Bell Laboratories

subject: Ambient Asbestos Concentrations
Case No. 48106-3

date: August 16, 1983

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1F-210 X3449

MEMORANDUM FOR RECORD

Summary

Ambient atmospheric concentrations of asbestos have not been examined as intensively as indoor air levels. Ambient concentrations range from 0.01 to 0.1 ng/m^3 for rural areas and 0.1 to 70 ng/m^3 for urban areas. Fifty percent of urban residents are exposed to 20 ng/m^3 (0.0004 optical fibers/cc). Connecticut has adopted an ambient air quality standard of 30 ng/m^3 for a 30 day period. Current methods for analyzing asbestos air filters are inaccurate at low ambient levels.

Background

Asbestos is the generic name for a class of natural fibrous silicates with four commercially important forms: chrysotile, amosite, amthophyllite, and crocidolite. Chrysotile composed 94% of the U.S. consumption in 1974.

Asbestos is currently used in more than 5000 products including roofing, thermal, and electrical insulation, cement pipe and sheet, flooring, gaskets, friction materials, coatings, plastics, textiles, and paper products. Total production of asbestos dropped to 200 million pounds in 1979, as suitable substitutes are developed.

Human exposure to asbestos occurs primarily by inhalation, although ingestion of fibers is considerable. Asbestos is so widely used that the entire population is exposed to some degree. Worker exposure occurs during the mining and milling of raw asbestos, manufacture of products and in the construction and ship building industries. OSHA reports that about 2.5 million wokers are estimated to be exposed to asbestos.

The general population is exposed to asbestos from air, beverages, drinking water, pharmaceutical and dental preparations, and consumer products. Families of asbestos workers have been exposed to high fiber levels through contaminated clothing which is laundered at home.

Asbestos fibers are released into the environment by the wearing and deterioration of asbestos products and the natural occurence of fibers in the earth. Major sources of atmospheric emissions include mines and milling facilities, manufacturing plants and vehicle brake linings. The application or deterioration of asbestos containing fireproofing and insulating materials creates elevated indoor levels of fibers. The removal and disposal of building materials releases asbestos into the environment.

Asbestos levels in the workplace were originally restricted to a maximum concentration of 5 mppcf by the Walsh-Healy Act of 1951. Numerous revisions of occupational asbestos standards have taken place with the current OSHA limit effective on July 1, 1976. The 8-hour time-weighted average (TWA) is 2 fibers greater than 5 um in length per cubic centimeter of air. The ceiling value is 10 fibers greater than 5 um in length per cubic centimeter of air. The 8-hour TWA corresponds to a general public exposure of 25,000 ng/m^3 of asbestos. This is approximately 1000 times greater than prevailing urban ambient levels.

In 1977, the Consumer Product Safety Commission restricted the use of asbestos in products by regulating patching compounds, gas fireplaces, and hand-held dryers. The EPA regulates asbestos under the Clean Air Act, Clean Water Act, Toxic Substance Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA). The National Emission Standards for Hazardous Air Pollutants (NESHAP) reduced asbestos emissions by engineering and practice controls. Ambient air quality standards for asbestos have been adopted by some states (i.e., Connecticut).

Discussion

Numerous studies have measured atmospheric asbestos concentrations in urban and rural areas. Philadelphia, Los Angeles, and Manhattan have asbestos levels ranging from 8 to 100 ng/m^3 (0.00016 to 0.002 optical fibers/cc) during the early 1970's. Boston had a lower average asbestos level of 5.0 ng/m^3 (0.0001 optical fibers/cc) when measured by Nicholson et al, 1975.

An intensive ambient monitoring program was conducted in Connecticut between 1974 and 1977 by Bruckman and Rubino, 1978. Ambient chrysotile asbestos levels in both urban and rural areas were below 10 ng/m^3. Samples collected near industrial sources and adjacent to toll plazas were elevated to the 10 to 25 ng/m^3 range. The highest level of 41 ng/m^3 was measured at a site near an urban toll station and one of the largest industrial asbestos users in the state. The prevailing levels were "relatively low indicating the ambient asbestos problem is limited to populations residing in close proximity to point sources of asbestos emissions".

An indoor survey performed during the Connecticut study suggested that the public health risk posed by asbestos containing surface coatings "may not be as great as previously thought". Indoor asbestos levels were measured below 1 ng/m^3.

Several studies have compared asbestos levels inside buildings containing spray asbestos and outside air. Asbestos levels are directly related to the type, composition, and integrity of spray coatings in combination with air change and circulation rates. A person working in a building with fibrous spray asbestos inhales 45% more asbestos than the median exposure level of 20 ng/m^3 for urban populations.

Nicholson et al, 1975, reported an average asbestos concentration of 2.5 ng/m^3 inside the JFK Building verses 5.0 ng/m^3 in outside air in Boston.

Numerous surveys of asbestos levels have been performed by Bell Labs personnel. Although they focus on indoor air levels, ambient samples were collected for a basis of comparison. Ambient concentrations ranged from 0.01 to 0.08 optical fibers/cc. The highest level was measured in Camden, New Jersey on February 23, 1976.

Ambient concentrations measured during Bell System industrial hygiene surveys are considerably higher than those in the literature. The major factor contributing to this difference is the sampling and analytical methods. Bell Labs industrial hygiene surveys collect short term periodic samples which are analyzed by optical microscopy. The lower limit of reliable measurement of this NIOSH analytical method of fiber counting is 0.1 fiber/cc.

Ambient atmospheric studies collect long term (monthly) samples at low volumes and analyze the filters by electron microscopy. The accuracy of electron microscopy to determine concentrations in ng/m^3 ranges is "likely to be within 50% of the actual value and certainly within a factor of two".

Conclusion:

Indoor and outdoor concentrations of asbestos are highly variable and directly influenced by the specific location, sampling duration, collection and analytical methods. The validity of comparisons between various sites and studies is questionable.

The EPA does not perform routine sampling to compile a nationwide ambient database for urban asbestos levels (personal communication with H. Steeker of Region II, EPA and H. Davis of Region I, EPA). EPA regulations have been proposed governing the removal of indoor asbestos containing materials.

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MH-78691-KDT-mpb

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