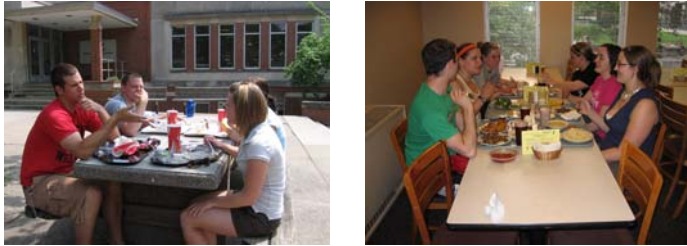


## Eat-in or Carry-out?



### A Life Cycle Assessment of Carry-Out & Traditional Meals at The Ohio State University

Eric Riethman  
4 March 2008

## Overview

- Why am I here?
- Life Cycle assessment – what is it?
- Results
- Conclusions
- Recommendations

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## Eat-in or Carry-out?

- Have you ever considered the differences between carry-out and traditional meals and how they impact the environment?

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## Why am I Here?

- Present results of project
  - Compare life cycle impacts of carry-out & traditional meals at the North Commons
- Demonstrate tangible and intangible benefits for Campus Dining Services
  - Save money
  - Improve reputation
  - Reduce environmental impacts
- Stimulate research and debate
  - Increase awareness of life cycle assessment

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# Life Cycle Assessment (LCA)

A systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life cycle.

ISO 14040.2 Draft: Life Cycle Assessment - Principles and Guidelines



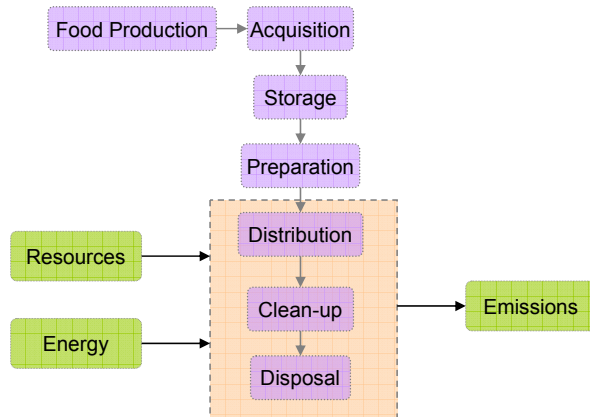
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## One Meal



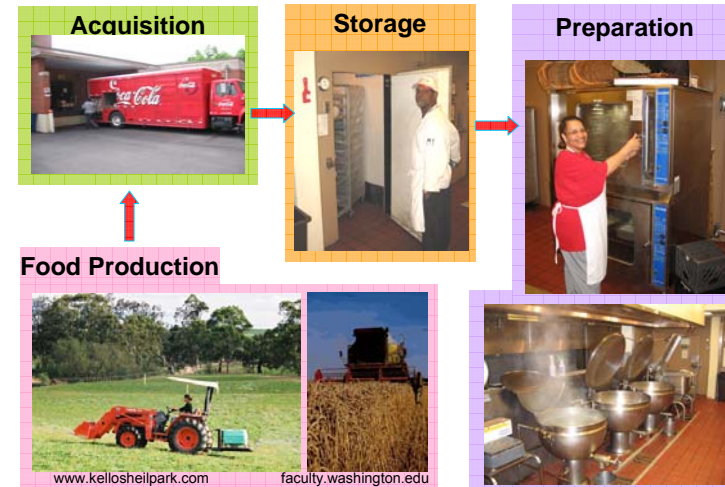
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# Life Cycle Assessment




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# Phases of the Meal Life Cycle




### Meal Phases Continued

**Distribution**




**Clean-up**




### Meal Phases Continued

**Distribution**




**Main Line Clean-up**



### Meal Phases Continued

**Disposal**




Wastewater Treatment

Landfill

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### How are Results Obtained?

- Economic Input-Output Life Cycle Assessment (EIO-LCA)
  - Database developed by Carnegie Mellon University's Green Design Institute
  - Input an economic value and receive various outputs
    - Conventional air pollutants
    - Greenhouse gas emissions
    - Nonrenewable energy consumption
    - Environmentally toxic releases
- Waste audit conducted in November
  - 7:00 a.m. – 2:30 p.m. (breakfast and lunch periods)



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## How are Results Obtained?

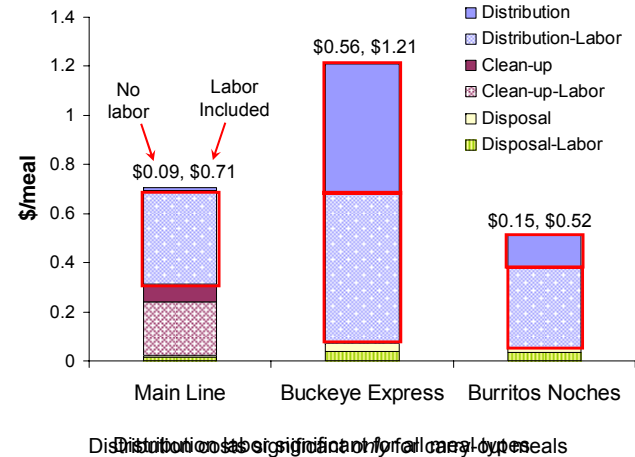
Carry-out Main Line

Item or Process	Lifetime (meals/unit)	Price (\$/meal)	Physical Input	Units	Sector Description
Distribution					
Stainless silverware (K-F-S)	244	0.0012	0.336	g	Jewelry & silverware mfg.
Plastic silverware kit (K-F-S)	1	0.0447	13.260	g	Plastic bottle mfg.
Large plate	489	0.0055	2.135	g	Earthenware articles mfg.
Clean-Up					
Dishwasher production	11,000,220	0.0057	--	N/A	Commerical service industry mfg.
Dishwasher Rinse Water	N/A	0.0039	3,800	g	Water, sewage, & other systems
Dishwashing Heat	N/A	0.0091	1,200	kJ	Natural gas distribution & supply
Dishwasher operation	N/A	0.0009	0.023	kWh	Power generation & supply
Disposal					
Waste collection	N/A	0.0056	22,505	g	Waste remediation services

Each product or process considered separately

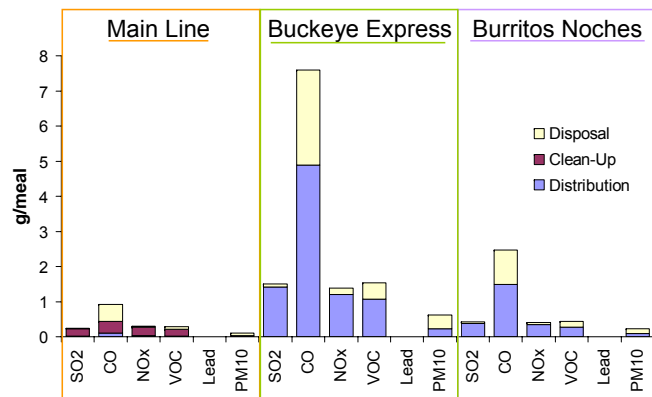
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## Life Cycle Cost



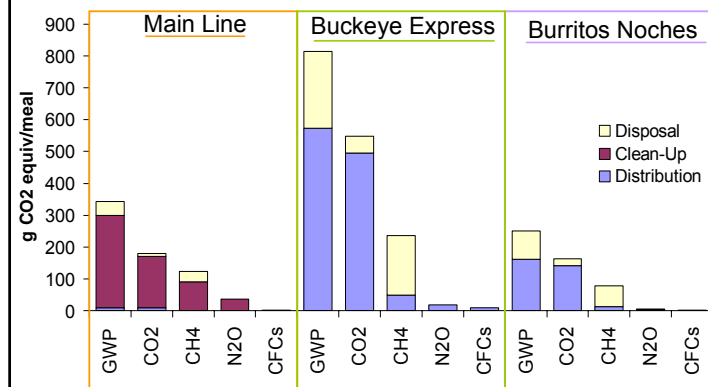
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## Conventional Air Pollutants



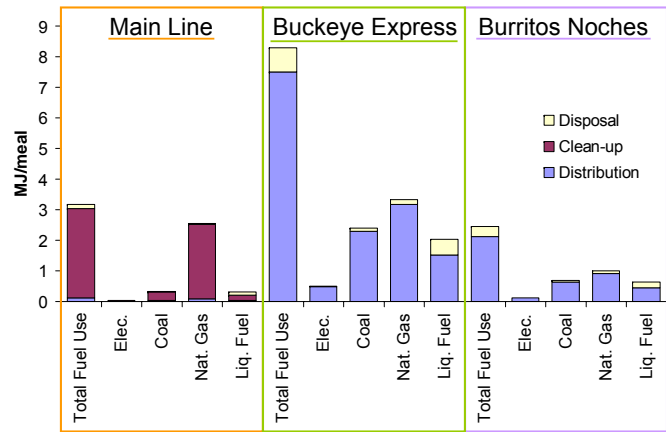
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## Greenhouse Gas Emissions



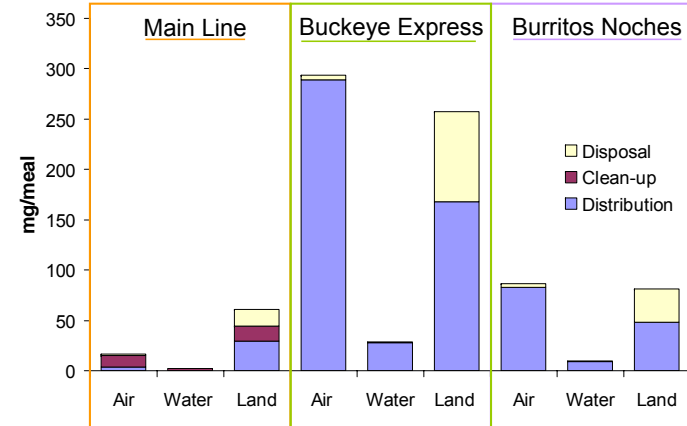
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## Energy Consumption



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## Toxic Releases



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## Conclusions

- Main line “greener” than carry-out
  - Can only improve from current state
- Inefficient clean-up phase dominates main line
  - Rinse water consumption (13.8 L/meal = 3.7 gal/meal)
  - Rinse water heating via natural gas ( $T \approx 103$  F)
  - **Large** mass of organic waste and small volume
    - 0.25 lb/meal (83% of total meal waste)
- Disposable serving items dominate carry-out meals
  - Single-use items cannot compete with reusable main line items
  - **Large** volume of disposable waste and small mass
    - 0.108 lb/meal (BE)
    - 0.18 lb/meal (BN)

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## Main Line Recommendations

- Clean up the clean-up phase
  - Regulate rinse water use and temperature
    - Install low-flow devices
    - Turn the water off between washing periods
    - Select a reasonable operating temperature
- Utilize organic waste stream
  - New technology – downstream solutions
    - Composting operation
    - Anaerobic digester
  - New business practices – treat problem at source
    - Limit amount of uneaten food from buffet style serving line

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## Carry-out Recommendations

- Reduce the volume of disposable serving items
  - Burritos Noches impacts comparable to main line
  - Lump food into one container
- 35% of all carry-out meals are eaten-in
  - Contradictory to their intended purpose
  - Offer china for eat-in customers
  - Refer eat-in customers to the main line
- Increase customer awareness of the lifecycle-environmental impacts of carry-out meal

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## Summary

- Life Cycle Assessment as a tool
- Quantified inputs and outputs
  - Emissions, energy, and money
- Concluded that the main line meal is the greenest option that can only become greener
- Recommended improvements to main line clean-up phase and reductions in use of food packaging
- Bottom line: traditional meals are greener than carry-out meals; students need to know

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## Questions



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