Report on the Impact of EPA Region III's Green Building Lease Philadelphia, PA

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Introduction

When planners for the United States Environmental Protection Agency (EPA), Region III began looking for new space in 1992, they knew they wanted to do everything they could to support the environmental ethic for which EPA is known. But at that time, six years before they were to move into their new offices, the push by the United States General Services Administration (GSA) and other agencies to establish standards and specifications for acceptable green products and services was only just beginning. Planners were, therefore, asked to justify every item that was divergent from common GSA standards - both on a cost basis and on a performance basis.

As a result, the planners knew that some of the items being requested would be difficult to justify. They also knew there would be insurmountable obstacles, as well as sacrifices to make. More than anything else, they knew that much of the work before them would be an educational process - both for themselves and for GSA.

Despite challenges, the project has yielded numerous benefits. Project planners are satisfied that their combined efforts produced a high quality work environment that was completed 25% below budget - a savings of approximately $500,000. The bulk of these savings came from the decision to reuse many existing items during building renovation, including ceiling and lighting systems, interior doors, and numerous components of the HVAC system.

More important than project cost savings was the opportunity for EPA officials to evaluate environmental issues in conjunction with numerous aesthetic, ergonomic, and budgetary issues. This ultimately led to the inclusion of environmental requirements into a broader mix of divergent considerations, “above and beyond” basic GSA standards. The final result was a practically designed facility that incorporated economically sound elements into an efficient and

comfortable work environment. The mix of environmental concerns with other quality issues is the primary reason for the success of this project.

The Region III Experience

Environmentally responsible building design has been a concern of architects, engineers, and interior designers for a number of decades. Until recently, it has not been part of mainstream facility design. In the last decade, however, a growing awareness of the environmental impacts of commercial and industrial buildings, coupled with the maturation of sustainable design principles which lead to predictable and quantifiable financial benefits, has finally moved a number of “green building” principles into the forefront of architecture and design. Advances in energy management, building interior products, information technologies, window systems, and flooring technologies, along with a greater sensitivity to the needs and habits of building users, have led to significant breakthroughs in standard design principles. Today, the range of choices for architects and planners is so vast as to make the development of green building space increasingly practical and popular.

Although environmental concerns are of great importance, budget limitations and the necessities of project deadlines often constrain planners’ options for green design. To a certain extent, this was the case as EPA Region III planners set about designing 300,000 square feet of new office space to be leased in Philadelphia. Decisions were complicated by the fact that they were not redesigning an office the agency owned; they were planning new space in a leased property. In essence, the planners sought design solutions suitable for a multi-tenant office building in which they were only renters.

Consequently, planners and EPA's architect for the project knew they could not incorporate every sustainable, green building principle they may have wanted. Despite a "wish list" of options, practical and financial constraints drew their attention to several key areas. These areas include:

- Recycling
- Materials Reuse
- Energy Efficiency
- Air Quality Management
- Transportation

These five areas of concern are summarized below:

Recycling

Diversion of any waste material through recycling or reuse during the construction process and the long-term operation of the building has the potential of reducing operating costs. Throughout this report, the disposal of waste is estimated to cost $100 per ton (these costs include container rental, pick-up, transportation, transfer and disposal costs).

Construction & demolition waste - In order to maximize recycling during the construction phase of this project, planners sought to ensure recycling by including recycling provisions in the contract for waste removal. To this end, the contractor utilized local construction and demolition (C&D) haulers equipped with off-site material processing capabilities designed to enhance the recovery of metal, concrete, and wood.

During the planning process, the construction contractor established a list of available recycling options for renovation waste. A list of materials that could be easily source separated was established. The local recycling community was then contacted to identify companies with recycling centers that would accept these materials, including wood, all metals, cardboard, glass, and vinyl baseboards. Materials that could not economically or logistically be recycled included: drywall, carpet, insulation, ceiling tiles, and vinyl floor tiles.

Fluorescent lamp recycling - Approximately 11,000 fluorescent lamps were removed from the project site and diverted to a specialized recycling company. The charge for this service was $0.40 a tube. Total cost for recycling is estimated at $4,400. Fluorescent tubes contain small quantities of mercury, which can pose environmental concerns if disposed of improperly. The avoided cost savings from other measures in the project more than adequately justify the cost of recycling old fluorescent lamps.

Design for office recycling - Early in the project, EPA determined that specifically designated “Recycling Rooms” on every floor would enhance the logistics of recycling. This is a somewhat unique design element for a commercial high-rise renovation. Office recycling programs designed to recover office paper, cardboard and aluminum beverage containers are often limited due to a lack of intermediate storage space and the labor deployment problems associated with centralized storage in basements. It is not unusual for even the best recycling programs to be compromised by cleaning personnel and maintenance staff if space becomes a problem. Recycling rooms create a more functional material flow structure for cleaners and reinforce the importance of recycling to employees.

Recycling rooms measure 9’ x 7’ and can hold over a week’s worth of recyclables per floor. The container system for collecting material at desks was also upgraded. Cardboard desktop

containers were replaced by larger blue, 14-quart recycling bins that fit under desks. In order to minimize cleaner time in servicing floors, a dual trash and recycling collection system was put in place using a split chamber collection cart, thus allowing for simultaneous collection of trash and recycling by cleaning personnel. According to the property management firm's recycling consultant, this has significantly reduced waste diversion problems that had existed with a two-pass collection model.

Estimates are that a well-functioning recycling program in a facility with 1,200 government employees and support personnel will recover up to two tons of paper, cardboard and beverage containers per week. This can cut the amount of trash generated by 50 - 65 percent. Assuming the figure of $100 per ton for trash disposal and a small charge of $20 per ton for recycling services, the overall net annual savings from office recycling will be approximately $8,000 a year.

Materials Reuse

The reuse of building materials in a sustainable design application is often overlooked. In part, this is because many sustainable projects are new construction. But the reuse of materials is often overlooked as a sustainable design principle simply because it is so obvious and sensible. Materials reuse is actually one of the more economically proven of all sustainable design principles. Not only is there the obvious diversion of waste from the disposal stream (and the attendant avoided landfill costs), but there is also a clear avoided cost in the purchase of new materials. In addition, although it is difficult to quantify, there is also a reduced cost to management and professional design staff for the specification and procurement of new materials.

The best overall indicator of the value of reuse in this project is that while project managers struggled to maximize sustainable initiatives given budget limitations, the team delivered their newly renovated facility on time and 25% under budget.

Reusing interior office doors - Doors in the building prior to the EPA lease measured 36" x 95" and were solid core in composition. The standard measurement for typical new interior doors on today's market is 36" x 80". Using Means' *Commercial Cost Data*, the cost of a new replacement solid core door is approximately $228. Planners reused approximately 260 interior doors on this project, saving roughly $59,280 and eliminating nearly seven tons of material that might otherwise have required landfilling. Assuming an average cost of $100 per ton for container rental, trucking, and tipping fees combined, diversion of seven tons of material represents another $700 in savings. Total avoided cost savings are approximately $60,000.

Reusing steel ceiling structure and acoustic tiling - The decision to reuse over 170,000 square feet (nearly four acres) of acoustic tiling and steel ceiling structures on 14 floors eliminated more than 42.5 tons of material from disposal, saving the project an estimated $4,250 in waste hauling costs. According to industry experts, the cost per square foot to install a comparable commercial ceiling is $3.75. Project leaders estimate that roughly 50% of the tiles were removed for cleaning and refurbishment, then reinstalled. Although this added labor costs to the project, leaving the other 50% of the ceiling intact created an avoided cost savings of nearly $320,000.

Reusing existing HVAC - Air quality issues were considered one of the highest priorities when redesigning this facility (see below). Planners were careful to evaluate the capacity of the existing HVAC system and determined that at least a portion of it was serviceable. Old ducts

were scrubbed clean and reused as well. The return air system was not used during the construction process in order to minimize dust and other particulate contamination.

Avoided cost savings from utilizing this portion of the existing HVAC was beyond the scope of this study to evaluate.

Reusing lighting fixtures - The reuse of over 3,000 lighting fixtures in EPA's redesigned space resulted in a disposal reduction of another 45 tons. In addition, the avoided disposal cost savings is calculated at $4,500. Assuming the installation of new reflectors, mounting hardware and connections would have cost $140 for each fixture, reuse of these fixtures saved $420,000 on labor and materials. Ballasts and lamps were replaced as part of the Green Lights program (see below).

Reusing bathroom tiles, fixtures and stalls - EPA's space contains approximately 30 bathrooms. While it would have been possible to replace bathroom tiles, fixtures and stalls with high quality recycled content products, reuse of the existing materials reduced project costs considerably and eliminated an incalculable amount of waste in demolition disposal requirements. Where tiles were in poor condition, to the best of their ability project planners arranged to have tiles repaired. Significant costs would have been incurred had the contractors been required to significantly renovate the bathrooms.

Using steel studs for wall construction (recycled content) - Steel studs were used for wall construction as opposed to wood. On average, steel is composed of at least 25% recycled material. Typically, steel studs in today's market are anywhere from 25 - 35 percent less expensive than their wood counterparts. In addition, due to its durability, steel framing may be more recoverable if the building is deconstructed in the future. It is likely then that significant

savings were achieved by using steel studs, but such calculations are beyond the scope of this analysis.

Other reuse measures - The move into a new facility prompted an upgrade of many of the computer systems utilized by EPA staff. Obsolete computer equipment was donated through existing EPA and GSA programs to schools and non-profit organizations.

Venetian blinds in the new facility were also cleaned and refurbished. With more than 1,200 windows in EPA's space (measuring 9' x 5' each for a total of 54,000 square feet of window space), purchase of new blinds would have required an additional outlay of $90,000 for materials alone (assuming a low-end figure of $75 per blind).

Energy Efficiency

Retrofitting lamps and ballasts (EPA Green Lights compliant) - Annual energy savings through the use of electronic ballasts and energy efficient lighting (specifically 32-watt fluorescent lamps as opposed to standard 40-watt units), assuming lighting requirements of 12 hours a day on average, a demand reduction per fixture of 40-watts (three lamps plus an electronic ballast), and $0.08/kwh, is conservatively estimated at $28,800. These energy savings mean a simple payback on the cost of fluorescent lamp recycling (see recycling section above) of roughly 2 months. For the purposes of this report, it is assumed that lamps and ballasts would have been replaced regardless of their energy saving potential as part of the building's scheduled maintenance program, therefore these costs are not included in any avoided cost savings analysis. This project is fully compliant with EPA's Green Lights program.

Motion detectors were also installed throughout the building to shut off lighting in unoccupied space. Due to the variable nature of this measure, savings calculations are not possible.

Installing a state-of-the-art energy management and HVAC system - Although the bulk of the heating and cooling system was reused, a state-of-the-art energy management control system was installed in the building that allows operators a tremendous amount of flexibility in monitoring and changing comfort levels. Temperature and humidity controls for numerous zones on each floor of the facility are accessible through a centralized computer console. Operators can adjust temperature and humidity calls through this centralized panel. In addition, EPA facility staff have thermostat and humidity sensor access through a "read only" terminal in EPA's offices. This allows EPA staff to monitor climate issues for employees on all 14 floors. As is alluded to below in the Air Quality section, the ability to respond to work space comfort levels has a direct impact on productivity.

Appliance conservation - Refrigerators in each kitchenette are energy efficient appliances with Energy Star ratings. Fixtures in bathrooms are low-flow, water conserving products.

Lease reduction - In order to assess the impact of their investment in energy conservation, planners sought from the beginning of the project to install a sub-meter energy measurement system that would allow them to track energy use separate from the entire building. Besides the obvious educational benefits of accurate measurement, the thought was to seek a reduction in lease costs once a baseline of energy reduction had been established. Unfortunately, the cost of submetering was deemed too high for practical implementation. Project planners did, however, negotiate a small lease reduction based on the investment they were making in energy saving devices.

Air Quality

"Sick Building Syndrome" has become a major environmental concern in office buildings throughout North America over the last several decades. In simple terms, this condition is caused by numerous factors that contribute to poor air quality in places of work which often affects the health of workers. In some cases the effects can be acute, in others they can be more subtle. As would be expected, EPA is deeply concerned about the health of its employees. In addition, "Sick Building Syndrome" can reduce worker productivity and increase absenteeism. Project planners were thus exceedingly careful to include air quality concerns in designing the new space.

VOCs - Minimizing air quality problems by seeking to limit the emission of VOCs from adhesives and other materials found in newly installed carpet, furniture, drywall, paint, and other wall coatings has limited the negative impacts on EPA employees in the new facility. Careful consideration of the building's air quality for the long term, including the assurance that the fresh air intake system is clean, adequately sized, and properly functioning, will contribute to a long lasting "healthy" building and increased employee productivity. Indoor air quality tests were performed on every floor of the facility after carpet was installed. One of the criteria for furniture selection was the relatively low level of off-gassing. The material chosen as flooring in eating areas and break rooms is a state-of-the-art non-vinyl, natural rubber-based product called *Marmoleum*.

Carpet - Planners committed a significant amount of time to finding suitable carpet made of recycled products for this project. At the time of their research (1993-94), no reliable data was available on the indoor air quality impacts of recycled carpet. The final choice for carpet was made based on proven air quality standards of the brand chosen. Applied in tile form, this carpet

was also deemed maintenance-friendly (i.e., worn, stained and soiled sections can be cleaned or replaced easily).

Other applications - Finally, a number of other applications were employed to further maintain air quality. These include the use of electrostatic painting of bathroom stalls to limit paint emissions; manual cutting of fiberglass and gypsum board (at an additional cost); and the use of wood products containing no formaldehyde. Wood specifications also included a provision prohibiting the use of endangered species. Attempts were made to find wood that was certified as "non-endangered," however, as with carpet requirements, the testing and certification protocols to meet GSA and EPA standards had not yet been established at the time planners were making project decisions.

Productivity gains - According to the Building Owners and Managers Association (BOMA) International, the estimated costs associated with maintaining space for the typical office worker are roughly $130/square foot annually. Thus, a minor drop in productivity of just 2% can cost an average of $2.60 per square foot (for comparative purposes, annual energy costs in office buildings often range from $0.75 per square foot to $1.50 per square foot).

Using the figures cited above, a simple 2% gain in productivity by EPA's 1,200 employees in 300,000 square feet of space due to well-maintained air quality and responsive climate controls would translate into roughly $780,000 annually. Productivity gains from other health and efficiency improvements in the facility may also increase these dramatic benefits.

Transportation

EPA's new offices are located just above Suburban Station – one of Philadelphia's main regional rail and subway stations. By choosing an office building directly over a major public transportation hub, EPA has actively sought to provide employees and visitors to their regional office with environmentally preferable alternatives to automobile transportation for commuting. In addition, EPA provides secure, interior bicycle parking facilities and access to showers on-site to encourage other alternative commuting options.

EPA estimated that prior to moving into their new regional office as many as 80% (960) of the agency's employees used public transportation to commute to work. According to staff in the new facility, this number has increased to 95% (1,140 employees,). This is due in part to the closer proximity of the office to a transportation hub, but it is also due to the availability of public transportation vouchers of $60 a month to encourage eligible employees to use public transportation. These vouchers offset public transportation costs by over 50% in some cases.

In addition to reducing air pollution and energy consumption, the substitution of mass transportation for private automobiles has the potential to provide huge benefits to individual employees. Transportation planners estimate the average commuting cost for private automobiles ranges from $5,500 to $6,500 a year (fuel, maintenance, insurance, parking, wear and tear, etc.). Using the lower figure, this translates into a potential added reduced cost to the 180 more employees not using their automobiles for commuting of $990,000 annually, which is slightly offset by the added expense of public transportation (approximately $1,500 a year) to those no longer driving. Factoring in these alternative costs at a maximum of $1,500 per person for the 180 employees, the cost of public transportation would be $270,000, meaning the aggregate net savings to those employees is $720,000.

Use of public transportation also significantly reduces the load on parking spaces in Center City Philadelphia and cuts down on traffic congestion and air pollution.

Summary of Benefits

	Simple Avoided Cost Savings	General Economic Benefits
Recycling	**$3,600**	
Fluorescent Lamps	*-$4,400*	
Office Recycling Upgrade	*$8,000*	
Materials Reuse	**$898,750**	
Interior Doors	*$60,000*	
Ceiling	*$324,250*	
Lighting Fixtures	*$424,500*	
Venetian Blinds	*$90,000*	
Energy Efficiency	**$28,800**	
Green Lights	*$28,800*	
Air Quality Management		**$780,000**
Transportation		**$720,000**
Totals	$931,150	$1,500,000

Conclusion

Communication between EPA and GSA planners, building owners, managers and the general contractor was a significant factor in the success of this project. In particular, the general contractor suggested numerous materials that would enhance the sustainable nature of EPA's space. From the contractor's perspective, the success of the project is being used as a marketing tool for other projects.

Ongoing communication between EPA facility managers and other EPA employees is also a valuable aspect of this project. EPA's facility management staff are in constant contact with the property management firm about numerous environmental and comfort issues. Upon moving into

the building, each employee was provided with a “Welcome,” orientation kit. The facilities management branch also publishes an electronic bulletin called the “Green Lease News” on a monthly basis. Open communication and feedback are deemed critical to a project such as this.

Finally, the link between environmentally responsible, green building principles and quality design cannot be overstated. While the direct avoided cost savings on this project are significant, at least a portion of the money saved allowed for the inclusion of other quality components that might not have been possible otherwise. As might be expected, the complexity of this project and the numerous details and demands placed on planners and managers makes it exceedingly difficult to document the full range of costs and benefits associated with this “green lease.” Nonetheless, the information contained herein demonstrates how the principles of sustainable design have had a positive impact on this project.

On-line Resources for Further Information

Greening Federal Facilities

http://www.eren.doe.gov/emp/greenfed/

Energy Star Buildings Program

http://www.epa.gov/appdtar/buildings/

EPA Affirmative Procurement Fact Sheets

http://www.epa.gov/epaoswer/non-hw/procure.htm

US Green Building Council

http://www.usgbc.org/

Environmental Building News

http://www.ebuild.com

Clean Washington Center: Recycling Plus Program Manual

http://www.pnl.gov/esp/greenguide/cscport.pdf

Mid-Atlantic Consortium of Recycling and Economic Development Officials (MACREDO)

http://www.libertynet.org/macredo

16