Living in a High-Performance Green Building: The Story of EPA's Region 8 Headquarters (Abridged)

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U.S. General Services Administration
Office of Federal High-Performance Green Buildings

Acknowledgements

This report summarizes research by teams with expertise in sustainable design, building performance, and occupant experience. Their combined efforts have created a story that is rich in detail and insight. We want to thank them for their contribution to our knowledge about designing, operating, and living in a high-performance green building.

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Living in a High-Performance Green Building: The Story of EPA's Region 8 Headquarters
(Abridged)

Every building is a hypothesis waiting to be tested—a hypothesis about performance, occupant work effectiveness and comfort, and design for organization effectiveness. And it remains a hypothesis until it is lived in, experienced, and evaluated through rigorous testing and observation.

This summary report is the story of living in a high-performance green building. As such, it is about adaptation and change, not about a "finished" product. Even as this report is being completed, the building and its occupants are co-evolving to meet new challenges.

In the ideal world, buildings would work precisely as designed, and their stories would reach an end once they were completed. But that is not the case in the real world, where buildings are dynamic and constantly evolving.

EPA Region 8 Headquarters Building, Denver

The Wynkoop Building

The Wynkoop building in downtown Denver, CO is a test bed for sustainable practices—from integrated project team and design-build practices to operational performance, workplace functionality, and occupant experience. The building, which houses a regional office of the Environmental Protection Agency (EPA), is a "demonstration project" of the General Services Administration (GSA) Office of Federal High-Performance Green Buildings.

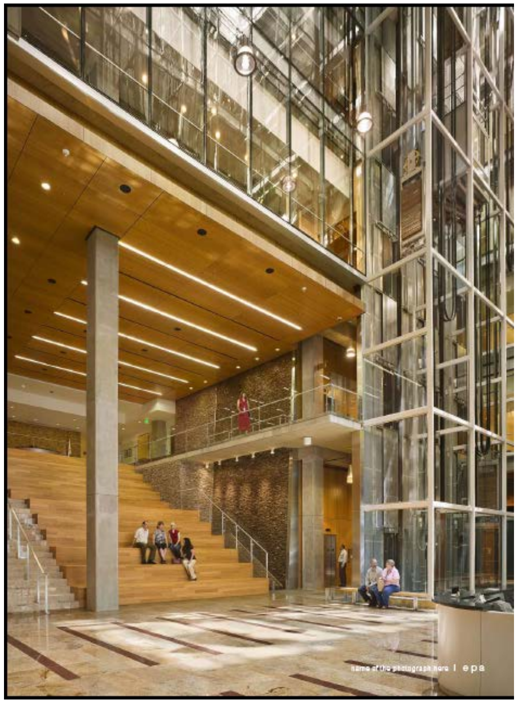
This "build-to-suit" Leadership in Energy and Environmental Design (LEED) Gold office and retail space was designed and constructed to be as sustainable as possible given the available technology and budget. A prime objective of the design team was a sustainable facility that looked and functioned like "normal" class A commercial office space in its market.

A video highlighting features of the Wynkoop building is available on the EPA website at: http://www2.epa.gov/region-8-green-building/video-region-8-headquarters.

A self-guided tour itinerary is available on the EPA Region 8 website at: [http://www2.epa.gov/region-8-green-building/self-guided-tour.](http://www2.epa.gov/region-8-green-building/self-guided-tour)

EPA Region 8 is committed to using the Wynkoop building as a learning lab and a teaching tool, opening the facility up to researchers, sharing performance data, and developing lessons learned to enhance understanding of the operational aspects of high-performance green buildings. EPA's partnership with GSA involved coordinating research teams from two Department of Energy national laboratories, the Pacific Northwest National Laboratory and the National Renewable Energy Laboratory (NREL); the Center for the Built Environment at the University of California, Berkeley; the Harvard Graduate School of Design; Colorado State University; the University of Colorado, Denver; and private-sector firms specializing in water, air quality, and acoustics. Unlike many building performance studies, this report is being released 6 years after the building was completed and occupied. The time lapse is intentional. The intervening years enabled EPA and the research teams to understand how the building works and how it responded to the organization's needs, the behaviors of the building occupants, and operational practices.

The facility was designed and constructed through a design-build public-private partnership, incorporating sustainability elements developed jointly by GSA (the government lessor) and EPA (the tenant agency). The 9-story building includes retail space on the 1st floor, a fitness center, conference center, library, break rooms on each floor, data center, and record center. The building gets heat from Xcel Energy's district steam system rather than operating its own boiler. The district steam system also supplies the building's domestic hot water.



Occupants rate the atrium as a favorite place.

The key findings and lessons learned in this summary are organized around three topic areas. *Building operations* focuses on building performance outcomes and fine-tuning the building*; livability* focuses on the building as experienced by the occupants; *and moving toward the future* discusses issues of change and adaptation.

Building Operations

Buildings are full of surprises and seldom operate as expected across all performance indicators. They have great successes as well as unanticipated problems.

In the operations area, real-world interactions and effects are often difficult to foresee. The results from the Wynkoop building research show that EPA's extensive commissioning and preparation made the transition from design to operations successful in many ways. An essential element was a broad partnership dedicated to solving problems and moving forward with evidence-based solutions.

This section focuses on operational findings from research by national laboratory teams, academic researchers, and private-sector firms.

Performance-Based Contracting and Integrated Teams

Despite some difficulties related to roles and expectations in this complex project, team members credit the combination of a performance-based contract and an integrated team as crucial to delivering the project on time and on budget.

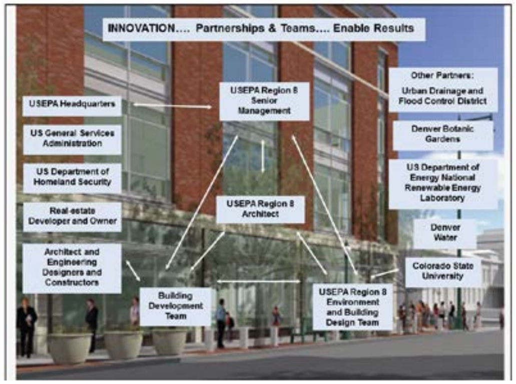
The solicitation for offer (SFO) for the design and construction detailed numerous requirements and preferences relating to sustainable design and established strict terms for achieving LEED and ENERGY STAR certification. The team was required to achieve a minimum of LEED Silver certification within 14 months of reaching 95 percent occupancy, or risk a penalty of $250,000 annually to be subtracted from the rent. Similarly, the developer was required to provide and maintain an ENERGY STAR rating within 14 months of occupancy, or make changes to achieve the rating and offer the government a rent reduction during noncompliance.

The SFO, while requiring LEED Silver certification, did not prescribe exactly how to accomplish that. It included a LEED scorecard showing EPA's preferences for which LEED credits to pursue, but no real way to enforce its preferences. This disconnect created some conflict between EPA and the developer, which was not as strongly motivated to achieve the specific credits that EPA identified. In the end, however, the building exceeded the SFO requirements and achieved LEED Gold certification.

Given the complexity and sophistication of the building, communication across the full team was a critical element. One example of the team's effort to balance sustainability and construction cost was the evolution of the exterior sunshades. Both the design team and EPA were concerned about enhancing daylight, preventing solar gain, and controlling low-angle glare in the early morning and late afternoon. In addition, the project needed to balance the desired performance with construction costs and blast security. The original design called for 36-inch-deep horizontal shades on the south facades, and 36-inch-deep vertical fins on the north facades. The security and blast consultant recommended changing the shades and fins from fritted laminated glass to perforated metal, to perform better in the event of a blast. Consulting engineers Syska Henessy performed energy and daylight studies to reduce the depth, and therefore the cost, of the shades and fins. As a result, the horizontal shades were reduced to a depth of 20 inches and the fins to 11 inches. The interior light shelves on the south facades were also studied to see if they could be removed without compromising the daylight performance, but were left in the design. Architecture firm Zimmer Gunsul Frasca (ZGF) used both an Ecotect software model and a physical model to study these issues, and passed the models to Syska Henessy for further study, in an unusually direct collaboration process.

Risk is also an issue in performance-based contracting. EPA and GSA tried to limit their risk by assembling knowledgeable internal teams and hiring outside experts for technical advice. This created some uncertainty about who was responsible for what. EPA relied on a consultant to fill in information gaps by suggesting products and strategies to consider, in the absence of answers from the design development team—even though the contract required the developer to have a LEED expert on its team.

In an effort to transition this project from conceptual design to an engineered solution, significant changes were proposed to the structural system, mechanical system, and team structure after the development contract was awarded. GSA and EPA had to evaluate the impact of each change and negotiate with the developer to find a fair agreement bringing good value for the government. Cost to the developer and value to the government were key motivators behind changes.



Extensive partnering was a key to success.

The integrated team approach continued into the operational phase. Shortly after moving in, EPA realized that active management would be required to ensure that the building met its high performance goals and that occupant behavior would be a critical factor. EPA and the building management team established a performance tracking system and actively collaborated on everything from operation of mechanical systems to the cleaning and recycling programs and tenant education.

Building Energy Performance

Even though the Wykoop building is performing well on its energy use, with an ENERGY STAR rating of 96, it is still consuming substantially more energy than projected during design development. The actual energy use is 76 kBtu per square foot per year, versus 52 kBtu modeled in the "as built" final.

Solar panels are on the southeast corner.

To understand the energy performance better, EPA conducted several analyses of the building. Shortly after occupancy, a team assessed temperatures in the building and identified a pronounced "stack effect:" the lower floors were noticeably cooler than the upper floors. This differential has required more heating for lower floors in winter, and an early Monday morning chilled air "flushout" to cool the upper floors in summer.

A second research effort addressed plug and process loads in the building. The energy models used in design primarily focused on the building envelope, glazing, and heating, ventilation, and air conditioning (HVAC) systems. Plug and process loads were not factored in. Yet recent research shows that these loads can account for 30–40 percent of building energy use and represent the fastest growing component of electrical energy consumption. Process loads not accounted for in the EPA building may be substantial, given the significant amount of electrically powered security equipment, the building data center, and a large EPA investment in projection monitors built into most conference rooms and the 2nd floor conference center. The building's changing ENERGY STAR rating provides anecdotal evidence that process loads contribute to total energy consumption: immediately after installing the conference room monitors, the building's ENERGY STAR rating dropped 2 percentage points.

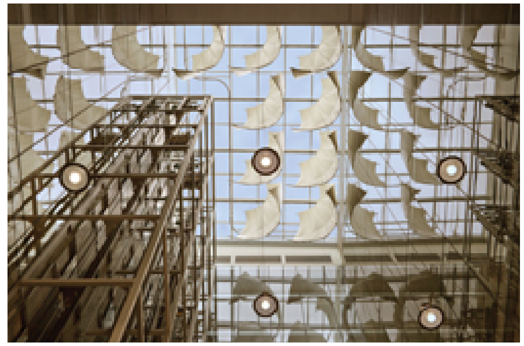
A research team from NREL studied the Wynkoop data center and desktop plug loads to identify potential interventions for saving energy. The NREL team recommended changes to the data center to reduce its energy use, including server virtualization, which is well underway. Other recommendations are being implemented as budget permits.

A behavioral intervention, also conducted by NREL, focused on reducing energy from desktop equipment using two approaches. The first employed an automatic energy management system that turned devices off when a workspace was unoccupied for

30 minutes. The second method used behavioral change protocols. One protocol focused on messages urging study participants to turn off their computers, desk lamps, and other devices when they were away from their desks. A second protocol employed competition among workstation pods (clusters of six workstations) to induce participants to save energy. Results showed that the automatic system, tied to occupancy sensors, was more effective than behavioral change in reducing energy use. However, economic analysis found that the energy management system had a poor return on investment and was not recommended. Another factor limiting the benefits of behavioral change was that participants could opt out of having their computers turned off. Since computers represent the largest user of desktop energy, giving users this option limited the achievable savings.

Daylight Design Innovation

The central atrium raised issues regarding how best to direct light down to the bottom of the atrium while protecting the upper levels from heat and glare. Inspired by the array of parabolic faces on the reflector grid in a light fixture, which increased its brightness and uniformity of illumination, ZGF developed a concept for a C-shaped piece of fabric, curved around two sides of each of 15 "sails" deployed to enhance the uniformity of the light in the atrium



Fabric "sails" were an innovative solution.

ZGF first went to tensile companies for fabrication, but their bids came in very high, and there were concerns that solar radiation would degrade the elastic in the fabric "sails." ZGF then approached a Portland, OR area sailmaker about fabricating them, and a Denver-based theatrical rigging company for installation and maintenance. ZGF printed a cutting pattern from its computer model, which the chosen sailmaker used to create a scale model. The bids for fabrication and installation fell within the allowable budget, so the sails remained in the project.

The sails not only control daylight in an innovative way but also provide an iconic image for the building and evoke aesthetically appealing natural imagery. The occupants rate the atrium as one of their favorite places in the building.

Building Water Performance

In its first year of operation, the Wynkoop building used 1.65 million more gallons of water than expected.

A water use investigation started with the steam system. The building is located in a downtown Denver steam and chilled water district. Steam heat goes to buildings in the district via distribution lines under city streets. Steam is piped into the Wynkoop building and around the 1st floor parking level, transferring heat to the potable hot water lines as well as some heat to the unconditioned parking space. As it circulates, the steam converts to hot water condensate, which is discharged to a sanitary sewer and returned to the local water plant.

During a visual inspection, the building engineer discovered that a plumber had installed a cold-water makeup valve next to the steam system's discharge point. Water temperature at this discharge point was above 175°F, hot enough to melt plastic parts in the pumping system that returned hot water to the sanitary sewer. The cold water makeup valve had been installed to reduce this water temperature before discharge. This makeup valve operated almost continuously, however, dumping large volumes of potable water into the sanitary system—31,000 gallons in just 2 days. The building engineer reprogrammed the circulation system to send the discharge steam and hot water condensate through the parking level piping three times (instead of once), which brought the temperature down sufficiently to discharge it safely into the sanitary sewer pumping system. Once this correction was made, water consumption dropped dramatically.

Even though that major water problem was resolved, EPA decided to continue research to assess LEED modeling assumptions and evaluate indoor water use related to some concerns that EPA staff expressed about restroom fixtures.

Analysis of toilet use indicated that the dual-flush toilets were not being used properly and could be using more water than intended. Their handles were designed to trigger a full flush (1.1 gallons) when pushed down, and a reduced flush (0.8 gallons) when pulled up. Anecdotal evidence and concerns from occupants not using the handles properly prompted a more detailed study.

During March 2011, an ultrasonic sub-meter and data logger were installed on the cold water supply to washrooms on the 7th floor, selected as a typical office floor for this building. Data were collected in 1-second intervals to capture short water use events and determine the average volume per event. The data collection procedure provided a means to record the number of low-flow flushes (0.8 gallons each) versus full flushes (1.1 gallons each). Tests indicated that the toilets were operating properly: water volumes for the full and low flush options matched design specifications, showing that the problem was not with the toilets themselves.

Most of the water use events were greater than 1 gallon per flush, indicating that users were selecting mostly full flushes and were habitually pushing down on the handles. As a result of this study, EPA installed new handles on all toilets. The new handles trigger a low flush when they are pushed down and a full flush when pulled up. Similar results were found in a building study by a research team from the University of Missouri. They recommended changing the handles to take advantage of a strongly conditioned response to push the handle down.

The next question EPA addressed was unexpectedly difficult to answer: what impact did the handle retrofit have on overall building water use? Researchers could not quantify this impact, due to variations in occupancy that affected toilet use and concerns about the accuracy of the ultrasonic meter used. Furthermore, the volume of water saved was low relative to overall building use, making it even more difficult to single out the results with confidence.

EPA was also concerned about water use models. Assumptions used in the domestic water use model do not accurately reflect actual behavior and occupancy patterns. Occupancy levels can greatly influence the use of restroom fixtures and showers in the fitness center. At the Wynkoop building, occupancy varies considerably due to work schedules and time spent in the field, but the models omit these weekly and seasonal variations. In addition, there is some uncertainty about how frequently people actually use toilets on a daily basis.

Water pressure in the building can also affect consumption and, thus, the accuracy of toilet flush volumes. In the Wynkoop building, the pressure varies considerably between floors. Floors 2 through 5 are served by city-supplied water pressure; floors 6 through 9 have a booster pump. Pressure tests showed that pressure dropped from 42 psi on floor 2 to less than 30 psi on floor 5, while the floors above that all had pressures greater than

70 psi. Lower pressures can instigate more flushing to clear toilets.

All these factors complicate the accurate determination of "full-time equivalent" building occupancy values, which are an important component of modeling assumptions.

The findings from the water research show that plumbing systems need to be included in the normal overall commissioning process. The Wynkoop water system was investigated only after the higher consumption was discovered. Formal commissioning would have identified problems with the overall system. However, it would not have identified the behavioral or occupancy.

Vegetated Roof Performance

The vegetated roof served as a test bed to assess plant species diversity, irrigation requirements, stormwater management, and thermal performance, including heat island mitigation.

The green roof tempered temperature swings.

Research showed that the roof was largely successful in managing stormwater (with 75 percent of stormwater retained), mitigating heat island effect, and providing an effective irrigation system that was necessary to keep the vegetated roof healthy.

The roof was the first planned installation of this type of system in a North American high-mountain desert eco-region. Denver's environment imposes challenges that green roofs in most other major cities do not encounter, including highly variable solar irradiance, low precipitation (an average of about 15 inches/year), and an exceptionally wide range of temperatures (from -20°C/-4°F to 40°C/104°F).

The roof is in the southern portion of the 9th floor and totals nearly 8,000 square feet (740 m^2). A flat gravel ballasted roof on a renovated LEED Gold historic building across the street served as a control roof for the study.

Roof of nearby building was a study control.

Irrigation. Irrigation originally came from a drip system with emitters spaced roughly 1 foot apart. However, only a small cone of moisture formed beneath each emitter, leaving the growing medium dry between emitters, and considerable water drained through the medium to discharge drains. This system was replaced with an overhead spray that distributed moisture more uniformly across the roof, reducing wasted water.

Irrigation rates are estimated at 0.25 to 0.75 inches per week throughout the growing season. In combination with moisture from precipitation, moisture retained in the roof substrate and plant materials arguably brings benefits, even in this arid region. The retained moisture also helps to cool the immediate environment during hot weather and warm it during cold weather. This tempering effect protects the synthetic rubber roof membrane from temperature swings and helps to prolong its life.

Thermal performance. Throughout most of the year, the vegetated roof functions as an energy sink, retaining heat in the thermal mass of the green roof growth substrate and plant materials and moderating temperature swings. A representative summer day was selected to compare thermal performance of the green roof and control roof. The temperature variation at the control roof membrane was 205 percent greater than at the green roof membrane.

Findings also indicate that the green roof plant community uses the retained moisture to suppress temperature variation and extremes and sustain favorable growing conditions.

Temperature variation is greatest on exposed control roof surfaces, and lowest beneath the substrate surface on the green roof. This is an important observation, because such variations are the likely reason for differences in the serviceable lifespan of a vegetated roof.

Plant Protection. A photovoltaic panel was installed on part of the vegetated roof, causing some concern that the shade from the solar panel would harm the plants. However, research showed that the shade actually benefits the sedum plants, whereas sunlight reflected off the building glass and metal siding has caused overexposure detrimental to plantings in other areas. These two observations taken together suggest that the ambient sunlight in the region exceeds what plants require.

Solar panel shade benefited the green roof.

The Value of Green Roof Longevity

Using consolidated findings from the Wynkoop research, EPA concluded that converting just 1 percent of roofs in the United States from conventional to green roofs could avoid about 70,000 tons of construction and demolition waste annually, assuming the serviceable lifespan of a green roof is 2.5 times that of a conventional roof. Thus the financial benefits of extending the life of the roof membrane could be significant. This is one more aspect of green roofs that warrant further investigation, along with stormwater and urban heat island mitigation and the potential value of ecosystem services, which a conventional roof cannot provide.

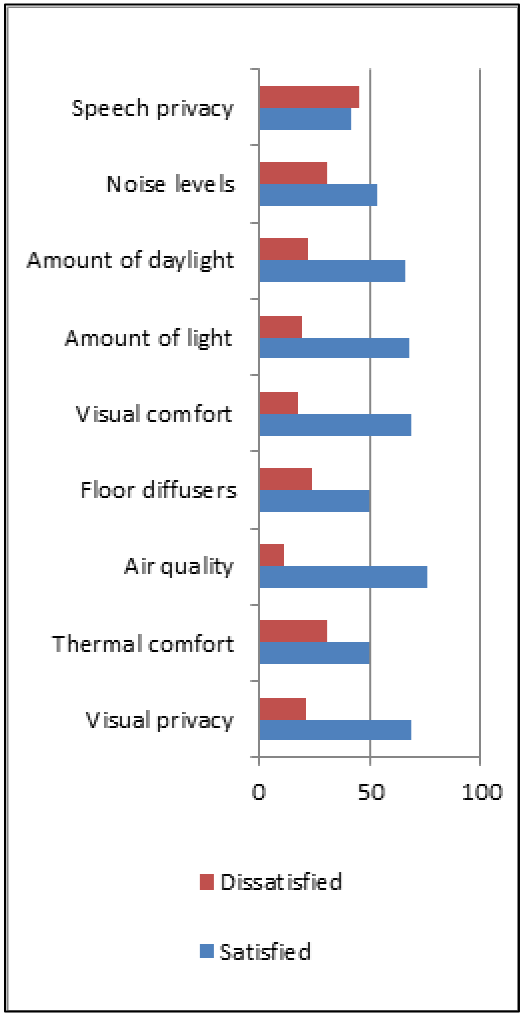
Livability

Livability deals with the occupant experience—the overall satisfaction and happiness with the building, the impact of the space and technologies on work effectiveness, and the building as a social system for work and other interaction.

An occupant survey was administered by the Center for the Built Environment at the University of California, Berkeley. The Wynkoop building was highly rated overall, with 83 percent saying they were satisfied with the building and looked forward to working in it. Furthermore, 80 percent were also satisfied with their personal workspace, and a similar percentage said they were proud to show the office to visitors.

The vast majority of occupants are satisfied with ambient conditions and also say that the office environment helps their productivity. More than 60 percent of respondents expressed satisfaction with the amount of daylight and electric light, visual comfort, air quality, and visual privacy. Furthermore, 62 percent said the overall quality of the environment benefited their work.

Ratings were lower for thermal comfort, speech privacy, and noise levels, a finding consistent with other workplace studies.



Survey results showed occupant satisfaction.

Overall the results show that occupants regard the building as largely a success, but also that some concerns exist.

Open-ended comments expressed some concerns about the lack of color in the building and the absence of obvious connections to EPA's environmental mission, such as links to the natural environment. After hearing these concerns, EPA began an aesthetics improvement effort, which included hanging large colored landscape photos taken by EPA staff throughout the workspace.

Window shades control daylight.

Problems with glare and sunlight are due in part to a deficiency of the design-build process. The controls and commissioning were left up to the installer, rather than having the design team document requirements and follow through during bidding, installation, and commissioning. Automated systems also require ongoing attention and maintenance to sustain their effectiveness. The problem of insufficient daylight in some areas of the building stems from both a natural drop-off of daylight in spaces farthest from the windows and the high workstation panels that reduced daylight in the cubicles.

As the preceding graph shows, about one-third of the occupants were dissatisfied with noise levels from people talking nearby or on the phone. Even though occupants complained about such distractions, almost 60 percent of respondents said they stop and talk to people in corridors near workstations, and almost 80 percent say they learn a lot by overhearing other people's conversations. These results suggest that the acoustical environment is complex, bringing both benefits and costs for work effectiveness. Most research focuses on distractions from people talking and ignores the benefits of overhearing.

Conversations create a complex workspace.

Measures of ambient qualities of the office space showed that conditions were largely within recommended ranges for temperatures, air quality, and sound. Nonetheless, almost half of the survey respondents were dissatisfied with acoustics and temperatures. A research team from the Center for the Built Environment analyzed the thermal environment and found that average occupied zone temperatures were within the comfort range, but at the lower end. This finding could explain the concern that temperatures were too cold in many locations. Despite the high physical performance of the system, half the occupants experienced thermal discomfort.

This problem is not unique to the Wynkoop building and is widely reported in research, due to high variability in thermal preferences among people and situations. One effective way to improve comfort is to allow greater personal control over temperature conditions. Although the Wynkoop occupants could operate the floor grilles to reduce or increase ventilation, they could not affect temperatures, which many found to be too cold. Acoustic research by the Greenbusch Group addressed both the sound properties of the HVAC system and the sound masking system located in the under-floor air distribution plenum. The researchers found that the HVAC system is unusually quiet and therefore does not provide the normal sound masking expected from HVAC equipment. The research also found that the white noise system is set at the proper decibel level, but the sound leaks through the air grilles, causing it to emanate unevenly, rather than creating the desired random, diffuse sound. In some areas, this created noise hot spots. The acoustic consultant recommended placing "boots" or acoustical dampers in the air grilles to reduce the sound leakage and minimize spatial variations in sound level. Tests showed that installing boots reduced the measured spatial variation of sound masking. A Battelle research team found similar results in a rapid assessment of air quality, sound, and temperature conditions in selected spaces in the building and outdoors. The team found all conditions to be within recommended levels.

Moving Toward the Future

Conversations with EPA's regional leaders revealed a desire to "pull to the future"—that is, to gather intelligence on social, environmental, technology, and design trends that are likely to influence work practices, including where people will be working, how they work best in teams, and how to train and provision a more mobile workforce.

Workplace design is largely an adaptation to past or current ways of carrying out business. As the nature of work changes—often in ways that cannot be fully anticipated—how does an organization adapt? How can it anticipate the future? These were central questions facing EPA when GSA researchers conducted a workplace functionality assessment in February 2011.

The assessment focused on better understanding how the physical environment influences individual and group work effectiveness. The assessment was not intended to be a robust analysis, but rather to illuminate how people worked, how spatial features and furnishings aided or inhibited work, what role technology plays in work effectiveness, and how the changing nature of work is influencing EPA's approaches to the workplace.

The walk-through analysis included informal conversations with employees in their offices and workspaces, a photographic record, identification of "workarounds" or other evidence of personal or group adaptations to the space, and identifying opportunities for change. The following are key findings.

Although formal meeting rooms and facilities received high satisfaction ratings, the functionality assessment identified a need for more informal and unstructured group work. People cited difficulty knowing who was at work and a lack of space for networking and "light conversation." There are some informal teaming areas, but these are largely unused because they are adjacent to individual workstations and might create noise that will be disturbing to others. What people appeared to want was more informal, opportunistic connections and interaction within and across teams and a greater sense of camaraderie. Ironically, the awareness of others is aided by high internal visibility, which is hindered throughout the building by the high workstation panels that, ironically, are valued for providing visual privacy and supporting concentration.

Analysis of the open ended questions in the Center for the Built Environment survey also revealed a desire by occupants to be able to have quick meetings that focus on visual materials used in their work, such as maps and data printouts. However, EPA rules do not permit posting such materials on cubicle partitions or walls in the work areas.

The functionality assessment also concluded that investment in appropriate technologies and changes in policy are necessary to support shifts to new ways of working. Recommendations address a request by EPA management to identify how the agency could respond to the changing nature of work that requires an integration of policy, communication, and procedural solutions to traditional workplace and technology challenges. GSA calls this mix "integrated mobility solutions," because it leverages the overlapping disciplines of space design, hardware, software, furniture, technical support, human capital, and others to craft practical solutions to problems, recognizing that neither problems nor solutions obey traditional professional boundaries. The "integrated mobility solutions" approach aligns and communicates policies, practices, and technology resources to support mobility, collaborative work, and distributed teams.

As a result of the functionality assessment, one EPA group rearranged its workspace to enable greater personal choice and improve the flow of work. The changes were done by reconfiguring existing workstations rather than purchasing new furnishings or equipment. Because the group is small, no formal post-occupancy research was conducted. However, opportunistic conversations show that the group has adapted well to the space and has created informal behavioral protocols to increase its overall functionality. The group is also using recommended new technologies that promote mobility, including Internet-based phones with headsets. EPA staff created two new workspaces in the year after the launch of the first experimental space.

Open space improves interaction.

Although the interest in flexibility and new ways of working remains strong among EPA regional leaders, these ideas have not taken hold broadly among the employees in the building. There is continuing resistance from those who cannot yet imagine themselves working in a different way in a more open environment.

However, as more experiments are rolled out, there will be more opportunity to test what works, what doesn't, and how to solve lingering concerns. An "action research" effort is especially valuable for capturing lessons learned and best practices while changes occur, rather than waiting until the end of a project when policies, behaviors, and spaces feel locked in place and difficult to revise.

As a result of experimenting and testing, EPA will be able to make more informed decisions and to implement appropriate training as it addresses federal challenges to reduce space, promote telework, and reduce the greenhouse gas emissions that result from commuting.

Summary and Conclusions

Many high-performance federal buildings have undergone post-occupancy evaluations in the past several years. Compared with the Wynkoop building, however, none has had as many researchers studying the design process or analyzing building performance across as many facets to learn how it works, and how to fix what is not working.

The Wynkoop research has produced or demonstrated methods for assessing indoor water use, building thermal performance, workplace functionality, acoustic performance of sound masking in under-floor air plenums, rapid indoor environmental quality assessment, installation of under-floor ventilation systems to avoid air leakage, green roofs for the high mountain desert climate, data center energy improvements, and behavior change to reduce plug load energy use. The results will be widely shared through webinars, conference presentations, white papers, and outreach to audiences who can use the findings to improve the performance of their own buildings.

Is the Wynkoop Building a Successful Green Building?

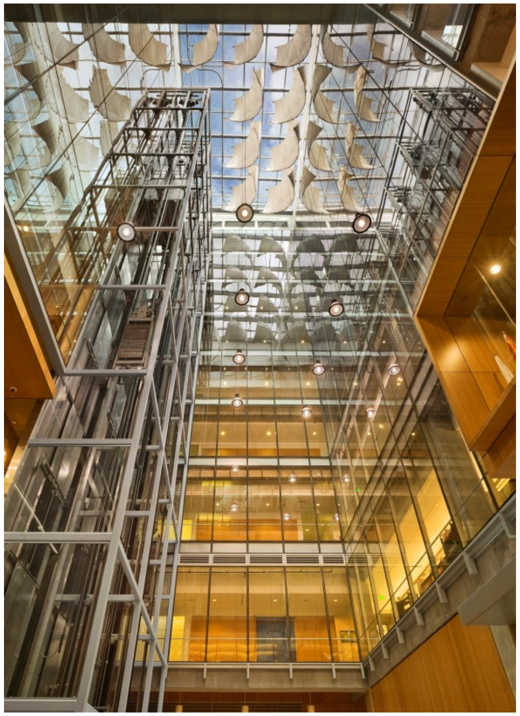
The Wynkoop building can readily be considered a success as a living laboratory and teaching tool. It is also a successful example of performance-based contracting, an integrated team process, and overall environmental performance.

It continues to deal with some comfort problems—especially for thermal conditions, which are notoriously difficult to resolve without significant individual control over temperatures and airflow. Other problems, such as noise from human activity, are behaviorally based and outside the direct control of designers. Concerns such as the drab décor were met by EPA's effort to decorate walls with large landscape photos. Still other problems identified during the functionality assessment will require changes in rules (such as allowing employees to post large maps or data displays on workstation panels for quick meetings) or in funding allocations (such as providing smart phones for all employees and better remote access to EPA documents).

Ultimately, “success” is not something that can be declared based on any single snapshot in time, but only by an ongoing, broad-based, interdisciplinary commitment to measure, evaluate, invest in, and maintain sustainable performance. The EPA’s ongoing focus on and commitment to this building, therefore, is the most positive indicator for its continued success and improvement.

The research also raises important questions about designing for change and flexibility, and anticipating the future during design and development. Of particular concern are the energy and water modeling processes for green building certification. Changes in demographics, occupancy levels, occupant behaviors, organizational polices, and operational practices are important inputs for building design, but they are not adequately considered in current models.

Above all, the research shows that an office building is more than a structure to house a workforce. It is a complex ecosystem of people, work practices, and business decisions all linked toward one end—carrying out a mission in a way that is cost-effective and treads softly on the land. The work of fine-tuning the building and meeting the myriad challenges of the future—from energy to changes in work practices will continue, even as the formal research program comes to an end.



EPA’s ongoing commitment to maintaining sustainable performance is a key indicator of this building’s future success.