CHAPTER 4
ENVIRONMENTAL SUSTAINABILITY: LIMITING IMPACT ON THE ENVIRONMENT

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Checklist

1. Sustainable sites: Are the architect/construction teams, materials, and site choice geared toward low environmental impact?
2. Water: Are fixtures and systems designed for maximal water efficiency?
3. Energy: Is energy efficiency a consideration in lighting, heating, and design choices? Can "green" energy be purchased by the facility?
4. Indoor environment: Are interior materials eco-friendly and recyclable? Is environmental sustainability a factor in operating room (OR) surgical and anesthesia equipment evaluation?
5. Innovation and design: Can operative and perioperative spaces be proactively designed to accommodate recycling programs and other features that lower environmental impact?

Introduction

The imperative to limit environmental impact extends to the health care industry, which is very high impact and energy consuming. However, this imperative presents many special challenges given the needs for patient safety, infection control, and cost containment. Fortunately, with some specific guidance for the industry, "green" design and "green" operations in health care may work in concert with health care's goals and challenges by improving building efficiency and cost and providing safer, more pleasant surroundings for patients and employees. The Leadership in Energy and Environmental Design (LEED) program of the US Green Buildings Council offers guidance and certification for new and remodeled building projects and currently has over 350 health care construction projects registered. The LEED for Healthcare system, a more specialized version tailored to the challenges of health care, is under final review and expected to be available by mid-2011. This more specific guidance, along with the currently available Green Guide for Health Care (www.gghc.org), will enable implementation of many low environmental impact solutions.

A LEED certification involves accumulating points in at least six areas of evaluation: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design. Based on the degree of compliance in these areas, projects can be deemed LEED "certified," "silver," "gold," or "platinum." Each of the areas of LEED certification will be briefly addressed, with comments about how they generally pertain to a health care facility and might more specifically pertain to ORs and perioperative areas.

Sustainable Sites

First, consider what it means to have a sustainable site and whether the other "green" plans for the project fit into this location. The ultimate goal is to minimize impact on the surroundings while choosing a location that best serves the intended patient and employee populations. Suggestions include:

- General considerations: Choose an eco-friendly team of architects, engineers, and contractors. Discuss plans for possible LEED certification at an early stage. Discuss the contractors' plans for keeping the construction or remodeling site low impact.
- New site versus previously developed site: Building on a previously developed site avoids disturbing undeveloped terrain. However, with a new site, attempt to work with the terrain and biosystem rather than just replacing it. The Green Guide for Health Care (GGHC) has very specific recommendations for perimeter footage beyond which the terrain should remain undisturbed. The GGHC also recommends limiting parking capacity to the specified minimum; however, this must take into account that patients and their families will often be driving.
- Limited footprint: Can the structure be built "up and not out" to limit the footprint? Also, avoid unnecessary replication. Do other nearby facilities or businesses with which to share parking, energy, water, office, or research facilities exist?
- Transportation: Though patients and families will most often be driving to the facility, health care employees may be encouraged or provided incentives to take advantage of public transportation. The site should be near mass transit lines or offer shuttles to them. In addition, bicycle and walking paths should be provided. Adequate lockup space for bicycles should be included as well.

"Regenerative" systems: Some hospitals have been built to enhance the area and have positive impact (e.g., rain collection systems, habitat and pond restoration, etc.). These health care systems are termed "regenerative."

Water Efficiency

Many hospitals and surgicenters are older and have not been built for water efficiency. Nonetheless, there are several key strategies for conserving water for both new and existing facilities, including:

- Use less water. Low-flow fixtures may be utilized for urinals, toilets, and showers. Sensing devices may be placed on sinks used for hand washing. As an alternative to hand washing in some situations, alcohol hand rubs can be made available.

Energy- and/or water-saving appliances can be installed. Water used in cleaning or preparation of surgical/operative items or areas may be difficult to reduce, but efficiency of water conservation processes should be evaluated.

- Use reclaimed water. The GGHC estimates that only 20% of the water in an urban area actually need be potable, leaving 80% that could be reclaimed water. Given the patient safety, infection control, and operative sterility needs, 20% potable-quality water may be a low estimate for a health care facility. However, interior and exterior maintenance operations could utilize reclaimed water in situations such as closed-loop cooling systems and landscape maintenance. Consider designing dual-water distribution into health care structure whenever possible.

Energy and Atmosphere

The LEED certification and the GGHC stress saving energy and limiting the impact on the atmosphere.

Energy

Energy efficiency can be planned for a new design or remodel with assistance from a system designed by the Environmental Protection Agency (EPA)—the Energy Star rating system, LEED, and GGHC. Newer facilities are building in methods for monitoring energy use, but some means of measuring energy consumption should be undertaken. Metering electrical, mechanical, and air distribution systems will help find weak points and confirm energy saving strategies. Key strategies include:

- Purchase energy-efficient equipment.
- Purchase or produce “green” energy. It may be possible to purchase some percentage of solar, wind, geothermal, and other “green” energy. Health care, as an industry, is finding that smaller “energy auctions” can add “green” energy to their portfolios. In addition, some health care facilities are dedicating some of their own land to installing solar panels and wind turbines. This allows the facilities to generate their own “green” energy and sell surplus to the community.
- Utilize natural lighting and energy-efficient artificial lighting. New “green”-design hospitals and surgicenters emphasize the use of large windows and weather-resistant glass walls to allow natural lighting. This is not only more pleasant and healthier for patients, families, and employees, but can reduce overall energy costs by 30%. The cost of light energy is reduced by greater than half, and, in some climates, the need for further energy consumption to modify temperature is reduced as well. In areas requiring artificial lighting, use the most efficient lighting available. In areas with variable use, such as bathrooms, offices, and storage areas, consider installing motion sensors. In ORs, light-emitting diode (LED) surgical lighting is now available from several companies. Lighting with LED is highly efficient; diodes have a very long life, and LED lighting produces very little heat, reducing the energy needed to cool ORs.
- Consider installing a central monitoring and controlling system for energy use. Older hospitals and surgicenters may not be monitoring individual rooms or surgical suites.

However, this could be very helpful, particularly for individual ORs. Lighting, temperature, surgical equipment, computers, and anesthesia machines all contribute to energy use. Because overnight and weekend use can be variable, energy conservation can be achieved for low- or non-use periods. Placing monitors and controls in a central OR location (where patient flow and surgery scheduling occurs) and designating staff for monitoring and operations places priority on energy savings.

Limiting the Impact on the Atmosphere

- A number of waste gases have been implicated in ozone depletion and the greenhouse warming effect. The EPA has recently cited six gases in particular: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Key strategies to limit their impact include:
- Consider monitoring and minimizing any of these waste gases in design or remodel whenever possible.
- Consider replacing older equipment (e.g., refrigeration systems) that may utilize chlorofluorocarbons.

In the ORs, potent inhaled anesthetics are greenhouse gases, with their own global warming potentials having been established. In addition, nitrous oxide has both global warming potential and ozone-depletion capability. Currently, there are no restrictions on expelling these gases into the atmosphere. However, their atmospheric impact can be lessened. Considerations include:

- Use relatively low fresh gas flows during anesthetic delivery to limit atmospheric impact.
- Consider recovery of potent inhaled anesthetics. Several systems to do so are under development. One recovers anesthetics through a canister placed on the scavenging system of individual anesthesia machines (Blue Zone Technologies, Canada). Another pipes anesthetic gases from several ORs into a central location, where recovery occurs (Vanderbilt University). Neither system is yet available for use in the United States.

Materials and Resources/Indoor Environmental Quality

The LEED guidelines and the GGHC encourage the use of eco-friendly materials from design to final operations. General suggestions during construction and remodeling include:

- Consider use of recycled or salvaged materials, depending on quality.
- Show preference for local and rapidly renewable materials. Use of local materials cuts down on the energy cost of attainment and bolsters local economy. Use of rapidly renewable materials has a lower impact on the environment.
- Consider use of materials that can be recycled into future projects.
- Choose wood that is Forest Stewardship Council certified.
- Avoid toxic chemical and polyvinylchloride (PVC) use; PVC is very toxic to produce and toxic on incineration. It cannot be recycled.
- Consider carpeting with recycled content and PVC-free backing (which allows the carpet to be recycled).

- Use eco-friendly interior woods, furniture, fabrics, and lighting. Avoiding materials that emit volatile organic chemicals or formaldehyde can be very important to patient health. Many of these chemicals can trigger asthma attacks or migraine headaches.
- Use accepted nontoxic cleaners that meet or exceed Green Seal standards whenever possible. Green Seal is a nonprofit organization that promotes environmentally responsible products (taking into account manufacturing, use, and disposal).

All of these suggestions pertain to perioperative areas (e.g., waiting rooms), preoperative areas, postoperative areas, and ORs. Modifications for infection control may be necessary. Materials in and practices of the OR encompass many facets of design and operation. General guidelines for low environmental impact practices within this specialized area include:

- Preferential, responsible purchasing: Though many items are purchased through purchasing cooperatives, some cooperatives are more sensitive to limiting the environmental impact. For group or individual purchasing, suppliers should be able to discuss responsible manufacturing practices, use of recycled and recyclable materials, toxicity-related questions, and use of local manufacturers. Some examples might include masks, gloves, intravenous bags, and surgical instruments. Companies should also be able to discuss practices for disposal of old equipment or products.
- Reprocessed equipment purchase: Many surgical and anesthesia equipment items are designated “single use” by the manufacturer (but not the Food and Drug Administration). Several companies collect these used items and then reprocess, test, sterilize, and resell them at a reduced cost. Examples include surgical laparoscopic trocars, sequential compression devices, and pulse oximeter probes. Several large health care systems in the United States regularly buy certain reprocessed equipment items.
- Reusable versus disposable equipment: Many items, both surgical and anesthesia related (airway equipment, in particular), can be purchased as reusable or disposable. Each surgical/anesthesia practice should interface with material services and sustainability coordinators to determine the purchase strategy that has the lowest environmental impact for each item or group of items while safely and efficiently functioning.
- Efficiency system: Each practice should have a system in place to prevent waste of outdated or overstocked items. Surgical case cart and anesthesia equipment cart reviews should periodically take place. Removal of rarely used surgical items from a case cart can prevent the waste of opened, exposed, unused items. Purchase of metal sterilization pans can avoid “blue wrap” (a paper/plastic material that is difficult to recycle) waste. Anesthesia cart reviews can cut down on medication as well as equipment waste.
- Reduce and manage waste: Surgical suites and perioperative areas produce voluminous waste, with more biohazardous waste than produced by other areas of a health care facility. Much of the waste in the ORs need not be considered biohazardous. Paper and plastic may be removed before the patient enters the room, allowing recycling and regular waste disposal, both being of lower impact on the environment and less costly.

A recent report from Oregon Health and Science University, a suite of 21 ORs, estimated that they are currently recycling approximately 300 pounds of uncontaminated paper and plastic each day. In addition, utilizing closed-fluid waste management systems will not only protect personnel, but likely decrease secondary biohazardous waste.

Innovation and Design

Innovation and design in "green" health care projects is currently focused on a two-pronged approach: (1) innovate and design to reduce or remove negative impact on the environment; and (2), provide a healthier and more pleasing environment to help the healing process and retain satisfied and healthy employees. General strategies that bridge both prongs when considering perioperative design include:

- Efficiency: Provide a pleasant and healing environment throughout the perioperative settings while keeping efficient patient and family flow in mind. Waiting and preoperative areas should be well lighted (ideally with natural light) and comfortable. Plan and design private areas for doctor-patient or doctor-family discussions. Plan for efficient movement from waiting room to preoperative area to OR to postanesthesia care unit. This efficiency will result in savings in energy and OR time.
- Operating and procedure rooms: Good instrument care, waste management, and recycling require space. The design should incorporate staging areas that facilitate segregation of different materials and make it easy to sort, recycle, handle sharps, manage materials, and incorporate closed-fluid waste systems. Currently, low-cost waste removal and recycling are afterthoughts in the OR; thoughtful design can help change the culture.
- Waste anesthetic gas capture: For both cost and environmental reasons, anesthetic gas capture may be planned and designed into OR systems. Dual-waste medical gas removal systems will allow segregation of anesthetic gases from other gases piped out of ORs. Alternatively, individual machines may be equipped with gas capture capability.

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