

Occupational Uses

- Historically, Asbestos exposure was common in mining, construction, and product manufacturing sectors
- Asbestos has been utilized in pipe insulation, floor tiles, building supplies, and vehicle brake and clutch systems
- In the 20th century, asbestos was widespread in many products including fireproofing construction materials, appliances, and various household items

Occupational Exposure

- 1.3 million American workers are still exposed to workplace asbestos today.
- 2,500 to 3,000 new mesothelioma cases are diagnosed in the U.S. each year.
- Today in the United States, most occupational exposures occur during
 - Repair
 - Renovation
 - Removal
 - Maintenance

Toxicological Data

- Asbestos primarily enters the body through inhalation and can also be ingested or trapped in the skin.
- Asbestos exposure can cause lung disease, pleural disorder, and cancers of the lung, pleura, and peritoneum in humans and animals
- Asbestos is officially recognized as a cancer-causing substance by the HHS, EPA, and International Agency for Research Cancer.
- Animal studies show carcinomas from injected asbestos, while inhalation-induced carcinomas are less evident, mostly seen in rats.

Epidemiological Studies

- The paper reviews the history, epidemiology, and health impacts of asbestos. Analyzing studies since 1906 on nonmalignant and malignant disease caused by asbestos including lung cancer and mesothelioma. And the roles of different fiber types
- The article compiles research on the health outcomes of the workers exposed to asbestos including lung disease and various cancers, and examines how asbestos and smoking interact as well as the risk of nonoccupational source exposure
- The review concludes that all commercial asbestos types cause cancer, with evidence of increased cancer risk exposed in workers, a heightened lung cancer risk from combined asbestos exposure and smoking, and the presence of related disease in those indirect exposures



Figure 2. What Asbestos looks like on a pipe installation <https://www.epa.gov/asbestos/learn-about-asbestos>

Sampling Methods

- NMAM Method 7400, Issue 3
- Technique: Light Microscopy
 - OSHA: 0.1 asbestos fiber (> 5 µm long)/cc; 1 f/cc, 30 min excursion
 - NIOSH: 0.1 fiber (>5 µm long and ≥3:1 aspect ratio)/cc, for a 400 L sample; carcinogen
 - Sampler: FILTER (0. 45- to 1.2-µm mixed cellulose ester membrane, 25-mm; conductive cowl on cassette)
 - Flow Rate: 0.5 to 16 L/min

Analytical Methods

- Phase contrast polarized light microscopy (PLM)
 - Can be identified with this method based on:
 - Appearance
 - optical properties refractive index
- Scanning electron microscopy (SEM)
 - Can be identified with this method based on:
 - chemical composition
 - appearance
- Transmission electron microscopy (TEM)
 - Can be identified with this method based on:
 - Appearance
 - chemical composition
 - crystal structure



Figure 1. Image of Asbestos <https://en.wikipedia.org/wiki/Asbestos>

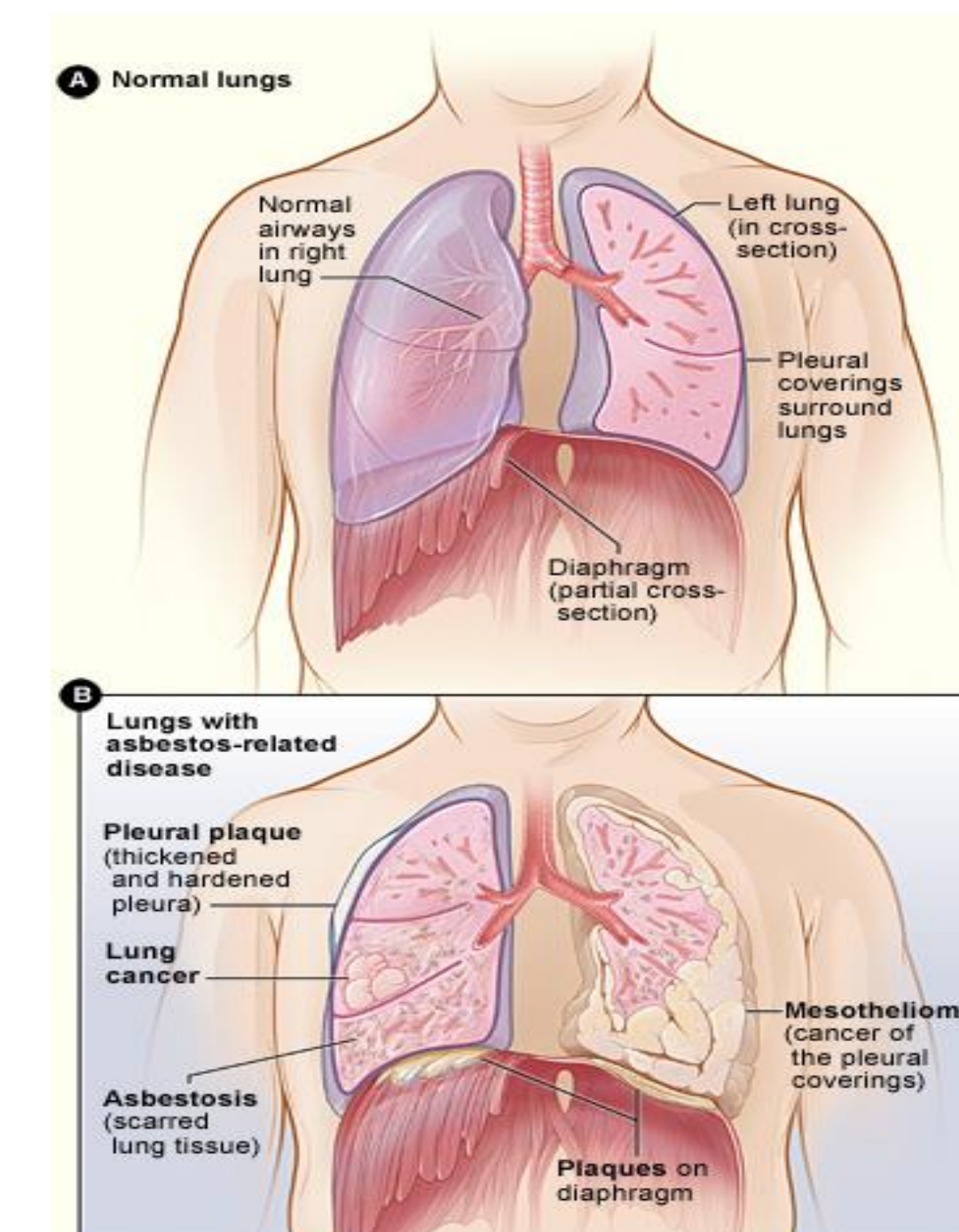


Figure 3. Lungs Before and After Asbestos Exposure https://en.wikipedia.org/wiki/Asbestos-related_diseases

Occupational Exposure Limits (OELs)

- OSHA, the permissible exposure limit (PEL):
 - 0.1 fibers per cubic centimeter of air over an 8-hour time-weighted average (TWA).
- (NIOSH) recommends an airborne exposure limit (REL)
 - 0.1 fiber per cubic centimeter (0.1 f/cc) of air averaged over a 10-hour work shift
- (ACGIH) recommended exposure limit:
 - Time weighted average: 0.1 fibers per cubic centimeter (f/cc).

Case Study

- The study examines the relationship between asbestos, smoking, and lung cancer among shipbuilding workers in Yokosuka City, Japan.
- Lung cancer cases at Yokosuka City, Japan from 1978-1982 were compared to a control group, with occupational and smoking histories gathered from family interviews.
- Results show a clear link between asbestos exposure and higher lung cancer risk, particularly for certain cancer types, and this risk increases with smoking.

Control Measures

- Engineering controls: isolating the exposure source or using other engineering methods, such as ventilation equipped with HEPA filters
- Administrative actions include limiting the workers exposure time and providing showers
- PPE controls: respiratory protective equipment (RPE), overalls which are impervious to asbestos dust, footwear – appropriate for the work being undertaken

References

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