

Who Is at Risk of Exposure to Asbestos?

[CDC atsdr.cdc.gov/csem/asbestos/who_is_at_risk.html](http://www.cdc.gov/atsdr/csem/asbestos/who_is_at_risk.html)

Course: WB 2344

CE Original Date: January 29, 2014

CE Renewal Date: January 29, 2016

CE Expiration Date: January 29, 2018

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Learning Objectives

Upon completion of this section, you will be able to

- Name the populations most heavily exposed to asbestos and
- Describe who is at risk of domestic exposure to asbestos.

Introduction

In the past, asbestos exposure was associated mainly with mining and milling of the raw material and with workers engaged in construction and product manufacture or use of end products. In the industrialized west, these heavy asbestos exposures peaked during the 1960s and 1970s and then declined as worker protection regulations were put in place and later as industrial use of asbestos decreased [NIOSH 2011a].

Because of long latency periods (10-40 years), workers exposed to asbestos in the 1960s and 1970s are now manifesting asbestos-associated diseases. Indeed, the mortality of asbestosis has increased from the 1960s to 2000. The National Institute of Occupational Safety and Health (NIOSH) data indicates that asbestosis deaths increased substantially from the 1960s to the 2000s; they are expected to continue occurring for decades [NIOSH 2011a; CDC 2004; Antao et al. 2009].

National statistics that illustrate this trend are available at <http://www2a.cdc.gov/drds/WorldReportData/FigureTableDetails.asp?FigureTableID=2567&GroupRefNumber=FO1-01>

Today in the United States, most occupational exposures occur during

- Repair,
- Renovation,
- Removal, or
- Maintenance

of asbestos-containing products installed years ago. The Occupational Safety and Health Administration (OSHA) has estimated that 1.3 million employees in construction and general industry are exposed to asbestos on the job during these above-mentioned activities [NIOSH 2011a].

People can also be exposed at home, both to old sources of asbestos as a result of activities such as home renovation or to new sources of asbestos as a result of certain types of recreational activities and hobbies such as auto repairs and, in areas of naturally occurring asbestos in local soils, gardening.

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Past Direct Occupational Exposures

In the past, many occupations entailed exposures to asbestos (see table below). Studies have documented the scale of the problem.

In the United States, an estimated 27 million workers were exposed to aerosolized asbestos fibers between 1940 and 1979 [Nicholson et al. 1982]. These past exposures were heavier than what workers face today. According to NIOSH, current worker exposures exceeding the NIOSH recommended exposure limit (REL) declined from 6.3% of workers in 1987-1994 to 4.3% in 2000-2003 [NIOSH 2011a].

Occupations	Businesses

- | | |
|---|--|
| <ul style="list-style-type: none"> • Auto mechanics • Boilermakers • Bricklayers • Building inspectors • Carpenters • Demolition workers • Drywallers • Electricians • Floor covering workers • Furnace workers • Glaziers • Grinders • Hod carriers • Insulators • Ironworkers • Laborers • Libby vermiculite exfoliation plant workers • Longshoremen • Maintenance workers • Merchant marines • Millwrights • Operating engineers • Painters • Pipefitters • Plasterers • Plumbers • Roofers • Refinery workers • Sheet metal workers • Shipyard workers • Steamfitters • Tile setters • U.S. Navy personnel • Welders | <ul style="list-style-type: none"> • Asbestos product manufacturing (insulation, roofing, building materials) • Automotive repair shops (especially those that involve repair of brakes, clutches) • Construction companies • Maritime companies • Mining companies • Offshore rust removal businesses • Oil refineries • Power plants • Railroads • Manufacturers of sand or abrasives • Shipbuilders, ship lines, and shipyards • Steel manufacturers • Tile installation |
|---|--|

Table 3. Occupational Exposure to Asbestos

* Source: NIOSH 2003; 2008

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Past Secondary Occupational Exposure

Secondary exposure occurred when people who did not work directly with asbestos were nevertheless exposed to fibers as a result of sharing workspace where others handled asbestos. For example, electricians who worked in shipyards were exposed because asbestos was used to coat the ships' pipes and hulls [Pan S et al. 2005].

Past Paraoccupational Exposures

In the past, asbestos workers went home covered in asbestos dust because of a lack of proper industrial hygiene. The workers' families and other household contacts were then exposed via inhalation of asbestos dust:

- From workers' skin, hair, and clothing, and
- During laundering of contaminated work clothes.

A mortality study of 878 household contacts of asbestos workers revealed that 4 out of 115 total deaths were from pleural mesothelioma and that the rate of deaths from all types of cancer was doubled [Joubert et al. 1991]. Also, 11 cases of mesothelioma (6M:5F ratio) were diagnosed from 1995-2006 among individuals who had not worked at the vermiculite operations in Libby, Montana, but who had some other indirect association with those operations. Most had environmental exposure from living, working, or regularly shopping in Libby community; two were family members of vermiculite workers [Whitehouse et al. 2008].

In other environmental exposures [Constantopoulos 2008] asbestos was released into the air and soil around facilities such as

- Building demolitions,
- Factories handling asbestos,
- Power plants,
- Refineries,
- Shipyards,
- Steel mills, and
- Libby vermiculite mine.

People living around these facilities have been also exposed to asbestos through their residence close to asbestos-using industries.

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Current Occupational Exposures

Currently, the people most heavily exposed to asbestos in the United States are those in construction trades. This population includes an estimated 1.3 million construction workers as well as workers in building and equipment maintenance [American Thoracic Society 2004]. Because most asbestos was used in construction, and most asbestos produced is still used in this industry, risk to these workers can be considerable if the hazard is not recognized and Occupational Safety and Health Administration (OSHA) standards are not enforced.

Disaster-Related Exposures

Responders to the World Trade Center (WTC) disaster were exposed on an acute short-term basis to an asbestos-containing mixture of particulate matter released by the collapsing towers and by rescue, recovery, and clean-up activities.

Among the early responders who were exposed short-term during the hours to days after the collapse were

- Firefighters,
- Police,
- Paramedics,
- Construction workers, and
- Volunteers [Landrigan et al. 2004].

Some people exposed acutely to the high concentrations of dust released by the towers collapse subsequently developed reactive airways dysfunction syndrome (RADS). The U.S. Environmental Protection Agency (EPA) found that exposure of laboratory mice to WTC PM_{2.5} also developed airway irritation [EPA 2002].

Another population potentially exposed to the complex particulates from the tower collapse was the people whose residences in nearby buildings were contaminated with dust from the WTC collapse.

Public concern about possible health risks faced by this population led authorities to study the air quality and settled dust in residences near Ground Zero. EPA found asbestos fibers greater than 5 microns in length in 0.4% of settled dust samples (n=22,497) collected from these residences [EPA 2005]. At the time of residential air sampling for a study by the New York Department of Health and the Agency for Toxic Substances and Disease Registry (ATSDR) in November-December 2001 [New York City Department of Health and Mental Hygiene and ATSDR 2002] total fiber levels (i.e., including asbestos and all other fibers present) were orders of magnitude below the occupational exposure limit for asbestos, even with aggressive sampling. It was estimated, based on an extreme worst-case scenario, that someone living for a full year in an uncleaned residence would have a 1 in 10,000 risk of developing cancer (mesothelioma) due to that exposure [New York City Department of Health and Mental Hygiene and ATSDR 2002]. The same authorities concluded that, with appropriate cleaning of residences, the dust would present little risk.

Natural disasters can also release asbestos from both naturally occurring and man-made sources. An example of a natural disaster involving the release of naturally occurring asbestos is the Swift Creek landslide in Washington State. The rock in this very large, unstable slope contains naturally occurring asbestos. As it progressively breaks up over time, slumping and sliding into the valley below, it releases asbestos into the environment, leaving those nearby at risk of exposure [ATSDR 2008].

An example of a natural disaster releasing man-made asbestos would be a tornado that releases asbestos into the environment when it destroys asbestos-containing buildings.

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Direct Domestic Exposures

As noted previously, some Libby vermiculite home attic insulation produced before 1990 and many other home and building materials produced before asbestos was banned for fireproofing in 1975 contain asbestos.

- People who live in homes with these materials are at risk of exposure if the materials are loose, crumbling or disturbed by household activities or renovations.
- In such cases, the asbestos materials should be removed or encapsulated by a trained and certified asbestos contractor.
- For information on where to find certified asbestos contractors in your state, homeowners should contact their local health department.

On the other hand, asbestos contained in intact solid material poses a negligible risk of exposure. Air levels of asbestos in a building with asbestos embedded in building materials show an undisturbed average 0.0002 f/cc, nearly 3 orders of magnitude below OSHA's permissible exposure limit for occupational exposures [Holland and Smith 2003].

People can also be exposed to asbestos through hobbies and recreational activities that entail contact with materials containing asbestos; some examples are such activities as home renovation, auto repair, and urban spelunking. In places where naturally occurring asbestos is close to the earth's surface, activities such as gardening and dirt biking can cause exposures if asbestos-bearing rock is disturbed.

Exposures at School

Measurable asbestos levels in schools are usually 100 to 1,000 times below OSHA's permissible exposure limit of 0.1 fibers/cc of air for asbestos [Holland and Smith 2003]. However, ATSDR does not use occupational standards when considering the risks to health of the general population from asbestos in the general environment. A specific environmental health assessment process is used.

Over time, public concern led to widespread removal and abatement programs. Some facilities have higher levels of airborne asbestos after removal than before, highlighting the importance of proper encapsulation or removal by contractors; to avoid higher levels after remediation.

Schools are required by EPA to conduct inspections for asbestos and to follow correct abatement procedures using the techniques recommended by EPA. For more information on how schools should handle asbestos under the Asbestos Hazard Emergency Response Act (AHERA), refer to the section in this case study on standards and regulations.

Background Exposures

No known truly unexposed group exists in the world. The cumulative risk of background exposures is probably minor, however, and these concentrations cannot be reduced [Hillerdal 1999]. Whenever feasible, any source of pollution that releases significant amounts of asbestos fibers should be eliminated, using proper equipment and techniques, as soon as it is discovered.

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The Libby Vermiculite Example

Most vermiculite used today contains low or non-detectable levels of asbestos. However, the vermiculite mined in Libby from the 1920s to 1990 was contaminated with various fibrous amphiboles. The amphiboles were comprised of “elongated mineral particles identified as a mixture of asbestiform amphiboles, including winchite, richterite, and tremolite asbestos” [Virta 2013] and constituted 95% of the vermiculite used in the United States during that time. The vermiculite operations in Libby are a good example of the many ways people can be at risk of asbestos. In this example, mining of the asbestos- contaminated vermiculite ore in Libby resulted in asbestos exposures to

- Vermiculite miners,
- Household contacts of miners and Libby vermiculite plant workers,
- Children playing in piles of vermiculite in the area,
- Workers who worked in vermiculite exfoliation plants and other vermiculite handling sites throughout the United States after it was shipped there from Libby,
- People who live in homes with vermiculite home insulation, and
- Vermiculite transportation routes.

This vermiculite was also used in potting soil, but the U.S. EPA concluded that consumers “face only a minimal health risk from occasionally using vermiculite products at home or in their gardens” [EPA 2000].

For more information about amphibole-contaminated vermiculite, see

- ATSDR summary report on 28 priority vermiculite exfoliating sites at https://www.atsdr.cdc.gov/csem/asbestos_2014/images/figure3_USAmap.jpg
- EPA fact sheet about how to recognize and avoid exposure to vermiculite insulation in homes at <http://www2.epa.gov/asbestos/protect-your-family-asbestos-contaminated-vermiculite-insulation>

Key Points

- Today, the populations most heavily exposed to asbestos are those in construction trades.

- In the past, pipe fitters, shipyard workers, military workers, automobile mechanics, and people in many other occupations were also exposed.
- In the past, household contacts of asbestos workers were exposed to asbestos dust carried home on workers' skin and clothing.
- People in homes and buildings with loose, crumbling, or disturbed asbestos materials can be exposed to asbestos.
- During renovations or asbestos abatement, asbestos materials should be encapsulated or removed by trained and certified asbestos contractors.
- Asbestos embedded in intact solid materials poses little risk of exposure as long as it remains intact and undisturbed.
- Natural outcroppings of asbestos can lead to human exposure in a number of ways.
- Natural and technological disasters can lead to asbestos exposure.