

## HOW DOES INDOOR AIR QUALITY IMPACT STUDENT HEALTH AND ACADEMIC PERFORMANCE?

The Case for Comprehensive IAQ Management in Schools

### All Children Deserve a Healthy Learning Environment

Children are inherently more vulnerable to environmental hazards because their bodies are still developing. Substandard environmental conditions in schools, such as insufficient cleaning or inadequate ventilation, can cause serious health problems for children. Evidence continues to mount demonstrating that indoor air quality, or IAQ, directly impacts student academic performance and health.<sup>1,2</sup> IAQ refers to those characteristics of the air in indoor environments that impact the occupants' health, comfort and ability to perform. Taking steps to improve the IAQ of schools is critical to bettering student health and academic performance.

### Building the Case

#### The Evidence Exists

Scientific evidence has long demonstrated an association between poor IAQ and respiratory health effects, including asthma. Maintenance issues in schools, such as insufficient cleaning or excessive use of cleaning chemicals, have been shown to trigger asthma and allergies. According to the Centers for Disease Control and Prevention, or CDC, asthma is one of the leading causes of school absenteeism.<sup>3</sup> Multiple studies have found that children's overall performance decreases with illnesses or absences from school.<sup>4,5</sup>

#### The Evidence is Mounting

Evidence demonstrating the relationship between IAQ and human performance and productivity has become more robust. Studies demonstrate that improved IAQ increases productivity and improves the performance of mental tasks, such as improved concentration and recall in both adults and children.<sup>6</sup>

### Supporting Evidence from Scientific Literature

**Managing Your School Environment Can Improve Academic Performance:** A structured maintenance program is a cornerstone of academic performance and IAQ. With tight operating budgets, school boards and administrators often consider the maintenance budget as soft money, an expense that they can cut without affecting core academic program needs. However, the literature demonstrates otherwise, with several studies finding that health, attendance and academic performance improves with increased maintenance.<sup>7,8</sup> Furthermore, schools with better physical conditions show improved academic performance while schools with fewer janitorial staff personnel and higher maintenance backlogs show poorer academic performance.<sup>9</sup>

#### Providing Adequate Outdoor Air Ventilation Can Improve Student Health and Performance:

In most schools, ventilation rates are below recommended levels.<sup>10</sup> Growing evidence suggests that improving outdoor air ventilation rates can improve student and teacher performance, increase test scores, and reduce airborne transmission of infection.<sup>11,12,13,14,15</sup> In one study, students in classrooms with higher outdoor air ventilation rates scored 14 to 15 percent higher on standardized test scores than children in classrooms with lower outdoor air ventilation rates.<sup>16</sup>

**Dampness and Mold are Associated with Asthma and Other Respiratory Illnesses:** Studies show that dampness and mold in homes, offices and schools cause a significant increase in several respiratory and asthma-related health outcomes.<sup>17,18</sup> Symptoms identified in building occupants exposed to dampness or mold include: coughing, throat irritation, tiredness, headache and increased wheezing.

*(For action steps, continue onto the next page.)*

## Establish an IAQ Management Program

### ✓ Leverage Your IAQ Management Program

Many effective school IAQ management programs are implemented in conjunction with other health programs, such as physical education, nutrition and counseling services. IAQ implementation strategies, including moisture management, integrated pest management, and adequate ventilation help control environmental triggers and interface well with asthma and other health program initiatives. Literature reflecting field experience with health programs suggests that integrating related health programs into a coordinated or comprehensive program can achieve improved results for learning and health, and be more resource efficient.<sup>1,2</sup>

### ✓ Follow a Structured Process

The *IAQ Tools for Schools* Framework provides a comprehensive approach to help maintain healthy school environments. The Framework equips schools with strategies to establish and sustain a successful IAQ management plan. The Framework is also highly flexible and adaptable allowing any school, regardless of location, size, budget, or condition to launch, sustain or invigorate an effective IAQ management program.

### ✓ Learn More About the *IAQ Tools for Schools* Program

The *IAQ Tools for Schools* Program provides a variety of products, materials and tools at no cost to help schools implement an IAQ management program. In addition to the Framework, the *IAQ Tools for Schools* Action Kit, specialized fact sheets and checklists are available to provide in-depth guidance and tools to support your IAQ management program.

## References

<sup>1</sup> Stolz, A.D., A. Knickelbein, and S. Coburn. 2008. "Linking coordinated school health to student success." *Presentation at the Annual Conference of the National Association of School Nurses*, Albuquerque, NM.

<sup>2</sup> Vinciullo, F. 2008. "The relationship between multi-component school health programs and school achievement." *Presentation at the Annual Conference of the National Association of School Nurses*, Albuquerque, NM.

<sup>3</sup> Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. *Healthy Youth!* Retrieved July 14, 2009, from CDC's Asthma Health Topics Web site: <http://www.cdc.gov/HealthyYouth/Asthma/>

Also see Akinbami, L.J. 2006. *The State of Childhood Asthma, United States, 1980-2005*. Advance Data from Vital and Health Statistics: no 381, Revised December 29, 2006. Hyattsville, MD: National Center for Health Statistics.

<sup>4</sup> Silverstein, M.D., J.E. Mair, et al. 2001. "School attendance and school performance: A population-based study of children with asthma." *Journal of Pediatrics* 139(2):278-283.

<sup>5</sup> Moonie, S., D.A. Sterling, et al. 2008. "The relationship between school absence, academic performance, and asthma status." *Journal of School Health* 78:140-148.

<sup>6</sup> For a summary of the impact of indoor environmental quality on work and school performance, as well as other IAQ research findings, see the IAQ Scientific Findings Resource Bank (SFRB) established as a cooperative venture between EPA and the Lawrence Berkeley National Laboratory: Accessible at <http://www.iaqscience.lbl.gov/performance-summary.html>

<sup>7</sup> Schneider, M. 2002. "Public school facilities and teaching: Washington, DC and Chicago." 21st Century School Fund, Washington, D.C.

<sup>8</sup> Earthman, G.I., C.S. Cash, and D. Van Berkum. 1995. "Student achievement and behavior and school building condition." *Journal of School Business Management*, 8(3).

<sup>9</sup> Branham, D. 2004. "The wise man builds his house upon the rock: The effects of inadequate school building infrastructure on student attendance." *Social Science Quarterly* (85)5.

<sup>10</sup> California Energy Commission. 1995. *Air exchange rates in non-residential buildings in California*. California Energy Commission.

<sup>11</sup> Myhrvold, A.N., E. Olsen, and O. Lauridsen 1996. "Indoor environment in schools—Pupils health and performance in regard to CO<sub>2</sub> concentrations." *Proceedings, Indoor Air '96: The 7th International Conference on Indoor Air Quality and Climate*. Nagoya, Japan. 4:369-371.

<sup>12</sup> Mendell, M. 1993. "Non-specific symptoms in office workers: A review and summary of the epidemiologic literature." *Indoor Air* 3(4):227-236.

<sup>13</sup> Seppänen, O., W.J. Fisk, et al. 1999. "Association of ventilation rates and CO<sub>2</sub> concentrations with health and other responses in commercial and institutional buildings." *Indoor Air* 9(4):226-252.

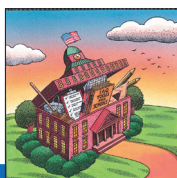
<sup>14</sup> Apte, M., W. Fisk, and J. Daisey. 2000. "Associations between indoor CO<sub>2</sub> concentrations and sick building syndrome symptoms in U.S. Office buildings: An analysis of the 1994-1996 BASE study data." *Indoor Air* 10(4):246-257.

<sup>15</sup> Shendell, D. G., R. Prill, et al. 2004. "Associations between classroom CO<sub>2</sub> concentrations and student attendance in Washington and Idaho." *Indoor Air* 14(5): 331-41.

<sup>16</sup> Shaughnessy, R.J., et al. 2006. A preliminary study on the association between ventilation rates in classrooms and student performance. *Indoor Air* 16(6): 465-468.

<sup>17</sup> Fisk, W.J., Q. Lei-Gomez, and M.J. Mendell. 2007. "Meta-analyses of the associations of respiratory health effects with dampness and mold in homes." *Indoor Air* 17(4):284-295.

<sup>18</sup> Mudarri, D. and W. J. Fisk, 2007. "Public health and economic impact of dampness and mold." *Indoor Air* 17(3):226-235.



IAQ Tools For  
Schools Program

For more information on this research, visit EPA's IAQ, Health and Academic Performance Web site at [http://www.epa.gov/iaq/schools/student\\_performance](http://www.epa.gov/iaq/schools/student_performance)