UNIVERSITY OF CALIFORNIA Global Food Initiative

Waste Auditing Practices

Best Practices Subcommittee—Zero Waste Dining

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Introduction

Zero Waste Dining is a critical component of the University's goal to achieve Zero Waste[1] by 2020. The Best Practices Subcommittee on Zero Waste Dining seeks to support progress toward the goal of Zero Waste by 2020 within campus dining operations, improving waste diversion[2]. The Subcommittee seeks to support progress toward this goal in two Phases. In Phase 1, the Subcommittee seeks to support progress in locations that rely entirely on Back-of-House (BOH) waste sorting. In Phase 2, the Subcommittee seeks to support progress in locations relying on both Back-of-House (BOH) and Front-of-House (FOH) waste sorting.

In locations relying entirely on BOH waste sorting, dining staff are responsible for ensuring waste is placed into the proper receptacles, as available – compost, recycling[3], or landfill. Because all waste is sorted by staff, only a limited number of people need to be educated and trained on proper sorting to divert 95% or more of solid waste from the location. Additionally, dining administration can use preventative action (such as unambiguous bin labels) and corrective action (coaching and re-training employees as needed, or when product changes occur that affect waste sorting) more effectively than in locations relying on both BOH and FOH waste sorting, where potentially thousands of guests are responsible for waste sorting.

Waste Assessments allow a location to measure the successful waste sorting by staff or guests and determine a location's **waste diversion** percentage – the percentage of waste not landfilled or incinerated. Multiple models of waste assessments exist to support locations based on their staffing capacity and other limitations. This toolkit outlines different models of waste assessments and provides and explains how to use several available waste assessment tools developed by UC staff.

[1] **Zero Waste**: For the purposes of measuring compliance with UC's zero waste goal, locations need to meet or exceed 95% diversion of municipal solid waste. Ultimately, UC's zero waste goal strives for the elimination of all materials sent to the landfill by 2020.

[2] **Waste Diversion**: The process of diverting waste from landfills or incinerated, also calculated as a percentage of waste generated that is not sent to landfills or incinerated.

[3] Some areas may require further separation of recyclables into waste streams, such as plastics, metals and glass, or even into different types of plastics.

Waste Assessment Models

There are two principal models for conducting a waste assessment: the **waste characterization** or the **waste audit**. Both models can be used to determine a location's current waste diversion percentage.

A **Waste Characterization** is a formal, hands-on waste assessment to characterize the specific types and quantities of the waste generated by a facility, determining both the location's current waste diversion percentage and its potential waste diversion percentage.

During a waste characterization, the party conducting the assessment opens every bag and empties every bin. Tarps are laid out, onto which the waste is emptied. The accurate waste diversion percentage is determined by cataloguing each bin's weight using scales and records each bin's municipal solid waste type before it is emptied, then determining if it is below the acceptable threshold for contamination (subject to local program restrictions) by weighing misplaced items. Following this, the party conducting the assessment then physically separates the types of waste, determining the maximum potential waste diversion percentage by identifying misplaced items that could have been recycled, composted, etc. and weighing again as needed. Where it is not possible to directly weigh using a scale, EPA volume-to-weigh conversion factors (or other location-specific conversion factors) are used to determine the weight.

A waste characterization may be particularly useful when first identifying what is being thrown away in a facility, what can or cannot be recycled, and determining if a facility has the potential to become a Zero Waste facility based on its current waste generation and mix of municipal solid waste types and quantities.

Conducting a waste characterization can also help to identify how best to educate staff and/or guests on how they can improve their waste sorting. Because of the methods used in the waste characterization, a waste characterization may be more time- and labor-intensive and additionally require vehicles. Additional cleanup is also needed following a waste characterization.

A **Waste Audit** is a waste assessment to determine the types and quantities of the waste generated by a facility, determining the location's current waste diversion percentage but not directly determining the location's potential waste diversion percentage.

During a waste audit, the party conducting the waste assessment catalogues each bin's weight using scales and records each bin's municipal solid waste type but does not empty the bins, and determines if it is below the acceptable threshold for contamination (subject to local program restrictions) through visual inspection. Where it is not feasible to directly weigh using a scale, EPA volume-to-weight conversion factors (or other location-specific conversion factors) are used to determine the weight.

Waste Assessment Tools and Resources

The following sections outline specific case studies from UC Irvine's and UC Merced's dining halls, where waste assessments have been conducted to identify need for product changes and new educational strategies and to designate locations as Zero Waste once they are operating on a daily basis with more than 95% solid waste diversion.

UC Irvine Waste Audit Calculator & Case Study

Understanding the UCI Waste Audit Calculator

The UCI Waste Audit Calculator (download here) consists of three sections:

Section 1: Location Information: This section is used to identify the facility for which the waste audit is being conducted, the party responsible for managing the facility, and the party responsible for conducting the waste audit.

Facility	Pippin Commons/Pippin P.O.D/Espress Yourself Law Cart
Facility Manager	UCI Hospitality & Dining
Waste Auditors	UCI Facilities Management

Section 2: Calculation: This section is used by the party conducting the waste audit to input each bin's weight or volume.

Bin Location	Bin Type	Bin Size	% Full	MSW Type	Lbs. Recycle	Lbs. Food	Lbs. Oil/Grease	Lbs. Trash/Landfill
West Station	Gallon	5	0%	Food		0.00		
West Station	Gallon	22	50%	Recycle	11.00			
Salad Station	Gallon	22	50%	Recycle	11.00			
	Gallon	5	0%	Food		0.00		
East Station	Gallon	22	0%	Recycle	0.00			
	Gallon	5	0%	Food		0.00		
Reception	Gallon	6	50%	Recycle	3.00			
Kitchen	Gallon	32	50%	Food		85.00		
	Gallon	32	50%	Recycle	16.00			
	Gallon	32	50%	Recycle	16.00			
	Gallon	32	25%	Food		42.50		
	Gallon	32	25%	Food		42.50		
	Gallon	32	25%	Recycle	8.00			
	Gallon	22	50%	Recycle	11.00			
	Gallon	32	25%	Recycle	8.00			
	Gallon	32	25%	Recycle	8.00			
	Gallon	5	25%	Food		6.64		
	Gallon	32	50%	Food		85.00		
	Gallon	32	25%	Recycle	8.00			
	Gallon	5	100%	Food		26.56		
	Gallon	5	50%	Food		13.28		
	Gallon	10	100%	Oil/Grease			74.50	
Exterior Enclosure	Yard	2		Uncompact Cardboard	200.00			
	Compactor (lbs.)	750		Food		750.00		
	Yard	4	100%	Recycle	708.00			
MSW	Gallon	32	100%	Trash/Landfill				48.00
TOTAL					1008.00	1051.48	74.50	48.00

The UCI Waste Audit Calculator uses the following EPA volume-to-weight conversion factors.

Municipal Solid Waste Type	Volume	Weight (lbs.)
Cardboard (uncompacted)	1 $yard^3$	100
Food	1 gal	5.3125
Oil/Grease	1 gal	7.45
Recycle (Commingled)	1 $yard^3$	11
Trash/Landfill	1 gal	1.5

Section 3: Results: This section displays the total waste generated in pounds, the total waste diverted in pounds, and the waste diversion percentage.

	Total	Food	Oil/Grease	Recycle	Trash/Landfill
Waste Generated (Lbs.)	2,181.98				48.00
Waste Diverted (Lbs.)	2,133.98	1051.48	74.50	1008.00	
Diversion Results	**97.80%**				

Using This Tool to Conduct a Waste Audit

The steps below outline how to use this tool in practice.

1. **Planning**
    a. Arrange with necessary stakeholders, including both the party responsible for managing the facility and the party that will be conducting the waste audit, as well as any other key stakeholders to determine a date and time for the waste audit.
    b. Schedule your waste audit as close as possible prior to your date of bin pickup to accurately account for all waste generated by the location.
2. **Setting Up the Tool For Your Facilities:**
    a. It is recommended to download a separate copy of the UCI Waste Audit Calculator file for each audit, as the calculator uses formulas that may be deleted in the process of conducting a waste audit.
    b. The name of the facility being assessed is entered in cell L1.
    c. The name of the organization that manages the facility is entered in cell L2.
    d. The name of the party conducting the waste audit is entered in cell L3.
    e. The list of bins present is entered in columns B (Bin Type) and C (Bin Size), where B (Bin Type) is the unit of volume and C (Bin Size) is the number of units of volume the bin holds. For example, a 22-gallon “Slim Jim” bin would be listed by entering “Gallon” in Column B (Bin Type) and 22 in Column C (Bin Size).
    f. The location of bins throughout your facility can be designated in column A (Bin Location) to assist in identifying the proper corrective actions to take, if any, after the waste audit.
    g. Additional rows can be added, as needed, through the following steps:
        i. Right-click the row label on the far left for any row from 10-27.
        ii. Select “Copy.”
        iii. Right-click the row label on the far left for any row from 10-27.

iv. Select “Insert Copied Cells.”

3. **Conducting Your Waste Audit**
    a. For each bin in the location, the party conducting the audit must do the following:
        i. Determine the type of municipal solid waste the bin is used for and weigh the bin. Enter the type of municipal solid waste in column E (MSW Type) and enter the weight in pounds in the appropriate column for the municipal solid waste type (columns F through I).
        ii. If unable to weigh the bin directly, instead determine the type of municipal solid waste the bin is used for and, to the nearest available approximation, how full the bin is. Enter the type of municipal solid waste in column E (MSW Type) and enter the approximation of how full the bin is in column D (% Full). In the example, these fullness approximations are displayed in increments of 25%.
        iii. Determine if the bin exceeds the acceptable threshold for contamination (subject to local program restrictions). If it does, enter Landfill in column E (MSW Type) instead.
4. **Results**
    a. The UCI Waste Audit Calculator will displays the total lbs. of waste generate, lbs. of waste diverted and the waste diversion percentage.

Sample Case Study: UCI Pippin Commons

Background: UCI has 25,256 undergraduate students, 6,295 graduate students and 11,053 faculty and staff (excluding medical center staff at the UCI Medical Center in Orange, CA and student employees already counted as students). UCI’s Pippin Commons, operated by UCI Hospitality & Dining in partnership with Aramark, serves approximately 19,000 meals a week.

Using the UCI Waste Audit Calculator, UCI Facilities Management conducted a waste audit of Pippin Commons. The UCI Facilities Management team entered the types and sizes of the bins in the Bin Size and Bin Type columns, and added which locations within Pippin those bins were placed in the Bin Location column. The types of municipal solid waste were noted in the MSW Type, using the Food, Recycle, Oil/Grease, Cardboard, and Trash/Landfill types. Because this waste audit was conducted after a prior full-scale waste characterization, EPA volume-to-weight conversion factors were used, approximating the fullness of each bin to the nearest 25%.

Based on the results, with minimal to no contamination in each bin, the location had a 97.8% diversion rate, sending less than 3% (48 pounds) of the 2,181.98 pounds of waste generated to landfill. Food waste and commingled recycling are hauled to the local Waste Management of Orange County (WMOC) site in Orange, CA. At the WMOC site, commingled recycling is sorted in a Materials Recovery Facility (MRF) using both machine-automated processes as well as manual processes. Fryer oil is picked up by a third party, which uses the oil to produce bio-diesel.

UC Merced Waste Characterization Case Study

UC Merced conducted a full-scale waste characterization of both Housing and Dining in February 2016. This study categorized waste into 13 types for Dining and 14 types for Housing.

Through this waste characterization, each ban was emptied and re-sorted to identify the waste stream composition, shown in the tables below.

DINING

TONS	DESCRIPTION	WASTE TYPE	% OF STREAM
763.2	Pre- & post-consumer food waste	Compost	45.39%
188.4	Compostable food packaging	Compost	11.20%
349.2	Cardboard	Recycle	20.77%
105.4	Mixed recycle	Recycle	6.27%
35.6	Plastic film	Recycle	2.12%
18.2	Glass CRV	Recycle	1.08%
18.0	Plastic CRV	Recycle	1.07%
2.6	Paper	Recycle	0.15%
2.2	Cans CRV	Recycle	0.13%
7.6	DC dishes	Recycle	0.45%
42.0	Plastic bags	Recycle	2.50%
38.2	Gloves	Landfill	2.27%
110.8	Plastic food packaging	Landfill	6.59%
1681.4	**TOTAL**		

In Dining, pre- and post-consumer food waste constituted the largest single type of waste, making up 45.39% of the waste stream. Combined compostable materials, including pre- and post-consumer food waste and compostable food packaging made up 56.60% of all waste. Combined recyclables constituted an additional 32.04%. Altogether, material that could be diverted from landfills made up 88.64% of the waste stream.

WASTE TYPE	LBS./DAY	% OF STREAM
Combined Divertable (Compostable + Recyclable)	1490.4	88.64%
Compostable	951.6	56.60%
Recyclable	538.8	32.04%
Landfill	191.0	11.36%

Given the UC goal of Zero Waste by 2020 requiring 95% or more of all solid waste to be diverted from landfills, this has prompted UC Merced Dining Services to examine product alternatives that would reduce food-soiled plastic packaging, as well as to consider bulk options that require no single-serve packaging.

HOUSING

TONS	DESCRIPTION	WASTE TYPE	% OF STREAM
440.6	Food	Compost	29.90%
308.8	Compostable food packaging	Compost	20.95%
118.2	Cardboard	Recycle	8.02%
59.8	Mixed recycle	Recycle	4.06%
4.2	Plastic film	Recycle	0.28%
71.8	Glass CRV	Recycle	4.87%
66.4	Plastic CRV	Recycle	4.51%
38.6	Paper	Recycle	2.62%
8.4	Cans CRV	Recycle	0.57%
6/8	DC dishes	Recycle	0.46%
54	Plastic bags	Recycle	3.66%
12.4	Metal	Recycle	0.84%
146.0	Plastic food packaging	Landfill	9.91%
137.8	Misc. trash	Landfill	9.35%
1681.4	**TOTAL**		

In Housing, food waste once again constituted the largest single type of waste, making up 29.90% of the waste stream. Combined compostable materials, including food waste and compostable food packaging made up 50.85% of all waste. Combined recyclables constituted an additional 32.04%. Altogether, material that could be diverted from landfills made up 80.74% of the waste stream.

WASTE TYPE	LBS./DAY	% OF STREAM
Combined Divertable (Compostable + Recyclable)	1190.0	80.74%
Compostable	749.4	50.85%
Recyclable	440.6	29.90%
Landfill	283.8	19.26%

As a result, UC Merced Housing started a composting pilot in on-campus housing on October 1, 2016 to divert the 50% of the waste stream comprised of compostable items. The pilot will continue through Spring 2017.

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