

Oregon Wasted Food Study: Institutional and
Commercial Sector Case Studies

Case 1

Reducing plate waste through standardized portions



This report was prepared for
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Introduction

This is a report on the methods and results of one of 15 food service business case studies, as part of the commercial 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 commercial portion of this study are to:

- Understand components of commercial wasted food
- Highlight causes of commercial wasted food and key opportunities for source reduction
- 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 looked at wasted food at a brewery/restaurant, focusing on the food service portion of the business. Waste from the brewery portion of the business was not studied. The wasted food reduction practice was deployed in the back-of-house but aimed at reducing front-of-house waste by reducing the over-serving of french fries. The portion standardization practice outlined here could be deployed at any food service institution where standard portioning should be expected. Finally, the analytical tools used here (wasted food assessments, customer review analysis and customer perception surveys) are models for other institutions hoping to better understand their wasted food profile and customer perceptions of portion sizes, meal value and satisfaction.

Business context

The business is a large brewery and eatery, with three separate restaurants and kitchens on a multi-building site. It is located in a small but popular coastal city in Oregon, with a population of about 10,000 people. The restaurants serve traditional pub fare with beer brewed on site. One of the restaurants on site is a small pizza eatery. The business hosts a range of events throughout the year, and generally experiences seasonal variability, with sales volume peaking in the summer months. The business' food sales range between \$5,000 and \$10,000 per day, depending on the time of year.

Methods

Study design

The study was conducted over an eight-month period in late 2017 and early 2018. It included:

- Employee interviews
- Waste assessments (2 waste sorts, front- and back-of-house)
- Other information including online customer review analysis and on-site customer surveying
- Practice selection
- Implementation and analysis of recommended practice

- Post-implementation assessment

The intent of these analyses was to (1) identify types of wasted food and key causes of waste, (2) develop and implement a best practice for wasted food reduction, and (3) analyze the effectiveness of the practice.

Interviews

A total of eight employees were interviewed for this study. Seven were interviewed at the onset of the study: the executive chef, two front-of-house managers, a sous chef, a server, a prep cook and the sustainability coordinator. Another sous chef was interviewed post-practice implementation. Initial interviews were all conducted on the same day in August 2017.

Employees were asked by researchers to voluntarily participate in brief, semi-structured interviews. Interviews were conducted with employees individually, on site in a private location. Interviews were recorded and lasted between 15 and 25 minutes each. Interviewers followed a protocol with standard questions, following up with additional questions as needed.

Waste assessments

Waste was assessed with two waste sorts, conducted in September and December of 2017, to identify components of the restaurants' front-of-house and back-of-house waste. The sorts were conducted before and after implementation of the waste reduction practice. Food was sorted into 11 categories, as described in Table A1 in the Appendix.

24-hours of wasted food was collected from a 4-yard landfill dumpster in September 2017. Additionally, one 25-gallon roll cart was sorted that contained three days' worth of food scraps that typically goes to a local pig farm. No other sources of food waste are commercially composted at this site. The post-practice waste assessment was conducted in December 2017 following the same process as in the baseline sort with a few minor differences. Details on the sorting process for both assessments can be found in the Appendix.

The waste assessment data was normalized to account for differences in the restaurant's sales on the days the waste was generated. Waste weights were divided by the total gross daily food sales (in thousands of dollars). Data is reported in terms of pounds of wasted food per one thousand dollars in gross food sales.

Online customer review analysis

To better understand customer perceptions of portion size and meal value, an analysis of customer reviews posted on a popular online review site was conducted. Only reviews from January 2016 – October 2017 were analyzed. A key word search was performed, using the following words: portion, small, tiny, large, huge, big, hungry, price(y), cost, expensive, cheap. Reviews with search terms were screened for relevance – only those that related to portion size or perceptions of meal price were included. Relevant reviews were coded by small, neutral or large if related to portion size, or expensive, neutral or great if related to perceived value. Selection bias is an acknowledged issue with this type of data where customers who write a review tend to have either very positive or negative experiences. However, researchers analyzed this data not as a random sample of customers, but to assess whether portion size and price are notable issues and if so, in which direction, positive or negative.

Customer surveys

A survey assessed customer perceptions of portion size and actual leftovers. Surveys were distributed in mid-October on a Tuesday during a lunch and dinner shift. Surveys were distributed by the sustainability coordinator to patrons 18 years of age or older. Customers were asked to fill out the voluntary surveys anonymously and return them to an envelope by the main exit, which was mailed to PSU without review by the business' employees. 38 surveys were collected.

Recommended practice

Three best practices were recommended to the restaurant to test: (1) offering a lunch menu with increased portion variety for diverse appetites, (2) reduced standard french fry portions alongside the informal offering of additional french fries to customers with large appetites and (3) the standardization of french fry portions through employee retraining and a short period of calibration tests.

The restaurant was concerned that offering smaller menu items (at a reduced cost) would decrease their revenue. They were also concerned that reducing french fry portions across the board would leave customers dissatisfied, and that limited staff capacity would mean serving staff could not adequately offer customers more french fries as their meal went on. The restaurant agreed to test the portion standardization practice. This included setting a standard, training employees on that standard, and reinforcing proper portioning through tracking of spot checks on portions for french fries to minimize over-portioning, saving costs for the restaurant and reducing customer plate waste. Standard portion sizes were set for the restaurant's three portion sizes: the side portion (set at 4 ounces), a small a-la-carte order (8 ounces) and a large a-la-carte order (16 ounces).

The standardization of portion sizes and avoidance of over-portioning has several positive aspects:

- Standard portion sizes give customers value for their money, but prevents misuse of resources (unnecessary labor, food costs, additional costs and environmental impact).
- Employee training is considered a key component of portion control and as such does not require specialized equipment or extra costs¹.
- Over-portioning is sometimes intentionally used by employees to meet perceived customer expectations, or match expectations set by marketing materials².

Practice components

After staff-wide training on portion size targets and displays of visual representations of proper portion sizing, french fry portions were spontaneously weighed during normal restaurant operation, with results recorded and feedback given to employees. The practice was deployed for 14 consecutive days. Calibrations were intended to give employees regular feedback so that they could adjust their behaviors to portion fries more in line with company expectations.

The process was:

- Employees responsible for portioning french fries were trained on newly set standardized post-frying portion sizes (4, 8 and 16 ounces).

¹ Mior, C., Waddington, K., & Foster, D. (2009). Strategies to reduce waste in patient food services. *white paper, Aramark*, 5.

² Schau, H. J., & Gilly, M. C. (1997). Social conventions of a fast food restaurant: An ethnomethodological analysis. *ACR North American Advances*.

- Pictures of target portion sizes in their commonly served dishware were posted by the portioning station next to the fryer.
- For the duration of the practice, a sous chef or manager would drop in during each of two shifts per day and weigh one plated fry portion before delivery to the customer. Accordingly, two measurements were taken each day, each of a random portion size (4, 8 or 16 ounces).
- The fries were weighed on a tared dish and rounded to the nearest half ounce.
- Results were recorded and communicated to the employee responsible for plating.

Results

Waste assessments

For the complete results of the waste assessments, see, Appendix. Wasted food from the back of house included waste from preparation, misfires, and overproduction. Wasted food from the front-of-house included plate waste and uneaten foods, as well as non-restaurant food from patrons. Wasted food included a wide variety of items that could have been eaten, including fries, lettuce, lemon wedges/peels, vegetables, partial burger buns, tortilla chips, raw shrimp, raw oysters, focaccia, etc. Inedible parts of food waste included clam shells, oyster shells, chicken bones, etc.

In the pre-practice assessment, the most prominent types of front-of-house waste included edible fruit and vegetables, mainly french fries weighing a total of 36.13 pounds, and prepared foods, primarily leftover uneaten entrée portions, burger buns and pizza which weighed a total of 40.85 pounds. The most prominent categories for the back-of-house were inedible food and prepared food, totaling 70.64 pounds and 23.18 pounds respectively. Inedible items were predominantly clam shells, chicken bones, soup stock remnants and lemon rinds while the prepared category largely constituted fryer waste and over-prepped flour dredged chicken and oysters.

In the post-practice assessment, the most prominent type of front-of-house food waste was vegetables and fruit, at 12.17 pounds, followed by inedible food at 8.05 pounds and prepared food at 4.97 pounds. Back-of-house waste was primarily made up of inedible food at 28.65 pounds, vegetables and fruits at 27.84 pounds and prepared food at 24.6 pounds.

Interviews

Causes of waste and barriers to prevention

Plate waste was identified by both front-and back-of-house staff as being a primary source of wasted food. Serving staff and back-of-house staff both noted that this was caused by portions being too large. The chef, when asked about the portion sizes, acknowledged they were large, but said that they made customers think they were getting their money's worth.

Kitchen staff acknowledged that **misfires**, or an order either burned or not made to customer expectations, were a consistent source of wasted food. One front of house manager thought about half of the time mistakes were made by restaurant staff and the other half of the time it was customers not clearly expressing what they wanted. A server estimated they saw at least one misfire per shift.

Another source of waste was **overproduction**. Menu items that required pre-preparation, that had a short shelf life, or had a limited offering (like a special) were at risk for being thrown out without sale. However, the chef also creatively developed specials to use excess product before spoilage, a common strategy in food service to maximize value for the restaurant and provide customers with more variety.

As previously mentioned, large portion sizes appeared to be causing plate waste. Staff illuminated another related cause: the **lack of portion size offerings** via menu variety. There was no lunch menu at the restaurant and limited half-order options. Servers also mentioned that older adults with smaller appetites feel awkward ordering off of the children's menu, where smaller portions were offered. Lastly, the front-of-house managers acknowledged the restaurant does not offer a discount if no side dish was ordered with an entrée.

Another restaurant-wide cause of wasted food was the **normalization of waste**. Numerous restaurant staff expressed a general concern about wasted food, and the environmental impacts it has, but that at least their wasted food was going to feed pigs. A different justification used by staff was that wasted food was "part of the business" and "inevitable". Furthermore, during discussions about how to reduce the significant amount of french fry waste staff indicated that this type of waste was a low priority because it had minimal financial impact.

Policies and expectations were also influential in supporting the creation of wasted food. Kitchen staff responsible for plating food said they perceived an expectation by management that plates should be full, so that high cost meals are perceived by customers to be worth the price. Additionally, the chefs' policy is to never run out of menu items on weekends.

Lastly, a suite of **logistical constraints** was perceived to both exacerbate the wasting of food and inhibit its reduction. A pervasive theme across interviews was that of intense time constraints. Employees in all positions expressed that they were extremely busy, especially during the summer months, which limited (among other things) their ability to worry about wasted food. Compounding this factor, management expressed that staff turnover made consistency difficult, which may have contributed to the problem of inconsistent portioning and over-portioning. Finally, kitchen staff explained that the restaurant had inadequate infrastructure for storage of overproduced food for reuse or repurposing, with their small walk-in refrigerator often approaching capacity with their current practices storing only raw ingredients and essential prepared foods.

Prevention strategies

Interviewees shared a variety of constructive and pragmatic wasted food prevention strategies. These recommendations have been organized into three sections: portioning, menu offerings, and waste tracking.

Portioning: Serving staff recommended reductions of standard portion sizes across the board, as well as the reduction in the size of burger and sandwich buns. In addition to reduced sizes, an employee recommended implementing trainings and routine check-ins to help standardize portion sizes across employees, shifts and business volume.

Menu offerings: Serving staff shared their experience encouraging adults with smaller appetites to order off the children's menu to avoid excess plate waste. A front-of-house manager also recommended offering a lunch menu with half orders or reduced portions because that was a strategy they had observed at previous places of employment.

Waste tracking: The chef shared that they had ambitions to fully utilize the restaurant’s point-of-sale (POS) system (these systems often integrate business and kitchen management capabilities) to track spoilage and kitchen waste in order to quantify wasted food and build a business case for efforts to prevent it.

Online customer review analysis

A total of 350 customer reviews were posted on the restaurant’s page on a popular online customer review website from January 1st, 2016 to October 26th, 2017. The analysis of these reviews uncovered the following results related to portion sizing and customer perceptions of value.

Portion sizing

22 unique reviews referenced portion sizes, using any of the relevant search terms: “portion”, “large”, “huge”, “big”, “small”, “tiny”, “hungry”. Ten (2.8% of total posts) expressed discontent with portion sizes being too small. Twelve (3.4% of total posts) expressed satisfaction with portion sizes or explicitly referenced portion sizes being large.

Perceptions of value

16 reviews expressly referenced perceptions of meal value, using any of the relevant search terms: “cost”, “price(y)”, “(in)expensive”, “cheap”, and “deal”. Nine (2.6% of total posts) considered food offerings to be expensive or pricey. Six (1.7% of total posts) considered food offerings to be appropriately or inexpensively priced. Two (0.6% of total posts) expressed neutral opinions on food price.

Customer Survey

A total of 38 pub customers completed the survey. Customers who ate at the pizza restaurant were not offered the survey. Of these 38 customers:

- 22 customers (58%) had unfinished food after eating
- 9 customers (24%) specifically had fries left over.
- 3 customers (8%) said portions were "too small"
- 30 customers (79%) said portions were "just right"
- 5 customers (13%) said portions were "too large"

Recommended practice

The practice and all of its components were first conducted for three weeks in November 2017. However, during a brief closure for the holidays, the calibration records were misplaced and likely discarded. The restaurant then re-conducted the same practices in late March and early April. In total, two weeks of calibrations were collected, twice a day, totaling 28 individual samples.

Figure 1 graphically represents percent off target weight over time, with a trend line showing a weak but present correlation between time and target weight accuracy.

Post-practice interviews gave additional information regarding the effectiveness of the practice. The chef in charge of leading calibrations had mixed feelings on the practices’ effectiveness. First, the chef said it was difficult to do; it was time consuming, and especially burdensome because it fell on spring break (a week with high sales volume). Second, **the trainings and awareness raising done before the calibration test was more effective at getting staff to pay more attention to portioning.** The overall process of

reinforcing portion size targets, training and setting employee expectations, and the routine check-ins and feedback was a positive experience. The interviewee just wished it wasn't so time consuming. Finally, the chef said the waste assessment was valuable in pairing numbers and data to the issue and that it spurred important conversations about what was being wasted and why.

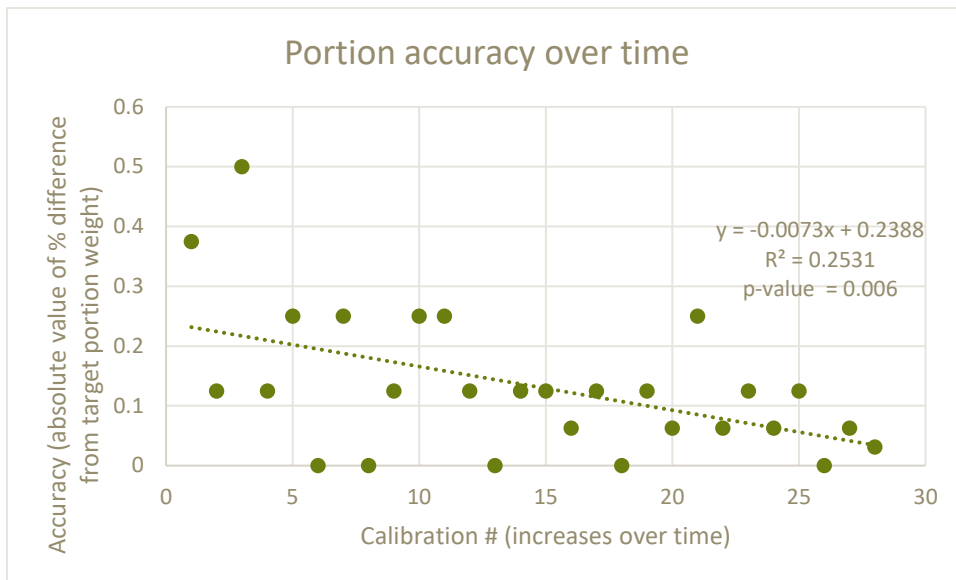


Figure 1: Portion accuracy over time.

Analysis and Conclusion

Key causes and barriers to full food utilization

Portion sizes

The two largest sources of edible wasted food, discovered in the waste assessment were prepared foods and french fries. Interviews supported a similar conclusion: many customers are not finishing their food. Survey data backed this up as well: 58% had unfinished food after eating. At the same time, a majority of customers surveyed thought portion sizes were just right. It appears that customer expectations are of abundance – that they should be able to eat their fill and have food leftover. This mindset had carried into managers' expectations as well. They indicated that they would rather overfill customers plates with low-cost fillers (i.e., french fries) than have the customer leave dissatisfied.

But is that risk real? Only 10 online customer reviews over a two year period (2.8% of the total) referenced portion sizes being too small. Setting portion sizes to the appetites of a small minority is a key cause of wasted food. But a core issue remains: customers are accepting of or actually want a portion that is too large for them to finish. Either reason suggests that cultural shifts are needed to bring portion sizes more in alignment with health, hunger satisfaction and the reduction of wasted food. Food service institutions should be leaders in shepherding that change. Portion sizing and preferences are an entwined mixing of social norms and deeply held customer preference. Restaurants can actively work to change that norm – by themselves reducing portion sizes and messaging the change in ways that aligns with other customer desires and expectations, such as healthy eating, sustainable choices or a priority on high quality food and service.

Normalization of waste

While employees demonstrated care for the environment and a desire to act sustainably, there was a **misunderstanding of the relative benefits of food waste diversion (which were overstated) and the relative benefits of food waste prevention (which were understated)**. Employees' understanding that wasted food grown to feed people was being fed to pigs, in some ways, justified the continuation of wasteful practices.

Wasted food as an externality

Not only is **wasted food justified through perceptions of inevitability** but it is also written off as having little financial impact. This is in part because wasted food is generally understood only through lens of food costs – but **costs of labor, stress burden of under-staffing, storage and preparation costs and environmental costs are important**. Focusing on french fries, over-portioning results in extra time and financial costs, imbedded in unpacking, storing, and preparing the potatoes. More energy and frying oil is used to fry unnecessarily large batches of fries, and when the restaurant is busy, unnecessarily served fries mean more frequent batches need to be fried – using limited staff capacity and slowing down orders. These impacts are only those internal to the restaurant; many more exist as externalities such as wasted energy, water, pesticides and labor that went into producing, processes, and transporting the food.

Recommendations

Drawing evidence from three sources (1) the pre-practice and post-practice waste assessments, (2) the results from the portion calibration test and (3) staff feedback, we end with recommendations that could improve the viability and effectiveness of the practice.

Waste assessments

The data suggests a significant decrease (44%) in front-of-house waste from the initial waste assessment to the follow-up waste assessment (Table A2). Specifically, related to the portion standardization practice, we look towards the fruits and vegetables category, which saw a decrease of 34% between the two assessments (see, Table A2). However, the results also show a 70% increase in back-of-house waste (Table A3). To the researchers' knowledge, no significant back-of-house practices or policies were changed. These inconsistent results suggest either (1) our information about what waste we were sorting and when it was generated was inaccurate, or (2) wasted food generation is variable, making it difficult to extrapolate trends over time from two point-in-time assessments. As a result, the waste assessment data – which only capture a point in time – do not allow us to draw conclusions on the effectiveness of the portion standardization practice.

Portion calibration

Statistical tests were conducted suggesting some improvement in accuracy in portion size over time (see, the Appendix for trendline figures). The results suggest accuracy improved by about 20% over the two-week trial period, and that the relationship between accuracy and time was statistically significant. The results also suggest accuracy varied by target portion size. Accuracy for the 4 ounce portion was significantly lower; average over-portioning was 20%, compared to the 8 ounce portion (13%) and the 16 ounce portion (6%). While the average percent off target was different, the absolute value of ounces over or below target was similar. The average amount each portion differed from target was 0.8 ounces, 1.00 ounces and 0.94 ounces (4 ounce, 8 ounce and 16 ounce, respectively). Results suggest that staff are not over-portioning at rates related to target portion size (for example, consistently over portioning by 25%), but rather **are consistently**

over-portioning in the case of the 4 ounce, and both under and over portioning at that same amount for the 16 ounce portions.

While the over-portioning of the larger portion sizes are significant, these results suggest more net waste per serving exists at the 4 ounce side portion. This is also significant because the 4 ounce portions are by far the most commonly served.

These results suggest that even with the establishment of standard portions, staff training, and consistent calibrations tests, up to 20% of fries produced are unnecessarily served. This reiterates that over-portioning is a significant problem with non-trivial financial, labor, environmental and health costs.

Staff feedback

Overall, staff feedback was critical of the effectiveness of the calibration test, though they were more supportive of the portion standardization efforts overall. Primary concerns were centered on time burden, feeling like the calibration tests were disruptive and just another task to check off. Staff also did not think the calibrations were particularly useful in improving accuracy. That said, they did perceive value in the overall process, (training, reinforcing standardized portion sizes, and the waste assessment). They reported that **the process started important conversations, making everyone more conscious of wasteful practices. Reducing wasted food is a process, not a project.**

Opportunities for improvement

For research or analytical purposes

If the calibration tool is to be further researched or used by a food service institution to track accuracy over time and quantify over or under portioning there are a few recommended changes:

- Create a baseline by inconspicuously weighing plated food items without the knowledge of staff who plate food or other kitchen staff.
- Collect data less frequently (i.e. once per day or every other day)
- Implement the practice for longer periods of time (months instead of weeks)
- Focus on a single portion size (i.e. only the 4 ounce size portion)
- Use a more precise scale (ideally to the tenth of an ounce/gram) to capture more nuance.

To improve portioning accuracy

For use in a food service institution with the intent of improving portioning accuracy, we suggest the following changes to the practice:

- Reduce number of calibration tests to one per day or fewer but conduct trial over a long period of time.
- Consider additional items, especially high cost, high environmental impact items.
- Analyze results on an ongoing basis and report progress to staff.
- Consider using appropriately sized kitchen utensils (for example, a 4 ounce scoop) to assist with proper portioning. In this case, fries broke when a smaller scoop was used, but for other food items this may be less of a problem.

Limitations

- Waste assessments were point-in-time assessments, and therefore inadequate tools to determine the effectiveness of a practice over time. They were, however, helpful tools to illuminate the composition and causes of wasted food.
- Customer surveys had small number of responses.
- The research team did not have the ability to track baseline portion weights prior to the intervention without influencing behavior. This was in part because the restaurant was a significant distance from the research center so routine testing using an impartial observer was not possible.
- Calibration data was collected and reported by restaurant staff. It is possible that staff presented bias during the weighing and recording of the data.
- The calibration test had to be re-run, and only for two weeks, due to limited restaurant staff capacity.

Conclusion

There was a statistically significant improvement in portioning accuracy over the two-week trial period, as well as a statistically significant difference in accuracy based on portion size; other results were notable but were either not statistically significant or not amenable to statistical analysis such as:

- **Consistent over-portioning for the 4 ounce portion size.**
- Staff perceptions that the calibration tests were not worth the time burden, but that the overall exercise appeared to be valuable at raising awareness about wasted food and encouraging wasted food reduction behavior.
- Fruit and vegetables, prepared foods, and inedible items are wasted in the largest quantities due to plate waste, misfires, and overproduction.
- **While waste assessment data suggests reduction of fruit and vegetable waste over time, point-in-time samples are limited in assessing ongoing effectiveness of a practice.** However, conducting waste assessments **spurred employee conversations about what was being wasted and why.**

Finally, the calibration tests did work to further illuminate the problem of over-portioning. During the intervention the average french fry side portion, **the most commonly served portion size, was 20% over-portioned, or 0.8 ounces per 4 ounce serving.** This not only promotes wasted food, but also over-eating. That extra 0.8 ounces itself is 71 calories, or 5% of a person's daily recommended fat. This suggests the calibration tool could be a powerful tool to quantify and translate wasted food into other meaningful metrics.

Additional opportunities

While portion standardization was the focus of this case study, the restaurant and others with similar causes of wasted food could benefit from the strategies discussed below. These strategies are drawn from interviews and observations as part of this research.

Increase Portion Size Variety

Offer a lunch menu, add half-portions to the existing menu, or alter the name of the children's menu to make it explicitly for anyone with smaller appetites. By offering a wider variety of portion sizes, the restaurant can better suit a variety of customer appetites and better set expectations about the portions customers are receiving. Offering free additional fries to customers who have eaten their entire meal could alleviate the pressure to cater all portion sizes to the largest appetites. A final option could be to have different standards

for side portions to match the size of entrée (i.e. a 5 ounce portion of fries with fish compared to the standard 4 ounce portion with a burger). **This must include frequent checks on whether the portion is accurate, since this study found that smaller portions are more vulnerable to over-portioning.**

Change waste-causing policies and employee communications

Allow menu items to run out, even on the weekends. Focus flexibility on items that cannot be saved or repurposed. Add or change the menu to ensure complimentary dishes exist to fulfill customer wants (i.e. “the salmon was popular tonight so we’re all out, how about the halibut?”). **Set expectations among all members of the team that waste is not an acceptable part of doing business, and that wasted food diversion to feed animals is not the highest and best use of food.** Employees generally overstate the relative benefits of food waste diversion and understate the relative benefits of food waste prevention.

Demonstrate value without filler

Consider using other means to communicate the value of a meal without filling the plate with food. Try using non-food fillers or creative presentation techniques to fill up space. Alternatively, try new strategies to better communicate the high quality of the food and the ingredients used. For example, in this case, many ingredients were locally and sustainably sourced.

Smaller plates or plates with rims

Evidence from other studies suggest that smaller plates can satisfy customers as a full, smaller plate signals abundance as effectively as a full larger plate, while still using a smaller amount of food.³

³ See, <https://foodpsychology.cornell.edu/discoveries/large-plate-mistake>

Appendix

Waste sort process and data

Waste sorts were conducted as follows:

- Two folding tables were set up adjacent to one another lengthwise with two large low-rimmed black bins on tables with five CES staff and one restaurant staff conducting the sort. Bag contents were dumped into black bins to facilitate sorting contents with two sorters per black bin. Numerous yellow bins were placed around the perimeter of the sorting area and labeled with each specific food category for collecting all edible or inedible foods items.
- Back-of-house and front-of-house waste was sorted separately.
- Once all foods were sorted and categorized, photos are taken of each yellow bin. Yellow bins were then weighed and weights were recorded. Tare weights of each yellow bin were also collected and recorded.

The post-practice waste assessment was conducted in December 2017. Researchers used the same process as the baseline sort, with the following differences:

- Four CES staff conducted the sort, on-site at the business
- 100% landfill dumpster and food scrap roll cart contents were sorted from a 24-hour period. The food scrap roll cart, in this case, contained only one business day's worth of waste.

Table A1: Waste sort categories and definitions

Categories		Definitions	Examples
1	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
2	Meat & Fish	Uncooked or cooked meat (with mostly edible components) unmixed with other types of food	Chicken drumstick, salmon fillet
3	Dairy	Solid dairy products unmixed with other food types or in original form	Cheese, yogurt
4	Eggs	Egg products unmixed with other food types or in original form	Fried egg, whole eggs, liquid egg whites
5	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
6	Baked Goods	Baked goods and bread-like products unmixed with other food types or in original form, including pastries	Bread, tortillas, pastries
7	Dry Foods	Cooked or uncooked grains, pastas, legumes, nuts, or cereals unmixed with other food types or in original form	Rice, cereal, pasta
8	Snacks, Condiments, Sauces	Includes confections, processed snacks, condiments, and other miscellaneous items	Condiments, candy, granola bars, sauces, jellies
9	Liquids, Oils, Grease	Items that are liquid, including beverages	Sodas, milk, oil, juice
10	Cooked or Prepared Food	Items that have many food types mixed together as part of cooking or preparation	Lasagna, sandwiches, burritos
11	Unidentifiable	Used only if necessary	

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

Table A2: Front-of-house wasted food assessments, weight per thousand dollars in sales

Wasted food category	Pre-Sort (Lb/\$1,000 in sales)	Post-Sort (Lb/\$1,000 in sales)	Percent Change
Inedible	2.08	2.42	16%
Meat & Fish	0.31	0.50	62%
Dairy	0.02	0.00	
Vegetables/Fruits	5.50	3.65	-34%
Baked Goods	0.22	0.02	-93%
Dry Foods (Grains, Pasta, Cereals)	0.00	0.00	
Snacks, Condiments, & Other	0.92	0.51	-45%
Liquids/Oils/Grease	0.05	0.00	
Cooked/Prepared/Leftovers	6.22	1.49	-76%
Unidentifiable	0.00	0.00	

Total **15.31** **8.58** **-44%**

Table A3: Back-of-house wasted food assessments, lb per thousand dollars in sales

	Pre-Sort (lb/\$1,000 in sales)	Post-Sort (lb/\$1,000 in sales)	Percent Change
Inedible	10.76	8.60	-20%
Meat & Fish	1.20	1.94	61%
Dairy	0.05	0.06	13%
Vegetables/Fruits	1.88	8.36	344%
Baked Goods	0.98	4.14	322%
Dry Foods (Grains, Pasta, Cereals)	0.29	2.66	824%
Snacks, Condiments, & Other	0.00	0.60	
Liquids/Oils/Grease	0.13	0.11	-19%
Cooked/Prepared/Leftovers	3.53	7.38	109%
Unidentifiable	1.13	0.00	
Total	19.96	33.84	70%

Calibration test results and analysis

A regression analysis was conducted for the calibration test results. There was a statistically significant (p -value = 0.006) moderately negative correlation ($R^2 = 0.246$) between time and portion inaccuracy - the absolute value of the percent off of target (see, Figure A3). This suggests that some of the improvement of accuracy was due to time. What is unclear is whether or not the unequal spread of portion sizes tested (i.e., seven 4 ounce portions week 1 versus three in week 2) accounts for some of this difference.

To better understand the relationship between accuracy and target portion size a one-way ANOVA test was conducted. A statistically significant difference in accuracy across target portion size groups was found ($p < .05$).

Table A4: Portion accuracy by target portion size, difference from target

	Difference (in ounces)			Difference (as % of target)		
	4 oz	8 oz	16 oz	4 oz	8 oz	16 oz
Average	0.80	0.40	-0.19	0.20	0.05	-0.01
Median	0.75	0.50	-0.25	0.19	0.06	-0.02
# of Samples	10.00	10.00	8.00	10.00	10.00	8.00

Table A5: Portion accuracy by target portion size, absolute value of difference from target

	Absolute Difference (in ounces)			Absolute Difference (as % of target)		
	4 oz	8 oz	16 oz	4 oz	8 oz	16 oz
Average	0.80	1.00	0.94	0.20	0.13	0.06
Median	0.75	1.00	1.00	0.19	0.13	0.06
# of Samples	10.00	10.00	8.00	10.00	10.00	8.00

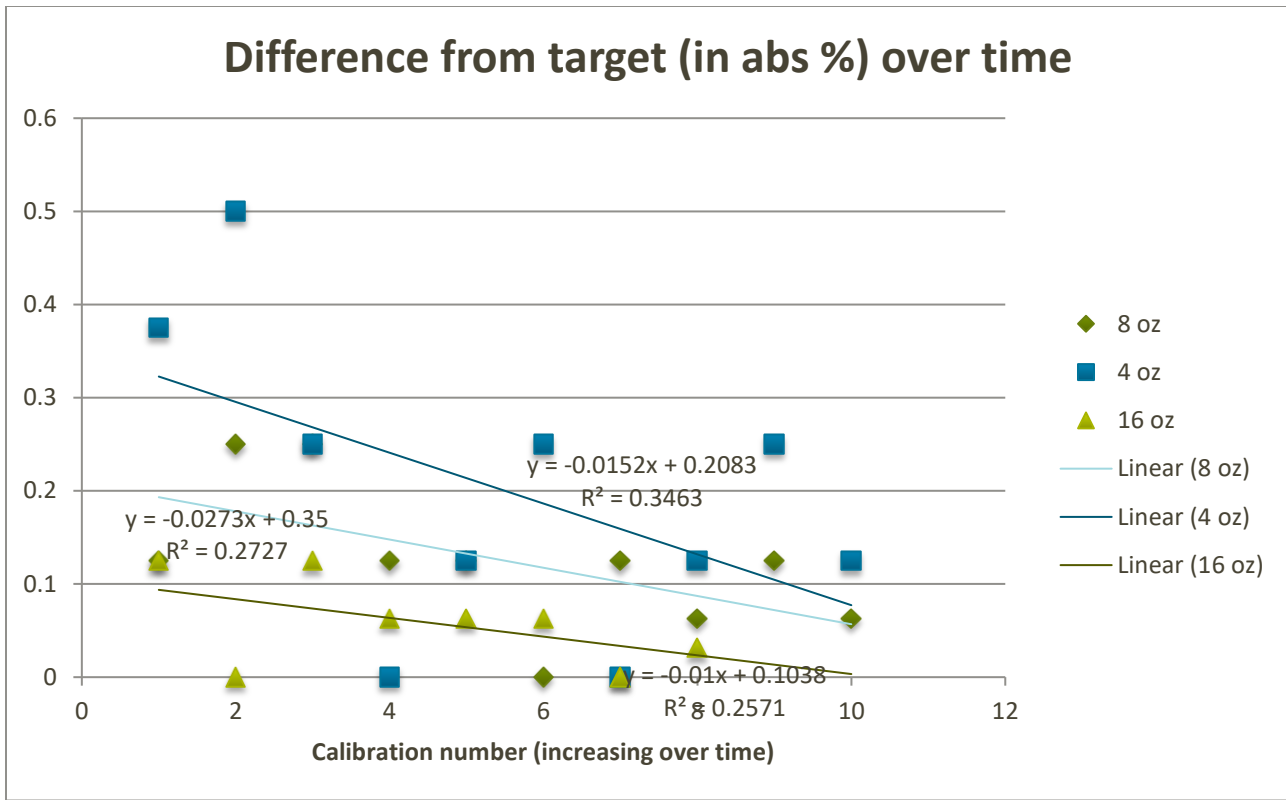


Figure A2: Regression analysis for calibration test results, by target portion size

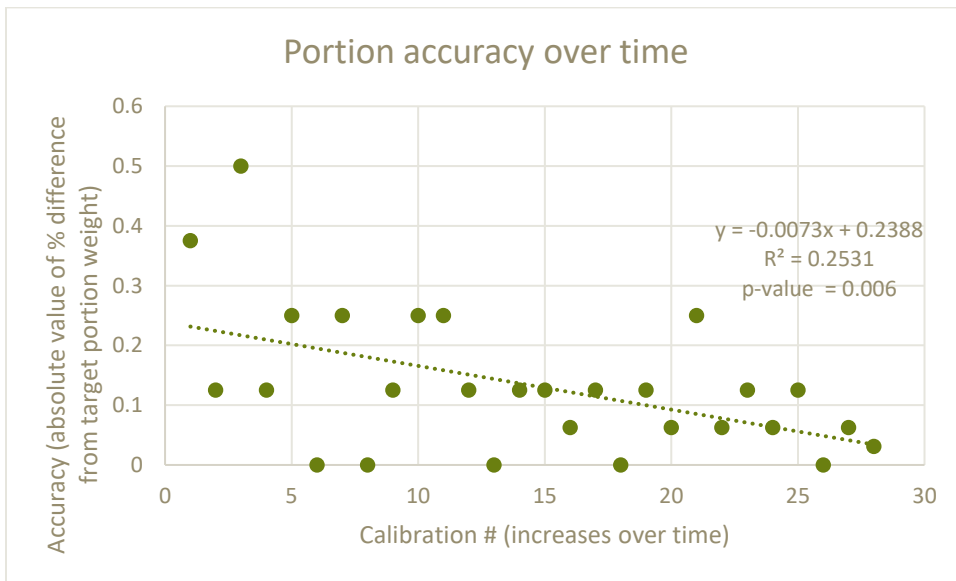


Figure A3: Portion accuracy over time

Conformance to Food Loss and Waste Reporting Standard

[The Food Loss & Waste Protocol](#)⁴ 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 1 of the institutional and commercial sector assessment of the Oregon Wasted Food Study using the FLW Standard.

Food loss + waste protocol

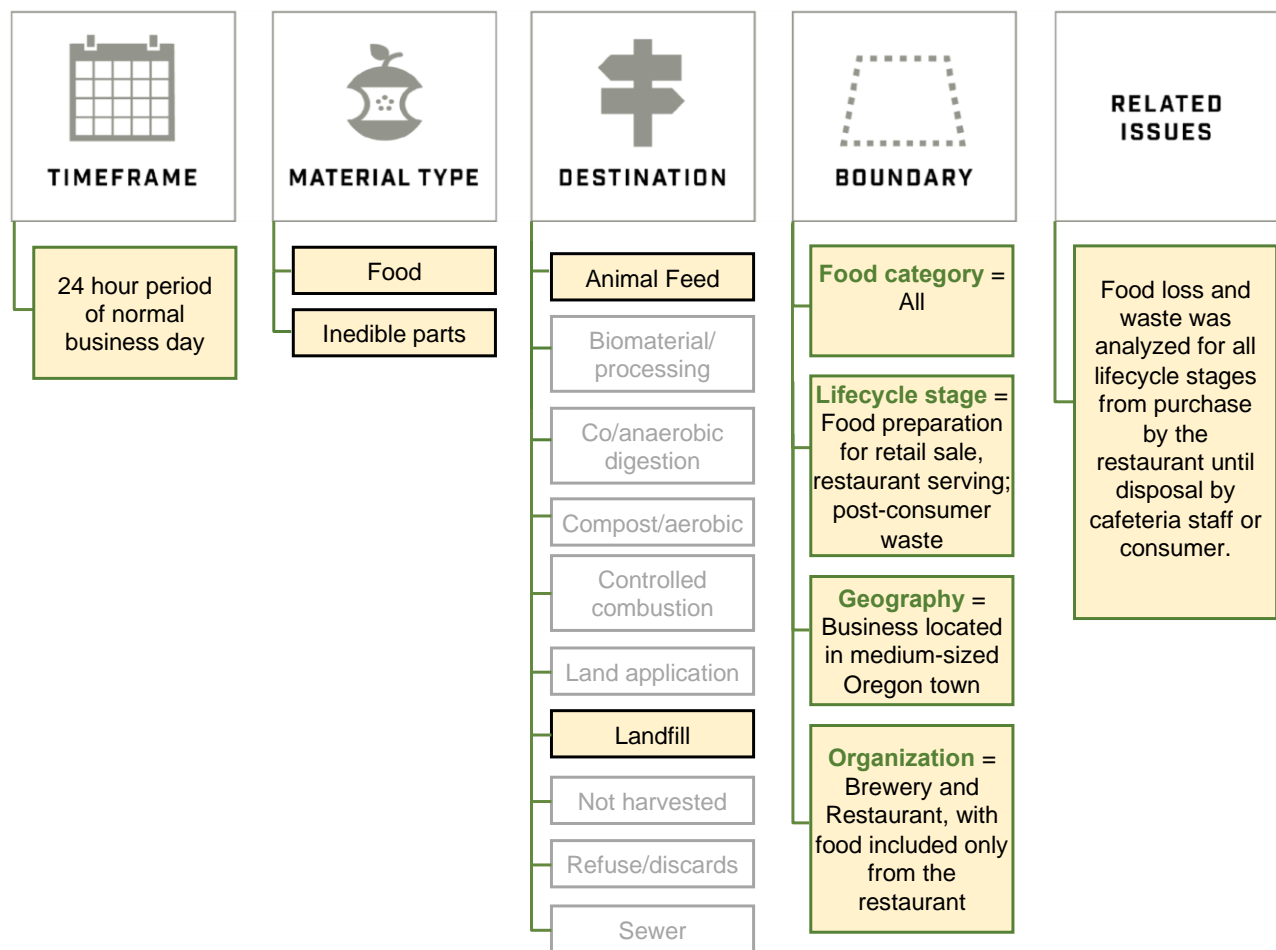


Figure A4: Scope of Case Study 1 as relates to the Food Loss and Waste Reporting Standard

⁴ See, <http://flwprotocol.org>