



**REDUCING ASTHMA TRIGGERS IN SCHOOLS:
Recommendations for
Effective Policies, Regulations, & Legislation**

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**REDUCING ASTHMA TRIGGERS IN SCHOOLS:
Summary Recommendations for Effective Policies, Regulations, & Legislation**

VENTILATION

- At a minimum, comply with the air supply specifications contained within ASHRAE Standard 62, with updates to reflect changes in the standard.
- Provide a minimum of 20 cubic feet per minute of outside air for each occupant, with a greater quantity of air in areas that require more dilution.
- Provide a minimum of 25% outside air.
- Provide a minimum of ten air changes per hour.
- Develop/reference a checklist for inspecting and troubleshooting the HVAC system.
- Use/install local exhaust ventilation for areas where the use or storage of hazardous materials prevents dependence upon dilution ventilation for control of the hazards.
- Locate outside air intakes away from any potential sources of contamination.
- Locate exhaust vents to prevent exposure of school occupants to potential sources of contamination.

MAINTENANCE

- Develop/use a standardized maintenance program for the HVAC system and implement it on a regular basis.
- Develop and implement a routine maintenance program, emphasizing cleaning of occupied areas, using methods that minimize particulate in the air.
- Develop and implement a protocol for water damage, including inspection criteria and schedules, immediate response, and remediation.
- Record and maintain details of maintenance activities.
- Develop and implement a protocol for responding to reports of health problems or conditions that may be related to indoor air quality.
- Develop, implement, and document training for maintenance personnel.

CHEMICALS AND PRODUCTS

- Compile a list of chemicals and potentially hazardous materials in use or in storage in all school buildings.
- Develop a protocol for managing and disposing of materials that are hazardous, out of date, or no longer used.
- Develop a list of materials that are not to be used or stored in any school building, on the basis of health, safety, and environmental concerns.
- Use the least toxic materials and develop concentration limits.

DESIGN, CONSTRUCTION, AND RENOVATION

- Design, construction, and renovation should reflect the most stringent standards at the time of the work.
- Comply with CHPS* standards in the design of schools.
- Use SMACNA** Guidelines when performing construction in occupied buildings.

* Collaborative for High Performance Schools ** Sheet Metal & Air Conditioning Contractors National Assoc.

REDUCING ASTHMA TRIGGERS IN SCHOOLS: Full Recommendations for Effective Policies, Regulations, & Legislation

**Produced by Joan N. Parker, MS, CIH, for the Asthma Regional Council (ARC)
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Overview

INTRODUCTION

According to the National Center for Health Statistics, 31 million Americans surveyed in 2001 were diagnosed at some point in their lives with asthma. Children have been particularly severely affected: asthma is the most common chronic childhood disease and one of the leading causes of school absenteeism. Indeed, a recent survey conducted by The National Association of School Nurses found that asthma is more disruptive of school routines than any other chronic condition, with more than a third of nurses having to respond to an acute asthma episode at least 11 times in the last school year. Asthma is also common among teachers, an indication that the school building environment may be associated with asthma prevalence in all occupants of school buildings.

Children are particularly sensitive to environmental pollutants, which are more concentrated in indoor air environments than in outdoor environments. Schools are a significant source of indoor air pollutants and children spend a large portion of their lives in these buildings. Yet little research has been conducted that addresses the causal relationship between asthma and specific levels of indoor pollutants, particularly mold, fungi, and bacteria.

By and large, indoor air quality is not controlled in schools in a way that minimizes exposures that cause or aggravate asthma. While there are few laws that specifically limit indoor air pollutants in schools, there are laws that outline or mandate practices that can effectively control exposures. This report provides concise recommendations for laws and regulations that control and, ideally, prevent indoor air quality problems, with the goal of reducing the occurrence and severity of asthma and other respiratory diseases.

METHODOLOGY

Indoor air quality laws and regulations for schools were reviewed to determine which states provide some good models for protecting students and staff. No state has a completely ideal regulatory package. Therefore, what is presented here is a compilation of recommendations based on the best laws in several states. These recommendations come mainly from those states with the best overall structures, but certain aspects of other states' laws have been incorporated if they appeared to be particularly innovative, protective, or synergistic with the laws from the model states. Some of the recommendations are not taken directly from existing laws; rather they are suggested as improvements to them.

While these recommendations are aimed at prevention and control of asthma, it may be beneficial to consider other health effects caused by exposure to indoor air pollutants, such as allergic reactions, including skin and eye irritation, and other respiratory conditions, including hypersensitivity pneumonitis and reactive airway disease. These conditions may indicate exposures that also have the potential to cause or aggravate asthma. Therefore, recommendations are not limited to controls that only prevent exposure to known asthmagens.

In addition, it is important to expand the generally accepted view that mold and other microbiologicals are the only indoor air pollutants in schools responsible for causing or aggravating asthma. Other potential causes include volatile organic compounds, such as solvents in cleaning and art supplies, and particulate matter, such as diesel exhaust, dust, and by-products of construction and renovation work.

The recommendations that follow are broken down into the main technical areas that relate to minimizing indoor air pollution in schools. These areas include:

- 1) maintenance of buildings;
- 2) ventilation systems;
- 3) design, new construction, and renovation; and
- 4) chemicals and other materials, including their purchase, storage, disposal, and safe use.

For each of these areas, the most important elements that address asthma are summarized and sample language from effective state laws is quoted or cited. For an excellent comprehensive review of all states' indoor air quality laws, see the Environmental Law Institute's research report, "Healthier Schools: A Review of State Policies for Improving Indoor Air Quality."¹ In addition the National Association of State Boards of Education (NASBE) has released a new on-line publication, "Issue Brief: Summary and Analysis of State Policies on Asthma Education, Medications, and Triggers."² This 20-page issue brief synthesizes current state policies addressing various asthma-related topics that NASBE has collected in its state school health policy database. Among the topics addressed are asthma education, identification of students with asthma, administration of medications by school staff, self-administration of medications, tobacco-free schools, air quality, pest control, and other environmental health policies.

The recommendations presented here differ from the documents cited above in that they not only reference model laws, but they include suggestions for improving upon those laws. In making these recommendations, consideration has been given to cost effectiveness, to long-range benefits, and to avoiding conflict with existing laws or standards for environments other than schools.

¹ Available from the Environmental Law Institute's website at http://www.elistore.org/reports_detail.asp?ID=10925

² http://www.nasbe.org/HealthySchools/States/State_Policy.html

Recommendations

I. VENTILATION SYSTEMS

Any indoor air quality law must require that schools adhere to minimum ventilation standards. The most efficient way to prevent the build-up of indoor air pollutants, apart from complete source elimination, is through effective ventilation. A good ventilation system must function properly, and must comply with minimum standards established by state building codes or, in this case, laws designed to reduce exposure to asthmagens in schools.

Many state laws require compliance with the specifications of Standard 62, titled “**Ventilation for Acceptable Indoor Air Quality**,”³ which is prepared and routinely updated by the American Society for Heating, Refrigeration, and Air Conditioning Engineers, Inc. (ASHRAE). This standard is not a legal requirement, but it can be incorporated into law. The state of Maine, for example, requires that Standard 62 be applied to all buildings occupied by state employees.⁴ This requirement should be altered to include and to specifically apply to all school buildings. In addition, the law should make clear that the schools’ ventilation systems must comply with the ASHRAE standard that is or was current at the time the ventilation system was installed or renovated.

Minnesota goes further and requires certification that, for any new or extensively renovated facility, the HVAC system “will meet or exceed code standards; will provide for the monitoring of outdoor airflow and total airflow of ventilation systems; and will provide an indoor air quality filtration system ...” that meets the most updated standard.⁵

What is most crucial, however, is that certain specific minimum standards for ventilation be clearly established. For example, each school should provide a **minimum of 20 cubic feet per minute of outside air for each occupant**⁶ of any room in the school. More should be provided in certain areas, such as rest rooms, lockers, and kitchens, where additional dilution is important. The air supplied to each occupant should consist of a **minimum of 25% outside air**⁷. Recirculating more than 75% of the total air will result in an excessive build-up of any contaminants in the air.

The **total amount of air available per person** is as important as the proportion of outside air. Increasing the total amount of air increases the rate of removal of

³ American Society of Heating, Ventilating, and Air Conditioning Engineers Standard 62 entitled “Ventilation for Acceptable Indoor Air Quality” (available only by purchase from ASHRAE: www.ashrae.org)

⁴ <http://janus.state.me.us/legis/statutes/5/title5sec1742.html>

⁵ www.revisor.leg.state.mn.us/stats/123B/71.html

⁶ Recommended by the Occupational Health Program within the Massachusetts Department of Occupational Safety

⁷ Recommended by the Occupational Health Program within the Massachusetts Department of Occupational Safety

contaminants through the room's exhaust system. Each room or area should undergo a **minimum of ten full air changes per hour**⁸.

HVAC or related systems should be able to provide a range of **30-60% relative humidity**. Levels over 70% are conducive to microbial growth and levels under 30% are drying and may increase sensitivity to irritants in the air.

HVAC systems should be **operated continuously during all hours of occupation** so that before- and after-school activities don't take place in unhealthy environments. Most states recognize that some exceptions to this requirement will be necessary and must be stated. For example, most states drop the requirement for ventilation during scheduled maintenance and emergency repairs.

Ventilation systems should be **routinely inspected** to ensure proper functioning and to facilitate maintenance, which is covered in another section of this report. California's standards for workplaces require that HVAC systems be inspected at least annually and that inspections and maintenance of the HVAC system be **documented in writing**, listing the name of the individual inspecting and/or maintaining the system, the date of the inspection and/or maintenance, and the specific findings and actions taken. The state further requires that the records be kept for at least five years, available to employees upon request.⁹

To further increase the effectiveness of this requirement, the law should reference a straightforward checklist for inspecting the HVAC system. Minnesota has developed an operations and maintenance manual for such a purpose. While the manual is still in draft form, it can be used as a reference for developing criteria for ventilation system inspections.¹⁰

In addition to general ventilation systems, which do no more than dilute contaminants in the air, **local exhaust systems** are necessary to remove recognized chemicals and toxins in certain areas of known risk. Examples of areas that should be equipped with systems to remove hazardous gases and particulates without recirculation of air include chemistry and biology labs, art classrooms and facilities, autobody and mechanical shops, and areas in which cleaning and maintenance products are stored. Auto body shops are particularly hazardous because of their use of isocyanates, which can aggravate existing asthma and can cause asthma in individuals with no history of the disease. An indoor air quality law should reference or include the specifications contained in **workplace standards** on local exhaust ventilation. California's general industry safety orders that cover dusts, fumes, mists, vapors, and gases¹¹ serve as a good reference.

⁸ Recommended by the Occupational Health Program within the Massachusetts Department of Occupational Safety

⁹ <http://www.dir.ca.gov/title8/5142.html>

¹⁰ www.health.state.mn.us/divs/eh/indoorair/schools/plan/appdxf.pdf

¹¹ www.dir.ca.gov/title8/5143.html

Fume hoods are a form of local exhaust ventilation and should conform to the most recent version of the American National Standard for Laboratory Ventilation¹². Testing methods to determine compliance should follow the ASHRAE Method of Testing Performance of Laboratory Fume Hoods.¹³ Fume hoods should be on at all times and should never be used to store hazardous or toxic chemicals.

The preceding recommendations are of a technical nature, but some common sense recommendations are also in order. For example, it is crucial that the **outside air intakes for ventilation systems** be located away from any possible contaminants,¹⁴ such as parking lots, areas where fuel burning equipment is operated, trash containers, outdoor painting applications, or exhaust from other areas within the building, such as cafeterias, laboratories, janitors' closets, and trade shops. In addition, all vents that **exhaust air from hazardous areas** should be located so that the contaminated air does not re-enter the building or expose students or school personnel when they are outside the building. To ensure the effectiveness of the above recommendations, the system should be regularly inspected and repaired, maintained, and updated.

II. MAINTENANCE

A well-designed and properly functioning ventilation system is critically dependent upon effective building maintenance. In addition, maintenance and cleaning can significantly reduce the opportunities for exposure to respiratory hazards. A conscientious *routine maintenance* program will decrease the need for *emergency maintenance* and repairs, thereby reducing the duration of exposure and eliminating unanticipated costs for such emergency work.

Most states require maintenance of *ventilation* systems in school buildings, but often fail to require routine maintenance that also addresses the *broader areas*, such as proper and frequent cleaning of buildings, that can prevent or reduce indoor air quality problems. Many laws also fail to specify a schedule or particular criteria for such maintenance.

Vermont law¹⁵ requires that a **model policy** be implemented, to include the “compilation of a recommended maintenance schedule and checklist for the school, summarizing when and how maintenance of heating and ventilation systems should occur.” This law could be improved by listing the specific criteria for maintenance and schedules, perhaps by referencing and requiring compliance with ASHRAE's Standard 62¹⁶ or the EPA's “Tools for Schools”¹⁷. This section of the law should clarify whether or not the maintenance is mandatory and should clearly include all phases of maintenance in addition to the HVAC system.

¹² ANSI/AIHA Z9.5 1992 at www.ansi.org

¹³ ASHRAE 110-1995 or most recent at www.ashrae.org

¹⁴ As per ASHRAE Section 5.4 (see footnote 2)

¹⁵ www.leg.state.vt.us/DOCS/2000/ACTs/ACT125.html Section 3(a) and Section (b)(3)

¹⁶ American Society of Heating, Ventilating, and Air Conditioning Engineers Standard 62 entitled “Ventilation for Acceptable Indoor Air Quality”

¹⁷ <http://www.epa.gov/iaq/schools/tfs/building.html>

Connecticut law is broader and does not limit maintenance to the HVAC system. It requires that “Each local or regional board of education ... shall undertake maintenance of its facilities ...”¹⁸ ... and shall adopt and implement an indoor air quality program that provides for **ongoing maintenance and facility reviews** necessary for the maintenance and improvement of the indoor air quality in its facilities ...”¹⁹ This law, like the Vermont law, fails to include specific schedules and criteria for maintenance, but it does require that HVAC systems be “maintained ... in accordance with the prevailing maintenance standards, such as Standard 62,²⁰ at the time of installation or renovation of such system.”²¹ Standard 62 does recommend maintenance schedules.²² The shortcoming of this section is that it only addresses maintenance *schedules* that relate to the HVAC system. The law should reference a standard that includes all phases of maintenance, as does the EPA’s “Tools for Schools.”²³

Maintenance procedures and schedules should address the day-to-day cleaning of classrooms, offices, common spaces, personal service rooms, storerooms, and utility areas. As per California’s General Industry Safety Orders,²⁴ cleaning should be done with the following considerations:

- **Wet or damp mopping** is the ideal way to clean floors without increasing the amount of suspended particulate matter in the air.
- **Vacuumping** is always preferable to dry sweeping and should be done using a high-efficiency particulate air (**HEPA**) filtration machine.
- **The choice of cleaning materials** should take into consideration their toxicity and potential to cause respiratory problems.
- Whenever possible, cleaning should be done when **the area is not occupied**, and large cleaning projects should be done in areas that are sealed off from occupied areas.

In addition, a good law will recommend appropriate criteria for responding to reports of health problems or other conditions that may be related to indoor air quality. The model school environmental management plan required by Vermont law must include “mechanisms to resolve hazardous chemical exposure and indoor air quality problems as they occur ...”²⁵

¹⁸ Connecticut General Statutes Chapter 170 section 10-220 Subsection (a) (3)

¹⁹ Connecticut General Statutes Chapter 170 Section 10-220 Subsection (a) (4)

²⁰ American Society of Heating, Ventilating, and Air Conditioning Engineers Standard 62 entitled “Ventilation for Acceptable Indoor Air Quality” as referenced by the State Building Code adopted under section 29-252 of the general statutes (see footnote below)

²¹ <http://www.cga.ct.gov/2003/act/Pa/2003PA-00220-R00HB-06426-PA.htm>

²² ASHRAE Standard 62-2001 referenced in footnote 20), Table 8-1

²³ <http://www.epa.gov/iaq/schools/tfs/building.html>

²⁴ Subchapter 7, Group 2, Article 9 (www.dir.ca.gov/Title8/3362.html)

²⁵ www.leg.state.vt.us/DOCS/2000/ACTs/ACT125.html Section 3(c)(2)

A thorough and effective maintenance program can be implemented by following the recommendations contained within EPA's "Tools for Schools" program.²⁶ EPA has more specific recommendations for response to and clean-up of mold and moisture.²⁷ These programs should be integrated into indoor air quality laws.

Another good reference for maintenance is the "checklist for schools," developed by the Massachusetts Multi-Agency Task Force on Schools.²⁸

A very important means of reducing exposure to microbial²⁹ contaminants is ensuring that carpets that become wet be dried within 24 hours. **Wet carpets** provide an ideal growth medium for mold and mildew, and attempts at drying them after they have been wet for more than 24 hours are rarely successful. Wet carpets and rugs should be disposed of after one day.³⁰

Appropriate laws that specify maintenance procedures and schedules cannot be effective unless **maintenance personnel are appropriately trained** to carry out their duties. Such training should be required, in particular, when an emergency arises that requires immediate attention.

Vermont law requires that "The commissioners of health and of buildings and general services, education and health, with help from the secretary of the agency of natural resources when appropriate, shall ... organize school environmental health training workshop[s] for school environmental health coordinators and school administrators, and an annual training for school maintenance and custodial staff ..."³¹

Connecticut law³² requires that training of maintenance personnel be reviewed during inspections, which must be conducted every five years, and those inspections are limited to new construction and buildings renovated after January 2, 2003. Both the Connecticut and Vermont laws could be improved by providing criteria for the training and Connecticut law could be improved by requiring the training for maintenance staff in all buildings, and by making the training mandatory, rather than simply making it a subject for inspection.

III. CHEMICALS AND PRODUCTS: HOW TO CHOOSE, STORE, AND USE

One of the reasons that ventilation and maintenance are so critical in ensuring a healthy environment is the ubiquity of hazardous materials encountered inside buildings. These include those released from cleaning and maintenance products; paints and other

²⁶ <http://www.epa.gov/iaq/schools/tfs/building.html>

²⁷ http://www.epa.gov/mold/mold_remediation.html

²⁸ <http://www.mass.gov/dph/beha/iaq/schools/checklist03.pdf>

²⁹ Such as mold, mildew, fungus, and bacteria

³⁰ Recommended by the Occupational Health Program within the Massachusetts Department of Occupational Safety, with specific recommendations available upon request (617) 969-7177

³¹ www.leg.state.vt.us/DOCS/2000/ACTs/ACT125.html

³² Connecticut public statutes Chapter 170 Section 10-220 (d)

coatings; furnishings; trade shops; building materials, and maintenance, repair, and renovation projects. A sufficient quantity of air and good filtration of the air entering the building will significantly reduce pollutants from the outside. To aid in reducing exposures originating indoors, however, it is crucial to eliminate or significantly reduce the concentration of those materials that can cause or aggravate asthma.

Rhode Island has passed model indoor air quality legislation, known as the Rules and Regulations for School Health Programs, amended October 2003,³³ **which includes a comprehensive list of approximately 500 chemicals that may not be purchased or used in schools.** Their regulations also specify a general chemical hygiene program for schools. Adding a list of specific nontoxic or low toxicity building materials would further strengthen these regulations. The Massachusetts Executive Office of Environmental Affairs has developed a list of Environmentally Preferable Products for schools and municipalities, many of which have been reviewed for health effects.³⁴

The state of Maine proposed legislation called **An Act To Protect Children from Toxic Chemicals in Schools**, which would fund a chemical clean-out program through a tax on certain pesticides. The state's Departments of Environmental Protection and Education would be charged with working together to implement the plan.

Some states rely upon non-governmental organizations for recommendations regarding chemicals and materials to use or avoid as a means of reducing environmental impact.³⁵³⁶ However, few states focus strictly on health criteria, and fewer still on respiratory health criteria, to comprehensively regulate the purchase or use of chemicals or other materials.

Federal³⁷ and state³⁸ "right-to-know" laws impose requirements for *providing information* about certain hazardous chemicals, but these laws do not *prohibit the use* of such materials. Respiratory hazards are not specifically addressed in most of these laws. For example, while the Massachusetts Right-to-Know law more stringently regulates the information that is released about certain categories of hazardous chemicals, these categories do not include respiratory hazards.

Some laws address environmental issues, but not human health issues. Laws that ban certain materials are usually federal laws, such as the bans against asbestos, lead, and mercury. None of these materials is a respiratory hazard, except for asbestos on the basis of its being a dust, but this is not the basis for the ban. The only significant ban that has had the potential to influence respiratory health was the ban on **urea-formaldehyde foam insulation**. The ban was lifted, however, shortly after it was issued.³⁹

³³ http://www.rules.state.ri.us/rules/released/pdf/DOH/DOH_2722.pdf Section 39.4 and Appendix A

³⁴ <http://www.mass.gov/epp/products/cleaning.htm>

³⁵ <http://www.greenseal.org/index.html>

³⁶ Coalitions for Occupational Safety and Health (COSH) are good resources for chemical information and less toxic alternatives. For a list of COSHs, go to http://www.coshnetwork.org/cosh_groups_list.htm

³⁷ 29CFR1910.1200 Federal OSHA's Hazard Communication Standard applies to private sector workplaces

³⁸ See individual states' websites for details, such as Massachusetts at www.state.ma.us

³⁹ <http://www.epsc.gov>

Workplace health and safety laws, which are based on human health, do not prohibit the use of materials, but they do limit the concentrations to which workers may be exposed. However, these limits are not often not protective enough for healthy, self-selected working populations, much less the more vulnerable population of children, particularly those with respiratory illness. There is limited information about the concentration levels of chemicals or other hazardous materials that may cause or aggravate asthma. In addition, many chemicals used or manufactured in the workplace are not regulated at all. For these reasons, it is critical to limit exposure to respiratory hazards to whatever extent possible.

A law designed to effectively reduce the risk of asthma should address:

- **materials whose use is prohibited;**
- **materials whose use must be limited to certain concentration levels;**
- **materials that can be used or stored only under specified conditions;**
- **materials that are recommended for specific purposes; and**
- **conditions under which certain materials cannot be used.**

The EPA “Tools for Schools”⁴⁰ is a document that provides extensive guidance on indoor air quality in schools, including **how to manage chemical use and disposal**. More specific guidance on managing chemicals already in use in schools is provided in a document assembled by an environmental consultant for the Burlington, Massachusetts Health Department.⁴¹ These guidelines should be incorporated by reference, as recommended under the section on Maintenance.

Rhode Island’s law provides a good example for reducing exposures to chemical hazards. Following are additional elements that can be incorporated into law or guidance to more specifically reduce exposures to chemicals and products that may cause or aggravate asthma and other respiratory conditions.

- Use the least toxic and most easily maintainable **flooring**. Consult the Asthma Regional Council of New England’s guide to the purchase and use of healthy flooring.⁴²
- If **carpeting** must be used, consult the CRI Indoor Air Quality Green Label Plus Program⁴³ for testing results on the components of the carpet, adhesive, and pad.
- Use the **least toxic** paints, sealants, coatings,⁴⁴ and adhesives, preferably those that are listed as “low VOC”⁴⁵ or “zero VOC”.
- Purchase only paints, furnishings and other building materials, such as chip board, that do not contain **formaldehyde** and that do not generate formaldehyde while they are drying;⁴⁶

⁴⁰ <http://www.epa.gov/iaq/schools/toolkit.html>

⁴¹ http://www.epa.gov/Region7/education_resources/teachers/ehsstudy/index.htm

⁴² <http://www.astharegionalcouncil.org/>

⁴³ http://www.carpet-rug.com/drill_down_2.cfm?page=8&sub=6

⁴⁴ Particularly avoid acid-cured wood floor finishes

⁴⁵ VOC: volatile organic compound

- Use building materials for indoor surfaces that are **non-porous**, making them easier to clean and less likely to serve as a medium for the growth of mold, bacteria, and fungus;
- Purchase products without **fragrances** or other respiratory irritants;
- Do not use **ozone generators** or air purifiers that emit ozone;⁴⁷
- Reduce exposure to **cockroaches and other insects** that can cause or aggravate asthma, but ensure that the use of pesticides is a last resort and that, where used, they are applied under an **integrated pest management system**. A good example of such a system was developed by the California School Integrated Pest Management Program⁴⁸. Massachusetts has one of the most restrictive laws addressing pesticide use both in schools and daycare centers:
www.mass.gov/agr/ipm .
- Eliminate or reduce exposure to **animals or plants** in classrooms and other areas of schools.
- Prohibit **smoking** of any materials in school buildings and on school grounds.
- Do not purchase or use **latex** gloves or other latex products that may cause or aggravate asthma.
- Do not purchase cleaning products without first giving preference to those that are approved by **Green Seal⁴⁹ and Environmentally Preferable Products⁵⁰**.
- Do not purchase materials that contain or emit **isocyanates** or urethanes.
- Complete a regular **inventory** of stored chemicals and properly dispose of those no longer used, needed, or safe.⁵¹

Regardless of the progress any school may make in reducing the number of materials that may cause or aggravate asthma, it is essential that staff, students, and their parents have full knowledge of the actual exposures that may be encountered at school. For this reason, states that do not have their own “**Right-to-Know**” laws should incorporate the federal Hazard Communication Standard⁵² or another state’s Right-to-Know law into a similar law of their own. Some states have Community Right-to-Know laws that may fill the gap. The federal Hazard Communication Standard only applies to private sector employees, but its requirements in that sector can be applied by incorporating them into state law. Rhode Island did this with respect to their chemical hygiene plan for schools.⁵³

⁴⁶ Some paints, even those without formaldehyde in their formulations, generate formaldehyde as a by-product of the components of the paint when exposed to air. Studies have focused mostly on oil-based paints, but formaldehyde has also been produced as a by-product of latex paints, which do contain some VOCs. <http://www.epa.gov/ORD/NRMRL/Pubs/600R01093/600R01093chap6.pdf>

⁴⁷ These are often used to reduce odors, but ozone is a respiratory irritant

⁴⁸ <http://www.schoolipm.info/>

⁴⁹ This organization focuses more on environmental concerns than on issues of human health, but it does list some health concerns (although not respiratory health) and is a good place to start

<http://www.greenseal.org/index.html>

⁵⁰ <http://www.mass.gov/epp/products/cleaning.htm>

⁵¹ List of Chemicals Prohibited from Use in Schools

⁵² The federal OSHA Hazard Communication Standard does not apply to public sector employers.

⁵³ http://www.rules.state.ri.us/rules/released/pdf/DOH/DOH_2722.pdf Section 39.2

Vermont law⁵⁴ requires the commissioner of education to distribute to all public schools a “model environmental health management plan” which “provides suggestions for communicating school environmental health status to building occupants and parents ...” This requirement could be strengthened by specifying the criteria and timelines for communicating hazards and by making such communication mandatory.

IV. DESIGN, CONSTRUCTION, AND RENOVATION

Many of the common indoor air quality problems can be prevented by prudent design of new construction and major renovation. Good design is cost effective in that it can significantly reduce the cost of subsequent repairs and renovation. Laws should include a list of materials that are known or suspected to cause or aggravate respiratory problems and prohibit their use in new or renovated school buildings. Ventilation and cooling systems have the most profound effect on subsequent indoor air quality. The recommendations contained in the previous sections should serve as standards for design and renovation.

Design of new or renovated schools should reflect the most stringent standards at the time of construction. For example, some ventilation designs may *allow* operation that complies with these standards, but the same designs may not *prevent* operation that falls outside the standards. A case in point is the ventilation system design that provides a variable volume of outside air, determined by the outdoor temperature. In an effort to reduce costs for cooling or heating, outside air that is above or below certain temperatures will be limited, and may be limited to fall below the standard set by building code or non-mandatory criteria. New designs should ensure that the reduction of outside air does not allow the quantity to fall below the minimum criteria.

Massachusetts has been very successful in devising criteria for new construction and the extensive renovation of school facilities. Schools engaging in such construction should refer to the work of the Massachusetts Technology Park Collaborative (MTC), a quasi-governmental agency that has supported the drafting of a manual for construction of “high performance schools.”^{55, 56} Such schools are those that meet strict criteria related to sustainability, energy conservation, and environment, including the indoor environment. These criteria are based on those developed by California’s Collaborative for High Performance Schools.⁵⁷

A crucial issue covered in the manual is how to address indoor air quality during construction and renovation projects. Some states, including Massachusetts and Connecticut, have required the use of SMACNA’s⁵⁸ “**IAQ Guidelines for Occupied Buildings under Construction.**”⁵⁹ Adherence to these guidelines should be a condition

⁵⁴ www.leg.state.vt.us/DOCS/2000/ACTs/ACT125.html Section 3(c)(2)

⁵⁵ http://www.eley.com/MTC/CHPSMA_vI.pdf Best Practices Manual - Volume I - Planning

⁵⁶ http://www.eley.com/MTC/CHPSMA_vII_1.pdf Best Practices Manual – Volume II - Design

⁵⁷ <http://www.chps.net>

⁵⁸ Sheet Metal and Air Conditioning Contractors National Association at www.smaccna.org

⁵⁹ <http://www.smacna.org/bookstore/>

of all school construction projects. All reputable contractors will have access to the SMACNA guidelines. These guidelines list recommendations to reduce exposures, including the following:

- Perform as much of the work as possible when the building is not occupied.
- Keep building occupants as far from the construction as possible.
- Install temporary barriers and ensure that the ventilation system is not drawing any pollutants to occupied areas (create positive pressure in those areas).
- Use methods that will reduce the concentration of airborne pollutants, such as wet methods.

A valuable guide for construction planning and practices that reduce the chance of subsequent health problems is the EPA's "Schools for Tools" manual on indoor air quality design.⁶⁰ The salient recommendations for **construction planning** include:

- Incorporate indoor air quality goals into the bid and construction documents.
- Require the development and use of an indoor air quality management plan.
- Ensure that all members of the project team are familiar with indoor air quality issues and have defined their responsibilities to address those issues.
- Require contractors to provide information on any product substitutions.

Recommendations for safer **construction practices** include:

- Keep building materials dry to prevent microbial growth.
- Dry water damaged materials as soon as possible.
- Clean spills of toxic or irritant materials immediately.
- Seal unnecessary openings.
- Temporarily seal ductwork to prevent contamination during construction.

Many practices that are crucial for healthy design, construction, and renovation are required as a contingency for funding. As illustrated in the section of this report on funding, many states will not accept bids for contracts unless the proposal incorporates standard practices that optimize indoor air quality.

Overall Policies to Support Healthy Schools

The following sections - **assessment, funding, and implementation** - address the policies necessary to support the technical recommendations presented in the previous sections. These policies are all inter-related. **Assessment** of indoor air quality allows schools to carry out the technical recommendations and allows authorities, such as the state department of education or the legislature, to evaluate a school's **implementation** of

⁶⁰ <http://www.epa.gov/iaq/schooldesign/construction.html>

state-based laws and mandates. **Funding** for repairs and renovations is often contingent upon appropriate **implementation** of those laws and mandates, and the need for funding cannot be determined without a thorough and accurate **assessment** of the buildings.

a) Assessment

In order to establish appropriate measures to reduce indoor air pollutants, it is essential to determine the needs within each building. Such a determination requires a thorough assessment of at least:

- the ventilation and cooling systems;
- the chemicals and materials in use or in storage in and around the school;
- the condition of the roof and building envelope;
- the condition of ceilings, walls, floors, and carpets, with special attention to moisture and particulate matter;
- the condition of horizontal surfaces, with regard to dirt and dust;
- the condition of porous materials, such as drapes, furniture and partitions;
- the presence of insects, feathered or furry animals; and
- the schedule, frequency, and effectiveness of maintenance.

Connecticut law⁶¹ requires an inspection and evaluation of the indoor air quality in all school buildings “constructed, extended, renovated or replaced on or after January 1, 2003.” The evaluation must be completed every five years and must cover a broad range of potential sources of indoor air quality problems, such as:

- HVAC systems;
- exposure to airborne microbiological particles, such as fungi, mold, and bacteria;
- the presence of hazardous substances;
- moisture incursion; and
- training of building staff.

The law references the EPA Tools for Schools, which contains several checklists for evaluating indoor air quality in schools.⁶²

The Connecticut law could be strengthened by extending it to all schools, instead of limiting its coverage to recently constructed or renovated buildings, given that some of the worst ventilation conditions can be found in older buildings. Connecticut requires an assessment of newer or renovated buildings only once every five years. Maine law, however, requires an annual inspection of the HVAC system,⁶³ but the inspection is not as broad as that called for by the Connecticut law. Maine law also requires the correction of any HVAC problems identified during the inspection, but does not specify a time period for corrective action. Both states require that records of the inspection be

⁶¹ Connecticut public statutes chapter 170 section 10-220 (d)

⁶² <http://www.epa.gov/iaq/schools/toolkit.html>

⁶³ <http://janus.state.me.us/legis/statutes/20-A/title20-Asec6302.html> (3)

maintained, which is critical for evaluating progress and for providing information about past exposures.

Most states depend upon individuals employed by or contracted by the Department of Education, Health or Environment to address indoor air quality issues. The important point is that an organization is responsible for this monitoring function.

It can be difficult in some cases to reach agreement about the air quality in a particular environment, particularly if funding for remediation is dependent upon a substantiated need. In Connecticut, if a standard doesn't exist to dictate how to address the specific conditions, the state may call in outside consultants to evaluate whether or not the indoor air quality is adequate. The University of Connecticut,⁶⁴ is specifically referenced in the legislation as an example of a source of expert consultants. School departments that hire outside consultants should request in advance full details of the work that is proposed and the final cost. The work should address the specific issues, rather than be limited to a boiler plate analysis that is costly, but does not ultimately abate the conditions of concern.

b) Funding

An effective means of incorporating good indoor air quality practices into school renovation or construction projects is to require that bidders include in their proposals provisions for minimizing or eliminating health hazards potentially associated with the work. Bidders should also be required to submit a detailed assessment of the status of the indoor air quality in buildings to be renovated.

Improvements to indoor air quality should receive priority status for funding. Maine has established a "School Revolving Renovation Fund," which assigns first priority for certain projects, including improving indoor air quality in school buildings.⁶⁵

Several states make approval of school building projects contingent upon certain conditions, such as Connecticut's requirement that plans for the construction, renovation, or replacement of a school building include: a) adherence to the SMACNA guidelines to ensure good indoor air quality in occupied buildings under construction; b) roof construction specifications that minimize the potential for water damage; and c) indoor air quality training for building maintenance staff.⁶⁶

Minnesota and Massachusetts require that state municipalities planning major construction or renovations undergo an environmental impact statement (EIS). The local school department may not approve the project until the EIS is reviewed.⁶⁷ In Massachusetts, the assessment must conform to ASTM Phase I standards. A Phase II assessment, which requires actual testing, shall be conducted based on the Phase I assessment results. California recently passed a law prohibiting schools being built

⁶⁴ University of Connecticut Health Center Division of Occupational and Environmental Medicine

⁶⁵ Maine statutes title 30-A, Part 2, Subpart 9, Chapter 225, Subchapter 3, Section 6006-F

⁶⁶ <http://www.cga.ct.gov/2003/act/Pa/2003PA-00220-R00HB-06426-PA.htm> Section 6 (b) 2,3,4

⁶⁷ Minnesota statutes 16D.04, sub. 2b

within 500 feet of a freeway, as a new study connects freeway proximity with asthma in children.

c) Implementation, Oversight, and Enforcement

Most states designate responsibility for indoor air quality to local or regional school or health districts or boards of education. To ensure adherence to legal or mandated standards, many laws require that reports of the status of indoor air quality be submitted to the state commissioner of education or to the state legislature. Connecticut, for example, requires that the boards of education “report annually to the Commissioner of Education on the condition of its facilities and the action taken to implement its long-term school building program and indoor air quality.”⁶⁸ Maine law convened a task force to establish and implement the state’s standards for indoor air quality in schools.⁶⁹ One of the functions of the task force was “to provide adequate state oversight so that indoor air quality standards for school facilities may be enforced.”⁷⁰

Effective compliance with indoor air quality standards is essential, not only for protecting the health of students and staff, but for determining whether or not the standards themselves are sufficiently protective.

There are very few states with laws that contain true enforcement, which makes it difficult to ensure accountability on the part of the agencies responsible for indoor air quality in schools. Maine’s law does contain enforcement language, making the school administrative unit responsible for correcting potentially hazardous conditions and holding the unit liable for penalties.⁷¹

As illustrated in the previous section, many states have tied funding to compliance with indoor air quality standards. Rhode Island has done the same, but rather than making prospective funding contingent upon the promise of compliance, the law imposes a penalty for non-compliance in the form of withholding public money that has been apportioned to the city or town.⁷²

Rhode Island has written some broad language to protect the health and safety of students and staff in their schools. In addition to creating an extensive list of chemicals and materials prohibited in schools, *the state has extended OSHA standards to students*, standards that generally cover only employees.⁷³

The age and deteriorating conditions of many schools, the lack of good information about potential health hazards and their control, the high cost of remediating unhealthy conditions, and the dearth of funds for education and capital improvements, all contribute

⁶⁸ Connecticut public statutes chapter 170 section 10-220 (a) (4)

⁶⁹ <http://janus.state.me.us/legis/ros/lom/LOM120th/Res1-50/Res1-50-49.htm>

⁷⁰ <http://janus.state.me.us/legis/ros/lom/LOM120th/Res1-50/Res1-50-49.htm>

⁷¹ <http://janus.state.me.us/legis/statutes/20-A/title20-Asec15912.html>

⁷² Rules and Regulations for School Health Programs (RI6-21-SCHO), Part V, Section 42.1

⁷³ Rules and Regulations for School Health Programs (RI6-21-SCHO), Part V, Section 39.2

to a problem that cannot be easily resolved. While compliance can be difficult and expensive, even with some of the minimal standards, enforcement may be necessary to focus the attention of the accountable entities on creative solutions to a growing problem.

Conclusion

School buildings are environments where children not only learn, but where they spend a good portion of their daily lives. School buildings are also environments where the air quality is often poor and where asthma rates are high. There are solutions to these problems, which can be accomplished through adhering to appropriate laws, regulations and recommendations to improve the air quality in schools.

Some effective national advocacy organizations that are involved in promoting healthy school environments include the:

- National Council for Occupational Safety and Health, which has a list of state COSH chapters. <http://www.coshnetwork.org/>.
- American Lung Association (ALA) which has a list of state affiliates. www.lungusa.org/asthma/
- National Healthy Schools Network <http://www.healthyschools.org/index.html>

These organizations could provide assistance and support for strategies and policies to promote healthy schools. School administrators and educators can also play an important role in protecting the health of students and staff by becoming familiar with the air quality issues in their schools. They can respond to those issues through thoughtful implementation of the recommendations contained in this report, as well as by using the many resources available to prevent and correct school air problems. Often, however, consistent and timely changes must be effected by passing, implementing, and complying with laws and regulations. This report summarizes many of the best state laws and makes recommendations to minimize conditions that can cause or exacerbate asthma among all school occupants.

The Asthma Regional Council is a coalition of governmental and community agencies dedicated to addressing the environmental contributors to asthma in New England. They have an excellent brochure entitled, "What's That Smell? Simple Steps to Tackle School Air Problems" that can be downloaded or ordered from their website. www.asthmaregionalcouncil.org ARC is a program of The Medical Foundation.