## Motivating Question & Research Focus

**Does the adoption of compostable foodservice packaging, implemented under the right operating conditions, correlate to increased capture of Front of House food scraps with minimized contamination?**

**HYPOTHESIS 1**

**COMPOSTABLES & FOOD CAPTURE**

Venues that adopt compostable foodservice packaging under the right operating conditions should be expected to capture more food scraps in the Front of House compost stream.

**HYPOTHESIS 2**

**COMPOSTABLES & CONTAMINATION**

Venues that adopt compostable foodservice packaging under the right operating conditions, should be expected to have less contamination in Front of House compost streams.



## Desired Project Outcomes

- DEVELOP A METHODOLOGY for characterizing best practices related to the use of compostable foodservice items, characterizing organics streams, and making the correlation to both levels of contamination and food capture.
- GAIN DIRECT INSIGHTS into how the use of compostable foodservice items, under best practices, can facilitate food scrap capture at venues, while controlling for levels of contamination.
- CREATE A GUIDE to serve as a consistent and repeatable approach so interested parties (venues, researchers, compost operators, etc.) can take steps to sample additional venues and gather information that will enhance the depth, diversity, and volume of data over time and strengthen the underlying correlations.
- DRIVE DIALOGUE and greater understanding within the composting community around how compostable packaging can play a positive role in diverting high-quality FOH food scraps from foodservice environments




CHARACTERIZE WASTE STREAMS

## 7. Venue Insights from Waste Characterizations

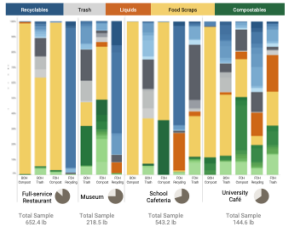
| | VENUE 1 Full-Service Restaurant | VENUE 2 Museum | VENUE 3 School Cafeteria | VENUE 4 University Café |
|---|---|---|---|---|
| **Influential Venue Characteristics** | • Compostable foodservice packaging used for to-go meals<br>• Majority of meals eaten on site (75%-100%)<br>• Staff manages FOH streams | • Open to the general public<br>• Large venue, serving hundreds of meals/day, with 30+ single use products<br>• Recycled content cups substituted for unavailable compostable product by distributor | • Virtually 100% repeat customers<br>• Sorting station – students dump liquids, sort materials, etc.<br>• Strong signage<br>• Low percentage of outside materials<br>• Dedicated student "Green Team" supports program / sorting | • Mostly repeat customers<br>• Use both compostable and non-compostable foodservice packaging products<br>• PLA cutlery in use but guidance to landfill<br>• One FOH compost bin had correct signage but incorrect 'Waste' bin label |
| **Contamination Insights (% by weight)** | • FOH Compost Contamination: <1%<br>• BOH Compost Contamination: <1%<br>• 95%+ of compost streams made up of food scraps | • FOH Compost Contamination: 13%<br>• Main contaminants: plastic cups (4%), non-compostable wrappers (3%), & residue (2%)<br>• Distributor provided PET lid with large compostable cup | • FOH Compost Contamination: 0%<br>• BOH Compost Contamination: 0%<br>• Compostable trays stacked and separated after food scraped | • FOH Compost Contamination: 18%<br>• BOH Compost Contamination: 3%<br>• Main contaminants: plastic bags / film (12%) |
| **Food Capture Insights** | • **79% food in compost bins,** by weight<br>• BOH trash high in food waste & compostable serviceware (46%) | • **93% food in compost bins,** by weight<br>• FOH Trash and BOH Compost missing | • **87% food in compost bins,** FOH and BOH by weight | • **61% food in compost bins,** FOH and BOH by weight |
| **Top Compostable Materials Found in FOH Compost (% Total Stream by weight & vol)** | **Compostable Clamshells** Vol: 16.2% / Wt: 0.9%<br>**Napkins/Paper Towels** Vol: 4.3% / Wt: 1.6%<br>**Compostable Straws** Vol: 3.2% / Wt: 0.3%<br>**Other Compostables** Vol: 1.1% / Wt: 0.2% | **Fry Boats:** Vol: 11.5%/Wt: 14.6%<br>**Plates/Bowls:** Vol: 10.7%/Wt: 9.9%<br>**Bev Cups:** Vol: 9.5% / Wt: 4.9%<br>**Napkins/Towels:** Vol: 7.3%/Wt: 8.2%<br>**Bags/Films:** Vol: 5.5%/Wt: 4.3% | **Plates Bowls:** Vol: 85.1%/Wt: 35.3%<br>**Bags/Films:** Vol: 1.7%/Wt: 0.2%<br>**Napkins/Towels:** Vol: 0.4%/Wt: 0.2% | **Clamshells:** Vol: 39.8%/Wt: 29.4%<br>**Napkins/Towels:** Vol: 10.2%/Wt: 7.9%<br>**Bags/Films:** Vol: 5.1%/Wt: 2.2%<br>**Bev Cups:** Vol: 3.4%/Wt: 3.1%<br>**Bags/Films:** Vol: 5.1%/Wt: 2.2%<br>**Containers:** Vol: 2.5%/Wt: 2.3%<br>**Wrappers:** Vol:6.8/Wt: 0.5% |



ANALYZE RESULTS

## Food scraps and compostable items, by **weight**, are the largest component of restaurant FOH compost streams

- For the highest scoring venue, food scraps were found to be, by a wide margin, the largest component of compost streams
- Food scraps were generally found in FOH compost streams to be more predominant than compostable packaging materials
- Significant food scraps and compostable packaging was identified in all trash streams, however FOH trash streams were not able to be sampled from the restaurant and the museum



## Chicago Sort Study: Methodology

**Venue Identification, Characterization, and Waste Sort Comparison**

Venues are selected according to a minimum criteria around geography, material streams, program maturity, commitment, and minimum generation rate. Selected venues are diversified across food services.

| Ideal Material Streams | Minimum Material Streams | Measures |
|---|---|---|
| Front of House Compost | Compost (FOH) | Weight & Volume |
| Back of House Compost | | |
| Front of House Trash | Trash (FOH or BOH) | Weight & Volume |
| Back of House Trash | | |
| Recycling | Recycling (if provided at the venue) | Weight & Volume |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| IDENTIFY VENUES TO PARTICIPATE IN STUDY | PRE-SCREEN VENUES FOR COMPATIBILITY Assess venue candidacy | ON-SITE VENUE WALKTHROUGHS & QUESTIONNAIRE Perceive site practices, flow of materials, collection bin set-up, meals served | CHARACTERIZE VENUE ATTRIBUTES & BEST PRACTICES | COLLECT WASTE STREAM SAMPLES Provide staff container signage & bags to move material to correct container | SORT & CHARACTERIZE WASTE STREAMS Sort according to category; weigh material; ¼ full measure for volume | ANALYZE DATA & EVALUATE CORRELATION Combine data; dependent variables: captured quantities of food scraps/ compostable materials in organics stream and contamination rates |



## Materials Collection

CHARACTERIZE WASTE STREAMS

The Project Team met with venue staff to detail how materials would be separated and samples would be collected from each stream

- Using material density factors, the Project Team estimated the number of containers needed for each material stream. Total of 20-24 containers were placed at each venue
- Based on the venue-reported generation, haulers placed containers up to a week prior to the sort, as required
- Containers were labeled according to material streams. Venue staff were instructed to label bags of materials for the stream with stickers or tape before depositing bags in the matching container



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# APPLYING THE FRAMEWORK:

HOW CASE STUDY VENUES FARE IN THE ADOPTION OF COMPOSTABLES



IDENTIFY & SCREEN VENUES

## 2. Participating Venues

| VENUE 1 | VENUE 2 | VENUE 3 | VENUE 4 |
|---|---|---|---|
|  |  |  |  |
| **Full-Service Restaurant** Full Service (includes casual and fine dining) | **Public Attraction (Museum)** Quick Serve (includes fast food and fast casual/cafe) | **School Cafeteria** Self-Serve Cafeteria Style (includes catered events) | **University Café** Quick Serve (includes fast food and fast casual/cafe) |



CHARACTERIZE VENUE PRACTICES

## Combined Results – 4 Dimensions

Quantifying the degree of implementation of compostable foodservice items with an overall score.

| DIMENSION SCORES | VENUE 1 Full-Service Restaurant | VENUE 2 Museum | VENUE 3 School Cafeteria | VENUE 4 University Café |
|---|---|---|---|---|
| 1 PROCUREMENT | 18/20 | 13/20 | 10/20 | 14/20 |
| 2 OPERATIONS | 20/20 | 18/20 | 16/20 | 10/20 |
| 3 COMMUNICATIONS | 10/15 | 12/15 | 11/15 | 12/15 |
| 4 PEOPLE | 6/10 | 6/10 | 10/10 | 9/10 |
| COMBINED SCORE | 54/65 | 49/65 | 47/65 | 45/65 |

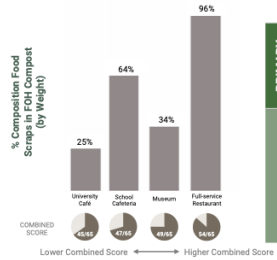
Low ⟷ High

*NOTES:*

- *Comprehensive scores reflect total of scores of all underlying attributes within each category. Scores based on 1-5 scale; lowest possible combined score is 13/65*
- *It is to be expected that a sole attribute might have outsized influence on outcomes relative to that of other attributes*
- *Continued sampling over time may reveal further insights into useful weighting*

## Evaluating Hypothesis 1: Adoption of Compostables will Increase Food Scrap Capture

Evaluate Correlation




**PRIMARY FINDING**

- Food scrap capture in FOH compost was found to trend higher at venues with stronger adoption of compostable foodservice items
- Relatively high % of food scrap in school compost stream may be influenced by exceptionally strong "People" dimension

**CONCLUSIONS**

- Findings suggest that venues implementing FOH composting with compostable foodservice packaging, under the right operating conditions, should be expected to collect more food scraps in Front of House compost streams*
- Findings suggest high likelihood of a strong positive correlation between compostable foodservice items and rates of FOH food capture, though individual attributes likely have significant influence

COMPOSTABLE CHICAGO

* Adoption of compostable items defined by operating conditions as outlined in 4-Dimensional Framework

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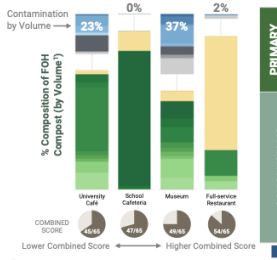
## Evaluating Hypothesis 2: Adoption of Compostable Foodservice Packaging will Result in Less Contamination

Evaluate Correlation




**PRIMARY FINDING**

- Contamination levels generally trend lower with stronger adoption of compostable foodservice items
- Much of Museum's contamination was likely non-compostable substitutes for compostable items ordered but not received due to supply chain disruptions

**CONCLUSIONS**

- Likely a significant positive correlation between higher degree of adoption of compostable foodservice items and higher FOH food capture[2]
- Much of Museum's contamination likely from procured compostables that were substituted with non-compostable items due to supply chain disruptions
- Specific underlying attributes can have outsized impacts on contamination. For example, this phenomenon is likely observed with the presence of the School Cafeteria Green Team

COMPOSTABLE CHICAGO

1) Represented here by volume as composters frequently measure contamination by volume
2) Adoption of compostable items defined by operating conditions as outlined in 4-Dimensional Framework

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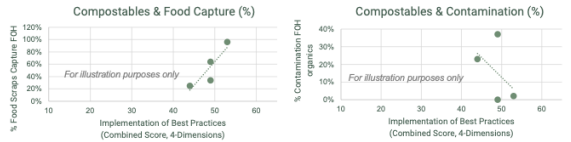
# KEY LEARNINGS

FROM CHICAGO CASE STUDY

COMPOSTABLE CHICAGO

## Next Steps: Developing a Statistical Correlation

- This study's approach and methods should be applied to additional venues in order to link how operating conditions impact the FOH compost streams
- Future studies will contribute to a body of data that can facilitate statistical evaluation of correlations. With a larger sample size, including variation in the degree of compostable foodservice packaging implementation (High vs Low), these variable cases should illustrate stronger patterns
- The correlation of individual venue attributes to both food scrap capture and contamination should be studied to enable refinement of the framework generally, and inform weighting approaches




COMPOSTABLE CHICAGO

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COMPOSTABLE CHICAGO

## Summary of Outcomes

## This study has successfully:

- Demonstrated a replicable research approach that can shed insight into the relationship between use of compostable packaging, food waste capture, and levels of contamination
- Provided an organized framework by which composting operators can evaluate a foodservice venue to gauge how thoroughly and effectively compostable foodservice items are being utilized
- Implemented a multi-venue waste study, with results suggesting that with stronger operating conditions and best practices for compostable foodservice items, higher percentages of food scraps might be captured relative to packaging, and with low levels of contamination
- Developed a methodology by which a venue's waste stream can be characterized and quantify the contents of a foodservice venue's waste streams, including the contents of the Front of House organics stream
- Articulated a pathway by which to enable consistent and repeatable data collection over time through repeated sampling
- Presented a vision for future studies that will provide the level of data needed to evaluate the correlations in a statistical way

## III.How to Select Venues & Sample Waste Streams

*Guidance on Selecting Venues*

**VENUE ELIGIBILITY**

This Guide Methodology offers a framework by which statistical correlations can be evaluated through iterative sampling and collection of data. For projects to generate data that is usable in a future 'meta study', food service venues should meet the following minimum eligibility:

1) **Geography** – Food service venues should be in North America.
2) **Material Streams** – Venues need to have separate waste streams for organics and for trash. The venues may also have a recycling stream. The venue must have FOH compost collection for inclusion in the larger dataset study. Ideally, venues evaluated would have six material streams: FOH compost, BOH compost, FOH trash, BOH trash, FOH recycling, and BOH recycling.
3) **Program Maturity** – Venues need to have had a source-separated organics collection program for at least six months prior to the waste assessment and sort.
4) **Commitment** – Venues need to be willing to answer questions about their venues, waste streams, and inventory (e.g., compostable products procured) and be willing to have their waste streams collected and sorted through. Participating venues' data may need to be anonymized in the study's results.
5) **Minimum Generation Rate** – Venues need to generate at least 150 lb of material per stream over seven days. This allows the material sample and sort to be carried out using reasonable quantity of material.

Of course, a project team may conduct this assessment for venues that do not meet these minimum eligibility requirements, however, data collected from venues that meet these minimums will be better suited for evaluation in aggregate in the future. Table 1 below highlights different types of food service venues and potential advantages and challenges of each one.

*Table 1: Advantages & Disadvantages of Different Types of Foodservice Venue Types*

| | Venue Type / Location | Advantages | Disadvantages |
|---|---|---|---|
| RESTAURANTS OPEN TO GENERAL PUBLIC | Quick Service Restaurants (QSR) | • Mix of customers and employees handling waste | • Significant fraction of material is "on-the-go" and will not be collected in-house |
| | Full-Service Restaurants (FSR) | • No outside food service packaging and containers brought in<br>• Employees handle waste, easier intervention point; customer education less influential | • No front-of-house material streams; customer food waste added to back-of-house |
| | Airports | • Large generation of materials<br>• Will have different venues in the same location, QSR, & FSR<br>• Less outside food service packaging & containers brought in | • Customers are less likely to be repeat customers<br>• Spaces may not offer organics / composting |



*Table 7: Sort Categories, Compostable Products*

| Compostable Products | | | | |
|---|---|---|---|---|
| Category Name | Description / Example | Weight (lb) | Volume (GAL) | Count (#) |
| CERTIFIED COMPOSTABLE PRODUCTS | | | | |
| Beverage Cup | Cold or hot cups, paper, and plastic | ✓ | ✓ | |
| Clamshell | Take-away containers | ✓ | ✓ | |
| Container | Other container types like soup cups | ✓ | ✓ | |
| Wrappers | Compostable wrappers (i.e., sandwich wrappers) | ✓ | ✓ | |
| Portion Cup | Small cups for sauces or sides | ✓ | ✓ | |
| Lid for Cup / Containers | Cold or hot cup lids, other lids | ✓ | ✓ | |
| Cup Sleeve | Sleeves | ✓ | ✓ | |
| Plate / Bowls | Compostable plates / bowls | ✓ | ✓ | |
| Bag / Films / Pouches | Compostable bags or pouches | ✓ | ✓ (Un-compressed) | |
| Straws | Straws | ✓ | ✓ | ✓ |
| Cutlery | Forks, spoons, knives, other utensils | ✓ | ✓ | ✓ |
| ORGANIC MATERIAL | | | | |
| Liquids | Liquid (drinks, soup, etc.). Poured out into bucket | ✓ | ✓ | |
| Food Scraps | Includes pre- and post-consumer food waste | ✓ | ✓ | |
| Other Organics | Other organics like oil/grease, ash, fur, yard/plant waste | ✓ | ✓ | |
| FIBER & OTHER MATERIAL | | | | |
| Napkins / Paper Towels | Fiber based towels or napkins | ✓ | ✓ | |
| Molded Paper | Molded paper trays, clamshells, cups | ✓ | ✓ | |
| Cardboard | Corrugated cardboard | ✓ | ✓ | |
| Paperboard | Paper or boxboard, includes paper plates that aren't certified compostable | ✓ | ✓ | |
| Mixed Paper | Includes newspapers | ✓ | ✓ | |
| Other Compostable Products | Items that do not fit into above categories like toothpicks, wooden stirrers, coffee pods | ✓ | ✓ | |



# Evaluating the Impact of Compostable Foodservice Packaging

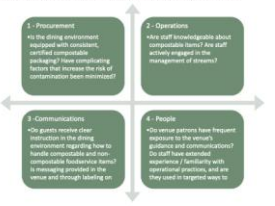
A Guide to Examining Operating Conditions that May Increase Food Capture and Reduce Contamination in Front of House Composting Programs

Developed through the 2022 CompostAble Chicago Project

A Framework for Best Practices Using Compostables

The question at hand is how compostable single-use items will lead to better outcomes for both foodservice operators and composters. More specifically, the question can be framed as, "How do compostables, used thoroughly and systematically according to best practice, result in more food scraps and less contamination in the front-of-house organics stream?" The following framework characterizes a venue's implementation of best practices for compostables across four dimensions: procurement, operations, communications, and people.

*Figure 1: 4-Dimension Framework for Characterizing Venue Implementation of Compostable Serviceware*




This guide provides an approach by which venues can be evaluated, both in terms of characterization by the above attributes and best practices and in terms of their waste streams. Together, this information can be used to identify how the use of compostables can result in compost streams containing more food and less contamination.



*Figure 5: Example Illustration of a Postive Correlation*

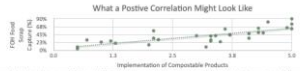
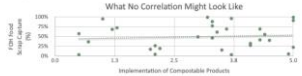



Figure 6 below, also presented for illustration purposes only, is representative of what a non-correlation might look like.

*Figure 6: Example Illustration of No Correlation*




Negative correlations are also possible (no example is shown here), where the best fit line for food scrap capture would decrease as the independent variable for implementation of compostable products increases.

**EVALUATING REGRESSION ANALYSIS**

Given the numerous attributes across the multidimensional framework that all likely have tangible correlations to varying degrees, an effective approach to studying the relationships is to concurrently correlate, via multiple regression, the respective effects of any, or all, of these attributes to food capture rates and contamination. Multiple regression will evaluate the relative effect of these attributes on the dependent variables in question while holding all the other variables in the model constant and provide correlation coefficients for each of the independent variable attributes.