

Waste Reduction in The Hospital Sector

Case Study Report: McPherson Hospital

prepared by the:

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PREFACE

PROJECT DESCRIPTION

Overall Project Objectives

This study of solid waste reduction practices at McPherson Hospital in Howell is part of a project comprising five case studies. The objective of the project is to analyze and document successful waste reduction programs implemented by commercial and industrial firms in the state of Michigan so that the identified waste reduction practices can be transferred effectively to other firms. The information presented in these reports may also serve to suggest ideas for waste reduction which could be implemented in other industries beyond those selected for the five case studies.

The primary focus of each case study is a change or innovation in a product or process that resulted in source reduction of nonhazardous solid waste. Process, economic, and organizational/motivational analyses are performed in each study. The process analysis includes a description of the product and process changes and the amount of waste reduction achieved. The economic analysis evaluates the costs and revenues to the firm that result from the waste reduction activity. Baseline economic data, including fixed and variable costs and revenues before the intervention, are compared with the after-intervention data. An organizational/behavioral study then examines the decision-making process, incentives and organizational support, company policy, and employee attitudes related to the initiation of the waste reduction activity.

The overall benefits of waste reduction measures also depend on the reduction of societal and environmental impacts associated with the life cycle of the goods provided or services rendered. External social and environmental factors relating to each program are identified and discussed where possible.

Some of the waste reduction programs documented in this report can be implemented relatively easily, whereas others may require significant capital investment, employee training, or operational changes. Each case study attempts to identify key elements of the model waste reduction program that are necessary for its successful implementation.

Case Study Firms

The case study firms were selected according to the following criteria: a priority of source reduction over recycling and other waste management strategies; the transferability of the waste reduction practices to other firms; information availability and accessibility; the potential amount of solid waste reduction achieved if other firms adopt the model waste reduction practices; and a diversity of businesses in terms of their SIC Code, size, organizational structure, and geographic location.

The five firms studied are the following:

1. Hudson's department stores in Michigan; retail department stores
2. Gretchen's House III in Ann Arbor; child day care facility
3. McPherson Hospital in Howell; cafeteria and patient food service
4. Packard People's Food Cooperative in Ann Arbor; grocery store
5. Steelcase in Grand Rapids; office furniture manufacturer

Project Publications

The following documents are available through the Office of Waste Reduction Services:

- Fact Sheets - two page document summarizing waste reduction efforts of each case study firm.
- Detailed Case Study Report - a comprehensive guide to assist firms with the actual implementation of waste reduction efforts.
- Final Project Report - description of the methodology, major findings, and recommendations covering all five case studies.

A Fact Sheet and Detailed Case Study Report are published for each of the five case studies. Documents may be obtained from:

Office of Waste Reduction Services
Michigan Departments of Commerce and Natural Resources
PO Box 30004
Lansing, MI 48909
Phone: (517)-335-1178

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Solid Waste Research Group, School of Natural Resources, University of Michigan

The Solid Waste Research Group selected the case study firms, conducted the on-site data collection and analysis, documented the waste reduction activities, evaluated the potential impacts of these activities on the waste stream if they are adopted by other firms throughout Michigan, and prepared the case study reports. The following members of the Solid Waste Research Group participated in this project:

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The Office of Waste Reduction Services of the State of Michigan Departments of Commerce and Natural Resources provided assistance in the selection of case study firms and in reviewing the final report. Ms. Myra Grant served as project manager and administered the grant for the Resource Recovery Section, Waste Management Division, State of Michigan Department of Natural Resources.

The information presented in this report is the sole responsibility of the Solid Waste Research Group, School of Natural Resources, University of Michigan.

McPherson Hospital

The staff of McPherson Hospital and its food service provider, Servicemaster, Inc., contributed greatly to this project by providing data on dishware use and being available for interviews. Special thanks are given to the following people for sharing information on waste reduction activities and helping the research team conduct its on-site data gathering: Cliff Lewis, Servicemaster; Betty Gottshalk, Volunteer Coordinator; Sue Smith, Director of Obstetrics; and Robert E. Mack, Jr., Vice President, Planning and Development.

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1. SUMMARY

This case study documents successful waste reduction programs at McPherson Hospital in Howell, Michigan. McPherson Hospital's source reduction and recycling practices can serve as a model for other hospitals in Michigan. Process and cost analyses of McPherson Hospital's conversion from disposable to reusable dishes are the focus of this report. Major findings are:

- Waste produced by disposable dish use was virtually eliminated after conversion to reusable dishes.
- Reusable dishware use increased overall labor needs by 80%.
- Disposable dishware costs as much to use as washable dishware. The cost of disposable dishware balances the increased labor costs required to wash reusable dishes.
- Costs of disposable dishware use are sensitive to dishware prices, which comprise 64% of total costs.
- Comparative costs of reusable dishware use are less sensitive to rises in labor costs, which comprise 62% of total reusable costs, because labor also constitutes 33% of total costs for the disposable case.
- A conversion from disposable to washable dishware by all hospitals in the state could reduce annual solid waste production by as much as 880 tons.

The conversion from disposable to washable dishes at McPherson was facilitated by staff involvement and management responsiveness at all levels. Hospitals with dishwashing equipment can readily adopt the reusable dishware process studied in this report.

McPherson hospital also recycles a variety of papers and glass, steel, and aluminum containers. The hospital further reduces waste production by using cloth diapers rather than disposables, and reusing and refurbishing a variety of linens and housekeeping products.

- Adoption of McPherson's recycling program could divert as much as 7,000 tons from state landfills annually.

Waste disposal may be an increasingly important issue for hospitals in the future. A review of the successful waste reduction practices at McPherson Hospital could help other hospitals deal more effectively with waste disposal issues.

2. INTRODUCTION

NONHAZARDOUS WASTE PRODUCTION IN THE HOSPITAL SECTOR

Hospitals are significant generators of municipal solid waste. Major contributors to the nonhazardous hospital waste stream are: food service activities, medical and surgical services, and housekeeping operations.

Food service activities produce compostable waste from inventory loss, food preparation, and uneaten portions of meals. Napkins, straws, cups, and cup lids are also added to the waste stream by most food service operations.

In addition, food preparation produces the following packaging waste: plastic containers, wraps, and bags; corrugated boxes; and containers consisting of glass, aluminum, and steel. Expanded polystyrene dishware and other plastic utensils are discarded in significant quantity by hospital food services that use disposable dishware.

Other nonhazardous elements of the hospital waste stream typically consist of office paper, sheets, pillow cases, gowns, masks, surgical garments and cloths, gloves, and various items related to housekeeping such as rags and mops. Mattress covers, pads, linens, and additional bedding supplies are also discarded on a regular basis.

Disposable linens and bedding chosen to replace reusable items can significantly increase waste production. Hospitals using disposable diapers, particularly if specializing in obstetrics, may also produce significant waste from diaper use.

In addition to nonhazardous waste that is handled and discarded in the same manner as other municipal solid waste, hospitals produce specialized waste. Infectious medical waste can not be mixed with other municipal waste but must be discarded in a regulated manner. Toxic chemical residues, including solvents, are also produced by hospital operations and these require disposal in accordance with the Resource Conservation Recovery Act (RCRA). Radioactive waste generated by therapeutic and diagnostic procedures requires yet another type of special handling and disposal.

WASTE REDUCTION IN THE HOSPITAL SECTOR

Nonhazardous hospital waste can be reduced through source reduction, which includes the following activities:

- Serve food on reusable rather than disposable dishware
- Reuse primary and secondary packaging (when this is feasible and conforms to health codes)
- Repair and reuse linens and housekeeping materials
- Use washable instead of disposable gowns, linens, and other single-use supplies
- Keep records on microfiche and use double-sided copies for necessary paper documents
- Keep report and memo writing to a minimum and limit distribution

Hospitals can also reduce discards by composting food waste and recycling the following materials:

- Corrugated cardboard
- Office paper
- Mixed papers, including newspaper and computer paper

- Glass, steel, and aluminum containers
- Solvents and some chemicals
- Small batteries

Waste reduction practices that require small capital investments and low operating costs are likely to attract more interest and be more readily transferable to other hospitals than reduction methods that increase costs. Simple waste reduction programs which involve minimal adaptation of existing systems can also be expected to be more widely implemented.

The model waste reduction activity studied in this report meets the process and organizational criteria for transferability, but some modification of the model may be required by hospitals that differ from McPherson in size, medical services provided, kitchen equipment, and nature of the food service provider.

CRITERIA FOR SELECTION OF MCPHERSON HOSPITAL

The 1987 Bureau of Census reports 196 hospitals in Michigan, which includes 26 hospitals of McPherson's size employing from 250 to 499 persons. McPherson is a typically sized hospital: 75 hospitals in the state employ more people and 96 employ less.

McPherson Hospital serves its immediate community and a portion of the surrounding area. It is neither a teaching and research hospital that draws a substantial patient population from distant areas nor a very small hospital offering only restricted services; McPherson is in the mainstream of Michigan hospitals.

The selection of McPherson Hospital was based on the following additional criteria: a commitment to waste reduction in a variety of areas, recent conversion from disposable to reusable dishware in its food service department, easy transferability of these practices to other businesses in the sector, cooperative staff that provided accessible information, and the impact on the state's waste stream if other businesses within the sector adopted the waste reduction processes detailed in this report. Also, McPherson's use of washable dishes may be transferable outside the hospital sector and could have an even greater impact on state waste reduction than practices unique to hospitals.

DESCRIPTION OF THE HOSPITAL

McPherson Hospital, a unit of Catherine McAuley Health System which is a division of Sisters of Mercy Health Corporation, is a 136 bed hospital with 420 full time equivalent employees located in Howell, Michigan. McPherson offers Howell and the surrounding area primary and secondary services. Food for patients in the hospital is provided by Servicemaster, Inc., which also runs a cafeteria for hospital employees and visitors.

CONTENT AND ORGANIZATION

McPherson Hospital's conversion from disposable to washable dishware is the focus of a detailed case study. Other waste reduction activities at McPherson are described more qualitatively.

This report contains the following main sections:

- A detailed case study consisting of process and cost analyses of the conversion from disposable to washable dishware
- A brief description of other successful waste reduction activities
- An organizational study of how waste reduction was implemented
- An estimation of the potential impact on the state's waste stream if the use of washable dishware was adopted by other hospitals, and a discussion of the transferability of the McPherson model
- Conclusions and Recommendations

Although this case study report presents several successful waste reduction practices, it is not meant as a comprehensive guide to waste reduction for the hospital sector. Other resources include: the Office of Waste Reduction Services, Michigan Departments of Commerce and Natural Resources, and the U.S. Environmental Protection Agency.¹

3. DETAILED CASE STUDY: DISPOSABLE VS. REUSABLE DISHWARE

Many hospital food services have converted from ceramic to disposable dishware during the last several decades in an effort to lower costs. Although disposable dishware may be more expensive to stock than an inventory of ceramic dishes, labor and equipment savings realized by disposing of dishware, rather than washing it, were thought to reduce overall costs in most cases. The increase in solid waste generation caused by using disposable dishware was rarely considered to be a significant factor in decision making because of relatively low disposal fees.

Recent events have begun to change assumptions about the use of disposable dishware. The cost of disposable dishware has risen, accompanied by significant increases in fees charged for solid waste disposal. The conversion to washable dishes at McPherson offers an opportunity to contrast the use of disposable dishware with washable dishware while the food service practices at the hospital are still directly comparable.

PROCESS

Methodology

The process analysis quantifies material and energy flows through each step of dishware use from purchasing to final disposal. Equipment needs and labor use are also evaluated and described.

Details of dishware use were gathered from on-site observations and interviews with Servicemaster, the food provider at McPherson Hospital. The process of dishware purchase, storage, and distribution were studied in detail. Dishwashing procedures before and

¹Manual for Waste Minimization Opportunity Assessments; U.S. EPA Hazardous Waste Emergency Research Lab, April 1988 (EPA/600/2-88-025); and Waste Minimization Manual; Developed by University of Michigan School of Natural Resources for U.S. EPA; Draft, July 1990.

after conversion to reusable dishes were also observed and quantified. A complete collection of the process data is in Appendix A.

Results

McPherson Hospital serves approximately 3100 cafeteria meals and 900 patient meals per week. Both figures remain constant before and after conversion to reusable dishware. Before the introduction of washable dishes, all meals in the cafeteria were served on disposable dishware, primarily expanded polystyrene. Some paper cups and other plastic implements, such as cup lids and straws, were also used. Patients received ceramic plates. All other dishware for patient meals was disposable. Disposable dishware consisted of a large and small plate, a large and small bowl, and two types of cups.

When the hospital food service provider began using washable dishes, ceramic items replaced comparable disposable dishware with two exceptions. Paper disposable cups are currently used rather than washable glasses, although ceramic cups have replaced expanded polystyrene cups for dispensing hot drinks. A small ceramic bowl replaced the clear polystyrene cup, previously used for serving puddings and other foods, without requiring extra dish use. Equipment, material, and labor flows through each step of dishware use for both cases are outlined in Figures 1 and 2.

Process changes were required to convert from disposable to washable dishware, but these changes were not complicated. Figure 1 outlines the disposable dishware process, while Figure 2 shows the washable dishware use process. These figures do not directly contrast the disposable dishware use case with the reusable case, because some ceramic plates were used for patient meals in the disposable case, and washable glasses have not yet replaced disposable paper cups.

The kitchen at McPherson Hospital was equipped with rinsing equipment and a dishwasher that handled trays, cutlery, and ceramic plates for patients before conversion to the current system. No new equipment was required for processing reusable dishes.

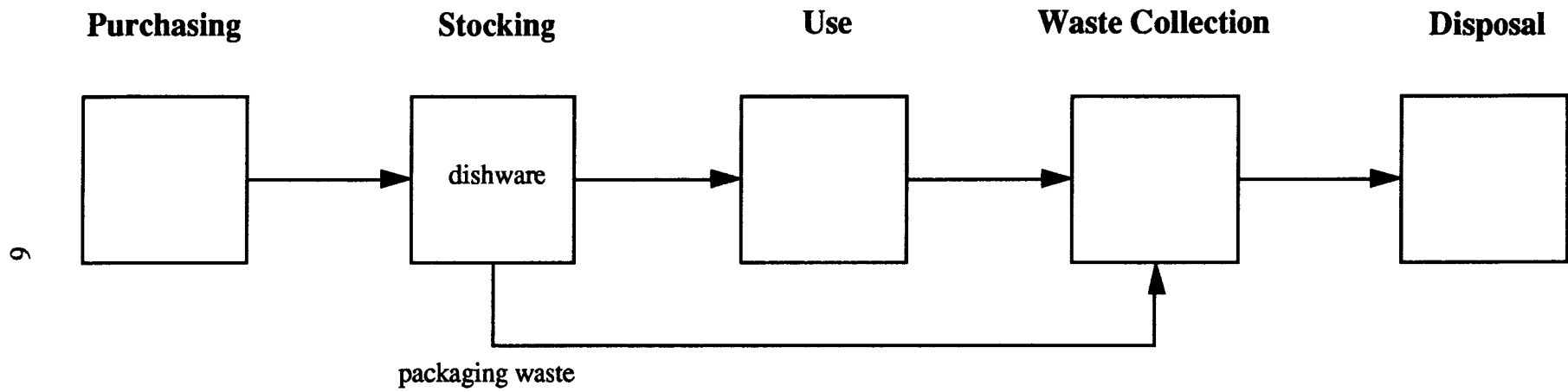


Figure 1. Material Flow Diagram for Disposable Dishware

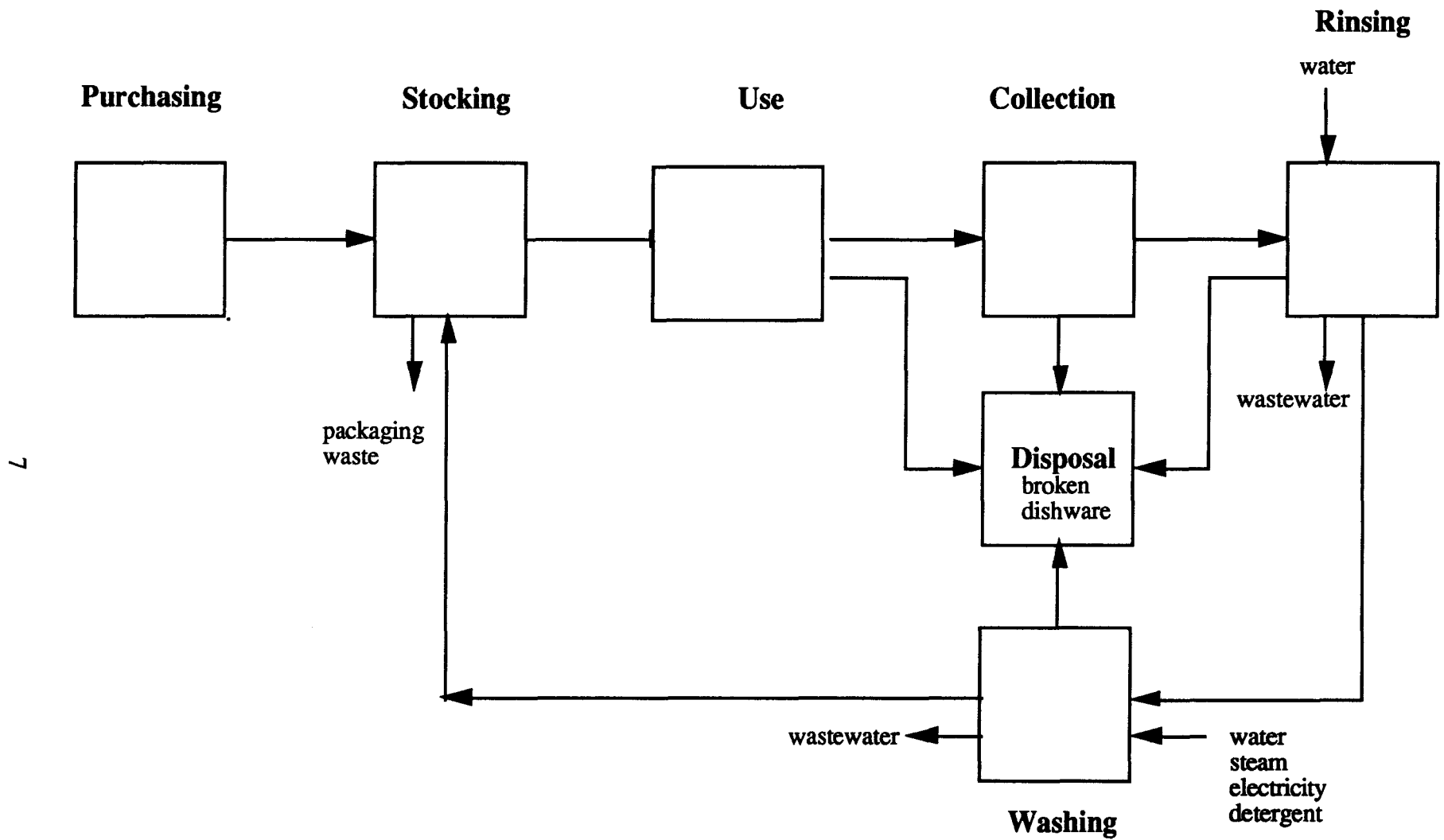


Figure 2. Material Flow Diagram for Reusable Dishware System

Substituting reusable for disposable dishware produces two major changes in the dishware use process at McPherson:

- Total waste disposal from dishware use falls dramatically
- Labor inputs increase substantially

These changes are quantified in Tables 1, 2, and 3.

Table 1. Waste Production per 1,000 Meals

Item Being Measured	Disposable Case	Reusable Case	Difference
Dishware Disposal Weight	33.5 lb	0.25 lb	33.3 lb
Packaging Weight	9.5 lb	0.00 lb	9.5 lb
Total Disposal Weight	43.0 lb	0.25 lb	42.8 lb

Table 1 shows that disposable expanded polystyrene dishware contributed 33.5 pounds to the hospital's waste stream for every 1,000 meals served. Even though McPherson has no access to a corrugated cardboard recycling program, packaging material comprised only 22% of total discards from disposable dishware use.

Ceramic dishes are much heavier than polystyrene equivalents, but only 5% of total inventory breaks each year, adding .25 pound to the kitchen waste stream for every 1,000 meals served. McPherson hospital reduced waste production by 42.8 pounds per 1,000 meals after converting to washable dishes in its food service operation.

Table 2 shows that labor requirements increased by nearly 80% after McPherson converted to washable dishes.

Table 2. Labor Required per 1,000 Meals

Item Being Measured	Disposable Case	Reusable Case	Difference
Purchase Labor	0.13 hour	0.04 hour	0.08 hour
Stocking Labor	0.13 hour	3.50 hour	-3.38 hour
Rinsing Labor	0.00 hour	4.38 hour	-4.38 hour
Dishwashing & Drying Labor	1.17 hour	7.00 hour	-5.83 hour
Refuse Disposal Labor	7.00 hour	0.29 hour	6.71 hour
<i>Total Labor</i>	<i>8.4 hour</i>	<i>15.2 hour</i>	<i>-6.79 hour</i>

Labor required to distribute meals and collect used dishes is the same for both cases and was omitted from the process analysis. Labor to unload collection carts in the kitchen is included in the disposal category for disposable dishes and in the rinsing category for reusable dishware.

Stocking labor in the reusable case is an estimate of the time required to unload the dishwasher after its cycle and place clean dishes in storage racks. Stocking labor in the disposable case refers to the labor needed to place weekly shipments of disposable dishware in inventory.

Table 3 shows compares utility use for the two dishware cases.

Table 3. Utility Use per 1,000 Meals

Item Being Measured	Disposable Case	Reusable Case	Difference
Rinsing Water Use	7 gal	125 gal	-118 gal
Washing Water Use	305 gal	1390 gal	-1085 gal
Booster Steam Use	116.7 lb	700.0 lb	-583.3 lb
Dishwasher Electricity Use	2.3 kwh	14.0 kwh	-11.7 kwh
Dishware Rack Electricity Use		25.9 kwh	-25.9 kwh

Water, steam, and electricity use increased after conversion to washable dishes, as Table 3 shows. Electricity for heated, self-leveling dispensing racks, which were not used in the disposable case, added to electricity use as did increased use of the dishwasher.

A more complete analysis of energy inputs into the dishware use process may reveal that total energy use did not increase. If the energy required to manufacture and distribute washable and disposable dishware was added to the calculations presented here, total energy use for each case would be different.

Discussion

McPherson hospital enjoyed several dishwashing process advantages that facilitated the conversion from disposable to washable dishware. The hospital already used a dishwasher to clean trays, cutlery, and ceramic plates for patient meals but employed it only twenty minutes per day in the disposable case. The hospital kitchen was also equipped with underused rinsing equipment and sinks. As a result of these factors, no additional capacity had to be added and no basic procedures changed to implement the conversion to reusable dishware.

Other hospitals may have similar excess dishwashing capacity, but it should not be expected that all hospitals can convert to reusable dishware use so easily. Substantial process changes may be required for hospitals with no rinsing and dishwashing equipment.

Total labor requirements increase by 80% when washable dishes are used. The overwhelming majority of labor inputs in the disposable case are concentrated in discarding dishware, while in the reusable case, washing and handling dishware requires the majority of labor inputs. The reusable case may appear more complex, but a similar concentration of labor in one activity would be demonstrated if activities related to dishwashing, such as rinsing and stocking clean dishes, were included in the washing category.

COST ANALYSIS

Methodology

This section analyzes costs for each step of the dishware use process. Data on equipment costs were obtained on-site and through contact with equipment manufacturers. Estimates of the labor required in each case and the unit cost of that labor were obtained from Servicemaster, the food provider at McPherson Hospital. Waste disposal costs were also provided by Servicemaster. The City of Howell provided utility costs. Detailed labor, supply, equipment, utility, and disposal costs were then used to calculate total costs for both the disposable and reusable dishware cases.

Results

Converting from disposable to reusable dishware did not significantly change food service costs at McPherson hospital. Savings were realized in some categories, but costs increased in others. The following table provides a detailed breakdown of costs associated with each case.

Table 4. Total Costs of Dishware Use per 1,000 Meals

Item Being Measured	Disposable Case	Reusable Case	Difference
Dishware			
Dishware & Supplies	\$160.00	\$60.00	\$100.00
Cost of Dishware Alone	\$133.75	\$1.20	\$132.55
Cleaning Chemicals Cost	\$1.01	\$18.00	-\$16.99
<i>Total Dishware Cost</i>	<i>\$161.01</i>	<i>\$78.00</i>	<i>\$83.01</i>
Equipment			
Equip. Maintenance & Repair	\$0.35	\$2.31	-\$1.97
Dishware Racks	\$0.00	\$7.50	-\$7.50
Refuse Collection & Disposal	\$3.89	\$0.00	\$3.89
<i>Total Equipment Cost</i>	<i>\$4.24</i>	<i>\$9.82</i>	<i>-\$5.58</i>
Utilities			
Water/Sewer Costs	\$1.02	\$4.30	-\$3.28
Steam Cost	\$1.15	\$6.87	-\$5.73
Electricity Cost	\$0.18	\$3.01	-\$2.83
<i>Total Utilities Cost</i>	<i>\$2.35</i>	<i>\$14.18</i>	<i>-\$11.84</i>
Labor			
<i>Total Labor Cost</i>	<i>\$83.13</i>	<i>\$163.74</i>	<i>-\$80.60</i>
Total Costs per 1,000 Meals	\$250.73	\$265.73	-\$15.01
Total Costs per Year	\$52,151.67	\$55,272.87	-\$3,121.20

Two categories account for over sixty percent of total costs in each case.

- Labor costs nearly double when ceramic dishes are used.
- Dishware and supplies cost half as much when ceramic dishes are used.

The substantial differences in these two categories essentially counterbalance resulting in little overall change in costs between the disposable and reusable dishware cases. Disposable paper cups are still used at McPherson, and these add \$31.00 to the cost of dishware and supplies per 1,000 meals, or 40% of total cost in this category. Napkins constitute much of the remaining cost for dishware and supplies in each case.

Water, steam, and electricity costs increase substantially when washable dishes are substituted for disposable dishware. An increased burden on existing equipment is addressed in the cost analysis by a proportional increase in maintenance costs. New equipment requirements include racks for collecting the ceramic dishware and heated, self-leveling dispensing racks. The heated racks in which dishes are stored after they have been washed use electricity resulting in a minor additional energy cost to the reusable dishware case.

Discussion

Labor costs increased significantly after McPherson Hospital converted to washable dishes. When disposable dishes were used, fifty (50) thirty (30) gallon bags of trash were discarded from the kitchen daily. After the conversion to washable dishes, the kitchen discarded only two (2) thirty (30) gallon bags of trash daily. The labor required to transfer disposable dishes from collection carts and place them securely in bags, while significant, proved substantially less than the labor required for rinsing, washing, and handling ceramic dishes.

Ceramic dishes cost much less on a per use basis than disposable dishware. The savings realized from lower dishware costs essentially counterbalance increased labor costs. The following figure shows how costs are allocated in each case.

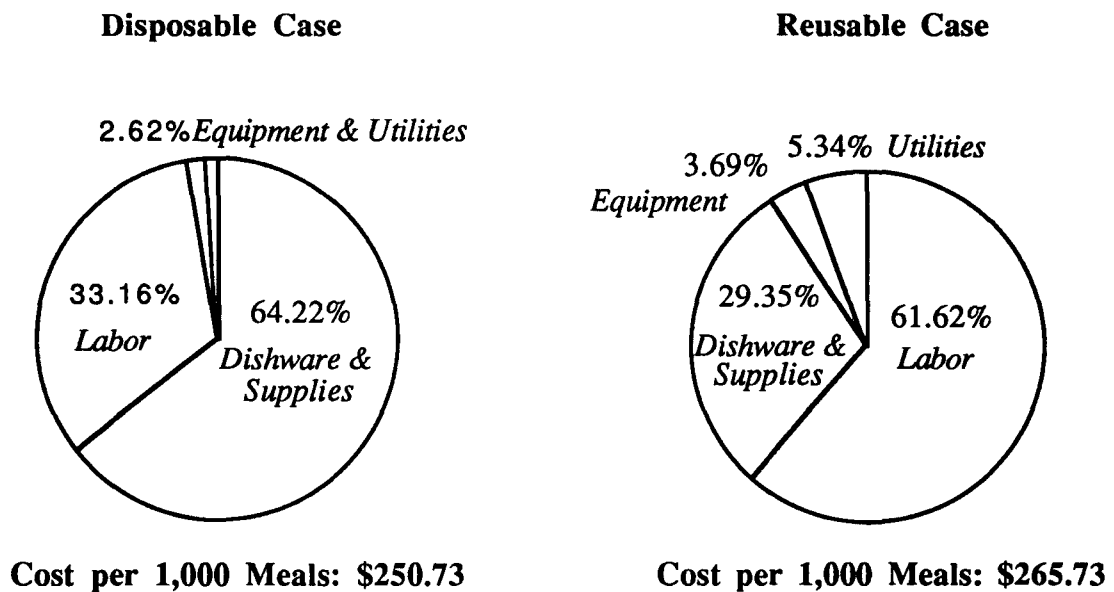


Figure 3. Dishware Use Costs per 1,000 Meals

Equipment and utility costs do not play a significant factor in either case. Labor was the major cost in the reusable case, while dishes and supplies provide the major cost in the disposable case.

Changing costs in relatively minor categories could easily make reusable dishware less expensive to use than disposable equivalents. McPherson Hospital employs heated dispensing racks in its washing operation, an item that is not essential, especially for cafeteria meals that will be eaten promptly. Eliminating heated racks would save the hospital approximately \$7.70 per 1,000 meals. Offering drinks in washable glasses could have a much more powerful effect on comparative costs. Even if disposable cups are deemed essential, expanded polystyrene cups cost half as much as paper equivalents. Use of EPS cups would reduce costs in the washable dishware case to approximately \$250 per 1,000 meals.

Further analysis reveals that overall costs in the disposable case are sensitive to changes in the price of dishware but less sensitive to changes in disposal fees. Sixty four percent of total costs are allocated for dishware and related supplies; disposal fees account for only 1.6% of total costs. In the short run, increases in the cost of disposable dishware can thus be expected to have a much greater impact on the economics of disposable dishware use than increases in disposal fees.

Changes in labor costs would have the greatest impact on the cost of using washable dishes. An increase in labor costs, without an accompanying increase in the cost of disposable dishware or increase in the productivity of the workforce, could change the comparative economics of reusable dishware use. However, labor also constitutes 33.2% of total disposable dishware use costs, so any increase in labor costs would also affect the disposable case.

McPherson already had a dishwasher capable of washing all dishware used at the hospital and sufficient rinsing equipment and space in the kitchen, so no major capital investment was needed for the conversion. Purchasing a new dishwasher of the same brand and size of McPherson's would cost an additional \$7 per 1,000 meals, depreciated according to accepted accounting practices (i.e., yearly costs are purchase price divided by life expectancy of the product).

Reorganizing a kitchen to accommodate a rinsing and washing area may be just as costly as purchasing new equipment in those hospitals where no dishwashing is now done in the kitchen. Hospitals with dishwashers and rinsing equipment are likely to find the economic aspects of the conversion at McPherson more applicable.

4. ADDITIONAL WASTE REDUCTION ACTIVITIES

DESCRIPTION OF ACTIVITIES

The activities described in this section, in addition to using washable dishware, helped McPherson Hospital reduce waste production from 3 forty (40) cubic yard dumpster loads per week to 2 loads per week. Separation of infectious material from the hospital's regular municipal solid waste stream contributed significantly to this figure. McPherson's waste reduction program includes both source reduction activities and recycling.

Source Reduction

Linens

McPherson Hospital successfully obtains assistance with its waste reduction efforts from the local volunteer community. Four volunteers donate their sewing skills to McPherson Hospital one day per week. The volunteers repair and refurbish a number of linen and bedding items that were previously discarded. About 25 bedsheets per year are made into stretcher sheets, and 45 old surgical drapes are converted into biopsy cloths annually. Another 10 surgical drapes per year are made into mayo towels, which are similar to handcloths. Ties are repaired on about 26 gowns per year, allowing them to be reused. A total of 26 blankets, mattress pads, and quilts are converted into potholders each year.

Medical Waste

Medical waste previously disposed in a nonhazardous landfill is now incinerated at an Ohio facility. Incineration reduces the amount of waste discarded locally by McPherson but the effect on the state's waste stream may be minimal. McPherson Hospital has also adopted procedures to reduce waste labeled as infectious. Additional materials are required to package and transport medical and infectious waste, so any reduction in the category of infectious waste may offer some overall waste stream reduction. Aside from the packaging reduction produced by discarding less infectious waste, shifting waste from one category to another has no major impact on the municipal solid waste stream unless such waste can be effectively reused or recycled. Waste previously labeled as infectious does not present many opportunities for either reuse or recycling as long as it

consists of disposable material. Instruments and materials that are capable of being sterilized and used repeatedly could be substituted for single-use material thus reducing the amount of infectious waste currently sent to incinerators or discarded in a supervised manner.

Office Paper

Double-sided photocopies are produced for office documents unless otherwise specified. A microfiche system is also used for some documents to reduce paper requirements. Tablets made at the hospital from office paper printed on one side have replaced some purchased tablets.

Diapers

The Obstetrics Department at McPherson recently converted from disposable to cloth diapers. Letters from the community and the hospital's waste reduction program encouraged the Director of Obstetrical Services to make the conversion. The program has met with support from nurses, the housekeeping director and staff, and parents of newborns.

The Director of Obstetrics researched diaper use before deciding to experiment with cloth diapers. She found that a cloth diaper system costs about the same as a disposable system, but disposables are more wasteful and have a greater negative impact on the environment. Disposable diapers compose roughly two percent of the municipal solid waste stream and contribute more than any other consumer item to landfills, with the exception of newspapers and beverage containers.²

The first trial of the cloth diaper program began in August 1990. It lasted only one week because the hospital did not have an adequate supply of outer wraps to put over the cloth diapers. Wraps are necessary to hold diapers firmly in place and prevent leakage. An additional problem arose when the wraps proved incapable of withstanding the hospital's washing and drying procedures. Since this time, the hospital has purchased a large supply of outer wraps and has reinstated the cloth diaper program. No dryer modification was attempted; outer wraps are not laundered at the hospital. An average of two wraps are used and discarded during each newborn's stay in obstetrics.

The McPherson Obstetrics Department serves over 650 infants per year. Six to eight babies are generally in the hospital every day. Babies are changed at feeding times, which occur six to eight times per day. For an average of seven babies changed seven times a day, McPherson will use approximately 16,000 cloth diapers per year. This will divert about 1 ton of disposable diapers per year from landfills (disposables weigh approximately .12 pounds each).

McPherson intends to make the cloth diaper conversion permanent. The hospital also encourages cloth diaper use at home but has experienced limited success in this area, because many parents of babies delivered at McPherson do not have access to a diaper service. To address this problem, the hospital is now considering a proposal to provide a diaper service within the hospital itself. This proposal is currently in a preliminary draft stage.

Recycling

Both Servicemaster and other hospital departments have an interest in recycling. Mr. Rubbish, the solid waste disposal contractor at McPherson Hospital, recycles various packaging materials discarded from food service activities. Waste paper collected from other areas of the hospital is also recycled. Mr. Rubbish has not yet implemented a corrugated container recycling

² Lehrburger, Carl. *Diapers in the Waste Stream: A Review of Waste Management and Public Policy Issues*, December 1988.

program for the hospital, and there are no other local outlets for the hospital's old corrugated containers.

The following table provides the most recent figures on recycling at McPherson.

Table 5. Recycling at McPherson

Material	Pounds Recycled	
	<i>Jun-90</i>	<i>Jul-90</i>
Computer Paper	1375	1025
Mixed Paper	1950	1300
Glass	355	380
Steel	310	315
Plastic	20	70
Aluminum	2	
Total	4012	3090

If current recycling rates are maintained, McPherson Hospital will divert 21 tons of material per year from the municipal solid waste stream through its recycling program.

5. ORGANIZATIONAL AND MOTIVATIONAL ANALYSIS

McPherson Hospital is located in the city of Howell and has strong links to the city and surrounding community. Howell's landfill was closed due to leachate problems. There are currently no landfills operating in the remainder of Livingston County. Refuse at McPherson and in the surrounding community is collected by Mr. Rubbish and transported outside the county for disposal.

An area near Howell was targeted by Mr. Rubbish for a landfill, but this plan met with strong opposition from the community. Realizing that it was inconsistent to oppose the construction of a landfill while shipping substantial quantities of garbage to other communities, waste consciousness in the Howell area increased. McPherson Hospital responded when staff members and people in the community expressed significant interest in waste reduction by offering its grounds as a recycling drop-off site. Recycle Livingston handles recycling activities at the drop-off center.

Neither Recycle Livingston nor Mr. Rubbish now provide a recycling outlet for corrugated cardboard. There has also been some difficulty maintaining consistent volunteer recycling programs for other materials in Livingston County, so the hospital was interested in adopting waste reduction practices that were not entirely dependent on external services.

Employees in the kitchen were particularly effective in motivating Servicemaster to respond to the local solid waste crisis. The decision to use washable dishes may also have been facilitated by the relative independence of the food service provider. Servicemaster allows on-site managers considerable leeway in running their operations. Deviations from rules require approval from central management, but successful local managers usually find their requests are well received. The manager at McPherson gained rapid approval of his proposal to switch from disposable to reusable dishes.

McPherson's prominent role in the community helped make the hospital more amenable to both internal and external suggestions. Management at all levels seemed willing to respond expeditiously when an interest in reusable dishware was expressed by staff and the community. Motivated by a need to reduce waste generation in Howell, citizens, hospital staff, and managers cooperated to institute a program of waste reduction that is apparently supported equally by all three groups.

SUMMARY

- McPherson Hospital's prominent role in the community made it amenable to outside suggestions for waste reduction.
- A landfill crisis in Howell motivated McPherson Hospital and the surrounding community to reduce waste.
- Food service is provided by Servicemaster, an outside contractor. A motivated staff and relatively independent manager were major factors in quick implementation of a reusable dishware program.
- Management at Servicemaster and in the hospital responded to staff suggestions. Staff initiated interest in many waste reduction programs and helped make them successful.

6. IMPACT AND TRANSFERABILITY

IMPACT ON SOLID WASTE STREAM

Waste is reduced by using washable dishware. McPherson Hospital will produce 4.5 fewer tons of solid waste per year after converting to reusable dishes. Assuming all hospitals in Michigan are currently using disposable dishware, a conversion from disposable to washable dishes could reduce statewide solid waste production by 880 tons per year, based on McPherson representing an average hospital. If some hospitals are already serving meals on washable dishes, less waste reduction will be realized by a total conversion to reusable dishware.

Implementation of the full range of waste reduction methods now practiced at McPherson could have an even greater statewide impact. Assuming that recycling programs are available to all hospitals, but none are now being used, recycling in the hospital sector could divert 7,000 tons of material from Michigan's waste stream each year. This figure does not include corrugated cardboard, which is readily recyclable in many areas. In addition, some hospitals are already recycling various materials, so the actual waste reduction realized by adoption of the McPherson model throughout the hospital sector cannot be precisely quantified.

TRANSFERABILITY

Dishwashing and rinsing capacity may be one of the keys to how easily the McPherson hospital example can be transferred to other hospital food service providers.

Hospitals with dishwashing equipment and sufficient kitchen area for handling an increased load of rinsing and washing will likely find the process of converting to washable dishware relatively straightforward. Equipment requirements are confined to collection racks and heated, self-leveling storage racks for receiving dishes after they have been washed, an optional

item. Space for an inventory of reusable dishes can usually be found with minimal kitchen reorganization, and inventory area previously used for storing disposable dishes may be made available for other items.

However, labor needs increase substantially and new hiring may be necessary. Other process changes, such as the reorganization of kitchen space needed to accommodate a new method of handling dishware, may also produce resistance to using washable dishware in hospitals without dishwashing equipment.

An economic analysis shows that using washable dishes does not increase costs. In most cases, the similarity in costs between the disposable and reusable dishware cases increases the transferability of washable dishware use. Even so, organizations that base decisions solely on cost may avoid converting from disposable to reusable dishes until it can be demonstrated that such a conversion will produce significant savings.

McPherson hospital recently negotiated a merger with Catherine McAuley Health System. The growing trend in the hospital sector toward conglomeration can impact transferability of the waste reduction programs outlined in this study in several ways. Transferability is enhanced when economies of scale make source reduction or recycling possible in areas where they were previously seen as impractical. But centralized management may also react less strongly to local interest in waste reduction or be more inclined to base decisions solely on cost than local institutions involved in the community.

Factors Enhancing Transferability

- Process changes required to replace disposable dishware with reusable dishes are minor, particularly when dishwashing equipment already exists.
- Significant waste reduction can be achieved by using washable rather than disposable dishes.
- Washable dishware costs about the same to use as disposable dishware.
- Motivation for waste reduction is high in many communities and companies.
- Other waste reduction practices outlined in this report require no special technology or organizational effort to implement.

Impediments to Transferability

- Hospitals without dishwashers may find the process of converting from disposable to washable dishware more complicated than the McPherson case.
- Costs of implementing a reusable dishware program may be viewed as too high in hospitals with no dishwasher or limited kitchen space.
- Substantial motivation may be missing in communities that do not feel pressured by landfill problems.
- Large organizations may find it more difficult to implement the full range of waste reduction programs practiced at McPherson. Differences in scale may require organizational efforts more complicated than those needed at McPherson.

7. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- McPherson Hospital reduced waste production by converting from disposable to reusable dishware.
- Washable and disposable dishware use essentially cost the same. The expense of buying disposable dishes balanced the labor costs of washing reusable dishes.
- The process of using washable dishes is easily transferable to other hospitals and low cost food providers who already have dishwashing equipment.
- Conversion from disposable to washable dishware by all hospitals in the state could reduce annual solid waste production by as much as 880 tons. Adoption of McPherson's recycling program could divert as much as 7,000 additional tons of solid waste from state landfills annually.

Waste reduction activities at McPherson were facilitated by staff involvement and management responsiveness at all levels. Employee suggestions and community interest played an important role in the implementation and success of McPherson Hospital's waste reduction program.

Many of the other waste reduction methods followed by McPherson Hospital could also be adopted by hospitals in Michigan with minimal difficulty. Additional opportunities for waste reduction exist. The amount of solid waste currently being disposed in Michigan's landfills could be significantly reduced if some of these practices were instituted across the state's hospital sector.

RECOMMENDATIONS

The waste reduction practices followed by McPherson Hospital are transferable to other hospitals and low cost food service providers. Businesses interested in waste reduction should consider the following recommendations to facilitate the implementation of individually designed waste reduction programs.

- Waste disposal may be an increasingly important issue for hospitals in the future. A review of McPherson Hospital's waste reduction practices may prove useful for hospitals seeking waste reduction ideas.
- Hospitals can position themselves for the future by deciding to reduce waste production now.
- Adaptation of some waste reduction methods followed by McPherson may be necessary. Interested hospitals should conduct their own process and economic studies to determine which methods best suit them.
- Organizations that respond to employee suggestion and encourage participation by all staff members in decision making will find their waste reduction efforts are more successful.

APPENDIX A-McPherson Hospital Data

	Disposable Dishware	Washable Dishware	Difference
PROCESS			
Waste Production			
Dishware Disposal Weight	33.5 lb	0.25 lb	33.3 lb
Packaging Weight	9.5 lb	0.00 lb	9.5 lb
<i>Total Disposal Weight</i>	<i>43.0 lb</i>	<i>0.25 lb</i>	<i>42.8 lb</i>
Utility Use			
Rinsing Water Use	7 gal	125 gal	-118 gal
Washing Water Use	305 gal	1390 gal	-1085 gal
Booster Steam Use	116.7 lb	700.0 lb	-583.3 lb
Dishwasher Use	2.3 kwh	14.0 kwh	-11.7 kwh
Dishware Rack Electricity Use		25.9 kwh	-25.9 kwh
Labor			
Purchase Labor	0.13 hour	0.04 hour	0.08 hour
Stocking Labor	0.13 hour	3.50 hour	-3.38 hour
Rinsing Labor	0.00 hour	4.38 hour	-4.38 hour
Dishwashing & Drying Labor	1.17 hour	7.00 hour	-5.83 hour
Refuse Disposal Labor	7.00 hour	0.29 hour	6.71 hour
<i>Total Labor</i>	<i>8.4 hour</i>	<i>15.2 hour</i>	<i>-6.79 hour</i>
COST			
Dishware			
Dishware & Supplies	\$160.00	\$60.00	\$100.00
Cost of Dishware Alone	\$133.75	\$1.20	\$132.55
Cleaning Chemicals Cost	\$1.01	\$18.00	-\$16.99
Equipment			
Equip. Maintenance & Repair	\$0.35	\$2.31	-\$1.97
Dishware Racks	\$0.00	\$7.50	-\$7.50
Refuse Collection & Disposal	\$3.89	\$0.00	\$3.89
Utilities			
Water/Sewer Costs	\$1.02	\$4.30	-\$3.28
Steam Cost	\$1.15	\$6.87	-\$5.73
Electricity Cost	\$0.18	\$3.01	-\$2.83
Labor			
<i>Total Labor Cost</i>	<i>\$83.13</i>	<i>\$163.74</i>	<i>-\$80.60</i>
Total Costs per 1,000 Meals	\$250.73	\$265.73	-\$15.01
Total Costs per Year	\$52,151.67	\$55,272.87	-\$3,121.20

	A	B	C	D
4		Disposable	Washable	
5		Dishware	Dishware	Difference
6	Process			
7	Waste Production			
8	Dishware Disposal Weight	33.5	0.25	=B8-C8
9	Packaging Weight	9.5	0	=B9-C9
10	Total Disposal Weight	=B8+B9	=C8+C9	=B10-C10
11	Utility Use			
12	Rinsing Water Use	=225*(1/32)	=1/32*4000	=B12-C12
13	Washing Water Use	=(2*(10/60)*372+50)*7/4	=(2*372+50)*7/4	=B13-C13
14	Booster Steam Use	=10/60*2*200*7/4	=2*200*7/4	=B14-C14
15	Dishwasher Use	=10/60*2*4*7/4	=2*4*7/4	=B15-C15
16	Dishware Rack Electricity Use		=(2.8*220/1000)*24*7/4	=B16-C16
17	Labor			
18	Purchase Labor	=0.5/4	=10/60/4	=B18-C18
19	Stocking Labor	=0.5/4	=2*7/4	=B19-C19
20	Rinsing Labor	0	=(2*7/4)+(6*5/60*7/4)	=B20-C20
21	Dishwashing & Drying Labor	=10*2*2/60*7/4	=2*1*2*7/4	=B21-C21
22	Refuse Disposal Labor	=4*7/4	=10/60*7/4	=B22-C22
23	Total Labor	=SUM(B18:B22)	=SUM(C18:C22)	=B23-C23
24	Economics			
25	Dishware			
26	Dishware & Supplies	=0.16*1000	=0.06*1000	=B26-C26
27	Cost of Dishware Alone	=535/4	=5000*0.05/52/4	=B27-C27
28	Cleaning Chemicals Cost	=225*0.25*0.018	=0.018*1000	=B28-C28
29	Equipment			
30	Equip. Maintenance & Repair	=((0.3/4)*963)/52/4	=((2/4)*963)/52/4	=B30-C30
31	Dishware Racks	=0	=(3*600+6*1000)/5/52/4	=B31-C31
32	Refuse Collection & Disposal	=(B8*(1/135)+B9*(1/1161))*15.18	=C8*1/4455*15.18	=B32-C32
33	Utilities			
34	Water/Sewer Costs	=((B12+B13)/1000*(1.08+1.74))+((B12+B13/1000)*0.0198)	(((C12+C13)/1000*(1.08+1.74))+((C12+C13)/1000*0.0198)	=B34-C34
35	Steam Cost	=(B14/200)*26*0.0755	=(C14/200)*26*0.0755	=B35-C35
36	Electricity Cost	=(B15+B16)*0.0755	=(C15+C16)*0.0755	=B36-C36
37	Labor			
38	Total Labor Cost	=(B18*21.88)+SUM(B19:B21)*10.76+B22*9.5	=(C18*21.88)+SUM(C19:C21)*10.76+C22*9.5	=B38-C38
39	Total Costs per 1,000 Meals	=B26+SUM(B28:B38)	=C26+SUM(C28:C38)	=B39-C39
40	Total Costs per Year	=B39*4*52	=C39*4*52	=B40-C40

**Dishware Waste Analysis
Per 1,000 Meals**

Disposable			Weights		
Item	Quantity	Unit	Dishware	Packaging	Total Weight
Large Plate	775	7.4 g	5,704 g	1,407 g	7,111 g
Small Plate	1000	3.3 g	3,340 g	908 g	4,248 g
Large Bowl	500	3.9 g	1,925 g	454 g	2,379 g
Small Bowl	500	1.8 g	880 g	454 g	1,334 g
Cup	1000	2.1 g	2,060 g	908 g	2,968 g
Clear Cup	103	12.7 g	1,306 g	187 g	1,493 g
Total of Items			15,215 g (33.5 lb)	4,318 g (9.5 lb)	19,533 g (43.0 lb)

Reusable					
Item	Quantity	Unit Weight	Breakage:no./1000 meal	Total Weight	
Large Plate	1000	350.0 g	0.12	42 g	
Small Plate	1000	132.8 g	0.12	16 g	
Large Bowl	500	182.0 g	0.12	22 g	
Small Bowl	500	107.7 g	0.12	13 g	
Cup	1000	175.0 g	0.12	21 g	
Total of Items				114 g (.25 lb)	

Wages and Utility Costs

Dietary Labor	\$10.76/hr
Housekeeping Labor	\$9.51/hr
Purchasing Labor	\$21.88/hr
Trash Disposal	\$15.18/cu. yd.
Electricity, kwh	\$0.034
Water/ 1000 gal.	\$1.08
Sewer/ 1000 gal.	\$1.74