Pursuing Sustainability with University of Michigan, Patient Food and Nutrition Services: Aligning Sustainable Practices with Healthcare Delivery

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ABSTRACT

With 45 thousand inpatient stays and 1.9 million outpatient visits in 2012, the University of Michigan Health System (UMHS) manages a vast network of patients in constant flux. The Patient Food and Nutrition Services (PFANS) group provides in-room dining services for these patients and delivers meals and supplements to homebound seniors in the community through its Ann Arbor Meals on Wheels program. PFANS is committed to expanding its existing environmental responsibility initiatives and has the potential to serve as an important case study, providing a sustainability roadmap for UMHS and national patient food services.

The project objectives included:

1. Reducing waste, water and energy footprints
2. Capturing cost savings
3. Designing a strategy that serves as holistic approach to sustainability for UMHS
4. Aligning sustainable practices with future models of U.S. healthcare delivery

The approach to meeting these objectives included a current state assessment through primary research focused on interviews, waste and energy auditing and cost-benefit analysis as well as secondary literature reviews to identify best practices in the industry. Using the findings from these methods and developed criteria for evaluation—environmental, financial, reporting ability and scalability—the report outlines a series of recommendations that respond to the following key findings:

1. Immediate energy savings can be achieved through passive operational changes and additional long-term savings through active behavior changes.
2. Opportunities for reducing water usage would require major investment and PFANS would not directly see these savings. Therefore, PFANS should consider behavior-based reductions in water usage until a time where the case for capital expenditure on new equipment can be made.
3. Further improvements will require PFANS to form partnerships to overcome the challenges of sustainable and local food procurement in a healthcare setting.
4. Implementing an organic waste stream is possible and environmentally preferable.
5. PFANS can better utilize existing waste management infrastructure to increase diversion from landfill.
6. Areas for source reduction can be identified more readily by implementing better food waste tracking procedures.
7. Employee engagement is the lynchpin to successful implementation and to tracking progress against goals.

The project is intended to demonstrate how PFANS can support both sustainability and patient care through its operations and services to position the unit as a sustainability leader within UMHS and in the patient food service management space.

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GLOSSARY OF TERMS AND ACRONYMS

Term	Acronym	Notes/Definition
Adjusted eating patient		A way of more accurately quantifying the number of hospital patients served by PFANS, patient populations who don't eat meals or eat very little are given a coefficient of 0 or 0.5, respectively, and thus reduce the number of patients served by PFANS relative to the overall hospital population
Ann Arbor Meals on Wheels	MOW	Community program delivering meals to home-bound seniors; meals produced by PFANS' staff
C.S. Mott Children's and Von Voightlander Women's Hospitals	C&W	One of the health system hospitals and the location of PFANS' smaller kitchen servicing C&W patients
Carbon dioxide equivalent	CO_2e	A value that represents the sum of all GHG emissions, normalized to CO_2 units
Cardiovascular Center	CVC	One of the UM Health System hospitals
Digestate		Material left after the anaerobic digestion of a feedstock
Diversion from landfill		Also just 'diversion', refers to means of managing waste such that less is stored in landfills (i.e. recycling and composting)
EPA's Waste Reduction Model	WARM	Model developed by the U.S. EPA to track/report emissions from solid waste
Global Reporting Initiative	GRI	Non-profit organization that promotes the use of its standardized sustainability and CSR reporting framework. Currently, one of the most globally used formats for reporting.
Greenhouse gases	GHG's	Five gases that contribute to the 'greenhouse' effect that traps heat within Earth's atmosphere
HealthCare Without Harm	HCWH	HCWH is an international coalition of organizations, working to transform the health care sector, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment.
Healthier Hospitals Initiative	HHI	Health Care Without Harm's national campaign and corresponding guidelines aimed at improving environmental health and sustainability in the healthcare sector.
Metric tonnes	MT	Unit of weight, one MT is the equivalent of 2,204.62 pounds
North Campus Research Complex	NCRC	A UM Health System owned facility on North Campus that housed PFANS' MOW and cook-chill operations temporarily during the UH kitchen construction phase
Patient Food and Nutrition Services	PFANS	Serves meals to hospital patients and their guests (not associated with cafeteria operations)
Post-consumer organic waste		As defined by City of Ann Arbor standards, organics that have been cooked in addition to meats, bones, dairy and compostable products.
Post-patient waste		Waste that has been on a patient tray (i.e. uneaten food, straws and napkins, disposable drink containers)

Pre-consumer organic waste		As defined by the City of Ann Arbor, food that has not been cooked or prepared for consumption (e.g. raw apples) excluding meats, bones and dairy.
Pre-patient waste		Waste that is never on a patient tray (i.e. trim, overproduction, expiration, non-food trash)
Source Reduction		Most preferred means of waste management whereby upstream efforts minimize consumption and preclude waste generation
U.S. Environmental Protection Agency	EPA or U.S. EPA	Federal agency mandated with protecting human health and the environment
U.S. Food and Drug Administration	FDA or U.S. FDA	Federal agency mandated with protecting & promoting public health; publishes the *Food Code* that PFANS uses as a model for its standards and procedures with regard to food safety
UM Office of Campus Sustainability	OCS	Office within UM overseeing sustainable campus operations
University Hospital	UH	One of the health system hospitals and the location of PFANS' larger kitchen servicing UH and CVC patients
University of Michigan Health System	UMHS	
University of Michigan Waste Management Services	UM-WMS	UM-WMS offers an offsite composting option considered in this report
Windrow Composting		A composting process in which waste is staged in piles outdoors and natural decomposition is assisted through the "turning" of piles

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1 PROJECT OVERVIEW

With 45 thousand inpatient and 1.9 million outpatient visits in 2012, the University of Michigan Health System (UMHS) manages a vast network of patients in constant flux. The Patient Food and Nutrition Services (PFANS) group provides inpatient food services for all three hospitals: University Hospital (UH) including the Cardiovascular Center (CVC), the Von Voigtlander Women's Hospital and C.S. Mott Children's Hospital (C&W). It also delivers meals and supplements to elderly outpatients through the Ann Arbor Meals on Wheels (MOW) program. PFANS staffs about 250 employees and has an operating budget of over $16 million.

PFANS' existing social and environmental responsibility initiatives focus primarily on the quality of the food it serves to patients. Its commitments include serving only 100% juice and zero industrial trans-fats, using BPA-free plastic containers and pledging to follow the four-star Healthy Food Hospitals campaign led by the Michigan Health & Hospital Association. PFANS is now ready to expand its sustainability efforts with a particular interest in growing its sustainable procurement strategy, reducing food waste and energy usage and engaging employees in the advancement of these sustainability initiatives.

PFANS is currently undergoing a significant transition in the way it operates, revising its food service strategy to incorporate industry-leading just-in-time food delivery methods to ensure unparalleled customer satisfaction. At the same time, there is significant impetus from the group to identify sustainable practices that lead to streamlined operational processes and deliver tangible cost-savings. Considerations include expansion and improvement of recycling efforts, incorporation of sustainable food waste disposal, product improvement or replacement, evaluation of equipment energy and water usage, and changes to employee behaviors and responsibilities.

PFANS has the opportunity to become a sustainability leader within UMHS. By integrating sustainability into its long-term strategy and operational objectives, PFANS will serve as a model to other departments. In addition, if PFANS develops an atmosphere in which sustainability and patient care are aligned and integrated, it has the potential to serve as an important case study for holistic, sustainable patient food & nutrition service in the healthcare industry.

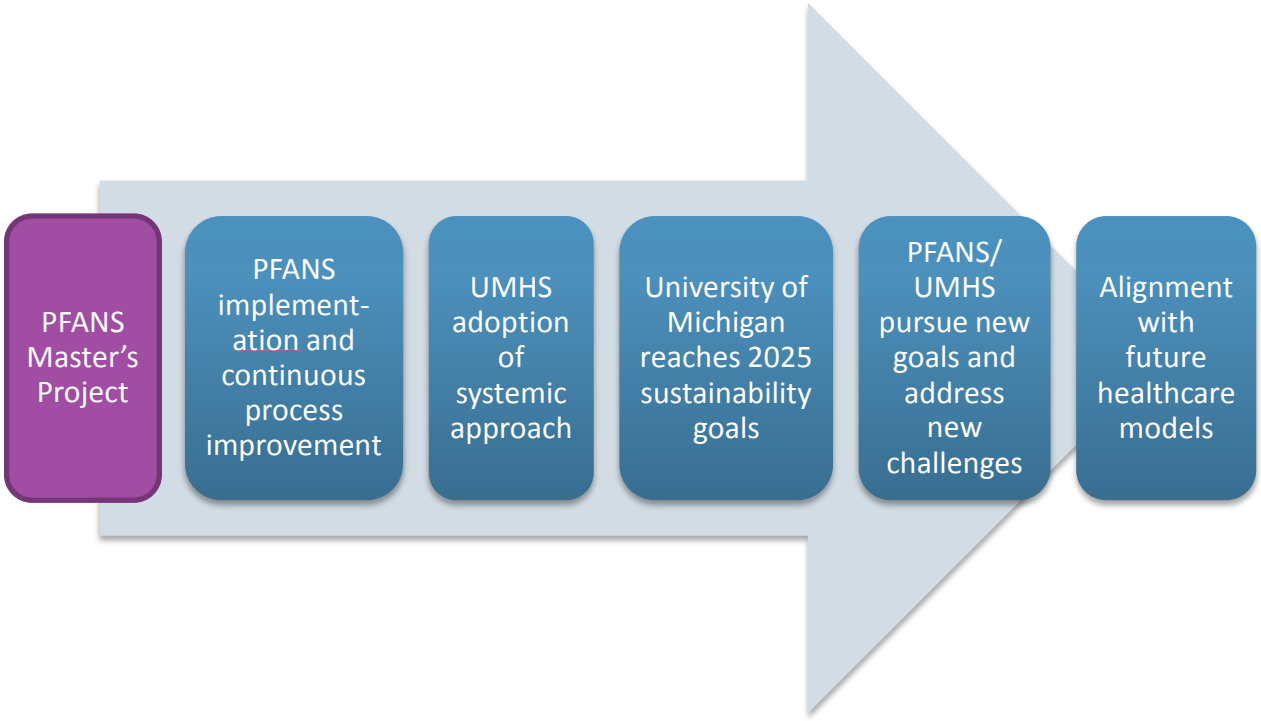
1.1 PROJECT SCOPE & OBJECTIVES

The scope of work for this project was designed to meet the objective of recommending processes, strategies and actionable changes to support the expansion of sustainability efforts within the PFANS organization and lay the groundwork for long-term sustainable development within UMHS (see **Figure 1**). We analyzed and considered opportunities and ultimately made recommendations for PFANS related to 1) waste reduction 2) water usage 3) sustainable procurement 4) energy efficiency and 5) employee engagement. We also identified barriers to implementation and developed creative solutions for navigating these challenges.

Additionally, our team studied the factors unique to the healthcare industry that make establishing sustainable practices different from doing so in other sectors. By researching hospitals and health organizations across the country, our team gained greater understanding of the value of sustainable health services and learned about

initiatives currently being considered by leaders in the space. We used these findings to provide insights into the processes and strategies required for implementing successful sustainable practices in a healthcare setting. In our analysis of PFANS, the current environmental efforts within UMHS and at certain hospitals around the country, we aimed to identify best practices that can advance PFANS' sustainability goals in both the short and long term, while also supporting and advancing its efforts to provide fresh, healthy food to patients. In addition, we attempted to uncover practices that are transferrable to other areas of UMHS including operational modifications and employee engagement. Our approach positions this project to serve as the initial step in creating and implementing a holistic approach to sustainability within PFANS and across UMHS that will ultimately align the health system with the changing University of Michigan and healthcare landscapes related to sustainability illustrated in **Figure 1**.

Figure 1: Positioning PFANS Masters Project: UMHS' Long-term Roadmap for Sustainability



1.1.1 RESEARCH QUESTIONS

How could PFANS go about aligning sustainability with future healthcare models in its operations and services?

- What are the current employee behaviors and beliefs regarding food waste and water use?
- What is PFANS' current waste landscape?
- Who are the actors/stakeholders involved in managing PFANS' waste and what are their roles and interests?
- What is the life cycle of PFANS' waste? (What is landfilled, what is recycled, etc.?)
- What operational challenges does PFANS currently face in managing its waste?

- What water is used within PFANS operations?
- What is PFANS' current waste footprint?
- What leading-edge techniques are currently available for waste reduction and sustainable waste management?

Is there a way to create an atmosphere *today* in which sustainability and patient care align?

- Does pursuing sustainability enhance patient care? Furthermore, do the traditional justifications for sustainability—cost savings, waste reduction, efficiency—support the justification that sustainability enhances patient care?
- What are the current values within the UM Health System concerning sustainability?
- What are the key inertia points that have prevented UM Health System from pursuing sustainability goals?
- Are there particular characteristics of the healthcare space that make sustainability viable/complementary or problematic/conflicting with the purpose and mission of the industry?
- What is the role of PFANS in the UM Health System?
    - How does it connect to other areas of the system organizationally?
    - What is PFANS' ability to make changes in the context of the larger health system?
    - How does PFANS' waste connect to the larger waste stream?
- What are the values within PFANS with regard to sustainability and waste?

1.2 DELIVERABLES

Although PFANS has already made significant progress in incorporating more sustainable practices into its operations, the department engaged our team to accelerate its efforts and to gain strategic direction. There is significant impetus from the group to identify sustainable practices that lead to streamlined operational processes and deliver tangible cost-savings. As such, we pursued deliverables that would lay the groundwork to establish PFANS as a leader in sustainable hospital food service by addressing the most critical sustainability-related issues in the department. These deliverables include identifying key areas for expanding sustainable procurement, advancing energy efficiency efforts related to the equipment used in PFANS' kitchens and a comprehensive analysis and approach for reducing/diverting waste from landfill. Additionally, this report delivers a methodology for engaging employees in the sustainability initiatives recommended to ensure that our recommendations can be effective, well received by staff and are feasible to implement in this specific health system environment.

1.3 BACKGROUND

To direct our approach and define our project scope, it was important to consider the system drivers facing UMHS, the current state of patient food services in healthcare, PFANS and UMHS operations and sustainability

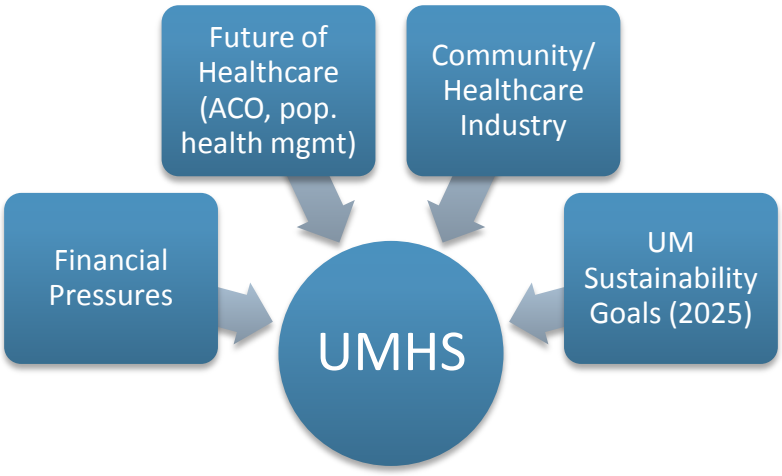
efforts within the health system and the University of Michigan to date. This background information is outlined below.

1.3.1 UMHS SYSTEM DRIVERS

For many years, UMHS has earned distinctions in environmental excellence from notable organizations such as Practice GreenHealth, a membership organization that is leader in promoting sustainability in the healthcare industry. These awards are based on efforts spearheaded by UMHS' Environmental Stewardship Steering Committee, a collaborative leadership team from functions across UMHS that meets monthly to review and commit to ongoing sustainability efforts. The work of the Environmental Stewardship Steering Committee is conducted through its Environmental Stewardship Initiative. To date, the Environmental Stewardship Initiative has conducted limited programming focused on engaging employees and patients in sustainability. Attempts to establish programs that would influence employee behaviors and communicate the message of sustainability have yet to show significant results. However, sustainability related activities that require greater employee engagement is an area the Environmental Stewardship Steering Committee plans to pursue in the near future.

As one department within the larger health system, PFANS is subject to the drivers UMHS faces as an organization. Many of these are drivers that all hospitals and health systems in the country are facing as they adjust to large-scale change in the way that healthcare is delivered in the U.S. shaped by shifting regulatory and reimbursement requirements. These system drivers include financial pressures, changes in healthcare delivery models, community interest in sustainability and the 2025 sustainability goals adopted by the University of Michigan.

Figure 2: System Drivers for UMHS



Financial Pressures: are the financial pressures facing healthcare providers that will only continue to grow as the population ages and additional regulatory changes are realized in the industry. Finding innovative ways to reduce costs will be essential in this new environment and for this resource intense industry. Currently, healthcare accounts for about 17% of U.S. GDP and is the second highest commercial energy user next to the food and beverage industry.

Future of Healthcare: We also understood that new forms of healthcare delivery focused on accountable care, outcomes based medicine and population health management has to be accounted for in our recommendations. We wanted to take a holistic approach to these long-term drivers and understand how we could use sustainable practices to address them. In fact, we see sustainable operations as an integral part of realizing the full potential of future health care models and dealing with a new healthcare mandate for managing population health.

Community/Healthcare Industry: Other drivers include changes within the healthcare industry and the patient populations they serve. Of increasing concern are the growing rates of chronic diseases, many of the environmentally driven, such as diabetes and asthma. There is also a growing movement amongst healthcare providers towards pursuing sustainable strategies supported by a fast-growing number of new products and services from suppliers to the healthcare industry. There is also a growing group of environmentally conscious system stakeholders in the community including patients and employees.

University of Michigan Sustainability Goals: PFANS' effort to promote more sustainable practices aligns with a wider movement taking place across the University of Michigan campus. The University's various sustainability efforts are dictated by the UM Sustainability Initiative, which is supported and led by two key campus departments: the Graham Sustainability Institute and the Office of Campus Sustainability. The University of Michigan's Graham Sustainability Institute coordinates the sustainability efforts across the campus in an effort to promote collaboration and shared goals. Another influential campus program, The Office of Campus Sustainability (OCS), works to implement and monitor environmental targets set by the UM Sustainability Initiative. Additionally, in September 2011, UM President Mary Sue Coleman announced aggressive campus sustainability goals to be achieved by 2025 in the areas of climate action, waste prevention, healthy environments and community awareness. In January 2013, OCS released a progress report documenting campus successes and progress towards its 2025 sustainability goals.

As one of the largest components of campus operations, UMHS is expected to drive significant progress toward these overarching UM sustainability goals. One current challenge is a lack of clarity as to how exactly these larger targets have been delegated to the various campus units, including UMHS. As an individual component of the UMHS system, PFANS must too contribute to these goals, but its actual responsibility has not been formally delineated. Thus, our team has used the higher-level OCS goals to help guide and inform our own operational goals, but has not formally set targets for PFANS that would fulfill its commitment to the campus mission.

1.3.2 THE ROLE OF PATIENT FOOD SERVICES IN HEALTHCARE

Patient food service plays a unique role in the hospital setting. It is responsible for the nourishment of patients admitted to the hospital assuring that their dietary needs are met during recovery. Depending on the size of the hospital, patient food service responsibilities can include preparing hundreds of patient meals throughout the day and overseeing a large operating budget. In the case of UMHS, PFANS must deliver meals to an average of 600 patients and their families per day.

To date, patient food service units have not often been fully incorporated into the sustainability initiatives of many health systems. This is attributed to the particular function of patient food services in the hospital setting,

which usually does not encompass cafeteria services. The particular challenges that must be addressed when incorporating sustainable practices into patient food service operations are outlined below.

Procurement: Patient food services must work with its hospital's procurement unit to make decisions about the type and amount of food to purchase. Patient food services and the procurement unit must coordinate regularly and reevaluate purchasing decisions in order to remain under budget while also assuring that there is sufficient food to serve patients. Food procurement guidelines and vendor contracts dictate the quality and specifications of food coming into the system. As a result, incorporating sustainable practices into procurement practices can be a long and difficult process.

Waste Management: Patient food service is the largest contributor of food waste across most areas of the hospital including cafeterias. This is mostly due to the large amount of food that is returned to the kitchen after being sent to patients. Therefore, patient food service groups produce a waste stream that is different in composition from other areas of the hospital, has different regulatory constraints and requires an alternative method for diverting its waste from landfill.

Energy and Water Usage: Patient food service is resource intense in a different way from other areas of the hospital. Its kitchens must operate throughout the day with staff supporting the preparation, delivery and cleaning of patient meals over several kitchen stations. In addition to labor, patient food is heavily reliant on kitchen equipment including large freezers and fridges, ovens and stoves, resulting in large energy and water usage. Along with the energy and water usage by equipment, employee practices throughout the kitchen may contribute to increased usage of energy and water.

1.3.3 OVERVIEW OF PFANS

As the UMHS patient food services provider, PFANS' mission is to meet the nutritional needs of UMHS inpatients. This includes the monitoring of patient diets and the preparation and delivery of food to patients with a range of nutritional restrictions. Additionally, PFANS manages the UHMS Meals on Wheels program in conjunction with a local non-profit by coordinating the preparation and packing of meals for distribution throughout Ann Arbor. Of these responsibilities managed by PFANS, our project is focused on the patient food services portion of the department.

PFANS is located under the Operations Division of UMHS and is a member of the UMHS Environmental Stewardship Steering Committee. To perform its work, PFANS coordinates with various departments within the hospital's Operations Division. PFANS managers and chefs work directly with the Materials Services Department to procure the food required to ensure that its kitchens are stocked at correct levels. PFANS coordinates with the Environmental Services department, to which it sends all of the waste produced in its kitchens throughout the day.

PFANS' physical operations extend across two kitchens: 1) a kitchen in C&W that serves children, nursing mothers and immunocompromised patients and 2) a kitchen in (UH) to serve all other inpatients and house the MOW program. While fundamentally the responsibilities and operations of both kitchens are similar, there exist differences related to staffing and the volume and type of meals served.

1.3.3.1 ORGANIZATIONAL STRUCTURE

PFANS is overseen by the Department Director who reports into the Associate Director of Operations & Support Services for UMHS within the hospital's Operations Division. The PFANS Department Director supervises the Associate Directors of each patient food service location (C&W and UH) and the Associate Director of Nutrition Services. This structure enables the hospital to connect its patient food service with the nutritional service it provides to its patients (see **Exhibit 1**).

Within C&W and UH, managers oversee the operations and staff within each kitchen. These managers report to their respective Associate Directors. Their roles vary based on the size and operations of each kitchen, however, these managers are located within the kitchens to provide daily on-the-ground supervision.

Kitchen staff members serve in a variety of roles covering food preparation, food delivery and cleaning. The staff in each kitchen is comprised of both unionized and nonunionized workers with different levels of experience, responsibility and compensation.

A multi-shift system is needed to fulfill the needs of patients across all mealtimes and encompasses morning meal prep and setup as well as end of day cleaning and overnight activities. Additionally, this system requires a large management and staffing structure with both managers and staff assigned to specific shifts.

1.3.3.2 KITCHEN OPERATIONS AND DESIGN

The operations and setup of the kitchen are listed below. Throughout the course of the day, each kitchen area and function experiences changes in workflow resulting in adjustments to staffing or staff responsibilities.

Food Preparation (Prep) is the area of the kitchen where cold and hot dishes are prepared by dedicated staff, including chefs, in advance for use in patient meals. This consistently includes side dishes (salads, fruits, Jell-O, etc.) and main courses.

Tray Line is the area of the kitchen responsible for assembling patient meals by using the items produced by Prep in addition to pre-packaged food items and beverages. The tray line staff varies based on the patient food service method used (see **Section 1.3.3.3**) and the number of meals needed to fulfill patient demand.

Food Delivery is the activity of delivering meals to patient. This includes a staging area of food delivery carts at the end of the Tray Line, which are loaded with patient meal trays and used by staff to cart food to all designated inpatient rooms. Following an allotted time, PFANS staff returns to inpatient areas to collect and return trays to the kitchen for cleaning.

Ware Wash is the area of the kitchen where dishes used in the preparation of food as well as dishes and trays returned from patient rooms are cleaned. Staff in this area is responsible for separating aluminum cans and plastic bottles before dumping the remainder of the waste generated into a trash can, sink-based disposal (C&W only) or pulper machine (UH only).

1.3.3.3 RECENT CHANGES TO OPERATIONS AND SERVICE

Over the past year, PFANS has been transitioning its kitchens from the standard patient food service method to a new room service format. Traditionally, patient food services operated much like a factory in which the same meal was prepared for all patients at each mealtime with slight modifications to meals based on dietary restrictions of specific patient types. While this standard patient food service method attempts to account for the number of hospital beds in use each day and adjusts meal production accordingly, this system has traditionally resulted in large amounts of food waste, specifically food waste that results after it has been delivered to the patients. Patient food service professionals explain this large amount of waste is due to the need to ensure that there is enough food to feed inpatients, as numbers may fluctuate throughout the day. An additional reason for such waste is the lack of satisfaction with the food served based on food type, volume and rigid delivery time.

The new room service format being used by PFANS allows patients to call in a specific meal request at any time during kitchen operating hours and to select items from a restaurant style menu provided by the hospital. To support this new system, PFANS has converted the design and operations of its C&W kitchen. In this new system, patient requests are received by the PFANS Call Center, whose staff works with the patients to fulfill requests based on dietary restrictions. This approach enables customers to order the type and amount of food that fits their needs at times when they are ready to eat. To process the patient meal orders, PFANS has reconfigured C&W's kitchen to have parallel service lines manned by chefs and tray line staff. In this process, the chef prepares and places fresh food immediately on a tray, the line staff adds food items and beverages and places the tray on a cart for delivery to patients.

The move from the standard patient food service method to the room service method has enabled C&W kitchen to reduce the amount of food wasted, thus reducing the amount of food it procures to meet patient needs. Additionally, this approach has led to increased patient satisfaction about the type, amount and timing of food delivery during their hospital stays. With the success of its transition to the room service method at C&W kitchen, PFANS is now in the process of transitioning the UH kitchen from the standard patient food service method to the room service method. This transition is underway and is expected to be completed in 2013. Although this an important first step toward reducing its resource use, PFANS recognizes that other steps can be taken to limit its environmental impact and even lower operating costs through operational and process changes.

1.4 METHODOLOGY

Our team conducted a series of primary and secondary research activities in order to address the scope of our project. These activities are outlined below and incorporate both quantitative and qualitative data collection.

1.4.1 WASTE SORT

To gather comprehensive data on the waste produced by PFANS, we conducted a waste sort on August 22, 2012. This waste sort was limited to the C&W kitchen because C&W has fully transitioned to its new room service style of food service. UH kitchen is expected to transition to this new food service style over the course of 2013. Therefore, we decided that C&W could serve as a proxy for the ultimate switch of all of PFANS operations to the room service style.

During the August waste sort at C&W kitchen, we sorted all waste produced by the kitchen from open to close and tracked where in the kitchen the waste was generated. Results of this sort provide a snapshot of the kitchen's waste context, yielding data on the amount and types of waste produced. For a full list of material/item categories used, see **Exhibit 2**.

Data produced by the waste sort was used to develop an understanding of the composition of C&W kitchen waste and current waste practices, such as the locations where specific types of waste are generated. In addition, waste totals and food waste totals from this data were paired with tray ticket data (the number of trays ordered by patients on a given day) and C&W census data (daily patient occupancy) to create waste per tray and waste per patient metrics.

1.4.2 LEANPATH WASTE AUDIT

In order to complement the data gathered during our August waste sort at the C&W kitchen, our team conducted waste audits in September 2012 at both the C&W and the NCRC kitchen spaces (where much of PFANS' food production was housed during kitchen remodeling). The purpose of these audits was to gather a detailed record of all unutilized pre-patient food sent to waste each day. While the team waste sort provided a one-day snapshot of all items deposited into trash bins after their disposal, this waste audit focused specifically on the composition of food waste before its disposal. Weighing and tagging this food by type and specific reason for disposal provided a robust set of data that enabled better understanding of the factors driving food waste in PFANS operations.

1.4.2.1 WASTE AUDIT PROCESS OVERVIEW

After researching the various techniques and methodologies commonly utilized in waste audits, our team identified and connected with LeanPath, a leading vendor providing food waste tracking equipment, software and services to institutional food service providers. LeanPath provides tracking equipment that allows individuals to capture mass and tracking data of organic food waste in an automated system. Additionally, LeanPath auditing equipment actively engages users in the kitchen itself. By manually weighing and logging each item of food waste by type and loss reason, employees gain exposure and a connection to the volume of food sent to landfill each day. In long term waste audits, this sense of connection often develops into a sense of personal accountability and ownership that motivates employees to consider waste reduction throughout their workday.

We selected the LeanPath Food Waste Tracking system for our one month audit in the two PFANS kitchens. Our rental included the one-month use of tracking equipment, comprised of a metal scale connected to a touch screen Tracker device (see **Exhibit 3**). After placing a container of food waste onto the scale, a user was then prompted by the touch screen to enter certain descriptive information corresponding to that waste. Data collected in the tracker was then transferable via USB device to be stored and analyzed by the LeanPath software system. In addition to compiling the raw data collected by each transaction conducted on the LeanPath equipment, this software system generated reports visualizing the waste measured by filters including type of food, time of day and reason for the food loss itself.

We installed this LeanPath Tracker system in the NCRC and C&W kitchens for a two-week period each during September 2012. The tracker was programmed specifically for its kitchen location to capture all pre-patient waste collected by the Food Preparation (Prep) and Tray Lines. We excluded the collection of any post-patient food waste information in the waste audit process.

After placing a container of food onto the metal scale, each user selected appropriate responses to each of these three categories before the transaction was finalized:

- **Food**: A list of 20 food types and corresponding prices (cost per pound) could be programmed into the system. Our team worked with PFANS to identify the appropriate food categories for each kitchen and customized the software to display these specific food types prior to each individual audit.
- **Loss Reason**: Food loss reasons such as Overproduction or Expiration were programmed into the equipment so that the audit properly captured the drivers behind food waste in each kitchen.
- **Container**: The Tracker was programmed with the types and weights of all containers that held waste placed onto the scale. This allowed the Tracker to adjust its weight reading for each food type so that only the mass of food itself was recorded.

Appropriate selections to these three categories were determined after interviewing North Campus Research Complex (NCRC) and C&W PFANS managers to determine what food types and loss reasons would properly capture the anticipated waste. Container weights were collected prior to each audit.

1.4.2.2 NCRC AUDIT

Our initial two-week audit was conducted at PFANS' temporary kitchen in NCRC, a facility that temporarily handled components of PFANS' meal preparation during the University Hospital kitchen's closure for remodel.

The majority of food produced in this temporary kitchen was prepared for either UH patients or MOW. We chose not to track the waste generated by these processes due to the significant operational changes that would be implemented upon the completion of the UH kitchen renovation. Instead, our team focused on items prepared by water chill, a component of the food production process at NCRC that would not be affected by the move to the UH kitchen.

The water chill process enables the early production of storable foods like soups and sauces to be delivered to any of PFANS' UH, C&W, or MOW patient food operations. Normally conducted at the UH kitchen facility, water chill preparation was moved to the temporary NCRC facility during the UH construction process. We focused our

NCRC waste audit on any food waste generated in the preparation of water chill items to be sent to the C&W kitchen only**.** We limited our data collection to C&W items to align with our C&W focus in our other waste collection methodologies, recognizing that this pre-production trim waste would be missing from the waste sort and audit conducted at the C&W kitchen.

We worked with one PFANS employee responsible for preparing all vegetable ingredients for these water chilled meals. The prep employee then weighed and logged all food prep waste during her shifts for two business weeks. Data stored in the tracker was transferred and uploaded twice into the LeanPath software during the two week collection period.

Due to the simplicity of the anticipated food waste from the NCRC kitchen, we programmed the LeanPath equipment to include a limited number of food types and loss reasons (see **Exhibit 3**). Data was collected each weekday during the two-week audit period.

1.4.2.3 C&W AUDIT

Our second two-week audit at the C&W kitchen took place from Monday, September 10, 2012 through Saturday, September 22, 2012. Three PFANS employees responsible for kitchen cleaning took ownership of conducting the waste audit process in the C&W kitchen, with assistance from the C&W Managers on staff. This audit was set up to include all pre-patient waste collected from the prep and dish lines within the PFANS kitchen. No post-patient waste was included in this audit.

Food categories programmed into the LeanPath tracker for the C&W audit are available in **Exhibit 3**.

1.4.3 EMPLOYEE SURVEYS

As part of our project, it was important to gain insight into the values and beliefs of PFANS staff related to sustainability. To do so, our team developed and distributed a survey to PFANS kitchen staff to learn how employees engage with larger issues such as climate change and environmental policy as well as those activities that may be part of their daily lives including transportation and local food sourcing.[1] See **Exhibit 4** for a copy of the survey. These results gave us an idea of how open the hospital workforce might be to a culture shift towards sustainability principles and practices. It also helped us garner feedback and leverage ideas specific to the staff perspective.

1.4.4 FOCUS GROUP

Our team conducted a focus group with PFANS staff comprised of participants that perform various roles and functions throughout its kitchens. This focus group excluded PFANS managers in order to gain particular insight into how PFANS staff would respond to operational changes in the kitchens that support sustainability related

[1] The survey was developed by modifying and tailoring similar surveys associated with the Sustainability Cultural Indicators Project, a partnership led by the Graham Sustainability Institute and the Institute for Social Research and launched campus-wide in Fall 2012.

objectives such as waste reduction or diversion from landfill. This enabled our team to include the employee perspective in our recommendations for PFANS and to validate and assess our hypotheses related to employee behaviors and work-related practices.

1.4.5 CONFERENCES

Our team attended two conferences over the course of this project. First, two members attended the CleanMed Conference in May 2012 hosted by Practice Greenhealth. This annual conference brings together leading hospitals, organizations and businesses that are committed to healthcare sustainability. At this conference, our team gathered information from leading organizations on best practices, latest trends and key challenges in advancing sustainability initiatives in a hospital setting. Through this conference, our team was able to understand better where UMHS stands in its sustainability efforts as well as how the missions of public health and sustainability complement one another. Additionally, connections made at this conference led the team to work in partnership with a healthcare consultancy SOS Partners and Practice Greenhealth to host a one-day conference at the University's Stephen M. Ross School of Business focused on learning how to make a business case for sustainability initiatives in a healthcare organization.

The second conference our team attended was the Michigan Health and Hospital Association's annual Michigan Green Health Care Committee conference. Hosted in Ann Arbor, this conference brought together leaders in healthcare sustainability, healthcare institutions and other health-focused organizations from around the state of Michigan to discuss work being performed related to healthcare sustainability in the region. This conference provided our team with greater insight into the healthcare sustainability landscape in Michigan with a particular focus on sustainable food production and procurement.

1.4.6 INTERVIEWS

Interviews comprised a bulk of our research when it came to industry benchmarking, identifying best practices and engaging with the staff and management of PFANS and the larger UMHS system. At the outset of the project, we identified stakeholder groups that we felt could provide us with the data we needed to address our research questions. We determined the best manner to reach these stakeholders was to leverage our client's relationships, individuals we already knew in the space and contacts we met at related industry conferences. In addition, after each interview, we asked the interviewee if he or she could direct us to a colleague or industry contacts to offer further insight. While this did not necessarily lead to a fully comprehensive sample of constituents, it was the best way to reach a high quality group of hospitals, employees, vendors and industry contacts within a reasonable period.

Interviews were conducted through a mix of phone conversations and in-person meetings. Members of the team also participated in site visits to Spectrum Health in Grand Rapids, MI, the Valley Health System in Ridgewood, NJ as well as several hospitals within the North Shore-LIJ Health System in New York.

Interviewees included the following:

Stakeholder Category	Name	Title	Organization
UMHS/UofM	Andy Berki	Manager	Office of Campus Sustainability
	Ann MacLean	Associate Director	PFANS
	Diane Knibbs	Associate Director	PFANS
	Gina Keilen	Food Service Manager, Production	PFANS
	Jessica Zokas	Food Service Manager, Production	PFANS
	Joyce Kerestes	Director PFANS	PFANS
	Judge Mills	Food Service Manager, Galley	PFANS
	Kim Berg	Food Service Manager, Production	PFANS
	Michelle Maloney	Associate Supervisor MOW	PFANS
	Randy Burns	Senior Buyer	PFANS
	Sara Tutor	Manager, C&W Room Service	PFANS
	Terry Drew	Food Service Manager, C&W Room Service	PFANS
	Uryna Gerber	Food Service Manager	PFANS
	Tina Johnson	Food Service Manager	PFANS
	Tracy Artley	Director	Recycling and Waste Reduction
	Chris Victory	Senior Mechanical Engineer	UMHS
	Colin Murphy	Energy Conservation Engineer	UMHS
	Michelle Eleby	Project Senior Manager, Office of the COO	UMHS
	Robert Harris	Director, Facilities Planning and Development	UMHS
	Joe Stchur	Director, Facilities Maintenance	UMHS
Hospitals/Health Systems	Daria Holcomb	Manager Dining Services, Nutrition Services	Fletcher Allen Health Care
	Dennis Connors	Executive Director	Glen Cove Hospital
	Carolyn Billetdeaux	Sustainability Associate, Office of Sustainability	Inova Health System
	Seema Wadhwa	Director of Sustainability	Inova Health System
	Linda Zengen	Waste Reduction Manager, Department of Waste Management	Lehigh Valley Health Network
	Tzipora Lubarr	Project Manager, Sustainability	Memorial Sloan-Kettering Cancer Center
	Tom Kelly	Energy & Sustainability Manager	Montefiore Medical Center
	Jessica Prata	Sustainability Officer, Division of Support Services	New York Presbyterian
	Jennifer Molloy	Project Manager, Procurement	North Shore-LIJ Health System
	Lisa Burch	Director, Sustainability and Social Responsibility	North Shore-LIJ Health System
	Neil Rosen	Director, Sustainable Development	North Shore-LIJ Health System
	Sarah Chartier	Sustainability Officer	Spectrum Health
	Krisanne Hanson	Director, Sustainability Department General Services	Stanford University Medical Center
	Audrey Meyers	President & CEO	The Valley Hospital
	Howard Halverson	Environmental Services Director	The Valley Hospital
	Maria Mediago	Vice President, Facilities Management	The Valley Hospital
	Paul Watkins	Executive Director	UCLA Medical Center
	Jack Henderson	Associate director of Nutrition and Food Services	UCSF Medical Center
	Dr. Steven Szydlowski	MHA Program Director	University of Scranton
	Major David Zajac	Affliated VA Hospitals	US Army
Vendors/ Suppliers	Ellen Kondracki	Director, Sustainable Innovation & Stakeholder Relations	BD
	Glenn Barbi	Chief Sustainability Officer	BD
	Jason Saft	Manager, Sustainability Programs for Medical Surgical Systems	BD
	Meredith Gethin-Jones	Client Specialist, Lean Practioner	Haley & Aldrich
	Audrey Copeland	Business Development Manager	LeanPath, Inc.
	Nicole Chardoul	Principal and Vice President	Resource Recycling Systems, Inc.
	David Sturza	Founder	ReValue Waste
	Sandra Tuthill	Owner	Tuthill Farms
Other Industry Stakeholders	Hillary Bisnett	Healthy Food in Health Care Program Director	Health Care Without Harm
	Cecilia DeLoach Lynn	Director of Facility Engagement & Metrics	Practice Greenhealth
	Andrew Novak	Education & Culinary Consultant	Real Food Colorado
	Josh Miller	Senior Healthcare Sustainability Consultant	SOS Partners
	Rick Ament	CEO	SOS Partners

1.4.7 LITERATURE REVIEW

To best understand the context under which healthcare sustainability efforts are taking place in Michigan and nationwide, our team conducted an extensive literature review utilizing the resources within the University of Michigan library system. Our search topics centered on the following information themes: Waste Management, Healthcare Sustainability, Hospital Food Systems, Michigan Agriculture and Sustainable Sourcing.

We created a shared information database to organize and store our findings into the following categories:

- Agriculture & Public Health
- General Food Waste
- Hospital Food Waste Specific
- Michigan Agricultural Landscape
- Michigan Public Health
- More General Green Hospital Information
- Other Hospital Food Programs Information
- Procurement

During our initial literature review process, our team quickly identified two key primary resource networks that contributed significant to our research process: Practice Greenhealth and Healthcare Without Harm. These two organizations, both focused upon the creation of more sustainable healthcare systems, house websites and databases with an immense collection of primary and secondary research that we found relevant to our project. We frequently utilized these organizations – first online and then via direct inquiries – throughout our data collection process.

Over the course of this project, we collected, reviewed, and synthesized over 100 reports and documents and used this background research to guide our project objectives and eventual recommendations.

1.4.8 DATA ANALYSIS

In addition to the opportunities outlined above for primary collection of waste data, we were able to obtain further PFANS and hospital data to aid in the waste analysis and creation of key metrics and estimated totals. An overview of the data used in the waste analysis, as well as the metrics and estimates calculated follows.

1.4.8.1 WASTE SORT

As noted above, the team conducted a sort of all waste from the C&W kitchen on August 22, 2012. The strength in this data lies in its comprehensiveness: it is an overview of every piece of trash produced in that kitchen. The sort was organized in such a way that rather than just producing waste weight totals, we have data on specific types of waste based on material type. This allows for greater detail and specificity in the application of this data. In addition, data from this waste sort provides our only source of information on post-patient food waste, that is, food that comes back to the kitchen on trays once patients have finished eating.

The primary limitations of this data are twofold. First, it only represents one day of waste generation within a dynamic and variable kitchen system. While the relative degree of kitchen activity (i.e. how busy or slow with respect to patient food orders) on waste sort day is at least partially accounted for when combined with occupancy and order ticket totals, it does not necessarily take into account any cyclical variations in disposal of expired food. C&W kitchen managers indicated there are not specific days when expired food is generally thrown away so it is possible this snapshot of a single day's waste will overestimate or underestimate the norm to a certain degree.

Second, this waste sort captures only waste from the C&W kitchen and obtaining similar representative data from the UH kitchen during the timeline of this project was impossible. A key assumption made in this waste assessment is that this waste sort data is representative of an average day of kitchen waste in both the C&W and UH kitchens, though it is important to remember there is opportunity for error inherent in this assumption.

1.4.8.2 LEANPATH WASTE AUDIT

As described above, the LeanPath waste tracking equipment and software were employed for two weeks each on the large UH production line and in the C&W kitchen. In the analysis of the LeanPath data, only the results from the C&W kitchen tracking were utilized. Data from the C&W tracking captures all of the pre-patient food waste generated in this kitchen. The great strength of this data is that kitchen employees were highly consistent throughout the two weeks of tracking so we can be confident that all pre-patient food waste is represented in this data. In addition, since tracking lasted two weeks, we can assume this data provides a more comprehensive picture (with respect to pre-patient food waste) than results from the waste sort.

The primary limitation of this data is a result of the equipment itself. Only 20 descriptive names for food items could be programmed into the tracking software. Thus, food items had to be organized into basic categories, such as "Potatoes," which included all mashed potatoes, baking potatoes, tater tots, etc. This placed limitations on the degree of specificity attainable by analyzing the kitchen food waste from this audit.

1.4.8.3 WASTE LOGS

The team helped PFANS management refine the waste log it had developed and deployed a few months prior to the onset of this project. The updated log created a more consistent and comprehensive tracking methodology for pre-patient food waste. After our updates were implemented, PFANS management then instructed the chef's assistants to fill out these logs daily. The logs were designed primarily to track food waste from the hot and cold prep lines, items such as scrambled eggs that are prepared in large batches throughout the day and thus quickly served as orders come in. This data largely parallels that collected by the LeanPath system, however it covers a longer period, from October 2012 to January 2013. It is also more specific than the LeanPath data in that each food item is recorded individually. While some data limitations exist due to inconsistent recording by staff, overall the data was still helpful due to the specificity of recorded food items.

1.4.8.4 UH/CVC AND C&W CENSUS DATA

Census data collected for UH, CVC and C&W included both the bed complements for each unit (the number of available beds) and historical occupancy data for each unit. UH and CVC data spans from July 1, 2011 through October 31, 2012 while C&W data spans from December 5, 2011 through October 31, 2012. Data was obtained from various hospital personnel referred to us by PFANS management. This dataset allowed for the calculation of historical occupancy rates for each unit. In addition, unit occupancy data was used to profile the patient population with respect to diet. For example, patients under critical care might have very limited diets, perhaps restricted to liquids, while other patients might have a 'normal' diet. In using the unit occupancy data to determine waste metrics per patient, units were assigned one of three coefficients in order to account for patients who might not receive a lot of food from the kitchen. Units with a coefficient of 1 are those with patients on an unrestricted diet with regard to food type. Units with a coefficient of 0.5 are those for patients on highly restricted diets or who are transitioning from liquid to solid food. Units with a coefficient of 0 are those with patients receiving nutrition through stomach tubes or other means that do not require kitchen preparation. Raw daily patient counts were amended using these coefficients to produce values for "adjusted eating patients." Note that unlike the UH/CVC data, we do not have a full years' worth of occupancy data available for C&W.

A list of C& W and UH/CVC units, their patient population and assigned eating coefficients can be seen in **Exhibit 5**.

1.4.8.5 C&W TRAY DATA

Data on the number of trays ordered by C&W patients and guests was obtained from PFANS management and spans January 1, 2012 through October 31, 2012. This data represent the total number of trays leaving the C&W kitchen each day and can be combined with waste data and occupancy data to create key metrics. This data is highly accurate, however, it only accounts for 10 months of tray deliveries. Additionally, during the period of this study C&W was piloting the room service style of meal delivery (just-in-time service) that will soon be a system-wide operation (discussed further in **Section 1.3.3.3** above). Thus, a necessary assumption was made that this C&W data will be representative of tray deliveries from the UH kitchen (adjusted for number of patients) once the same room service delivery model is fully implemented in that kitchen as well. One potential source of inaccuracy in calculations due to this assumption concerns the percentage of "Guest" trays ordered. Over the 10 months of C&W data, 32.4% of patient trays were ordered by Guests (family and friends of patients), but PFANS managers expect a higher Guest tray rate at UH once room service is fully implemented. Without additional data, it is impossible to correct for this, but it is important to recognize that potential source of error for future assessments.

1.4.8.6 MEALS ON WHEELS FOOD WASTE TRACKING

Food waste from MOW operations was tracked daily for two months. MOW has four rotating weekly menus, so two months' worth of waste data represents two full menu cycles. Each waste item was tracked according to the day of the week of a specific menu, which allowed for menu comparisons. To discern fully accurate trends in the

waste data it would require tracking over many more menu cycles, but two months' worth of data is assumed here to be adequate in providing a general picture of MOW's food waste levels.

1.4.9 KEY WASTE METRICS CALCULATIONS

The datasets reviewed above were used to develop metrics pertaining to kitchen waste from the C&W and UH kitchens. These metrics provide a picture of the current waste landscape in PFANS kitchens and could continue to be a useful benchmark against which to track performance with respect to waste in the future. Calculated metrics fall into three general categories: waste ratios, annual estimates and diversion rates (see **Exhibit 6**). All mass values are in pounds. These metrics will be used throughout the report as the basis for our calculations and recommendations.

1.4.9.1 WASTE RATIOS

Due to the comprehensive nature of the waste sort data collected, this dataset was used as the basis for most of the metrics calculated. Waste sort data as well as C&W Tray and Census numbers from August 22, 2012 were used to create waste/tray and waste/patient ratios for both total waste and food waste. The per-tray ratios used the raw data while the per-patient ratios used the adjusted number of eating patients. As described above, the total number of patients on August 22 was adjusted using unit coefficients to correct for patient populations not receiving food from the PFANS kitchen.

Additionally, LeanPath data was used to determine the amount of pre-patient food waste/patient. This ratio was calculated by dividing the total waste weighed over the two-week tracking period by the adjusted number of eating patients over that period. The difference between this value and the total food waste per patient was also calculated to determine an estimate of the amount of food wasted by patients.

The weekly MOW food waste was also determined by dividing the total amount of food waste by the 8 weeks of tracking. The MOW program has a relatively consistent average of around 200 meals delivered daily throughout the year so we assumed that this weekly food waste value is representative of an entire year of operations.

Lastly, we calculated the number of trays delivered daily to each patient. The number of trays per adjusted eating patient was calculated for each day over the 10 months in which we had both census and tray data for C&W. These daily values were then averaged to determine the daily trays/patient value used in subsequent calculations.

1.4.9.2 ANNUAL WASTE ESTIMATES

In an effort to calculate annual waste estimates, we assumed that hospital occupancy determines how much waste is created and thus we took census numbers into account in our calculations. We acknowledge that there is likely to be some error inherent in this assumption. For example, patient occupancy can shift quite dramatically from day to day making it difficult for the kitchen cook line to determine an optimal amount of pre-prepared foods to make each day. Rather than a simple, one-to-one relationship between number of patients and amount of food waste, there is most likely a baseline level above which occupancy determines the total

amount of waste. Determining this waste equation would require far more waste data than we had available as well as regression analysis, which was outside the scope of this project.

An estimate of annual C&W kitchen waste was calculated using adjusted eating patient numbers from the C&W Census data and the tray/patient and waste/tray ratios described above. The adjusted number of eating patients was summed in weekly increments and used in the equation below, where *i* = specific week of the year:

$$\sum_{i=1}^{i=52} (adj.\#\ eating\ C\&W\ patients_i * \frac{\#\ trays}{patient} * \frac{total\ waste}{tray})$$

As noted in the discussion of C&W Census data, this dataset was four weeks shy of documenting a full year of occupancy. In the calculation above, the average weekly number of adjusted eating patients from the other 48 weeks for which we do have data was used in calculations for the missing four weeks. An estimate of annual C&W kitchen food waste was calculated by substituting the food waste/tray ratio for the total waste/tray ratio in the equation above. Additionally, the LeanPath ratio of pre-patient food waste/patient was substituted in the equation above for the product of trays/patient and total waste/tray to produce an estimate for annual pre-patient food waste.

Similar annual waste estimates (total waste, total food waste and total pre-patient food waste) were made for waste generated in the UH kitchen. The adjusted number of eating UH patients was summed in weekly increments and used in the equation above, replacing the C&W patient numbers. While C&W Census data only covered 48 weeks of C&W occupancy, the UH Census dataset covered 71 weeks of occupancy. The adjusted eating patient values used for week numbers 26 through 44 were thus averages of the numbers for the years 2011 and 2012. UH food waste and pre-patient food waste estimates required the same modifications to the equation as described above for C&W estimates.

An annual estimate of MOW food waste was made by simply scaling up the weekly average through multiplication by 52. As discussed above, the MOW operation serves a consistent average of about 200 meals daily, so using a straightforward scaling method in this case was deemed appropriate.

System-wide totals were estimated to be the sums of C&W, UH and MOW annual estimates. System-wide numbers were calculated for total waste, total food waste and total pre-patient food waste. In addition, the difference between total waste and total pre-patient food waste was used to estimate a system-wide total of annual patient food waste.

1.4.9.3 DIVERSION ESTIMATES

Current estimates of PFANS' waste diversion from landfills were calculated using the Waste Sort dataset. The sum of mass values for current recycling of mixed paper, soda cans and bottles was divided by the waste total for the day to yield the current diversion rate. Some aluminum cans and bottles were not actually recycled and these were added to the recycled mass to determine the diversion rate with 100% compliance of the current recycling processes. As will be discussed in later sections of this report, there are sizable gains possible within

PFANS kitchen operations with regard to diversion from landfill. Discussion of possible increases in diversion rates all stem from similar calculations as described above, all based on the waste sort data.

2 BENCHMARKING FINDINGS

2.1 COMPOSTING AND FOOD WASTE DISPOSAL

The most apparent finding from our benchmarking exercise was that almost no hospital we contacted concentrates its composting efforts on patient food services, in particular, post-service patient trays. Fletcher Allen is the closest to patient food composting, but concentrates only on pre-patient waste and not tray waste. Most organizations we researched focus on changes to their cafeteria services or employee-focused food service because they: 1) do not affect the patient experience 2) avoid regulatory hurdles and 3) are easier to implement. However, there are several hospitals with composting programs in place and many more that are exploring options to institute composting. In addition, several systems indicated that they would like to find a way to expand their current composting and recycling efforts more broadly to their kitchens to cover patient food service. The Healthier Hospital Initiative supports composting as a part of its waste management set of goals. This research shows us that composting in patient food service is challenging to pursue, but if it were to be successful for PFANS, it would place UMHS ahead of the curve.

2.2 ADVOCACY

An area that received an overwhelming amount of attention by health systems was local food purchasing. While these efforts were widespread and diverse in their goals, every single hospital we spoke to had some type of activity in this space. "'Hospitals understand they can no longer be large buildings where sick and injured people show up to receive care,' said Brian Peters, the executive vice president of the Michigan Health & Hospital Association, who views the trend as a 'a real sea change' in the evolving role of hospitals to put more emphasis on health prevention" (Sanchez, 2011). Serving healthier foods to visitors and patients and supporting farmers markets are two ways hospitals now pursue that role. However, there was significantly less effort placed in support for regional food hubs and other programs that attempt to address systemic issues in delivering this "sea change." Up until recently, Michigan had a state level subcommittee of the Michigan Health and Hospital Association (MHA). However, this subcommittee has been disbanded as a part of a reorganization. This leaves an opening in the space for PFANS and UMHS to potentially step up and promote cross-hospital coordination. A key partner in this could be St. Joe's Mercy, also in Ann Arbor, as it has a recognized commitment to healthy food initiatives. Overall, Michigan is relatively progressive as compared to many other states. Research shows that advocacy is an area ripe for innovation and for involvement on the state level, however, we recognize that PFANS may need to first pursue these activities itself before promoting or seeking partnerships on a wider scale or in a more public manner.

2.3 WELLNESS MESSAGING

We observed that at many hospitals across the country changes to food service are coupled with an increased focus on wellness or preventive care. This messaging resonates with both patients and employees and aligns with larger changes in the healthcare system moving toward accountable care and population health management. Many hospitals that are strongly rooted in their communities want people to be comfortable at their hospitals both when they are ill and when they are well. It is about a much broader engagement with the community and sustainability can and should be a staple of that engagement. PFANS and UMHS must find opportunities for incorporating sustainable elements that benefit the organization and patients. Linking these changes and enhancements to health outcomes could be one way to achieve this objective.

A wellness focus also translates effectively to employee-focused sustainable food efforts that might evolve at UMHS. Cafeteria Services seems keen to increase its sustainability efforts and Aramark, the food vendor provider for Cafeteria Services, could be an important partner in making that a reality. A wellness orientation also creates a platform for more advocacy-focused food efforts such as expanded farmers markets, patient and cafeteria menu changes, a Meatless Monday campaign or healthier vending machine offerings. Wellness provides employees a concept that they recognize to which to sustainability efforts—most hospitals have at least some initiatives related to employee health and wellness—and could prove to be a powerful motivator. For example, North Shore-LIJ Health System has recently launched a "Know Your Environmental Numbers" campaign based off a previously successful wellness campaign called "Know Your Numbers" that was focused on employees learning about their BMI, cholesterol and glucose levels. The new environmental employee engagement program is aimed at teaching employees about their carbon footprint numbers and helping them find ways to reduce their footprint both at home and at work.

2.4 METRICS

Defining appropriate metrics for sustainability is a huge challenge, not just in the healthcare space, but in business in general. There are no universally accepted standards and, in fact, there are not even clear industry-wide accepted metrics. The most consistent metric for waste in health systems is diversion rate, followed by reuse rate. Very few hospitals have found an easy way to report greenhouse gas (GHG) effects. Nevertheless, GHG or carbon footprint is a highly preferred metric across many industries and, in particular, larger health systems reporting on sustainability. Many organizations including the University of Michigan have a carbon footprint reduction goal and waste diversion can and should play a role in reaching this objective. Energy use is the easiest to capture in terms of carbon footprint and is more easily translated into GHG units than other sustainability measures such as waste reduction. However, there are efforts being made outside of Michigan when it comes to more robust waste-related GHG reporting. For example, in New York City Mayor Bloomberg's Carbon Challenge for Hospitals is designing a reporting mechanism for waste in addition to the one it already uses for energy. Fletcher Allen health system in Vermont reports GHG and does so through a collaborative endeavor between its environmental services and facilities management groups.

Many Fortune 500 companies as well as large health systems use some form of the Global Reporting Initiatives (GRI) framework. GRI is a non-profit organization that maintains and promotes the use of a robust standardized sustainability and corporate social responsibility reporting framework. Currently, it is one of the most globally used formats for reporting. Other reporting formats include folding sustainability efforts into a health system's overall community benefits reporting. The benefit of this method is that it takes advantage of existing data capture mechanisms, enabling it to translate the effect of sustainability into community benefit dollars, a key metric in healthcare. The challenge with this method is that often the sustainability aspects get lost in the larger report and do not translate as well as "big ticket" items such as charity care dollars spent. Some of the most successful reporting efforts for hospitals are those that partner with their vendors to obtain progress on metrics. This method, according to Practice Greenhealth, is highly prevalent. Partners could include large waste vendors, such as Waste Management and Stericycle, or local vendors, such as Rapid Shred used by Spectrum Health in Grand Rapids, MI. Spectrum uses Rapid Shred to upload waste data directly to Key Green Solutions, Spectrum's sustainability data and metric tracking partner.

The rest of this report details specific metrics associated with our recommendations for PFANS and draws on the findings from our benchmarking work.

2.5 EMPLOYEE ENGAGEMENT

Robust employee engagement can be the asset that sets great hospitals apart from simply good ones. Hospitals that invest in employee engagement can increase patient satisfaction, employee retention and satisfaction, outcomes and organizational success. When pursuing sustainability-related goals, most hospitals find that employee engagement is the lynchpin that ensures both short- and long-term success. It produces employees with a willingness to invest themselves and expend their discretionary effort to help the organization succeed, which is essential to truly integrate sustainability into a health system's culture, operations and strategy. There was not a single hospital we interviewed or researched that does not already have (or is building) a significant employee engagement effort around sustainability to support the changes it is making. The methods of employee engagement were different across systems with many building off other previously successful methods used for cultural changes. Some of the methods best used by other health systems included the use of environmental affinity groups, green teams and individual green champions, sustainability education, sustainability-related events, farmers markets, on-campus farms and the use of employee and patient wellness outcomes tied to sustainability issues. Please see **Section 4** for a more in-depth discussion of employee engagement.

2.6 UNTESTED AREA: PATIENT REACTION & SATISFACTION

Assessing effects of sustainability related efforts by PFANS on patient satisfaction could be a possible next step for PFANS and would provide data that the overall industry is currently missing. While there is some data related to menu changes and to cafeteria satisfaction, investment in long-term bigger picture sustainable actions is both

hard to communicate and hard to determine what, if any, effect it has on patient satisfaction. However, one big obstacle is that it would require extensive patient surveying once changes were implemented. Fletcher Allen, for example, made the switch over to room service dining, instituted its aggressive local-focused procurement plan and has a patient menu that emphasizes seasonal fresh produce and other healthy menu items. The health system states that these changes helped boost patient satisfaction scores from 42 to 90 percent after implementation.

3 FINDINGS AND RECOMMENDATIONS

Through our investigation of PFANS, we were able to ascertain the current context within which PFANS operates and determine appropriate first steps in the move towards greater sustainability. We then used findings to develop a series of specific recommendations aimed both at supporting PFANS' sustainability goals and at providing a working framework of a holistic approach to sustainable healthcare delivery.

3.1 ASSESSMENT AREAS

Our approaches to specific areas of sustainable operations are summarized below and are later followed by our recommendations in full:

Energy & Water – We initiated an investigation into energy usage within PFANS' kitchens. This analysis was largely carried out by Colin Murphy, an Energy Conservation Engineer within the UMHS Facilities group. His findings primarily led to "quick win" recommendations that passively reduced PFANS' energy use. Thorough exploration of water use was beyond the resources available to us and thus fell outside the scope of the project. Initial findings indicate that large-scale changes to water use would require major investment in machinery, in particular, the older Hobart dishwashers.

Procurement – The primary aim of this study was to determine first steps PFANS can take towards sustainable operations. Investigations into procurement strategies revealed this to be the area in which first steps have already been taken and the most progress has been made. As a result, our procurement-based recommendations focus on high-level suggestions for areas of investigation that have the most potential to bring to light next steps for sustainable sourcing.

Plastic & Metal Waste – We investigated plastic and metal waste generated in PFANS' operations by gathering primary data during the C&W Waste Sort and analyzing operational procedures that utilize these materials. Recommendations on plastic waste rely on source reduction and leveraging the current health system diversion capabilities/infrastructure. Metal waste recommendations focus only on diversion.

Food Waste – We investigated food waste within PFANS by gathering data during the comprehensive C&W waste sort, installing food waste tracking equipment and software for two weeks, and by analyzing waste logs kept by PFANS employees. Additionally, we evaluated the processes and procedures PFANS follows regarding food preparation, storage and disposal. Recommendations in this area focus on source reduction and diversion strategies.

Office Waste – Waste analysis in the study focused primarily on kitchen waste, though the C&W Waste Sort included data on waste from the kitchen office. Office-related recommendations are generally high-level proposals addressing issues that fell outside the scope of the core study.

Note: One notable omission from this list, paper waste, was not addressed due to the strong, system-wide management of paper. Recent transition to digital record keeping has reduced the health systems' paper usage and what is used must be contained and shredded to maintain patient confidentiality. All shredded paper in the system is recycled, leaving little room for us to make meaningful recommendations.

3.2 IMPORTANT CONSIDERATIONS FOR PROPOSED RECOMMENDATIONS

One of the most important considerations for implementing the recommendations we have proposed will be in creating tracking metrics in order to measure successes and challenges. Not only will metrics be required to assess how well PFANS managers and employees are performing in any given sustainability task, but they will be key in maintaining engagement and enthusiasm among employees. Though many behavior or task changes that will be required for more sustainable operations are minor or are logical extensions of current processes, they are crucial for success. Additionally, some recommendations will have more challenging implications for employees, such as adding to the time required to achieve job tasks. Working with employees to set goals, periodically checking in on progress, and celebrating key milestones and achievements are made possible and meaningful when metrics are tracked.

Where applicable, suggestions for potentially important metrics or strategies will be given with each recommendation, but determining the most meaningful and useful metrics to track will ultimately be an iterative process that PFANS must undertake. Data tracking will need to be very consistent in order for metrics to be truly informative and thus must be as easy as possible. An assessment of the data already successfully tracked within PFANS and the health system is a great place to start. For example, Dignity Health System in California combines its overall waste output with hospital occupancy data to create a waste per adjusted patient day metric that allows them a meaningful way to assess their efforts at waste minimization (Dignity Health System, 2012). Both waste and occupancy trends are already measured by separate groups within the health system making it simply a matter of combining existing datasets. Beyond existing data, PFANS will need to determine what additional trends it will be worth their time and efforts to capture.

Lastly, the waste recommendations outlined below, as well as identification of many of the unique waste challenges facing PFANS, were derived based on an a comprehensive understanding of the full PFANS waste stream. This understanding was garnered as a result of the August 22 Waste Sort in which we sorted and quantified every item of trash that left the C&W kitchen. We have found this knowledge to be invaluable in directing reduction strategies and believe that similar such waste sorts should become an essential component of PFANS' yearly calendar. The data derived from annual waste sorts will continue to drive creative approaches to waste reduction as well as provide comprehensive data for tracking progress. More frequent "mini" sorts could also be employed to track progress for specific waste categories.

3.3 ENERGY & WATER

3.3.1 ENERGY

In 2012, the entire UMHS utilized $28 million in utilities including electricity, steam, natural gas and water to operate its facilities. Roughly $10 million of this was attributed to UH and about $5 million to C&W. In the U.S., hospitals are the second highest commercial energy users next to the food and beverage industry. Further, kitchens are generally thought to be three times as energy intensive per square foot than most other spaces. It is estimated that the PFANS kitchens in UH and C&W account for roughly $400,000 of the annual utility expenditures.

The operational budgeting for UMHS, like most large institutions, is designed so that any financial benefits garnered from energy savings will be not be realized by PFANS, but rather by other groups in the health system. However, despite energy reduction not being able to reduce PFANS costs, finding these potential energy savings in the hospital's kitchens is an important component in placing PFANS as a leader in sustainable patient food service.

To identify opportunities for reductions in energy consumption, we engaged Colin Murphy, an Energy Conservation Engineer within UMHS, to conduct an energy use audit of the C&W and UH kitchens. Mr. Murphy assessed the kitchens' heating, ventilation and HVAC variable air volume (VAV) systems and discovered inconsistencies in temperature and exhaust airflows. His findings and their associated savings are summarized below.

3.3.1.1 UH AND C&W VAV CONTROLS

In both kitchens, it was found that simultaneous heating and cooling was resulting in thermostat readings between 60 to 100 degrees Fahrenheit, indicating that the VAV system was expending excess energy to reach its desired 70-74 degree kitchen temperature range. As with simpler systems such as in a home, thermostats in the kitchens are set to a desired temperature and monitor the surrounding air to determine if heating or cooling is needed. However, in large spaces such as the kitchens that have multiple air diffusers and thermostats, regional temperature readings are rarely good indicators of the overall room temperature, particularly if thermostats and diffusers are responding to each other. For example, a regional thermostat indicating a lower than desired local temperature will initiate its accompanying heating system even if the overall room temperature is adequate, which might then cause a nearby fan to commence its cooling system to account for the hot air it then senses. Such a chain of unnecessary airflow processes results in excess energy consumption.

To decrease this inefficiency the user adjustment point on each kitchen thermostat was disabled to avoid conflicting system signals such as one person turning up one thermostat when they felt cold while at the other end of the kitchen, the thermostat was turned down. Instead, all kitchen VAV controls are now internally set to maintain a temperature control range of 70-74 degrees. This limited and nonadjustable range minimizes the likelihood of disparate airflows among neighboring VAV units. As indicated, these changes have already been made and are saving roughly 2,066 MLbs of steam annually, a financial savings of $30,000 per year. Increasing

the energy efficiency of this system also avoids 139 metric tonnes (MT) of CO_2e (carbon dioxide equivalents) annually.

3.3.1.2 C&W EXHAUST FAN AIRFLOW CONTROL

Due to the smoke and cooking fumes produced during food preparation, the kitchens generally exhaust more air outside the ventilation system than other areas in the hospital. In order to maintain a comfortable air pressure, inflows and outflows of air must be equal, thus, the vacuum left by the exhausted air must be replenished by fresh air pulled in from outside the system. Elsewhere in the hospital, more air is allowed to recirculate, resulting in less air being pulled in. This is a more efficient use of energy in that outside air must be conditioned (either heated or cooled) before being circulated, while recirculating air is generally closer to the desired temperature and requires less conditioning energy.

To maintain the pressure balance and accommodate the exhausted air in the kitchens, the system is set to pull in a certain amount of outside air. In C&W, 10,000 cubic feet per minute (CFM) of air is circulated into the building while the kitchen exhausts 3,000 CFM. The system is thus set to re-circulate 7,000 CFM while pulling in 3,000 CFM of outside air to supplement exhausted air. C&W kitchen closes at night, however, and exhaust fans are turned off, but the ventilation system continues to recirculate only 7,000 CFM while pulling in and conditioning 3,000 CFM of outside air. Thus, during the night, excess energy is being used to heat the night air.

To correct this inefficiency, Mr. Murphy adjusted the timing of the automatic ventilation system controls such that at night when the kitchen is closed and exhaust fans are turned off, the system no longer pulls in a full 3,000 CFM of outside air but rather recirculates most of the 10,000 CFM currently being circulated. This adjustment will save the health system $2,400 and 10,000 kWh per year. This energy savings also eliminates over 13 MT of CO_2e annually.

3.3.1.3 BEHAVIOR-BASED OPPORTUNITIES TO REDUCE ENERGY USE

In the future, energy savings can be garnered through actions such as turning off lights when a space is not in use or turning off equipment when it is idle. Many such changes would be a natural result of employee engagement efforts such as regular sustainability training and open lines of communication (see **Section 4** of this report). For example, through an employee focus group it was revealed that energy usage could be reduced by adjusting to freezer traffic processes to limit the number of times a freezer is opened during operating hours. The high-powered freezers in each kitchen consume a lot of energy to keep temperatures as low as food codes require. The large differential between freezer and room temperatures means that a sizeable amount of warm air enters every time the freezer is opened, requiring even more energy to bring the overall temperature back down. Analysis of traffic flow in and out of freezers can assist in developing more efficient retrieval and in-kitchen storage plans for freezer items. This example is one that would be very difficult for anyone not working “on the ground” in the kitchen every day to discern and required engaging PFANS employees to identify it. This demonstrates the great value of having employees who are engaged around the issues of sustainability.

3.3.2 WATER

In 2012, UMHS spent $2.6 million on water and sewer services for the entire health system. Despite the impression given by this large water bill, the per unit price of water is artificially low creating little incentive for investments in water conservation. Future projections on water availability, however, are not optimistic and simple economics tells us that as the supply of water goes down, its price will rise. Though Michigan and the greater Midwest are traditionally not thought of as water stressed areas, a 2010 study released by the Natural Resources Defense Council indicates that Washtenaw and five other Michigan counties will have a 'High' risk of water shortages due to the effects of climate change by mid-century. Many more Michigan counties will face a 'Moderate' risk of water shortage (Tetra Tech, 2010).

These projections indicate both that water will be less available to the health system in the future and that UMHS will be paying more for it. As with energy, the PFANS budget does not pay for water, and the current, artificially low price of water makes it difficult to make the business case for the health system to invest in water conservation initiatives. However, the future realities of healthcare delivery should encourage PFANS and the health system to begin addressing water efficiency and conservation sooner rather than later.

Specific to PFANS, the most significant opportunity for water savings in the future will be replacing the commercial dishwasher in UH with a newer, more efficient model. This will require a large capital expenditure, however, that would likely not be approved until the current Hobart washer reaches the end of its useful life. Additionally, the pulper used in UH to decrease the volume of tray waste uses a large volume of water as well as the garbage disposals used to dispose of food waste in C&W. However, both the pulper and the garbage disposals could be made nearly obsolete if PFANS implements recommendations for diverting food and plastic waste outlined in **Section 3.5** of this report. These waste specific recommendations thus have the indirect benefits of reducing both water and energy use by reducing PFANS use of its pulper and garbage disposal equipment.

3.3.2.1 BEHAVIOR-BASED OPPORTUNITIES TO REDUCE WATER USE

As with energy, many opportunities for reducing water used in the kitchens will be employee behavior-based such as being mindful of turning off the taps and minimizing how much water is used for a given task. These behaviors can be encouraged through simple means such as attaching timers to water faucets to remind employees of how much water is being used or to install foot pedals that must be pressed in order for water to flow in the kitchen ware wash area.

Some opportunities might also be available via process changes. The water chill process, for example, uses large volumes of water and could be a potential area of investigation to determine what opportunities are available for saving water during water chill. Again, it will most likely be employees who are "on the ground" and engaged with the sustainability mindset and goals that will identify these opportunities for savings.

Though exploring water usage and savings opportunities in depth ultimately fell outside the scope of this project, the use of this resource is an important area for PFANS to address, in the next phase of sustainability initiatives following the implementation of the 'first step' recommendations outlined in this report.

3.4 PROCUREMENT

The University of Michigan Health System is an active participant in a growing national and regional effort to improve the quality of the food it provides to patients, employees and visitors. The following sections provide a contextual understanding of this movement and the role UMHS currently plays as well as recommendations for contributing to the expansion of sustainable food sourcing.

3.4.1 UM SUSTAINABLE FOOD PURCHASING GOALS

The University of Michigan has committed to purchasing 20% sustainable food by 2015. In January of 2013, the Office of Campus Sustainability released its sustainable food purchasing guidelines, which define the University's expectations and allowances for this food goal (Office of Campus Sustainability, 2012). In order to qualify as "sustainable food," purchases must meet least one of the following specifications:

- **Local:** Grown/Processed in Michigan or within 250 miles of Ann Arbor campus. For processed foods, at least 50% of the ingredients (by annual $ expenditures) must be sourced from within 250 miles of the processing facility.
- **Third Party Certified** (by one of these approved certifying programs):
    - USDA Certified Organic (U.S. DOA, 2013)
    - Food Alliance Certified Sustainable (Food Alliance)
    - Protected Harvest Certified (Protected Harvest)
    - Certified Humane Raised and Handled (Certified Humane Raised and Handled)
    - Marine Stewardship Council (MSC) Certified (Marine Stewardship Council)
    - Fair Trade Certified (Fair Trade USA)
    - Rainforest Alliance Certified (Rainforest Alliance)
    - Smithsonian Migratory Bird Center (SMBC) or "Bird Friendly" (Migratory Bird Center)
- Artificial hormone free and antibiotic free
- Free-range poultry and eggs
- Grass fed or pasture raised meats
- Sustainable fisheries

In order to achieve this progressive 20% target by 2015, UM will require significant participation from the UMHS food production facilities, including PFANS' two kitchens at UH and C&W.

One particular challenge in UM achieving its food purchasing goals will be that despite delineating such specific food purchasing guidelines with an aggressive 2015 achievement date, UM does not currently require its suppliers to participate in this program.

3.4.2 UMHS PROCUREMENT INITIATIVES AND ACTION

As of December 2012, UMHS purchased 90 items from Michigan sources (Eleby, 2012). When seasonally available, PFANS chefs work to incorporate fresh produce into their menus. UMHS Senior Buyer Randy Burns is an important advocate for enhancing the availability of local and sustainable food ingredients throughout the

UMHS system. Mr. Burns participates in farmer development workshops and farm tours, manages a close relationship with key suppliers and regularly attends Michigan food vendor conferences to source new products for the hospital system. For example, Mr. Burns has been working with Goetz Farm, a popular Ann Arbor farmer's market vendor, to assist the farm in its certification efforts. Once Goetz Farm is properly certified according to the standards required by UMHS, the farm can begin supplying its products to UMHS.

Sysco Detroit supplies a significant portion of the food in the PFANS kitchen. UMHS and Sysco maintain a strong buyer-supplier relationship and many key strategic sourcing decisions are the results of mutual collaboration with Sysco. Sysco Detroit has committed to increasing UMHS' local food assortment and works closely with Michigan vendors to identify new opportunities for incorporating Michigan products into UMHHS kitchens. UMHS must maintain its productive relationship with Sysco Detroit to achieve its portion of the University's aggressive 20% sustainable food goals.

Another important element of UMHS Food Procurement strategy to date has been use of Health Care Without Harm's Healthier Hospitals Initiative as a resource. Health Care Without Harm (HCWH), a coalition of member organizations pursuing reductions in the environmental impacts of health providers internationally, created the Healthier Hospitals Initiative (HHI) "as a guide for hospitals to reduce energy and waste, choose safer and less toxic products, and purchase and serve healthier foods" (Healthier Hospitals Initiative, 2012). Viewed as a model for sustainability improvements in health systems nationwide, HHI serves as a regularly cited resource and criteria-setting guiding post for the UMHS Sustainable Steering Committee. This enables goal and incentive alignment between the recognized HHI program and that of the UMHS, as seen most prominently in HHI's healthy food program.

3.4.3 SUSTAINABLE FOOD PROCUREMENT CHALLENGES

While the procurement team at UMHS has made commendable commitments to improving its products, the hospital faces significant hurdles to achieving the UM sourcing goals. In our interviews with Mr. Burns, we identified three primary challenges to incorporating additional sustainable food into UMHS kitchens:

3.4.3.1 VOLUME AND COMPETITIVE PRICING

One challenge preventing UMHS from sourcing more food from local vendors is one of capacity: small producers do not grow at the scale required to satisfy UMHS' requirements. Local food development programs must enable these farms to produce at the requisite volume to meet institutional demand. In addition, sustainably farmed and locally-grown produce are almost exclusively more costly than their traditional counterparts, posing a formidable challenge to buyers who are restricted by limited and often fixed priced budget constraints.

3.4.3.2 CERTIFICATIONS

Small farmers frequently cite difficulties meeting certification requirements and competitive costs mandated by many institutional vendors. At UMHS, all food products must be certified due to strict hospital health and safety restrictions. The UMHS procurement team actively engages local area farmers to support their certification process, hosting educational sessions for producers at the hospital and conducting field trips to area farms to

build connections and address production and certification concerns. Such proactive, community-driven and ongoing support is commendable and indicative of UMHS' authentic commitment to sustainable sourcing, and will be crucial to success going forward. However, producer resource constraints and burdensome certification requirements remain significant barriers to many area farmers.

3.4.3.3 PATIENT FOOD CONSISTENCY REQUIREMENTS

PFANS' meals are bound by strict diet requirements that satisfy specific nutrition and caloric needs of each patient served. Because each menu has been calculated to exact dietary specifications, absolute consistency is required between identically composed meals. A centralized electronic system hosts all patient diet options and calculates the nutritional information of each based upon pre-specified nutrition specifics for every ingredient utilized. For example, if the system knows the exact calorie, fat and sodium content of a particular slice of wheat bread used in the C&W kitchen, it can account for that slice of bread in the overall nutrition calculation for any meal utilizing that type of wheat bread.

What this means for PFANS, however, is that every slice of bread used in the C&W kitchen must be the exact size and composition as that used for the system's original wheat bread slice calculations. Slices of bread cannot vary within or between loaves because patient treatment includes very specific nutrition requirements that must be met. This bodes particularly challenging to the sourcing of non-processed foods, particularly fresh produce, which must also fulfill the strict quality and consistency expectations for patient food ingredients.

3.4.3.4 ADDITIONAL CONCERNS

The following additional challenges prevent UMHS from sourcing more sustainable and/or local food at this time:

3.4.3.4.1 SEASONALITY

Michigan's seasonal produce availability, limited by Michigan's short growing season, presents an additional challenge to meeting an increased local food supply as mandated by the UM sustainable procurement goal. When seasonal fruit options are available, PFANS chefs initiate menu substitutions to best utilize the produce; however, an entirely seasonal menu cannot accommodate strict patient dietary requirements. Additionally, the heightened costs of local produce are currently only affordable given its limited seasonal supply; during the off-season, UHS offsets its high seasonal costs by sourcing much cheaper supply from non-Michigan growers.

3.4.3.4.2 EDUCATION

Additional education is needed to bridge a knowledge gap between institutional demand and the production capacity of suppliers and producers. Institutional vendors frequently cite the need to educate small-scale producers and potential new vendors about their institutional needs, requirements, financial constraints, and a number of other topic areas before contracting conversations can even begin to take place. This education process requires extensive time and resources from both parties and is a significant barrier for many buyers when they commence the local food sourcing process.

Intermediaries between producers and buyers are often forced to absorb this educational process and cite it as a major challenge in their own efforts to increase local product capacity. An Iowa study focused on capacity building between small food businesses and large-scale distributor Sysco cited the "lack of understanding of customer's needs" as the top challenge for Sysco representatives working with small-to-midsize food businesses (Ennis, 2006). Significant communication, training and knowledge sharing must take place so that all links in the food value chain are aligned in a common understanding of each partner's needs, capabilities and constraints.

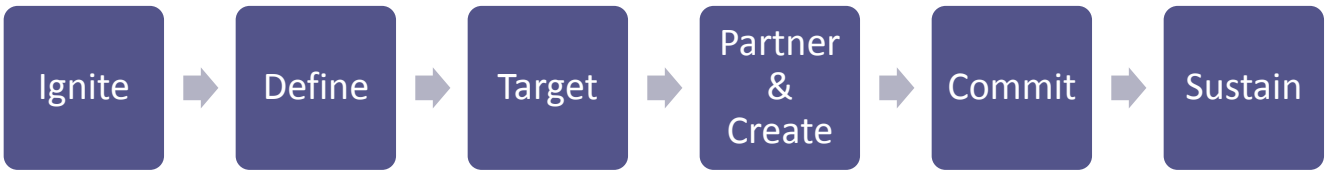
3.4.3.4.3 SUPPLY CHAIN & INFRASTRUCTURE

Lastly, the fragmented food system infrastructure and inefficient supply chains pose additional barriers to creating a scalable regional food network. Increasing interest in the local food movement has prompted the creation of digital connectivity networks to link suppliers with potential buyers but significant work must be done to facilitate the distribution process. Storage requirements, quick expiration and spoilage timelines and wide product variety further complicate the food supply chain. In order for regional food networks to grow and sustain, infrastructure must transform so that it supports small producers, who provide fragile food products from disparate locations that require almost immediate delivery to their end user.

3.4.4 STEPS TO ACHIEVE SUSTAINABLE FOOD SOURCING GOALS

UMHS has already initiated or completed the initial steps required to grow its local and sustainable food sourcing. The following goal-setting framework provides a model by which UMHS can further drive its sustainable procurement program. The foundational support for this recommendation is the idea that sustainability initiatives are best attained through collaborative goal-setting partnerships between buyers and suppliers.

Figure 3: Goal-Setting for Sustainable Procurement



3.4.4.1 IGNITE: IDENTIFY AN ADVOCATE WITHIN THE INSTITUTION WHO STARTS THE CONVERSATION

Randy Burns is a critical asset to the UMHS organization and has demonstrated his commitment to responsible sourcing by constantly reevaluating his product mix and looking for alternative sources. Mr. Burns actively participates in sustainability initiatives within UMHS and externally, and his personal dedication to the cause has directly resulted in the presence of local and sustainable food on patient menus.

Leadership by PFANS head chefs have also facilitated sustainable food procurement success in the PFANS kitchens. Active communication between the chefs and the procurement specialists has enabled information sharing, idea-generation and project planning that lead to regular menu reviews and sustainability changes.

Active sustainability participants like Mr. Burns and the kitchen head chefs are critical advocates for the UMHS sustainable food mission. Leveraging their enthusiasm, experience and involvement in all sustainable food goal-setting discussions is crucial to assure program success.

3.4.4.2 DEFINE: CONDUCT BASELINE ANALYSIS

Defining a sustainable food procurement strategy first requires an understanding of current state operations. UMHS has engaged the Graham Institute and its suppliers to conduct a baseline analysis of its current food supply composition. This assessment is critical so that UMHS can 1) evaluate its current product mix and identify particular areas of improvement and 2) create a strategic and operational roadmap toward UM's 2020 sustainable sourcing goals.

Setting a baseline also alerts suppliers to an institution's new sustainable sourcing priorities and starts the process of establishing new expectations for vendor products. Baseline data can be used as a tool to evaluate, engage and incentivize UMHS suppliers. Requiring suppliers to report the composition of their product mix by sustainability criteria alerts suppliers to a potential shift in UMHS priorities, signaling that this initial request for baseline data will later be followed by expectations of improvement. This indication of interest from a major buyer, followed by the data collection process the supplier must initiate in order to respond to the baseline request, launches the supplier into the sustainability space, facilitating education through product analysis and engagement through participation. Having a baseline promotes idea generation and personal commitment to improvement, so stakeholders who actively participate in this process will be important resources during the goal-setting period.

3.4.4.3 TARGET: IDENTIFY IMPROVEMENT OPPORTUNITIES AND BEGIN INVESTIGATION

Data gathered through the Define process should identify gaps or potential areas of improvement in the UMHS food supply. During the Target phase, UMHS use this baseline information to help target a particular area of improvement for additional exploration, utilizing whatever criteria deemed appropriate given the current financial, operational or political landscapes. Targeting simply provides UMHS with a certain level of initial focus and direction to guide its sustainability investigation, avoiding resource dispersion among the myriad possible improvement opportunities.

Once UMHS selects a topic area to investigate, the procurement and PFANS teams must initiate a more detailed analysis of that food category or product type. For instance, if we discover through the baseline process that a significant percentage of PFANS' dairy products are sourced from beyond the 250-mile 'local' radius and we suspect that we can perhaps reduce that percentage, we might decide to initiate a 'dairy focus project' to begin evaluating the feasibility of changing that supply mix. Targeting can be done by any type of categorization, from food category to sustainability topic ('carbon intensity' or 'humanely processed,' for example) to any other

thematic mix. The key here is to define a focus area so that UMHS can quickly move to the next step and engage its partners in the more data-intensive goal-setting process.

3.4.4.4 PARTNER & CREATE: UTILIZE VENDORS TO DETERMINE SUSTAINABILITY GOALS

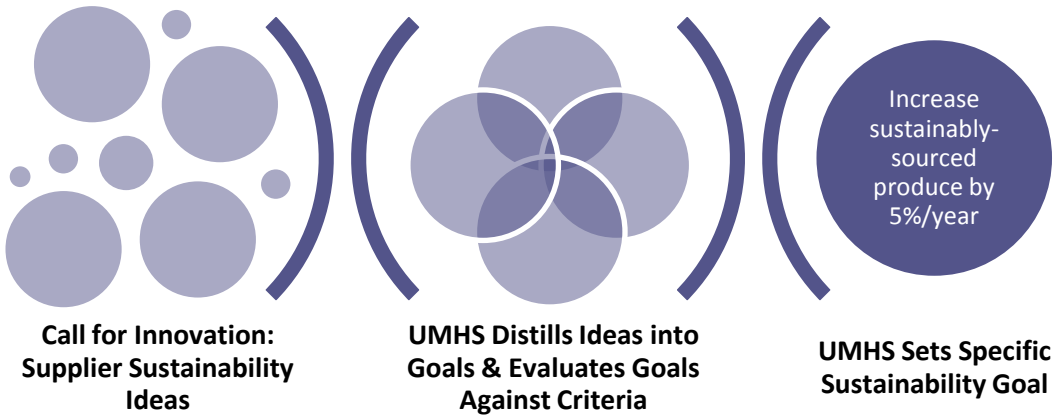
Institutions must leverage their purchasing power to prompt each of their vendors to create and commit to sustainable sourcing improvement goals. Setting actual targets holds suppliers to their stated commitments and gives buyers the opportunity to select and award vendors based upon sustainability criteria. However, goal setting must be a collaborative and iterative process between supplier and buyer in order to maximize effectiveness. Relationships are crucial in this space and any implementation plan must incorporate regular, established communications plans to ensure that partnerships are solidified and effective.

3.4.4.5 SOLICIT VENDOR IDEAS WITH A CALL FOR INNOVATION

In what can be seen as a creative spin on the formal Request for Information (RFI) process, a Call for Innovation asks vendors to submit product innovation ideas based on their capabilities, capacity and business priorities. The goal of an initial Call for Innovation is to solicit new sourcing ideas at all levels of scale, impact and feasibility; request should frame the exercise so that unhampered creativity is encouraged and expected. Calls for Innovation provide the buyer with two important pieces of information: 1) indication of supplier commitment, interest and enthusiasm around sustainable sourcing initiatives and 2) a set of new product improvement ideas to explore.

Once armed with this information a buyer can move to the next step in sustainable product improvement: turning open-ended ideas into actionable goals. As indicated in the diagram below, UMHS must take the ideas submitted by vendors and distill them into specific, actionable sustainability goals.

Figure 4: Sustainability Goal Setting



Each buyer utilizes a different set of criteria to evaluate its goals and UHMS should establish its own prioritized criteria. Examples of potential filters include cost, sustainability impact and feasibility.

3.4.4.6 COMMIT: SET AND IMPLEMENT SUSTAINABILITY GOALS

After the proposal, vetting, and selection process, UMHS and its vendors must formalize their commitments to these new sustainability projects. Making such commitments as public as possible is a simple and effective incentive methodology and further highlights UMHS as a leader in the sustainability space.

3.4.4.6.1 RECOMMENDATION: INSERT SUSTAINABLE PURCHASING REQUIREMENTS INTO ALL FORTHCOMING VENDOR AGREEMENTS

While UM has committed to taking a vendor's ability to meet sustainable purchasing goals into "significant consideration in awarding contracts," these metrics are not currently mandated for UM vendors. Because these guidelines were only recently written and released to its vendors, the non-binding consideration allows UM vendors to build capacity and adjust practices to accommodate the university's sustainability expectations. However, because the UMHS procurement team has already been so active in the local and environmentally responsible arena, the hospital can accelerate pressure on its vendors to supply better products by incorporating sustainability language into all existing and future contractual agreements.

We recommend that UMHS procurement team set sustainable sourcing targets for each of its vendors. These targets should be progressive yet attainable, and thus should be crafted with iterative sub-targets and a set of actions required to meet each stepwise goal. Contract negotiation periods are a potential juncture at which UMHS can incorporate sustainability targets or requirements into its vendor contracts (Kulick M., 2005).

3.4.4.6.2 RECOMMENDATION: COMMIT TO HHI HEALTHIER FOOD CHALLENGE

Nested within the greater Healthier Hospitals Initiative is a series of Challenges in which health systems participate by signing a membership pledge. One such commitment is the Healthier Food Challenge, which in turn contains three topical subsets: Balanced Menus, Healthy Beverages and Local/Sustainable Food. This third guideline promotes increasing the percentage of environmentally and socially responsible food in health care cafeterias and patient food services (for more detail, see **Exhibit 7**).

By developing its food purchasing targets and definitions to align so closely with those of the leading health care organization in the sustainability space, UM has publically demonstrated its active awareness of and participation in a nationally relevant sustainable sourcing movement. Yet, despite these goal similarities, UMHS has not signed the Healthier Hospitals Initiative and thus remains unrecognized on the HCWH platform for its commitments. When questioned about UMHS' absence from the list of Initiative member pledgees in August 2012, Mr. Burns cited the hospital's reluctance to adopt such targets until it better understood its current composition of local and sustainable food. (Burns, 2012). At the time of writing, this baseline assessment was still underway and thus remains a barrier to HHI membership.

We recommend that UMHS prioritize joining HCWH as an official Initiative pledge. First, the program's national recognition within the health care sector will spotlight UMHS for its existing sustainability efforts and make UMHS eligible for its yearly leadership awards. Secondly, a benefit of pledge membership includes program implementation assistance from local HCWH offices (Bisnett, 2012).

3.4.4.7 SUSTAIN: CREATE INTERNAL ROADMAP TO PROGRESS

An ongoing procurement initiative cannot be sustained without some type of regular accountability. The UMHS Procurement team should create an internal roadmap to gauge progress and track internal actions and challenges. A successful ongoing sustainable procurement planning roadmap will be progressive yet iterative and revisable to account for changing priorities over time. In addition, any internal framework must include specific accountability processes to keep the program on track to achieve its goals. One particular methodology that has proven successful for tracking supplier progress is a sustainability scorecard.

3.4.4.7.1 RECOMMENDATION: CREATE SUSTAINABILITY SCORECARD TO RATE AND ENGAGE VENDORS

Scorecard methodologies are an effective and simple way to prompt supplier participation in desired improvement initiatives. Using the baseline product composition data to rate and compare suppliers by their current percentage share of UMHS' sustainable products, UMHS can "score" each vendor and set expectations for scorecard improvement before the next iteration is completed. Recognizing suppliers for progressive sourcing achievements provides incentives to encourage participation and innovation in identifying and adapting new projects.

3.4.5 SUSTAINABLE PROCUREMENT SUCCESSES IN OTHER SYSTEMS

Benchmarking has provided insight into the range of projects and actions taking place across the sustainable procurement field. We highlight the following examples as potential resources for PFANS to explore further.

3.4.5.1 SUSTAINABLE FOOD SERVICE GOALS: DIGNITY HEALTH

Dignity Health, a San Francisco-based healthcare system comprised of 40 facilities in California, Arizona, and Nevada, requires its Food and Nutrition Services managers to set annual sustainability performance goals and targets (Health, FY 2012 Social Responsibility Report, 2013). This initiative, in effect since FY 2008, is dictated by the Dignity Health Food and Nutrition Services Vision Statement:

> "Dignity Health recognizes that food production and distribution systems have wide ranging impacts on the quality of ecosystems and their communities, and so Dignity Health recognizes that healthy food is defined not only by nutritional quality, but equally by a food system which is economically viable, environmentally sustainable and which supports human dignity and justice, and so; Dignity Health aspires to develop a healthy food system." (Health, Sustaining our Healing Ministry: FY 2011 Social Responsibilty Report)

This clearly defined and publicized vision statement publicly positions the Dignity Health patient food services team as actively committed to and accountable for environmental improvement. A vision statement aligns all of the hospital's programs and initiatives related to improving its food operations under one common purpose. As UMHS expands its commitment to aligning healthcare with sustainability, it would prove beneficial to craft and publicize its own vision statement to guide this process.

3.4.5.2 IMPORTANCE OF PARTNERSHIPS: 2008 NATIONAL GOOD FOOD NETWORK / SYSCO CORPORATION PILOT PROJECT

In "Success For Family Farms," Sysco teamed with the National Good Food Network, a food information hub established by Michigan's Wallace Center at Winrock International, to conduct pilot projects that would help Sysco meet customer's increasing demand for local, value-based food products (Cantrell, 2010). Sysco engaged two regional sites, Sysco Grand Rapids and Sysco Kansas City, in a two-year initiative to increase what it called "Good Food," focusing primarily on local and sustainable produce.

Results of this successful pilot project indicate that collaborative partnerships among farmers, food distributors (like Sysco), and institutional customers (like UMHS) are key to strengthening the availability and procurement of local and sustainable food. Sysco Grand Rapids served as important mediator between customer requirements and source availability, working to identify collaborative solutions to accommodate quality, consistency and volume needs on both ends.

3.5 WASTE

Addressing waste management issues proved to be one of the biggest challenges for PFANS and aligned well with their transition to room service style food delivery that resulted in sizable reductions in food waste. Thus, most of our time and resources were allocated towards investigation of PFANS' waste. A summary of our waste findings can be seen in **Exhibit 8**.

Two waste management strategies, source reduction and diversion from landfill, play a key role in our waste recommendations to PFANS. Source reduction is a strategy in which waste generation is avoided through more efficient use of materials or ceasing the use of a wasteful product. The elimination of paper tray liners from UH described in the sidebar is an example of source reduction of paper trash. Diversion from landfill is a strategy in which waste is created but it is disposed of in some way other than in a landfill, such as through recycling.

The popular catchphrase, "Reduce, Reuse, Recycle" includes reference to these two strategies and is actually a prioritized list for landfill reductions. "Reduce," or source reduction, is the most environmentally

GLOSSARY OF TERMS IN WASTE FINDINGS & RECOMMENDATIONS

- *Pre-patient – food waste that generated in the kitchen that never crosses paths with patients*
- *Post-patient – food waste generated by patients (i.e. uneaten portions of meals)*
- *Diversion from landfill – also just 'diversion', refers to means of managing waste such that less is stored in landfills (i.e. recycling and composting)*
- *Source Reduction – most preferred means of waste management whereby upstream efforts minimize consumption and preclude waste generation*
- *Carbon dioxide equivalent (CO_2e) - a value that represents the sum of all GHG emissions, normalized to CO_2 units*
- *Greenhouse gas (GHG) – one of five gases that contribute to the 'greenhouse' effect that traps heat within Earth's atmosphere*
- *Tip fee – fee charged for disposing of waste at a specific site such as a landfill or composting facility*
- *Digestate – material left after the anaerobic digestion of a feedstock*
- *Pre-consumer – As defined by the City of Ann Arbor, food that has not been cooked or prepared for consumption (e.g. raw apples) excluding meats, bones and dairy.*
- *Post-consumer – As defined by City of Ann Arbor standards, organics that have been cooked in addition to meats, bones, dairy and compostable products.*
- *Windrow composting – composting process in which waste is staged in piles outdoors and natural decomposition is assisted through the "turning" of piles*

preferable way to avoid landfill waste because it also avoids the upstream, lifecycle impacts incurred by production, manufacturing and transportation of a future piece of waste. "Reuse" reflects the importance of extending the lifetime of a product such that the upstream impacts are made as worthwhile as possible, while "Recycling" extends a product's lifetime but incurs further impacts as a material is transformed into a 'new' product. The latter two are preferable to landfilling all our waste but do not avoid the upstream impacts of consumption the way source reduction does.

Where applicable, we have quantified the benefits of our recommendations from the financial and environmental standpoints. Financial benefits of source reduction are simply the cost savings realized when fewer products are procured. With regard to diversion, financial savings were the result of avoided landfill fees. The UMHS Environmental Services group manages the health system's waste within the following cost structure (only streams applicable to this project are outlined here):

Figure 5: Waste Disposal Cost Structure

Waste Disposal Cost Structure
General waste (destined for landfill) • $200/tip – the general waste compactor gets tipped (emptied) twice daily • $0.01/lb landfill fee – though charged by cubic yard, Environmental Services estimates they pay roughly one cent for every pound of waste they dump at the landfill
Metal waste (recycled) • No cost – because metal scrap is a valuable commodity, the metal hauler is willing to provide the metal compactor and take the material away for free in exchange for keeping any profit accrued from the sale of the scrap
Plastic waste (recycled) • $200/tip – the plastic waste compactor gets tipped once per week • No other fees

In determining waste management savings, the assumption was made that recommendations for PFANS will not divert so much waste from the landfill stream that fewer tips will be necessary (though PFANS stands to divert a significant component of their waste, this is not a huge amount relative to system-wide waste generation). Likewise, though we will recommend increasing plastic recycling efforts, the absolute amount of material added to the system-wide plastic stream will not be enough to warrant more frequent plastic tipping. Thus, savings are entirely based on the amount of material diverted from the landfill – for every 100 pounds of landfill waste avoided $1 is saved by Environmental Services.

Environmental benefits of our recommendations have been quantified based on the amount of greenhouse gas (GHG) emissions that will be avoided for each of our recommendations. Source reduction of materials primarily avoid the 'upstream' carbon dioxide (CO_2) emissions resulting from the energy used to produce and manufacture products, as well as the associated transportation emissions from product distribution. Recycling is generally allocated a portion of those upstream savings, accounting for the fact that through recycling, less primary material must be mined, pumped or otherwise recovered. In addition to recycling, our recommendations consider alternative disposal options for organic (food) waste, which will avoid sizable emissions of methane (CH_4), a GHG emitted when food waste decomposes under landfill conditions. In the

atmosphere, methane is 25 times more potent than CO_2 as a driver of the greenhouse effect that fuels climate change. In order to capture this savings in CH_4 emissions, we have used the unit of carbon dioxide equivalents (CO_2e), which represents the sum of GHG emissions normalized to CO_2 units.[2]

3.5.1 PLASTIC WASTE

Plastics are a ubiquitous part of modern life and while they have proven to be infinitely useful and often very cost-effective, they can pose a threat to both human health and the environment, especially after disposal. (Thompson, Moore, vom Saal, & Swan, 2009) Use of hormone altering chemicals in plastic production has been identified as a risk to human health and toxic plastic debris is often ingested by wildlife. Plastics account for roughly 10% of the U.S. waste stream but only about 6% of discarded plastic is recycled. (Barnes, Galgani, Thompson, & Barlaz, 2009) The rest ends up in landfills or as waste debris, which finds its way all over the world. The lifespan of plastic materials is estimated to be hundreds or even thousands of years, making the environmental effects of plastic debris a particularly long-term problem. (Barnes, Galgani, Thompson, & Barlaz, 2009)

Lastly, the manufacture and use of plastic materials is particularly unsustainable. About 8% of the world's oil and gas production is used to manufacture virgin plastics, though most plastic products are for disposable packaging or other short-lived products (Hopewell, Dvorak, & Kosior, 2009). The rapid disposal of plastics, paired with the material's longevity results in net accumulation of plastic debris in landfills and natural habitats. It is unlikely that plastic production will end any time soon, but the way in which they are disposed of can limit some of the health and environmental impacts of plastics. As Hopewell et al. state, "recycling is one of the most important actions currently available to reduce these impacts [of plastics] and provides opportunities to reduce oil usage, carbon dioxide emissions and the quantities of waste requiring disposal" (Hopewell, Dvorak, & Kosior, 2009).

Documentation for the U.S. Environmental Protection Agency's (EPA) Waste Reduction Model (WARM) outlines life-cycle GHG emission factors for a variety of materials in the solid waste stream that will be used in this analysis to discuss both plastic and metal waste. As noted above, plastic material is extremely long-lived no matter where it is disposed of, thus most GHG emissions from plastics are due to production and manufacturing processes.

SOURCE REDUCTION OF PAPER TRAY LINERS IN UH

C&W waste sort data indicated that paper trash, i.e. paper that cannot be recycled, comprised 16% of the entire waste stream. Of the paper trash, over 75% was paper tray liners.

The good news? PFANS is currently phasing in the room service style of meal delivery in UH with new, skid-less trays that do not require paper tray liners!

PFANS' move to eliminate paper tray liners from their UH operations, and eventually C&W as well, represents a major "win" towards sustainably managing their waste.

[2] For example, emissions of one unit of CO_2 and one unit of CH_4 would be reported as 26 units of CO_2e.

As such, the greatest gains to be made in emissions reduction are in source reduction wherein the material is not used in the first place. As discussed above, plastic recycling is also a key component of reducing the environmental impacts of such a pervasive material. Recommendations in this section focus on reduction of PFANS' impacts from plastics use through both source reduction and recycling efforts.

3.5.1.1 PLASTICS FINDINGS

Data from the August 22 Waste Sort reveals that over 19 pounds of plastic waste was generated that day, accounting for 13% of the total waste stream. Given an estimated yearly waste total of 335,818 pounds, an estimated 43,100 pounds of plastic waste is produced each year throughout PFANS' operations. The primary components of the plastic waste included Styrofoam, food lids, straws, gloves, packaging materials and bulky plastics and bottles.

Styrofoam: Roughly, 0.7% of the total waste was Styrofoam, resulting in an estimated 2,314 pounds of waste each year. Most of this waste is from cups that are provided by Material Services for employee use.

Food Lids: Roughly 2% of the total waste was food lids, resulting in an estimated 6,463 pounds of lids discarded each year. These lids are used to cover food items on trays such as desserts, fruit cups, etc.

Straws: Straws were not weighed individually but as part of the "Plastic Trash" waste. We did notice, however, that many straws in the waste stream were still in their paper wrappers and had not been used, so straws were counted according to "used" and "unused" classifications. Data suggests that two-thirds of straws that are part of patient tray assemblies come back to the kitchen unused.

Gloves: We counted roughly 560 discarded gloves that accounted for roughly 5 pounds of waste. This results in an estimated 312,534 pairs of gloves discarded annually by PFANS' staff.

Packaging Materials: Plastic packaging materials included items such as films and pouches used both in the transport of food orders (i.e. from the supplier to the hospital) and in the storage of food items such as sauces and soups. Since these plastics are not recyclable, they were included in the "Plastic Trash" waste category.

Bulky Plastics and Bottles: Roughly, 0.8% of the total waste was bulky plastics and bottles. Included in this category are soda bottles, large juice

PLASTIC STRAWS HIGHLIGHT THE CHALLENGES OF THE HEALTHCARE CONTEXT

Data collected during the August 22 waste sort suggests that two-thirds of drink straws delivered to patients on meal trays remain unused, an estimated 373,879 straws per year. At a rate of $2.50 per box of 500 straws, this waste has a financial cost of $1,870 per year. Since straws are not a recyclable plastic product, this waste cannot be diverted in an effort to reduce the environmental impact it causes.

Though there is some environmental and financial incentive to reduce straw waste, this issue highlights one of the challenges of making sustainable changes in the health care context. Adopting a 'no straw' default is infeasible and potentially compromises the quality of patient care in requiring that patients remember to ask for straws.

Is there a feasible way to meet both the objectives of exceptional patient care and sustainable food service when it comes to straws?

containers and other large plastic containers. We estimate roughly 2,567 pounds of bulky plastic waste annually. Though a small percentage of the waste stream, these items can be recycled.

3.5.1.2 RECOMMENDATION: ELIMINATE THE USE OF STYROFOAM CUPS IN PFANS' KITCHENS

As noted above, Styrofoam waste in the kitchens is primarily from employee beverage containers supplied by the Material Services division of UMHS.[3] Though the negative environmental impacts of Styrofoam are widely recognized, the low cost per unit relative to other beverage container options makes easy procurement of a more environmentally friendly alternative unlikely. Thus, implementation of this recommendation in the current context would most likely mean disposable beverage containers would not be made available to PFANS staff.

3.5.1.2.1 STYROFOAM FINANCIAL ANALYSIS

The Styrofoam beverage containers are supplied by Material Services, thus PFANS would not experience any financial savings by implementing this recommendation. Based on the estimated annual data cited above, Material Services would save roughly $1,386 (assuming a purchase price of about 2 cents per cup). Additionally, roughly a ton of material would not need to be landfilled, saving Environmental Services $24.14 in yearly landfill fees.

3.5.1.2.2 STYROFOAM ENVIRONMENTAL ANALYSIS

Plastic GHG data suggests that source reduction solutions for plastics can result in the avoidance of roughly 2.03 MT of CO_2e per ton of plastic avoided. The beverage cups used by PFANS employees amounts to about 2,314 pounds of Styrofoam waste each year. Complete source reduction of this waste can amount to the avoidance of 2 MT of CO_2e emissions annually.

3.5.1.2.3 CHANGES NEEDED FOR SUCCESSFUL IMPLEMENTATION

It is relatively simple to cease taking delivery of Styrofoam cups from Material Services, but the real challenge in implementation of this recommendation is in developing a new way to support the needs of employees that is more sustainable.

The best alternative to Styrofoam is for employees to use reusable beverage containers any time they are on shift. Behavior change such as this can often be challenging, requiring old habits to be broken and new ones to be formed. PFANS management can help by making these changes as easy as possible for employees, thus lowering the potential barriers to successful change. One such idea is to provide all employees with their own reusable water bottles and to designate an accessible space in the kitchens where these bottles can be kept

[3] A small amount of Styrofoam also enters into PFANS' waste stream both as small cups that pre-packaged ice cream portions are served in as well as when patients or guests send Styrofoam trash back to the kitchen on patient trays. There are currently no cost-effective (i.e. feasible) solutions to the former and PFANS has no control over the latter source. We recognize that Styrofoam will not be 100% eliminated from PFANS' waste stream through this recommendation, but the large majority will be source reduced.

while employees are on their shifts, and even better, where they can be stored when people are off the clock. Creating an environment in which it is just as easy for employees to get a drink in a reusable container as in a Styrofoam cup is an important component of success in this area. **Section 4.5** of this report talks more about this sort of "Take Back the Tap" initiative and the benefits a change like this could have for engaged employees and potential culture changes.

3.5.1.3 RECOMMENDATION: ELIMINATE THE USE OF DISPOSABLE PLASTIC LIDS TO COVER FOOD ON PATIENT TRAYS

3.5.1.3.1 LIDS FINDINGS

One element of current PFANS operations is the use of disposable plastic lids to cover food items on patient trays such as fruit cups, desserts and salads. These lids are in addition to the large reusable covers that are placed over main dish plates and are commonly found in most room service type operations. An estimated 6,463 pounds worth of plastic lids are discarded every year due to this practice, accounting for 15% of all plastic waste generated by PFANS. The ideal approach to implementing this recommendation is total material source reduction in which no food lids are utilized except for on trays delivered to immunocompromised patients. In these cases, reusable lids can be used.

Lids are generally used for protecting patient food from possible contamination, an important consideration in the healthcare context in which many patients will be very susceptible to infectious agents. There is little data, however, indicating that lids beyond the typical plate covers are effective in reducing food contamination. PFANS' Standard Operating Procedures for Food Service handbook outlines the primary rules and procedures for food production, storage and delivery that all employees are trained to follow. These standards and procedures are based on the U.S. Food and Drug Administration's *Food Code* that provides scientifically based guidelines for food regulation policies (U.S. Department of Health and Human Services, 2009). Nowhere in the most recent update to the FDA *Food Code* or in PFANS' *Standard Operating Procedures for Food Service* is it mandated that foods must be covered during delivery to patients. The PFANS' standards on preventing cross-contamination during storage and preparation require that prepared food be covered during storage, but not individually. This requirement can be met by covering larger batches of a prepared dish (Jell-O, for example) together rather than using individual lids to cover every serving.

FOOD LIDS AT FLETCHER ALLEN

Fletcher Allen Health Care in Burlington, VT is one of the hospitals on the leading edge of healthcare sustainability nationwide. The organization has eliminated the use of lids in its patient tray assemblies, except in the case of coffee and soup.

To cover coffee and soup, Fletcher Allen purchased reusable lids, which were originally piloted for a month. After receiving good feedback, Fletcher Allen made the change permanent and now only utilizes reusable lids in its operations.

Prior to making the switch to reusable lids, Fletcher Allen used and recycled disposable plastic lids. Of all of the adjustments that the food service group made to be more sustainable, switching to reusable lids was a change it made much later on in the process after tackling other issues.

The practice of using lids to cover these food items on patient trays is more a force of habit than a stringent requirement for maintaining food safety. It is the sort of practice that persists in organizations simply because it is what they have always done. This sort of habit can have deep psychological roots and be difficult to break, but exploring the scientific evidence can be a good start to behavior change.

3.5.1.3.2 FINANCIAL ANALYSIS OF COMPLETE SOURCE REDUCTION OF LIDS

In a complete source reduction scenario, financial savings will be realized both by no longer needing to purchase plastic lids as well as the avoidance of waste landfill fees. PFANS will benefit from the first savings, Environmental Services from the latter. PFANS will have the added cost, however, of purchasing reusable lids for immunocompromised patient service.

Based on PFANS procurement data, $12,800 was spent on lids for C&W in 2012. C&W and UH bed complement data (the number of patient beds available hospital-wide) can be used to create a ratio for resource allocation between the two kitchens, and we can project that the UH kitchen will spend roughly $32,000 per year on lids when they have fully transitioned to the room service style delivery system. (I.e. The UH kitchen services 2.5 times as many beds as does the C&W kitchen, thus we can estimate they will spend 2.5 times as much on plastic lids.) Adding these totals together, PFANS can expect to save roughly $44,800 in procurement costs when they no longer purchase lids.

PFANS will have to purchase, however, reusable lids to cover all food on trays for immunocompromised patients. Based on bed complements for each hospital unit, immunocompromised patients (primarily bone-marrow transplant patients) account for roughly 7.57% of adjusted eating patients, or at most roughly 61 patients at a time. Making the assumption that PFANS would need a reusable lid inventory of 2-3 times the possible immunocompromised patient population, roughly 200 reusable lids of each type would need to be purchased. Making specific purchasing recommendations is outside the scope of this study, and as such we can't be sure of the prices PFANS would be offered on reusable lids, but a quick look at the offerings in product catalogs such as Cambro Healthcare suggests the upfront purchase costs for reusable lids would be $540 (Cambro Manufacturing Company, 2013)(More analysis would need to be done to determine if all lids needs could be covered by the reusable options available). Given the current yearly expenditures on plastic lids, this initial purchase could likely be less than what PFANS spends on lids in any given month. For the Cambro options, customers purchase replacement lids for reasons such as discoloration long before lids have reached the end of their functional lives. Customer feedback has indicated the reusable lids generally last at least 18 months before any discoloration is seen.

Environmental Services will save roughly $64.63 in landfill fees annually if all plastic lids are source reduced.

3.5.1.3.3 ENVIRONMENTAL ANALYSIS OF COMPLETE SOURCE REDUCTION OF LIDS

As noted in the discussion of Styrofoam, 2.03 MT of CO_2e emissions are avoided for every ton of material source reduction. In this scenario, in which 6,463 pounds (over 3 tons) of material use could be avoided, 6.6 MT of CO_2e would be avoided annually. A full life-cycle estimate of emissions from the reusable lids is outside the scope of this study, but we can estimate that producing the plastic needed for this many reusable lids would result in

roughly 0.02 MT of CO_2e emitted (PlasticsEurope, 2005). This value is far below what will be avoided when disposable lids are no longer used, making the reusable option the most environmentally preferred.

3.5.1.3.4 CHANGES NEEDED FOR SUCCESSFUL IMPLEMENTATION

The changes needed to implement this policy will largely rely on employee behavior change. In this scenario, reusable lids will still be available for a small percentage of the patient population, which can make it more challenging to change habits. Communication with employees and some retraining will be a necessary component of implementation.

This is not the sort of procedural change that can be made without explanation. Rather, employees need to understand why this change is being made. Because the practice of using lids has been so widespread, many might have strong feelings concerning whether tray items are covered or not. The reasons supporting such a change, including a lack of scientific evidence regarding the effectiveness of lids and the environmental and financial savings that can be realized by discontinuing their use, should be communicated to employees. Because this is a change that some employees are likely to have strong initial opinions about, implementation of this new procedure may take longer than expected and require continual communication and reinforcement.

Special consideration will also need to be put into how employees are trained to work within this new procedural framework. While most trays will no longer necessitate items with lids, those prepared for immunocompromised patients will still require covered items. Employees working on the tray assembly line need training to look for indicators when a tray does require covered items. For example, indicators could include a special notation on patient order tickets or a clear delineation of the destination Unit (assuming employees are trained to know which Units have susceptible patients).

If it is determined that food portions for immunocompromised patients should be covered individually at the time of preparation, employees will also need a new procedure to guide them to determine what percentage of portions from each batch should receive lids. This could be a standard number such as 25% (the percentage of immunocompromised patients among adjusted eating patients in C&W where all meals for immunocompromised patients are prepared), or it could be a variable value each day depending on current inventory of covered vs. uncovered portions. PFANS should determine this process by working with the employees who will be following the guidelines.

Lastly, implementation of this recommendation would potentially require an educational campaign, explaining to both employees and patients why lids are no longer placed over food. Training time, staff meetings and employee newsletters can be used to educate employees about food lids and the amount of waste and money saved by eliminating them or switching to alternatives. Communicating changes to patients could be done via notices on the room service menus or table tents on the trays to reassure patients that their food is being handled with the utmost attention to their health and safety.

3.5.1.4 ALTERNATE LIDS RECOMMENDATION: RECYCLE PLASTIC LIDS WHILE PREPARING TO PURCHASE REUSABLE LIDS

Financially and environmentally, the best choice with respect to food lids is to eliminate them, but as noted above, this could potentially be a difficult decision to "sell" to both employees and patients since food lids have been such a deeply entrenched practice in hospital food operations. If complete elimination of food lids were not feasible, an alternative solution would be to invest in reusable lids for all patient trays. While procurement preparations are being made to purchase reusable lids, all plastic lids should be recycled (see below for recommendation on implementing plastics recycling).

3.5.1.4.1 FINANCIAL ANALYSIS OF MOVE TO REUSABLE FOOD LIDS

When PFANS has transitioned to reusable lids, the absence of regular plastic lid purchases and disposal will benefit PFANS and Environmental Services, respectively, in the same way as will the complete source reduction of lids (see above). PFANS will save roughly $44,800 annually in purchasing costs and Environmental Services about $64.63 per year in disposal fees.

PFANS would incur an upfront expenditure, however, of around $6,500 (based on generic catalog prices and an inventory of three of each lid type offered for every bed in the hospital). Based on current annual expenditures on plastic lids, the payback period of this initial purchase would be roughly 6-7 months.

3.5.1.4.2 ENVIRONMENTAL ANALYSIS OF MOVE TO REUSABLE FOOD LIDS

When considering the GHG emissions impacts from disposable products, the environmental analysis of this scenario is identical to the total source reduction scenario. Again, 6,463 pounds of plastic material would be source reduced for emissions savings of 6.6 MT of CO_2e. The emissions associated with the number of plastic reusable lids needed to cover food on every tray, 0.23 MT of CO_2e, are still much less than the avoided emissions from ceasing use of disposable lids.

During the interim period in which PFANS prepares to procure reusable lids for all patient trays, plastic lids will remain in use but will be recycled rather than landfilled. Recycling plastic results in a savings of 1.85 MT of CO_2e emissions per ton of material, thus avoiding almost 6 MT of CO_2e emissions per year even though the plastic lids are still being used.

3.5.1.4.3 CHANGES NEEDED FOR SUCCESSFUL IMPLEMENTATION

Once the transition to reusable lids has been made, there would be few procedural changes required as the reusable items could be used in the same way as the plastic lids. Prior to this transition, however, implementing plastic lid recycling will require proper employee training. Most affected are the employees who work the dish line, as they will now be required to sort plastic lids as they clean/break down used trays prior to washing. This sort of behavior change requires retraining of the position and frequent analysis of whether or not successful sorting is taking place. Additionally, the extra sorting will most likely add time to the process of preparing trays and dishes to be washed. As such, communicating to employees the high priority of sorting and recycling plastics

will be necessary. Employees may need to understand the environmental benefits of sorting plastics and be given frequent reminders to do so. See the section below on plastics recycling for more details on recycling procedures and see **Section 4** on employee engagement for further discussion on the importance of communication with employees.

3.5.1.5 RECOMMENDATION: IMPLEMENT PLASTICS RECYCLING FOR ALL RECYCLABLE PLASTICS (NUMBERS 1-7) THAT ARE DISCARDED IN PFANS' WASTE STREAM

While source reduction is the most preferred option for greening the waste stream, recycling is an important solution for reducing the environmental impacts of unavoidable plastic in PFANS operations. As discussed above, plastics have become one of the most popular materials used for product packaging so it is unlikely that PFANS would ever be able to rid themselves completely of plastic waste. Currently, PFANS recycles very little of its plastic waste, though some soda bottles are found in the recycling bin.

Environmental Services recycles plastic waste from other operations within the hospital and is willing and able to include PFANS' plastic in the plastic recycling waste stream. Recyclable materials are not collected and hauled in a single stream from UMHS as is typical across the University and the city of Ann Arbor. Instead, separate haulers pick up UMHS' plastics, paper and metals. For safety reasons, Environmental Services will not sort streams that include metal waste. Thus, implementing greater plastics recycling within PFANS' operations requires a new waste stream to collect recyclable plastics.

3.5.1.5.1 FINANCIAL ANALYSIS OF PLASTICS RECYCLING

As discussed above in the findings on plastics, PFANS operations generate an estimated 43,100 pounds of plastic waste annually. Roughly, 9,030 pounds of this plastic waste were determined to be recyclable. Environmental Services would realize any financial benefits gained by recycling this plastic, while shifting costs from landfilling to recycling. We can assume that full plastics diversion will not add so much material to the plastic waste stream that additional tips are needed, nor will fewer general compactor tips

GLOVES: A HEALTH CARE SUCCESS BUT AN ENVIRONMENTAL CHALLENGE

The use of disposable gloves is a key component of maintaining health and safety standards in any part of a hospital setting. Glove use is a core part of PFANS' standard operating procedures and employees are well trained to comply with requirements, including that which requires a new pair of gloves for each distinct task. Waste Sort data suggests that roughly 312,534 pairs of gloves are used in PFANS' operations annually, which is a clear success story with respect to employee compliance of glove policies.

However, this creates a waste challenge in that these gloves total over 2 tons of non-recyclable plastic waste each year. Health system-wide, this number would be much higher, but disposable glove use is a clear necessity in the healthcare context.

Advances in specialized recycling capabilities might provide potential solutions. For example, glove provider Kimberly-Clark has partnered with TerraCycle to provide recycling for their nitrile gloves. UMHS uses Medline gloves and thus would not be able to participate in Kimberly-Clark's current program, but the health system could leverage its position as a Medline customer to explore a similar recycling program or PFANS can advocate for switching glove providers.

Tackling solutions such as this would be more appropriate at the health system level, but PFANS could be a first proponent and potential pilot location if UMHS were to choose to explore more sustainable solutions for glove disposal.

be realized. Thus, recycling more plastic will not affect tipping expenditures, but it will save roughly $90.30 in avoided landfill fees each year.

3.5.1.5.2 ENVIRONMENTAL ANALYSIS OF PLASTICS RECYCLING

Of the 43,100 pounds of plastic waste generated annually, about 9,030 pounds of this waste are recyclable. Assuming no source reduction, recycling this plastic would avoid 8.4 MT of CO_2e emissions annually.

At 6,463 pounds in annual waste, the plastic lids discussed above account for 72% of the recyclable plastic waste that PFANS generates and source reduction of these lids would result in 6.6 MT CO_2e of avoided emissions. If the remaining 2,567 pounds of plastic were recycled, an additional 2.4 MT CO_2e would be avoided for a total of 9 MT CO_2e.

3.5.1.5.3 CHANGES NEEDED FOR SUCCESSFUL IMPLEMENTATION

As noted above, plastic recycling within the UMHS system requires material sorting at the point of disposal since Environmental Services does not provide sorting services. This will require PFANS to purchase plastics-only trashcans for its kitchens and to determine appropriate locations for bin placement (see sidebar on Spectrum Health System on page 65). Data from the C&W Waste Sort suggest that the dish area is the primary location for recyclable plastic disposal, but recyclables were also found in the trash from the cook and tray lines and in the trash used by the kitchen cleaning staff. It is probable that the dish area in UH will also see a lot of recyclable plastic waste, but additional investigation will be necessary to determine other high priority sites for locating plastics recycling bins in both kitchens. Considering the relatively large size of the UH kitchen as compared to that at C&W, successful implementation will likely require more recycling locations at the UH kitchen than at C&W.

Employee training (and regular re-training) will be required to successfully implement plastics recycling and to keep the diversion rate as high as possible, that is to ensure the maximum amount of plastic is properly sorted and then recycled. Employees will need to be trained to look for the universal, 1-7 numbering system for identifying recyclable plastics and will need to develop the habit of sorting these items into plastics-only recycling bins. Since the plastic haulers used by Environmental Services will accept all seven types of recyclable plastic, this task will not be quite as challenging initially as if only some plastic types were accepted. However, the ‘contamination’ of a recyclable waste stream, i.e. the presence of non-recyclable plastic trash, can have detrimental effects on recycling efforts and can cause an entire “batch” of waste to be landfilled rather than recycled. PFANS management must communicate and emphasize the priority of and reasons for recycling plastics.

In developing processes for recycling plastics, PFANS must work *with* the employees who will be doing the plastics sorting to determine optimal procedural guidelines. For example, plastic containers with liquids still inside (a half-finished soda for example) do not necessarily need emptying prior to disposal because the liquid will escape when the plastic waste is compacted (although from a cleanliness perspective, emptying is ideal). Plastic containers that contained milk products do need emptying and/or rinsing, however, due to Environmental Services policies regarding milk products. Employees should be engaged in the development of

guidelines that outline in what instances emptying and rinsing should take place or if this type of responsibility beyond sorting is infeasible. Sorting and rinsing/emptying plastic containers will add to the time it takes for employees to complete daily job responsibilities and involving these employees in the planning process will promote concept buy-in and a sense of agency. It also makes it more likely that employees will be willing to "go the extra mile" to divert as much plastic waste from landfills as possible.

Once procedural guidelines are determined, signage will need to be developed to support and reinforce the content employees receive during training. Signage might specifically highlight core recyclable products that are always in the waste stream and outline the procedures for determining if unfamiliar items can be recycled, for example. Reminders that packaging from milk products must be rinsed or otherwise excluded from the plastic recycling waste stream could also be included in supporting signage materials.

3.5.2 METAL WASTE

The majority of metal waste produced by PFANS operations is composed of aluminum soda cans and tin-coated steel cans, also called bulky metals in this assessment ("# 10 cans" used to store large quantities of pantry items such as canned tomatoes). Currently, PFANS recycles aluminum soda cans but no other metal waste.

The Environmental Services division of UMHS is equipped to recycle all metal material, but separate waste haulers are contracted to pick up metals and other recycled materials. This requires that all materials be sorted prior to pick up, as Environmental Services does not perform this service as a safety precaution.

3.5.2.1 RECOMMENDATION: IMPLEMENT METALS RECYCLING FOR ALL METALS DISCARDED IN PFANS' WASTE STREAM

3.5.2.1.1 METALS FINDINGS

During the August 22 Waste Sort, almost 11 pounds of metal were discarded, accounting for 3.6% of the total waste stream. This total was evenly distributed between aluminum cans and bulky metals. Given an estimated yearly waste total of 335,818 pounds, an estimated 12,111 pounds of metal waste are produced each year throughout PFANS' operations.

One interesting and important piece of information revealed by the Waste Sort data indicates that though PFANS currently has a policy for diverting aluminum cans from landfill waste, the success rate for this diversion is actually quite low. Of all the aluminum cans counted and weighed throughout the sort, 74% of them were in landfilled trash bags, not the recycling bin. Most of the cans in the landfilled trash were found in trash at the dish station, suggesting that aluminum cans generally enter the waste stream at this location. Thus, special attention must be paid to material sorting as trays come back from patient units. This data serves as a reminder that engaging employees in efforts to make the waste stream more sustainable is vital to the success of these initiatives.

3.5.2.1.2 FINANCIAL ANALYSIS

Metal recycling at UMHS has no associated fees as the metals hauler provides the dumpster and covers all pick up costs. In addition, recycling metal materials will save Environmental Services the landfill fees it would otherwise pay when metals are not diverted from the general waste stream. As noted above, an estimated 12,111 pounds of metal material are generated by PFANS annually. Avoiding landfill fees for this material will save Environmental Services roughly $121.11 per year. We will not assume any difference in the tipping frequency of the general compactor waste, thus will see no savings there.

3.5.2.1.3 ENVIRONMENTAL ANALYSIS

Since metal waste does not decompose, most GHG emissions from metals are created during production and manufacturing processes. Emissions from metal disposal occur primarily during the transportation of waste materials. As such, the greatest gains to be made in emissions reduction are in source reduction wherein the material is not used in the first place. Source reduction opportunities with respect to metal waste produced in PFANS' kitchens were not identified, thus increasing metal recycling rates is the recommended approach to reducing PFANS' emissions from metal waste.

In this analysis, aluminum can metrics from the U.S. EPA's WARM documentation are used to estimate the potential emissions savings from 100% diversion of all metal waste to recycling. Currently, aluminum cans are produced using input material composed roughly of 68% recycled aluminum and 32% virgin material. WARM estimates that aluminum production with this current mix produces 6.03 MT CO_2e per ton of aluminum cans produced. Production using 100% recycled aluminum as input material produces 2.08 MT CO_2e per ton of aluminum cans produced. Recycling metal contributes to the stock of secondary input material so for this analysis, the difference between current mix and 100% recycled content emissions, 3.95 MT CO_2e per ton, is assumed to represent the emissions avoided by recycling metal waste.

As noted above, an estimated 12,111 pounds of metal waste are produced by PFANS' operations yearly. Using the 3.95 MT CO_2e/ton metric, roughly 24 MT CO_2e can be avoided annually by implementing this recommendation to increase the metal diversion rate to 100%.

3.5.2.1.4 CHANGES NEEDED FOR SUCCESSFUL IMPLEMENTATION

As noted above, metal recycling within UMHS requires material sorting at the point of disposal since Environmental Services does not provide sorting services. This will require PFANS to purchase metals-only trashcans for their kitchens and determine appropriate locations for placement (see sidebar on Spectrum Health System on page 65). Data from the Waste Sort in C&W suggest that the dish and food prep areas are the primary locations for metals disposal. This is probably also true of the kitchen in UH, though more investigation will be necessary to determine other potential sites in the kitchen to place metals recycling. Considering how much larger the UH kitchen is relative to that at C&W, more recycling locations throughout the kitchen might be necessary for successful implementation.

As is the case with creating food and plastics waste streams, successful creation of a metals waste stream requires a significant amount of employee buy-in and support. Environmental Services can take all metal materials so educating staff on what can and cannot be put in the metals recycling stream might not need to be quite as rigorous as it will be for recycling plastics. Still, training staff in correct disposal processes for metals is necessary, both during new employee training as well as in regular reminders for all employees. As with the other recycling initiatives, proper sorting and disposal of recyclable materials must be emphasized as a priority within PFANS' operations such that employees are trained to consider recycling as a vital part of their day-to-day responsibilities.

3.5.3 TRACKING THE SUCCESS OF PLASTIC AND METALS RECYCLING

Once our metal and plastic recommendations have been fully implemented, periodic auditing of general trash will be necessary to track recycling performance. Source reduction of plastic lids and Styrofoam cups will eliminate 20% of the plastic waste stream, but over 30% of plastic waste and the entire metal waste stream are recyclable. As our waste data demonstrated, though PFANS' staff is trained to recycle soda cans now the current success rate is only 25%. Periodic auditing will reveal when future recycling rates are low, thus providing signals that intervention might be needed. Such interventions might include investigation of weaknesses, identification of strengths, provision of additional training and tools and creation of new incentives. Auditing will be the only way for PFANS to verify their success in recycling.

Periodically weighing the metal and plastic recycling streams could also be helpful in monitoring recycling success as well as the overall sustainability progress. For example, if soda cans in recycling streams are quantified and compared to soda procurement data more specific aluminum can success metrics can be generated. With respect to overall sustainability efforts, while we want to increase the recycling rate of each material, once that has been done we should not see an increase in the absolute amounts of recyclable material leaving the kitchens. If this begins to happen, it most likely will mean that product changes have resulted in more waste overall. Source reduction is always the most environmentally preferable option and changes that result in more overall waste are not desired, even if that material is being recycled.

3.5.4 FOOD WASTE

3.5.4.1 ABOUT FOOD WASTE

At 21%, food waste makes up the single largest percentage of waste going to landfills in the United States, totaling 33 million tons of food in 2010 (U.S. Environmental Protection Agency, 2010). While food waste does not persist in the environment in the same way that other materials such as plastic and metal do, its natural decomposition process when confined to a landfill releases large amounts of methane (CH_4). Methane, one of the major greenhouse gases, is 25 times more potent than carbon dioxide (CO_2) as a driver of climate change when released to the atmosphere. According to the U.S. EPA, methane from landfills accounts for over 20% of all methane emissions in the U.S. (U.S. Environmental Protection Agency).

In addition to the impact from food decomposition, the larger environmental impacts of food waste are the significant emissions associated with the production, processing, transportation and selling of food. For

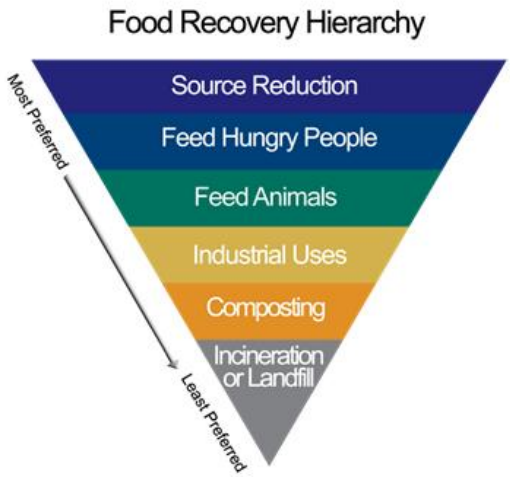
example, emissions associated with the production, processing and transport of grains accounts for 74% of the total life-cycle emissions from grain production, consumption and disposal. In the case of a more energy intense food like beef, the production process alone accounts for 96% of total emissions (Venkat, 2011). Modern industrial agriculture is also a primary source of nitrogen and phosphorus loading from fertilizers that pollute water systems and contribute to GHG emissions. While some might argue that these impacts are necessary to meet modern food production needs, this argument cannot hold up in the case of wasted food. Wasted food simply produces emissions without meeting any human needs or serving any purpose.

As such, in the hierarchy of methods for recovering food waste and minimizing the environmental impacts associated with food, source reduction is the most desired first step. The term "source reduction" refers to the waste management method in which disposal options are unnecessary because waste is just not created in the first place.

3.5.4.2 SOURCE REDUCTION OF FOOD WASTE

Overall, food waste is comprised of 'un-avoidable' and 'avoidable' food waste. In any food service operation, a certain amount of food waste cannot be avoided. This un-avoidable waste includes items like vegetable trimmings, fat drippings and the inedible parts of foods such as fruit rinds/peels, eggshells, and bones. In the context of this study, post-patient food waste, the uneaten food that returns to the kitchen on patient trays, is also considered unavoidable waste due to the measures PFANS has already taken to reduce this waste (see **Section 3.5.3.3.4**).[4] For this unavoidable waste, reducing its environmental impact relies on disposal options employed.

Figure 6: EPA's Food Recovery Hierarchy



Source: U.S. Environmental Protection Agency

[4] It is important to note, however, that though PFANS cannot ultimately control what patients leave on their trays, this source of waste could be reclassified as avoidable (or at least partially avoidable) at later stages of PFANS' sustainability path when more in depth analysis of this waste may reveal additional options for source reduction.

Avoidable food waste is everything else that is wasted pre-patient. This is primarily comprised of expired food and overproduced items. More stringent health code requirements for hospitals, meant to decrease the possibility of food borne illnesses in susceptible populations, result in shorter shelf lives for most products than would be permissible in most other contexts. This shorter shelf life for food can increase the probability that food will expire before it can be used completely. Procurement-based modifications would most likely be required to source reduce this waste.

Overproduction is also a significant source of avoidable food waste. In order to ensure timely food delivery to patients, many items must be prepared daily in larger batches to anticipate orders. These items include foods such as bacon, sausage, eggs, soups, potatoes, salads and fruit plates. At the end of the day, no leftover items can be saved for use the next day must all be thrown away. Source reduction of this waste will require consistent analysis of the waste to determine areas for more accurate projections of food preparation needs.

3.5.4.3 RECOMMENDATION: SOURCE REDUCE PRE-PATIENT FOOD WASTE BY 10%

As discussed above, source reduction of pre-patient food will focus on reducing the avoidable food waste that results from expiration and overproduction.

3.5.4.3.1 FOOD WASTE FINDINGS[5]

During the August 22 Waste Sort, we observed roughly 162 pounds of food waste, which accounted for 54% of the total waste. This value was used with historical census data to calculate an estimate of the total food waste generated each year (in both kitchens) of 148,168 pounds. This total also includes the estimated 2,355 pounds of food waste generated by Meals on Wheels (MOW) operations annually (more on MOW findings below).

During the LeanPath audit, a total of 1,351 pounds of pre-patient food waste was tracked, an average of roughly 59 pounds per day. Because the data collected during the LeanPath audit is the most comprehensive and consistent with respect to pre-patient food waste, it was used with the C&W census data during the audit period to produce the food waste metric of 0.5361 pounds of pre-patient food waste per eating patient. Using a similar process to that above of estimating yearly waste totals, this metric was used to determine that of the 148 thousand pounds of annual food waste, 134,510 pounds (91%) of waste is pre-patient, while 13,657 pounds (9%) is food left uneaten by patients.

The Meals on Wheels (MOW) meal preparation operation is housed in the UH kitchen and falls under PFANS' purview. Food waste left over after daily meals were prepared was tracked for 8 weeks to account for two complete menu cycles (MOW rotates through four weekly menus). Over the eight weeks of tracking, 362 pounds of food were disposed of, roughly 45 pounds per week. Since the number of recipients MOW prepares meals is a steady average of about 200 people per day, it was deemed appropriate simply to scale this weekly waste average up by 52 to yield an annual food waste estimate of 2,355 pounds per year. Analysis of the specific food

[5] A more detailed description of the calculations mentioned in this section can be found in the Methodology section of this report.

items suggests that slivered turkey is the food item most *consistently* wasted (some was left over every time it was part of a menu), while more minestrone soup was wasted (29 pounds) than any other item.

As noted in the Methodology section of this report (see **Section 1.4**), gathering food waste data proved extremely challenging and, thus, our analysis of the food waste stream is somewhat limited. While the Waste Sort was extremely comprehensive, representing every bit of trash that left the C&W kitchen, the data is only a snapshot of a single day in just one PFANS kitchen. Additionally, the food waste measurements are aggregate values that cannot distinguish between types of foods beyond the pre- or post-patient distinction. While the LeanPath data disaggregates this food waste data to some degree, it still tracked each food according to an overall product category, with much of the waste classified as 'Other.' While these efforts to document the food waste are a great start at characterizing PFANS' waste, consistent collection of more specific food waste data will be needed to implement source reduction strategies.

3.5.4.3.2 FINANCIAL ANALYSIS OF SOURCE REDUCING FOOD WASTE

PFANS and Environmental Services will recognize financial benefits from the source reduction of food waste via reduced food costs and via reduced disposal costs, respectively. PFANS spent nearly $447,000 on food in 2012. A 10% source reduction in food waste equates to a 10% reduction in food costs, saving PFANS almost $45,000 per year on food purchases. Targeting more expensive food items for waste source reduction could further increase this savings.

A 10% source reduction in pre-patient food waste results in 13,451 fewer pounds of waste that Environmental Services must dispose of. This will reduce annual landfill costs, saving Environmental Services roughly $135 per year.[6]

3.5.4.3.3 ENVIRONMENTAL ANALYSIS OF SOURCE REDUCING FOOD WASTE

As noted above, source reduction of food waste is the most preferred management option from an environmental perspective. Landfilled food waste emits an average of 2.03 MT of CO_2e/MT of food waste in a landfill, as measured from a life cycle perspective. This emissions value is much higher for energy intense foods such as beef (16.9 MT CO_2e/MT beef) and other animal products. No food types emit less than one MT of CO_2e per MT of food (Venkat, 2011).

A 10% source reduction in the 134,510 pounds of pre-patient food waste generated each year would divert 13,451 pounds from the waste stream. At 2.03 MT CO_2e per MT of food waste, this source reduction would avoid over 12 MT CO_2e annually. The larger the proportion of animal products in the mix of source reduced food, the higher the estimate of avoided emissions.

[6] In the C&W kitchen, a garbage disposal is utilized for food scraps and trimmings (which is also presumably true in UH as well). The exact amount that source reduction of food waste would decrease waste going to landfill would require closer assessment, but we are allocating all decreases to landfill savings in this study.

3.5.4.3.4 RECENT SOURCE REDUCTION SUCCESSES

PFANS has already engaged in significant source reduction of its food waste by transitioning to the room service style of meal delivery. While the timeline of this study did not allow for a before-and-after comparison with respect to total waste, the room service model is generally recommended as a method for significant source reduction. The *Green Guide for Healthcare*, published by HCWH, cites transition to this type of just-in-time delivery strategy for reducing patient food waste, limiting spoilage and for maximizing usage of fresh produce and meats (Health Care Without Harm, 2008).

Though not a new trend, PFANS' use of the water chill method for preparing and storing items such as soups and sauces also assists efforts to source reduce food waste. During the recent remodeling of the UH kitchen, much of the food production operation shifted to NCRC and water chill preparation of items such as soups and chili was suspended. Comparing the C&W waste logs from this interim period to those after the resumption of water chill production suggests that as much as 37% less soup and 34% less chili is wasted due to the water chill process.

3.5.4.3.5 FOOD WASTE TRACKING IS KEY TO SOURCE REDUCTION

Beyond the successful efforts highlighted above, effective source reduction of food waste necessitates consistent tracking of all food waste, both for patient meal operations and for MOW. "You can't manage what you don't measure" is a common cliché in business, but as with most clichés, it contains a clear element of truth, and applies to food waste reduction efforts. There will not be many changes that will yield huge reductions, but instead, through tracking and analyzing the food waste generated in each kitchen, PFANS managers and chefs will identify many smaller changes that will add up to reductions that meet their goals. While tracking will identify areas for improvement, it will also reveal areas of success. It is important to remember that these wins should be celebrated as they are discovered.

3.5.4.3.6 TRACKING EFFECTIVELY

Effective tracking requires two key components: the tracking method itself and the employees doing the tracking. Most important is that food waste be tracked consistently every single day. It will be difficult to identify waste trends that could lead to reduction efforts without consistent data.

The C&W kitchen began keeping daily food waste logs at the start of this study and we have worked with these logs periodically, entering the data into spreadsheets and using it as a comparison dataset to other waste data we have collected. Working with the logs, we have already identified consistency issues, such as the units that waste is recorded in, and worked with PFANS to improve this issue. In order to compare trends over time, it is necessary that each category of waste be recorded in the same way and in the same units—either through weight or through number of servings for example. By reviewing the waste logs regularly, PFANS will be able to identify data that is no longer useful and augment the logs with new data categories they want to explore in more depth. Ultimately, the development of the most useful and effective waste logs will fall to PFANS managers and staff, but some key components and considerations are summarized below.

- **Reason for waste:** The reasons why food is wasted (because it expires, because too much was prepared, because it was dropped, etc.) will be critical in developing solutions for waste reduction. For example, purchasing fewer potatoes at a time solves a different problem than preparing less mashed potatoes each day.
- **Who is tracking:** As discussed below, employees who track the waste are key to successful tracking. Monitoring who tracks waste each day will be key for maintaining accountability and identifying staff both who need to improve their tracking performance as well as those who track consistently and accurately.
- **Appropriate disaggregation:** As noted below, tracking waste takes time. The more detail that is captured, the more time is required to complete the task. Logged waste should be at the level of detail that is most informative, but no further. For example, tracking indicated that many of the yellow Jell-O portions prepared were regularly wasted, while red and orange Jell-O portions were not. This is an area in which detail was informative, but if waste were evenly spread over the three Jell-O flavors, tracking Jell-O waste all together would be the more appropriate level of detail. This is one area in which the iterative nature of these logs should be kept in mind and needed adjustments made regularly.

One of the most limiting challenges of the waste log data has been that the logs are not maintained in a consistent manner. In any given week, up to 3 or 4 days' worth of data was not recorded and conversations with chef's assistants (those who maintain the log) suggest that on busy days, data that is recorded might not be as accurate as it could be. Chef's assistants estimate that in order to do the job of logging daily food waste well, as much as 30 to 45 minutes worth of work can be added to their day. This additional work load that tracking requires is an important consideration that PFANS management must take seriously in future efforts to implement more effective tracking.

Employees are generally concerned, however, with the food that is wasted in the kitchen, so motivating waste log buy in and participation might ultimately be a matter of communication. As has been noted elsewhere, it is imperative that those doing the tracking are included in discussions to determine best practices. Those tracking need to understand both why they are doing it and the importance of the information they collect in monitoring, and eventually reducing, food waste. Additionally, those who will track food waste must have the opportunity to contribute to developing tracking processes, as they will have unique knowledge of the workflow and how tracking can be accomplished most efficiently. Most likely, this will be an iterative process in which a clear understanding of the data that is ultimately required will yield the most efficient methods of obtaining said data.

3.5.4.3.7 TRACKING ANALYSIS

The analysis of collected tracking data, whether in C&W, UH or MOW, should be used to identify and drive any changes needed for source reduction of food waste. This will potentially include procurement solutions meant to reduce expiration waste as well as those addressing overproduction issues. For example, waste log analysis may indicate ways to develop more accurate projections of how much pre-prepared food is needed. Kitchen managers are most likely in the best position to take on regular food waste analysis, though more senior management staff should also be aware of analyzed trends and potential solutions.

If food waste data continues to be captured on paper, frequent data entry into a spreadsheet will be necessary. This both reduces the potential data entry burden at any given time and makes it possible for more frequent analysis. Data should be analyzed often to enable a timely response when trends begin to emerge. For example, adjustments may be needed with regard to the data that is being captured or the types of analysis metrics that are being developed in order to understand a trend in waste generation fully; or, solutions may need to be tried out to determine their effectiveness before full implementation. It is possible to analyze the data too frequently, however, such that trends are obscured by a lack of enough data and it is a waste of managers' time. We estimate data should be analyzed monthly, but the optimum analysis frequency is again one component that must be determined iteratively through trial and error. Just as employees need to understand the importance of tracking itself, kitchen managers must understand and be incentivized to keep up with the analysis. If possible, adding this task into the official roles and responsibilities of the job description is one way to reinforce the importance of the task.

As with most of the other elements of effective tracking, the exact analysis methods that will yield meaningful results will be found only through trial and error. In addition to tracking basic waste trends for each food item, potentially interesting and revealing ways of manipulating the data are suggested below.

- **Include financial data:** Incorporating the costs associated with the food waste into the spreadsheets will be an important component for justifying and prioritizing solution efforts (i.e. target more expensive waste first)
- **GHG emissions data for each item:** Incorporating greenhouse gas emissions data into the spreadsheet can help guide reduction efforts to maximize emissions avoidance
- **Sort by reason for waste:** As noted above, items wasted for different reasons might potentially have different solutions for reduction; analyzing the data from this lens could provide key insights
- **Sort by day/week/month:** Sorting by day of the week can identify regular peaks in waste generation and/or regular dips that can be analyzed to determine what is "going right" on those days; trends over weeks or months can start to provide historical data that could potentially be used in future projections of food needs
- **Sort by who tracked the waste:** Accountability in tracking will be a key component for success; approaching the data this way could help recognize and applaud employees who are tracking consistently versus those who are sporadic or otherwise inconsistent in their waste measurement and recording

In addition to using the waste log data to identify specific areas for improvement and possible solution options, the data can be used to create performance metrics that are reported internally and that serve as a yardstick of waste reduction success. Using other data currently collected by PFANS or others in UMHS, such metrics could include a weekly or monthly average of the total (logged) food waste per patient, or perhaps the total food waste per tray ticket. Generating performance metrics and making them known to staff are key to maintain employee engagement in the food waste source reduction task.

3.5.4.3.8 EXPLORING OTHER DIVERSION OPTIONS

In the U.S. EPA food waste hierarchy above (see **Figure 6**), source reduction is the most preferred waste management option but there also are other preferred alternatives to landfill or even composting of food waste. Feeding people and feeding animals are intermediaries between source reduction and disposal that should be explored further. Food that is expired by healthcare standards might still be edible for non-compromised populations. Past investigation by Environmental Services indicates that animals intended for human consumption cannot eat food from hospitals due to potential contamination by sick populations. This suggests pre-patient food waste, waste that has never had contact with the patient population, might be acceptable. As PFANS moves towards taking greater responsibility for their waste output, investigating more opportunities for avoiding food disposal will be an important component of their sustainability success.

3.5.4.4 RECOMMENDATION: CREATE A NEW WASTE STREAM FOR FOOD

As discussed elsewhere, PFANS has made great strides in reducing its organic (food) waste by transitioning to the room service model of food delivery. Determining more environmentally preferred methods for disposing the remaining organic waste is the next step on the road to more sustainable operations. Specific options for organic waste stream disposal will be discussed below, but it is also necessary to explore the implications of creating an entirely new waste stream for both the kitchens and for the health system. If the entire 148,168 pounds of annual food waste were diverted from landfill, PFANS could avoid nearly 20 MT of CO_2e each year and almost 30 MT if 10% of pre-patient food waste was source reduced prior to diversion. Food waste accounts for almost half of PFANS' total waste and creating a separate waste stream for organics also significantly boosts diversion from landfill rate to well past the health system average.

3.5.4.4.1 HOW TO CREATE A FOOD WASTE STREAM

While the concept of recycling metal and plastic might be familiar for many PFANS employees, it is likely that diversion of organic waste will be a new concept for most. The potential changes that will be made to expanding the metal and plastic recycling programs can also create a beneficial context for introducing and implementing the concept of organic waste management. Since employees will already be increasingly encouraged to consider waste generation and proper disposal procedures, adding an entirely new waste

RECYCLING AND COMPOSTING AT SPECTRUM

Spectrum Health System in Grand Rapids, MI recycles system-wide and currently composts all pre-patient food waste. In preparation for diverting waste from the landfill, kitchen managers and employees assessed all trash bin locations and determined those where recyclables and food waste were generated. Constraints such as space and Joint Commission requirements can create challenges in determining proper placement of trash bins, but it is also imperative to locate bins such that sorting waste is as easy as possible for employees.

To date, the cost of compostable trash bags (at $0.75 per bag) has been the binding constraint that limits Spectrum from broadening its composting efforts. Spectrum is currently experimenting with alternative disposal processes to determine if compostable trash bags can be eliminated from composting procedures.

PFANS will likewise discover this and other hidden costs of food waste diversion and will need to work with employees to find the best solutions for making diversion feasible.

stream might not present quite as large a challenge as would creating awareness and a new stream from scratch. Current PFANS operations, in which some food waste is already effectively sorted due to the use of in-sink garbage disposals, can be leveraged to decrease the potential challenges of adopting new practices for the handling of food waste.

The potential organic waste disposal options discussed below will accept all types of organic waste so PFANS will not be constrained to sorting out only some of its food waste for disposal. Sorting pre-patient food waste will likely not present a great challenge beyond developing the new habit of where it is placed. Expired food is already singled out for disposal and would only require separating out packaging material. Much of the trim and scrap food waste is likewise singled out for disposal using the in-sink garbage disposals and would just require a change of disposal location.

In C&W, it is possible that post-patient food waste capture will not be particularly difficult since tray food waste is sorted for the garbage disposal on the dish line. Again, all that would be required is the change from locating the food waste in the sink to placement in an organics trash bin during sorting. Post-patient food waste in the UH kitchen, however, will be the most challenging to capture. In that kitchen, all tray waste (including organics and inorganics) is fed into a pulper to diminish overall waste volume. The greater number of trays delivered in UH makes this an efficient, though environmentally unsound, way to clear tray waste and facilitate quicker dishwashing. Sorting food waste at the UH dish line will require additional dish wash resources, either through added time or through an additional employee. PFANS will need to weigh more closely the costs and benefits to sorting food at this location in particular.

Creating a new waste stream for organics will require acquiring new, food-only trashcans and placing them throughout the kitchens (see sidebar on Spectrum Health System's process for collecting new waste streams). As PFANS introduces new waste streams and corresponding trashcans, signage and other indicators such as color-coded trashcans will become necessary to enable employees to sort waste as quickly and effectively as possible. At Spectrum Health System, for example, all recycling trashcans are blue and all compost bins are green to distinguish them from each other and the general waste bins. PFANS will need to determine a system that works best, specifically accounting for the need to recycle metal and plastic separately.

Success in implementing and maintaining a food waste stream will largely depend on how well employees are engaged with the goal of reducing food waste sent to the landfill. Existing job descriptions must incorporate new responsibilities and adequate time must be dedicated to training employees to sort and dispose of food waste correctly. For example, different disposal options allow for different degrees of contamination, i.e. inorganic waste in the waste stream, which may impact the specific procedures employees will follow in sorting out food waste.

Beyond training, however, more will be expected of PFANS staff and maintaining an atmosphere of teamwork whereby management is working *with* employees to reduce the food waste sent to landfills will be key. One important component of the teamwork atmosphere will be maintaining clear and open lines of communication between management and staff. Those staff on the "front lines" of waste sorting, in particular, must understand the importance of diverting food waste from the landfill and that such efforts are a priority within PFANS. It will also be important that these employees be given the opportunity to be part of the process of developing the

food diversion program in an effort to determine the processes that will be most effective in ensuring employee buy in and participation.

3.5.5 FOOD WASTE MANAGEMENT

Despite identifying opportunities and implementing approaches for reducing the amount of waste produced within PFANS, organic waste cannot be entirely eliminated. PFANS is responsible for meeting the changing nutritional needs of UMHS inpatients, and this task necessitates that the department maintain a surplus of food to meet these demands. Additionally, food waste is generated from food ordered by patients that is returned to the kitchen uneaten. While the new room service style helps reduce overproduction of food and food waste generated by patients, the amount of food waste produced in the new system is still significant and warrants the implementation of a strategy for diverting food waste from landfill.

As described above, our team projects that PFANS will produce 148,168 pounds of organic waste annually across its two kitchens once the room service style operation is fully implemented and measures to increase recycling are taken. By diverting this amount of food waste from landfill, PFANS can expect to eliminate 64 MT of $C0_2e$ annually that would result from decomposition of organics in landfill. In addition, removing food waste from UHMS' landfill waste stream would reduce hauling fees for landfill waste by $1,481.68 annually. Food waste is consistently heavy, resulting in higher fees for landfill disposal than other materials.

In considering potential opportunities for a food waste management system, PFANS needs a solution that fits into UMHS' overall waste management operations, adheres to health code policies and supports the food waste composition produced within the PFANS kitchens. Despite these particular challenges, PFANS is positioned to implement a successful program due to support from leadership within UMHS Operations and a strong infrastructure that can incorporate this program.

Our team explored options for handling food waste that would be located both on and off site. These options are outlined and compared in **Figure 7** below.

Figure 7: Comparison of On-Site and Off-Site Organic Disposal Options

Disposal Types	Space Required	Infrastructure Investment	Maintenance and Labor	Impacted Regulations Policies	Value from Recovered Products
On-Site Disposal	High	High	High	Low	High
Off-Site Disposal	Low	Low	Low	High	Low

3.5.5.1 ON-SITE DISPOSAL

An on-site disposal option for managing the food waste generated by PFANS is a solution in which food waste would be treated and converted into digestate or compost on the hospital premises. Disposal options feasible for most businesses include onsite bio digestion technologies that vary based on the type of organic waste in can process (pre-consumer vs. post-consumer), contamination levels of the organic waste, volume of waste produced, space availability at hospital, and recovered products produced.

3.5.5.1.1 ADVANTAGES

Value or Use of Recovered Products: An on-site option for processing food waste produced by PFANS would give the hospital a chance to benefit from the recovered products created from the waste. For instance, the use of digestion technology on-site would result in the creation of energy that the hospital could use, possibly reducing its energy expenses. Additionally, these on-site units would create digestate, the material formed following the anaerobic digestion of an organic feedstock, from which compost could be created. This digestate would need to be sent to a facility for conversion into compost. It is unlikely that the hospital would be able to sell either the energy or digestate it creates because of lack of demand. However, there might be an opportunity to use both the energy and compost on the hospital campus.

Insensitive to Policy Changes: An on-site method for processing food waste would be less affected by changes in policies and regulations related to yard and organic waste management occurring locally or statewide.

3.5.5.1.2 DISADVANTAGES

Space Requirements: An on-site disposal option requires significantly more space than an off-site disposal option. This is due to the need to place equipment such as a bio-digester on site in addition to designating staging areas both for food waste prior to being processed and for the digestate or compost that this equipment would produce.

Investment in Equipment and Maintenance: An on-site disposal option would require significant investment and management by PFANS and Environmental Services staff. Due to equipment, maintenance, and labor costs that would be associated with this disposal option as compared to the amount of waste it supports, PFANS could not expect a reasonable payback period.

Requires Significant Coordination: An on-site option would be challenging to implement and would require heavy planning. This is in part due to the need to ensure that an end destination (and possibly market) is in place for the recovered products produced by the equipment (i.e. digestate, compost, energy).

3.5.5.2 OFF-SITE DISPOSAL

An off-site disposal option for managing the food waste generated by PFANS is a solution in which food waste would not be treated and converted into digestate or compost on the hospital premises. Instead, the food waste is taken to an outside facility specializing in processing organic waste. Off-site disposal options can range from anaerobic digesters to composting facilities. All of the off-site disposal options available to support PFANS food waste program are windrow composting facilities in which waste is staged in piles outdoors and natural decomposition is assisted through the “turning” of piles using heavy equipment.

3.5.5.2.1 ADVANTAGES

Reduced Space Requirements: Unlike on-site methods for managing food waste, off-site options require less dedicated space; an off-site solution predominately requires space for staging food waste in the hospital docking area for pick-up by an outside hauler.

Limited Investment Required: An off-site solution does not necessitate large investment in equipment and infrastructure. Therefore, rather than incurring maintenance and labor costs to support on-site food waste management equipment, an off-site solution has the opportunity to be incorporated into the existing roles and responsibilities of both the PFANS and Environmental Services departments more easily.

3.5.5.2.2 DISADVANTAGES

Cost Program: An off-site solution would not allow the hospital to capture value created from food waste in the form of compost or energy. The off-site solution is a cost program in which the hospital pays a vendor to haul the waste from the hospital grounds without receiving credits or revenue in exchange for the organic waste.

Coordination with Outside Vendors: An off-site solution requires coordination with an additional outside vendor, which will influence the program parameters such as pick-up schedule, type of food waste accepted and contamination levels allowed.

Sensitive to Policy Changes: An off-site solution is sensitive to policies and regulatory changes. For instance, adjustments to policies that determine the type of waste allowed in landfill will affect the demand for various waste disposal options.

3.5.5.3 OFF-SITE DISPOSAL OPTIONS

Based on the comparison of on and off-site options, our team determined that an off-site food waste disposal option is more advisable than an on-site option for PFANS at this time and meets the needs of the department's food waste management program. We have identified and evaluated three possible options for off-site organic waste disposal that could support PFANS food waste program.

3.5.5.3.1 TUTHILL FARMS

Tuthill Farms is a privately owned and operated farm in South Lyon, MI. The farm operates a windrow composting facility and accepts post-consumer organic waste from institutions and businesses in the region. A significant portion of Tuthill Farms business comes from yard waste, which is required by state law to go to composting facilities. Currently, Tuthill receives organic waste from schools and centers within the University of Michigan, including the Ross School of Business and the Michigan Law School.

Tuthill Farms does not offer hauling services to its composting site, but instead requires the organic waste generators it works with to find a means for hauling waste to the farm. Once it receives the organic waste, Tuthill manages an extensive composting process creating three products for sale: farm compost, top soil and mulch.

Figure 8: Tuthill Farms Program Details

Program Details	Values
Hauling fee	TBD
Tipping fee	$8-$14 per cubic yd.
Accepted contamination level	0%
Fee for contamination in organic waste	$75
Schedule for accepting organic waste	Weekday business hours

3.5.5.3.1.1 STRENGTHS OF TUTHILL FARMS DISPOSAL OPTION

Flexible Schedule: Tuthill Farms is available to accept organic waste any day of the week except weekends during the Summer and Fall. This would provide PFANS with the flexibility to deliver its organic waste to the site as often as needed.

Potential Collaboration with Other Programs: By choosing Tuthill Farms as its composting site, UMHS may be able to collaborate with other University of Michigan schools and centers using the facility's services. This approach may potentially reduce the hauling fees for the program, enable the hospital to coordinate deliveries of its food waste to Tuthill Farms and leverage best practices from these partners.

3.5.5.3.1.2 IMPORTANT TUTHILL FARMS CONSIDERATIONS

Logistics: UMHS will need to contract with a separate entity to manage the hauling of organic waste to Tuthill Farms. This will require the hospital to implement a two-part process for disposing its food waste, first coordinating with the hauler to collect the waste at UMHS and then working with Tuthill Farms to ensure that the waste is dropped off during Tuthill's operating hours.

Hauling Cost: UMHS will be charged a separate cost for hauling the waste in addition to the tipping fee cost at Tuthill. Due to the distance to the facility (20+ miles), hauling fees may fluctuate due changing gas prices.

Investment in Toters: UMHS will be responsible for purchasing and cleaning its own toters, plastic bins used to store and stage the organic waste in the hospital dock area managed by Environmental Services.

Contamination Level: Tuthill Farms only accepts organic waste with 0% contamination level of the waste with non-organic materials. This enables Tuthill to ensure the quality of the compost it sells. To avoid fees for contamination, UMHS must ensure that its food waste program within the kitchens is strictly adhered to by PFANS staff to avoid non-organic waste ending up in the organic waste stream. Otherwise, PFANS may consider sorting its food waste prior to or upon delivery to Tuthill Farms.

3.5.5.3.2 CITY OF ANN ARBOR / U-M WASTE MANAGEMENT SERVICES

The City of Ann Arbor, through the University of Michigan's Waste Management Services (UM-WMS), is piloting a program that accepts post-consumer organic waste at the City's windrow composting facility. To date, Ann Arbor's windrow composting facility, managed by WeCare Organics, has only accepted pre-consumer organic residential waste. While the City of Ann Arbor will continue to offer only pre-consumer organic waste pick-up for

residents, it is prepared to expand its post-consumer program to include the University of Michigan in those areas of the University where the food waste contamination level can be managed effectively.

In the program, UM-WMS would collect the food waste produced by PFANS from the hospital docking area and deliver it to the City of Ann Arbor's composting facility. UM-WMS has dedicated one truck to date for its program and is currently prepared to perform pick-ups three days per week; however, UM-WMS is committed to expanding its services if demand increases.

Figure 9: Program Details for City of Ann Arbor Composting

Program Details	Values
Hauling fee	$12.40 per toter
Tipping fee	N/A
Accepted contamination level	0%
Fee for contamination in organic waste	Unknown
Schedule for collection of organic waste	Monday, Wednesday, Friday

3.5.5.3.2.1 STRENGTHS OF ANN ARBOR/UM-WMS OPTION

Ease of Implementation: The City of Ann Arbor / UM-WMS program is equipped to handle the volume of waste expected to be generated by both UH and Mott kitchens each day. Additionally, while UH transitions its operations over the next year, UM-WMS is willing to gradually expand its services to meet PFANS needs during this time.

Hauling Service: Additionally, UM-WMS program would be responsible for the hauling of food waste, limiting PFANS and Environmental Services responsibilities to the collection and staging of food waste for pick up. UM-WMS would provide the necessary 40 gallon toters for food collection, providing clean, empty bins to the hospital upon collection of filled bins.

Cost: The UM-WMS offers an affordable option for PFANS. This is due to the low hauling costs charged in part due to the City of Ann Arbor's close proximity to campus (reducing gas required) and UM-WMS operating the program at cost. Additionally, there is no tipping fee for disposing the organic waste at City of Ann Arbor's composting facility.

3.5.5.3.2.2 IMPORTANT ANN ARBOR/UM-WMS CONSIDERATIONS

Pick-up Schedule: Currently, UM-WMS is only equipped to pick-up food waste generated by PFANS Mondays, Wednesdays and Fridays. This could pose a particular challenge to the PFANS food waste program as it would expand the amount of space required in the hospital docking area to support the program and require particular placement of the food waste bins in the docking area because of concerns about odor and rodent control. However, hospitals such as Spectrum Health in Kalamazoo have successfully implemented a food waste program in which a large dumpster of food waste is collected, staged in a docking area and collected by its organics hauler twice per week. Additionally, as demand for UM-WMS' services increases, there is potential for daily pick-ups of food waste to occur.

Contamination Level: WeCare Organics only accepts organic waste with 0% contamination level at the City's composting facility. To avoid fees for contamination, UMHS must ensure that its food waste program within the

kitchens is strictly adhered to by PFANS staff or otherwise, consider sorting its food waste prior to or upon delivery to the City's facility.

3.5.5.3.3 REVALUE WASTE

ReValue Waste (formerly known as ReValue Ann Arbor) is a commercial hauler and composter. This social enterprise's service extends beyond hauling food waste to its composting site to include education and data collection. ReValue Waste's current clients include local grocers, restaurants and institutions.

ReValue Waste is prepared to haul organic waste from the hospital docking area at any time (24/7). The company hauls the organic waste to Corman's Farm and the Washtenaw Food Hub where it is sorted and prepared for windrow composting. ReValue Waste sells the compost it produces.

Figure 10: Program Details for Revalue Waste

Program Details	Values
Hauling fee	$495-$695 per month
Tipping fee	Included in Hauling fee
Accepted contamination level	10%
Fee for contamination in organic waste	N/A
Schedule for collection of organic waste	Anytime

3.5.5.3.3.1 STRENGTHS OF REVALUE PROGRAM

Full Service Model: ReValue Waste provides a full service option for managing PFANS' organic waste. This service model includes providing clean toters for PFANS to use in staging waste in the hospital docking area, hauling services, employee training, program data and a site for disposing PFANS' organic waste. Therefore, PFANS would be able to manage one contract to manage its organic waste program and reduce the labor hours needed to track the progress of its program.

Data and Program Tracking: Unique to the off-site option provided by ReValue Waste is the company's commitment to educating its clients on organic waste produced and tracking the quality, composition and amount of its client's organic waste. This service would reduce the need for PFANS to conduct its own waste sorts and implement tracking systems to evaluate its organic output in order to achieve sustainability program goals.

Contamination Level: ReValue Waste allows for 10% contamination in the organic waste of its clients. While the implementation of a food waste stream can support a 0% contamination level if accompanied by appropriate training and employee involvement, the 10% contamination level provides room for error. This may be particularly helpful as the program is rolled out across both kitchens and would avoid high contamination fees charged by other off-site services.

3.5.5.3.3.2 IMPORTANT REVALUE CONSIDERATIONS

Contract Commitment: ReValue Waste encourages its clients to enter into three-year contracts for its services. Therefore, PFANS should evaluate whether it can commit to its program both operationally and financially and how these commitments might develop or change over time.

Cost: When evaluated on a cost per cubic yard or volume basis, the ReValue Waste solution may be more costly than other offsite options available. However, this should be evaluated with the understanding that ReValue Waste offers comprehensive services.

3.5.5.4 COMPARISON OF OFF-SITE OPTIONS

As mentioned above, our team concluded that an off-site disposal option would be feasible for PFANS to implement at this time. Criteria identified below can be used to evaluate and compare off-site disposal options for the food waste generated by PFANS. These criteria consider ease of implementing the program, cost, environmental impact, contamination level allowed, flexibility of hauling and dumping food waste, and data collection and program tracking. Depending on PFANS priorities and concerns related to a potential food waste program, the organization can determine which option meets the department's needs for a food waste program.

Figure 11: Criteria for Comparison of Off-Site Disposal Options

Off-Site Option	Ease of Implementation	Environmental Impact	Contamination Level Allowed	Flexible Schedule	Data Collection and Tracking
Tuthill Farms	Low	Medium	Low	Medium	No
City of Ann Arbor	High	Low	Low	Medium	No
ReValue Waste	High	Low	High	High	Yes

Of the criteria outlined, food waste disposal costs will be a critical decision factor as UMHS continues to manage budgetary constraints. Below is a breakdown of food waste disposal options by cost assuming 148,168 lbs. of food waste annually. Please note, while Tuthill Farms appears to have the lowest cost, this option does not account for the cost of hauling the food waste to the farm. This hauling fee may cause the program to be twice as expensive unless PFANS were to find a low cost hauler, haul the waste using UMHS' vehicles or partner with other programs on campus using Tuthill Farm's service. Additionally, ReValue Waste provided its cost assessment based on higher expected volumes of food waste than our study suggested. Therefore, there may be an opportunity to re-evaluate the cost range of this program if the projected amount of food waste is reduced.

Figure 12: Cost Comparison of Off-Site Disposal Options

Off-Site Option	Weekly	Monthly	Annually
Tuthill Farms	$38-$66	$165-$286	$1976-$3432
City of Ann Arbor	$118	$504	$6,132
ReValue Waste	114-$160	$495-$695	$5940-$8340

Our analysis leads us to recommend ReValue Waste as offering the greatest value to PFANS based on its full service model, ease of implementation and cost range as compared to City of Ann Arbor and Tuthill Farms option.

3.5.6 OFFICE RECOMMENDATIONS

Each of the two kitchens that PFANS operates has an office for kitchen managers and an associated call center that handles patient meal orders. PFANS also occupies 13 office spaces in North Ingalls Building (NIB) for operations administrators. Call centers and kitchen offices are more closely associated with the kitchens and will generally use the same waste streams. Though located within the kitchens, these spaces more closely resemble a typical office setting, as do the offices in NIB. As such, sustainability in these spaces will require changes more characteristic of general workplace initiatives rather than the operational kitchen recommendations made above.

3.5.6.1 RECOMMENDATION: INTEGRATE NEW WASTE STREAMS INTO WASTE DISPOSAL PROCEDURE WITHIN KITCHEN OFFICES

As new waste streams are delineated within PFANS' overall waste stream, it will be important that kitchen managers and office staff are as invested in appropriate waste separation practices as kitchen employees will need to be. This includes both manager offices and call centers. Not only does the commitment of managers to lead by example in utilizing new waste streams contribute to the successful implementation of recycling and food waste disposal efforts, but it also presents a potential opportunity for cultivating of a sense of teamwork between employees and managers.

Waste generated in the offices that could be part of a landfill diversion stream should be disposed of in the appropriate stream container. This necessitates either that additional bins be located in each office or that staff be diligent about walking waste to an appropriate bin within the kitchen. It might be necessary to locate extra bins in the call centers, specifically, since call center clerks are required to remain at their posts and the UH call center is not located within the kitchen itself. At the end of each day, desk side trash in kitchen offices should only contain non-compostable/recyclable trash. Periodic auditing of office trash bins can help ensure diversion compliance by office staff.

3.5.6.2 RECOMMENDATION: BECOME CERTIFIED THROUGH THE OFFICE OF CAMPUS SUSTAINABILITY SUSTAINABLE WORKPLACE PROGRAM

The University of Michigan OCS has recently launched a Sustainable Workplace certification-based program in which simple recommendations with respect to energy, waste, procurement and awareness are tailored to the context of individual workplaces. We recommend that the PFANS offices, those located within hospital kitchens, the call centers and the administrative offices located in North Ingalls Building, participate in the Sustainable Workplace program and become certified at the Gold or Platinum level. Participation ensures that PFANS is approaching sustainability as holistically as possible, not only through modifications in kitchen processes.

3.5.6.3 FINANCIAL AND ENVIRONMENTAL ANALYSES

Both recommendations above require primarily behavior changes that do not have significant financial impacts. Most prerequisites for certification in the Sustainable Workplace program require participation in programs and services that are already available to UM workplaces and/or adjustments to workplace habits.

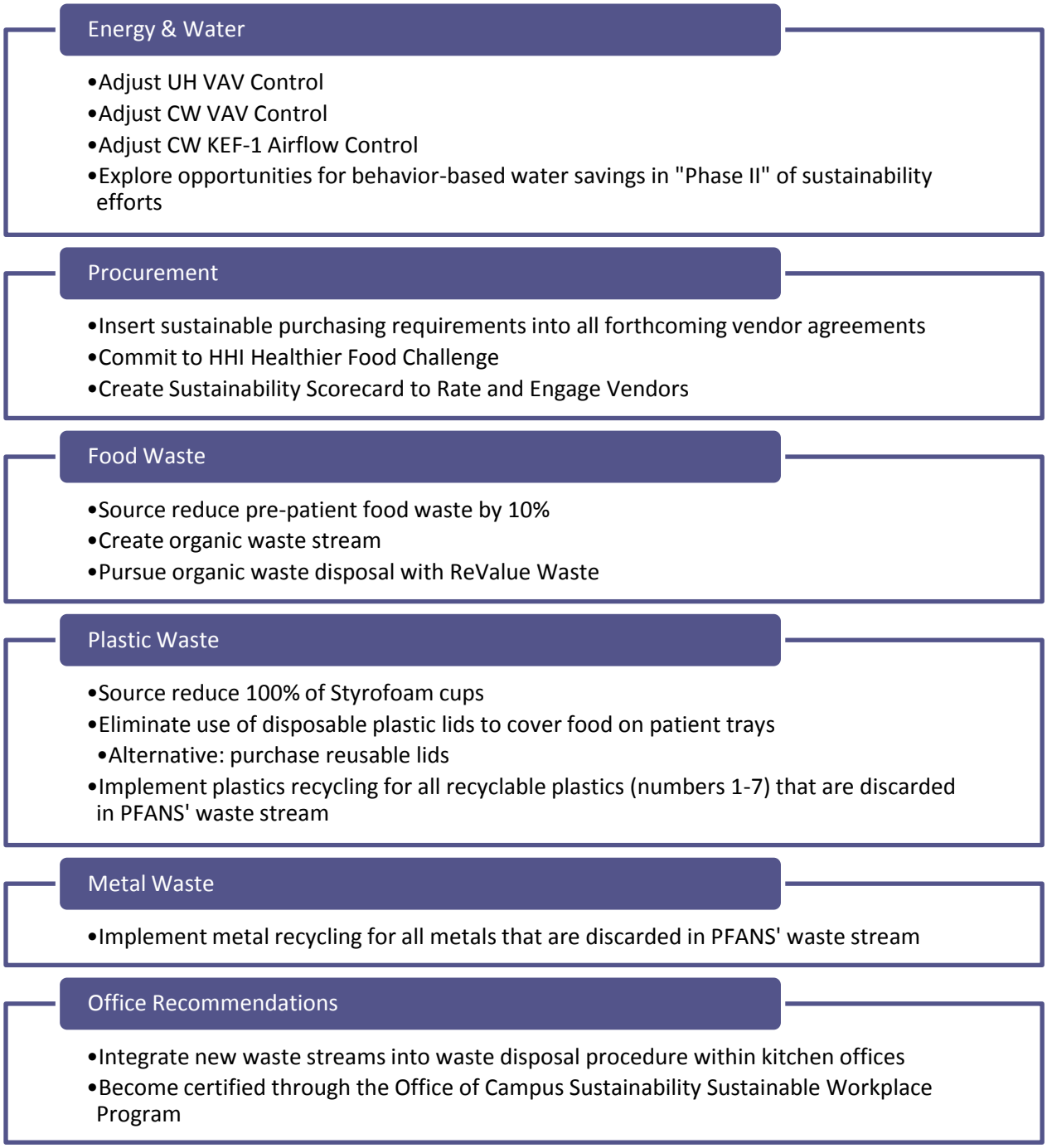
Participation by kitchen office staff in recycling and food waste sorting efforts is a necessary component of successful implementation of the numerous waste stream recommendations above. Benefits of office staff participation are included in the environmental assessments of each recommendation in preceding sections.

The environmental benefits of the Sustainable Workplace program are dependent on the level of participation/certification and are estimated based on workplace assessments by OCS staff. Those estimates are outside the scope of this study, however, significant savings in energy use can often be accomplished through typical recommendations made in that program.

3.6 RECOMMENDATION CONCLUSIONS

As outlined above, our team developed a series of comprehensive recommendations that evaluated both short- and long-term opportunities, considered passive operational changes and behavior changes and determined the environmental and financial impact if implemented. Our recommendations show that PFANS has the greatest areas of opportunity in implementing sustainable practices in its management of waste and procurement practices. While areas for improvement have been identified for both energy and water, organizational structure in terms of who captures savings from these initiatives, as well as the large investment required to significantly reduce energy and water usage, makes these areas more challenging to pursue.

Figure 13: Recommendations



Additionally, our team considered how recommendations for PFANS fit into the broader sustainability goals of the University of Michigan. As mentioned earlier, the University of Michigan aims to achieve 40% waste diversion and 20% energy usage reduction by 2025. Depending on the level of implementation of our recommendations, PFANS has the opportunity to achieve up to 55% waste diversion and 8% energy usage reduction.

To evaluate the potential impact of our recommendations, we outlined a series of diversion scenarios (See **Exhibit 6**). This allowed us to consider the collective impact of recommendations at varying degrees of implementation. In improving from its current rate of diversion of 3.41%, PFANS has the opportunity to make small diversion improvements through using the hospital's infrastructure more efficiently with more significant diversion advancements through diverted organics and select products (i.e. Styrofoam and plastic gloves).

Critical to the success of the sustainability initiatives this report proposes is ensuring that employees are actively informed of and involved in the implementation and management of these initiatives. This coupled with a collection of useful metrics and tools and a methodology for tracking these metrics will ensure that the programs are regularly reviewed for effectiveness, integrated into the overall strategy and mission of PFANS and communicable to the greater UM Health System and University community. By following these recommendations and establishing the necessary tools and structure, PFANS will have the opportunity to establish itself as an important example of sustainable food service delivery in healthcare.

4 EMPLOYEE ENGAGEMENT

4.1 BUILDING A CULTURE OF SUSTAINABILITY

Hand in hand with changes to operations and strategic planning comes behavior change, the foundation of our framework. This component is really about employee engagement and will not only be vital to the success of PFANS' sustainability program, but the key to building a culture of sustainability. This report outlines the environmental benefits and financial implications of change, but why engage employees in sustainability in the first place? What does PFANS stand to gain from effective employee engagement around sustainability issues? While the definitions of employee engagement are varied, common to all is the notion that employee engagement is a desirable condition. A well-read review of employee engagement by psychologist Dr. William H. Macey puts forward that employee engagement, unlike one-dimensional employee satisfaction, has an organizational purpose and connotes involvement, commitment, passion, enthusiasm, focused effort and energy. That is, "it has both attitudinal and behavioral components" (Macey & Schneider, 2008). To put its importance in context, according to an update of a popular 2001 Gallup poll, actively disengaged employees, which are people fundamentally disconnected from their jobs, cost the U.S. economy between $400 - $500 billion a year (Gallup Client Support, 2011). However, also according to Gallup, "teams of emotionally engaged employees deliver significantly better growth (productivity, profitability and customers) and cost-reduction (turnover, absenteeism, theft and safety) outcomes than disengaged work teams" (Fleming & Harter, 2012). By seeking employee input, capitalizing on their expertise and creating a sense of a shared team effort in being a leader in sustainability, PFANS will be able to drive a much more bottom-up approach that will not only ease program implementation, but could also establish long-term viability and increase employee satisfaction and retention.

Changing culture takes time, roughly 6-10 years according to those who study change management. One advantage that PFANS has to draw on is changes coming at the broader UMHS and University of Michigan levels. The University's vision for sustainability reads, "We dedicate ourselves to ethical and responsible stewardship of financial, physical and environmental resources. We look for tools and strategies to create and enhance sustainable practices in all facets of operations and seek to lead in the global quest for a sustainable future." In

addition, in September 2010, University President Mary Sue Coleman issued a set of University-wide sustainability goals to be measured against a FY2006 baseline and achieved by 2025. This includes a commitment to reduce waste tonnage sent to landfill by 40%. Every area of the University is expected to be a part of achieving these goals, including Michigan Athletics and UMHS. President Coleman said, "I want the message to be clear: Sustainability defines the University of Michigan. Combine maize and blue, and you get green." The University's goal is to create a seamless culture of sustainability across campus and both UMHS and PFANS should be a part of creating that culture.

The UMHS Sustainability Steering Committee has also worked on aligning the UMHS vision for sustainability within the larger University context. Its vision reads, "We aspire to be a healthcare industry leader and corporate citizen for environmentally responsible practices, featuring: 1) Appropriate use of natural resources 2) Contributions to safe and healthy communities and 3) Education and engagement at all levels." PFANS' own goals should reflect these values held by the larger organizations of which it is a part. In fact, one of our clear recommendations is to *align with the sustainability mission, vision and organizational pillars of UMHS when communicating sustainability*. See **Exhibit 9** for some examples of leading sustainable hospital's vision statements and values, including UMHS.

Since before 2000, UMHS has been actively involved in environmental stewardship initiatives—robust recycling and reuse programs, becoming a mercury-free environment and energy consumption reductions—and has achieved regional and national recognition for its efforts, but employees of the health system generally know very little about these accomplishments. For example, only one survey respondent knew about UMHS winning the 2012 Practice Greenhealth national Environmental Leadership Award and only half knew about Mary Sue Coleman's University sustainability goals. The culture of the organization does not yet reflect the seriousness with which the health system approaches sustainability, nor the larger sustainability culture of the University. Employees of the health system need to visibly see and feel that the health system at large values sustainability otherwise the culture will not change. PFANS has the chance now to lead by example in making these changes more visible and passing these values on to employees. It also aligns with the Health System's new internal strategy of reengaging the staff in sustainability from the bottom up. In fact, PFANS, as the hub of food-related efforts in the health system, has a unique role to play in pushing the boundaries of UMHS' overall sustainability efforts. According to a Brighter Planet survey of 1000 organizations, "the most effective programs promote sustainability in emerging areas like business travel, purchasing, water use and food at much higher rates than their ineffective counterparts" (Brighter Planet, 2011).

In reality, employees want to do work that matters and may already be doing more environmentally-speaking at home rather than at work. According to our employee survey and focus group, at least half of individuals practice some sustainable practices at home, meaning that wasting less food reflects how people live at home. They want to be able to use those same behaviors in the workplace and PFANS needs to continue to provide the processes and incentives to facilitate these practices. PFANS could see the added benefit of increased employee satisfaction and retention. A recent study conducted by Rutgers University and released by Net Impact found that "employees who feel they can make an impact on social and environmental issues while on the job are twice as satisfied with work as those who don't" (Maw, 2012). See **Exhibit 10** for more detailed information. However, while the total number of organizations engaging employees in sustainability continues to rise (currently more than half), Brighter Planet found that the favorability of these programs is on the decline with

only 17% of workers deeming their employers' program "very effective" (see **Exhibit 11**). This may or may not be due in part to a shift towards management being the main advocate of sustainability rather than employees, which had been the norm prior to 2009. What is clear is that employee engagement, in addition to upper-level leadership, is still key to successful sustainability efforts.

We want to position PFANS as a leader in sustainability so in considering the employee engagement activities that will promote and maintain long-term adoption of pro-environmental behaviors, we asked ourselves the following questions:

- How do we help PFANS and its individual employees embrace these larger UM and UMHS cultural changes *in a context that speaks to them specifically*?
- How can PFANS promote long-term pro-environmental behavior in addition to incorporating sustainable behaviors into core tasks that employees perform to meet job requirements?
- How do we prevent or minimize environmentally irresponsible behaviors? These can be individuals that abstain from performing required sustainability activities that are expected of them, such as recycling, or actively perform behaviors that harm the environment.

4.2 BEHAVIOR CHANGE: PASSIVE VS ACTIVE

To address these questions we needed to make recommendations that fit the organization, the flow of the kitchen, the available physical space and address the issues with most potential to impact the environmental and financial bottom line. As this report has outlined, we have determined a clear set of new practices that encompass passive as well as active behavior changes.

Passive changes, once implemented, can be relayed to employees as successful small wins, particularly if they have a clear metric or result to report. We highly recommend that PFANS management celebrate these small wins and use them to tackle larger and more active changes. Examples of passive changes include just in time service (reduced food waste), switching tray type to avoid the use of paper liners or implementing the energy saving measures Mr. Murphy identified. We know that in UH, the switch to paperless trays could eliminate roughly 75% of its paper waste over the course of a year.

Other recommendations include a combination of both passive and active changes such as adjusting the storage of frozen items in C&W to avoid having to open the freezer more than 1-3 times per day, but also needing the right operations to support less freezer openings each day. However, the majority of our waste related recommendations require active employee participation and this is where employee engagement around sustainability can help support these changes. See **Figure 14** for a breakdown of all recommendations.

Figure 14: Breakdown of Passive and Active Recommendations

Recommendation	Type of Change
Adjust UH VAV Control	Passive
Adjust CW VAV Control	Passive
Adjust CW KEF-1 Airflow Control	Passive
Explore opportunities for behavior-based water savings in "Phase II" of sustainability efforts	Active
Source reduce pre-patient food waste by 10%	Active
Utilize organic waste stream	Active
Engage ReValue Waste for organic waste disposal	Passive
Source reduce 100% of Styrofoam cups	Passive
Eliminate use of disposable plastic lids to cover food on patient trays	Passive
Implement plastics recycling for all recyclable plastics (numbers 1-7) that are discarded in PFANS' waste stream	Active
Implement metal recycling for all metals that are discarded in PFANS' waste stream	Active
Integrate new waste streams into waste disposal procedure within kitchen offices	Active
Become certified through the Office of Campus Sustainability Sustainable Workplace Program	Active
Insert sustainable purchasing requirements into all forthcoming vendor agreements	Passive
Commit to HHI Healthier Food Challenge	Passive
Create sustainability scorecard to rate and engage vendors	Passive and Active

The truth is you need both passive and active changes. Living in an energy efficient home does not excuse someone from actively recycling and the same should be said for workplace-related sustainability efforts. That is, real behavioral change might lead an individual to choose to retrofit their home, but the reverse may not be true. Behavior change has the potential to have the biggest total impact because it can change how an employee approaches decision-making and engages with their job, both on a daily basis and long-term. It produces employees with a willingness to invest themselves and expend their discretionary effort to help the organization succeed. It is how PFANS and UMHS will build new social norms and a *culture of sustainability*.

4.3 RECOMMENDATIONS

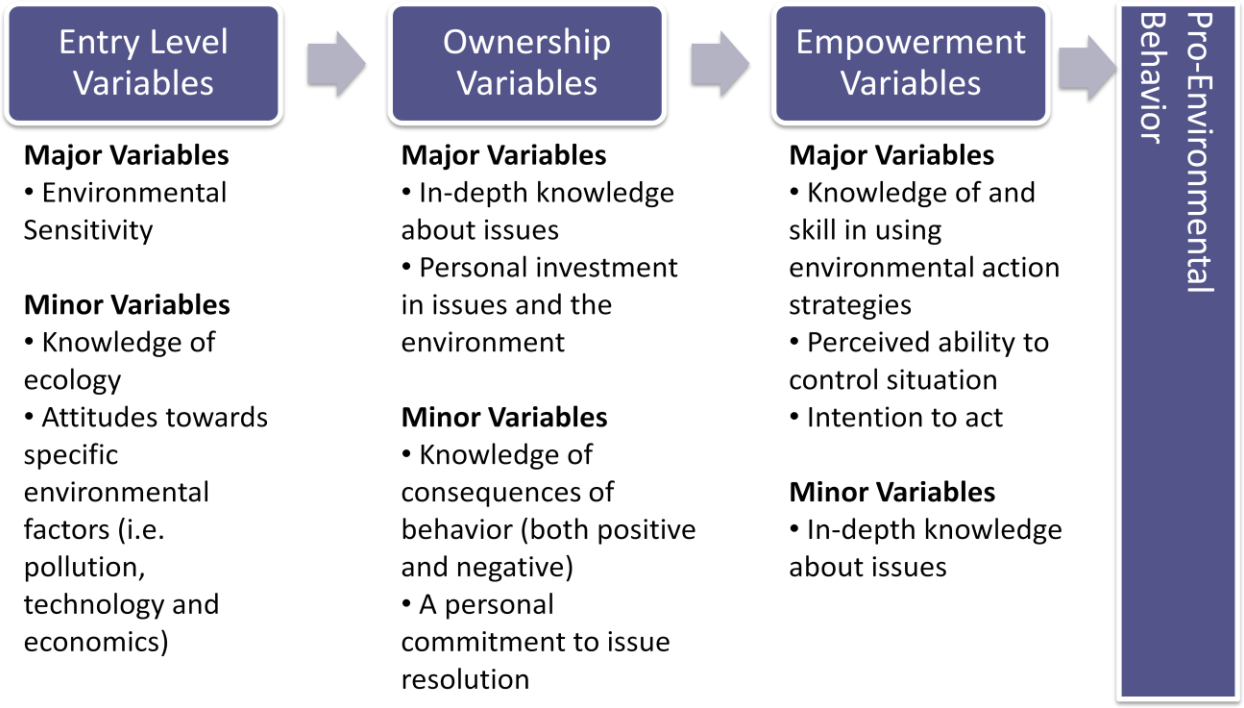
A focus on (1) visible communication, (2) training/tools and (3) promotion of teamwork will be the three keys to successfully changing behavior within PFANS

Using data from our focus group, feedback from managers and employees throughout the project, and our secondary research we have identified three areas that PFANS needs to strengthen if its sustainability efforts are

to be successful. Testing these activities, tracking results and communicating those results will help PFANS serve as a bottom-up approach pilot for the rest of the health system.

To help put our communication, training and teamwork recommendations into perspective we will use an adapted basic behavior change framework put forth by Hungerford and Volk as part of a 1990 UN conference on behavior change's role in sustainable development (see **Figure 15**).

Figure 15: Adapted Hungerford & Volk Behavior Change Model



Source: (Hungerford & Volk, 1990)

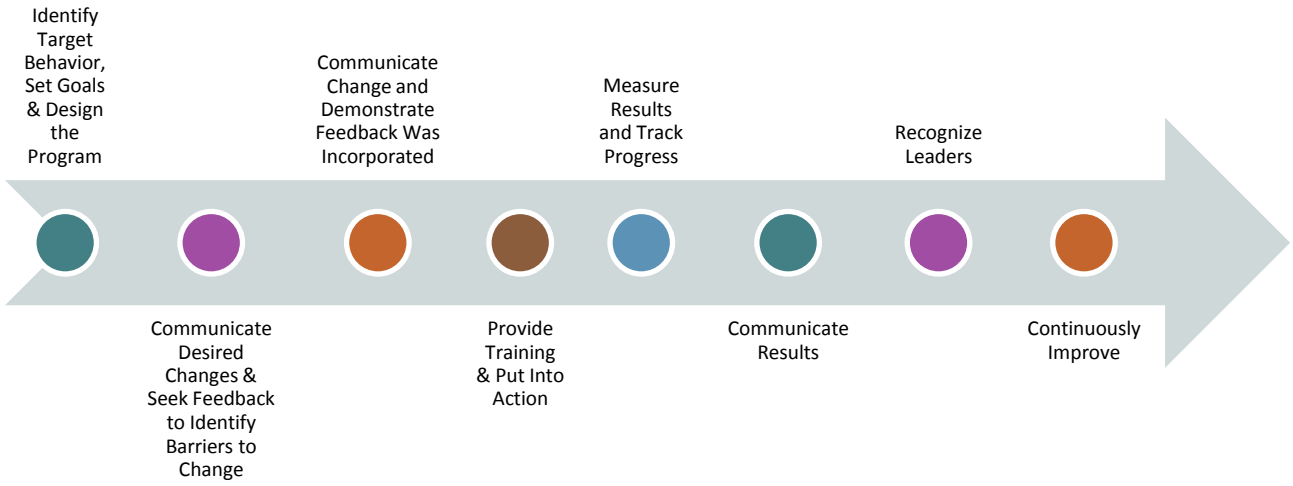
The model suggests that there are several factors that lead to pro-environmental behavior that PFANS has the ability to attempt to affect or tap into in some way. "Entry level" variables, while they change over time, particularly with increased exposure to environmental practices, will be the hardest to influence from the outset. However, they can help to identify potential advocates for sustainable practices amongst the staff. Even from our survey sample five of the seven respondents out indicated that climate change was a "somewhat important" or "very important" issue to him or her personally. However, all seven survey participants indicated they were either somewhat or very committed to sustainability regardless of their feelings towards climate change. Combined with the feedback we received from the eight participants in the focus group this group of employees seems to have an overall interest in pursuing pro-environmental behaviors and sees the merit in it regardless of personal feelings towards large-scale environmental issues. Our survey clearly indicates that the development of the next two factors, "ownership variables" and "empowerment variables," are still inconsistent amongst staff. The rest of this section will discuss how to build up the requirements in each of these areas

through a robust education, training and feedback mechanism to small group social situations to increase feelings of personal responsibility.

However, first to help clarify, let us apply this framework to promotion of recycling. Although we may not immediately be able to affect entry level variables, we can use it to our advantage by searching for a person who has environmental sensitivity and perhaps an internal locus of control (a person who believes he or she has the ability to control events that affect them). This person would be more likely to listen and try out a new behavior. Next, we would approach the ownership variables by sharing WHY we want to increase recycling and the benefits, both financial and environmental, that could be achieved by recycling. However, we cannot stop there: next would be tackling the empowerment variables, which corresponds with our training and tools recommendation. We would try to fulfill those requirements by teaching the person how to take such action (i.e. recycling), communicating potential action strategies (i.e. how to sort recycling properly) and making proper bins available to empower the individual to act. If the process has been designed in a way that makes change achievable and the person feels that they are part of a larger process with a goal they will be more likely to act. Over time, pro-environmental behaviors can begin to develop those entry level variables and increase the likelihood of an individual adopting non-targeted behaviors.

Figure 16 below shows the recommended basic engagement process for PFANS. The following three sections will highlight how each of our three overarching recommendations for employee engagement—communication, training/tools and teamwork—supports carrying out this process.

Figure 16: Basic Engagement Process



4.3.1 COMMUNICATION

The Health System as a whole must clearly define and articulate what the organization's broader mission and priorities are first, and then connect the dots to every department and level of staff. While this is a stated goal of the UMHS Sustainability Steering Committee, our survey indicated that all participants knew little to nothing about the awards the health system has received for past environmental practices, C&W's LEED certification or about Mary Sue Coleman's university sustainability goals. They also are not overly confident in their understanding of larger hospital waste management practices, although they did express familiarity. It is clear that there is a lot of room for growth in terms of bi-directional communication. Most employees want to feel a direct link between their day job and making a social and environmental impact, but that can be difficult when bogged down in the grind of daily responsibilities. Communication is one way to help address this disconnect. Inova Health System is implementing and building its sustainability programming credits "over communication" of its goals and program details, particularly in a visible manner in the form of emails, posted signage, events and training as being one of the keys to its success.

Employees need to know why changes are being implemented *before* they are implemented and should have a chance to participate in the process. For example, employees indicated that filling out waste logs thoroughly and consistently could add a significant amount of time to their jobs. This tells us that it is imperative that we properly explain *why* we need the waste logs, provide the right training and the amount of time necessary to do it and, most importantly, show them the results/progress on key metrics that that the waste logs reveal. One employee explained, "if I felt like it was worthwhile and that it was important, I'd be willing to do more."

One effective method to sustain sustainability efforts is feedback on the results of those efforts and is a step in our recommended engagement process. If you can get those who are responsible for enacting the new measures to also verify the results, that is even better (with appropriate oversight so ensure correct measurement). The use of the waste logs is a perfect example of this. Overall, if people cannot see the results of their efforts, new practices will eventually slip back to old behaviors (see **Exhibit 12** for an example of LeanPath-based results feedback). The more immediate

COMMUNICATION BREAKDOWN & THE IMPORTANCE OF FEEDBACK

The galleys located on each floor provide a staging and holding area for PFANS. Galley workers are tasked with offering patients supplemental snacks as proscribed by PFANS dieticians. Due to strict nutritional requirements, galley workers must complete a daily log indicating whether patients accept or deny these snacks.

However, galley workers indicate that it is unclear if these logs are reviewed regularly because of lack of a feedback process. Some patients never accept snacks, creating food and material waste, yet galley staff members are tasked with repeatedly offering snacks each day.

Without proper feedback from the dieticians, galley employees are left to wonder what becomes of the log data they keep. In instances where patients repeatedly refuse the supplements, are snacks continually offered for treatment purposes or because the logs are not checked and thus dietary plans are not modified?

Questions like these can lead galley workers to believe their careful documentation is not important and discourages them from putting in the effort to do this task well. A simple feedback mechanism that acknowledges the employee's effort and shows potential action being taken to reduce the waste, can go a long way towards ensuring happy, engaged employees.

the outcomes of new practices are reported, the better. Throughout this report, we have discussed potential metrics associated with each one of our recommended changes to operations. Measurements in the right areas will allow PFANS to diagnose problems more quickly, better use resources and improve through an iterative methodology.

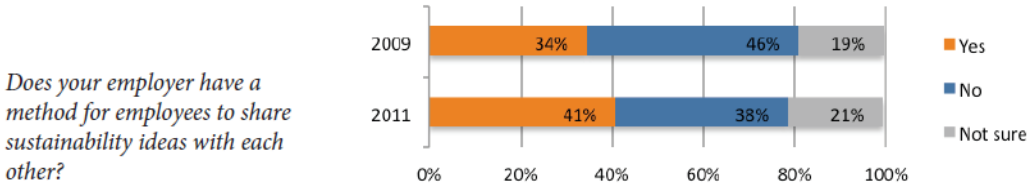
Outward communication is also an important part of this effort as it can 1) feed into UMHS and University level reporting and 2) bring recognition to PFANS management and staff. Detailed research into the proper methodology for reporting was not a part of the scope of this project, but we suggest that PFANS participate in any larger efforts by UMHS including email marketing and community benefits reporting. An interesting example of how sustainable food efforts were used by a hospital in outward reporting is Fletcher Allen, which used kitchen staff specifically in its marketing videos posted on its website and those shown inside the hospital on its TV screens. A woman we spoke with at Fletcher Allen said that "now that it is part of our culture the marketing department is much more willing to help us push these things and are open to our incremental ideas." Furthermore, at Fletcher Allen all patients are introduced to the dining service process and the focus on local, sustainably-sourced foods through a video that is shown on the screen in every patient room upon admittance.

A more aggressive messaging technique would include the incorporation of a card that highlighted sustainable efforts—such as conveying that the food not consumed will be composted—placed on every tray delivered. Fletcher Allen, North Shore-LIJ and other systems have all expressed interest in finding an effective and paperless way to do this and have set it as a goal. When one North Shore-LIJ system hospital incorporated a tray card system to highlight its chefs' culinary certifications, they saw a marked increase in patient satisfaction with the food service. There is room for PFANS to innovate in original ways to share sustainable practices with patients that could set its program ahead of its competitors.

4.3.1.1 SEEKING FEEDBACK: FEEDBACK BOARD AND FOCUS GROUPS

Part of opening lines of communication and a next step in the engagement process is seeking feedback. According to Brighter Planet, "41% of employers now support methods for staff to share sustainability ideas directly with each other; up from 34%...this is a key trend, as inter-employee sustainability communication correlates strongly with employee engagement program effectiveness." The report also states, "organizations with a method for employees to share ideas were more than six times as likely to have a very effective program" (Brighter Planet, 2011).

Figure 17: Sharing Sustainability Ideas



Source: (Brighter Planet, 2011)

Our interaction with staff throughout this project has indicated that employees generally feel that they do not have an open line of communication with management or a clear (well-understood) manner in which to give feedback or make suggestions. This could be extremely detrimental to implementation of sustainable practices given the data on effectiveness that Brighter Planet observed and the generally stereotypical view that sustainable behaviors require sacrifice. While on a positive note employees indicated they would feel very comfortable "asking their supervisor or manager to consider a new environmentally-friendly or "green" practice or initiative that he or she felt was important," no employee indicated that he or she had done so in the past year. This seems to support the idea that employees want to share feedback/ideas, but do not feel that they have a clear process for doing so.

4.3.1.1.1 FEEDBACK BOARDS

We recommend employing a strategy that has been used successfully by both Fletcher Allen and Gundersen Lutheran, two leaders in this space. They have instituted a feedback board that they use prior, during and after implementation new programs. Employees are encouraged to write thoughts and suggestions on a publicly displayed board inside the kitchen. Managers are then tasked with reviewing the suggestions and then writing on the board how the feedback was either incorporated or addressed. They do this for every piece of feedback received so that employees visibly see how their contributions are taken into consideration. Fletcher Allen indicates that the board has been extremely successful in making employees feel a part of the decision-making process and fosters buy-in and adoption of practices.

4.3.1.1.2 FOCUS GROUPS

As part of the feedback system Fletcher Allen has also instituted the use of focus groups. We piloted this technique during the course of the project by setting up a staff-only focus group with eight PFANS employees. Overall, we found this process to be extremely enlightening and positive. All eight participants indicated that they liked this format and found the experience worthwhile, so much so that they would be willing to participate in similar forums in the future. We recommend that PFANS build on this success by creating a more structured format that spans across both kitchens.

Overall, the social support present in small group settings, like in a focus group, can motivate solution development and make individuals more likely to want to see the program succeed in the long-term. That is, they will have a stake in the outcome, feel a more acute sense of personal responsibility and may be more likely to attempt to influence co-workers' behavior—a clear connection to the empowerment variables previously discussed.

Involving individuals in the process can promote intrinsic motivation, a much more durable behavior change tool than external rewards, because they can find personal justification for the behavior. Such intrinsic motivators can include competence (in an action), frugality (saving money for the organization) or participation (contributing meaningfully to a larger team). The use of feedback systems can allow PFANS to identify these intrinsic motivators. Studies find that individuals are motivated by exploring solutions, sharing successes and failures with a team and gaining the respect of others. All of these can play out with the consistent use of focus groups.

4.3.1.2 MESSAGING

As discussed in the benchmarking section, as much as possible, messaging for PFANS efforts should have a wellness/nutrition focus as both PFANS employees and patients identify with these goals and values. Our own research gives some validity to this concept. All eight focus group participants identified in the highest two categories—"very concerned" and "somewhat concerned"—when asked how concerned they were about whether the food served to patients is produced in a way that is potentially harmful to the environment. This was true even for participants who expressed little or no concern for the overall use of natural resources by UMHS or the effectiveness of its recycling programs.

4.3.2 TOOLS AND TRAINING

In line with the empowerment variables, PFANS needs to ensure that employees are given the tools and training to implement change. As we worked with employees throughout the project to implement waste logs, the LeanPath system and to participate in our focus group, we observed that staff expressed concern over both knowing what is expected of them and whether they have the time and tools to actually carry out these tasks. They indicated that up front training could be improved and recognized that over time sometimes the expectations of what they were to do did not align with the structure of their workday. This becomes exacerbated when jobs are consolidated, which is something PFANS may be facing more in the near term due to the switch over to room service dining in UH. It is clear employees need the right amount of time to complete the tasks properly otherwise, they will become discouraged from carrying out these behaviors.

This is also an opportunity for PFANS to link the "why" of certain practices to the practice itself. Sustaining behavior change takes investment in time and resources. Action should be taken after training to ensure that change is sustained for lasting impact, which is where the feedback suggestions in the previous section can be used. "Focus on training delivery rather than one-off training initiatives and follow-up activity is needed to sustain effective behavior change" (Scrivener, 2012). Consulting firm McKinsey maintains that training should not be a one-off event; instead, a "field and forum" approach should be taken, in which training is spread over a series of learning forums and practice is assigned in between. This will require employees to "put into practice new mindsets and skills in ways that are 'hardwired' into to the things for which [employees] are accountable" (Keller & Aiken, 2000). These assignments should have quantifiable, outcome-based measures that indicate levels of competence gained, and certification that recognizes and rewards the skills attained.

4.3.3 TEAMWORK

Employees also need the following three things in place to be willing to make changes: 1) they need to know *why* they are doing it, 2) *how* they are going to be able to do it and 3) the *outcomes* of change. These three factors are not specific only to sustainability, but because you are asking your employees to do more or to incorporate new values into the work they do, these three categories are even more essential to success in this case.

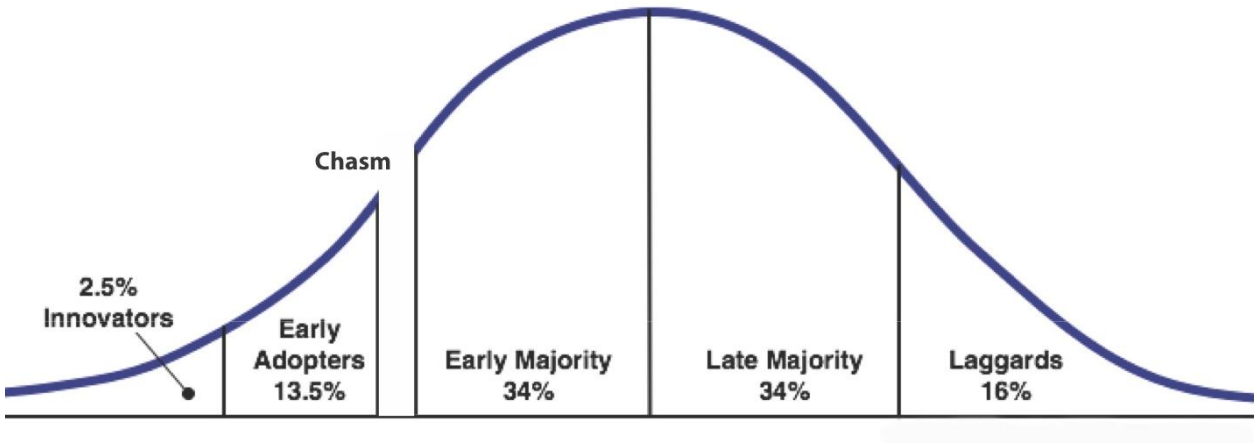
Overall, PFANS staff has stressed that they would like to feel that they are part of a team WITH management. In a study by the Forum Corporation, "the most frequently cited reasons for failure to sustain behavior change

were lack of management commitment (62 per cent) and insufficient measurement (58 per cent), followed by lack of employee commitment (36 per cent), poor communication (36 per cent) and lack of integration of behavioral change into daily work (29 per cent)" (Scrivener, 2012). The study argues that managers are likely to be less committed if they have insufficient data to prove some type of payoff, whether that is financial or otherwise. Working directly with management in the small group feedback format could help build that team-like feeling. Continuing to involve the highest levels of PFANS management in the UMHS Steering Committee meetings would be another way to help solidify management backing. Strong commitment on the part of kitchen managers to successfully maintain multiple material waste streams, or to abstain from the use of Styrofoam, for example, also creates opportunities for fostering the teamwork paradigm "on the ground" with kitchen employees. In the long-term, PFANS, Cafeteria Services and UMHS as a whole could consider hiring a full-time sustainable food program manager like Kaiser Permanente did to oversee its sustainable food efforts across the organization so that all areas of the health system are all working towards similar goals.

4.3.3.1 IDENTIFY GREEN "CHAMPIONS" TO SUPPORT CHANGE AND ADVOCATE AMONG STAFF

In a way, sustainable efforts can be charted on the basic adoption curve (see **Figure 18**). Identifying green champions among staff can be a key tool in prepping UMHS overall to cross the chasm from early adoption to the goal of majority adoption.

Figure 18: Adoption Curve



As discussed in **Section 2** on Benchmarking, most hospitals (and at least seven we interviewed) find that the chefs in their kitchen are natural leaders and thus are often the most effective advocates for change. Fletcher Allen tapped into these leaders to run its three on-site gardens, for example. This seems like a natural fit for PFANS as well as the chefs at C&W seem to have taken on that role with the switch to dining service. However, they are not the only potential advocates. Six out of the seven employees surveyed responded "agree" or "strongly agree" when asked if they would consider playing more of a part in sustainability-related activities within PFANS if an opportunity was made available. While we did not participate in the focus group selection process so cannot determine if there are other factors at play, this does seem to indicate that there is already a pool of people within PFANS who are interested in helping the organization pursue sustainability objectives.

Other potential PFANS champions could be those who regularly interact with patients and nurses on patient units. They will be able to see what is happening on the patient floors and bring back valuable feedback.

At Spectrum Health, each of the hospitals has a green team. The hospital-level green teams work on implementing various sustainability initiatives in their respective facilities. Sub-committees are formed to focus on specific functional or departmental issues, e.g. pharmaceuticals or food. Individual PFANS employees have the opportunity to be green advocates within PFANS or the basis of a new highly-functional sub-committee for the overall health system. UMHS is also planning on bringing back some type of green team structure that is enmeshed with the University's Planet Blue ambassadors. PFANS should work with the Steering Committee on how to capitalize on this existing resource.

The key benefits to using a green champion and team structure are that it will ease program implementation, establish long-term viability, spread the work among many, drive feelings of personal responsibility and the intrinsic desire to do good. All of the hospitals we spoke with pointed to these advantages and many indicated that this structure has given them a baseline to spread awareness, educate, create visibility and gain employee buy-in.

4.3.4 EMPLOYEE RECOGNITION

Previously we mentioned the promotion of intrinsic motivation. This is extremely important for sustainability efforts, but we recognize the extrinsic motivators are also a useful tool (see Exhibit 13). Employee recognition is a strength that PFANS already has and the organization should build on its successes here and apply its process to its sustainability efforts. The written commendations or financial incentives that PFANS currently uses are applicable. The tools that are used may be contingent on whether sustainable criteria are incorporated into individual employee job responsibilities or performance metrics (discussed in more detail in **Section 4.4**). A unique example is Montefiore Medical Center in New York. The organization has CSR internal awards to promote cross-pollination of ideas, essentially measuring success by how much effect individuals had on *other* groups.

Some less traditional approaches could focus on competition, which is shown to be a strong motivator. Examples from other health systems and universities include a random recycling bin assessment per area of the hospital with letter grades assigned or competitive waste sorts. PFANS could also challenge other departments in competitions to spur inter-departmental efforts and bring recognition to the efforts PFANS started.

4.3.5 LONG-TERM IMPROVEMENT THROUGH EDUCATION & MESSAGING

Building a culture of sustainability will require an ongoing commitment to continuous improvement and education. We heard from one interviewee, "we [Fletcher Allen] are a teaching hospital so teaching about sustainability is important because teaching is engrained in the culture" (Holcomb, 2012). North Shore-LIJ takes a similar perspective and is building on its strong education infrastructure to support employee behavior changes related to sustainability by working to offer a "Greening the OR" course into its large training offerings. Similarly, PFANS can begin by taking advantage of UMHS' current work to align itself with the University's Planet Blue organization and use this group's education tools, signage and other marketing collateral. We would

recommend that PFANS plan to have a Planet Blue Ambassador visit the staff and give a set of educational presentations when they become available to the health system.

Other educational activities should be aimed at helping to cement the behavior changes learned. Focusing on this will increase the "empowerment variables" and begin to change individual environmental sensitivity. An example of an educational activity coupled with a communication tool is what Harvard University calls its Recyclable-of-the-Week. Each board near the dorm recycling bins features a recyclable of the week that was identified to be something that was frequently found in the trash that should have been recycled. It helps students concentrate on problem areas and gives them a new challenge to tackle each week. For example, yogurt cups were a frequent offender at the beginning of the competition, but their presence in trashcans dropped significantly during the competition.

Another tool that has been used successfully by several health systems such as Inova, North Shore-LIJ and St. Joseph's Mercy is a cook-off challenge to highlight fresh and healthy cooking. Inova had the CEOs of each of its hospitals compete and North Shore-LIJ had the head chefs of each hospital compete to create a dish that met specific nutritional parameters. Other hospitals like Geisinger perform healthy cooking demonstrations for staff and patients and Ohio State University Medical Center paired up with a trained chef from the Nutrition Services Department at the Ohio State University Medical Center to compete to create a unique dish using a mystery basket of ingredients that may help prevent cancer.

Initiatives focused on creating links between the practices inside the PFANS kitchens, patient outcomes and the environmental impacts behind operations will be the most effective in building environmental sensitivity and give employees a clear way to address their personal environmental concerns as indicated by the employee survey we conducted. For example, PFANS could organize an educational outing to the new UM campus farm through the University of Michigan Sustainable Food Program or host an opportunity for employees to actually participate in a waste sort of the PFANS kitchen trash and identify wrongly sorted material.

The suggested wellness messaging identified in the benchmarking exercise discussed at the start of this report can provide a platform to make additional changes in the future. In particular, it can help frame more aggressive changes such as an extension of food procurement from just local food to other sustainability metrics such as organic produce, sustainable fish or pasture-raised beef and eggs or menu changes such as the Mediterranean diet for heart health or reduction of high-fat foods for children. It can also help frame more progressive initiatives that other hospitals have begun to tackle such as Meatless Mondays and expanded farmers markets or a partnership with the new UM campus farm.

These types of changes could be a part of PFANS' continuous process improvement and eventually will position PFANS to be a model for support of the university-level goals and to participate in advocacy for sustainable food service and procurement at the local and state level (i.e. food hubs, farmer certification programs to serve the healthcare space, etc.).

4.4 MEASURING SUCCESS

The metrics for assessment of the other recommendations presented in this report will also serve as a barometer of how well employees are adopting active behavior changes. If the waste logs are filled out correctly

over the course of a quarter or year or if there is a reduction in overall food tonnage sent to compost it would indicate that employees are adopting the behaviors. Furthermore, as discussed, because engaging employees in sustainability issues has the potential to increase employee retention additional metrics such as first year turnover rate or average tenure length can be used to measure the success of employee engagement efforts. In the long-term, sustainability metrics could be worked into the performance review of both staff and management. This is an area that many health systems have not been able to achieve. It would most likely have to work in tandem with larger UMHS endeavors to incorporate these types of performance measures for employees from the top-down. Bon Secours Health System said that "success hinges in part on clear and formal processes of decision-making and accountability, as well as incorporating sustainability-related activities into core work processes rather than as voluntary or add-on activities" (Boone, 2012).

Whichever metrics are chosen to assess progress on PFANS' goals, management is required to communicate up front what will be tracked, provide feedback and make sure the right amount of time and proper tools are supplied. See Figure 15 below for some additional basic evaluation dimensions of behavior change. These criteria would be an excellent metric for assessing the use of the feedback board and the focus group technique described in this section.

Figure 19: Behavior Change Evaluation Dimensions

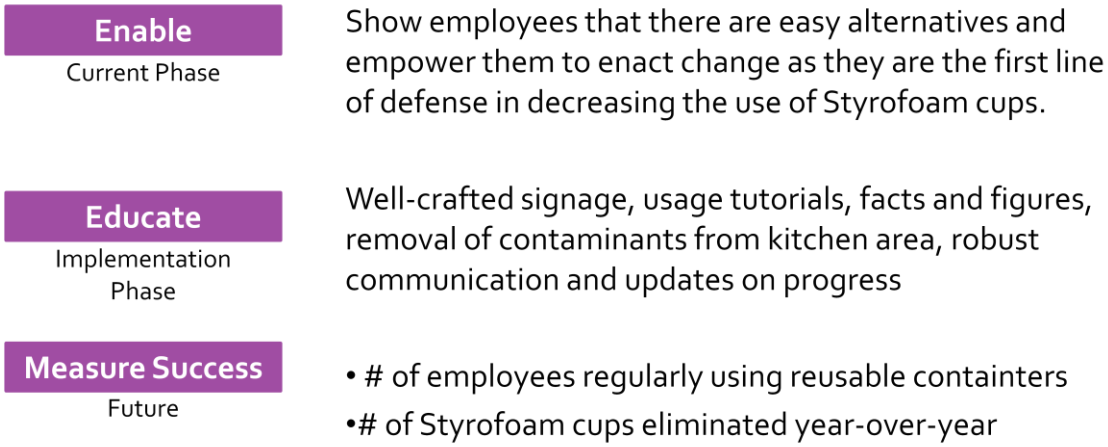
5 PRIMARY EVALUATION DIMENSIONS OF BEHAVIOR CHANGE	
Speed of Change	How rapidly can it affect change? How fast will one improve performance of an existing behavior?
Reliability	Percentage of people affected when first using technique? Does repeated exposure to the technique continue to work?
Particularism	Can it be applied universally or must it be customized for each context, culture and sub-group?
Generalizability	Does a person become a change agent for the target behavior? Is there a tendency for the person to adopt non-target behaviors?
Durability	Once behavior change is achieved, can it be maintained without repeated intervention?

The University plans to assess the development of the University's "culture of sustainability" with a campus-wide initiative called the Sustainability Cultural Indicators Project, a partnership led by the Graham Sustainability Institute and the Institute for Social Research. This year more than 4,000 U-M students and 1,500 faculty and staff members were surveyed about sustainability issues, which included about 400 participants directly from UMHS. The survey will continue to be conducted annually and can provide PFANS and the UMHS Sustainability Steering Committee with a progress report on changes in behavior and feelings towards sustainability issues. However, as part of our goal of garnering meaningful and more tailored feedback from the PFANS employees and to get a feel for the baseline level of understanding, we administered a modified version of the ISR survey (see Exhibit XX for a copy of the survey we created). It focused on issues closely aligned with PFANS' goals. We recommend that PFANS administer this survey to the full PFANS organization, including management, and then do so each year going forward as a way to assess staff development. It can be used as a way to assess particularism defined in **Figure 19** above. It can show if employees are adopting non-targeted behaviors, becoming "change agents" within the organization and promoting other sustainable behaviors independently

both for themselves and others around them. As opposed to those who simply modify only behaviors that are targeted by management. These change agents would be the employees targeted for any new "Green Team" structure created by the UMHS Sustainability Steering Committee or as test pilots/advocates for a new behavior targeted by PFANS in the future.

4.5 SUPPORTING A "TAKE BACK THE TAP" INITIATIVE WITHIN PFANS

Figure 20: Take Back the Tap Roadmap



According to the Sierra Club, 25 million Styrofoam coffee cups are thrown away every year, enough to circle the Earth 436 times which does not even include other uses of Styrofoam. As mentioned in the recommendation on Styrofoam source reduction, there are no low-cost alternatives to Styrofoam, thus eliminating its use from kitchen operations is not feasible at this stage. However, there is one type of use in PFANS operations that the organization can have direct control over, employee use of Styrofoam cups. See **Figure 20** above for a basic implementation timeline. The benefit of undertaking a "Take Back the Tap" initiative straight away is that making the switch to reusable alternatives is very easy in the kitchen space given the proliferation of other types of glasses, mugs and drinking receptacles. If management were to talk to staff about alternatives, set the goal of eliminating its use and, most importantly, stop requesting it from Materials Services this would help address the empowerment variables. Explaining to staff how much Styrofoam could be diverted from landfill and what that means in terms of the environment—given that Styrofoam takes more than 500 years to breakdown in a landfill and truly never fully decomposes—will address the ownership variables. Thus, our recommendation on Styrofoam source reduction has the fortunate distinction of supporting PFANS' environmental improvement efforts while simultaneously building its capacity for a culture of sustainability.

In fact, from our survey, we saw that 3 participants already "always/most of the time" use reusable containers like coffee mugs or water bottles and another 2 indicated they did so "sometimes." Again, due to the small sample size it is hard to draw verified conclusions, but at least 3 of the same participants using reusable containers said they had "always/most of the time" encouraged coworkers to perform pro-environmental

behaviors like turning off lights or recycling. This indicates that there is a group of people that is willing to try to influence others and the use of water bottles or coffee mugs is heavily dependent on creating the right social norms. PFANS should attempt to create an environment where the use of Styrofoam is no longer socially acceptable.

5 CONCLUSION

As the healthcare industry continues to face the challenges of responding to policy changes, growing economic pressures and advancements in performance tracking and technology, it will become increasingly important for hospitals to incorporate sustainability practices and initiatives as a means of addressing these industry drivers. By managing resources more efficiently and reducing the environmental impact of its operations, health systems will be able to continue to serve their patients effectively into the future and address the mounting evidence linking environmental issues—climate change, agricultural pollution, chemicals, energy and water usage—to public health challenges. For UMHS, we hope that PFANS can offer an example of how changes to infrastructure, processes and tracking can lead to financial savings, greener operations and employee engagement. Additionally, PFANS' connection to other areas of the hospital, specifically to Environmental Services and Procurement, provides an opportunity for sustainability initiatives led by PFANS to influence and affect change throughout the health system.

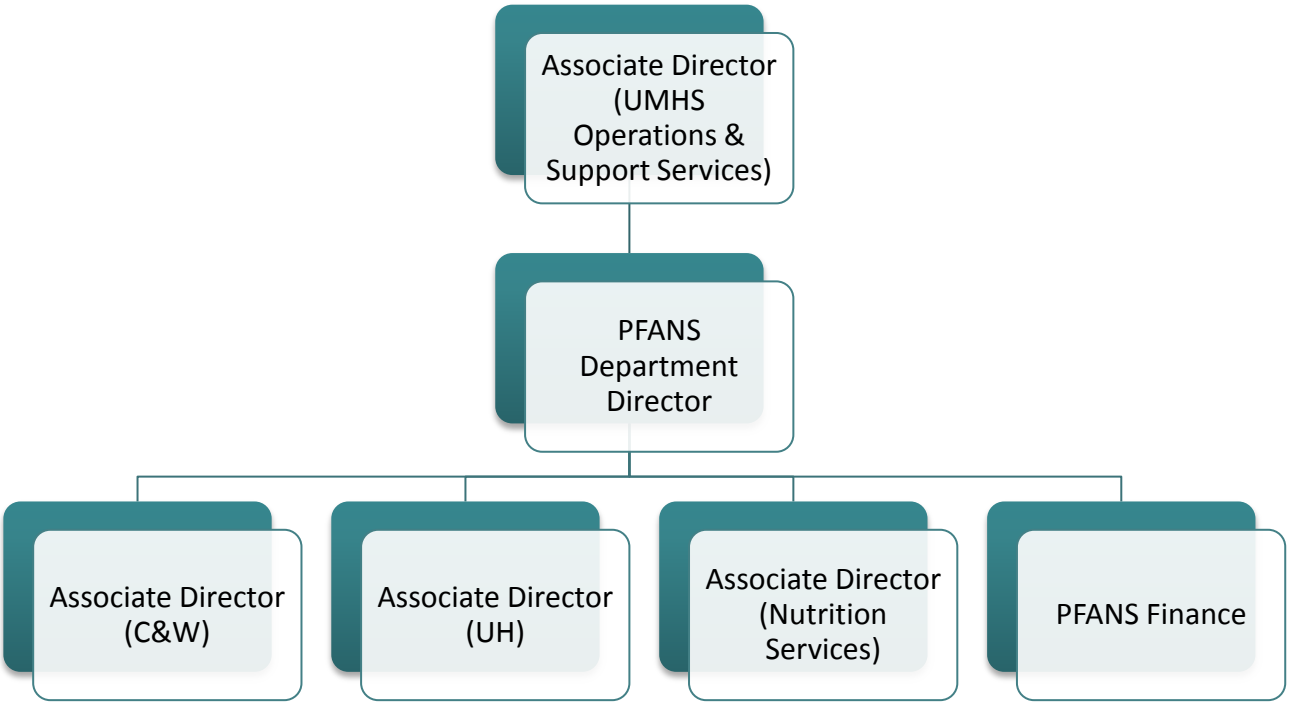
This project serves as an initial step in creating and implementing a holistic approach to sustainability in healthcare. As such, the recommendations outlined were not designed as a series of one off projects, but rather form the foundation for achieving the long-term objectives of UMHS and the University of Michigan. By recommending processes, strategies and actionable changes, PFANS will reduce and divert waste from landfill, take steps toward more sustainable procurement initiatives and find more opportunities to reduce energy and water usage.

However, it is critical to also promote a culture of sustainability within PFANS in order to ensure the endurance of these behavior changes. By shifting the mindset of the unit towards considering environmental impact in day-to-day operations, engaging employees in implementing changes and developing a system to track progress, PFANS will be positioned to build upon the work it has already performed related to sustainable operations and processes.

The intersection of healthcare and sustainability is an interesting and complex convergence of two missions. Healthcare providers have a mission to protect and enhance the health of patients, employees and the communities that they serve, however the environmental impacts of its operations can often contradict this responsibility. However, this report attempts to illustrate that by approaching sustainability from a holistic perspective, PFANS and UMHS can find ways to create widespread sustainable change while adapting to the changing health needs of the public, reducing its environmental footprint, stewarding financial resources and fulfilling its vital mission.

6 EXHIBITS

6.1 EXHIBIT 1: PFANS ORGANIZATIONAL CHART

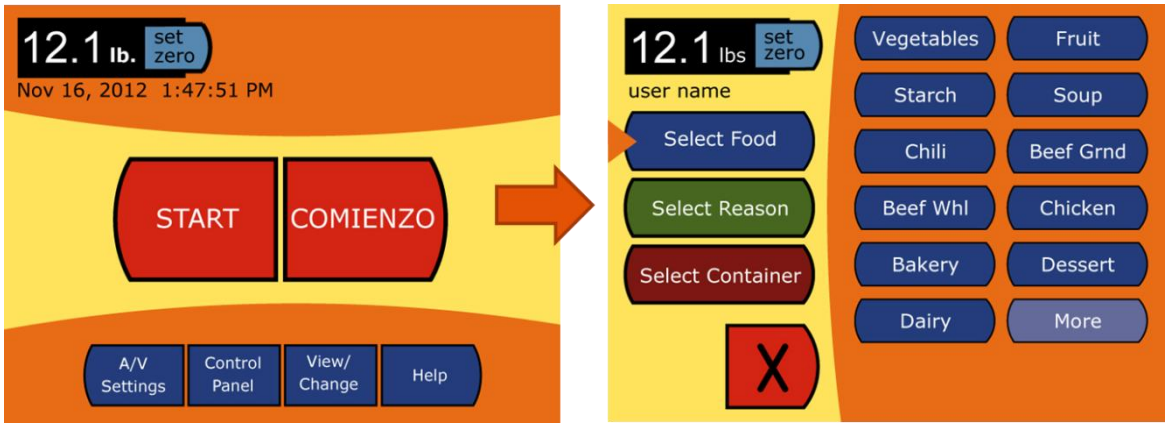


6.2 EXHIBIT 2: MATERIAL CATEGORIES USED IN WASTE SORT DATASET

Category	Description (if needed)
Food Waste (pre)	Food waste that was not on a patient tray before being wasted
Food Waste (post)	Food waste from patient trays
MPG	Metals, plastic, glass – a traditional recycling classification
Mixed Paper	Recyclable paper
Paper Trash	Non-recyclable paper
Plastic Trash	Non-recyclable plastics (films, etc.)
Bulky Rigid (metal)	Large metal cans such as “#10s”
Bulky Rigid (plastic)	Larger plastic waste such as juice containers
Trash (other)	Any waste not categorized elsewhere
Lids (weight and count)	Disposable lids used to cover pre-portioned items
Juice Boxes (weight and count)	No description needed
Condiments Unused (weight and count)	Condiments that came back on patient trays unopened
Gloves (weight and count)	Employee’s latex gloves
Styrofoam (weight and count)	Primarily employee cups
Plastic Utensils	No description needed
Food Scraps	Bits of food thrown in general trash
Bacon Wax Paper	Wax paper used to wrap bacon portions
Aluminum Foil Sheets	No description needed
Straws (used count)	Straws that patients used
Straws (unused count)	Straws that came back on patient trays unopened
Tea Bags	No description needed
Chip Bags	No description needed
Cereal Bowls (weight and count)	No description needed
Dove Bar Box	No description needed
Plastic Bottles (weight and count)	Soda bottles
Milk Cartons	No description needed
Aluminum Cans (weight and count)	Soda cans
Expired Ketchup	No description needed
Other #2 plastic	Plastic bottles other than for soda
Dishware	Broken dishware

6.3 EXHIBIT 3: LEANPATH WASTE AUDIT PHOTOS AND SETTINGS

Pictured: LeanPath Tracking System and Scale



Pictured: Sample screenshot from LeanPath Tracker Touchscreen

Source: (Copeland, LeanPath Food Waste Tracking Systems, 2013)

The following food types and loss reasons were programmed into the LeanPath tracker for the NCRC and C&W Audits:

NCRC Waste Audit		
Food Type	·	Cucumber
	·	Celery
	·	Other Food
Loss Reason	·	Trim Waste
	·	Overproduction
	·	Dropped / Burned
	·	Miscellaneous

C&W Waste Audit	
Food Type	· Potatoes · Rice · Bagels · Bread · Chili · Desserts · Dressing · Soup · Breakfast Pastries · Jello · Egg/Cheese · Strawberries · Tomatoes · Other Fruit/veg · Turkey · Bacon · Ham/Sausage · Egg Salad · Tuna Salad · Sm. Grn Salad · Lrg. Grn Salad · Oatmeal/pancake batter
Loss Reason	· Trim Waste · Overproduction · Overcooked · Expired

6.4 EXHIBIT 4: PFANS EMPLOYEE SURVEY

Questions 1-5 pertain to your home life and personal actions or beliefs.

1. How important is the issue of climate change to you personally?
   - ☐ Not at all important
   - ☐ Not too important
   - ☐ Somewhat important
   - ☐ Very important
   - ☐ Extremely important

2. Have you done any of the following during the past year to promote sustainability issues such as environmental protection, energy or water conservation, open space preservation, use of public transportation, etc.

	Yes	**No**
a. Given money to an organization or advocacy group supporting one of the above issues?	☐	☐
b. Volunteered for an organization or advocacy group supporting one of the above issues?	☐	☐
c. Voted for a candidate for public office because of her/his position one any of the above issues?	☐	☐

3. Please say whether you agree or disagree with the following statements.

a. In general, people should recycle even if it is inconvenient.
☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐ **Disagree** ☐ **Strongly disagree**

b. In general, people should conserve electricity even if it is inconvenient.
☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐ **Disagree** ☐ **Strongly disagree**

c. In general, people should conserve water even if it is inconvenient.
☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐ **Disagree** ☐ **Strongly disagree**

d. In general, people should reuse things even when it is inconvenient.
☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐ **Disagree** ☐ **Strongly disagree**

e. In general, people should buy environmentally-friendly products even if they are more expensive.
☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐ **Disagree** ☐ **Strongly disagree**

4. During the past year, how often have you encouraged <u>your friends or coworkers</u> to do the following things?

	Always/Most of the time	**Sometimes**	**Rarely**	**Never**	**Don't know**
a. Walk, bike, or take the bus rather than drive	☐	☐	☐	☐	☐
b. Buy locally sourced or sustainable food	☐	☐	☐	☐	☐
c. Conserve electricity	☐	☐	☐	☐	☐
d. Reuse or recycle plastic, metal or glass	☐	☐	☐	☐	☐
e. Buy things that are better for the environment	☐	☐	☐	☐	☐

5. "*Sustainable food*" can be defined as one or more of the following: locally-sourced, organic, from humanely-treated animals, antibiotic- and hormone-free, grass-fed, from sustainable fisheries, or fair trade food. In general, people should buy sustainable food even if it costs more or is less convenient.
   ☐ **Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐**Disagree** ☐**Strongly disagree**

Questions 6-10 pertain to your life at work at UM.

6. How much do you know about the following at ***UM and UM Health System***?

	A lot	**A fair amount**	**A little**	**Not much/nothing**
a. Recycling glass	☐	☐	☐	☐
b. Recycling plastic	☐	☐	☐	☐
c. Recycling paper	☐	☐	☐	☐
d. University President Mary Sue Coleman's "Sustainability Goals"	☐	☐	☐	☐
e. UM Health System winning the 2012 Practice Greenhealth's national Environmental Leadership Award	☐	☐	☐	☐
f. About Mott C&W being a U.S. Green Building Council LEED® Silver certified facility	☐	☐	☐	☐

7. During the past year, how often did you do the following *at work* when you had the opportunity?

	Always/ Most of the time	**Sometimes**	**Rarely**	**Never**	**Not Applicable**
a. Turn off the lights when you leave the room	☐	☐	☐	☐	☐
b. Recycle bottles, containers, and/or paper products	☐	☐	☐	☐	☐
c. Use a reusable water bottle, coffee cup, travel mug, etc.	☐	☐	☐	☐	☐
d. Ask your supervisor or manager about introducing something you consider a environmentally-friendly or "green" practice or initiative	☐	☐	☐	☐	☐

8. How concerned are you about the following?

	Very concerned	**Somewhat concerned**	**Not that concerned**	**Not at all concerned**
a. Whether the food served to patients *is produced* in a way that is potentially harmful to the environment.	☐	☐	☐	☐
b. The amount of natural resources that the hospital uses—such as water and fossil fuels/energy.	☐	☐	☐	☐

c. The amount of waste PFANS produces.	☐	☐	☐	☐
d. The amount of waste UM Health System produces.	☐	☐	☐	☐
e. The effectiveness of PFANS' recycling program.	☐	☐	☐	☐
f. The effectiveness of UM Health System's overall recycling program.	☐	☐	☐	☐

9. Would you feel comfortable asking your supervisor or manager to consider a new environmentally-friendly or "green" practice or initiative that you felt was important?

☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐**Disagree** ☐**Strongly disagree**

10. Please indicate your feelings about the below.
    a. Would you consider playing more of a part in sustainability-related activities within PFANS if an opportunity was made available?
       ☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐**Disagree** ☐**Strongly disagree**

    b. Do you believe your coworkers would be interested in becoming more involved in sustainability-related activities within PFANS?
       ☐**Strongly agree** ☐**Agree** ☐**Neither agree nor disagree** ☐**Disagree** ☐**Strongly disagree**

The following are general questions.

11. Overall, how committed are you to sustainability? Are you:

Very committed	☐
Somewhat committed	☐
Not very committed	☐
Not at all committed	☐

12. How long have you worked at U-M?
    ☐ Less than a year
    ☐ 1-2 years
    ☐ 3-5 years
    ☐ 6-10 years
    ☐ More than 10 years

13. Are you
    ☐ Male
    ☐ Female

6.5 EXHIBIT 5: PATIENT UNITS, POPULATION AND EATING COEFFICIENTS FOR C&W AND UH/CVC

Hospital	Unit	Patient Population	Diet	Coefficient
UH	1OBS	Post surgery adults	Transitions - clear liquids to regular	0.5
UH	4A	Neurology	Regular	1
UH	4AS	Stroke unit	Soft and dysphagia diets	0.5
UH	4B	Neurology and neurosurgery	Regular - specialized diets	1
UH	4C	Cardiovascular surgery	Regular - specialized diets	1
UH	4DNI	Neurology and neurosurgery ICU	Regular - specialized diets	1
UH	5A	Orthopedic surgery, moderate trauma	Transition - liquid to regular	0.5
UH	5B	Surgery	Transition - liquid to regular	0.5
UH	5C	Surgery & post transplant surgery	Transition - liquid to general	0.5
UH	5D	Surgery ICU	Mostly NPO (not by mouth)	0
UH	6A	Rehab - spinal cord injury	Regular - specialized diets	1
UH	6B	Medicine	Regular - specialized diets	1
UH	6C	Medicine	Regular - specialized diets	1
UH	6D	Medicine ICU	Mostly not eating or liquids/soft	0
UH	7A1	Medicine	Regular - specialized diets	1
UH	7B	Cardiac medicine	Regular - specialized diets	1
UH	7C	Cardiac medicine	Regular - specialized diets	1
UH	7DN	Cardiac medicine ICU	Regular - specialized diets	1
	8A1	Hematology, oncology, cancer	Regular	1
UH	8A2	Hematology, oncology, cancer	Regular	1
	8A8B	Hematology, oncology, cancer	Regular	1
UH	8AS	Hematology, oncology, cancer	Regular	1
UH	8B1	Hematology, oncology, cancer	Regular	1
UH	8C	Dermatology (medicine overflow)	Regular - specialized diets	1
UH	8DNS	Medicine/surgery ICU step down	Transition - liquid to regular	0.5
UH	9C	Adult psychiatry	Regular	1
UH	AMOU	Observation for medicine patients	Regular - specialized diets	1
UH	BAC	Trauma and Burn step down	Regular - specialized diets	1
UH	BICU	Trauma and Burn ICU	Regular - specialized diets	1
CVC	CV2A	Post cardiac procedure unit	Regular - specialized diets	1
CVC	CVC4	Cardiac surgery ICU	Regular - specialized diets	1
CVC	CVC5	Cardiac surgery and medicine	Regular - specialized diets	1
C&W	12West	Surgery	Regular	1
C&W	12East	Surgery	Regular	1
C&W	11West	Pediatric cardiology	Regular	1
C&W	10East	PICU	Critical (not a lot of meals served)	0.5

C&W	10West	PCTU	Critical (not a lot of meals served)	0.5
C&W	9East	Birth	Regular for moms	1
C&W	9West	Birth	Regular for moms	1
C&W	8West	NICU	Neonatal (some breastfeeding trays)	0.5
C&W	7West	Adult BMT	Regular - specialized diets	1
C&W	7East	Pediatric BMT	Regular - specialized diets	1

6.6 EXHIBIT 6: SUMMARY OF WASTE METRICS AND TOTAL WASTE ESTIMATES

Key Metrics		
Waste Ratios	**Value**	**Notes**
# trays/patient each day	2.275	Based on adjusted # of eating patients (calculated daily over 10 months and averaged)
Total waste (lbs/tray)	0.5946	Based on August 22 data
Food waste (lbs/tray)	0.260	Based on August 22 data
Pre-patient food waste (lbs/patient)	0.5361	Based on adj. # of eating patients during LeanPath
Post-patient food waste (lbs/patient)	0.1048	Food waste/patient – (Pre) Food waste/patient
MOW food waste (lbs/week)	45.289	Average from 8 weeks (2 menu rotations)

Annual Waste Estimates		
Estimates	**Value**	**Notes**
PFANS total waste (lbs/year)	335,817.51	UH, CW & MOW waste
PFANS food waste (lbs/year)	148,167.74	UH, CW & MOW waste
PFANS pre-patient food waste (lbs/year)	134,510.89	UH and CW pre-patient waste & MOW waste
Patient food waste (lbs/year)	13,656.85	Total food waste – Pre-patient food waste

Waste Diversion Scenarios		
Current	**% Diversion (by weight)**	**Notes**
Current	3.41	Equipped to recycle mixed paper, soda cans & bottles
Scenarios	**Increase from Current**	**Notes**
Scenario 1	6.26%	Divert all recyclables (paper, plastics, metals)
Scenario 2	11.02%	Scenario 1 + divert Pre-Patient Food waste
Scenario 3	60.04%	Scenario 2 + divert Post-Patient Food waste
Scenario 4	60.73%	Scenario 3 + divert Styrofoam
Scenario 5	62.36%	Scenario 4 + divert Gloves

6.7 EXHIBIT 7: HEALTHIER HOSPITAL INITIATIVE LOCAL/SUSTAINABLE FOOD CHALLENGE

The Local and Sustainable Food Challenge requires the following commitment from its pledges:

Increase the percentage of local and/or sustainable food purchases by 20 percent annually over baseline year OR achieve local and/or sustainable food purchases of 15 percent of total food dollar purchases, within three years (Healthier Hospitals Initiative, 2012).

The Health Care Without Harm (HCWH) definitions of "local" and "sustainable" align with those of the UM Sustainable Food Purchasing Goals with slight variances in acceptable certifying organizations:

Local: HCWH defines local as food that is grown/produced and processed within 250 miles (of a health care facility). For processed foods, greater than 50% (by weight) of the product must meet this definition.

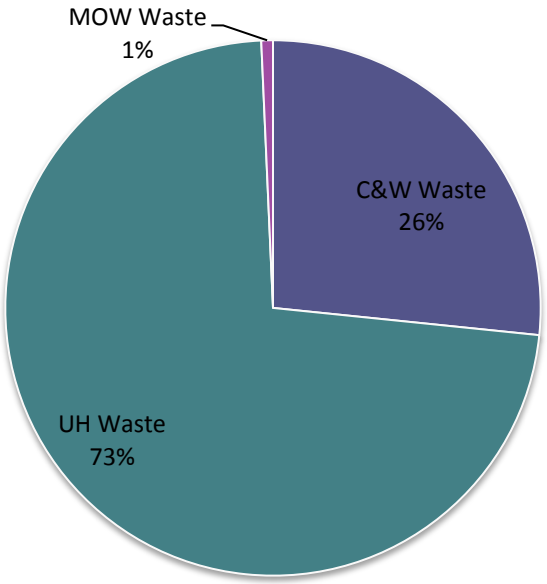
Sustainable Third-Party Certification: The challenge utilizes third-party certifications to assign the term "sustainable" to its foods. In addition to the eight certifying organizations included in the UM goals, HCWH accepts the following organizations and criteria:

- Animal Welfare Approved (Animal Welfare Approved)
- Salmon Safe (Salmon Safe)
- Or other eco-label that has transparent and meaningful standards and independent verification processes
- And/Or carries one of the following label claims allowed by USDA or FDA:
    - "Raised without antibiotics" or "No antibiotics administered" (poultry and meat products); "Raised without antibiotics that cause antibiotic resistance in humans" (poultry); "Raised without added hormones"
    - Or "No hormones added" (beef and lamb only); "No genetically engineered ingredients" (products made from corn, soy, canola or their derivatives); "rBGH-free", "rBST-free",
    - Or a statement such as "Our farmers pledge not to use rBGH or rBST"/"Our farmers pledge not to use artificial hormones"(milk, butter, cheese, yogurt, ice cream, sour cream, cottage cheese); "Grass-fed" (products from ruminants such as beef cattle, dairy cattle, lamb).

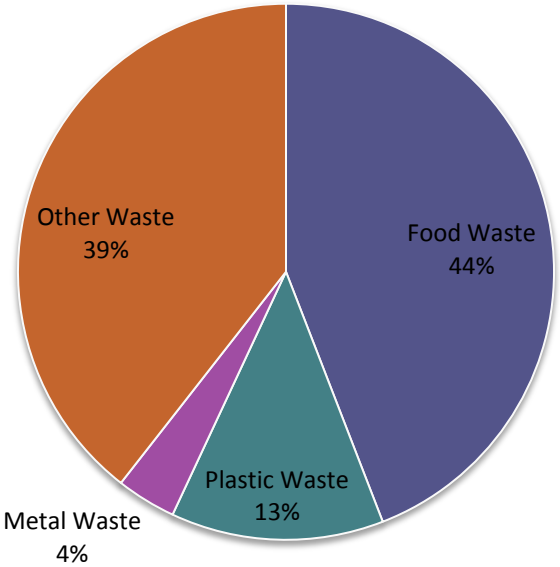
6.8 EXHIBIT 8: BREAKDOWN OF WASTE FINDINGS

- Total estimated waste generated by PFANS annually: 335,818 pounds

Waste Area Distribution

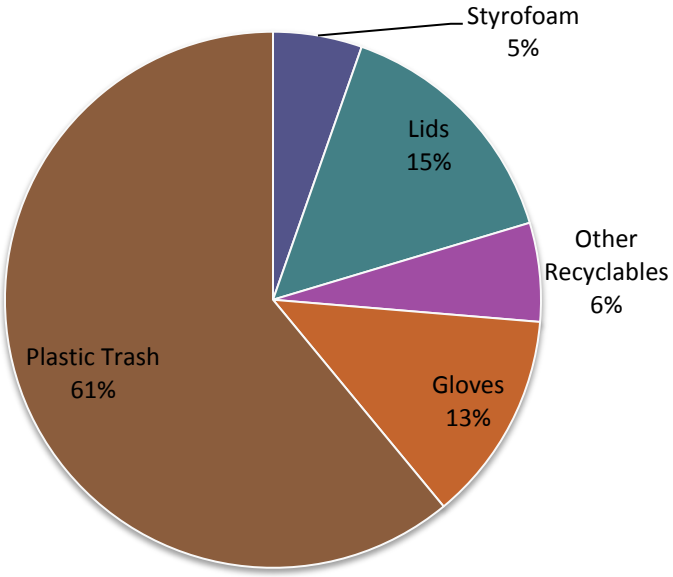


Waste Stream Distribution



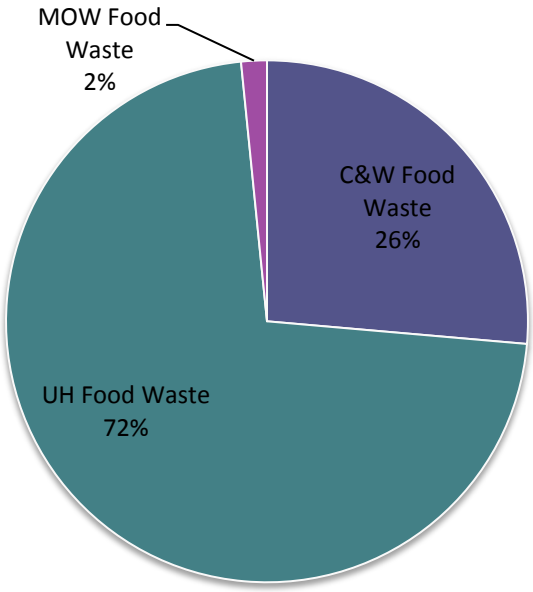
- Plastic Waste totals 43,100 pounds annually

Plastic Waste Distribution

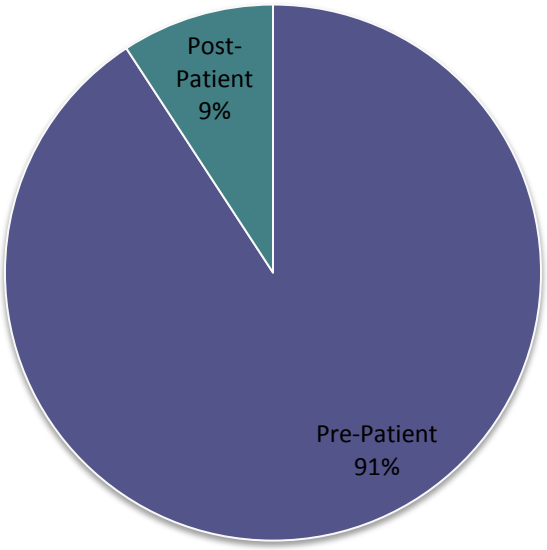


- Food Waste totals 148,168 pounds annually

Area Distribution of Food Waste



Food Waste Category



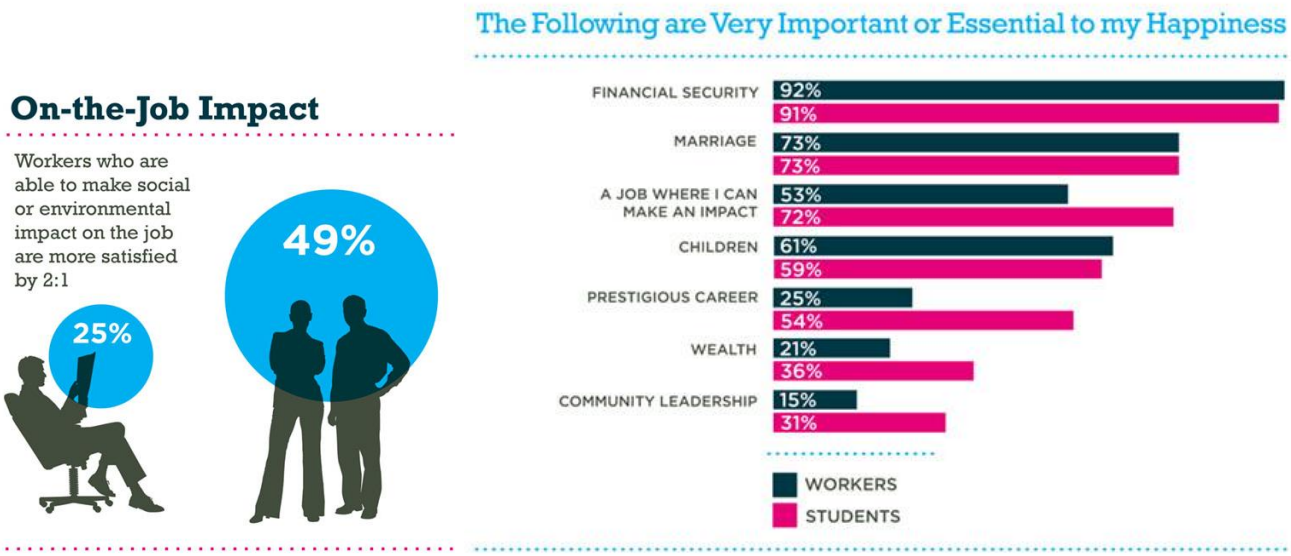
6.9 EXHIBIT 9: PEER INSTITUTE SUSTAINABILITY MISSIONS

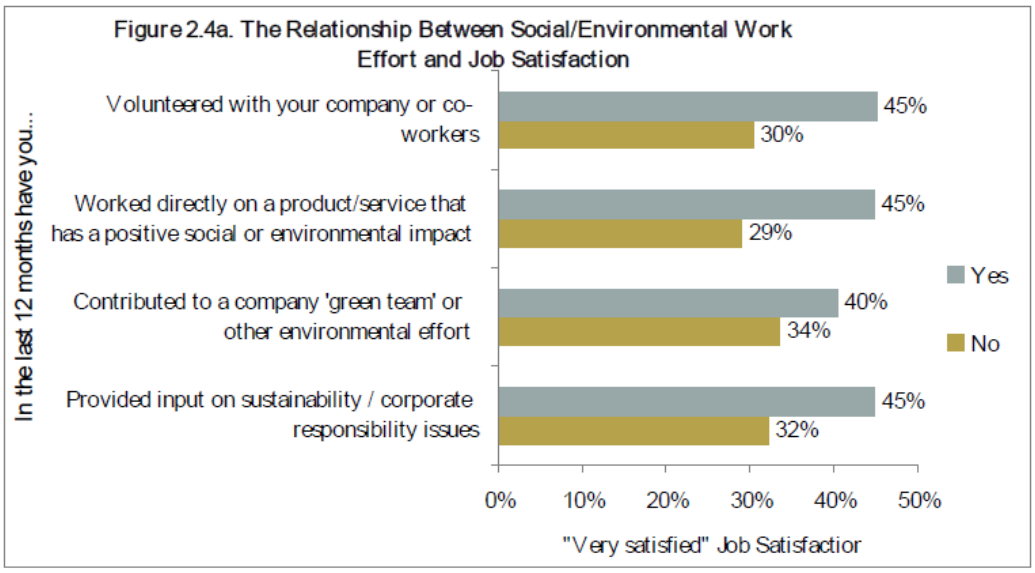
Healthcare System	Mission or Commitment Statement	Values
New York Presbyterian Health System	By adopting environmentally responsible practices in the hospital and the community, it is our goal to create a healthier environment for our patients, their families, and our staff, and improve health outcomes for the communities we serve.	Respect, Teamwork, Excellence, Empathy, Innovation, Responsibility
Inova Health	Inova Health System is committed to establishing an environmental program that contributes to a safer and healthier environment for our patients, employees and community	
Metro Health	Metro Health's commitment to sustainability goes beyond the many innovative design features of our new hospital. It's evident in our day-to-day business practices and ongoing strategies to conserve natural resources and promote a healthy environment.	Strive for excellence; Treat others with integrity, respect and compassion; Use effective communication and teamwork; Demonstrate a commitment to our universe: the environment, the community, the organization and one another
Spectrum Health	We are committed to being a responsible steward of resources in terms of waste management and recycling, energy use, water recovery and healthy food initiatives. Spectrum Health's goal is to create a nationally recognized sustainability model for regional health care by 2014.	Excellence, Integrity, Compassion, Teamwork, Respect
Gundersen Lutheran	Gundersen Health System's energy plan is providing leadership for the healthcare industry on a journey to demonstrate that "green" is a healthy, socially responsible and economically beneficial strategy. Our specific plans turn good intentions and "green" theory into action.	Integrity, Excellence, Respect, Innovation, Compassion
Fletcher Allen Health Care	Fletcher Allen Health Care recognizes that the health of the community is linked to the health of the environment. Fletcher Allen Health Care therefore, will strive to ensure that the day-to-day operations are founded in sound environmental policies in all aspects of care delivery.	We are just and prudent stewards of limited natural and financial resources
Stanford University Medical Center	Promote a culture of individual responsibility for sustainability within the school, engaging the entire SOM community and working collaboratively with the Hospitals.	

University Hospitals Health System	University Hospitals is committed to sustainability to provide economic value and enhanced health to our patients, employees, and communities, and to steward our natural environment.	
Cleveland Clinic	We understand that environmental health and human health are linked and that we have a responsibility to take a precautionary approach to environmental stewardship through our operations and community leadership.	Quality, Innovation, Teamwork, Service, Integrity, Compassion
North Shore-LIJ Health System	North Shore-LIJ Health System's sustainability and social responsibility (SSR) mission is focused on improving the health and well-being of our communities and society at large. Through responsible decision-making and support of our communities, we will protect and enhance the environment and improve quality of life.	
Memorial Sloan-Kettering Cancer Center	Providing patient care and improving our understanding of disease require a significant use of energy and materials and produce a considerable amount of waste. Finding innovative strategies to address these issues holds the potential for us to limit wasteful use of our resources and reduce our impact on the environment.	
Bon Secours Health System	To bring good help to those who are poor and dying … and to help bring people and communities to health and wholeness as part of the healing ministry of Jesus through the sustainable use of natural resources and reduction in the use of toxic chemicals and materials	Respect, justice, integrity, stewardship, compassion, quality, growth, innovation
Partners HealthCare	Partners HealthCare aspires to be a national leader in promoting a healthy environment that optimizes the care of our patients and the well being of our employees while nurturing the resources we bring to the task.	
Henry Ford Health System		Each Patient First, Respect for People, High Performance, Learning and Continuous Improvement, A Social Conscience
St. John Providence Health System	Vibrant sustainable communities where engaged people of all ages choose to live, work, play, and experience optimal health and well-being.	Quality of Life, Partnerships, Economic Self-Sufficiency, Continuous Education, Health & Wellness, Accountability, High Expectations, Safe Environment, Respect

Dignity Health	Compassionate, high quality, affordable health services; serving and advocating for...poor and disenfranchised; and partnering with others in the community to improve the quality of life	Dignity, Collaboration, Justice, Stewardship, Excellence
Providence Health & Services		Respect, compassion, justice, excellence, stewardship
Kaiser Permanente	To provide high-quality, affordable health care services and to improve the health of our members and the communities we serve	
University of Chicago Medical Center	The University of Chicago Medical Center has placed an emphasis on superior quality which includes being sustainable in our environment for patients, visitors, staff and local communities.	

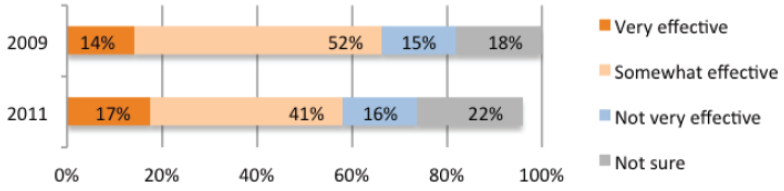
6.10 EXHIBIT 10: WHAT WORKERS WANT



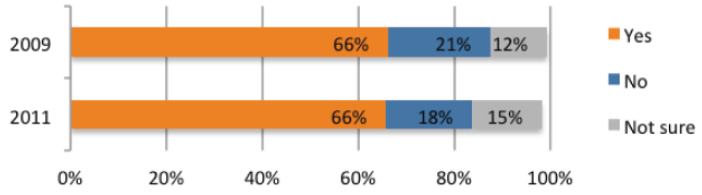


Source: (Szeltner & Zukin, 2012)

6.11 EXHIBIT 11: EFFECTIVE EMPLOYEE ENGAGEMENT



If your employer engages employees on conservation, how efffective is it in changing behavior?

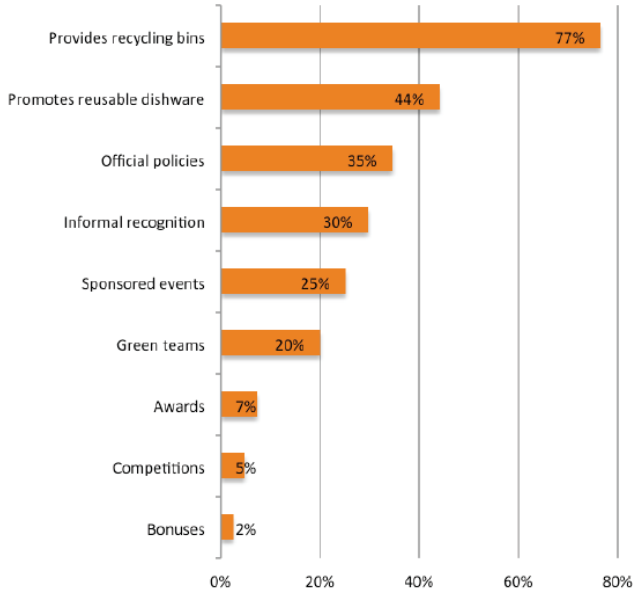


Would you like to see your employers change their stance on employee sustainability efforts?

Source: (Brighter Planet, 2011)

6.12 EXHIBIT 12: RESULTS FEEDBACK EXAMPLE

6.13 EXHIBIT 13: INCENTIVE EXAMPLES



In the workplace, what incentives does your employer use to promote sustainable actions?

Source: (Brighter Planet, 2011)

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