Healthy School Environments

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More than 53 million children and about 6 million adults spend a significant portion of their days in more than 120,000 public and private school buildings. Many of these buildings are old and in poor condition, and may contain environmental conditions that inhibit learning and pose increased risks to the health of children and staff.
In 1995 General Accounting Office presented a report to Congress assessing the condition of American schools buildings.

They found that only two-thirds of the schools in America were in adequate condition.

Approximately 14 million students attended the remaining 25,000 inadequate schools. 15,000 of these schools had poor air quality not suitable for breathing.
“Amazingly, we continue to have learning happen, even under these conditions. What better job could we do if we had good lighting, adequate space, good air flow and constant temperatures? Maybe that should be considered in the No Child Left Behind recommendations.”

—Second-grade teacher in North St. Paul-Maplewood, Minn.
"I think the conditions convey a message to the students: You are not worth the effort of providing and maintaining a good school."

—Boston math teacher
In 2004, Gilbane Building Company was hired by the Providence Public Buildings Authority to assess their school facilities. Gilbane was charged with the responsibility of conducting a demographic study and assessing the condition of school buildings. The facility conditions and related building information are reflected in the tables and charts on the following slides.
Our Own Backyard
Almost half of the Providence Public School Department buildings were built prior to 1930. There were no school buildings constructed during the 1940’s or 1980’s.

<table>
<thead>
<tr>
<th>Years</th>
<th># of Buildings</th>
<th>% of Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1920</td>
<td>10</td>
<td>24%</td>
</tr>
<tr>
<td>1920-1929</td>
<td>9</td>
<td>22%</td>
</tr>
<tr>
<td>1930-1939</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td>1940-1949</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>1950-1959</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>1960-1969</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>1970-1979</td>
<td>3</td>
<td>7%</td>
</tr>
<tr>
<td>1980-1989</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>1990-1998</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>&gt; or = 1999</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>
Facility Condition

The chart below indicates that the majority of the school buildings have been assigned a poor building condition and are in need of major renovation or replacement.
Recommendations

1. Proposed Projects - It is recommended that the following projects be included in the Facility Master Plan.

Based on the data collected and input received, 37 major projects are proposed or may currently be in process. These projects along with the projects completed by the City in the past 10 years will result in updating the entire inventory of the Providence Public School Department. These projects are as follows. Not all projects can be accomplished at the same time. The volume of construction required, the number of students impacted, and the financial resources require that these projects be spread out over a period of years, depending on funding levels.

1. Adelaide HS
2. Central HS
3. HS Athletic Complex / Hanley Gym Connector
4. Hanley Career Tech
5. Nathan Bishop MS
6. West Broadway ES [Move to Pell Complex]
7. New Alternative HS
8. Mt. Pleasant HS
9. Central Hanley Gym
10. George J. West ES
11. Alan Shawn Feinstein ES at Broad Street
12. Asa Messer ES and Annex
13. Laurel Hill Avenue ES and Annex
14. Gilbert Stuart MS
15. Carl G. Lauro ES
16. Esek Hopkins MS
17. Hope High School Complex
18. Lillian Feinstein ES at Sackett Street
19. Nathanael Greene MS
20. New North/Northwest School
21. Webster Avenue ES
22. Windmill Street ES [See Esek Hopkins]
23. Classical HS
24. Del Sesto HS
25. Edmund W. Flynn ES
26. Harry Kizirian ES
27. Mary E. Fogarty ES
28. Reservoir Ave ES
29. Robert F. Kennedy ES
30. Vartan Gregorian ES
31. William D’Abate ES
32. Oliver H. Perry MS
33. Dr. Martin Luther King, Jr. ES
34. Roger Williams MS
35. Pleasant View ES
36. Samuel W. Bridgham MS
37. Veazie Street ES
The American Lung Association found that American children missed more than 12 million school days in 2000 because of asthma exacerbated by poor indoor air quality.

Air quality also affects students’ ability to concentrate.

Researchers have found a difference of 5 and 17 percentile points in the achievement of schools in poor buildings. Poor buildings which are disproportionately found in urban areas.
Common Contaminants Found in Older Schools

- Mercury
- Asbestos
- Lead
- Mold/Moisture Control
- Pest/Pest Management
Mercury

Mercury is used in many items found in schools, such as thermometers, barometers, switches, thermostats, flow meters, lamps, shoes, and laboratory reagents in the science department. Accidental exposures to mercury can have a number of negative effects on children's health.

NEGATIVE EFFECTS INCLUDE BUT NOT LIMITED TO:

- headache, confusion, kidney function test abnormal, memory loss

http://hazmap.nlm.nih.gov/
Asbestos is a naturally occurring mineral fiber, once widely used in building materials for its thermal insulating properties and fire resistance.

Intact, undisturbed asbestos-containing materials generally do not pose a health risk. These materials may become hazardous if they are damaged, are disturbed in some manner, or deteriorate over time and release asbestos fibers into building air.

A number of building materials today still contain asbestos.

**NEGATIVE EFFECTS INCLUDE BUT NOT LIMITED TO:**

- Lung cancer
Exposure to lead-contaminated dust is the most common way to get lead poisoning. The most common lead hazards in schools are lead-based paint, lead dust, and contaminated soil.

Residential Lead-Based Paint Hazard Reduction Act of 1992

The Congress finds that –

(1) low-level lead poisoning is widespread among American children, afflicting as many as 3,000,000 children under age 6, with minority and low-income communities disproportionately affected;

(2) at low levels, lead poisoning in children causes intelligence quotient deficiencies, reading and learning disabilities, impaired hearing, reduced attention span, hyperactivity, and behavior problems;
Mold/Moisture Control

- Moisture problems in school buildings can be caused by a variety of conditions, including roof and plumbing leaks, condensation, and excess humidity.

- Potential health effects and symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints.

- If mold is a problem in your school, you must clean up the mold and eliminate sources of moisture within 24-48 hours of exposure.
Environmental Concerns in Newer Schools

- Vapor Intrusion- (will be explained in the following slides).

- Ventilation- newer buildings are so tightly structured that fresh air can not come in. Sometimes windows are made not to open or people are reluctant to open windows due to energy loss.

- Dust residue from recent construction is re-circulated indoors and can be breathe into the lungs.
Building depressurization may cause soil gas from soil and/or groundwater contamination to be drawn into buildings through holes and cracks in the foundation. Heating systems, basements, and strong winds promote vapor intrusion into buildings by reducing the internal air pressure and creating a vacuum effect that enhances advective flow from underlying soils and/or groundwater into buildings.
Vapor Intrusion

Figure 1-1. Typical conceptual model of vapor
Vapor Intrusion

- Soil gas can flow into a building due to a number of factors, including barometric pressure changes, wind load, thermal currents, or depressurization from building exhaust fans.

- The rate of movement of the vapors into the building is a difficult value to quantify and depends on soil type, chemical properties, building design and condition, and the pressure differential.

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Typical Vapor Intrusion Scenarios

- Gas stations near residential areas
- Dry cleaner in strip mall adjacent to neighborhood
- Large industrial sites with plumes under several buildings
- Vacant large commercial building with warehouse space
- Building with parking garage over groundwater plumes
- Former landfills or industrial site over groundwater plumes

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## Other Indoor Air Quality Contaminants

<table>
<thead>
<tr>
<th>VOC</th>
<th>Source material(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>Environmental tobacco smoke, urea formaldehyde foam insulation (UFFI), particle board, chipboard, plywood, water-based paints, fabrics, household cleaners</td>
</tr>
<tr>
<td><em>p</em>-Dichlorobenzene</td>
<td>Moth crystals, room deodorants</td>
</tr>
<tr>
<td>Styrene</td>
<td>Insulation, textiles, disinfectants, plastics, paints</td>
</tr>
<tr>
<td>Benzyl chloride</td>
<td>Vinyl tiles</td>
</tr>
<tr>
<td>Benzene</td>
<td>Environmental tobacco smoke</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>Dry-cleaned clothes</td>
</tr>
<tr>
<td>Chloroform</td>
<td>Chlorinated water</td>
</tr>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>Dry-cleaned clothes, aerosol sprays, fabric protectors</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>Industrial strength cleaners</td>
</tr>
<tr>
<td>Aromatic hydrocarbons (toluene, xylenes, ethylbenzene, trimethylbenzenes), aliphatic hydrocarbons</td>
<td>Paints, adhesives, petrol, combustion products</td>
</tr>
<tr>
<td>Terpenes (limonene, α-pinene)</td>
<td>Scented deodorisers, polishes, fabrics, fabric softeners, food, beverages, environmental tobacco smoke</td>
</tr>
<tr>
<td>Polycyclic aromatic hydrocarbons</td>
<td>Combustion products (smoking, woodburning, kerosene heaters)</td>
</tr>
<tr>
<td>Acrylic acid esters, epichlorohydrin, alcohols</td>
<td>Monomers may escape from polymers aerosols, window-cleaners, paints, paint thinning, cosmetics and adhesives</td>
</tr>
<tr>
<td>Ketones</td>
<td>Lacquers, varnishes, polish removers, adhesives</td>
</tr>
<tr>
<td>Ethers</td>
<td>Resins, paints, varnishes, lacquers, dyes, soaps, cosmetics</td>
</tr>
<tr>
<td>Esters</td>
<td>Plastics, resins, plasticisers, lacquer solvents, flavours, perfumes</td>
</tr>
</tbody>
</table>

From IEH (1996)
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