

Asbestos Exposure in Schools

Asbestos-induced cancer and asbestosis are diseases that are almost never seen in children. Practicing pediatricians should not expect to see any asbestos-related disease in their patients. There is a mounting concern, however, that exposure to asbestos in childhood, particularly in school settings, can put children at increased risk later in life for diseases caused by asbestos. Pediatricians are frequently asked to advise school authorities and parents on the dangers posed by asbestos. In this statement, current information on asbestos exposure in schools is reviewed and basic remedial approaches to prevent significant exposure to children are described.

BACKGROUND

Asbestos was used as a spray-on material in the construction of school ceilings, primarily during the 1950s through early 1970s, because of its acoustical, fire-proofing, and decorative qualities. Such dried materials can, over time, become friable; this process is dramatically speeded up by any external factors that disrupt the structural integrity of the ceiling material. Friable asbestos often flakes off as a fine dust that settles on surfaces but is readily resuspended in classroom air.

Asbestos was also used in insulating materials for pipes, boilers, and structural beams in schools. Less commonly, this use of asbestos may be a problem for children when deteriorating conditions lead to disruption and spread of asbestos fibers. In 1973, the US Environmental Protection Agency (EPA) banned most uses of spray-on asbestos materials. Concern for potential long-term effects in children surfaced dramatically in 1976 when flaking of asbestos ceiling materials was noted in six schools in one state. The initial public health strategy, which continues unchanged, was that (1) medical screening and follow-up of children so exposed should not be recommended because of the transient and uncertain degree of exposure, the probable rarity of significant asbestos-related disease, and

the extremely long latent periods (probably 30 or more years) for any effects that might occur, and (2) public health efforts should focus on the prevention of exposure to assure that any long-term risks are minimized or completely removed.

Levels of airborne asbestos inside school buildings with asbestos-containing ceiling materials may exceed outdoor ambient levels by a factor of approximately 100; these indoor levels are usually at least three to four orders of magnitude lower than historic workplace levels associated with the well-documented occurrence of asbestos-related disease.¹

RISK OF DISEASE

There are no available quantitative data on risk at the levels of airborne asbestos found in schools. Quantitative asbestos cancer risk assessment is based on extrapolation from relatively high-dose human exposures in occupational studies, by the use of mathematical modeling of the dose-response relationship, to predict effects in relatively low-dose, nonoccupational environmental exposure situations. Many assumptions are used in these calculations; nevertheless, conventional methodologies have been developed, particularly by regulatory agencies such as the EPA, for performing such extrapolations. The quantitative estimates of exposure used in the risk calculations are based on environmental surveys of school air asbestos levels. Cancer risk predictions are, therefore, heavily influenced by whether optimal, average, conservative, or worst-case estimates of exposure are used in the risk assessment.

The general conclusions regarding diseases of concern for most quantitative risk estimates for environmental asbestos exposure are as follows.

Mesothelioma

Mesothelioma risk is proportional to a power of time since first exposure, and calculated risk escalates rapidly when time since first exposure exceeds about 40 years. Early childhood exposure, even at very low levels, thus becomes a significant factor

when estimating risk, because it allows for such long latent periods.

Lung Cancer

Lung cancer risk is more closely correlated with cumulative dose (as a function of level and duration of exposure) and is less affected by age at first exposure. Early childhood exposure, therefore, is not as great a determinant of risk. However, lung cancer is far more prevalent than mesothelioma, and, unlike mesothelioma, smoking does interact with asbestos as a critical factor in increasing the risk of lung cancer.

Asbestosis

Asbestosis is unlikely to occur after exposure such as in schools. Therefore, risk assessments for school asbestos exposure consist of combining the mesothelioma and lung cancer risks in a cumulative cancer risk assessment.

In addition to their long life expectancy, children in school exposure settings are a particular concern because, compared with adults, they are more active; they breathe at higher rates and more often by mouth; they spend more time close to the floor, where sedimented dust and fibers accumulate; and they are more likely to seek direct contact with deteriorating surfaces out of curiosity or mischief. These factors must be considered when potential childhood exposures are estimated.

In 1980, the EPA provided a quantitative risk estimate for asbestos-containing materials in US schools.² The EPA estimated that more than 8,500 schools in the nation had friable asbestos and that approximately 3,000,000 students (and more than 250,000 teachers, maintenance workers, and other adults) were potentially exposed. Using available field studies to estimate airborne asbestos levels and assuming a 30-year life expectancy for schools with asbestos, the EPA report concluded that:

A total of approximately 100 to 7,000 premature deaths are anticipated to occur as a result of exposure to prevalent concentrations of asbestos in schools containing friable asbestos materials over the next 30 years. The most reasonable estimate is approximately 1,000 premature deaths. About 90% of these deaths are expected to occur among persons exposed as schoolchildren.

These estimates provided strong impetus for the development of mandated school asbestos control programs.

A recent review of quantitative risk assessment for asbestiform fibers in nonoccupational settings is available from the National Research Council/National Academy of Sciences.³ This review again emphasizes the relative importance of mesotheli-

oma in settings where children may be subjected to increased exposure. Two additional recent cancer risk estimates, using more extensive school air asbestos-sampling surveys, predict far lower risks^{4,5} than the earlier EPA risk assessment. These estimates, however, are based on ambient air levels and do not take into account worst-case conditions that will result from the inevitable deterioration of friable surfaces if preventive actions are not taken.

IDENTIFICATION OF ASBESTOS HAZARDS

The step-by-step evaluation of a school begins with a review of building records and a building inspection to determine whether friable materials are present.¹ If friable materials are present, then bulk samples are analyzed for the presence of asbestos fibers. Levels of asbestos in air are not obtained because (1) the procedure is expensive and (2) they would provide only a transitory and sometimes unreliable estimate of a potential exposure problem in the school setting. (Inspectors also look for evidence of deterioration in nonfriable asbestos-containing insulation or other materials.)

When the presence of friable asbestos has been confirmed, several methods have been used to evaluate the degree of hazard. The EPA and others originally recommended quantitative scoring systems based on a number of factors; these have not been demonstrated to be reliable. At present, the EPA recommends careful, qualitative consideration of the following six factors in ranking hazards related to condition of asbestos-containing material: (1) evidence of deterioration; (2) evidence of physical damage; (3) evidence of water damage; and hazards related to potential disturbance or erosion; (4) proximity to air plenum (duct) or direct airstream; (5) exposure, accessibility, and degree of activity; and (6) change in building use.

ASBESTOS CONTROL MEASURES

Friable asbestos hazards can be handled in four ways. (1) Removal is the most obvious and direct approach; however, improper removal techniques can produce a significant hazard to the workers carrying out the project. All responsible parties should strive to assure that all remedial activities are carried out under acceptable occupational guidelines (available from the EPA, Occupational Safety and Health Administration [OSHA], and the National Institute for Occupational Safety and Health [NIOSH]), with proper disposal of asbestos materials. After a removal operation, air samples should be collected to document that the environment has not been contaminated with airborne fibers. (2) Enclosure involves construction of air-

TABLE. Four Options for Asbestos Control*

Method	Advantages	Disadvantages
Removal	Eliminates asbestos source; eliminates need for special operations and maintenance programs	Replacement with substitute material may be necessary; improper removal may increase fiber levels; porous surfaces may also require encapsulation
Enclosure	Reduces exposure outside the enclosure; initial costs may be less than removal unless utilities need to be relocated or other major changes need to be made; usually does not require replacement of material	Asbestos source remains and must be removed eventually; fibers continue to be released behind enclosure (and during construction of enclosure); special operations program is required to control access to enclosure for maintenance and renovation; periodic reinspection is required to check for and repair damage; long-term costs could be more than for removal
Encapsulation	Reduces asbestos fiber release from material; initial costs may be less for removal; does not require replacement of material	Asbestos source remains and must be removed later; if material is not in good condition, sealant may (due to its weight) promote delamination and asbestos release; periodic reinspection required to check for and repair damage; encapsulated surface is difficult to remove—if that is required at a later date; long-term costs may be greater than for removal
Maintenance and inspection program	Lowest initial cost	Asbestos source remains; special operations program is required for maintenance or renovation procedures; periodic reinspection is required

* Adapted from EPA report.¹

tight walls and (drop) ceilings adjacent to surface with friable asbestos. (3) Encapsulation involves spraying friable asbestos-containing surfaces with sealants to prevent further release of asbestos fibers. Enclosure and encapsulation are only temporary solutions. (4) Finally, for hazards that are not immediate or are of low priority, a periodic building maintenance and inspection program can be set up to detect any appreciable changes in conditions. The key advantages and disadvantages of each of the four methods are presented in the Table.

The choice of a qualified and conscientious contractor to remove asbestos is essential. Sloppy removal by poorly trained and inadequately supervised workers will cause severe hazards for the workers. Sloppy removal and cleanup procedures will also increase the hazard to students. State licensure of a firm does not guarantee that it will follow acceptable procedures. Local authorities must become knowledgeable to assure that proper precautions are taken during asbestos removal. The EPA is developing standards and procedures for determining contractor qualifications for asbestos removal work; this effort should greatly increase the reliability of available contractors.

EPA PROGRAM

The EPA's authority for school asbestos control is based on the Toxic Substances Control Act (TSCA) legislation of 1976. During 1979 through 1982, the EPA had a voluntary school asbestos program that focused on the development of guidelines. A mandatory school asbestos control program was promulgated in 1982; it required educational

agencies to carry out a three-part process of inspection, identification, and notification: (1) inspection: by record review and visual inspection, identify all friable materials potentially containing asbestos; (2) identification: take bulk samples of friable materials ascertain presence or absence of asbestos using polarized light microscopy (with dispersion staining); (3) notification: notify teacher, parents, and other locally affected groups of potential exposure.

Absent from this mandated process were the following: (1) notification of the hazard beyond local school members; (2) national or systematic surveillance of hazards and remedial actions (as a result, it is unclear just how far we are from the goal of full inspection that the EPA required by mid-1983—some estimates have suggested that as few as 50% of schools may have been adequately inspected, although a recently reported national survey by the EPA estimated that more than 80% of local education agencies have begun or have completed inspections for friable materials)⁶; (3) technical standards for remedial actions; and (4) enforcement for compliance with remedial actions. Because of the limitations of this mandated process, it has not been possible to obtain an overall national estimate of the hazards identified and the corrective actions taken.

In July 1984, Congress passed new legislation (the Asbestos School Hazard Abatement Act of 1984), which appropriated \$50 million in 1984 and authorized the expenditure of \$50 to \$100 million per year during the next 6 years, in loans and grants from the EPA, to assist local school districts with limited financial resources in asbestos removal and

cleanup actions at high-priority sites. Another \$50 million has been appropriated by Congress for loans and grants to be made in 1986. The EPA has recently released guidelines on its plans to implement this program. The legislation requires the governor's office in each state to develop a priority list of schools that need such funds, and, in some instances, pediatricians may be able to assist in this process in their local areas. As part of its response to this new legislation, the EPA will provide expanded technical assistance and guidance programs, establish several information and training centers, and develop standards and procedures for determining contractor qualification for abatement work.⁷

RECOMMENDATIONS FOR PEDIATRICIANS

Pediatricians are usually involved with school asbestos problems on an ad hoc basis when they are called upon to advise local citizens' groups, school boards, health departments, and others. Pediatricians can provide careful, reasoned, and influential advice in such settings. To do this effectively, they need to understand and communicate the basis of the long-term health concerns and the available corrective options. The goal should be to promote effective prevention efforts by proper remedial actions. Each situation needs to be evaluated and judged according to its severity and the potential for exposure to friable asbestos; remedial options range from complete removal of asbestos or the establishment of physical barriers to continued exposure (enclosure or encapsulation, see above) to, simply, an ongoing maintenance and inspection program for asbestos materials that are not an immediate hazard. Where appropriate, pediatricians should work with the involved parents' groups and local authorities to ensure that cleanup or removal actions are timely and effective and that children, as well as employees, are fully protected during and after remedial actions. Sloppy removal and cleanup procedures by inadequate contractors will do more harm than good because they will increase the exposure and hazard to students. The EPA maintains a toll-free telephone number (1-800-835-6700) and can provide guidance and technical assistance in specific situations. Appended to this statement are the phone numbers for the asbestos advisors in each of the EPA regional offices. Because most of the available literature (see references) is not in the peer-reviewed medical literature that is easily accessible to most physicians, the Committee on Environmental Hazards has arranged for a packet of reference materials to be provided to each American Academy of Pediatrics state chapter for members' use.

COMMITTEE ON ENVIRONMENTAL HAZARDS, 1985-1986

Philip J. Landrigan, MD, Chairman
John H. DiLiberti, MD
John W. Graef, MD
Richard J. Jackson, MD
Gerald Nathenson, MD

Liaison Representatives

Henry Falk, MD (Centers for Disease Control)
Robert W. Miller, MD (National Cancer Institute)
Walter Rogen, MD (National Institutes of Environmental and Health Services)
Diane Rowley, MD (Centers for Disease Control)

Appendix: Regional Asbestos Coordinators

(For information on asbestos identification, health effects, abatement options, analytic techniques, asbestos in schools, and contract documents.)

Region 1

Regional Asbestos Coordinator
USEPA
JFK Federal Building
Boston, MA 02203
(617) 223-0585

Region 2

Regional Asbestos Coordinator
USEPA
Woodbridge Ave
Edison, NJ 08837
(201) 321-6668

Region 3

Regional Asbestos Coordinator
USEPA
841 Chestnut St
Philadelphia, PA 19107
(215) 597-9859

Region 4

Regional Asbestos Coordinator
USEPA
345 Courtland St NE
Atlanta, GA 30365
(404) 881-3864

Region 5

Regional Asbestos Coordinator
USEPA
230 South Dearborn St
Chicago, IL 60604
(312) 886-6879

Region 6

Regional Asbestos Coordinator
USEPA
First International Building
1201 Elm St
Dallas, TX 75270
(214) 767-5314

Region 7

Regional Asbestos Coordinator
USEPA
726 Minnesota Ave
Kansas City, KS 66101
(913) 236-2838

Region 8

Regional Asbestos Coordinator
USEPA
999 18th St
Denver, CO 80202
(303) 293-1730

Region 9

Regional Asbestos Coordinator
USEPA
215 Fremont St
San Francisco, CA 94105
(415) 974-8588

Region 10

Regional Asbestos Coordinator
USEPA
1200 Sixth Ave
Seattle, WA 98101
(206) 442-2632

REFERENCES

1. *Guidance for Controlling Asbestos-Containing Materials in Buildings: 1985 Edition*. US Environmental Protection Agency (EPA), Office of Pesticides and Toxic Substances, EPA report No. 560/5-85-024. Government Printing Office, 1985
2. Support Document for Proposed Rule on Friable Asbestos-Containing Materials in School Buildings: Health Effects and Magnitude of Exposure. US Environmental Protection Agency (EPA), EPA report No. 560/12-80-003, Office of Testing and Evaluation, Office of Pesticides and Toxic Substances. Government Printing Office, October 1980
3. National Research Council/National Academy of Sciences: *Asbestiform Fibers—Nonoccupational Health Risks*. Washington, DC, National Academy Press, 1984
4. Royal Commission on Matters of Health and Safety Arising From the Use of Asbestos in Ontario: *Asbestos in Buildings: Part IV. Report of the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Canada*, Ontario Ministry of the Attorney General. Toronto, Queen's Printer for Ontario, 1984, vol 2
5. Doll R, Peto J: *Effects on Health of Exposure to Asbestos*, Health and Safety Commission. London, Her Majesty's Stationery Office, 1985
6. *Evaluation of the Asbestos-in-Schools Identification and Notification Rule*, US Environmental Protection Agency (EPA), Office of Pesticides and Substances, EPA report No. 560/5-84-005. Government Printing Office, October 1984
7. *School District Officials Face Problems in Dealing with Asbestos in Their Schools*, US General Accounting Office (GAO), GAO report No. RCED-85-91B-20367. Government Printing Office, March 19, 1985

Asbestos Exposure in Schools
Pediatrics 1987;79:301

Updated Information & Services

including high resolution figures, can be found at:
<http://pediatrics.aappublications.org/content/79/2/301>

Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:
<http://www.aappublications.org/site/misc/Permissions.xhtml>

Reprints

Information about ordering reprints can be found online:
<http://www.aappublications.org/site/misc/reprints.xhtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN®



PEDIATRICS[®]

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Asbestos Exposure in Schools *Pediatrics* 1987;79:301

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/79/2/301>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 345 Park Avenue, Itasca, Illinois, 60143. Copyright © 1987 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN[®]

