**Asbestos and Fire Fighters**
**July 2019**

This document provides background information on asbestos, how fire fighters are exposed, what diseases asbestos exposure causes and what monitoring is recommended.

**What is asbestos?**

Asbestos is the name given to a group of six different fibrous materials. Asbestos is a naturally occurring mineral that is found in rocks and soil. According to the Agency for Toxic Substances and Disease Registry (ATSDR), asbestos can also be found in certain manufactured products including "insulation, automotive brakes and clutches, ceiling and floor tiles, dry wall, roof shingles and cement".[1] Use of asbestos in most of these products declined after 1980.[2]

**How can fire fighters be exposed to asbestos?** [1,3]

The construction industry was the major consumer of asbestos in the United States. Therefore, fire fighters can come into contact with it during fire suppression and overhaul. Asbestos lagging has been used for years, and pipes wrapped in it are commonplace. During the 1960's and 70's, thousands of buildings were "fireproofed" with asbestos products. Other asbestos containing products, such as floor tiles, were also commonly used. When the full extent of the dangers of asbestos was realized, legislation was passed that ended this application. It is felt that in most cases, if the asbestos insulation that is already in place is in good repair, it is best left alone and not removed. In 1985, the Environmental Protection Agency estimated there were over 700,000 buildings in the U.S. that contain friable (able to be crumbled with hand pressure) asbestos.[4] Consequently, asbestos will be in the fire fighter's environment for decades to come.

Asbestos that is not disturbed does not pose a health risk. However, damage or disturbance (such the act of crushing) of any friable asbestos-containing products can release asbestos fibers into the air. Airborne asbestos fibers can be inhaled into the lungs and swallowed.

Individuals are most likely to be exposed to asbestos by breathing in fibers that are suspended in the air. In general, being around asbestos-containing products is not dangerous, as long as the asbestos is enclosed and the fibers are not escaping into the air. Indoor exposure to asbestos will depend on what the asbestos was used for, and whether the asbestos-containing materials were damaged, in poor condition or easily friable (can be easily crumbled by the human hand). Individuals working with asbestos or products that contain asbestos without proper protection are likely to inhale much higher levels of airborne asbestos fibers.

Asbestos exposure can also occur by drinking asbestos fibers if they are present in water, although these levels are usually very low. Even though exposure through skin contact is possible, very few fibers, if any, are passed through the skin into the body.[5]

**What can it cause?** [6,7,8]

Asbestos-related diseases can be cancerous or non-cancerous. The U.S. Department of Health and Human Services, the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) have all classified asbestos as a cancer causing substance in humans. It can also cause non-cancerous diseases, such as asbestosis and pleural changes. The risk for these diseases increases with longer periods and higher levels of exposure. Smoking increases the risk for lung cancer with asbestos exposure.

***Cancerous diseases***-

- **Lung cancer**: This is cancer of the lungs. Symptoms may include a worsening cough, coughing up blood, shortness of breath, ongoing chest pain, fatigue and unexplained weight loss.

- **Mesothelioma**: This is cancer of the lining around the lungs or abdominal cavity. This cancer is relatively rare, and working with asbestos is a major risk factor for developing it. Symptoms include shortness of breath, chest pain, fatigue and unexplained weight loss.

***Non-cancerous diseases-***

- **Asbestosis**: This is a lung disease that occurs due to prolonged accumulation of asbestos fibers in the lungs. The damage done by the fibers can scar the lungs, leading to progressive shortness of breath, persistent cough and chest pain. This is because the scars prevent transfer of oxygen from the air into the body. There are also research studies to suggest asbestosis increases the risk of developing lung cancer and the risk is further increased in smokers.[9]

- **Pleural changes or pleural plaques**: This condition involves scarring of the pleura, which is the lining that surrounds the lungs. Individuals with this condition may not show any signs or symptoms, although some may experience persistent shortness of breath.

**How much asbestos is dangerous?**

Mere exposure to asbestos does not necessarily mean that one will develop health problems. The health risks from asbestos exposure increase with the amount and duration of exposure. Smoking also increases risk.

The present OSHA Permissible Exposure Limit (PEL) is 0.1 fiber per cubic centimeter of air. [10, 11] The PEL is the allowable exposure level in workplace air that is averaged over an 8-hour shift of a 40-hour workweek. The excursion limit is 1 fiber per cubic centimeter of air over a 30 minute period.

Diseases from asbestos exposure are generally thought to occur after exposures lasting a year or longer.[12] However, OSHA notes that there is no “safe level” of exposure.[13] Workers should be provided with the maximum feasible level of respiratory protection when they are or reasonably could be expected to be occupationally exposed to airborne asbestos.

The Agency for Toxic Substances and Disease Registry has information on effects based on duration of exposure: [1]

- **Acute-duration exposure (14 days or less)[14]**
  There are no human data to show the effects of acute exposures. However, a rodent study reported lung fibrosis after being exposed to a very high dose (132 fibers/cc) for 5 hours.[15] Another rodent study reported two mesotheliomas after one day of exposure to a "dust cloud" of asbestos.[16]

- **Intermediate-duration exposure (15 to 364 days)[17]**
  There have been studies that show workers who were exposed to asbestos for periods ranging from one to twelve months may go on to develop asbestos-associated pleural changes or lung disease. In one study, in which the median duration of exposure was 6 months and average exposure was 51.8 fibers/cc, about 20% of the chest X-rays from those exposed one month or less showed parenchymal abnormality and about a third showed pleural abnormality at 20 years after first exposure.[18] Studies in heavily exposed workers in a plant producing asbestos for pipe insulation reported an increased risk of mesothelioma and respiratory tract cancers even in those with only a few months of exposure.[19,20] The risk of lung cancer was twice as high as the control population in those exposed less than 3 months. The US OSHA also notes reports of mesothelioma following short exposure periods.[13]

- **Chronic-duration exposure (365 days or more)[21]**
  Chronic inhalational exposure to asbestos has been demonstrated to cause asbestosis, lung cancer and pleural mesothelioma in many studies.

**Data on asbestos exposure in fire fighters**

Firefighters have potential for exposure to asbestos which may be released when older buildings burn. Respirable asbestos fibers are likely to be dislodged during building destruction caused by fire, as well as during active building demolition by firefighters during overhaul. However, the extent of cumulative exposure to asbestos is difficult to ascertain because of the intermittent exposure and the use of respiratory protection. In an air monitoring study done to characterize exposures during the overhaul phase, area sampling for asbestos showed an average sample concentration of 0.073 fibers/cc across 46 samples (15 samples above the limit of detection) with a maximal concentration of 0.2 f/cc.[22] It is important to note that few data on asbestos exposure in fire fighters are available. Exposure is likely to vary with age of structures in the fire.

**Data on asbestos related diseases in fire fighters**

The recent NIOSH cohort study that included almost 30, 000 US fire fighters from San Francisco, Chicago, and Philadelphia observed the risk of death from and diagnosis of mesothelioma were both twice as high as in the general US population.[23] A recent study of cancer diagnosis of more than 16,000 fire fighters in five Nordic countries found excess risk of mesothelioma among older firefighters (age category of 70+)[24] This is consistent with the long latency period of this disease (30-40 years). Increased risks of asbestos-

induced pulmonary and pleural fibrosis were also reported in a cohort of New York City firefighters, including in those with no history of asbestos exposure other than from fire fighting.[25] One hundred and ninety-seven (93%) participants had been employed for at least 20 years as a fire fighter and all were at least 25 years from start of employment as a fire fighter. The authors concluded that long-term fire fighters in urban areas may have significant exposure to asbestos and are at risk for asbestos-related diseases.

**Screening of workers with asbestos exposures**

Federal OSHA requires medical surveillance examinations of employees who are or will be exposed to airborne concentrations of asbestos fibers at or above the TWA (0.1 fiber per cubic centimeter of air as an eight (8)-hour time-weighted average) and/or excursion limit (1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of thirty (30) minutes")."[10] The OSHA construction standard extends this requirement to workers who perform abatement or maintenance activities on asbestos containing materials for 30 or more days per year.[11] Employers are required to make these exams available at the start of exposure (pre-placement), annually while exposed, and at termination.

The medical evaluation required by OSHA for employees exposed to asbestos is similar to the medical evaluation required for fire fighters in NFPA 1582. These evaluations include: pulmonary function tests, chest x-rays, and annual physical examinations.

**What to do after exposure to asbestos?**[1,6]

Fire fighters who suspect that they have been exposed to asbestos from the firehouse should consult with their personal or fire department physician. The physician may take a medical history and perform a physical examination. He or she may also order further diagnostic studies as listed below, if necessary.

- The **chest x-ray** is the most common test used to evaluate individuals who have sustained exposure to asbestos. It is used to detect the early signs of lung disease caused by asbestos fibers, but not the fibers themselves. It could be obtained at the time of exposure to establish a baseline.

- A **computerized tomography scan (CT scan)** can also be used to detect changes in the lung. It detects earlier changes than chest x-rays. However, since this instrument emits more radiation than a chest x-ray, it is usually recommended only when the results of the chest x-ray are inconclusive.

- **Pulmonary function tests (PFT)**, are breathing tests that determine how well the lung is functioning. Spirometry, one type of PFT, is recommended in NFPA 1582.

- Tests using **urine, stool or sputum samples** are unreliable for determining how much asbestos is present in the lungs.[5] Most people have low levels of asbestos in these tests. It is not possible to use the results of these tests to estimate the level of asbestos exposure, even in the event of higher-than-average levels.

Individuals typically show no signs of illness for a long period of time after their initial asbestos exposure. It usually takes 10 to 20 years (and up to 40 years) before symptoms and or signs of asbestos-related disease begin to appear.[1]

According to the National Cancer Institute, persons exposed to asbestos fibers should look for the following signs and symptoms, however if these symptoms occur from exposure it would not be for many years after the start of the exposure: [6]

- Shortness of breath, wheezing, or hoarseness.
- A persistent cough that gets worse over time.
- Blood in the sputum (fluid) coughed up from the lungs.
- Pain or tightening in the chest.
- Difficulty swallowing.
- Swelling of the neck or face.
- Loss of appetite.
- Weight loss.
- Fatigue or anemia.

**How do fire fighters prevent further exposure?**

You can prevent exposure by avoiding areas with known asbestos. If that is not possible, such as during overhaul, then fire fighters should employ suitable personal protective equipment, including wearing their SCBAs. Regular medical examinations, vaccinations against flu and, if lung disease develops, pneumococcal pneumonia may also be recommended by physicians. Exposed fire fighters who are smokers should quit smoking, as studies show that smoking greatly increases the risk of lung cancer from asbestos exposure.[26]

**Is there anything else fire fighters should be aware of?**

Fire fighters that have been exposed to asbestos should have an injury and/or exposure report of the exposure in their medical record and again, as the law requires, medical monitoring should be provided. If you need additional assistance, please do not hesitate to contact the IAFF Division of Health, Safety and Medicine.

---

[1] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Toxicological profile for asbestos.2001. http://www.atsdr.cdc.gov/toxprofiles/tp61.pdf

[2] OSHA. Preamble to the Asbestos Standard https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=PREAMBLES&p_id=777 (accessed August 25, 2017).

[3] U.S. Department of Health and Human Services. National Heart Lung and Blood Institute. Diseases and Conditions Index. *Asbestos-related lung diseases*. http://www.nhlbi.nih.gov/health/dci/Diseases/asb/asb_all.html

[4] U.S. Environmental Protection Agency, Region 5. Region 5 Hazardous Waste and Toxic Substances, 1985. https://books.google.com/books?id=wdDzgI3ndXYC&pg=PA18&lpg=PA18&dq=Environmental+Protection+Agency+estimates+there+are+over+700,000+buildings+in+the+U.S.+that+contain+friable+asbestos&source=bl&ots=ZsRqoQ7ECC&sig=XmceUkV1VVWuijNKZMhFhIB4o3c&hl=en&sa=X&ved=0ahUKEwibmfCso-bVAhVCQiYKHaYYC9IQ6AEIKDAA#v=onepage&q=Environmental%20Protection%20Agency%20estimates%20there%20are%20over%20700%2C000%20buildings%20in%20the%20U.S.%20that%20contain%20friable%20asbestos&f=false. Accessed August 20, 2017.

[5] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Public Health Statement for Asbestos in the Toxicological profile for asbestos. 2001. https://www.atsdr.cdc.gov/ToxProfiles/tp61-c1-b.pdf. Accessed August 20, 2017.

[6] U.S. National Institutes of Health. National Cancer Institute. Asbestos exposure and cancer risk. http://www.cancer.gov/cancertopics/factsheet/Risk/asbestos

[7] World Health Organization. International Agency for Research on Cancer. Monographs Volume 100C: Asbestos. 2012. http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-11.pdf

[8] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Asbestos and health: frequently asked questions. http://www.atsdr.cdc.gov/noa/docs/Asbestos%20FAQ_ENG_web.pdf

[9] Markowitz SB, Levin SM, Miller A, Morabia A. Asbestos, asbestosis, smoking, and lung cancer. New findings from the North American insulator cohort. Am J Respir Crit Care Med. 2013;188:90–96.

[10] OSHA Asbestos Standard 1910.1001. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9995. Accessed 8/20/2017.

[11] OSHA Asbestos Standard 1926.1101. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10862. Accessed 8/20/2017.

[12] Rom WN. Asbestosis, Pleural Fibrosis, and Lung Cancer. In Rom, W. N., & Markowitz, S. (2007). *Environmental and Occupational Medicine*. Philadelphia: Wolters Kluwer Health. 4th edition, 298-316.

[13] U.S. Department of Labor. Occupational Safety and Health Administration. Safety and Health Topics. Asbestos. https://www.osha.gov/SLTC/asbestos/. Accessed August 22, 2017.

[14] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Toxicological profile for asbestos. 2001. p.35 Table 3-2, p121-122. http://www.atsdr.cdc.gov/toxprofiles/tp61.pdf

[15] McGavran PD, Butterick CJ, Brody AR. 1989. Tritiated thymidine incorporation and the development of an interstitial lesion in the bronchiolar-alveolar regions of the lungs of normal and complement deficient mice after inhalation of chrysotile asbestos. JEPTO 9:377-391.

[16] Wagner JC, et al. The effects of the inhalation of asbestos in rats. Br J Cancer. 1974;29(3):252-69.

[17] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Toxicological profile for asbestos. 2001. p.26 Table 3-1, p121-122. http://www.atsdr.cdc.gov/toxprofiles/tp61.pdf

[18] Ehrlich R, Lilis R, Chan E, Nicholson WJ, Selikoff IJ. Long term radiological effects of short term exposure to amosite asbestos among factory workers. Br J Ind Med. 1992;49:268–275.

[19] Levin, J. L., McLarty, J. W., Hurst, G. A., Smith, A. N., & Frank, A. L. (1998). Tyler asbestos workers: mortality experience in a cohort exposed to amosite. *Occupational and Environmental Medicine*, *55*(3), 155–160.

[20] Levin JL et al. Tyler asbestos workers: A mortality update in a cohort exposed to amosite. J Toxicol Environ Health B Crit Rev. 2016;19(5-6):190-200.

[21] U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Toxicological profile for asbestos. 2001. p.27 Table 3-1, p121-122. http://www.atsdr.cdc.gov/toxprofiles/tp61.pdf

[22] Bolstad-Johnson DM, Burgess JL, Crutchfield CD, Storment S, Gerkin R, Wilson JR (2000): Characterization of fire fighter exposures during fire overhaul. AIHAJ September/October 2000; 61:636-641.

[23] Daniels RD, et al. Mortality and cancer incidence in a pooled cohort of US firefighters from San Francisco, Chicago and Philadelphia (1950-2009). Occup Envion Med. 2014;71(6): 388-97.

[24] Pukkala E, et al. Cancer incidence among firefighters: 45 years of follow-up in five Nordic countries. Occup Environ Med. 2014;71 (6): 398-404.

[25] Markowitz SB, Garibaldi K, Lilis R, et al. Asbestos and fire fighting. Ann N Y Acad Sci 1991;643:573–81.

[26] Hammond EC, Selikoff IJ, Seidman H (1979): Asbestos exposure, cigarette smoking and death rates. Ann NY Acad Sci 330:473-490.