Can Environmental Purchasing Reduce Mercury in U.S. Health Care?

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Environmental purchasing represents an innovative approach to mercury control for the health care sector in the United States. The U.S. health care sector creates significant environmental impacts, including the release of toxic substances such as mercury. Our goal in this study was to provide the health care industry with a method of identifying the environmental impacts associated with the products they use. The Health Care Environmental Purchasing Tool (HCEPT) was developed and tested at nine health care facilities in the Great Lakes region of the United States. As a result, more than 1 kg of mercury was removed from four facilities. The complexity of the supply chain inhibits a direct environmental information exchange between health-care decision makers and suppliers. However, a dialogue is starting within the health care supply chain to address environmental issues. The HCEPT has been shown to assist health care facilities with that dialogue by identifying products that have environmental consequences. This promising tool is now available for further experimentation and modification, to facilitate overall environmental improvement, and to provide a systematic method for environmental assessment of health care products. ***Key words:*** **air pollution, environmental purchasing, green purchasing, health care, hospitals, mercury, pollution, purchasing, United States, waste management.** ***Environ Health Perspect*** **110:847–851 (2002). [Online 17 July 2002]**
http://ehpnet1.niehs.nih.gov/docs/2002/110p847-851eagan/abstract.html

Mercury is widely recognized as a pollutant that has significant environmental impacts. Thirty-nine states have advisories concerning mercury levels in fish that are unsafe for human consumption [U.S. Environmental Protection Agency (EPA) 1999b]. Although the largest source of mercury emissions is coal-fired power plants, the U.S. health care system is recognized as the fourth largest identifiable source (U.S. EPA 1997).

The focus of this article is the mercury reduction potential of an environmental purchasing tool, based on the application of an introductory case study and results of the development and testing process. This approach could also be modified and applied to other business sectors. Reductions in mercury were measured at the end of the testing period. This article follows an earlier one in *Environmental Health Perspectives* concerning the value of life-cycle approaches and environmental purchasing (Kaiser et al. 2001).

Environmentally focused purchasing initiatives have been emerging in U.S. government and industry for the past several years. Until recently, such initiatives have rarely been tested or used in the health care sector (Narasimhan and Carter 1998). The Great Lakes Protection Fund supported this groundbreaking project, which was designed to develop an environmental purchasing tool and field test it in hospitals and clinics of varying sizes in the midwestern United States.

Background

Green purchasing. Environmentally preferable purchasing (EPP), or "green purchasing," has been defined as purchasing products and services with "a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose" (Clinton 1998; p. 49643). The U.S. Environmental Protection Agency has proposed that federal agencies adopt guiding principles for EPP programs. These principles include pollution prevention and life-cycle perspective (U.S. EPA 1999c). The U.S. EPA, working with the American Hospital Association, Health Care Without Harm, and many other partners, created a Web site that provides explicit guidance on implementing environmental purchasing in health care (Hospitals for a Healthy Environment: How to Do EPP in Hospitals). In Europe, researchers have advocated collaboration among purchasing, administration, and environmental services within hospitals to reduce environmental impact (Daschner and Dettenkofer 1997).

Similarly, U.S. and multinational industries, including electronics, automotive, and furniture, are beginning to create green supply-chain management and purchasing initiatives (BMW 1998; Ericsson 1998; Fiksel 1995; Nagel 1998, 1999, 2000; Walton et al. 1998). The typical emphases of these initiatives have been waste reduction, energy efficiency, recycling, toxics reduction, and compliance with environmental regulations. The Health Care Environmental Purchasing Tool (HCEPT) was designed to address a similar range of such environmental concerns for the health care industry. In its final form, the HCEPT addresses materials selection, packaging design, design for recyclability, energy use, and environmental management. The HCEPT was also designed to be flexible enough to accommodate future environmental issues.

Mercury. Because the focus of this article is mercury reduction, we include a short summary of the impacts of mercury. Air pollutants, specifically mercury and other persistent, bioaccumulating, toxic substances (PBTs), have been detected in emissions from medical waste incinerators (Glasser and Chang 1991). Mercury, in its organic form, tends to accumulate and increase in concentration up the food chain to potentially toxic levels, negatively affecting wildlife and humans (U.S. EPA 1999a). Medical waste incinerators are among the top sources of anthropogenic mercury emissions in the United States.

Medical waste incineration accounts for approximately 10% of anthropogenic mercury emissions in the United States, making it the fourth largest emission source (U.S. EPA 1997). Mercury can also escape to the environment through wastewater emissions and spills at health care facilities. Mercury is a strong neurotoxin and has been linked to reproductive disorders at high doses (Dickman et al. 1998; U.S. EPA 1999b). The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) ranked mercury third on the ATSDR/EPA Priority List of Hazardous Substances for 1999 (ATSDR 2001).

When deposited to bodies of water, elemental mercury is transformed into a more toxic organic compound, methylmercury, by microorganisms (U.S. EPA 1999a). In the United States, methylmercury contamination has prompted about 2,000 fish consumption advisories for freshwater lakes, rivers, and

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We acknowledge J. Koning and A. Miner, University of Wisconsin-Madison; H. Shaner, Nightingale Institute for Health and the Environment; F. Kurk, Minnesota Office of Environmental Assistance; T. Easthope, Ecology Center; and M. Boyle and R. Ronda, Illinois Waste Management and Research Center.

The Great Lakes Protection Fund supported this work.

Received 6 November 2001; accepted 5 March 2002.

streams. The advisories recommend bans or limitations on the consumption of fish from affected waters, particularly for women of reproductive age and children (U.S. EPA 1999b). Of the 1,931 advisories in effect as of December 1998, more than 75% were in states adjacent to the Great Lakes. For this reason, the Great Lakes states were chosen as the focus of the HCEPT study.

Mercury is most often found in health care products in its elemental form as a liquid metal. It is used in thermometers, blood pressure cuffs, and esophageal dilators (Shaner 1997). Mercury can also be found in cleaning agents and fixatives for laboratory work. In a database of more than 5,000 medical products compiled by a technical assistance organization, more than 15% of the products contained mercury (Shapiro et al. 2000).

Health care purchasing. Health care facilities purchase large volumes of products and services. To obtain the lowest cost of products, health care facilities frequently enter contractual agreements with suppliers, distributors, and group-purchasing organizations that offer health care products at a volume discount. Up to 80% of health care and pharmaceutical purchasing involves formal contracts (Wira 2000). As a consequence of these relationships, there can be several layers of communication links between health care facilities and manufacturers. Although the functional attributes of products are usually discussed, the environmental attributes of products are often unknown to decision makers in health care facilities.

The purchasing process in health care facilities is typically, but not always, centralized in one department. Figure 1 illustrates the complexity of purchasing arrangements in the health care industry. These arrangements are as simple as credit card transactions or as complex as group-purchasing organizations. Traditionally, the primary factors in health care product selection are clinical effectiveness and cost (Shapiro et al. 2000). In the United States, environmental factors are rarely included in the selection process.

Group purchasing organizations (GPOs) are influential players in the acquisition of health care products. GPOs purchase products at low prices and offer many different products to hospitals. Most hospitals in the United States belong to one or more GPOs. Hospitals are often required to purchase pre-established dollar amounts from their GPOs and are frequently restricted to a limited number of product choices. Otherwise, they lose facility benefits. GPO contracts with suppliers are often multiyear commitments, which further restrict substitution of products. Sometimes groups or families of products are offered to hospitals. These product groupings can contain products that may not have desirable environmental attributes. Our research was designed to bridge the gap in communication between health-care decision makers and product manufacturers concerning environmental attributes and performance.

Health care facilities pay for different types of waste disposal by contracting with appropriate waste haulers. However, these costs are not typically associated with the products or product systems and their original costs.

Methods

The overall goals of the project were to *a*) produce a workable, general environmental assessment tool for health care purchasing that would be particularly focused on mercury; *b*) determine whether the environmental information gap between health care facilities and product manufacturers can be bridged; and *c*) encourage the purchase of environmentally preferable products by generally quantifying the environmental impact of health care products.

Tool development. To achieve project goals, a prototype environmental purchasing tool was developed by a team from the University of Wisconsin-Madison, the Minnesota Office of Environmental Assistance, the Illinois Waste Management and Research Center, the Ecology Center, and the Nightingale Institute for Health and the Environment. The HCEPT is a supplier-assessment method that provides streamlined life-cycle assessment information about the environmental impacts of health care products. The research team designed the HCEPT for health care facilities such as hospitals and clinics. As shown in Figure 2, the health care facilities distributed the questionnaire to their suppliers to facilitate better communication about the environmental impacts of products and services that hospitals purchase. The product suppliers were asked to complete the assessment and return it to the facility. The health care facilities then used the information in the hospital's product selection process. Although measures were taken to guide the facilities, the purpose was not to control the type and quality of information received from suppliers, nor how the facilities used the information. Further studies should be undertaken to address these facets of HCEPT use.

Because no tool of this nature had ever been developed and tested in health care, and most health care professionals in the United States have little environmental training (Burstein and Levy 1994), the project was designed to be educational and highly interactive. A desired functional characteristic of the tool was the capability to differentiate between two products that serve the same purpose but have different environmental attributes. The questionnaire was designed to be straightforward and flexible so that it could be amended in the future to reflect emerging environmental health care management issues. This perspective is consistent with the evolution of green purchasing programs, which have developed from single issues such as energy usage and chlorofluorocarbon releases and now encompass many impacts across the entire life cycle (OECD 2000).

The prototype HCEPT consisted of a series of 60 yes-or-no questions concerning the environmental aspects of a product and the associated manufacturing practices. Drawing

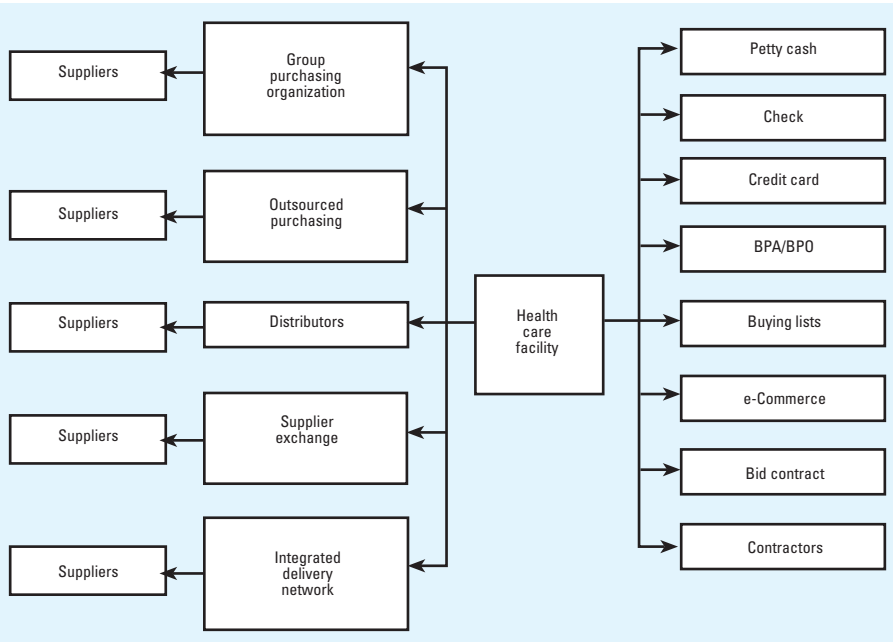

Figure 1. Purchasing methods in U.S. health care.

on the technique of streamlined life-cycle assessment (Graedel 1998), six categories of questions were developed: supplier facility management, product material content, manufacturing, packaging and distribution, use and service, and end of life. Within each category, questions were designed to gauge the product's ultimate impact on air, land, and water. Several questions focused particularly on mercury. The answers to these questions were translated into numeric scores that, when aggregated, generated an overall score for the product.

The field development of HCEPT focused on single-use, disposable health care products destined for treatment at medical waste incinerators, although a wide range of products could be evaluated with the tool. These single-use products appear to have the greatest impacts on the release of mercury and other persistent pollutants. Figure 3 shows the pathways that a substance such as mercury follows: from raw material, to waste product, to environmental contaminant, to source of human disease. As shown in this diagram, the pathways become very complex after a product enters a health care facility. Because taking a preventive approach includes stopping problems before they are created, the areas of highest leverage are located at the least complex levels. These leverage areas, represented on the right side of Figure 3, involve the health care supply chain. By focusing on these segments of a substance's pathway, it is possible for a health care facility to avoid incurring risk by preventing the release of problematic substances.

Site selection. The nine health care facilities that voluntarily participated in the HCEPT test were primarily located in the midwestern United States, in the Great Lakes air shed. The research sites were restricted to the Midwest because of geographic considerations from the funding agency.

Through a series of site visits and interviews, the research team determined that purchasing agents were hesitant to implement environmental purchasing programs. The concept was too new, and health care facilities were interested in other issues. Therefore, random sampling was not used to select sites for participation in the project. Bias was introduced into the study through selection of health care facilities that had some interest in environmental purchasing and had an individual who could act as an advocate for the project within the facility. As an added incentive to busy purchasing personnel, a $3,000 grant was offered to offset their cost of participation. Building on their experience working with health care facilities, the three technical assistance providers on the study team identified the health care facilities in the Midwest.

The nine health care facilities were instructed to implement the prototype HCEPT for a 9-month period. There were two facilities in Minnesota, three in Illinois, three in Michigan, and one in Arizona. The facilities ranged in size and complexity from a military hospital to a small outpatient clinic. The health care organization in Arizona, Catholic Healthcare West (CHW), volunteered to pilot test the tool before other sites were selected. With 48 hospitals, CHW was the largest facility involved in the study. While CHW was pilot testing the HCEPT, the other sites were identified and enrolled in the study. The results of the pilot test at CHW showed that the tool was capable of differentiating between products based on environmental attributes, as seen in Table 1. CHW received enough information to compare three competing suppliers who offered powder-free surgical gloves.

Field implementation. The research team estimated that 9 months would be a sufficient interval for contract negotiation opportunities to arise. Each facility selected between three and nine products to analyze using the HCEPT. Including the pilot study at CHW, 45 products were analyzed over the 9-month period. These were products being purchased that the facility suspected may contain substances of concern. The selected products ranged from intravenous (IV) bags and oral thermometers to exam gloves and laboratory fixatives. Although the research team did not manipulate the facilities' selection of suppliers, there was no overlap in suppliers among facilities.

A technical assistance provider worked with the health care facilities in each state to assist them with HCEPT use and provide a channel for data collection. Facilities used the HCEPT to measure the environmental profile for each product. Product choice and monthly product usage rates were measured once to determine if pollutants were actually reduced during the test.

Access to final tool. The HCEPT was modified after interviews with the test sites and representatives from the health care supply chain. The tool was shortened from its original 60 yes-or-no questions to 30 questions because of the newness of the tool and its ability to aggregate and interpret data. The revised HCEPT can be downloaded free of charge from the Web site of the Association for Healthcare Resource and Materials Management (Health Care Environmental Purchasing Tool), a society of the American Hospital Association.

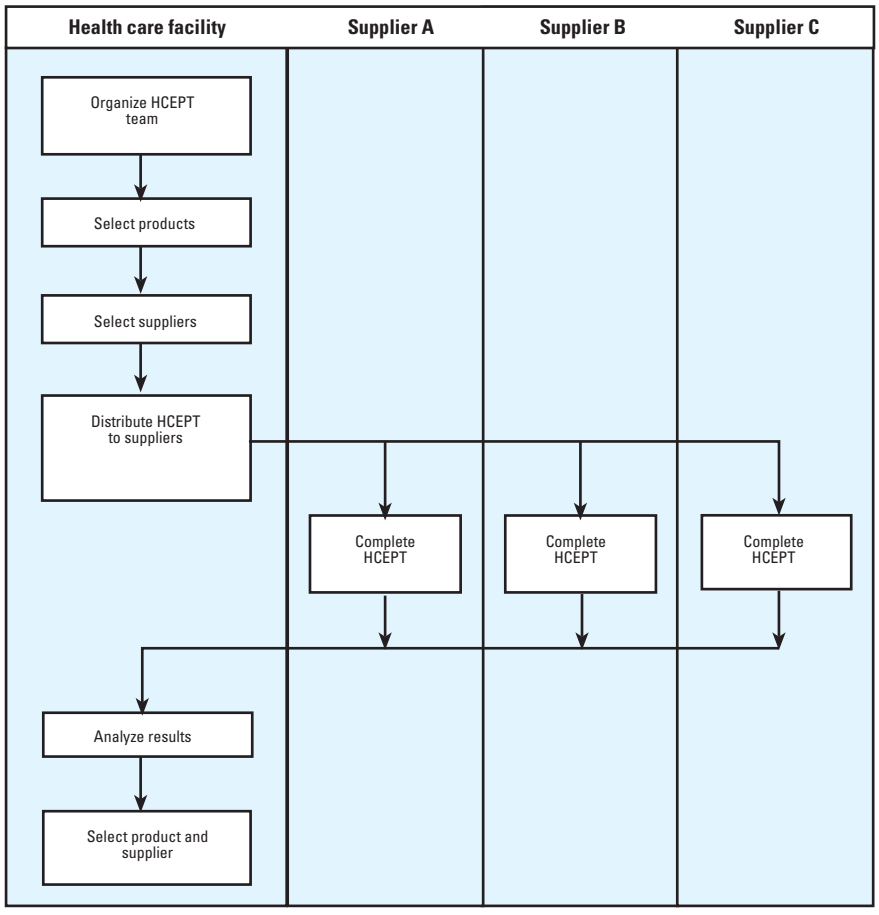

Figure 2. Implementation scheme for HCEPT.

Results

The research team aimed to determine whether the health care facilities of various

sizes could bridge the communication gap on environmental issues with their suppliers. To accomplish this, we calculated return rates for the questionnaire. Between all nine participating health care facilities, a total of 53 questionnaires were distributed to suppliers. Twenty-four questionnaires were returned, giving an overall response rate of 45%. Although statistically valid generalizations cannot be made about the nature of communication between health care facilities and their suppliers, the information from the nine test sites did provide some insights.

The most visible effects from the use of the tool were related to mercury content. Two facilities permanently removed 1,084 g mercury by replacing durable equipment with mercury-free devices. At two other facilities, purchasing changes led to a reduction of 270 g/yr. These reductions are detailed in Tables 2 and 3.

All nine of the sites had mercury reduction programs before the introduction of the HCEPT. Even though HCEPT evaluates general life-cycle environmental issues, it was effective particularly on mercury releases. The research team does not know the effect of the pre-existing focus on mercury reduction, although facility response and awareness outcomes suggest that the HCEPT played an important role in the reductions. Additionally, the nationally known Hospitals for a Healthy Environment initiative, which provides resources and support for mercury and waste reduction programs (Hospitals for a Healthy Environment: Program History; Shaner H. Personal communication), most likely had influence on the mercury reductions realized during the HCEPT pilot study.

Postproject surveys and interviews indicated that the tool increased environmental awareness. Environmental awareness building seems to be an important indicator of the success of the HCEPT. According to one of the participating hospitals, the HCEPT also provided a structure to deal with environmental issues in a formal way. As a result of the benefits the tool provided, five of the nine health care facilities involved in the pilot test indicated that they plan to use the HCEPT in the future.

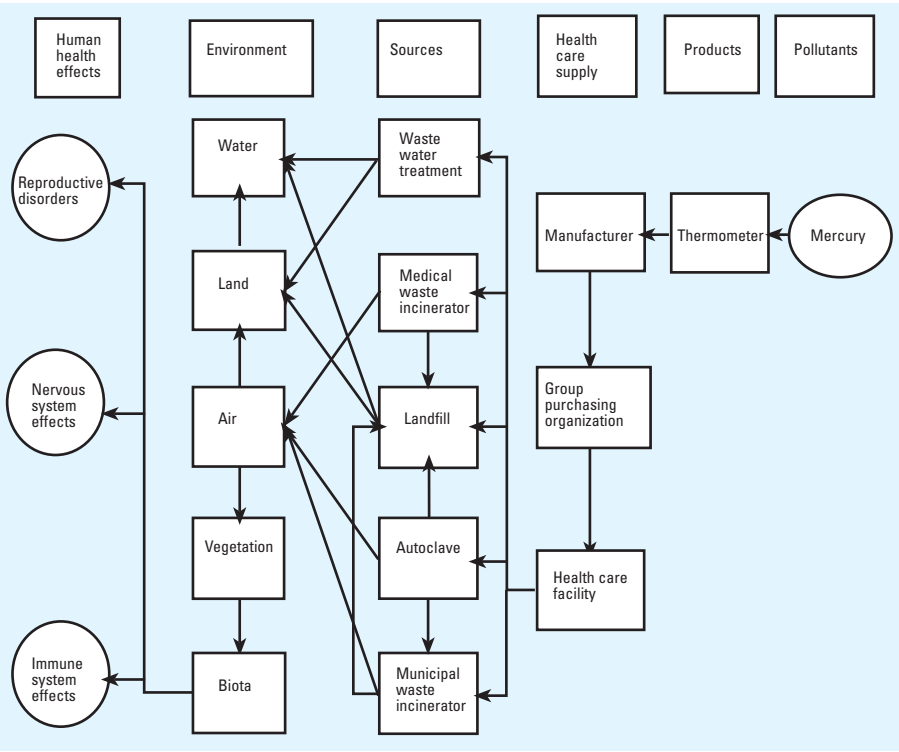

Figure 3. Linkage diagram.

Table 1. Scores for differentiation between products' environmental preferability for three different suppliers of powder-free gloves to a single hospital system.

Supplier	Product[a]	Packaging[a]	Life cycle[a]	General environmental[a]	Total[b]
A	2	6	3	1	12
B	0	0	2	1	3
C	0	6	2.25	6	14.25

[a]0 is the best score (most environmentally preferable); 10 is worst score. [b]0 is best score; 40 is worst score.

Table 2. Changes in mercury content at five of the participating health care facilities.

Facility	No. beds	Product	Units	Hg/unit	Total Hg removed
W	0	Blood pressure monitor	1	83 g	83 g
X	63	Blood pressure monitor	7	143 g	1,001 g
Y	230	Oral thermometer	9/month	0.7 g	6.3 g/month
		Rectal thermometer	3/month	0.7 g	2.1 g/month
Z	731	Thermometer	20/month	0.7 g	14 g/month

Discussion

A challenge in this project was measuring the impact of the HCEPT amid the turbulence in the health care industry. The current business climate is intensely driven by a need to minimize costs. Environmental concerns are not a driving force for most health care organizations. The following summarizes the major observations of the project.

The incorporation of environmental issues into health care purchasing can be seen as an evolving process. As health care organizations revise their definitions of quality care and service, identifying "greener" products can help to improve and protect community health. The HCEPT is designed to assist those health care facilities that wish to assess systematically the environmental impact their operations have on community health. Currently few tools are available to make these environmental evaluations.

After 9 months in the field, the project team learned that the tool could differentiate between products and provide an environmental assessment of individual health care products. As with any new approach, there were implementation challenges. The supply chain, as summarized in Figure 3, is so complex that a direct dialogue between health care facilities and product manufacturers was not always possible. Environmental attributes of health care products do not appear to be part of the dialogue at all. In fact, supplier response to requests for environmental information was sufficiently low that only the health care facility with the largest perceived purchasing power received enough responses to compare products. Of 53 expected responses from suppliers, only 24 responses were received by the health care facilities,

Table 3. Summary of reductions in mercury use.

Reduction type	Mercury (g)
One time only	1,084
Monthly	22.4
Annually	270

giving an aggregate response rate of 45%. This small sample size suggests that the communication gap between health care facilities and product manufacturers can be bridged by very large health care facilities at this time. However, the tool did enable the smaller sites to identify environmental aspects of single products. It also provided an explicit connection between products and environmental impact for health-care decision makers concerned about community health. Additionally, the HCEPT represents a way for health care facilities to send signals to their manufacturers that they want environmentally preferable products. If the manufacturers are responsive to their customers, they will design these attributes into future products. Based on the development and testing process used in this study, the HCEPT is a viable technique for environmental stewardship in health care facilities.

Conclusions

Mercury reduction is an important goal for environmental protection in health care. Because purchasing activities in health care are centralized, environmental purchasing represents an innovative approach to mercury control. Results of the HCEPT pilot project show that the complexity of the supply chain inhibits a direct dialogue between health-care decision makers and manufacturers. Virtually no communication on environmental aspects is taking place. However, a dialogue is starting between major health care systems and GPOs to systematically address environmental issues. The HCEPT, now available to facilitate this dialogue for overall environmental improvement, can help health care facilities identify products that contain mercury. This promising approach can be integrated into a health care facility's standing acquisition process. By using this tool, health care facilities can help to promote greener medical products and thereby protect community health.

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