to manage and track waste streams. This indicator suggests that approximately 70% do not actively manage and track their waste stream. Moreover, even when pressed, none of the 30% who reported actively managing their waste streams provided their reports to this study. However, there was one processor that did closely track their waste streams over time and could provide some historical data about their waste stream over the phone. Even this facility was unwilling to provide written reports or raw data about this waste.

This suggests 1) the proportion of plants that do not track and manage their waste is greater than 70%, or 2) the information contained in the reports is sensitive. Sensitivity of waste data can be driven by concerns of regulatory action, competitive pressures, and/or brand sensitivities. These and other sensitivities may be a reason that 20 of the 47 targeted subjects chose not to participate. However those that did participate represented a wide breadth of market segments, operating conditions, and waste challenges.

Food Processors Targeted and Sampled

The Portland-metro region has approximately 105 food processors. As noted above, 54 of these with over 15 employees were targeted for this study and 47 were deemed eligible for inclusion. The three largest food processing categories by employment are:

1. Other Food Manufacturing,
2. Grocery and Related Product Wholesalers, and
3. Fresh Fruit and Vegetable Merchant Wholesalers.

Table 1 below summarizes the overall market and the study sample by North American Industrial Classification System (NAICS).

Table 1 – Total Market to Sample Representation

		Total Market		Study Sample	
NAICS	Description	Count	Percent	Count	Percent
3111	Animal Food Manufacturing	7	7%		
3112	Grain and Oilseed Milling	1	1%	1	4%
3114	Fresh Fruit and Vegetable Merchant Wholesalers	18	17%	6	22%
3115	Dairy Product Manufacturing	10	10%	7	26%
3117	Seafood Product Preparation and Packaging	3	3%	1	4%
3119	Other Food Manufacturing	28	27%	5	19%
3121	Beverage Manufacturing	4	4%	1	4%
4244	Grocery and Related Product Wholesalers	34	32%	6	22%
	Total	**105**		**27**	

The sampling strategy of this study was designed to be as representative of the total food processing population as possible, while specifically targeting those with high expected waste volumes. While the sample is largely representative, Dairy Product Manufacturing is over represented but underreported. This was caused by higher participation rate among Dairy Product Manufacturing than expected, but with few sharing waste data.

Sample Data

The sample strategy and the survey questions were designed to supply discrete data points that, when analyzed, would provide insights about the industry as a whole. If the data collected is representative of the industry, then precise estimates can be made of total waste loads by market segment. Unfortunately respondents were not able to answer all of questions posed, and holes appeared in the underlying data. These holes limit the breadth and accuracy of the industry estimates. However, the data was sufficient to support most of the study's objectives.

Table 2 shows a summary of data collected and not collected. "NP" designates data the was Not Provided.

Table 2 – Summary of Raw Data (NP=Not Provided by the participant)

NAICS	Total Waste Volume (tons/yr)	Packaging (tons)	Raw Food Ingredients (tons)	Processed Food Waste	Oils	Water	Primary Method of Disposal	Cost of Disposal (% of variable costs)	No. of Employees	Total Waste Intensity (tons/emp)
3112	NP	NP	NP	NP	NP	NP	NP	NP	unknown	-
3114	468	NP	468	NP	NP	NP	NP	NP	136	3.441
3114	60	NP	60	NP	NP	111,280	Landfill	0.5%	164	0.366
3114	134	NP	NP	108	NP	NP	NP	NP	69	1.942
3114	7,229	NP	113	7,116	NP	NP	Animal Feed	0.5%	26	278.019
3114	675	NP	450	NP	NP	NP	NP	0.5%	92	7.337
3114	35	NP	NP	NP	NP	NP	Landfill	0.5%	18	1.964
3115	585	NP	NP	350	NP	NP	NP	0.5%	121	4.835
3115	NP	NP	NP	NP	NP	NP	Sewer	NP	173	-
3115	10	NP	10	NP	NP	NP	Sewer	1.5%	22	0.455
3115	416	1.600	NP	NP	NP	191,154	Sewer	1.0%	260	1.600
3115	NP	NP	NP	NP	NP	NP	Sewer	NP	90	-
3115	NP	NP	NP	NP	NP	NP	NP	0.5%	41	-
3115	NP	NP	NP	NP	NP	NP	Sewer	2.0%	67	-
3117	156	NP	NP	NP	NP	NP	Landfill	0.5%	16	9.750
3119	273	NP	NP	NP	NP	NP	NP	0.5%	16	17.063
3119	1,750	NP	NP	1,500	NP	192,105	NP	2.5%	57	30.702
3119	18	NP	NP	18	NP	NP	Animal Feed	2.5%	883	0.020
3119	2.6	NP	NP	NP	NP	NP	Landfill	2.5%	18	0.144
3119	NP	NP	NP	NP	NP	NP	Sewer	NP	31	-
3121	NP	NP	NP	NP	NP	39,360	Sewer	3.0%	50	-
4244	812.5	NP	16	NP	NP	NP	NP	0.5%	86	9.448
4244	NP	NP	NP	NP	NP	NP	NP	1.5%	19	-
4244	225	NP	225	NP	NP	NP	NP	0.5%	81	2.778
4244	90	NP	NP	NP	NP	NP	NP	0.5%	291	0.309
4244	2.4	NP	.480	NP	NP	NP	Landfill	0.5%	66	0.036
4244	10,500	NP	10,500	NP	NP	NP	Animal Feed	0.5%	513	20.468

Table 2 reveals several important findings. First, a small number of food processors produces the bulk of all waste. Second, Total Waste Volume is known to food processors, if even its constituent waste volumes are not. Third, Raw Food Ingredient Waste volumes are reported more often than Processed Food Waste volumes. For these reasons, it was determined the estimation technique required methods for correcting for the disproportionate food waste producers, and to compensate for the small amount of Processed Food Waste data.

Since it has been observed that waste volumes are generally consistent within market segments on a per employee basis, the decision was made to normalize all waste volumes by the number of employees at each facility. The total market load could then be estimated by multiplying the total number of people the market employs by the *waste intensity* (the average tons of waste divided by the number of employees at the representing facilities).

Table 3 shows the average waste volumes, the number of people employed, and the waste intensity for each market segment.

Table 3– Market Segment Waste Intensity

NAICS	Sample Waste (tons)	Sample Employed	Average Waste Tons/Employee
3114	8,601	505	17.0
3115	1,011	403	2.5
3117	156	16	9.8
3119	2,026	91	22.3
4244	11,630	1,037	11.2

While the employee method for normalizing the data solved the 'lumpy' data issue, there remained the problem of too little Processed Food Waste data. Estimates based on the limited data available produced unacceptable ranges of uncertainty. However, since Total Food Waste is well represented, and it stands to reason that Processed Food Waste is the net of Total Food Waste and Raw Food Ingredient Waste, the decision was made to use this indirect method for estimating the Raw Food Waste load.

Waste Load Estimates

While it's difficult to estimate market loads on a small data sample further limited by holes and inconsistencies, two minor assumptions about waste intensity and composition (see the Sampled Data section for more discussion) make market estimates possible.

As is shown in Table 4, the total market waste loads are broken out by Raw Food ingredient Waste, Processed Food Waste, and Total Food Waste.

Table 4 – Waste Volumes by Type

	Raw Food Ingredient Waste	Processed Food Waste[2]	Total Food Waste
Average Tons/Employee	4.0	17	21.0
Total Market Load (tons)	21,000	84,000	105,000

Estimating the distribution across market segments was also limited by sample size. While accurate loads for each market segment could not be determined, the segments can be ranked by relative load (See Table 5).

Table 5 – Ranking of Market Segments by Gross Waste Load

NAICS	Description	Rank
3119	Other Food Manufacturing	1
4244	Grocery and Related Product Wholesalers	2
3114	Fresh Fruit and Vegetable Merchant Wholesalers	3
3115	Dairy Product Manufacturing	4
3121	Beverage Manufacturing	5
3117	Seafood Product Preparation and Packaging	6
3112	Grain and Oilseed Milling	(unknown)

The distribution of waste across market segments is far from even. Three of the food processors sampled produce nearly 80% of the waste and 20% of the total employment. They represent NAICS 3114, Fresh Fruit & Vegetable Merchant Wholesalers and Grocery & Related Product Wholesalers. Their volumes are sufficiently large that they skew the waste load estimates in Table 4.

By volume, water is the largest waste stream food processors produce. This study found that water is utilized in two ways: as a rinse and as a primary ingredient. Rinse water is often flushed directly into municipal waste water systems with little to no treatment. This study attempted to collect rinse water waste loads separately, but was unable to estimate total market load due to the small sample size. While an estimate of total consumption could not be derived from 4 data points, it is clear the volume is very large (three of the four food processors reported using in excess of 100,000,000 gallons per year). Watery processed waste is discussed in greater detail in the Waste Mix section.

[2] Processed Food Waste is represented by a small subsample with high variance. For greater accuracy, this study calculated the Processed Food Waste load as the net of Total Food Waste and Raw Ingredient Waste. This assumes that the portion of Total Food Waste that is not Raw Ingredient Waste is all Processed Food Waste. See the Sample Data section for more discussion.

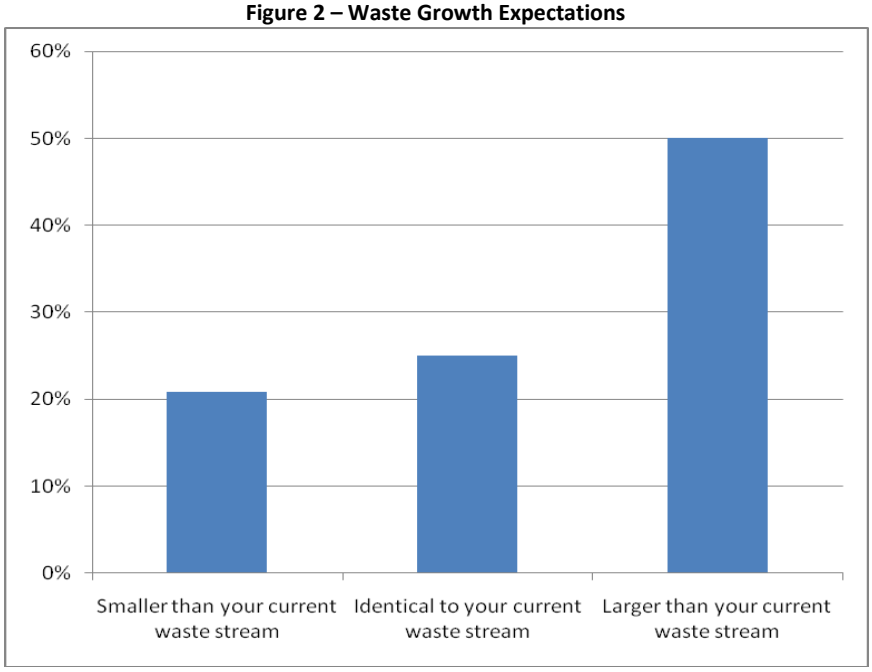
Not including water, this study found a considerable variance in the rate of raw material utilization or *shrinkage* of each market segment as shown in Table 6. Fresh Fruit and Vegetable Merchant Wholesalers produce the most waste as a percentage of the volume of their raw materials.

Table 6 – The Average Percent Shrinkage of Raw Materials to Finished Products

NAICS	Description	% Shrinkage
3117	Seafood Product Preparation and Packaging	30%
3114	Fresh Fruit and Vegetable Merchant Wholesalers	18%
3119	Other Food Manufacturing	8%
4244	Grocery and Related Product Wholesalers	7%
3121	Beverage Manufacturing	3%
3115	Dairy Product Manufacturing	2%
3112	Grain and Oilseed Milling	(unknown)

When food processors were asked if they expect their waste volumes to increase, decrease, or stay the same, a majority expected an increase (See Figure 2). The increase is driven by expected growth in sales and production. The four chosen for site verification expect their waste load to grow by 5% over the next 5 years, depending on the state of the economy. Unfortunately, the data were not detailed enough to support forecasts by market segment.

Figure 2 – Waste Growth Expectations



Waste Mix

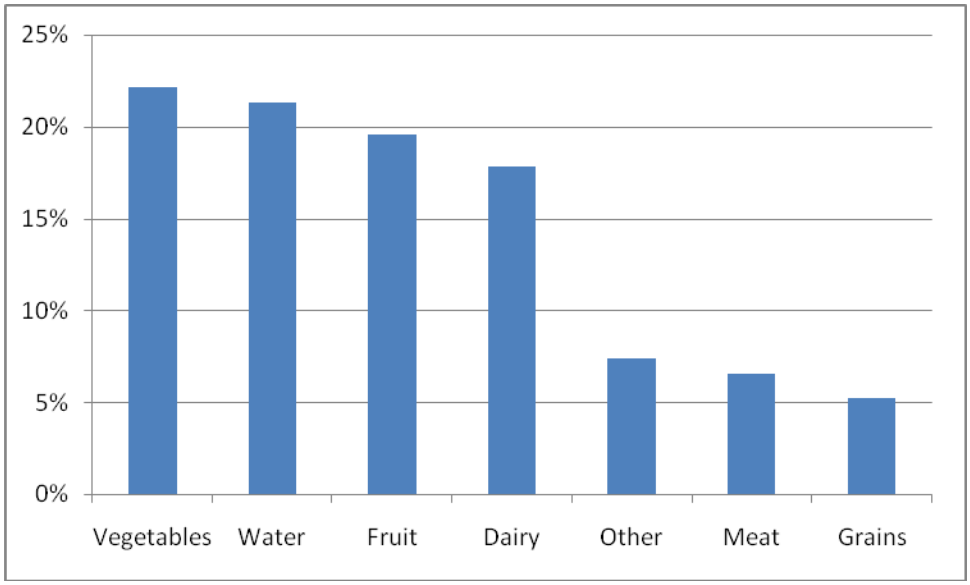
This study grouped waste into three categories:

1. Raw Ingredient Waste – waste produced before processing
2. Processed Food Waste – waste produced after processing
3. Wastewater

Raw Food Ingredient Waste

The Raw Food Ingredient Waste category accounts for 20% of all waste. It is chiefly comprised of vegetables, fruit, and water (see Figure 3). On-site observations suggest this waste stream is homogenous and disposed of in dedicated dumpsters and removed by waste haulers. In one instance, a food processor used one dumpster to dispose of defective fruit and vegetables and another dumpster to collect trimmings.

Figure 3 – Composition of Raw Food Ingredients Waste



Processed Food Waste

The Processed Food Waste category is divided into three types:

1. Solid Waste, and
2. Watery waste
3. Fat, Oil, and Grease (FOG)

While the proportion of each type is unknown, the study determined that Solid Processed Food Waste is often a mixture of fruit & vegetable materials and is disposed as animal feed or compost. In one case, a food processor of soy beans sells the waste as high protein animal feed. Watery Processed Food Waste, on the other hand, is often a heterogeneous mixture of organic material and water disposed through municipal wastewater systems. The composition of this waste stream will vary from plant to plant, or even day to day.

Unfortunately the study subjects were either unable or unwilling to report their volumes of FOG waste. There are two possible reasons for this: 1) subjects simply do not track FOG as a separate waste stream, or 2) the subjects were sensitive to potential regulatory action if it were disclosed. All DEQ permitted food processors must submit independent waste analysis reports to the Oregon Department of Environmental Quality (DEQ) or local regulator that includes FOG.

Analysis of Biochemical Oxygen Demand (BOD) concentrations tracked by DEQ suggests that FOG is a major waste stream for Fluid Milk Manufactures and for Fats & Oils Refining & Blending. It is well known that BOD disposal is a concern for Dairy Product Manufacturers, and while many Fluid Milk Manufacturers participated in the study, all declined to provide BOD data. Some dairies reported investing hundreds of thousands of dollars to treat their waste streams for BOD content. Furthermore, all dairies indicated they pay close attention to their waste water output to ensure they are within their permitting limits. The fact that they could be penalized for exceeding their permits may have been a factor in their unwillingness to share detailed data.

Methods of Disposal

As noted above, 80% of the waste has been processed, whereas the remaining 20% of the waste is raw food. By volume, most of the former is disposed as animal feed, compost, or through municipal wastewater systems, while the latter is almost exclusively destined for animal feed and compost. The food processors typically pay the hauling[3] expense with no payment from the farmers, except in cases where the feed has special nutritional value. Where animal feed markets are not available, some food processors send the waste to third-party composters. In any event, this report found that only small solid waste producers dispose of their waste in landfills. These producers commonly mix the food waste with organic and inorganic packaging.

Diverting the processed food waste from municipal wastewater systems would require collection equipment and operational changes not currently in place. However, all subjects were open to change if it sufficiently reduced the costs of disposal and permitting.

Waste Costs

Food waste disposal accounts for approximately 1% of total variable costs, as summarized in Table 7. Solid food waste for animal feed incurs only transportation costs. While a cost breakdown of each waste type was not ascertained, wastewater and animal feed hauling are likely the greatest waste cost-drivers. One respondent indicated he recently invested in an expensive system to reduce the amount of wet waste that was hauled from his facility in an attempt to lower transporting costs. This respondent estimated that his investment in the moisture removing equipment would be paid back is less than three years because of a reduction in hauling fees.

[3] Information on waste haulers was not collected. However, it is known that they are independent from the food processors and municipal services. Their size, service territory, and target markets are unknown.

Waste costs are not managed as closely as labor, energy, or raw materials. While shrinkage is a major cost concern, the management of waste materials is not. A plant manager characterized his waste reduction strategy as, "…go for the biggest most costly things first [such as labor or energy costs]." Waste costs are a relatively low priority when compared to other cost-drivers, with a possible exception of Dairy Product Manufacturing. However, participants representing this segment did not provide enough information to draw conclusions.

Table 7 – Average Food Waste Disposal Costs as a Percentage of Total Variable Operating Costs

Market Segment NAICS	Average Variable Waste Disposal Cost as a Percentage of Total Variable Cost
3114	0.50%
3115	1.00%
3117	0.50%
3119	1.83%
4244	0.50%

Permitting and compliance are not considered variable costs. The labor cost of compliance far exceeds permitting or third-party testing costs. In fact, permitting and compliance is viewed as a necessary inconvenience. One fresh fruit processor said his hauling costs can be as high as $13,000 per month while he pays only a few hundred dollars a year in permits.

Onsite Treatment

Onsite treatment is driven by wastewater permits. Food processors report installing sophisticated high-capacity wastewater treatment systems only after months or years of struggling to meet permit limits. In some cases, DEQ or the City of Portland had repeatedly levied substantial fees for exceeding permit levels.

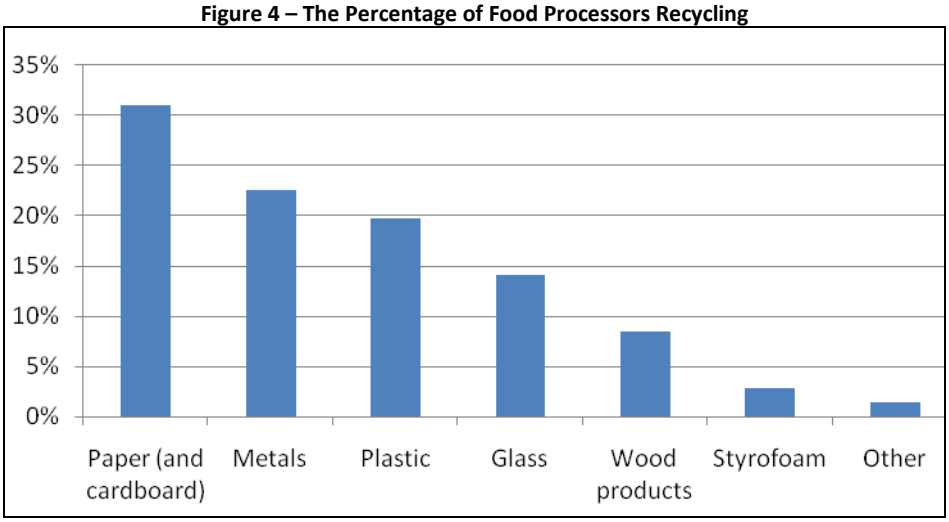
Approximately half of those interviewed reported doing some level of wastewater treatment. At the very least, pH balancing is performed before flushing collection tanks. For instance, before disposal from Fresh Fruit and Vegetable Merchant Wholesalers high volumes of low pH rinse water are neutralized.

A small number of food processors employ large dissolved air flotation and filtration (DAFF) systems to reduce BOD. These systems were reported most in the Milk Products Manufacturing market segment.

Other Sustainability Practices

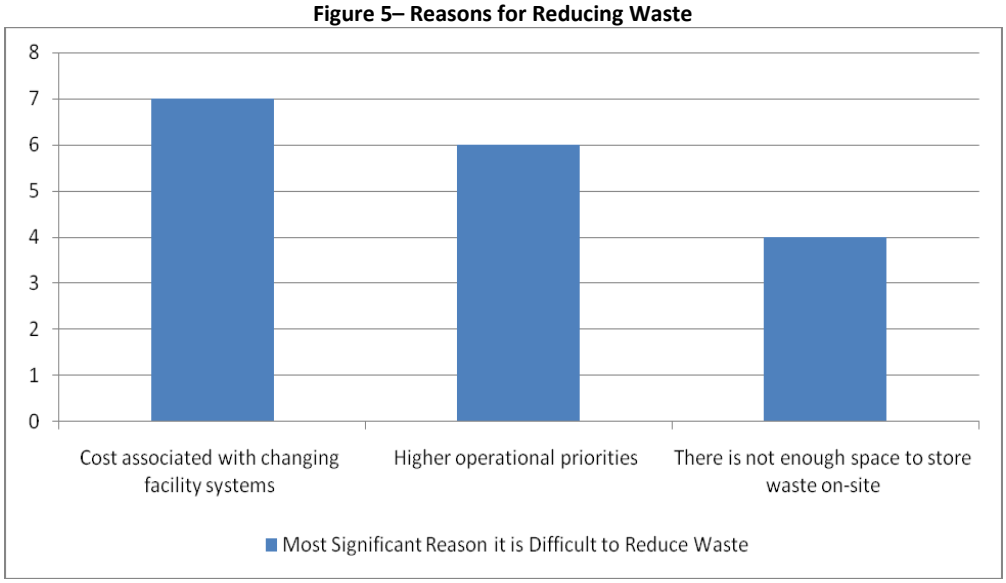
Ninety-two percent of food processors surveyed indicated they have active recycling programs. However, only one large food processor employed people specifically tasked with sustainability duties. Figure 4 provides a summary of their recycling practices.

Figure 4 – The Percentage of Food Processors Recycling



While recycling is an accepted practice, food processors do not actively work to reduce the volume of food waste; there is no single reason for this. Rather, it appears several barriers are working in concert. First, food processors have little incentive to reduce waste as it's only a tiny fraction of their operating costs. Second, treament options are capital intensive. Third, they are unaware of waste reduction best practices. When asked to identifty waste reduction barriers, seven stated the cost associated with changing facility systems, six stated they had higher operational priorities, and four stated there is not enough space on site to store waste (see Figure 5).

Figure 5– Reasons for Reducing Waste



However, these barriers may be coming down as nearly half reported their customers are beginning to inquire about how they dispose their waste. At least two respondents stated they recently changed their operations in some form to accommodate the waste reduction goals for one of their largest customers, a large national grocer.

Interest in Future Studies

Interest in future studies was not gauged during the interviews. However, the small number of site walkthroughs suggested an interest in future studies. In each case they were open to additional studies that may help to control their costs.

Onsite vs. Community Digesters

Subjects' preference for the digester locations was not asked during the interviews. However, anecdotal evidence suggests that those with adequate room are open to having a digester located at their facility. The food processors with limited space prefer an offsite or community digester.

Centralized digesters may not be ideal for the larger waste producers as they are fairly uniformly distributed throughout the Portland-metro area. Approximately half of these facilities appear to have adequate room for an onsite digester. The remaining food processors would likely require hauling the waste to centralized digesters.

6. Conclusions

Summary

This study estimates that 105,000 tons of food waste is disposed in the Portland region each year by industrial food processors. The food waste can be broken down into Raw and Processed wastes. Raw Ingredient Waste accounts for 20% of all waste. Processed wastes are broken down further into solid and watery waste streams. While the watery waste is likely best treated by wastewater treatment plants already in place, the Solid Processed and Raw wastes could be opportunities for bio-digestion. This waste is chiefly comprised of fruit and vegetable matter either as whole fruit, trimmings, or finely processed material. The waste is generally homogenous, consistent, and disposed separately from other wastes. The market segments producing the vast majority of this waste are Fresh Fruit & Vegetable Merchant Wholesalers and Grocery & Related Product Wholesalers. Within these segments are three food processors producing 80% of the waste load identified in this study. As large has these waste streams are, the largest waste-related cost, waste hauling, accounts for less than 1% of all variable costs. Therefore, waste management, tracking, and reduction are low priorities for food processors, even as customers are increasingly asking about their waste practices.

Recommendations for Further Study

The following recommendations are made with the assumption that follow-up studies will be conducted to refine the conclusions of this study.

1. The immediate opportunities for bio-digestion are in Raw Ingredient Waste at the largest producers. Additional studies should further refine the character of these waste streams and estimate the energy content of the waste streams.
2. Characterize the proportion of Solid Processed waste to Watery Processed Waste. The total Processed waste load accounts for 80% of the region's waste. The volume and composition of this waste will be critical as bio-digestion efforts expand.
3. Since most of the region's waste load is generated by a very small number of food processors, subsequent studies should attempt to reveal any additional large waste generators. This may include additional markets like brewing, wine making, and agricultural waste.
4. Characterize the economic impact of diverting large volumes of animal feed away from agriculture markets to fuel markets.
5. Design studies to specifically target Dairy Product Manufacturing. This market segment was unwilling or unable to share detailed data. Regulatory data suggests that they may have large wastewater and 'sludge' loads. Strategies for overcoming these barriers may include more site visits and developing stronger relationships with executive management.

7. Appendix

Survey Instrument

My name is _____ I am calling on behalf of the Northwest Food Processors Association and the Energy Trust of Oregon. We are conducting a study of food waste in the Portland area, to learn what might be converted into energy. You may have already received a letter sent on [date] by the NWPFA introducing the study.

By collaborating with The Portland Area Regional Food Waste Study, you have the potential to

1. Receive a competitive advantage by reducing disposal cost;
2. Generate revenue or supplement natural gas usage from digester methane production; and
3. Include your involvement in your environmental marketing statements

This interview should take about 15-20 minutes and the information you provide us with will be kept strictly confidential.

Specifically, we would like to discuss the following.

1. Your top five raw ingredients;
2. How is waste disposed;
3. How/if you treat wastewater on site;
4. Your waste volumes;
5. Pressures to reduce the amount of waste ;
6. The barriers to reducing waste;
7. Sustainability planning; and
8. If your company has studied the issue?

We would like to meet with you between the weeks of ___ and ___ to conduct the survey on site and discuss the possibilities of turning your waste into an asset.

Portland Area Regional Food Waste Study

Site Inventory

1. Has your company conducted a waste stream evaluation in the past two years? (Q3)
    a. Yes [Go to Q2]
    b. No [Go to Q3]
    c. DK [Go to Q3]

2. If yes, Can we have a copy of the waste stream evaluation report? (Q4)
    a. Yes
    b. No
    c. DK

3. Please rate the following waste disposal issues at your facility on a scale of 1-5 with 1 indicating this is an **insignificant** issue for your company and 5 indicating this is a **significant** issue. (Q5_A)

	Insignificant ---------- Significant Don't know					
a. Increased waste hauling costs	1	2	3	4	5	DK
				N/A		
b. Disposal depot volume limits	1	2	3	4	5	DK
				N/A		
c. Disposal permit requirements	1	2	3	4	5	DK
				N/A		
d. Waste storage space (i.e. running out of space to store waste before it can be disposed of properly)	1	2	3	4	5	DK
				N/A		
e. Other, Please specify _____	1	2	3	4	5	DK
				N/A		

4. [If respondent selects 4 or 5 to Q3] Please describe the requirements to reduce your waste stream. (Q5_B)

5. Does your facility have a process in place to track disposed waste? (Q2)
    a. Yes (Go to Q6)
    b. No (Go to Q7)
    c. DK (Go to Q7)

6. If yes, what waste streams are tracked and how? (Q7)

7. What percent of your variable costs is waste disposal? (ask for an estimate if they cannot be precise and note that it is an estimate) (Q6A_B)
    a. _____%
    b. DK
    - estimate
    - precise

8. What are your **top five raw materials** in numerical order? I will read a list of possible ingredients, (Place a 1 next to largest ingredient, a 2 next to second largest ingredient, and so on with a 0 for any ingredient not used.) (Q9)
    a. _____Water
    b. _____Grains
    c. _____Fruit
    d. _____Vegetables
    e. _____Meat
    f. _____Dairy
    g. _____Other, please specify
    h. _____DK

9. What are the **top five components of your waste stream?** I will read a list of possible ingredients, (Place a 1 next to the largest ingredient, a 2 next to the second largest ingredient, and so on with a 0 for any ingredient not used.) (d-i) Now for each **of the top five, how often do you dispose** each waste stream – continuously, 1x/day, 2-3x/week, 1x/week, 1-2x/month, other? (Q8)

a. Waste Stream Component	b. Top Five Components (Q8A)	c. Volume disposed of each component ? (Q8B)	d-i. How often do you dispose of each waste? (Q8C)					
			d. Continuously throughout the day	e. 1 time per day	f. 2-3 times per week	g. 1 time per week	h. Monthly	i. Other, please specify (Q8D)
Packaging			❑	❑	❑	❑	❑	
Raw food ingredients			❑	❑	❑	❑	❑	
Processed Food waste			❑	❑	❑	❑	❑	
Oils			❑	❑	❑	❑	❑	
Water			❑	❑	❑	❑	❑	
Other, please specify			❑	❑	❑	❑	❑	
DK			❑	❑	❑	❑	❑	

10. Are there any waste products from your facility that are harder to deal with than other products? How are these products harder to deal with (probe: more expensive to dispose of, take up space, requires special permits)? (Q10)

11. For each of the top five, how is the waste stream mixed and concentrated during disposal? Probe: Is the waste separated by component or mixed with various kinds of waste? (Q27A)

Waste stream	Comments on how each waste stream is mixed and concentrated
Packaging	
Raw food ingredients	
Processed Food waste	
Oils	
Water	
Other, please specify	
DK	

12. What are the top five products made at your facility? (Q28A)	a. What do you estimate your loss to be on each item? (Q28B)	How is this waste disposed? (please select one per row) (Q28C)			
		b. Recycled	c. Trashed	d. Washed down sewer	e. Other, please specify (Q28D)
1.	%	❑	❑	❑	
2.	%	❑	❑	❑	
3.	%	❑	❑	❑	
4.	%	❑	❑	❑	
5.	%	❑	❑	❑	
DK		❑	❑	❑	

13. Do you have a wastewater treatment or pre-treatment operation on site? (Q11)
    a. Yes
    b. No
    c. DK

14. What are the primary items in your wastewater load? (Q29A)	a. Is there any seasonality to the wastewater volume or load for each item? (Q29B)	b. Please explain (Q29C)

1.	Yes	No	DK	
2.	Yes	No	DK	
3.	Yes	No	DK	
4.	Yes	No	DK	
5.	Yes	No	DK	

15. In five years do you expect your waste stream to be_____. (Q12)
    a. Identical to your current waste stream
    b. Smaller than your current waste stream
    c. Larger than your current waste stream
    d. Other, please specify
    e. DK

Site Practices:

16. Do you have a recycling program in place? (Q13)
    a. Yes [Go to Q17]
    b. No [Go to Q18]
    c. DK [Go to Q18]

17. If yes to Q16, What does your plant actively recycle? (Q14)
    a. Metals
    b. Glass
    c. Paper
    d. Plastic
    e. Wood products
    f. Styrofoam
    g. Other (specify)_____

Site Concerns:

18. I will read you a list of possible reasons it is difficult to reduce your waste, please rank in order from most significant (1) to least significant (4) (Q17)
    a. _____Cost associated with changing facility systems
    b. _____Higher operational priorities
    c. _____There is not enough space to store waste on-site
    d. _____Other, please specify_____

19. Does your plant follow any best practices for waste reduction? (Q19)
    a. Yes
    b. No
    c. DK

20. What are these? (Q15)

_____
_____
_____

21. What do you consider to be the ideal waste reduction strategies for your type of plant? (Q16)

_____
_____
_____

22. Have you had any inquires from customers about your waste management practices? (Q21)
    a. Yes
    b. No
    c. DK

23. If yes, please describe how often and what type of inquiries. (Q22)

24. Is there a particular type of sewer waste at your plant that makes it difficult to meet permit limits? (Q19)
    a. Yes (Go to Q25)
    b. No (Go to Q26)
    c. DK (Go to Q26)

25. If yes, please explain. (Q20)

26. What wastewater components do you segregate prior to treatment?	a. What are the annual volumes? (Q23A)	b. How are these wastes disposed of? (Hauled to Land Fill, Recycled, Compost , Animal Feed, Land Applied, Other, please specify) (Q23B)
a.		
b.		
c.		
d.		
e.		

27. Are there specific products that your plant produces that generate higher demands on wastewater treatment? (Q24)
    a. Yes
    b. No
    c. DK

28. At what rate have your wastewater treatment costs been increasing or decreasing? (Q30)

_____%

Digester knowledge

29. Are you familiar with bio-digesters? (Q25)
    a. Yes
    b. No
    c. DK

Thanks for taking the time to speak with us today. Goodbye.

**********END OFSURVEY**********

Interviewer comments: (Q26)