BY WINSTON HUFF, CPD, LEED AP

Water Efficiency and Hospitals

As hospitals try to reduce their impact on the environment and run efficient operations, they are faced with some important concerns. First, hospitals are consistently one of the largest municipal water and sewer customers, as well as one of the largest energy customers in their communities. Such facilities are filled with complicated life-saving technology that demands reliable sources of medical gases, water, and power.

Second, medications that pass through the bodies of patients staying in hospitals are discharged into the wastewater stream and can cause environmental problems because modern wastewater treatment plants cannot remove the substances from the wastewater. A study conducted last year by the Associated Press found a vast array of pharmaceuticals—including antibiotics, anti-convulsants, mood stabilizers, and sex hormones—in drinking water supplies. (See the sidebar for the results of the study.) Although this problem is not confined to hospitals alone, hospitals are caught between the need to save lives without causing harm to others.

One way plumbing engineers can help hospitals caught in this balancing act is to find ways to handle waste streams and reduce water usage, which can reduce the amount of wastewater from a facility as well as the energy used by a facility. This column looks at how a hospital can set a moderate or aggressive approach to meet their sustainable water-efficiency goals. It also discusses the emerging water-efficient technologies in plumbing fixtures, mechanical systems, civil systems, food service equipment, and medical equipment that can help hospitals develop strategies to meet their goals.

At the end of the process, the hospital's operators can create a water balance between the amount of water coming into the facility and where it is used in the facility. Then the facility can operate efficiently for years into the future.

FINDINGS OF AP STUDY ON DRUGS IN DRINKING WATER

During a five-month study, the Associated Press discovered that drugs have been detected in the drinking water supplies of 24 major metropolitan areas across the country. Some of the key findings follow.

- Philadelphia officials discovered 56 pharmaceuticals or by-products in treated drinking water, including medicines for pain, infection, high cholesterol, asthma, epilepsy, mental illness, and heart problems.
- Anti-epileptic and anti-anxiety medications were detected in a portion of the treated drinking water for 18.5 million people in Southern California.
- Researchers at the U.S. Geological Survey analyzed a Passaic Valley Water Commission drinking water treatment plant, which serves 850,000 people in Northern New Jersey, and found a metabolized angina medicine and the mood-stabilizing carbamazepine in drinking water.
- A sex hormone was detected in San Francisco's drinking water.
- The drinking water for Washington, D.C., and surrounding areas tested positive for six pharmaceuticals.
- Three medications, including an antibiotic, were found in drinking water supplied to Tucson, Arizona.

Source: "AP Probe Finds Drugs in Drinking Water," The Associated Press

AGGRESSIVE VERSUS MODERATE APPROACH

Hospitals first should decide if they want to take a moderate or aggressive approach when implementing water-efficient strategies. In new construction, hospital design involves many professionals. It is not uncommon for department heads, board members, and even chief executive officers to change positions during the design and construction process. The sustainable vision of one group may not be similar to the next.

This also is true during the operation of a facility. Personnel change over time, and sustainable goals change with them. Maintaining a consistent sustainable approach can be difficult.

An administrative team with an aggressive sustainable approach can find themselves bogged down in the complex details of building or operating a facility, and middle management does not receive a clear sustainable direction. The end result can be hours of wasted effort and frustrated management.

For example, during the programming stage of a project, the design team may spend hours designing a rainwater collection system for irrigation. As the project progresses into schematic design and design development, new administrators may replace the original visionaries, and they may not have the same aggressive sustainable vision. The end result is that the system is cut from the project, and the design time is wasted.

On the other extreme, another administrative team may take a moderate approach that is diluted during the building or operational process, and the end product is a facility with little or no sustainable elements.

DETERMINING MOTIVATION

The first step is to decide why the facility should use sustainable elements and what needs to be changed in the design, construction, and operation. Some hospital owners are motivated by obtaining LEED certification. In this case, the entire building team and hospital staff have, or should have, clear direction on the sustainable elements to include in the facility. (Some education may be in order on your part.)

Another motivation is finances. More lending institutions, utilities, governments, and research organizations are providing incentives for sustainable elements in a hospital. In new construction projects, the hospital should define these incentives early in the programming stage so the building team is clear on the direction.

Sustainable elements also help recruit quality staff to a facility. It is easier to recruit nurses when their work space is filled with light and natural views. Some organizations have overall institutional

SUSTAINABLE GUIDE OPTIONS FOR HEALTHCARE

USGBC LEED for Healthcare

www.usgbc.org

The LEED for Healthcare green building rating system was developed to meet the unique needs of the healthcare market, including inpatient care facilities, licensed outpatient care facilities, and licensed long-term care facilities. LEED for Healthcare also may be used for medical offices, assisted living facilities, and medical education and research centers. This is a third-party review that is scheduled for release later in 2009.

Green Guide for Healthcare Construction

www.gghc.org

The Green Guide for Healthcare is a best practices guide for healthy and sustainable building design, construction, and operations for the healthcare industry. This guide is a self-review system that is now available.

Energy Star for Healthcare

www.energystar.gov

The Energy Star program provides partners with guidelines for superior energy management built on the practices of industry leaders. This rating concentrates on energy and not as much on water efficiency.

goals or mission statements that include sustainability. In all these motivations, it is important to obtain a planning, architectural, and engineering team that supports the same sustainable goals.

CHOOSING THE APPROACH

After the facility has defined its motivation, it could take a moderate sustainable approach. On construction projects, most hospital owners soon discover that outlining a clear sustainable approach from the beginning, including choosing a supportive professional team, results in little construction cost increases to obtain LEED certification.

For example, during the programming stage, the team may discover code incentives that include an expedited building permitting process and utility rebates for using a rainwater collection system for site irrigation. They also may learn that LEED certification helps them obtain funding.

In this situation, the rainwater system will remain in the project, even if there are added construction costs. This is because of the many low-lying fruits that a facility can incorporate into the design and construction of a building when sustainability is identified early in the project. Hospital systems often operate for long periods, and well-built, efficient systems are the baseline standard equipment for a facility.

Other facilities may take a more aggressive approach. When this is defined early in the programming phase of a new construction or renovation project, the team may discover many system upgrades that can be added to the facility with minimum upfront cost. After careful consideration, they determine that these system upgrades are worth the cost and can help gain clusters of LEED credits.

WATER-EFFICIENT TECHNOLOGIES

Water may be one of the next resources in short supply after oil. In reaction to this, the building industry is introducing many new water-efficient technologies.

Plumbing Fixtures

Low-flow toilets can reduce water usage in any facility. Standard fixtures use 1.6 gallons of water per flush (gpf). Some fixtures on the market use less than 1.6 gpf, but many hospitals are reluctant to use them because they don't know how well the new low-flow fixtures will remove waste from the trap.

Dual-flush water closets are an inexpensive alternative. Pushing the handle in one direction, usually down, uses the full 1.6 gpf. This typically is used to remove solids from the bowl. However, most of the time the user is not flushing solids. In these cases, the dual flush uses less water when the handle is pushed up. With proper signage, users usually use the lower water consumption option when flushing liquid wastes.

Showers are another fixture that can reduce water usage in a facility. Standard showers use 2.5 gallons per minute (gpm). New low-flow shower systems on the market work very well at about 2.1 gpm. These showers receive little complaints from users and are effective in both bathing and reducing water usage. The low-flow fixtures also save water heater utility costs for the facility.

It is important to remember to not simply install low-flow showerheads. The mixing valve and showerhead are specified as a system to ensure that the mixing valve is rated for the low flow and won't place the user at risk by exposing them to high-temperature water.

Hospital staff should test these systems before they go to the expense of installing them. In projects that include patient rooms, installing these two fixtures can help obtain one LEED credit with a minimal cost increase. These water-efficient technologies should be used in facilities taking moderate and aggressive sustainable approaches.

Low-flow faucets are other fixtures that do not cost extra money to purchase or install. Careful planning during design can place the low-flow fixtures where needed. Standard 2.5-gpm fixtures are appropriate for faucets that fill containers such as janitor's sinks or food service sinks. Scrub sinks also may need the full 2.5 gpm. As a result, most of these fixtures are exempt from the baseline calculations. Breakroom sinks and exam room sinks work well with faucets in the 1.5-gpm range. Some codes and LEED 2009 now require 0.5 gpm (or less) faucets and/or metering faucets in public toilet room lavatories.

Mechanical Systems

If the facility is taking a moderate approach to sustainability, the design team should start by considering options to reduce domestic water usage in cooling tower systems. In some applications, condenser water can be lost to the atmosphere. In these cases, drift eliminators can be used. In other cases, the combination sensible and evaporative-type cooling towers are applicable.

Facilities should monitor and improve the cooling tower's cycles of concentration. This is calculated as the ratio of the concentration of dissolved solids (or conductivity) in the blowdown water compared to the makeup water. More solids and minerals in the water result in a higher blowdown rate. (More information on cooling tower management can be found here: www1.eere.energy.gov/femp/water/water_bmp10.html.)

The cycles of concentration can be improved with a monitoring program, which may involve installing makeup and blowdown meters, conductivity controllers, and overflow alarms. The goal for the building operator should be to use no more than 2.3 gallons per ton hour of potable water for cooling tower makeup. Concentration cycles in cooling towers around the country usually range from 3 to 7. Many places with soft water can obtain close to 6 or 7 cycles.

Facilities taking a more aggressive approach to water efficiency may consider capturing air-conditioning condensate and directing this water into the cooling tower makeup water system. Condensate is relatively clean water and requires little treatment.

Hospitals often use water softeners for the mechanical systems and reverse osmosis water filtration systems for central sterile and labs. These systems backwash to clean the filter systems. Most standard systems use timers to backwash, which may waste water backwashing a filter system that does not need cleaning. More efficient units use a sensor and only backwash when needed.

Facilities with the aggressive approach may look at recovering the backwash water that is relatively clean and using it for cooling tower makeup, boiler water makeup, or irrigation. Packaged graywater systems now on the market work very well in these situations. Some of the plumbing system manufacturers are making equipment that can capture, monitor, filter, and store this water for future use. It is important to coordinate such systems with local health, plumbing, and codes officials before design work begins.

Food service also uses large amounts of water. In some projects, the plumbing engineer does not specify the kitchen equipment. However, the plumbing engineer can work with the food service vendor to help ensure that these items are included in a project. The dishwasher should be an Energy Star model. Rack-type dishwashers should use less than 0.70 gallon per rack. Dishwashers with a pre-rinse sprayer should employ a sprayer that uses less than 2.5 gpm.

Garbage disposals also use water, so sewer flow scrap basket strainers can be used as replacements. Disposals and grinders can use 2 to 12 gpm of water. By comparison, strainers utilize no additional water. Also, disposals run on 1- to 10-horsepower motors, which use considerable amounts of energy.

STRATEGIES

After developing an appropriate approach and looking at the available technologies, a hospital should implement strategies to meet their sustainable goals. The first step is to appoint a sustainable coordinator or director who can organize the activities. Hospitals have many department heads and levels of management. A sustainable coordinator can help facilitate important sustainable initiatives such as water efficiency through the layers of hospital management.

The next step is to develop a green master plan that includes a mix of strategies that will bring the desired goals. In existing facilities, a green master plan can set standards for sustainable initiatives such as specifying low-flow shower systems and water-efficient cooling tower systems.

The green master plan should include a water balance that shows where water is going once it enters a building. Before this is done, water meters may need to be installed in sections of a building or on water piping feeding the different systems. Once the staff has the tools to determine where the water is going, programs can be put in place to monitor and reduce water usage.

A facility should expect real water efficiency results after developing an approach and implementing strategies with the right mix of technologies. PSD

WINSTON HUFF, CPD, LEED AP, is a project manager, plumbing fire protection designer, and sustainable coordinator with Smith Seckman Reid Consulting Engineers in Nashville, Tenn. He is on the U.S. Green Building Council's Water Efficiency (WE) Technical Advisory Group (TAG). He was the founding editor of *Life Support and Biosphere Science* and has served as its editor-in-chief. He is president of Science Interactive, an organization promoting biosphere science. For more information or to comment on this article, e-mail **articles@psdmagazine.org.**