

AORN Guidance Statement: Environmental Responsibility

Introduction

This document is intended to guide perioperative registered nurses in the development of environmentally responsible practices. This document may be used by health care organizations to provide direction for the creation of environmentally responsible policies and procedures. This guidance document addresses

- ◆ infectious and noninfectious waste management,
- ◆ recycling practices,
- ◆ resource conservation,
- ◆ supply conservation and management practices,
- ◆ reprocessing, reuse, repair and refurbishing,
- ◆ sterilization and disinfection, and
- ◆ construction for efficiency and conservation.

It is recognized that not all portions of this document may be usable by all health care organizations because of the varying standards and regulations set forth in various geographic locations. It also is recognized that the perioperative setting is varied and includes hospitals, obstetrical surgical suites, ambulatory facilities, physicians' offices, specialty centers for invasive procedures (eg, cardiac catheterization laboratories, radiology departments, endoscopy suites), and other areas where invasive procedures or interventions are performed.

Background

Nurses comprise a large single group of health care providers and are in a position to influence environmental management practices. Nurses have long played a role in the protection of the environment. In the 1800s, Florence Nightingale was one of the first nurses to advocate for a healthy environment.¹ Nurses have an ethical responsibility to actively promote and participate in resource conservation and to protect the environment.

US health care organizations generate in excess of two million tons of waste annually.² Approximately 85% of this waste is noninfectious, with a large amount being generated in the operating room.³ Inpatient facilities spend more than five billion dollars a year on energy consumption. Health care energy consumption is increasing to support new and existing technology.⁴ Sterilizing, heating and cooling processes, and hand sanitization contribute to use of water, a limited natural resource.

In addition to waste generation, energy and water consumption has a significant negative impact on the environment.

Guidance Statement

The perioperative registered nurse should serve as a steward of the environment by being knowledgeable about perioperative practices that negatively affect the environment. Perioperative registered nurses should actively promote and participate in resource conservation. Effective resource conservation leads to an improvement of environmental health. The perioperative registered nurse should strive to understand the political, economic, and public health components of environmental responsibility.⁵ The following strategies provide a framework on which to build an environmentally responsible practice.

Infectious and Noninfectious Tissue and Waste Management

More than four million tons² of general waste are produced annually by US health care facilities.⁶ Waste materials can be classified as potentially infectious or noninfectious. Waste management is a major expenditure for health care organizations. Infectious waste management alone can consume as much as 20% of a hospital's annual budget for environmental services.⁷

Waste generated from the operating room includes potentially infectious and noninfectious waste as well as material that requires special disposal (eg, liquid chemicals, hazardous materials). Mercury-based products and dioxin generated by incineration of polyvinylchloride (PVC) are hazardous chemicals. Mercury, a heavy metal and neurotoxin, is a frequent contaminant found in medical waste. Dioxin, a known human carcinogen, has been implicated in cancer of the lung, thyroid, hematopoietic system, and liver as well as soft tissue sarcoma.⁸ Polyvinylchloride is found in many medical supplies, packaging, and building materials. The resulting air pollutants from medical waste incineration not only affect the local community, but also can migrate to pollute distant environments and populations.⁸ Disposal of mercury and medical waste are subject to regulation by local, state, or federal governmental agencies. Health care organizations must comply with the regulations.⁹

Perioperative nurses can significantly affect waste management practices by encouraging and implementing strategies that promote a safe and healthy environment. These strategies should be cost effective and conserve resources. Strategies that should be considered include, but are not limited to, the following.

- ◆ Conduct a survey to assess types of waste generated in perioperative practice settings.
- ◆ Conduct a cost analysis of waste management considering
 - the volume of noninfectious waste, and
 - the weight of potentially infectious waste generated and treatment technology available.⁷
- ◆ Define potentially infectious waste according to local, state, and federal regulations.
- ◆ Provide education to all health care workers, to include, but not limited to,
 - the definition of potentially infectious waste,
 - the importance of and process for segregation of potentially infectious waste from noninfectious waste,
 - the costs of waste management,
 - the environmental impact of waste disposal,¹⁰ and
 - state and federal guidelines and regulations for disposal of waste.
- ◆ Review and update organization-wide waste management policies.
- ◆ Limit contents of biohazardous waste containers (eg, red bags) to potentially infectious waste.
- ◆ Explore methods of waste segregation, which may include
 - placing noninfectious waste and biohazard containers side by side in a convenient location, and
 - using a bag-in-bag collection system (ie, clear bag inserted inside red bag for collection of waste used to set up for a procedure; clear bag is removed from bag holder but left in room before start of procedure when infectious waste may be generated).⁷ Consider risks to health care workers when using this system.
- ◆ Eliminate use of mercury-based products—ie, inventory, remove, and replace mercury-containing devices with nonmercury-containing devices (eg, digital thermometers, sphygmomanometers, batteries, bougies, cantor tubes, fluorescent lights).³
- ◆ Work with waste management services to explore alternatives to incineration, including, but not limited to,
 - microwaving,
 - autoclaving,
 - radiowaving, and
 - electrotechnologies.¹¹
- ◆ Explore recycling programs for noninfectious waste (eg, paper, irrigation bottles, sterilization wraps and other plastics).
- ◆ Evaluate the environmental impact of reusable, reposable, and disposable products.
- ◆ Develop an ongoing performance improvement program for waste management.
- ◆ Dispose of chemicals in accordance with state and local regulations, including, but not limited to,
 - dilution,
 - inactivation of solution before release, and
 - consideration of a program of controlled release.¹²
- ◆ Consider membership in Healthy Hospitals for the Environment (H2E), located online at <http://www.H2E-online.org> (accessed 23 Jan 2006); and Health Care Without Harm (HCWH), located online at <http://www.noharm.org> (accessed 23 Jan 2006).⁸

Recycling Practices

A significant amount of hospital waste is composed of noninfectious material, much of which may be recyclable.^{13,14} Recyclable items found in the perioperative environment include, but are not limited to, plastic bottles, sterilization wrap, peel packs, glass, paper, aluminum and metal cans, and corrugated cardboard.^{15,16} Only items that are clean and noninfectious, as defined by local, state, and federal regulations, should be recycled.³ Recycling noninfectious waste materials has environmental and financial benefits that may include¹⁷

- ◆ providing materials for remanufacture,
- ◆ preserving resources for future generations,
- ◆ decreasing air and water pollution,
- ◆ conserving energy, and
- ◆ limiting the expansion of landfills and incinerator use.

Health care facilities should modify purchasing and waste disposal practices to favor recycling.^{14,16} Perioperative nurses can significantly affect waste management practices by encouraging and

implementing recycling strategies that promote a safe and healthy environment. These strategies should be cost effective and conserve resources. Strategies that should be considered include, but are not limited to, the following.

- ◆ Perform a waste assessment to identify items appropriate for recycling.
- ◆ Investigate available community recycling programs to determine feasibility of participation.
- ◆ Obtain recycling containers from local waste management systems.¹⁸
- ◆ Begin with simple items (eg, paper, cardboard, plastics).
- ◆ Contact manufacturers regarding recycling programs.
- ◆ Identify waste versus recycling receptacles with distinguishing features:
 - use color-coded receptacles (eg, green for paper, silver for metal, blue for plastic); and
 - use a slotted top for paper, a round top for cans.
- ◆ Provide receptacles in areas where the waste is generated.
- ◆ Provide education to all health care workers regarding recycling practices, including separation procedures.¹⁸
- ◆ Implement a process improvement program to demonstrate changes and to identify additional recycling opportunities.
- ◆ Give feedback to healthcare workers related to the results of the waste management efforts to reinforce this behavior.

Resource Conservation

Health care organizations should conserve finite natural resources such as water, electricity, and natural gas. The average water consumption by US hospitals is 139,214 gallons per day.¹⁹ Health care organizations use 62 billion kilowatt hours of electricity annually, with a higher intensity than other commercial buildings (ie, 26.5 kWh per square foot).²⁰ The average per square foot consumption of electricity in health care organizations is \$1.67, compared to \$0.99 per square foot in commercial buildings, and inpatient facilities use more electricity than outpatient facilities.²⁰ Conserving electricity minimizes air pollution caused by electrical generation and reduces costs.²⁰

Health care organizations also consume large quantities of natural gas (252 billion cubic feet

annually) and have a much higher natural gas intensity than the average commercial building (143.0 cubic feet per square foot).²¹ The average per square foot consumption of natural gas is \$0.48 per square foot compared, to \$0.24 per square foot in commercial buildings.²¹

Perioperative registered nurses should actively promote and participate in resource conservation measures for water, electricity, and natural gas. Conservation strategies should be incorporated into daily practice, including, but not limited to, the following.

- ◆ Conduct a resource utilization assessment.
- ◆ Provide education to health care workers about the importance and benefits of resource conservation.^{19,22}
- ◆ Create resource conservation suggestion boxes and place in prominent areas.^{23,24}
- ◆ Install signs encouraging resource conservation.^{23,24}
- ◆ Develop a team of health care workers (eg, “green team”) to evaluate resource conservation opportunities and effectiveness.^{16,24}
- ◆ To conserve electricity,
 - install occupancy sensors in certain areas of the practice setting to control lighting based on the presence or absence of personnel and patients;²⁵
 - turn off lights when rooms are not in use;²⁶
 - turn off equipment when not in use;²⁴
 - install and use energy-efficient electrical equipment, lights, and appliances;
 - reduce flow to surgical vacuum pumps to minimum acceptable level and maintain proper operation;^{23,27} and
 - insulate hot water pipes.²⁸
- ◆ To conserve natural gas,
 - insulate hot water pipes,²⁸ and
 - shut off natural gas to equipment and areas that are not in current use.²⁸
- ◆ To conserve water,
 - ensure the return of sterilizer steam condensate to the boiler tank for reuse;^{19,27,28,29}
 - eliminate use of city water for cooling sterilizer condensate, possibly by using holding tanks as an alternative;^{23,27,30}
 - establish a preventive maintenance program for the evaluation and replacement of faulty steam traps on sterilizers;^{19,23,24,28,31}
 - recirculate noncontact sterilizer cooling water;³⁰

- install flow control fixtures on all faucets;^{27,28,31}
- install scrub sinks with timers and foot or knee controlled turnoff valves;
- install an on-demand water heater near sinks to avoid running water while waiting for hot water;³¹
- turn off water while scrubbing until needed for wetting or rinsing hands;
- evaluate the use of waterless surgical scrub products;
- evaluate the use of microfiber mops for cleaning;³²
- install high-pressure, low-volume nozzles on scrub sinks and showers;²⁹
- recycle and reduce water use whenever possible;²⁴
- operate washers, disinfectors, and steam sterilizers only when full, if possible;^{19,23,24,27-29}
- avoid flash sterilization of single items or small loads when possible;³¹
- repair leaks in water lines and faucets;^{19,23,31} and
- replace older equipment (eg, sterilizers, ice machines, automated endoscope reprocessors, disinfectors) with water-efficient models.^{19,22,29,31}

Supply Conservation and Management Practices

Supply management is essential to ensure that the correct products are available when needed.³³ Cost containment measures that minimize waste production provide economic benefits without compromising quality of care. Effective supply chain management will offer opportunities to minimize process inefficiencies and product waste.

Perioperative nurses can significantly affect supply management practices by encouraging and implementing strategies that promote a safe and healthy environment. The strategies should be cost effective and conserve resources. Strategies that should be considered include, but are not limited to, the following.

- ◆ Standardize products, devices, and equipment.³⁴
- ◆ Collaborate with other health care organizations to purchase partial quantities of infrequently used supplies.
- ◆ Preference cards and pick-lists should list the minimum number of items to be routinely opened and specify items to be available but unopened.^{33,35}

- ◆ Open implantable devices only when the desired specifications are known and confirmed by the surgeon.³⁵
- ◆ Identify processes or practices that increase efficiency or reduce cost, to include
 - monitoring preference card/pick-list supply utilization and remove items not used;
 - reducing excess supply inventory and returning slow-moving inventory;
 - rotating stock with expiration dates to use oldest inventory first;³⁶ and
 - evaluating excess supplies from customized packs.
- ◆ Evaluate implementation of a value analysis and product standardization program for supply purchase and selection.
- ◆ Consider natural resource requirements specific to item (eg, clean water availability).^{36,37}
- ◆ Consider the impact of the item on the waste stream when purchasing supplies and equipment.^{3,16}
- ◆ Collaborate with vendors to return unopened, expired items or donate items to charities or nonprofit organizations.³⁸
- ◆ Purchase items made from recycled products.³⁹
- ◆ Use double-sided photocopies.³⁹
- ◆ Use reusable totes and pallets instead of cardboard boxes or wooden pallets for transport of goods.³⁹

Reprocessing

Reprocessing single-use devices can potentially reduce the amount of waste entering the waste stream.^{39,40,41} A recent estimate shows that facilities with 250 beds or more rely on reprocessing to extend their budgets and reduce waste.⁴⁰ In 2004, reprocessing was estimated to have reduced the waste generated by health care organizations by more than 449 tons destined for landfills.⁴⁰

If a health care organization chooses to practice reprocessing of single-use devices as a means of decreasing the amount of waste entering the waste stream, the perioperative registered nurse should investigate and evaluate the environmental impact of reprocessing on the organization's waste stream as well as the total environmental impact. Refer to the AORN guidance statement on the reuse of single-use devices for more tools to use for evaluation of reprocessing⁴² and adherence to the US Food and Drug Administration regulations controlling reprocessing of single-use devices.

Reuse, Repair, and Refurbishing

Reuse of medical equipment demonstrates the health care organization's commitment to supply conservation and fiscal responsibility through

- ◆ conservation of resources and energy,
- ◆ optimization of resources, and
- ◆ reduction of the pollution that occurs with waste disposal in the environment.⁴³ (Pollution is reduced because the final disposal of the item is delayed.³⁸)

Reuse includes the repair, refurbishing, washing, or recovery of worn or used items.³⁸ Strategies the perioperative nurse should consider when deciding to purchase reusable items or repair and refurbish an item include, but are not limited to, the following.

- ◆ Identify factors affecting the longevity of instruments and equipment, such as
 - adequate inventory to reduce frequency of reprocessing and wear;
 - education of health care workers who use and reprocess instruments;
 - education of health care workers who operate and maintain equipment; and
 - adequate storage facilities to protect the instruments and equipment from damage.⁴⁴
- ◆ Implement proactive maintenance, repair, or restoration programs for instruments and equipment to prevent malfunction and maintain integrity.
- ◆ Consider purchasing reusable medical equipment, instruments, and supplies.
- ◆ Educate health care workers regarding their practice accountability for
 - safe care and handling of instruments and equipment,
 - environmental and workplace practices supporting care and handling of instruments and equipment, and
 - repair and refurbishing initiatives of the health care institution.
- ◆ Consider projected life span when purchasing instruments and equipment.
- ◆ Consider reuse of clean items internally (eg, corrugated boxes, packaging materials, interoffice envelopes, furniture).

Sterilization and Disinfection

Various sterilization and disinfection technologies that affect the environment are used in health care settings. Sterilization technologies in current use

include steam, dry heat, ethylene oxide gas, hydrogen peroxide gas plasma, and ozone.⁴⁵ High-level disinfectants commonly used include liquid chemicals such as peracetic acid, glutaraldehyde, and orthophthalaldehyde. Steam and dry heat are not known to generate by-products harmful to the environment, but these methods of sterilization do consume natural resources (ie, water, electricity, or natural gas).²⁰ Ethylene oxide gas sterilization and liquid chemical disinfectants can result in harm to the environment if used irresponsibly or contrary to existing local, state, and federal regulations.⁴⁶ Ethylene oxide gas, for example, is an air pollutant, a known carcinogen, a potential reproductive hazard, an allergic sensitizer, and a potent neurotoxin.⁴⁷ When choosing a sterilizing or disinfecting method or product, the effect on the environment should be considered.

Perioperative nurses can significantly affect the environment by encouraging and implementing strategies that are cost effective and/or conserve resources. Strategies that should be considered include, but are not limited to, the following.

- ◆ Develop a program for monitoring the environmental effects of sterilization and disinfection products on the environment.
- ◆ Ensure that the necessary equipment and supplies are available to deal with spillage of sterilizing or disinfecting chemicals.
- ◆ Use, maintain, and monitor sterilizers according to the manufacturers' written instructions.⁴⁵
- ◆ Establish, ensure, and maintain proper safety measures for handling hazardous materials (eg, monitoring compliance with emission control regulations for ethylene oxide sterilizers, glutaraldehyde disposal).
- ◆ Provide education for health care workers regarding the environmental impact of the sterilant or disinfectant being used and appropriate safety measures.
- ◆ Use and dispose of liquid chemicals employed in sterilization or disinfection in accordance with manufacturers' written instructions and local, state, and federal governmental agency requirements.
- ◆ When possible, purchase items for which the sterilization or disinfection process has the least potential for harm to the environment.³
- ◆ Additional glutaraldehyde precautions include
 - using fume cabinets,⁴⁸

- considering cold sterilization alternatives to glutaraldehyde,⁴⁵ and
- limiting areas in the facility where glutaraldehyde is used and stored.

Construction for Efficiency and Conservation

Building design, construction, and materials significantly affect the natural environment and health outcomes of patients, staff, and community.⁴⁹ Although such a discussion is beyond the scope of this document, perioperative registered nurses involved in the planning, design, and construction of health care facilities should incorporate the principles of “green” building design—ie, designs that are energy efficient and water conserving, among other qualities—whenever possible. Nurses interested in green building codes should refer to Healthy Hospitals for the Environment (H2E), located online at <http://www.H2E-online.org>; Health Care Without Harm (HCWH), located online at <http://www.noharm.org>; or the US Green Building Council, located online at <http://www.usgbc.org> (accessed 23 Jan 2006).⁵⁰

Summary

This document has provided strategies for perioperative registered nurses to use in becoming effective stewards of the environment, addressing

- ◆ infectious and noninfectious waste management;
- ◆ recycling practices;
- ◆ resource conservation;
- ◆ supply conservation and management practices;
- ◆ reprocessing, reuse, repair, and refurbishing,
- ◆ sterilization and disinfection, and
- ◆ construction for efficiency and conservation.

Glossary

Green building codes: Codes used during building design that require the building to be energy efficient and water conserving, have low environmental impact, and have high indoor air quality, among other requirements.^{49,50}

Noninfectious waste: Materials with no inherent hazards or infectious potential (eg, packaging materials, paper).⁷

Potentially infectious waste: The definitions of potentially infectious waste vary from state to state, but for the purposes of this document, potentially infectious waste is waste (eg, blood, body fluids, sharps) that is capable of producing infectious diseases.⁷

Reprocessing of single-use devices: Includes all operations necessary to render a contaminated reusable or single-use device patient-ready. Single-use devices to be reprocessed may be either used or unused. Reprocessing steps include disassembling for cleaning, decontamination, inspecting, packaging, relabeling, sterilization, testing, and tracking.⁴¹

Reuse: The repeated or multiple use of any medical device, whether marketed as reusable or single use. Repeated/multiple use may be on the same patient or on different patients with applicable reprocessing of the device between uses.⁴¹

Waste: Waste can be classified as potentially infectious and noninfectious materials. In this document, waste refers to the combination of potentially infectious and noninfectious waste.

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