

# **EPA'S NEW ENGLAND REGIONAL LABORATORY**

## **NORTH CHELMSFORD, MA**

### **1. Category.**

EPA's New England Regional Laboratory (NERL) is being entered in the "places of work" and "solar electric buildings" categories.

### **2. Building location with respect to local and regional resources of its context.**

Prior to construction, the site was delineated into two distinct zones; a large exposed portion resulting from quarrying of crushed stone including its use for the construction of nearby Route 3 in the 1950's, and a smaller portion housing a significant wetland in the SW corner that starts on the site and extends onto adjoining parcels. Both items were addressed early in the design process.

During the planning for the construction of the lab, the decision was made early on to site the building on a high outcropping of rock. The removed stone would then be crushed for reuse as roadbed material and fill under the structure. The reuse of on-site material lowered costs and significantly reduced trucking off site for disposal or importation of fill. Large stones were also set aside, not processed, and reused as a retaining wall on the north and west sides of the parking lot.

The wetland was initially more problematic. In conformance to national, state, and local regulations, the site design allocated site uses based on the setback requirements of: no disturbance within the first 25', roadways allowed in the 25'-50' zone, parking allowed within 50'-75', and no structures within 100'. When the design was further developed and the EPDM/metal roof system was chosen, the Town and the EPA, informed the design team that they consider storm water falling on this type of roof as clean. This decision allowed the design team to redirect approximately one half of the roof drainage from the existing storm water treatment system and instead to use this volume to re-charge the wetland.

### **3. List the key sustainable design features.**

**Site:** Utilize natural resources; solar; natural shading; erosion control; minimized site demolition; minimized building footprint; stockpile and re-use gravel for fill and loam for planting; stormwater management practices beyond code requirements; use collected roof rainwater runoff to recharge adjoining wetlands and minimize potable water for site plantings; Xeriscaping, including native grass lawns.

**Energy:** Aggressive energy reduction program with multiple collaborators led to a 35% reduction over the initial design; chillers upgraded to higher efficiencies; switched to low NO<sub>x</sub> modular gas-fired boilers; added variable speed drives on all pump; high efficiency motors; VAV air handling systems for laboratory and office space; 100% green power purchase; building Integrated Photovoltaic sunshading system; extensive program of incorporating daylight into the building by the extensive use of daylighting controls with skylights and tubular skylight; occupancy sensors; electronic ballasts with T8 lamps; electric vehicle recharging station; full DDC building control system; extensive building commissioning.

**Materials:** Extensive use of recycled materials: over 50% of non-mechanical materials contained a minimum of 20% post consumer content; estimated diversion of 200 tons of material from landfills including 126 tons of fly ash; low VOC materials and finishes.

Water Efficiency: Low flow fixtures; automatic controls; waterless urinals; Vortech filter unit to treat surface runoff; operational procedures in labs to reduce water below EPA baseline use.

Indoor Environmental Quality: Specified low VOC materials; soft materials were off-gassed off site and installation was sequenced to avoid contamination; advanced IAQ plan implemented including building wide testing for potential chemicals; permanent air monitoring; separate chemical storage facilities.

#### **4. Relationships between the formal, programmatic, and high-performance design strategies and the site.**

Building design began with site planning to maximize the best use of resources naturally available on the site, such as passive solar, natural shading, and site-specific drainage, in addition to avoiding the generation of unnecessary debris and minimize site demolition. The building was situated to take maximum advantage of the natural topography. Its hilltop location provides positive drainage away from the building and benefits from the natural cooling effects of prevailing winds. Existing trees and natural areas were maintained as much as possible to shelter and shade the building and natural out-croppings were left throughout the site to enhance the natural setting. Offices were placed on the north side of the building to minimize the need for cooling and the loading dock was designed for the south side of the building to maximize snow and ice melt.

From the earliest meeting, the site design sought to minimize impacts and long term carrying costs. As noted in our response to the local and regional context issues, in situ stone was reused on site and a significant portion of the roof stormwater was utilized to recharge the on-site wetland. 99% of the soft landscape area was seeded with native grasses in order to minimize irrigation and to reduce mowings to once per year. All plant material selected for this site are either listed as native or naturalized for this area. A concerted effort was made to obtain materials locally and the majority of materials were obtained within a 300-mile radius of the site, reducing fuel consumption and transportation costs. While supplemental water is required for any new installation under "normal" weather patterns, all materials will receive reduced water amounts in subsequent years until no supplemental watering is required.

#### **5. Summarize the building program and program specific features**

The New England Regional Laboratory is a state of the art environmental testing laboratory capable of performing a variety of biological and chemical analyses in air, water, soil and hazardous waste matrices that support both civil and criminal investigations. Some of the lab modules were customized for a specific use and include a "clean room" containing a metallurgical lab completely constructed without the use of metal; biology labs for culturing organisms and toxicity testing outfitted with special environmental chambers for storing fish and micro-organisms; and an air monitoring lab with provisions for conducting ambient air sampling on the roof and drawing the air samples directly into the lab via glass tubing. Other custom features include overhead utility service carriers handling power, data, nitrogen gas, deionized water, chilled water, and other utilities. Designed by the project team and custom-made by the lab casework manufacturer, the carriers were installed with an added longitudinal chase behind the cabinets for easy access to gas lines. The lab's HVAC system is designed for single-pass, 100 percent outside air.

The laboratory area is comprised of individual 12' x 22' lab modules, which provide benches and fume hoods for two scientists and can be ganged together for larger areas. Moveable workbenches allow for changing equipment and maneuvering under the utility carrier. Windowed doors and transom windows allow sunlight into the interior lab rooms. Twin service corridors acts as a central spine to the lab offering utility access and allowing for mechanical system maintenance and lab reconfiguration without

disruption to the scientists. Capped services were also extended to allow expansion with minimization of demolition and waste. Administrative offices and employee services are separate from the labs.

**6. Building's gross square footage.**

Block A-Office:	20,400
Block B-Office Support:	7,500
Block C-Laboratory:	26,000
Block D-Laboratory Support:	5,600
Block E-Storage:	7,600
Block F- Chem Storage Bldg:	1,900
<b>Total GSF:</b>	<b>69,000</b>

**7. Project cost.**

The total project cost was approximately \$22,200,000. This translates to approximately \$320 per gross square foot or \$560 per net square foot. Total construction cost was \$18,000,000 or approximately \$260 per gross square foot.

**8. Performance information.**

NERL presently uses 100% green power as its source of electricity. The supplier, Green Mountain Power of Vermont, generates or purchases wind-powered electricity to match the consumption of our facility, We also generate electricity from our building integrated photovoltaic awning shades which we use on site, approximately 3,000 - 5,000 watts per day. We use natural gas to operate our boilers.

The total energy consumption for fiscal year 2002 (October 1, 2001 -September 30, 2002)was 21,315,001,271 BTU's or approximately 308,900 BTU's/sf/yr. The natural gas use was 115,626 ccf or an equivalent of 11,921,040,600 BTU's or approximately 172,800 BTU's/sf/yr which was 55.9% of our total energy consumption. The electrical KWh was 2,753,200 or an equivalent of 9,393,918,400 BTU or approximately 136,100 BTU's/sf/yr which was 44.1% of our total energy consumption.

With regard to water usage, the following summarizes various estimated water usages versus actual measured uses in gallons per year (gal/yr).

<u>USAGE</u>	<u>ESTIMATED</u>	<u>ACTUAL</u>	<u>% OF ESTIMATED</u>
Laboratory	462,000	82,000	18
Cooling tower	726,050	1,061,000	146
Potable water	366,315	315,000	186
<b>Total</b>	<b>1,554,365</b>	<b>1,458,000</b>	<b>94</b>

## **9. Design intentions and methodological approach.**

NERL was designed to meet three criteria: provide a state of the art environmental testing laboratory; provide the safest facility possible for our employees; and make the facility as environmentally responsible or “green” as possible, adhering to the constraints of life cycle costing. “Green” in this context was defined as a building which uses the best commercially available materials and technologies to minimize consumption of energy and resources while maximizing the use of natural, recycled, and non toxic materials.

“Green” also means commitment to the Community and educational outreach. Displays have been set up in the lobby such as posters explaining the variety of work undertaken at the facility and a demonstration of the solar energy conservation through the use of the building integrated photovoltaic window shades. UMASS Lowell and Chelmsford High School have been contacted to collaborate on educational programs. EPA is committed to promote “Build Green” and groups such as the Boston Society of Architects have toured the facility with clients to show that green is not only correct but practical, efficient, and aesthetic. A composting project has been implemented and further projects such as a nature trail around the wetland are planned.

NERL contains a training center, conference rooms, and library. Conferences, workshops, meetings, and training for the EPA, state, industry, and environmental groups are encouraged. Designated meeting spaces and conference rooms are located throughout the facility. Outdoor seating, made of 100% recycled materials, allows further meeting options. Corridors with expanded window and sill space outside the labs provide multiple locations for scientists to spontaneously meet and collaborate. High-speed fiber optic, copper, and digital satellite connection ports are utilized throughout the facility.

Finally, for the health of employees, the design incorporated provisions for a wellness exercise room and an outside basketball and volleyball area.