Guide to School Design: Healthy + High Performance Schools

Healthy Schools Network, Inc.

www.Healthyschools.org

www.Cleaningforhealthyschools.org

Healthy + Green = A+

A "healthy and high performance school" uses a holistic design process to promote the health and comfort of children and school employees, as well as conserve resources. Children may spend over eight hours a day at school with little, if any, legal protection from environmental hazards. Schools are generally not well-maintained; asthma is a leading occupational disease of teachers and custodians— that is, they develop it on the job. There is a strong basis in science for designing schools: 1) for healthy indoor environments, and 2) for resource conservation. Together, healthy + green designed facilities promote indoor air and environmental quality; thermal, visual, and acoustical comfort; and energy, water and material conservation. Such facilities can also minimize construction and maintenance waste, fumes, debris and particulates that can harm school occupants and harm the environment. Design out common schoolhouse problems: healthy + green = A+.

Children Are Not Just Little Adults

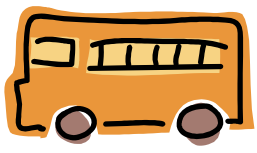
Children are especially vulnerable to environmental health hazards; moreover, schools are four times more densely occupied than commercial office spaces and not well-maintained. Children are at risk for exposure to school
hazards through breathing, touching, tasting the world around them, and by encountering toxic materials at home, in school, and in the community.

- Children eat, drink, and breathe more per pound of body weight than adults.
- Children are less able to identify and avoid hazards and have developing systems that may not detoxify poisons.
- Children often play on the floor or ground, and may accidentally be exposed to different sets of pollutants than adults, including toxics in schools.

Schools Are Not Just Little Offices

54 million children attend U.S. schools everyday; an estimated 90% of all school occupants are children and women

- Once a school is opened, *children are required to attend* regardless of conditions or hazards
- There is no mandatory tracking or reporting of child illness or injury at school.
- Facility codes and maintenance are often ignored.
- No regulatory authority oversees children's environmental health problems that arise at school.
- Increased indoor air quality results in better health, decreased absenteeism and occurrence of asthma, respiratory infection, and fatigue.
- Proper ventilation in schools can lead to better concentration and health of the children and staff as well as decreased occurrence of headaches and drowsiness.



Healthy and High Performance Schools Nationwide

- **Federal Education Law—*No Child Left Behind***
  Defines a Healthy and High Performance School (NCLB of 2001, Sec. 5581-86 ff) as:
  A school building in which the design, construction, operation and maintenance:
    - uses energy efficient and affordable practices and materials;
    - are cost effective;
    - enhance indoor air quality; and,
    - protects and conserves water.

- **Federal Law—*Energy Independence and Security Act***
  Calls for the US Environmental Protection Agency to establish voluntary school siting guidelines (EISA of 2007, Sec.461), taking into consideration:
    - susceptibility of children to environmental exposures
    - modes of transportation for students and staff
    - efficient energy use
    - potential of schools to serve as emergency shelters

- **US EPA *Design Tools for Schools***
  High performance design can have a positive effect on health and comfort, and design strategies such as daylighting have been shown to enhance student learning. Good indoor air quality is essential for teacher and student health. Good design also produces more comfortable environments with proper lighting, air temperature, humidity, and noise levels. This reduces distraction and creates environments where students and teachers can see clearly, hear accurately, and not feel too warm or too cold, *http://www.epa.gov/iaq/schooldesign/highperformance.html*

- **Collaborative for High Performance Schools (CHPS)**
  CHPS began in California with the US Green Building Council's LEED for New Construction design cri teria, were then adapted for school environments. CHPS has now been adapted for use by California, Colorado, Hawaii, Massachusetts, the Northeast (New Hampshire, Rhode Island, Connecticut, Maine and Vermont), Texas, Virginia and Washington. CHPS offers licensees a comprehensive design protocol and an Operations and Maintenance Manual, see *www.chps.net*

- **US Green Building Council LEED for Schools (v2, 2007)** is recommended for its guidelines on the siting of schools to ensure healthful sites and walkable communities, see *www.usgbc.org* or US GBC's **Center for Green Schools,** *http://www.centerforgreenschools.org/*

Comment: High performance/green schools are being built nationwide well within normal construction costs in California, New Jersey, Massachusetts, New York, North Carolina, Illinois, New Hampshire, Los Angeles, Montgomery County, MD, and elsewhere as a matter of policy: such as state or city laws (NYC, NH, CT), executive orders (NJ, CAL), and school district policy (LAUSD, Montgomery County, MD). See Building Healthy, High Performance Schools: A review of Selected State and Local Initiatives, Tobie Bernstein, Environmental Law Institute, 2003 (*http://www.elistore.org/reports_detail.asp?ID=10925*). In Connecticut, the state Department of Construction Services has developed high performance building guidelines, which includes 18 mandatory requirements for construction of public schools, h*ttp://www.ct.gov/dcs/lib/dcs/bdc/pubs/0450_capital_projects_high_performance_buildings_guidelines.pdf.*

CHECKLIST:
Designing and Renovating
Healthy & High Performance Schools

- ☐ **Siting.** Prospective school sites need to be evaluated for environmental and public health risks before a school site is selected. Considerations include environmental hazards on site and nearby, such as chemicals in the soil and proximity to industrial sites, the safety of that location, the environmental impact of constructing a building in that space, and whether the building will be a high performance school. (US EPA School Siting Guidelines, October 2011, *http://www.epa.gov/schools/siting/index.html*)

- ☐ **Good IAQ (Indoor Air Quality).** Prevent indoor air pollution by using nontoxic interior finishes, cleaners, and school supplies; have durable, easy to clean floor and walls. Avoid sites that are wet or have nearby hazards or fumes from freeways, and keep idling vehicles away from the school. Have windows that open and during construction, keep the building materials dry.

  Poor IAQ is associated with asthma, chronic respiratory infections, fatigue and absenteeism. In schools with poor ventilation, students suffer from headaches, drowsiness, limited concentration and other health complaints. Poor ventilation also contributes to mold growth indoors.

- ☐ **Visual Comfort.** Incorporate day lighting and high performance electric lighting. Control or eliminate glare.

  Day lighting refers to the controlled admission of natural light through windows. The design should posi tion windows and room layouts to maximize natural light. Natural lighting is associated with higher test scores, better work habits and decreased fatigue, headaches, and eye strain. Students in class rooms with large windows and skylights outperformed students in schools with less day lighting by up to 14 % on end-of-grade tests. It also leads to greater energy efficiency and cost savings for schools. (Nicklas, M.H. and Bailey, G.B. 1996, "Analysis of the Performance of Students in Daylit Schools" Raleigh: Innovative De sign, *http://www.innovativedesign.net/files/Download/Analysis%20of%20Student%20Performance%20in%20Daylit%20Schools.pdf*)

- ☐ **Thermal Comfort.** Install proper mechanical heating, ventilation, and air conditioning (HVAC) systems and allow for natural ventilation. Have individual classroom controls.

  Thermal comfort affects mold growth, indoor water intrusions and student performance on tasks. Mold growth contributes to decreased indoor air quality which can affect students with asthma. (Bates and Mahaffy. 1996, "Proceedings of the 7th International Conference on Indoor Air Quality and Climate", Vol. 1).

- ☐ **Acoustic Comfort.** Reduce sound reverberations, including those from HVAC systems, electric lighting and TV/VCRs. Limit the amount of "outside" noise from roads, playgrounds, gyms and cafeterias.

  Noise refers to any unwanted, extraneous sound. Excessive background noise interferes with the learning process and leads to noise-induced hearing loss, stress, mental health and behavior problems, decreased school performance and cognitive delays. (Slater, BR. 1986. "Effects of noise on pupil performance." Journal of Educational Psychology, 59 (4): 239-43).

- ☐ **Energy, Water, & Material Efficiency.** Use renewable energy when possible. Reduce water use in school with water-conserving faucets and fixtures, high efficiency equipment and automatic bathroom sink shutoffs. Use recycled materials and implement a recycling plan for the school.

  Material efficiency and conservation promotes environmental responsibility and reduces costs to schools.

- **Safety & Security.** Provide careful exterior lighting to minimize the areas of the school that are hidden. Open stairwells, graffiti-resistant surfaces, attractively fenced playgrounds, and limiting building entries will increase safety and security.

- **Cost Effectiveness.** High performance schools are energy efficient and can save up to 45% annually compared to conventional buildings (RLW Analytics study for NYSERDA, 2004). They are easier to maintain and use a life-cycle approach that reduces the total costs of ownership up to $50 per square foot. High performance schools also implement a commissioning process that ensures the facility will operate in a manner consistent with design intent. (Northeast Energy Efficiency Partnerships, 2006, *http://www.neep.org/*)
  Commissioning involves close communication throughout all stages or design, construction, and occupancy in order to ensure that all systems are designed, installed, calibrated, and maintained to perform correctly. Staff should be properly trained on the integrated maintenance and repair of healthy and high performance schools.

- **Polychlorinated biphenyls (PCBs).** Buildings constructed or renovated from the 1950's through 1978 may have caulk and fluorescent light ballasts which contain PCBs; children can be exposed to dust which is contaminated with PCBs. It is important that schools which renovate control for PCB exposure during renovation activities, and that PCB-contaminated materials are disposed of properly. (US EPA Fact Sheets for Schools and Teachers About PCB-Contaminated Caulk, *http://www.epa.gov/pcbsincaulk/caulkschoolkit.htm;* US EPA, Proper Maintenance, Removal, and Disposal of PCB-Containing Fluorescent Light Ballasts, *http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/ballasts.htm*)

- **Polyvinyl Chloride (PVC).** This chemical is an inexpensive, versatile plastic used in various consumer products, including construction materials such as siding, tile carpeting, gymnasium equipment and playground protective surfaces. Materials containing PVCs can off-gas, releasing chemicals into the air which can be harmful when inhaled, and which can also trigger asthma symptoms. (National Institutes of Health, Healthy Environments: A Compilation of Substances Linked to Asthma, 2012, *http://transparency.perkinswill.com/assets/whitepapers/NIH_AsthmaReport_2012.pdf*)

TIP: The renovation or retrofitting of an existing school is a school and a community challenge and an opportunity. Start by asking what needs fixing: ask custodians, occupants, and the health and safety committee, as well as parents. Design-out or fix problems first. Then make sure you protect occupant health during renovation project from the hazardous fumes, particulates, and contaminated debris and interior refinishing processes. (Healthy Schools Network, 2012, School Renovation and Construction, *http://www.healthyschools.org/clearinghouse.html*)

The Robust Science of School Environments

- ***Climate Change, the Indoor Environment, and Health, Institute of Medicine,*** 2011. "Poor indoor environmental quality is creating health problems today and impairs the ability of occupants to work and learn. Indoor exposures can be 100 -1,000 times more intense than outdoor exposure." Evidence suggests that indoor environmental quality deteriorates in buildings that are not well designed or are not adequately maintained in a timely manner. Off-gassing of harmful chemicals, such as formaldehyde, has been discovered in buildings where "sick-building syndrome" is present; this is related to issues with building design, material usage and building maintenance. In addition, symptoms of "sick-building syndrome", increased risk for allergies and respiratory infections are greater in buildings with low ventilation rates, due to either poor design or poorly functioning ventilation systems. Systems that are well-designed, maintained properly and operated correctly can improve humid conditions, and lead to decreased moisture and mold growth in buildings. Some states have endorsed design standards for health. In California, for example, the state's Green Building Standards Code (CalGreen), which applies to many types of buildings including public schools, focuses on improving public health and safety through standards such as building design and low-emissions materials. Although this report provides a review of other design standards programs, it has not endorsed any specific guidelines for building design. See *http://www.nap.edu/catalog.php?record_id=13115*.

- ***Green Schools: Attributes for Health and Learning, National Research Council of the National Academy of Science,*** 2006. The expert panel found that there is a "robust science" behind healthy indoor environments, and recommended that "conventional green schools" should also be designed for health benefits by addressing the following concerns: dryness, that is, keeping the site and building materials dry to help prevent mold and using mold-resistant building techniques; good indoor air quality through the proper ventilation and use of less-toxic interior materials; quietness, acoustical controls; well-maintained systems, that is, following construction with "building commissioning" to ensure that all systems work as specified; and cleanliness through ensuring that the building is durable and easy to maintain (ex., accessible custodial closets, durable finishes and flooring). See *http://books.nap.edu/catalog.php?record_id=11756*.

- ***Science-Based Recommendations to Prevent or Reduce Potential Exposure to Biological, Chemical, and Physical Agents in Schools***, Derek G. Shendell, et al., Journal of School Health – December 2004, Vol. 74, No. 10, a review of peer-reviewed publications and proceedings.

- ***A Summary of Scientific Findings on Adverse Effects on Indoor Environments on Student's Health, Academic Performance and Attendance,*** 2004, US Department of Education, Office of the Under Secretary, Doc # 2004-06, Washington, DDDC, 2004., prepared for Congress pursuant to HHPS/NCLB.

- ***Do Indoor Pollutants and Thermal Conditions In Schools Influence Student Performance?*** A Critical review of the Literature, M.J. Mendell, G.A. Heath, Indoor Air, Volume 15 Issue 1 Page 27 – January 2005.

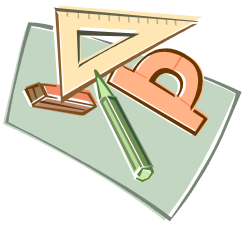
- ***Creating Safe Learning Zones: Invisible Threats, Visible Actions,*** Center for Health, Environment and Justice, 2001 and updated, for sample policies and GIS maps on schools built on or near Superfund and other hazardous sites, at *http://www.chej.org/wp-content/uploads/Documents/creating_safe_learning_zones_draft.pdf*

- ***Do School Facilities Affect Academic Outcomes?,*** Mark Schneider, National Clearinghouse for Educational Facilities, 2002, at *http://www.ncef.org/pubs/outcomes.pdf*

- ***New York State School Facilities and Student Health, Achievement, and Attendance: A Data Analysis Report,*** Healthy Schools Network, Inc., 2005, comparing data on 100 school facilities and building-level educational data in two counties, and finding that environmental conditions of schools related to achievement, attendance, and suspension rates, at *http://healthyschools.org/clearinghouse.html.*

- ***Impact of the Return to School on Childhood Asthma Burden in New York State,*** International Journal of Occupational and Environmental Health, January 2011, *http://www.ijoeh.com/index.php/ijoeh/article/view/1462*

- ***Greening America's Schools: Costs and Benefits,*** Gregory Katz, Capital E, October 2006. Studies cited include those indicating that healthy indoor environments can achieve an 87% reduction in flu, 67% reduction in Sick Building Syndrome, 46% reduction in upper respiratory problems, and a 39% reduction in asthma at school. Asthma is the leading cause of school absenteeism due to chronic illness and a leading occupational illness among teachers and custodians. See *http://www.leed.us/ShowFile.aspx?DocumentID=2908*



MORE RESOURCES

CHPS Partners. Collaborative for High Performance Schools, state organization partnerships, *http://www.chps.net/dev/Drupal/node/131*

CHPS Best Practices Manual: Volumes I-IV. Collaborative for High Performance Schools, *http://www.chps.net/manual/index.htm#v4*

High Performance School Buildings Resource & Strategy Guide, 3rd edition. Sustainable Buildings Industry Council, *www.sbicouncil.org/store/index.php*

US EPA Healthy School Environment Resources. See *http://cfpub.epa.gov/schools/index.cfm* for a suite of best practices for school facilities.

National Clearinghouse for Educational Facilities: *http://www.ncef.org/rl/*

The Impact of School Buildings on Student Health and Performance, The Center for Green Schools and McGraw Hill Research Foundation, February 2012, *http://centerforgreenschools.org/studies/k12.aspx*

New York State online training for high performance school design: *http://cmsapps.nyserda.ny.gov/hps/*

NY CHPS: High Performance Schools Guidelines: *http://www.p12.nysed.gov/facplan/documents/NY-CHPS_Sep2007finalNYSERDA.doc*

New York City School Construction Authority Green School Guide, developed to comply with NYC Local Law 86 (2005) requiring all public construction to be green. See *http://source.nycsca.org/pdf/nycgsg-031507.pdf.*

TIPS on POLICY: High Performance School Design

- If your **school district** is thinking about building new or renovating soon, start today by printing and sharing this guide or other suggested resources with your district officials and community groups.
- If your **city or state** is interested in SAVING ENERGY in schools, start today to make sure that any energy retrofits promote healthy indoor air quality and good acoustics.
- Ask your **Governor or Mayor** to consider an Executive Order, or, ask your city council and/or **state legislative committees** to consider a new law that directs all school construction/major renovations to meet healthy and high performance school design standards.
- If a school construction project is underway, make sure occupant health is protected.

Healthy Schools Network, Inc.
773 Madison Avenue • Albany, NY 12208
Tel. (518) 462-0632 • Fax (518) 462-0433

www.HealthySchools.org
www.NationalHealthySchoolsDay.org
www.CleaningforHealthySchools.org