

Oregon Wasted Food Study: Institutional and  
Commercial Sector Case Studies

**Case 15**

**Policies of abundance and overproduction of baked goods**



This report was prepared for  
**Oregon Department of Environmental Quality, Ashley Zanolli, Project Lead**

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# Introduction

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This is a report on the methods and results of one of 15 food service business case studies, as part of the institutional and commercial (IC) sector portion of the Oregon Wasted Food Study. This study is funded by the Oregon Department of Environmental Quality and conducted by Community Environmental Services (CES) at Portland State University.

The research objectives for the IC portion of this study are to:

- Understand components of wasted food in IC sector
- Highlight causes of commercial wasted food and key opportunities for waste prevention
- Test wasted food reduction best practices and quantify their effectiveness
- Promote wasted food reduction best practices for application at commercial food service institutions

## Focus of study

This study examines major types and causes of wasted food associated with small retail cafes and bakeries. It shows how expectations and policies of abundance cause significant wasted edible food, particularly overproduction of baked goods. **It is estimated that wasted pastries cost the business \$9,835 per year in food costs alone, and result in greenhouse gas impacts equivalent to consuming 520 gallons of gasoline.**

## Business context

The business participant in this case study is a retail cafe that is part of a chain that runs roughly 10 retail cafe locations across and beyond the Portland, OR Metropolitan area. It is part of a retail chain that is known for its sustainable practices and use of local ingredients. The retail location relies on a commissary kitchen that provides many of its retail items pre-prepared. The location receives baked items pre-prepared but frozen and freshly bakes these items for same-day sale on-site.

# Methods

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## Study design

The study was conducted over a 4 month period from February to May 2018. It involved a range of data collection and analytic components including employee interviews, waste assessments, and production and shrink data analysis. The intent of these analyses was to (1) identify types of wasted food and key causes of waste, and (2) document the impacts of corporate policies in supporting the wasting of food.

## Interviews

A total of four employees were interviewed for this study, including the store manager, a deli manager, the lead baker and the regional retail manager for the cafe chain. The interviews were conducted in three separate days from February to April 2018.

Employees were asked by researchers to voluntarily participate in brief interviews. Interviews were conducted with willing employees individually -- one employee interviewed at a time -- on-site, but in a private location. The regional retail manager was interviewed over the phone, however. Interviews were recorded and took between 15 to 30 minutes each. The interviews were semi-structured; standard interview questions were asked of each employee with additional questions asked that either responded to employee answers or pertained to their specific role.

## Waste assessments

Researchers conducted the on-site sort in February 2018, sorting all of the back-of-house food waste accumulated during a 24-hour period. Food scraps found were sorted and weighed according to the case study categories. Details can be found in the Appendix of this report.

## Bakery waste assessment

Four weeks of bakery production and leftover pastry data for this retail site was obtained and analyzed. Production data, in this context, refers to the number of pastries baked on-site (rather than ordered from the commissary kitchen). These represented four normal business weeks in April and early May 2018. This data was recorded daily by the lead baker and retail staff, and included product-level production amounts and records of when products sold out or what number of products were left at closing. In total, 31 different types of bakery items were made each week, including 27 standard items and 4 specials that varied each week. Daily averages, medians and standard deviation for baked items, unsold items and menu items that ran out were determined.

**This case study focused on analyzing company policies that promote or prevent the wasting of edible food, and complemented this analysis with a review of bakery production and waste data.**

Researchers discussed testing a few practices to promote waste prevention with corporate staff, including expanding repurposing opportunities and lowering bakery production on specific underperforming items, but staff said they would not pursue these practices at the time. They indicated that it was corporate policy to maintain consistency across stores, and that **piloting practices at a single store was not aligned with that policy**. Staff also declined to allow a robust product-level sales analysis that was intended to observe product-level sales trends and speak to the need for changes to point-of-sale (POS) system capacities.

# Results

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## Waste assessments

A total of 61.31 pounds of food waste was produced in the retail-location's back-of-house over the 24-hour period. Of this, 54.7% (33.51 pounds) was **inedible**, which was mainly coffee grounds (26.03 pounds or 78% of the inedible food waste). The highest category of wasted edible food was **baked goods**, representing 91.1% of edible foods, and mainly comprised of sliced artisanal breads, croissants, raw pastry and pizza dough. See, Table A2 in the Appendix, for full weights of all food categories.

# Interviews

## Sources and causes

### High quality standards

Three of the four employees interviewed said that the company's high quality standards were a significant cause of waste. While most of the sandwich counter product was produced at the commissary kitchen (except breads and bagels, which were produced at a commissary kitchen but baked on-site), meaning it was of high enough standard to serve, bakery products were more likely to be wasted due to quality issues. Generally, **quality issues for baked goods were aesthetic or cosmetic, or items were overcooked**, the baker said.

### Data

Interviews identified that the company measures wasted food using food costs as a proxy. They have a target to keep food costs down to 33% of revenue, which becomes, according to two of the interviewees, the stand-in for food waste. If that number is too high they work to reduce waste (generally by tightening PARs<sup>1</sup>). **The problem with this method, they said, is that food costs vary throughout the year because of seasonal price changes and menu changes.** Particular sets of specials, like those that utilize high-priced meats, make the stores' food cost jump, giving the false illusion that the store isn't meeting its waste prevention goals.

### Point of Sale (POS) system

Two staff members cited one key barrier to more accurate PARs (production) planning: inadequate point of sale (POS) capabilities. **The POS system the business uses does not allow employees to analyze product sales over time by a specific product. Rather, it only allows analysis of gross sales over time.** Finding average daily sales of particular products was impossible, without manually pulling daily or weekly sales records.

### Corporate policies

The company's generous food budget (at 33% of revenue) was understandable given the cafe purchases high-quality ingredients, many local and organic. However, the problem is that **by having a standard target based on cost, the company cannot account for variations in food costs and may hide waste and efficiency issues.**

Staff also said that **overproduction, particularly for the bakery, was planned and expected.** Staff said they generally hope to have most things left over towards the end of the day to **maintain a variety of products** for customers. According to one staff member, this is a fairly recent change in policy. "We used to aim for things to run out by the end of the day; now we're told to try and keep product on the racks," the employee said.

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<sup>1</sup> PARs, or periodic automatic renewals, are set production amounts that are generally set by management and followed by preparation staff. Some businesses have standard PARs across days or menu items, while others adjust their PARs according to anticipated customer demand.



## Existing prevention strategies

The cafe likely reduces wasted food by using a system of **daily orders and deliveries** from a central commissary. The cafe only tries to have, at most, two days' worth of product at any given time, reducing spoilage.

The baker used an **iterative PARs planning** process that included maintaining daily records of PARs set, actual product produced and products left at the end of the day. These records, kept as **weekly paper spreadsheets, were used to suggest edits for the next week's PARs, which although standardized by default, were adjusted according to the previous week's waste numbers.** The baker had a long history with the company and utilized it as an asset, remembering how certain school holidays, days of the week, or seasons affected sales.

## Bakery waste analysis

The results of the bakery production and unsold item records are highlighted here, but are provided in full detail in the Appendix. Major findings include:

### Overproduction is significant and consistent

Overproduction of bakery items was significant, averaging 17.96% of all products baked per day, or a total of 101.85 items per day. Overproduction was also found to be fairly consistent; **most of the time overproduction was between 13.62% and 22.30%.**

### PARs are increased over the week but still result in the same relative amount of unsold product

Interviewees suggested PARs were increased over the week to support higher sales volumes. Analysis of records show this to be true. **While sales went up as anticipated, the data suggests that the amount of unsold product increased proportionally.**

### Selling out occurred in all menu items, but the frequency varied significantly

On average, menu items sold out 28.92% of the time, but there was **significant variability across items.** The standard deviation was 11.86%.

### The cafe maintained product variety

On average, the cafe sold out of about a third (30.69%) of its menu items each day, though this too was variable (standard deviation was 10.24%). **On the highest sales day, the cafe sold out of 53.33% of product.**

One **significant outlier** both in terms of production and unsold product, was Friday, April 20, 2018 (April 20 is an informal holiday celebrating cannabis). The business anticipated higher-than-normal sales. The day had the highest production (at 760 items) and the highest amount of unsold product (at 196 items) of any over the 28-day study period. This day was removed from analysis as an outlier, but provides insights into planning for specials and holidays. In this instance, the cafe increased production of most items and ran a special on brownies (increasing PARs from 9 to 65 for the day). **While they sold most of the brownies,**

other items did not sell at the same high rate leading to more unsold product than any other day in the study period.

## Limitations

In the case of croissants, it can't be assumed that overproduced pastries were wasted as they are sometimes used to make twice-baked almond croissants. The weight estimate used for calculating costs of pastries by ingredient did not use actual weights of this cafe's pastry offerings, as these are proprietary.

# Conclusion and future directions

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## Key causes and barriers to prevention

### Corporate policies of abundance

Employee interviews, coupled with bakery production and waste records, show that corporate policies of abundance support significant amounts of waste generation. **Planned overproduction is the main driver of waste generation in this particular business.**

### Unclear waste goals

Employees discussed how the **use of food cost goals as a proxy for amounts of waste is unclear and misleading.** Food costs, they note, are seasonally variable. Using food costs as a metric to motivate waste reduction is an inadequate strategy. Rather, it can lead to fewer efforts to reduce waste if the store is reaching its food cost goals.

### Point of sale system not adequate for PAR planning

A barrier to more accurate PARs planning comes from the point of sale system's **inability to analyze product-level sales data.** The cafe's baker uses paper records and, at best, uses them to inform weekly PARs changes. **Long-term trends in specific product sales are therefore unavailable to the baker.**

## Bakery waste

Overproduction was abundant and fairly constant. This was supported by interview data which suggested overproduction was planned for. While adaptive PARs planning is indeed occurring, increasing PARs over the week to meet higher sales volume, it is not being utilized to reduce waste. Rather, it is supporting consistent overproduction.

The data suggests that 30% of menu items are selling out on average each day, but that many items rarely sell out and constantly have high amounts of unsold product left over. **Because sell out rates vary there is a clear opportunity for a targeted PARs reduction approach that could support less overproduction while minimizing impact on menu offerings.**

**It is estimated that wasted pastries cost this retail site \$9,835 per year in food costs alone. This does not account for the costs of labor or energy.** Preventing this waste would also avoid releasing 4.62 metric tons of carbon dioxide equivalents, or **the equivalent of consuming 520 gallons of gasoline.**

One interesting outlier was noted, a holiday on April 20 for which the cafe increased PARs. This outlier, and the increased amount of waste produced, speaks to the difficulty retail institutions face in planning for unpredictable demand for sales and holidays.<sup>2</sup>

**Corporate policies that mandate overproduction are the most significant cause of wasted edible food** at the retail cafe studied here. Overproduced pastries averaged 102 products per day, an average of 17.96% of pastries produced (25.46 pounds per day, or 9,192 pounds per year). Employees cited relatively recent changes to corporate policy as the cause of this overproduction, shifting expectations from running out at the end of the day to maintaining product offerings until closing. This policy is costing the business in terms of ingredients, labor, and environmental impact.

While the cafe increased PARs as the week progressed to match rising sales volume, the percentage of unsold product differed little, meaning a certain level of food loss is “baked in” or considered acceptable in the production system. **Reducing or eliminating this currently acceptable loss level presents the largest opportunity for this business.** Opportunity also exists by targeting PARs reductions. This would reduce waste while minimally impacting product availability as the frequencies of sell-outs across menu items varied significantly, with some items selling out less than 20% of the time. **This would, however, require a POS system that supports product-level sales analysis.**

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<sup>2</sup> For example, Taylor and Fearn, found that sales on meat were the largest cause of wasted product because they made demand unpredictable. See, Taylor, D. H., & Fearn, A. (2009). Demand management in fresh food value chains: a framework for analysis and improvement. *Supply Chain Management: An International Journal*, 14(5), 379-392.

# Appendix

## Waste collection and sorting

### Methods

Methods for this sort were the same as for other sorts, where a series of bins and buckets were used for collecting the wasted foods and weighed accordingly. Tare weights for the bins were recorded and subtracted to derive accurate weights of wasted foods. No follow-up sort was conducted for this site.

**Table A1: Waste sort categories and definitions**

	<b>Categories</b>	<b>Definitions</b>	<b>Examples</b>
<b>1</b>	Inedible	Items not intended for human consumption (small amounts of edible material associated with the inedible material are permitted to be included)	Egg shells, banana peels, pits/seeds, bones
<b>2</b>	Meat & Fish	Uncooked or cooked meat (with mostly edible components) unmixed with other types of food	Chicken drumstick, salmon fillet
<b>3</b>	Dairy	Solid dairy products unmixed with other food types or in original form	Cheese, yogurt
<b>4</b>	Eggs	Egg products unmixed with other food types or in original form	Fried egg, whole eggs, liquid egg whites
<b>5</b>	Fruits & Vegetables	Solid uncooked or cooked vegetables and fruits (with mostly edible components) unmixed with other types of food	Potatoes, spinach, berries, salad with only vegetables
<b>6</b>	Baked Goods	Baked goods and bread-like products unmixed with other food types or in original form, including pastries	Bread, tortillas, pastries
<b>7</b>	Dry Foods	Cooked or uncooked grains, pastas, legumes, nuts, or cereals unmixed with other food types or in original form	Rice, cereal, pasta
<b>8</b>	Snacks, Condiments, Sauces	Includes confections, processed snacks, condiments, and other miscellaneous items	Condiments, candy, granola bars, sauces, jellies
<b>9</b>	Liquids, Oils, Grease	Items that are liquid, including beverages	Sodas, milk, oil, juice
<b>10</b>	Cooked or Prepared Food	Items that have many food types mixed together as part of cooking or preparation	Lasagna, sandwiches, burritos
<b>11</b>	Unidentifiable	Used only if necessary	

Edited and used with permission of NRDC (Hoover, 2017)

## Results

**Table A2: Weight of food by category, back-of-house waste sort**

	<b>Weight (lb)</b>
Inedible	33.51
Meat & Fish	<.01
Dairy	0.65
Vegetables & Fruits	<.01
Baked Goods	25.33
Dry Foods (Grains, Pasta, Cereals)	<.01
Snacks, Condiments, Sauces	<.01
Liquids, Oils, Grease	<.01
Cooked, Prepared, Leftovers	1.82
Unidentifiable	<.01
<b>Edible wasted food (lb)</b>	<b>27.8</b>
<b>Edible wasted food (% of total food)</b>	<b>45.34%</b>
Total food scrap waste (lb)	61.31

## Bakery waste analysis

### Daily profile

28 days of data were analyzed in total, with records for 31 baked products each day. One day, April 20, was removed from analysis because it was a significant outlier. Both production and unsold waste was uncharacteristically high because of increased production for an April 20 cultural holiday.

The average number of pastries produced each day at this retail site was 565.67 (with a median of 571.0), and the average number of unsold pastries was 101.85 (with a median of 105.0). The average daily unsold pastries as a percent of total baked pastries was 17.96% (with a median of 17.86%). Finally, the average daily number of products that sold out (having no unsold product) was 9.37 (of 31 total products), with a median of 10 products. The average percent of products sold out daily was 30.69% (with a median of 32.26%). All of these results can be seen in Table A3.

Values are reported independent of one another, and correspond to days. The average does not correspond to an actual observed record, while the median, max and min each correspond to a particular observed (though not the same) day.

**Table A3: Daily production and unsold pastry**

	Total baked	Total unsold	Percent unsold	Number of products sold out	Percent of products sold out
Average	565.67	101.85	17.96%	9.37	30.69%
Std Deviation	67.62	28.66	4.34%	3.14	10.24%
Median	571.00	105.00	17.86%	10.00	32.26%
Min	684.00	174.00	28.38%	16.00	53.33%
Max	442.00	55.00	11.47%	3.00	10.00%

## Production analysis

The data supports interview results indicating that the cafe increases PARs over the week to match increased sales. Figure A1 shows this relationship. One outlier, the April 20 holiday, is in the graph below (the Friday with the highest number of items baked) but was excluded from statistical analysis.

Items baked by day of week

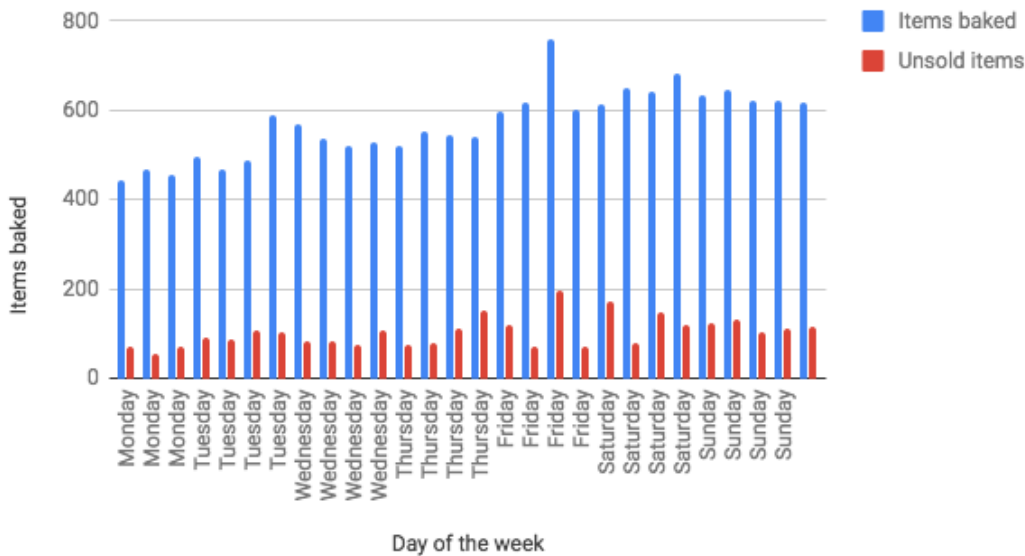


Figure A1: Items baked per day, sorted by day of the week.

## Menu item analysis

An analysis of specific menu items was helpful to determine more granular dynamics in overproduction. On average, 28.92% of menu items sold out on a given day (with a median of 28.57%). The day where the most number of products sold out had 53.57% of menu items sell out while the day with the minimum number of items sold had only 3.57% of menu items sell out. The standard deviation was 11.86%.

A regression analysis showed that there was a statistically significant ( $p < .001$ ) negative relationship ( $R^2 = 0.64$ ) between the frequency of selling out and the amount of unsold product as a percentage of total product baked.

In other words, as the frequency of selling out went up, the total unsold items for that menu item decreased. While this appears obvious, this relationship would not exist if selling out of a menu item was a random event. Rather, this analysis suggests that certain menu items frequently sell out and have fewer unsold items overall, while others rarely sell out and have high levels of unsold product.

## Unsold product as a variable of total product baked

Regression analysis suggests that there is a moderate positive relationship ( $R^2 = 0.24$ ), that is statistically significant ( $p = 0.01$ ), between the amount of unsold product and the amount of product baked. As the amount of items baked increases, so does the amount wasted. This is supported by data earlier discussed indicating that the average unsold products as a percent of baked is fairly consistent (with a standard deviation of 4.34%).

## Cost and greenhouse gas impact

Cost savings estimates were calculated using ReFED's value estimates for wholesale food costs, see Table A4 below.<sup>3</sup>

**Table A4: Costs per pound of retail and wholesale food groups, drawn from ReFED's Technical Appendix to the Roadmap to Reduce US Food Waste by 20%.**

	Grain products	Meat	Fruit and vegetables	Seafood	Milk and dairy
Retail	\$1.21	\$5.73	\$1.51	\$8.04	\$1.21
Wholesale	\$0.97	\$3.24	\$0.74	\$4.88	\$1.17

Pastries were assumed to be made of half dairy products and half grain products, considering most were sweet pastries which have high amounts of butter, milk and eggs. This assumption was drawn from the USDA's Food and Nutrient Database for Dietary Studies, using recipes for brioche (which was approximately 60% dairy and 40% grain by weight) and coffee cake (which was 40% dairy and 60% grain by weight), see Table A5.<sup>4</sup>

<sup>3</sup> ReFed. (2016). *A Roadmap to Reduce US Food Waste by 20%: Technical Appendix*. Retrieved from [https://www.refed.com/downloads/ReFED\\_Technical\\_Appendix.pdf](https://www.refed.com/downloads/ReFED_Technical_Appendix.pdf)

<sup>4</sup> United States Department of Agriculture. (n.d.). Food and Nutrient Database for Dietary Studies (FNDDS). Retrieved from <https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-surveys-research-group/docs/fndds-download-databases/>

**Table A5: Estimated annual cost of wasted pastries****Yearly Estimate**

	Pounds	Costs
Grain	4596.00	\$4,458.12
Milk & Dairy	4596.00	\$5,377.32
<b>Total</b>	<b>9192.00</b>	<b>\$9,835.44</b>

Carbon emissions and energy use associated with the wasted pastries were calculated using EPA's greenhouse gas equivalencies calculator<sup>5</sup> based on version 14 of the EPA's Waste Reduction Model (WARM)<sup>6</sup>. This analysis used the same ingredient estimations used in the cost impact analysis (half dairy, half grain). Estimates were conducted to determine the difference from the status quo (production and composting) to full source reduction (having never been made at all).

**Table A6: Results from the WARM analysis of pastry waste if it was prevented instead of produced and composted reported by category, with total reductions and their equivalents included**

	<b>Tons source reduced</b>	<b>Change in MTCO2E (compared to composting)</b>	<b>Change in Million BTU (compared to composting)</b>
Grain	2.30	-1.02	-14.31
Milk & Dairy	2.30	-3.6	-34.13
<b>Total</b>	<b>4.60</b>	<b>-4.62</b>	<b>-48.44</b>

**Equivalencies**

<i>Passenger vehicles</i>	1
<i>Gallons of gasoline</i>	520
<i>Barrels of oil</i>	8

<sup>5</sup> U.S. Environmental Protection Agency. (September 2017). Greenhouse Gas Equivalencies Calculator. Retrieved from <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

<sup>6</sup> U.S. Environmental Protection Agency. (2016, March). Waste Reduction Model (WARM) version 14. Retrieved from <https://www.epa.gov/warm>



# Conformance to Food Loss and Waste Reporting Standard

[The Food Loss & Waste Protocol](#)<sup>7</sup> is a multi-stakeholder partnership, which has developed the global Food Loss and Waste Accounting and Reporting Standard – also known simply as the FLW Standard. Launched in 2013, the Food Loss & Waste Protocol’s mission is to ensure wide adoption of the FLW Standard so companies, governments, cities and others are better informed about food loss and waste and motivated to curb this inefficiency.

The graphic below describes the scope of Case Study 15 of the institutional and commercial sector assessment of the Oregon Wasted Food Study using the FLW Standard.

## Food loss + waste protocol

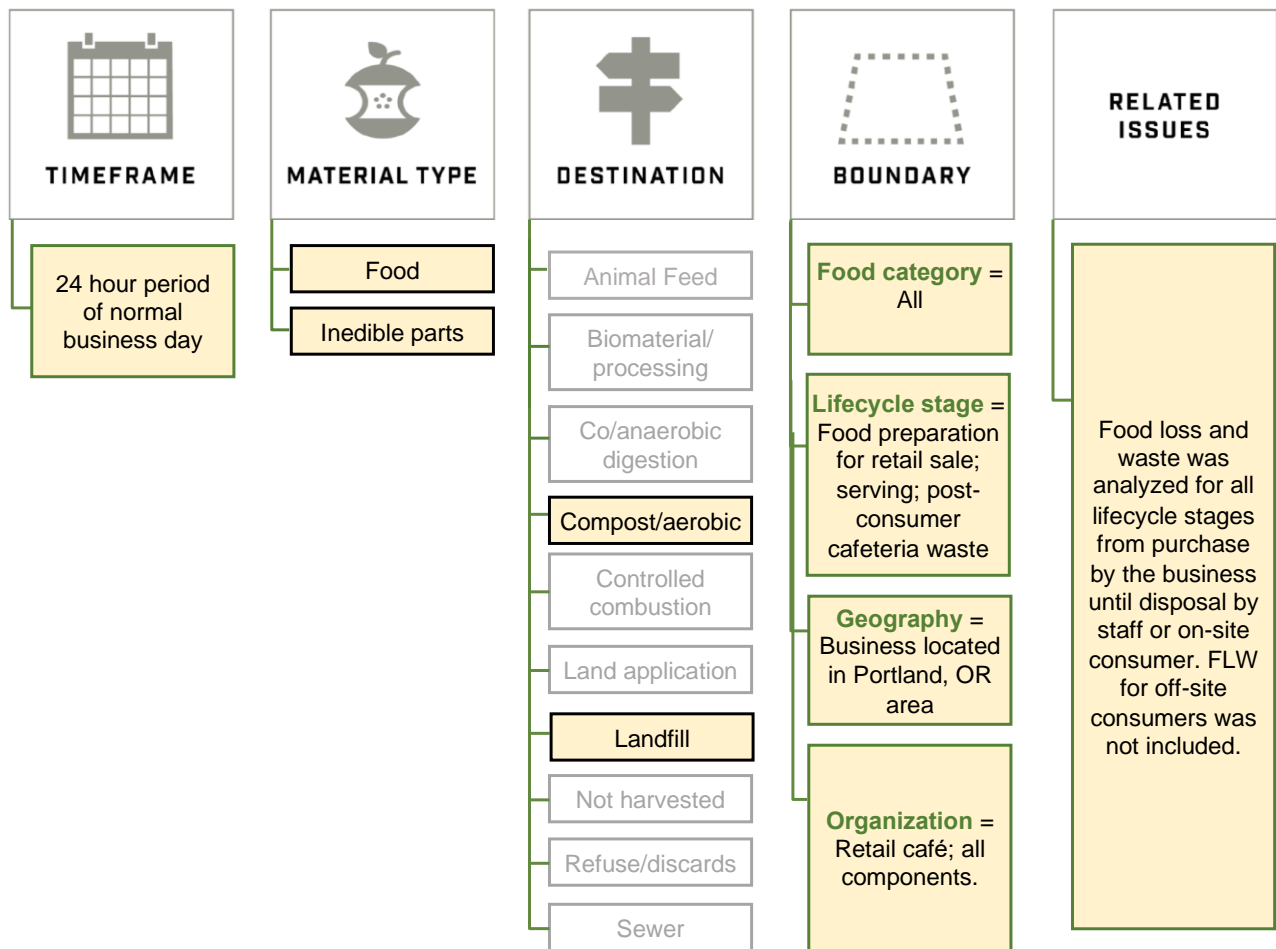


Figure A1: Scope of Case Study 15 as it relates to the Food Loss and Waste Reporting Standard

<sup>7</sup> See, <http://flwprotocol.org>