

# **Waste Prevention and Management in Hospitals**

**Proceedings of The Thirtieth International Conference on Solid Waste  
Technology and Management, Philadelphia, PA, March, 2015**

**Joan D. Plisko, Ph.D**

**Maryland Hospitals for a Healthy Environment  
University of Maryland School of Medicine  
[jplisko@som.umaryland.edu](mailto:jplisko@som.umaryland.edu)**

**Carrie Flora, MBA**

**Maryland Hospitals for a Healthy Environment  
University of Maryland School of Medicine**

**Colleen Cusick, MBA, MSN, RN, CMRP  
The Johns Hopkins Hospital**

**Abstract:** Hospital waste streams are large and complex. One estimate suggests that the nearly 5,000 hospitals in the U.S. produce more than 7,000 tons per day and spend \$10 billion annually in disposal costs. In terms of materials purchased and discarded and in terms of dollars spent, waste is one of the indicators of inefficiency. Prevention and reduction of hospital waste is key for any hospital beginning or continuing its environmental sustainability journey. This can lead to significant cost savings and reductions in environmental and health impacts. High performing hospitals can manage waste streams so that the portion of RMW is as low as 8 percent, recycling is 40 percent, solid waste at 50 percent, and hazardous waste under 2 percent. The portion of the waste stream diverted from disposal through recycling and other means varies, depending on hospital size and location, management techniques, and available local markets for different streams. Maryland Hospitals for a Healthy Environment (MD H2E), a program of the Center for Integrative Medicine at the University of Maryland School of Medicine, catalyzes a culture of environmental health and sustainability across Maryland. In 2013 and 2014, MD H2E conducted online surveys of Maryland hospitals regarding sustainability practices, including waste prevention and management. Additionally, MD H2E surveyed hospitals for the amount of waste generated in 2013 and for a baseline year. This paper will (1) provide background on the types of hospital waste, (2) present a brief history of hospital waste management in Maryland, (3) present the results of the 2013 and 2014 surveys as they relate to waste management, and (4) identify trends and opportunities for hospital waste prevention and management.

**Keywords:** hospital waste; waste prevention; waste management; environmental sustainability; recycling; Maryland hospitals

## INTRODUCTION

The nearly 5,000 acute care hospitals in the United States generate nearly 7,000 tons of waste every day and spend \$10 billion annually in disposal costs.<sup>i</sup> Health care facilities can generate up to 25 pounds of waste per day per patient; however, that waste represents an environmental footprint much larger than just the cost and impact of disposing of those materials. For every pound of product manufactured in the United States, 32 pounds of waste are created during the manufacturing process, and transportation adds to the environmental impact of products a hospital purchases.<sup>ii</sup> Hospitals bury and burn garbage composed of plastics, chemicals, paper, food, sharps, packaging, and electronics in an effort to dispose of this waste. However, amid concern about waste removal fees, mercury, dioxins, and other toxins released from medical waste incinerators, as well as pharmaceutical contaminants in water sources, hospitals are recognizing that waste disposal can have a negative impact on the communities in which they exist.<sup>iii</sup>

## BACKGROUND

Hospitals operate 24 hours a day, seven days a week, and are focused on the clinical care of patients. With the advent of family-centered care, hospitals have assumed aspects of the hotel and restaurant industries, along with other varied patient care services. From the basement to the boardroom and from anesthesia to X-ray, hospitals generate a complex and diverse mixture of waste streams. Different departments generate varying types of waste, sometimes not even resembling waste from a health care setting. For example, kitchen and cafeteria waste is completely different than laboratory waste, which is completely different than waste from a patient room, which is unlike waste generated in the operating room (OR). The OR produces 20 to 30 percent of a hospital's overall waste stream.<sup>iv</sup> Nonetheless, there are several categories of hospital waste, each with its own definition and management requirements. Broadly, these categories are: solid waste (SW), regulated medical waste (RMW), hazardous waste (HW), and recycling. Common definitions and examples are listed in Table 1.

Measures to prevent and manage hospital waste include implementing environmentally preferable purchasing policies and programs, implementing more efficient ordering protocols, using management efficiency processes to reduce wasteful practices and operations, donating materials that are no longer needed but are still useful, recycling non-traditional waste streams, and investing in local businesses to stimulate the recycling market. Commonly recycled items, in order of frequency, are listed below in Table 2. This list does not include the separate categories of construction and demolition debris, compostables, and reprocessables.

The cost of managing hospital waste streams varies considerably. Common comparisons dictate that disposing of RMW can be five to 20 times more expensive than disposing of SW. And while HW is typically a small percentage of the overall waste stream by volume, it is often the most costly. Of particular note, laboratory waste, a subset of HW, is often highly toxic.

**Table 1. Types of Waste Found in a U.S. Hospital<sup>v</sup>**

<b>Waste Type</b>	<b>General Explanation/Definition</b>
<b>Solid waste (SW)</b>	The largest component of a hospital waste stream. Common terms include trash, municipal waste, and clear bag. SW is general garbage.
<b>Regulated medical waste/infectious waste (RMW)</b>	Includes items soaked and saturated with blood and body fluids, medical sharps, fluid waste, and other potentially infectious material, as well as pathological, anatomical, isolation, and animal wastes.
<b>Hazardous waste (HW)</b>	Defined by the U.S. Environmental Protection Agency (EPA) <sup>vi</sup> is either “listed” or meets the certain characteristics. Common HW includes hazardous pharmaceuticals, bulk chemotherapeutic agents, formaldehyde, xylene and other solvents. Pharmaceutical and radioactive wastes are often combined with HW for non-regulatory reporting purposes.
<ul style="list-style-type: none"> <li>• Pharmaceutical waste</li> </ul>	Pharmaceutical waste is the byproduct of preparation and disposal of medication. Some pharmaceutical waste is considered HW while a large majority may not but should receive special disposal considerations, including controlled substances. Examples can be found on the EPA’s website. <sup>vii</sup>
<ul style="list-style-type: none"> <li>• Radioactive waste</li> </ul>	Used for functions such as diagnostic and therapeutic applications. For example, radiation from cobalt and powdered cesium used to sterilize blood and medical equipment.
<b>Recyclables</b>	Can be converted into a reusable material such as paper, beverage and food containers, metal, glass, and plastics. Hospitals often combine universal waste, reprocessable items, compostables, construction and demolition debris, and donated items into the recycling category for non-regulatory reporting purposes.
<ul style="list-style-type: none"> <li>• Universal waste</li> </ul>	Certain HW— <i>when sent for recycling</i> , may be managed under a less stringent set of regulations and do not have to be counted toward total HW volumes that determine generator status. Includes batteries, pesticides, equipment and bulbs containing mercury, and electronics.
<ul style="list-style-type: none"> <li>• Reprocessing reusable medical devices</li> </ul>	“A multistep process to clean and disinfect or sterilize reusable medical devices (devices that can be reused to diagnose and treat multiple patients.)” <sup>viii</sup> Examples include forceps, drills, and scopes.
<ul style="list-style-type: none"> <li>• Reprocessing single-use-only medical devices</li> </ul>	“Medical devices that are labeled or intended for single patient use are reprocessed in a remanufacturing process that includes demonstrating that the device can be adequately cleaned and disinfected or sterilized.” <sup>ix</sup> Examples include pulse oximetry probes, certain catheters, harmonic scalpels, and compression sleeves.
<ul style="list-style-type: none"> <li>• Compostables</li> </ul>	Materials that will break down into organic matter due to microorganisms in the soil, such as grass, weed clippings, waste from vegetable produce, food scraps, paper products, and dryer lint.
<ul style="list-style-type: none"> <li>• Construction and demolition debris</li> </ul>	Material debris generated during construction and renovation projects including ceiling tiles, plumbing fixtures, bricks, and fill dirt.
<ul style="list-style-type: none"> <li>• Donated items</li> </ul>	Supplies and equipment that can no longer be used by a hospital through obsolescence or other causes but can be reused in a different department, in the community or at another facility locally or overseas.

**Table 2. Commonly Recycled items in Hospitals, Listed in Order of Frequency<sup>x</sup>**

1. Batteries	10. Reusable Sharps Containers	19. Motor Oil
2. Fluorescent lamps	11. Single Use Devices	20. Steel Cans
3. Computers/Electronics	12. Aluminum Cans	21. Food Waste
4. Paper	13. Medical Supplies Donation	22. Linens
5. Comingled	14. Pallets	23. Shrink Wrap
6. Cardboard	15. Blue Wrap	24. Food Donation
7. Cooking Oil	16. Newspaper	25. X-Ray Film
8. Ink jet and Toner Cartridges	17. Plastic, #1 and #2	26. Foam Peanuts
9. Equipment Donation	18. Glass	27. Wood

Implementation of a hospital-wide waste prevention and management program is a multifaceted undertaking with multiple goals related to cost reduction, infection prevention, material management, and disposition requirements. To be as cost effective and environmentally sustainable as possible, a hospital should *strive* toward the goal of zero waste, which is a philosophy that encourages the redesign of products and materials such that everything is reused and nothing is sent to a disposal facility.<sup>xi</sup> Objectives for reducing and/or eliminating waste from a health care facility should include the following<sup>xii xiii</sup>:

- Define and understand waste categories and definitions including the regulatory components, policy and management aspects, and ultimate disposition of all streams.
- Measure the amount of waste in each category and identify associated costs.
- Complete an assessment of waste as a “non–value-added” component of hospital operations so that it can be systematically analyzed and functionally approached.
- Determine targets and goals for prevention and management.
- Establish an environment for managing waste that is regulatory compliant and safe from physical and health hazards for staff and patients.
- Reduce all risks for occupational illnesses and injuries.
- Develop an education process that covers all personnel, from the purchasing agent to the environmental services employee, regarding the risks associated with each waste stream.
- Maintain oversight by establishing administrative and engineering controls to track, measure, report, and sustain goals, staff satisfaction, safe work practices, and feedback.
- Develop an ongoing communication process to engage staff and promote participation in the waste reduction programs.

Selecting the most appropriate set of programs for a facility is a complex task and depends on a variety of factors, including:

1. Does the program reduce risk to patients, employees, and community members?
2. Is the program required by law?
3. Does the program save money?
4. Does the program have a likelihood of success?
5. Are there data to support implementation of the program?
6. Is it a highly visible program?
7. Are there partners, such as suppliers, that can assist with implementation?

Since the operation of the OR generates a large portion of the hospital waste stream, strategies for preventing and minimizing waste in the OR are needed. Examples are provided in Table 3.

**Table 3. Examples of Waste Prevention Strategies in the OR**

<b>Strategy</b>	<b>Example 1</b>	<b>Example 2</b>
Reduction	Eliminate unused or redundant products within custom packs	Convert to reusable hard cases to eliminate blue wrap
Reuse	Reusing items through local, regional, and global donations programs	Reusing gowns, table covers, linens, basins and other material reesterilization
Reprocessing	Reprocess and/or remanufacture single-use devices and instruments through third-party reprocessing companies	Reprocess open and unused supplies
Recycling	Recycle plastics, including sterile water and saline bottles	Recycle blue wrap

## **HISTORY OF HOSPITAL WASTE MANAGEMENT IN MARYLAND**

Maryland Hospitals for a Healthy Environment (MD H2E) is a program of the Center for Integrative Medicine at the University of Maryland School of Medicine. Since 2005, MD H2E has worked with hospitals across Maryland in developing and implementing environmental health and sustainability strategies to advance a culture of environmental health and sustainability in Maryland’s health care community. Through networking, education, technical assistance, and recognition, MD H2E leads Maryland’s hospitals in initiatives that promote economically responsible programs for the health and healing of patients, staff, and communities. Focus areas include waste and toxics prevention, resource conservation, community benefit, healthy sustainable foods, and patient, staff, and community health and wellness. MD H2E engages and sustains a network of hospitals and health care providers through the facilitation and advancement of the Maryland Health Care Sustainability Leadership Council and the Chesapeake Food Leadership Council, as well as through dissemination of best practices, newsletters, case studies, a listserv, and an annual award program.

At the time when MD H2E was established, many hospitals in the greater Baltimore (Maryland) area were discarding all SW and RMW as a single stream, destined for a local medical waste incinerator. It was common practice for some hospitals to recycle paper and aluminum cans at that time. In the early 1990s, Baltimore area hospitals responded to new disposal and air regulations, implemented to address pollution and the wash-ups of syringes on local shores.<sup>xiv</sup> The result was that 31 hospitals entered into agreement with a privately-owned medical waste disposal facility for the incineration of RMW. To secure a reasonable cost for financing the facility, “tax exempt” status was obtained for the \$24 million bond issue. The central features of the arrangement included: (1) *Put or Pay* contracts, where each hospital agreed to pay for the disposal of a minimum number of tons of waste per year; (2) a *20 year* contract, and (3) a flat rate of \$300/ton for disposal privilege. Due to the nature of the contracts, hospitals had little to no incentive, or options, for reduction and recycling efforts. In addition, as the overall culture for waste reduction practices was evolving, it was not considered a priority for hospitals. While the local medical waste disposal facility opened in 1991, it changed hands in 1994 due to financial

woes and environmental and labor violations.<sup>xv xvi</sup> In 2005, when the incinerator changed hands again, the new owners installed a \$200,000 pollution filtration system and invested millions of dollars to and repair the decaying plant. It was one of the largest medical waste incinerators in the nation and burned 70 percent of the RMW and SW from Maryland's hospitals.<sup>xvii</sup>

A milestone occurred in December 2011, which marked the end of the 20-year contract for the hospitals that signed on at the beginning of the *put or pay* contract. Until that point in time, the hospitals in this contract had no incentive to reduce or minimize waste streams since they were financially obligated to pay for a certain amount of waste destined for the incinerator. Since 2005, MD H2E has engaged with more than 75 percent of the hospitals across the state with respect to environmental health and sustainability programming. Presently, MD H2E has observed that waste prevention and reduction is often the first line of program implementation due to the large opportunity provided by the end of the long-term contracts, high visibility with staff, patients, and community, the significant cost savings potential, and the opportunity for more efficient operations.

## METHODOLOGY

In 2013 and 2014, MD H2E conducted online surveys of Maryland hospitals regarding environmental sustainability practices, including questions on waste. MD H2E sent the survey to 60 hospitals each year. In 2013, 35 hospitals completed the survey and in 2014, 23 hospitals completed the survey. Table 4 shows the types of hospitals that participated in the survey. MD H2E included survey questions related to waste management practices, recycling practices, and greening the OR, among others.

**Table 4. Survey Respondents by Type of Hospital**

Type of hospital	Number of Respondents	
	2013	2014
Academic/research hospital	2	2
Specialty hospital	3	3
Community hospital	27	17
State hospital	3	1
Federal hospital	1	0
Total	36	23

MD H2E offered several response categories in the surveys. For any given practice or programmatic area, hospitals could indicate it was an area the hospital considered (1) a best management practice, (2) [a practice they were] currently implementing, (3) in the planning stages, (4) not [implementing] at this time or (5) would like more information. Specifically, MD H2E surveyed hospitals regarding the tracking of waste streams, the implementation of waste reduction programs, and the implementation of recycling programs for materials including electronic waste, medical plastics, cardboard, food waste, and more. Related to practices in the OR, MD H2E collected information regarding single use device reprocessing, reformulating OR kits to minimize excess plastics, and more. MD H2E also collected data on the amounts and percentages of hospital waste generated in 2013 and for a baseline year, as identified by each hospital.

## FINDINGS

Portions of a hospital’s waste stream may be diverted from disposal through recycling and other means and practices that vary depending on the facility’s size, location, management, and available markets for recycling. High performing hospitals can manage waste streams so that the portion of RMW is as low as 8 percent, recycling is up to 40 percent, and SW just under 50 percent, and HW about 2 percent.

Survey results from 2012 and 2013 show that Maryland hospitals have extremely high rates of participation in the areas of waste management and recycling. This includes the tracking of waste streams, the implementation of RMW reduction programs, and the segregation of hazardous pharmaceutical wastes, as indicated in Table 5. Participation rates include hospitals that indicated they were currently implementing or considered their program a best management practice. Due to the small sample size, these answers show no significant change in programs from 2012 to 2013. MD H2E specifically questioned hospitals about their RMW programs, as RMW reduction is an important part of a hospital’s waste program and removing SW from the RMW stream can save hospitals millions of dollars a year in unnecessary waste disposal costs.

**Table 5. Maryland Hospital Participation Rate for Waste Management Strategies**

Waste Management Strategy	Percent Participation	
	2012	2013
Track the disposal of SW, RMW, recycling, and HW	94%	91%
Implemented a RMW reduction program	88%	91%
Segregate hazardous pharmaceutical waste	97%	91%

Similar to waste tracking and implementation practices, Maryland hospitals reported high rates of recycling program participation, with a few exceptions, as shown in Table 6. MD H2E did not find drastic differences in rates of recycling from 2012 to 2013.

**Table 6. Maryland Hospital Participation for Recycling**

Recycled Material	Percent Participation	
	2012	2013
Batteries	71%	78%
Electronic waste	80%	87%
Cardboard	91%	91%
Construction materials	68%	61%
Non-confidential paper	85%	87%
Equipment donation	80%	70%
Food Waste	50%	43%
Medical Plastics	65%	70%
Blue Wrap	34%	52%

There is, however, a noticeable increase in recycling of blue wrap. Used to cover medical devices, instruments, and surgery kits for sterilization, the wrap makes up approximately 20 percent of the waste stream generated by surgical services in the health care industry<sup>xviii</sup>. Not only did the percentage increase 12 points, but the actual number reporting as a best practice increased from six to eight. Twelve hospitals participated in this practice during both years, but given the lower sample size for 2013 data, the proportion is greater.

MD H2E surveyed hospitals regarding specific waste prevention and management programs targeted toward increasing efficiency and reducing costs in the OR. As shown in Table 7, year over year, OR initiatives for single use device reprocessing, transitioning to hard cases for surgical instruments, using reusable gowns and linens, reformulating kits, and installing a fluid management system, remained steady — with the exception of reusable gowns and linens, which decreased.

**Table 7. Maryland Hospital Participation for Waste Prevention in the OR**

Waste Prevention Strategy	Percent Participation	
	2012	2013
Implemented single use device reprocessing?	63%	68%
Transitioned to hard cases for surgical instruments?	55%	58%
Use reusable gowns and linens?	67%	47%
Reformulated OR kits to minimize excess products?	70%	68%
Installed a fluid management system?	51%	53%

In 2014, MD H2E asked respondents to include waste data in the survey response. Thirteen hospitals reported 34,000 tons of total waste generated during 2013. Hospitals were asked to provide a baseline year (some going back as far as 2003) and data for 2013. Tables 8 and 9 show the results, which are remarkable. Since Maryland hospitals started tracking waste streams, the percentage of the waste stream composed of RMW has decreased collectively by 22 percent while recycling has increased by close to 13 percent. This means hospitals are saving money, becoming more efficient, and reducing the environmental and health impacts on the communities in which they exist and serve.

**Table 8. Waste Types, by Percentage, at Maryland Hospitals for 2013 and Baseline Year**

	SW	Recycling	RMW	HW
<b>Baseline</b>	56.7%	7.9%	35.2%	0.2%
<b>2013</b>	66.0%	20.6%	13.2%	0.2%
<b>Percent change</b>	9.3%	12.7%	-22.0%	0%

**Table 9. Waste Types, by Percentage, at Maryland Hospitals for 2013**

	TOTAL	SW	Recycling	RMW	HW
<b>High</b>	8187	98%	39%	20%	0.6%
<b>Low</b>	890	44%	2%	0.1%	0
<b>Median</b>	1806	64.8%	27.7%	13.7%	0.1%



The Maryland hospital that recycled the most waste, by percentage, achieved a 39 percent recycling rate in 2013. This facility, after 20 years in the *put or pay* contract, has made tremendous strides since the contract was terminated in 2011. The median recycling rate for the Maryland hospitals that reported recycling data was just under 28 percent. Regarding hospital participants, one hospital reported SW as 98 percent of its waste stream and a 2 percent recycling rate with no RMW. This facility is a psychiatric hospital, not an acute care hospital facility and lacks an OR, among other clinical departments.

Table 10 compares Maryland hospitals’ waste generation rates to the levels that national award winning hospitals demonstrate through the Practice Green Health (PGH) award program. PGH is a national membership organization for sustainability in health care where membership is based on bed size. Hospital members are encouraged to apply for annual awards that reward high performance in multiple areas of environmental sustainability such as waste reduction, energy efficiency, toxics reduction, and more. According to PGH, top performing hospitals achieved a 56 percent recycling rate and averaged 2.3 percent for RMW. Smaller hospitals had slightly higher recycling rates. Larger hospitals generated a higher percentage of RMW and exhibited slightly higher HW generation rates.

**Table 10. Waste Types, by Percentage, at Maryland Hospitals and National Award Winning Hospitals<sup>xix</sup> for 2013**

	SW	Recycling	RMW	HW
<b>Maryland</b>	66.0%	20.6%	13.2%	0.2%
<b>National Award Winners</b>	59.0%	31.0%	9.0%	1.0%
<b>Difference</b>	7.0%	-10.4%	4.2%	-0.8%

## TRENDS AND OPPORTUNITIES

Hospitals in Maryland have a long history of managing their waste. During the past 10 years, hospitals have increased recycling rates and reduced the amount of RMW to save costs, reduce their environmental footprint, and decrease the environmental impacts of disposal. Maryland hospitals, as a collective, are working collaboratively in the waste prevention and management realm. MD H2E has provided waste prevention and management assistance to hospitals across the state since 2005. In reviewing hospital practices and national trends, there are opportunities for collaborations and programmatic development in hospital waste management.

***Non-governmental and Governmental Collaborations:*** Hospitals are working with one another in collaboratives, initiatives, and work groups both statewide and nationally. Examples of successful programs include:

*Maryland Health Care Sustainability Leadership Council – hospitals working with each other.* In 2011, MD H2E launched the Health Care Sustainability Leadership Council (HCSLC), a volunteer organization composed of health care providers who are leading environmental sustainability efforts across Maryland. The mission of the HCSLC is to foster environmentally conscious health care facilities that engage, educate, inspire, and advocate for social responsibility in their leaders, employees, patients, and the wider community. In this forum,

hospitals share waste prevention and management strategies, as well as cost and environmental data. Hospitals leverage the commonalities among facilities to reduce costs, improve environmental and health outcomes, and improve patient safety.

*Maryland Department of Health and Mental Hygiene (DHMH) RMW Workgroup – hospitals working with regulators.* In 2012, the DHMH, under direction from the Maryland Health Quality and Cost Council, invited hospitals and other stakeholders to join a working group to assist DHMH in understanding more about generation and management of special medical waste as it relates to both home health care and health care facilities. In 2015, DHMH plans to convene another group to examine alternative treatment technologies for RMW and validation of such treatment technologies.

*Practice Green Health's (PGH) Greening the OR – hospitals participating in national collaboratives.* PGH's Greening the OR Initiative is a collaborative effort that envisions what the green OR of the future might look like, and what kinds of products, programs, and practices hospitals can focus on as a means of getting there. PGH is committed to working with its partners and endorsing hospitals to provide the data, tools, and resources necessary to substantiate best practices as a critical step to widespread adoption across the sector.<sup>xx</sup>

*Centers for Disease Control and Prevention – hospitals in the spotlight on emerging issues.* As the need arises, there could be demand for handling waste differently based on general or specific problems at hand. Federal waste management guidance has been developed in the area of toxic substances and emerging infectious waste issues. Most recently, the Centers for Disease Control and Prevention (CDC) developed procedures for the safe handling and management of Ebola-associated waste.<sup>xxi</sup>

**Hospital Programs:** Hospital leaders are constantly seeking ways to become more efficient and more effective with limited resources. Leading the way are environmental service and supply chain managers, who in cooperation with other departments are implementing and tracking waste management programs. Examples include:

*Supply chain efforts – hospital innovators.* The delivery, usage, and disposal of patient care supplies produces a large amount of waste due to packaging — some of which is necessary to keep supplies clean or sterile, as well as protect items from damage. Cardboard packaging specifically presents a challenge since *outside* cardboard is unclean, cannot be placed in sterile environments, and is known for harboring insects and their eggs. Reusable sharps container programs and metal recovery programs are becoming the standard in the hospital setting. Innovative waste reduction programs can have a positive financial impact. For instance, many supplies taken into patient isolation rooms are discarded without ever being used or opened. Using hydrogen peroxide vapor to decontaminate these open and unused supplies is one way to reduce waste and prevent a financial loss.

*Paper/Electronic Media – hospital efficiencies.* While many hospital waste reduction programs look at clinical applications, hospitals generate a lot of paper waste. Instituting print management programs to reduce the number of copiers and paper usage overall can play into a

hospital's overall waste reduction. Meeting preparation can include the use of electronic media to project agendas, slides and handouts while reducing labor time and cost of printing.

*Staff Engagement – hospitals engaging staff for success.* From the basement to the boardroom, the success of a hospital waste prevention and management program must include education and engagement. Leadership support, management oversight, and end-user compliance are all critical components of a successful program. Unit or departmental champions are essential to support best practices. However, one of the best practices to reduce waste is to educate staff to conserve supplies.

***Product and Service Supplier Engagement:*** Product and service providers offer an alternative view of the waste prevention and management paradigm. Hospitals that express their sustainable purchasing goals help suppliers understand the importance institutions place on the health of the community at large. From creating less wasteful products to developing tracking tools to recycling waste, suppliers are integral in reducing inefficiencies in hospital waste management. Suppliers may also be a source for sustainability education, conducting audits, and leading waste initiatives. Supplier engagement examples include:

*Reprocessing – hospitals saving money.* Across the health care sector and in Maryland, remanufacturing and reprocessing of single use devices is a means to reduce waste and costs while maintaining patient quality and satisfaction. One study estimated that if the experiences of seven study hospitals' cost savings (about \$57 per procedure) were extrapolated for hospitals nationwide, cost savings would be \$540 million annually, or \$2.7 billion over five years.<sup>xxii</sup>

*Health Care Plastics Recycling Coalition (HPRC) – supply side coalition.* HPRC is a private, technical coalition of peers with representatives from the health care, recycling, and waste management industries who are seeking to inspire and enable sustainable, cost-effective recycling solutions for plastic products and materials used in the delivery of health care. HPRC exists in a collaborative effort to be a change agent for sustainable health care product and packaging lifecycle with the end goal of increasing the overall recycling of health care plastics.<sup>xxiii</sup>

*Dashboard Tracking Tools – innovative tools and technologies.* Hospitals are tracking waste and recycling to better understand waste diversion rate and cost, and to help develop better management protocols/procedures. MD H2E, in collaboration with Key Green Solutions, prepared a case study of five Maryland hospitals that utilized a sustainability dashboard tool to improve performance and efficiency. When The Johns Hopkins Hospital began using a sustainability dashboard, nearly one-third of the hospital's total waste stream, approximately 2,300 tons, was RMW. Now, the dashboard tool automatically collects and organizes all of the waste data for easy analysis and tracking. The Johns Hopkins Hospital reduced red bag waste by 62 percent in one year's time which resulted in a 25 percent annual cost savings across the total waste stream.<sup>xxiv</sup>

## CONCLUSIONS

Due to the complex nature of hospital waste streams, waste prevention and management is costly and labor intensive. Yet by implementing best management practices, hospitals have the opportunity to reduce environmental health impacts. Since 2005, MD H2E has worked with hospitals across Maryland in developing and implementing environmental health and sustainability strategies, including waste prevention and management programs. In 2012 and 2013, MD H2E collected waste related data from Maryland hospitals. Results of the online surveys indicate an increased awareness and adoption of programs to prevent and manage waste more effectively and efficiently. As one of the largest generators of waste, hospitals, as community anchors, are uniquely positioned to develop, implement, and model proper waste management techniques that keep patients and staff safe, reduce environmental impact, and promote environmentally beneficial practices.

<sup>i</sup> American Hospital Association. (2013, April). *Sustainability roadmap*. Retrieved from [sustainabilityroadmap.org/topics/waste.shtml](http://sustainabilityroadmap.org/topics/waste.shtml)

<sup>ii</sup> Ibid

<sup>iii</sup> Healthier Hospitals Initiative. (2012, January). HHI Challenges: Less Waste. Retrieved from [healthierhospitals.org/hhi-challenges/less-waste](http://healthierhospitals.org/hhi-challenges/less-waste)

<sup>iv</sup> Practice Greenhealth. (2014, October). Greening the OR. Retrieved from [practicegreenhealth.org/initiatives/greening-operating-room](http://practicegreenhealth.org/initiatives/greening-operating-room)

<sup>v</sup> Practice Greenhealth. (2011, November). Waste categories and types. Retrieved from [practicegreenhealth.org/topics/waste/waste-categories-types](http://practicegreenhealth.org/topics/waste/waste-categories-types)

<sup>vi</sup> Environmental Protection Agency. (2012, July). Hazardous Waste. Retrieved from [epa.gov/epawaste/hazard/index.htm](http://epa.gov/epawaste/hazard/index.htm)

<sup>vii</sup> Healthcare Environmental Resource Center. (2012, February). Pharmaceuticals. Retrieved from [hercenter.org/hazmat/pharma.cfm](http://hercenter.org/hazmat/pharma.cfm)

<sup>viii</sup> U.S. Food and Drug Administration. (2014, June). Reprocessing of reusable medical devices. Retrieved from [fda.gov/medicaldevices/deviceregulationandguidance/reprocessingofreusablemedicaldevices/default.htm](http://fda.gov/medicaldevices/deviceregulationandguidance/reprocessingofreusablemedicaldevices/default.htm)

<sup>ix</sup> U.S. Food and Drug Administration. (2005, March). Inspections, Compliance, Enforcement, and Criminal Investigations. Retrieved from [fda.gov/iceci/compliancemanuals/compliancepolicyguidancemanual/ucm073887.htm](http://fda.gov/iceci/compliancemanuals/compliancepolicyguidancemanual/ucm073887.htm)

<sup>x</sup> Practice Greenhealth. (2011). *Sustainability Benchmark Report*.

<sup>xi</sup> Zero Waste International Alliance. (2009, August). Zero waste standards. Retrieved from [zwia.org/standards/](http://zwia.org/standards/)

<sup>xii</sup> American Hospital Association. (2013, April). *Sustainability Roadmap*. Retrieved from [sustainabilityroadmap.org/strategies/planwaste.shtml#\\_VHzXzzHF-So](http://sustainabilityroadmap.org/strategies/planwaste.shtml#_VHzXzzHF-So)

<sup>xiii</sup> Nussbaum, G.F. (2008). *Alternative Waste Management Strategies*, *Perioperative Nursing Clinics* (3) 63–72

<sup>xiv</sup> U.S. Congress, Office of Technology Assessment (1990, September). Finding the Rx for Managing Medical Wastes, OTA-O-459

<sup>xv</sup> Pelton, T. (2004, December 16). Some residents call to close medical waste incinerator. *The Baltimore Sun*.

<sup>xvi</sup> Zorzi, Jr., W. (1992, October 20). Schmoke's support for waste plan surprises council Incinerator burns medical refuse. *The Baltimore Sun*.

<sup>xvii</sup> Pelton, T. (2005, March 24). Seeing progress, profit in medical waste. *The Baltimore Sun*.

<sup>xviii</sup> Berry, M. (n.d). From blue to green. *Greenhealth Magazine*. Retrieved from [greenhealthmagazine.org/from-blue-to-green/](http://greenhealthmagazine.org/from-blue-to-green/)

<sup>xix</sup> Practice Greenhealth. (2013). *Sustainability Benchmark Report*.

<sup>xx</sup> Practice Greenhealth. (2014, October). Greening the OR. Retrieved from [practicegreenhealth.org/initiatives/greening-operating-room](http://practicegreenhealth.org/initiatives/greening-operating-room)

<sup>xxi</sup> Centers for Disease Control and Prevention. (2014, December). Procedures for Safe Handling and Management of Ebola-Associated Waste.

<sup>xxii</sup> Kaplan, S., Sadler, B., Little, K., Franz, C., Orris, P. (2012, November). Can Sustainable Hospitals Help Bend the Health Care Cost Curve? *Commonwealth Fund*.

<sup>xxiii</sup> Healthcare Plastics Recycling Council. (n.d.). What is HPRC? Retrieved from [hprc.org/](http://hprc.org/)

<sup>xxiv</sup> Plisko, J. D. & Sutter, A. W. (2014, September). Maryland Hospitals Use Dashboard to Improve Sustainability Programs. *Maryland Hospitals for a Healthy Environment*. Retrieved from [mdh2e.org/wp-content/uploads/2014/09/Dashboard-Case-Study-FINAL-September-2014.pdf](http://mdh2e.org/wp-content/uploads/2014/09/Dashboard-Case-Study-FINAL-September-2014.pdf)