

## ASBESTOS SURVEILLANCE PROGRAM

NASA Lewis Research Center  
Occupational Medicine Service

**Background**

Asbestos is a family of minerals which includes six chemically and physically distinct substances: chrysotile, crociodolite, amosite, anthophyllite, tremolite, and actinolite. These substances are all crystalline hydrated silicates with a fibrous geometry. However, they are divided into two subgroups based on their fiber morphology: the **serpentine group** which includes chrysotile with curly, often bundled fibrils; and the **amphibole group** which includes crociodolite, amosite, anthophyllite, tremolite, and actinolite with needle-like fibers. This distinction is important medically as increased pathogenicity is attributed to the amphiboles which can penetrate deeper into the lung and are seemingly less soluble. Fortunately, it is chrysotile, a member of the serpentine group, which accounts for 90 to 95 percent of the asbestos produced and used commercially in this country.

There are four diseases associated with asbestos exposure: mesothelioma, lung cancer (specifically bronchogenic carcinoma), asbestosis (asbestos-induced pulmonary fibrosis), and benign pleural disorders.

**Mesothelioma** is a malignant tumor arising in the pleura and peritoneum, of which 80 percent have occurred in individuals exposed to asbestos in the workplace or who have lived near asbestos mines. The average latency period between first exposure to asbestos and the clinical diagnosis of malignant mesothelioma is 35 to 40 years. Most deaths have occurred in individuals over age 60. There is no evidence that smoking enhances the prevalence of this malignancy.

**Bronchogenic carcinoma** has developed in asbestos workers an average of 20 to 30 years after first exposure to asbestos. There seems to be a dose-response relationship between asbestos concentrations to which an individual is exposed and the length of time of exposure in the development of lung cancer. However, lung tumors are exceedingly rare among asbestos workers who do not smoke.

**Asbestosis** is a progressively restrictive lung disease characterized on pulmonary function tests by diminutions of vital capacity, total lung capacity, residual lung volume, functional residual capacity and diffusing capacity. Frequently there is concomitant obstructive lung disease due to smoking which exacerbates symptoms and worsens prognosis.

There are **four benign pleural disorders** due to asbestos exposure which include:

1. **Benign pleural effusions**: Often a unilateral sterile exudate, frequently serosanguinous, usually occurring in workers less than 20 years after the initial exposure to high concentrations of asbestos. Only one-third of these patients are symptomatic, and the majority of effusions resolve spontaneously.
2. **Pleural plaques**: The most common manifestation of asbestos exposure, characterized as fibrohyaline nodular lesions which are usually located bilaterally and appear 10 to 20 years after initial exposure to asbestos. These plaques cause no decrements in lung function, and currently it is felt that these plaques are not hallmarks of more significant disease.
3. **Pleural fibrosis**: A diffuse thickening of the visceral pleura which may impair pulmonary function but does not lead to malignancies.
4. **Rounded atelectasis**.

Of the three potentially fatal asbestos-related disorders, the development of bronchogenic carcinoma and the worsening of asbestosis are closely related to smoking. Therefore, any employee who smokes and who is entered into an asbestos surveillance program should strongly be encouraged to enter a smoking cessation program.

### **Purpose**

The purpose of an Asbestos Surveillance Program at the NASA Lewis Research Center shall be to:

1. Identify any Lewis employee who has been exposed to asbestos in the past, currently is exposed to asbestos, or who may be exposed to asbestos because of the nature of the employee's job.
2. Educate that employee about the nature of asbestos, proper use of respiratory protection, and the evils of smoking, especially in individuals exposed to asbestos.
3. Monitor those employees by obtaining an extensive past medical and occupational exposure history and then performing periodic physical exams, chest X-rays and pulmonary function tests to detect early signs of asbestos-induced disease.

### **Medical Surveillance**

The specifics of the Medical Surveillance Program for Asbestos Monitoring at NASA Lewis Research Center will fulfill the criteria required by OSHA and will incorporate recommendations from NIOSH, NOHIMS, and NAVOSH.

Significant asbestos exposure requiring medical surveillance is defined as exposure to any environment with an asbestos concentration of 0.1 asbestos fibers per cubic centimeter of air (0.1 f/cc), calculated as an eight (8) hour time-weighted average (TWA). This is called the action level (AL), which is half the permissible exposure limit (PEL) to asbestos of 0.2 f/cc, the environmental standard allowed by OSHA.

NASA employees identified by the Office of Environmental Programs as having been exposed to the AL for asbestos will be categorized into one of two broad categories:

1. Employees currently exposed to asbestos, or
2. Employees not currently exposed to asbestos but who have been exposed in the past. The Office of Environmental Programs (OEP) will evaluate historical data in cases where past exposure is alleged and no air monitoring results are available.

Employees in category 1 who are currently exposed to asbestos at or above the AL shall receive an annual physical exam (including a detailed examination of the chest,

and pulmonary function tests [PFTs] specifically including FEV1 and FVC), and a chest X-ray according to the schedule in Table 1.

Employees in category 2 who are not currently exposed to asbestos will receive a physical exam (with PFTs) and chest X-ray according to the schedule in Table 1. All chest X-rays will be submitted for certified "B" readings.

**Table 1**

| Years Since First<br>Asbestos Exposure | Age of Employee |               |               |
|--|-----------------|---------------|---------------|
|  | 15 to 35        | 35 to 45      | 45+           |
| 0 to 10 Years                          | Every 5 Years   | Every 5 Years | Every 5 Years |
| 10+ Years                              | Every 5 Years   | Every 2 Years | Every Year    |

All new employees who may be exposed to asbestos during the course of their employment at NASA will have a preplacement physical exam which will include a chest X-ray and PFTs. Employees who may be exposed to asbestos include:

- Electricians
- Mechanics
- Plumbers
- Carpenters
- Pipefitters
- Contracting Officer Technical Representatives (COTRs) for asbestos abatement projects or constructions jobs where asbestos is likely to be encountered
- Asbestos Center Inspectors
- Firemen.

Continued medical surveillance for asbestos-related disease will be necessary for these new employees only if there is evidence of exposure to asbestos above the AL or upon recommendation from the Office of Environmental Programs.

Any employee who was exposed to asbestos while employed at NASA Lewis Research Center will have a complete physical exam, with a chest X-ray and PFTs, upon completion or termination of their employment. The Occupational Medical Service (OMS) will not continue surveillance of an individual once they have either retired from NASA or are no longer employed by NASA, but during the final physical exam recommendations will be given to the individual for continued medical surveillance to be completed by the individual's private doctor.

### References

1. Mossman, B.T., and Gee, J.B.L. Asbestos-Related Diseases. *NEJM*, 1989; 320: 1721-1730.
2. Levin, J.L., Kronenburg, R.S., and Dodson, R.F. Asbestos in Place May Present Immeasurable Risks in Buildings. *Occupational Health and Safety*, September 1990: 23.
3. Gee, J.B.L., and Mossman, B.T. Asbestos Warrants Care, Management, but Society Must Resist Urge to Panic. *Occupational Health and Safety*, September 1990: 25.
4. Cooper, L.P. OSHA Medical and Workplace Surveillance Requirements and NIOSH Recommendations. NASA Contractor Report 3690, August 1983: 52-61.
5. *Medical Surveillance Procedures Manual and NOHIMS Medical Matrix (Edition 3)*, January 1989: 34-42.
6. *Navy Occupational Safety and Health (NAVOSH) Program Manual*, August 1983: 17-45.

