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Guidance for Controlling Asbestos-Containing Materials in Buildings

Friable materials are more likely than nonfriable materials to release fibers when disturbed or damaged. Although nonfriable ACM is of less immediate concern, it should not be ignored. Fibers will be released if nonfriable material is cut, drilled, sanded, or broken during building repairs or renovation.

1.2 Levels of Airborne Asbestos in Buildings and Other Settings

Levels of airborne asbestos in the asbestos industry workplace are substantially higher than levels found outdoors or in buildings with ACM. Figure 2 shows levels measured in the three settings: asbestos insulation plants before the 1972 Occupational Safety and Health Administration (OSHA) exposure standards, schools with ACM, and outdoor urban areas.[2] The range of values in each category reflects differences in location, source of asbestos, and variability in asbestos measurements. Concentrations may exceed the upper limits of these ranges for short periods if, for example, manufacturing equipment malfunctions, insulating material is pierced with a sharp object, or asbestos-coated surfaces are disturbed by the impact of a ball or similar object.

Figure 2 shows that prevalent concentrations of airborne asbestos in a sample of school buildings were approximately 10 to 100 times higher than outdoors. At the same time, asbestos levels in the schools were 10,000 to 100,000 times lower than pre-1972 levels in asbestos insulation workplaces.[3]

1.3 Diseases Associated with Exposure to Asbestos

Much of what is known about asbestos-related diseases comes from studying workers in the various asbestos industries. Exposure to levels of airborne asbestos typical of the asbestos workplace prior to 1972 has been linked with a debilitating lung disease called asbestosis; a rare cancer of the chest and abdominal lining called mesothelioma; and cancers of the lung, esophagus, stomach, colon, and other organs. In 1972 federal exposure standards were imposed.

The relationship between exposure level and health risk is complex. The potential for disease appears to be related to the physical and chemical characteristics of asbestos fibers as well as to the concentration of fibers in the air. Data on asbestos workers indicate that the risks of asbestosis, lung cancer, and mesothelioma decrease in direct proportion to a decrease in total asbestos dose. Because there is no direct information on health risks from exposure to asbestos in buildings with ACM, the risks are estimated by extrapolation from studies of asbestos industry workers (Nicholson 1984, NRC 1984, The Royal Commission of Ontario 1984). The estimates indicate that only a small proportion of people exposed to low levels of asbestos will develop asbestos-related diseases. However, combining smoking with occupational exposure to asbestos increases the lung cancer rate above the rate due to either smoking or asbestos exposure alone. Also, asbestos exposure in children is of special concern: since they have a greater remaining lifespan than adults, their lifetime risk of developing mesothelioma is greater. Avoiding unnecessary exposure to asbestos is prudent.

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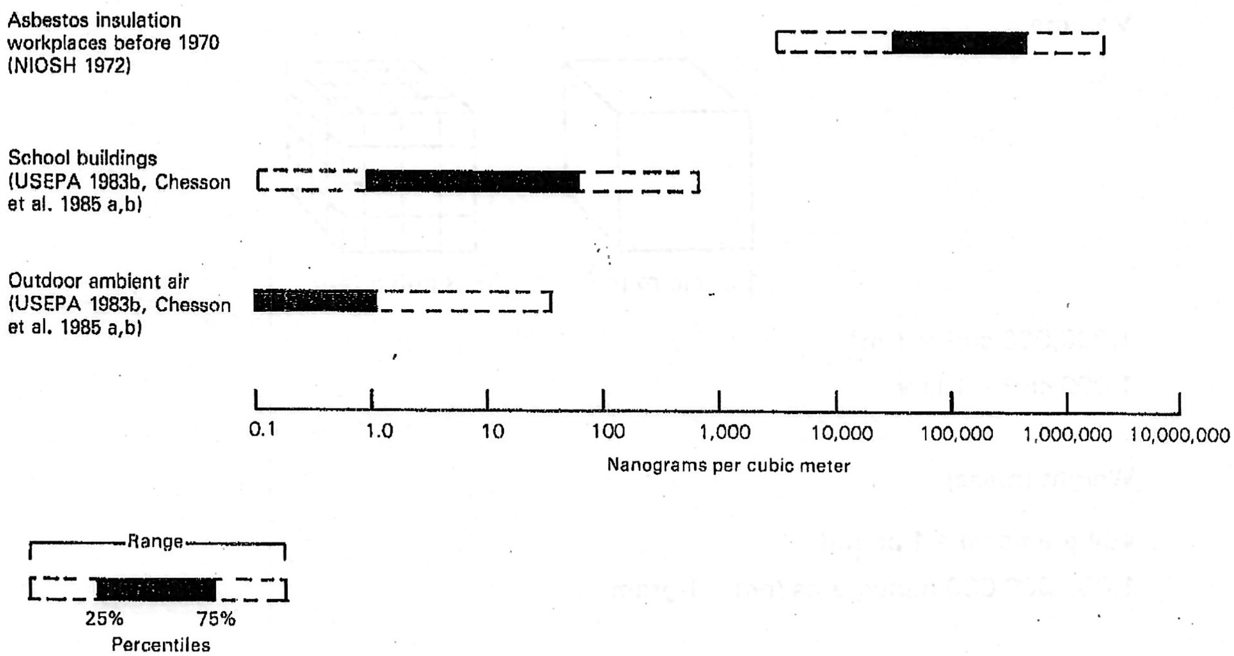
[2] For comparison, all data are expressed in nanograms per cubic meter (ng/m^3) units. Concentrations of asbestos fibers in the air are measured in terms of either the number of fibers per unit volume (typically, fibers per cubic centimeter) or the mass per unit volume (typically, ng/m^3). A nanogram is one-billionth of a gram. See Appendix B for a simple explanation of measurement units used for airborne asbestos concentrations.

[3] The data in Figure 2 should be interpreted with caution. Estimated concentrations in asbestos workplaces are based on measurements of airborne fibers using the method specified by OSHA (phase contrast microscopy), while the levels in schools and outdoors were measured by a different method (transmission electron microscopy). Comparisons of measurements obtained by the two methods are based on certain assumptions (see footnote to Figure 2). Measurement of airborne asbestos fibers is a complex subject and is discussed in more detail in Section 4.1.2.

Figure 2. Comparison of measured airborne asbestos concentrations in three settings.*



*Levels in asbestos workplaces were derived from measurements using phase contrast microscopy (PCM) while levels in school buildings and outdoors were measured using electron microscopy (EM). PCM and EM measurements are not directly comparable. PCM measures all fibers whereas EM can distinguish between asbestos and nonasbestos fibers. In addition, EM has a better capability than PCM for detecting small fibers. In order to translate the workplace PCM measurements (expressed as fiber counts) into values of asbestos mass (nanograms) that are approximately comparable to EM measurements, 30 fibers were assumed to equal one nanogram. This value is an average obtained from many comparisons of PCM and EM measurements taken at the same location (industrial settings) and time. Values for individual samples range from about 10 fibers per nanogram of asbestos to well over 100 fibers per nanogram, depending on the average size of fibers and the relative number of asbestos and nonasbestos fibers in the air (Versar 1980 and William Nicholson, personal communication, 1982).

asbestos measured in air samples indicate that, on an average, about 30 fibers counted by the NIOSH procedures equal one nanogram of asbestos. This relationship applies to samples collected during the spray application of asbestos insulation. For these samples, each fiber counted weighs an average of 0.033 ng, or about 37 times more than those in the example, and 2,000,000 of them would weigh about 67,000 ng.