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Sustainability in Action: Lab Buildings

You may be surprised to find out that lab buildings typically consume five to 10 times the energy of comparatively sized office buildings. A number of factors contribute to the increased energy needs of these buildings, but the most significant factor is the need for labs to be continuously supplied with 100 percent fresh air. A constant supply of fresh air is necessary in laboratories because it prevents chemical fumes from building up, potentially contaminating experiments or endangering the lab occupants.

This constant supply of fresh air is achieved through the use of a general exhaust system or through chemical fume hoods. Chemical fume hoods (you may remember from high school chemistry) are essentially large metal cabinets with a glass door. The top of the chemical fume hood contains large fans that suck potentially dangerous chemical fumes, as well as perfectly harmless air, out of the lab space.

A side effect of these exhaust systems is that a tremendous amount of energy is expended to condition air that is continuously being sucked right back outside.

In a typical office building the air inside the building is conditioned – either heated or cooled, to make it a comfortable temperature for the occupants. A large percentage of that conditioned air is then re-circulated through the rest of the building. That air is mixed with a small amount of fresh air which is conditioned using a relatively small amount of energy.

As you can guess, it requires far less energy to maintain the temperature of conditioned air than is required to constantly condition fresh air.

Adding a layer of difficulty to the issue, multiple factors of the lab environment such as temperature, humidity, air change rate and room pressurization must be closely monitored and controlled in order to maintain the integrity of experiments. Additionally, each of these factors is often related to, or dependent upon, other factors. For example, air change rate affects room pressurization, which affects temperature and humidity, and so on. Because of these added layers of complexity, it is very rare that lab buildings are constructed with energy reduction strategies in place.

Illinois Science + Technology Park – Q Building

Forest City's first experience with energy efficient design in a lab setting came in the form of the Q Building at the Illinois Science + Technology Park. Forest City acquired the former Searle/Pfizer biomedical campus in Skokie, Ill., in early 2005. One of the existing buildings, the Pharmacia Q-Building lab, was constructed in 2000 using the USGBC LEED rating system and was subsequently rated a Gold LEED building – the second highest rating possible.

To address the issue of energy conservation at the Q Building, the building's designers incorporated a combination of infrared sensors and high-efficiency air-handling units to ensure that the minimal amounts of energy were being expended to operate the building

Motion sensors allow for the mechanical monitoring of the presence of occupants. When there are no lab occupants for a specified period of time, a variety of adjustments are made within the building. For example, lights are automatically turned off; the velocity of air being removed through exhaust hoods is reduced, etc

Additionally, air-handling units were analyzed based on operating costs over an extended period rather than based on initial cost alone. Ultimately the "more expensive" system was chosen – the system that realized greater gains in energy efficiency and had a longer life cycle. Over the long term, the "more expensive" system was actually more affordable

For more information about sustainable design at the Q Building, read the Green Building Strategies document.

New East Baltimore Community – Life Science Building

Realizing the tremendous amount of energy that laboratory buildings consume, Forest City | Boston along with partner Elkus | Manfredi architects is designing the Life Science Building at the New East Baltimore Community using the LEED rating system as a guideline.

To address the issue of efficient energy management, Forest City will use an energy recovery system. This system will allow the heating, ventilating and air conditioning (HVAC) system to recapture some of the residual heat or coolness from the conditioned air and redistribute it into the fresh air coming in. With an energy recovery system in place, the HVAC system does not have to "start from scratch," continually conditioning the entire fresh air supply.

Additionally, to minimize the need for

continues pg 2

lab buildings (cont.)

conditioning the air in the first place, Forest City has taken a number of innovative approaches to key design elements of the building:

Light-colored roof: by using a white PVC plastic roofing material, heat retention from sunlight is minimized.

Low-E glass: low-E glass uses a microscopically thin layer of metal or metallic oxide on the surface of the glass to suppress radiative heat flow from sunlight.

Light-colored paving materials: using a light-colored paving material minimizes heat retention from sunlight on the ground surface.

Dual flush toilets and waterless urinals: by incorporating these new technologies, significant water savings can be realized.

Use of surplus energy from building steam system to preheat domestic water: The steam condensate is run through a heat exchanger prior to being discharged through the waste water system.