Asbestos Awareness

Course Number: HS-02-103

PDH: 2

Approved for: AK, AL, AR, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WI, WV, and WY

State Board Approvals

Florida Provider # 0009553 License #868
Indiana Continuing Education Provider #CE21800088
Maryland Approved Provider of Continuing Professional Competency
New Jersey Professional Competency Approval #24GP00025600
North Carolina Approved Sponsor #S-0695
NYSED Sponsor #274

How Our Written Courses Work

This document is the course text. You may review this material at your leisure before or after you purchase the course.
After the course has been purchased, review the technical material and then complete the quiz at your convenience.
A Certificate of Completion is available once you pass the exam (70% or greater). If a passing grade is not obtained, you may take the quiz as many times as necessary until a passing grade is obtained).
If you have any questions or technical difficulties, please call (508) 298-4787 or email us at admin@PDH Pro.com.

Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the historical progression of asbestos exposure limits established by NIOSH and OSHA.
- **Evaluate** the clinical reasoning behind early standard-setting and why those premises required reevaluation.
- **Select** appropriate sampling durations to determine compliance with proposed ceiling concentrations.

Executive Summary: Early asbestos standards were designed primarily to mitigate asbestosis but did not account for the prevention of asbestos-induced neoplasms. Modern regulatory shifts reflect a move toward significantly lower exposure limits as new medical data and technological feasibility have evolved.

Historical Standards and Rationale

In 1972, the **National Institute for Occupational Safety and Health (NIOSH)** established an initial recommendation for asbestos exposure. This standard was set at **2.0 asbestos fibers/cubic centimeter (cc)** for fibers greater than **5 micrometers (µm)** in length.

- **Initial Objective**: The 2.0 fibers/cc limit was intended to "prevent" **asbestosis**.
- **Known Limitations**: Regulatory bodies openly recognized at the time that this level would not prevent **asbestos-induced neoplasms**.
- **Feasibility**: Data at the time supported that existing technology was capable of achieving this standard.
- **Reevaluation**: Since 1972, sufficient additional data on asbestos-related disease developed to warrant a reevaluation of these limits.

OSHA Promulgation and Revisions

Following the NIOSH recommendations, **OSHA** promulgated its first formal standard on June 7, 1972. This rule introduced a multi-tiered approach to exposure management.

- **Original TWA**: An **8-hour time-weighted average (TWA)** of **5 fibers longer than 5 µm/cc**.
- **Ceiling Limit**: A maximum limitation of **10 fibers/cc**.
- **Scheduled Reduction**: The standard mandated a TWA reduction to **2 fibers/cc** effective July 1, 1976.

The Move Toward Lower Limits

Driven by court rulings and a reexamination of the most feasible occupational health protection, OSHA proposed a significantly more stringent rule in October 1975.

- **Proposed 8-hour TWA**: Reduced to **0.5 fibers longer than 5 µm/cc**.
- **Proposed Ceiling Concentration**: Set at **5 fibers/cc**.

⚠️ **Safety Constraint**: To determine compliance with the proposed 5 fibers/cc ceiling, the measurement must be determined by a **sampling period of up to 15 minutes**.

💡 **Design Tip**: Engineers should treat the 1972 standards as historical baseline data; the reevaluation requested by OSHA in December 1975 emphasizes that "sufficient additional data" regarding health effects now warrant much stricter controls to protect workers.

Checkpoint Quiz

---

1. **What was the primary clinical goal of the original 2.0 fibers/cc standard recommended by NIOSH in 1972?**
   a) Prevention of all lung-related cancers.
   b) Prevention of asbestosis.
   c) Mitigation of gastrointestinal issues.
   d) Elimination of all pleural thickening.

Answer: (b). The 1972 standard was recommended with the stated belief that it would "prevent" asbestosis, though it was recognized it would not prevent neoplasms.

2. **Under the OSHA proposal of October 9, 1975, what is the maximum duration allowed for a sampling period to determine the ceiling concentration?**
   a) 8 hours
   b) 60 minutes
   c) 30 minutes
   d) 15 minutes

Answer: (d). The proposed ceiling concentration of 5 fibers/cc was specifically to be determined by a sampling period of up to 15 minutes.

3. **True or False: The 1972 NIOSH recommendation of 2.0 fibers/cc was originally believed to be sufficient to prevent asbestos-induced neoplasms.**
   a) True
   b) False

Answer: (b). NIOSH made the recommendation with the "open recognition" that it would not prevent asbestos-induced neoplasms

Module 2: Biologic Effects of Exposure on Animals

Learning Objectives

By the end of this section, you will be able to:

- **Evaluate** the relationship between asbestos fiber characteristics (diameter and length) and their ability to induce disease.
- **Identify** the different routes of asbestos exposure and the specific types of tumors they produce in animal models.
- **Evaluate** the evidence regarding the translocation of asbestos fibers from primary sites of deposition to other organs.

Executive Summary: Animal studies provide conclusive evidence of the carcinogenicity of all commercial forms of asbestos. Chronic exposure through inhalation, injection, or ingestion results in significant pathologies, including asbestosis, lung cancer, and mesotheliomas, with fiber morphology playing a critical role in disease potency.

Carcinogenicity Fundamentals

The carcinogenicity of asbestos has been extensively documented through various experimental routes of exposure in multiple animal species.

Design Fundamentals: Routes of Exposure

Instillation and Intratracheal Injection

This technique focuses on direct delivery to the respiratory tract.

- **Co-carcinogenesis**: The effect of **chrysotile** is additive to that of **benzo(a)pyrene** for respiratory tract tumors.
- **Synergistic Results**: Injections of Russian chrysotile combined with benzo(a)pyrene produced lung papillomas, epidermoid carcinomas, and pleural mesotheliomas in rats within 9–28 months.
- **Threshold Observation**: No lung tumors occurred in rats given chrysotile alone or benzo(a)pyrene alone under the specific test parameters of the Shabad et al. study.

Intraperitoneal (ip) Administration

Injection into the abdominal cavity primarily targets the induction of peritoneal mesotheliomas.

- **Fiber Potency**: Peritoneal mesotheliomas were observed with chrysotile and crocidolite, but none with amosite in specific CD rat studies after 7–17 months.

- **Incidence Rates**: High rates of mesothelioma (65 total) were observed in Sprague-Dawley rats injected with **crocidolite**.
- **Milling Effects**: Powdered chrysotile results in a longer latent period for tumor induction compared to standard chrysotile, though the occurrence rate remains about 40%.

Intrapleural Administration

This method involves placing asbestos fibers directly into the chest cavity.

- **Commercial Fiber Impact**: All commercial types of asbestos produce mesotheliomas in Wistar rats.
- **Standardized Comparisons**: A 20 mg dose of UICC standard samples produced mesotheliomas in the following frequencies:
    - **Crocidolite**: 61%
    - **Amosite**: 36%
    - **Anthophyllite**: 34%
    - **Canadian Chrysotile**: 30%
    - **Rhodesian Chrysotile**: 19%

⚠️ **Safety Constraint**: Even the lowest dose tested (0.5 mg of chrysotile or crocidolite) is sufficient to produce mesotheliomas in animal models.

Ingestion

Experimental feeding studies have shown varying results regarding tumor induction.

- **General Findings**: Several series of feeding experiments with chrysotile and crocidolite showed no significant difference in tumor incidence compared to controls.
- **Specific Pathology**: Gastric leiomyosarcomas were observed in rare cases in rats fed chrysotile in malted milk powder.

Inhalation

Inhalation studies mimic the most common form of human occupational exposure.

- **Tumor Types**: Exposure to various asbestos dusts has induced adenocarcinomas, squamous-cell carcinomas, and pulmonary adenomatosis.

Purchase this course to see the remainder of the technical materials.