

**Green Projects Entry**  
Philadelphia Forensic Science Ctr. (o)

Section 1 - Project Overview Information Part 1

Project name: Philadelphia Forensic Science Ctr. (o)  
Project owner: City of Philadelphia  
Project address: 700 Poplar Street  
Philadelphia, PA 19123

Section 2 - Project Overview Information Part 2

Project completion date: 7/2003 (*m/y*) *format*  
Project Site: Previously Developed  
Project type: Laboratory  
Project site context/setting: Urban  
Other Building description: New  
Lot size: 214700.00 ft2  
Building gross floor area: 58700 ft2  
BOMA floor area method used?: no  
Number of permanent occupants: 72  
Number of visitors: 110  
Occupants (hours/week/occupant): 50  
Visitors (hours/week/visitor): 2  
Total project cost: \$11,450,000

Section 3 - Project Overview General Description

General description: The new Forensics Science Center for the Philadelphia Police Department is both a state-of-the-art forensics laboratory facility, as well as a demonstration project for environmental/sustainable design-intended as a model for future projects undertaken by the Capitol Program Office of Philadelphia.

The rigorous program includes a Firearms Unit, with a shooting range for ballistics analysis; Crime Scene Unit for 24 hours/day crime scene evidence gathering; Chemistry laboratories for drug analysis; Criminalistics and DNA laboratories for hair/fiber/blood analysis. The Forensics Science Center handles all crime scene evidence for the City of Philadelphia, with the exception of evidence from homicide crimes. The building is housed in a former K-12 school building on a site of 2.16 acres which had been abandoned for many years. It is a 1929 concrete frame, brick infill building, housing 44,000 square feet on four floors including a basement.

Challenges: \* limited financial resources \* multiple prime construction contracts \* low-bid awards \* communication and a cast of thousands \* Sustainable Building Partner Recognition Program \* the future of sustainable building in the City

City of Philadelphia mandate: \* improve management- over 1000 buildings \* reduce energy usage \* reduce impact on air and watersheds \* slow depletion of natural resources \* improve work environments of 30,000 employees \* develop local business opportunities \* save taxpayer dollars

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## Section 4 - Top Ten Measures

### Top Ten Measure 1: Sustainable Design Intent & Innovation

**Key environmental aspects:** The project has been fully simulated using the latest versions of PowerDOE and Superlite 2.0 modeling programs. Some of its many sustainable features include: precise mapping and load separation of areas requiring 100% outside air to minimize HVAC loads, envelope upgrades resulting in super-insulated building, "clean" products and finishes resulting in vastly improved indoor air quality, deep daylighting achieved by ceiling configurations, a rooftop photovoltaic array providing 15 kW, and primary access to all mechanical and infrastructure systems outside of lab areas. The project will also substantially increase pervious area of the site, with vegetated swales providing bio-remediation of runoff and reduction of input into city sewers.

Project Partners \* City of Philadelphia + Capital Program Office \* Municipal Energy Office \* Recycling Office \* Water Department \* Risk Management \* US Department of Energy \* Oak Ridge National Laboratory \* Non-Profits Energy Savings Investment Program

Capital Program initiatives \* worked with Municipal Energy Office on 'cool roofs' training, the development of PV installations, and the development of green building guidelines for the City \* developed a Sustainable Buildings Resource Guide with PA DEP \* Police Dept. Forensic Science Center - first green building model for Philadelphia

### Top Ten Measure 2: Regional/Community Design & Connectivity

**Regional/Community Design:** Located in an under-served neighborhood of north Philadelphia with higher crime rates, lower income levels and fewer services, the new Forensic Science Center has helped to breathe new life and a better sense of security to an entire neighborhood. A formerly-distinguished, but currently derelict school building that was only used by pigeons at the upper floors, and sitting amidst broken glass and other debris on a cracking, completely asphalted lot, the new Forensic Science Center has transformed both the site and the building to a new life. An existing train line connecting suburban areas of Philadelphia to Center City runs across the street from the site; active efforts are underway to re-open the station stop across the street that has been closed for many years. A noticeable upgrade to the entire area has taken place since this building opened; many Philadelphians see this part of North Phila. as the next wave of urban improvement. While it is impossible to substantiate the Forensics Center as the cause of this upsurge, it has certainly made a substantial contribution to the improved security and desirability of this zone.

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Use other transport options:

Parking spaces per person:

### Top Ten Measure 3: Land Use & Site Ecology

**Site ecology:**

The 2.16 acre site was a 100% impervious surface contributing to the 42 annual discharge events carrying storm water and sewage into the Delaware River at outfall D-45 (the original outflow of Cahocksink Creek) and into the Delaware River rather than onward for treatment at the Southeast Water Pollution Control Plant. Pennsylvania DEP

"Growing Greener" grant of \$225,000 was a key funding source for the "greening" of the site through a system of vegetated swales "rain gardens" and stone-reinforced water pathways. This exemplary system's performance, if generated as public policy within the D-45 outfall water shed would have the effect, overtime, of eliminating the frequent out falls.

The selection of indigenous scrubs, trees, and grasses has vastly expanded support for local fauna and the integrated health of the ecosystem.

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#### Top Ten Measure 4: Bioclimatic Design

**Bioclimatic design:** One of the greatest assets of the existing schoolhouse structure are the large windows; 9'-6" high and 3'-2" wide, organized in groups of three (they constitute over 30% of the exterior wall). Because the building is oriented north-south with the long facades facing east and west, these windows receive low level sun at sunrise and sunset. A typical day on either side has half a day of direct sun and half a day of an ideal, no glare, shaded view.

Our concern was to address what could be an extremely uncomfortable bioclimatic factor (glare and heat) through the design of the window, the shading device and the circulation/work station placement. The high performance glass reduces the visible transmittance and the addition of a white "thin line" blind allows either a self-diffusing light source at the window or a bounce of light toward the sloping ceiling. By placing the circulation corridor along this line of windows, and organizing the workstations perpendicular to the outside wall, a complimentary relationship has been struck. The users are delighted with the levels of full spectrum light and often prefer more direct "slatted" light than was expected.

The careful introduction of the tree, shrubs and vegetated swales to break up the "asphalt jungle", have greatly enhanced the site's micro-climate and provided an enriched habitat for indigenous flora and fauna.

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#### Top Ten Measure 5: Light & Air

**Light & Air:** Separation of Fresh Air & Exhaust Air streams: Located at most remote points: exhaust at north end of roof (directed straight up); supply at south wall (vertical face of grill), while still biasing all rooftop equipment to allow for best location for photovoltaics.

High-efficiency fluorescent lighting is used throughout the building All glues and adhesives are low to no VOC (volatile organic compounds) in order to insure good indoor environmental quality.

No CFCs or HCFCs are used in any of the equipment in the building, including the water fountains, refrigerators, and mechanical system equipment.

Rapidly renewable or recycled products (ceiling tile, steel, gypsum board) were used; alternative high-resistance materials that are typically vinyl were not allowed (instead using rubber flooring & base, stainless steel corner guards).

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Percent of building area that is daylit:	82%
Percent of building that can be ventilated or cooled with operable windows :	0%

## Top Ten Measure 6: Water Cycle

### Water Cycle:

Previously fully impervious site has been transformed, while still meeting the Center's demanding parking and servicing requirements - with large areas of vegetated swales and buffer vegetation, improving water catchment by roughly 33%. Linear vegetated swales, running parallel with parking areas, provide stormwater cleaning and absorption/evaporation before entering storm drains. Waterless Urinals - heavily utilized in 24 hour/day shifts - result in reduction of water consumption by approximately 176,000 gallons/year. (One urinal/bathroom x 4 bathrooms) Low-flow fixtures for all plumbing fixtures Site plantings are drought-resistant and require less watering/maintenance.

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Precipitation managed on site:	70%
Total water used indoors:	
Total water used outdoors:	
Percent of total water from reclaimed sources:	0%
Percent wastewater reused on-site:	0%
Calculated annual potable water use:	0

## Top Ten Measure 7: Energy Flows & Energy Future

### Energy description:

#### 1. ENERGY STRATEGIES

a. Separation of "100% Outside Air" Areas + 100% outside air required at labs but not offices + 4-pipe fan coil units are used at offices to minimize central plant load: central plant provides fresh air & ventilation only to offices + Pressurization system requires only minor modification in order to maintain separation of air flow to offices & labs

b. Setbacks + Real-time Occupancy Setback: air systems on a room-by-room basis go into setback mode when there is no occupancy + The entire facility can remain operational even in the case of failure of one air-handler or exhaust: pressure relationships maintained (temperature compromised)

c. Heat Recovery Systems/Economizers + Rooftop exhaust air heat recovery used for pre-conditioning outside supply air + Water-side economizers in office fan coil units: heat exchangers to utilize cooling tower water in shoulder seasons in lieu of using chillers + Air-side economizers in central 100% outside supply air for free-cooling + Gas Chiller heat exchanger recovers heat to generate hot water for heating & domestic water + Domestic hot water thru heat recovery systems & high-efficiency boilers

d. Fume Hoods + Limited sash openings for reduction in air volumes + Setback modes when lab is in setback mode (but still maintains pressure differentials)

e. Sustainable Energy Sources: Photovoltaics + Provisions to accept horizontal roof tile PV system of approx.15 KW. + Configuration of roof equipment to accommodate maximum best area for PV

f. Lighting + Occupancy Sensors + Daylight Dimming + T8 technology/electronic ballasts + Task/ambient lighting design - even at labs

### Performance Rating

EPA

HERS

Percent total energy savings

Base Case

Design Case

Total energy (Btu/sf/yr)

Electricity (Btu/sf/yr)

Natural gas (Btu/sf/yr)

Other: (Btu/sf/yr)

Heating (Btu/sf/yr)

Cooling (Btu/sf/yr)

Cooling capacity (sf/ton)

Lighting load connected (W/sf)

Lighting load after controls (W/sf)

Plug load (W/sf)

Peak electricity demand (W/sf)

Percent on-site renewable energy (%)

Percent grid-supplied renewable energy (%)

Supplemental Narrative

Top Ten Measure 8: Materials & Construction

Materials description: All glues and adhesives are low to no VOC (volatile organic compounds) in order to insure good indoor environmental quality. Glass Piping at lab waste avoiding PVC Piping: all piping is stainless steel, glass, cast-iron, copper No CFCs or HCFCs are used in any of the equipment in the building, including the water fountains, refrigerators, and mechanical system equipment.

Rapidly renewable (linoleum, agriboard products) or recycled products (cellulose, carpeting, tile, steel, gypsum board) were used whenever possible.

Ductwork: Galvanized sheetmetal, due to low volume/high dilution, all insulation external. Stainless steel ductwork only at acid fume hood

Top Ten Measure 9: Long Life, Loose Fit

Long life, loose fit: Restoration of physically intact, but derelict building, for entirely new purposes: existing linear building with tall windows on both long sides and center bay with higher structural capacity led to layout that put all occupied spaces along the windowed areas, with heavy equipment such as mass spectrometers, filing systems and other support spaces at center bays. Existing attic space used for massive trunk ducts allowing for furthest possible separation of intake air and exhaust air, as well as minimizing vertical distribution to various parts of building. Existing stairs reused; existing ventilation shafts used for vertical air and plumbing infrastructure. Existing subgrade space used for firearms testing areas. Building that is almost 100 years old is now upgraded to last another 100+ years.

## Top Ten Measure 10: Collective Wisdom & Feedback Loops

Collective Wisdom & Feedback Loops: A fundamental conclusion of our team over the years is to place the high-performance "intelligence" in the processors and software (highly reliable). We then select basic high reliability operating systems that are leveraged through integration with the processor or, in this case, the BMS.

Given the added layers of fume hoods, the heightened security demands and the inability to get full commissioning of the system, we were able to incorporate a three-year on-going maintenance/operations contract with SIEMENS who owns the system.

The following description communicates the solid operational concept that has been integrated with the mission of the Forensic Science Center.

### BUILDING AUTOMATION SYSTEM (BAS)

- a. Fully integrated DDC system \* Energy management \* Equipment monitoring/control \* Lab airflow control & pressurization \* Setbacks control \* Temperature \* Fume hood average face velocity \* Operated thru graphics control package \* Integrated with Fire Alarm & Security systems \* Location-specific alarm capacity
- b. Stand-alone fume hood controller incorporated into room pressurization system
- c. Provides trending for verification & measurement

## Section 5 - Project Economics

Finance: From the moment of project initiation, there was a strong feeling that the innovative and "green" characteristics of the Forensic Science Center would attract funding and that a core group should be established as expert advisors and/or advocates (as the case may be) to provide a broader perspective on project potentials and identify sources of funding/support. This group included representatives from the U.S. Department of Energy, Oakridge National Laboratory and the Municipal Energy Office in Philadelphia, among others and participated in two major reviews.

The major economic "hiccup" on the project however, was the City's delay in the receipt of significant Federal Funding which had the effect of delaying the project for 2 years and ultimately, having the project rebid. The good news was that during that time the "Growing Greener" Grant from Pennsylvania DEP came through for \$225,000.00 to accomplish the 'greening' of the asphalt parking lot with great result!

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Cost and payback analysis: Notwithstanding the energy intensive requirements of the laboratories with their massive numbers of the fume-hoods, extreme levels of brightness required at examination areas, and demanding levels of finishes for the work required, the project is projected to achieve the following improvements over a code-compliant building that would meet the fundamental program requirements and be compliant with ASHRAE 90.1, 1989 which was applicable at the time of the energy modeling.

\* 72% reduction in total annual source energy \* 69% reduction in 25-year CO2 Emissions (Global Warming) \* 67% reduction in total annual utility bill \* 65% SO2 + NOx 25-year

Emission reductions (Acid Rain) (Ozone-Smog) \* 61% reduction in annual peak electrical demand \* Cumulative payback of strategies = 2.2 years

## Section 6 - Process and Results

**PreDesign:** Shortly after award of the project, we began to get a sense of how “pre-wired” the criteria for a Forensic Laboratory had become. Various experts could tell you that you “HAD” to have a 200 lb. live load capacity throughout, therefore how could one possibly build in a building with less than half that capacity? Quickly we became aware of just how wasteful the recommended standards for material energy and redundant capacity were. Ultimately we were able to accommodate all lab functions with little or no building load capacity modifications.

**Design:** One absolute key environmental “tool” that we needed to pull off the high level of system cohesion and particularly lab fume hood performance, was the SIEMENS Building Management System. We had firm agreement that this particular system and the three-year maintenance contract would be through SIEMENS, however, an unrelated incident of corruption within the bidding procedures of the City of Philadelphia had the effect of “blowing up” this agreement and we were soon told that this would be bid with multiple contractors and the requirement to accept the lowest bid.

Our project manager continued to stand by our recommendations and eventually we were successful in getting the SEIMENS BMS. The lesson to take away from this is that any new field (Sustainability being only one) will have very few seasoned players and those limits can easily unseat a years work or undercut a key project “driver”.

**Construction Process:**

**Operations/maintenance:**

**Commissioning:**

**Measurement & verification/  
post-occupancy evaluation:**

**Rating System Name:**

**Version:**

**Rating Date:**

**Score or rating level:**

**Credits:**

## Sections 7: Visuals

Exhibit A

PLAB-context.gif



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Description:

Not Specified

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Exhibit B

PLAB-site.gif



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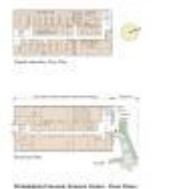
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Exhibit C

PLAB-first\_floor.gif



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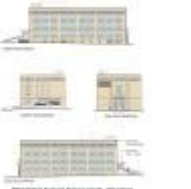
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Exhibit D

PLAB-elevations.gif



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Exhibit E

plab-section.gif



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Exhibit F

PLAB-pressure\_mapping.gif



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Description:

Innovative Energy Strategy: Pressure-Mapping

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Exhibit G

PLAB-01.jpg



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Exhibit H

PLAB-02.gif



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Exhibit I

PLAB-03.jpg



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Exhibit J

PLAB-04.jpg



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