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FEBRUARY 1977

Proceedings Define Qualities, Hazards of Asbestos

THE Hazardous Materials Committee chairman of the Wood Products Section, Lawrence S. Penkava, safety services manager, State Accident Insurance Fund, State of Oregon, promoted the industry's first seminar in Portland, Ore., December 6, 1974. The seminar agenda included:

Asbestos and Wood Dust. Joseph D. Wendlick, corporate industrial hygienist, Weyerhaeuser Co.

Wood Preservatives, Solvents and Flammables Al Riegert, director, Industrial Hygiene Department, Workers Compensation Board of British Columbia.

Carbon Monoxide Peter A Breysse, associate professor, Department of Environmental Health, University of Washington.

Formaldehyde and Caustics. Art Schoenborn, industrial hygienist, State Accident Insurance Fund, State of Oregon.

Respirators and Protection Equipment. Walter E. Ruch, regional program director, NIOSH.

Instrumentation and Controls. Donald Quilici, industrial hygienist, OSHA.

The proceedings will be published in several parts in order to give you a ready reference to some of the hazardous materials in our industry. This month's article will be from asbestos and wood dust proceedings.

Asbestos

What is asbestos? Asbestos is a member of a group of some 80 naturally-occurring inorganic fibers, which is principally characterized by two broad mineral groups, the serpentines and the amphiboles. Only one significant species of asbestos originates in the serpentine mineral group; *chrysotile* (a magnesium silicate occurring as long, white flexible, tubular fibers), the chief asbestos of commerce, mined principally in Canada, Italy, Rhodesia, and South Africa, as well as the USSR. Commercial deposits of asbestos also occur in the U.S in the states of Vermont, Arizona, and California. Amphiboles (iron silicates), on the other hand, include a number of asbestos species: amosite, crocidolite, anthophyllite, actinolite and tremolite which are mined in South Africa, Australia, Bolivia and Finland.

What are the Standards?

Prior to the Williams-Steiger Occupational Safety and Health Act of 1970, standards on asbestos were primarily directed at minimizing workers' exposure to within limits thought to cause the debilitating disease, asbestosis. Consider, for example, the level adopted under the Walsh-Healy Public Contracts Act of 1969, which set the acceptable limit at 12 fibers/cu cm This asbestos standard was in force until December 7, 1971 when OSHA published an emergency temporary standard concerning exposure to asbestos fibers which lowered the acceptable airborne concentrations in the workplace to 5 fibers/cu cm greater than 5 microns in length for an 8-hour time-weighted average (TWA); and 10 fibers/cu cm greater than 5 microns in length for a ceiling concentration, effective July 7, 1972.

NIOSH further recommended that the 5-fiber TWA and 10-fiber ceiling concentrations be permitted only for 2 years, thereafter, TWA concentrations should not be more than 2 fibers/cu cm, with no change in the ceiling concentration.

OSHA adopted this recommendation in the interest of the health of employees so exposed, such that after July 1, 1976, the acceptable airborne concentrations in the workplace will be 2 fibers/cu cm greater than 5 microns in length for an 8-hour TWA and 10 fibers/cu cm greater than 5 microns in length for a ceiling concentration

A specification on fiber size was included in the asbestos standards (greater than 5 microns in length) to denote those fibers possessing the greatest fibrogenic and carcinogenic potential. Fibers less than 5 microns in length, according to British studies, do not exhibit near the hazardous properties that mark their "greater than 5 micron" counterparts; hence the inclusion of a specific fiber size consideration.

What are the Hazards?

The concern which precipitated the writing, adoption, and eventual promulgation, by OSHA, of the emergency temporary asbestos standard and later the permanent asbestos standard, CFR 1910.93a, was the evidence from several investigators (notably Dr. Irving Selikoff of the Mt. Sinai School of Medicine, N.Y.) which indicated a causal relationship between exposure to asbestos and the development of certain types of cancers after a latent

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Asbestos

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(asymtomatic) period of 20-40 years

Medical science has long been cognizant that exposure to airborne asbestos fibers of high enough intensity and long enough duration will lead to a diffuse inorganic dust pneumoconiosis known as asbestosis.

Asbestosis is an exposure-related disease which is characterized by interstitial calcification and scarification, obliterating lung spaces, and replacing functional lung tissue with nonfunctional collagen. It first manifests itself with either dyspnea (shortness of breath) or an irritating dry cough, over a period of many years. Progressively, as the condition advances, the worker will become increasingly shorter of breath (possibly cyanotic) with death occurring from respiratory failure or heart failure.

The more recent revelation, however, that asbestos exposures also increase the risk of: 1) gastric neoplasiz (esophagus, stomach, and small intestine cancers); 2) bronchial carcinoma (principally among smokers); and finally, 3) a rare malignancy, mesothelioma of the pleura or peritoneum, has generated the most consternation. Because the attack rate of neoplasia among asbestos workers who smoke is 10-12 times higher than workers who do not smoke but are not exposed to asbestos, or who are exposed to asbestos but do not smoke, there would appear to be a synergistic cocarcinogenic effect involved in the development of bronchial carcinoma. It was with regard for the carcinogenic effects of asbestos that the standard was lowered.

What products contain asbestos?

Long recognized as a substance possessing desirable fire-resistant characteristics, asbestos fibers have found use in a tremendously broad and diversified array of products Some, but not all, of the product categories in which asbestos is used are given below.

Asbestos-containing blown insulation.

Asbestos-reinforced magnesia or calcium silicate steam pipe covering and block insulation

Brake shoes.

Asbestos-containing grouts and cements.

Clutch linings of cars

Asbestos-cement products/board.

Transite pipe.

Asbestos-reinforced floor tiles.

Asbestos cloth, blankets, clothing, gloves.

Asbestos rope.

Gasketing.

Asbestos-containing taping for sheet rock joint work.

Fibrous talcs.

Filtering medium for wine, gin, etc

Filtering medium for sulfate precipitates (Gooch crucibles) in analytical laboratories.

Substitute Materials Available for Use

Because of the recognized hazards of working with asbestos-containing materials, especially friable asbestos-containing products, many asbestos-free (but not fiber-free) products have been developed to lessen the asbestos hazard to workers and the general public Mineral wool fiber or fiber glass fiber-reinforced magnesia and calcium silicate pipe coverings and block insulations are now available throughout the United States in all the shapes and sizes formerly available in asbestos-containing insulative materials. By example (not to be construed as product endorsement), the following asbestos-free insulations are on the market:

Pabco Super Cal Temp Type NA

Johns-Manville Thermobestos (asbestos-free)

Kaylo-10 (asbestos-free)

Asbestos has been replaced in grouts and cements also, an example of which is Ryder One-Coat asbestos-free grouting. For products with asbestos bound tightly in a rigid, nonfriable matrix such as with brake shoes, clutch linings, asbestos-cement board, most gasketing and asbestos-containing floor tiles, only a mechanical process such as cutting, sawing, drilling, or sanding would represent potentially hazardous work exposures All other handling activities could be performed with relative impunity

Asbestos has been phased out of laboratory gravimetric analysis schemes in favor of turbidimetry, etc , and is no longer employed as a filtering medium for wine and gin (in this country). Nonfibrous talcs (no tremolite asbestos) are available to replace the more potentially hazardous fibrous variety. Asbestos cloth, blankets, clothing, and gloves are now surface-treated by the manufacturer to minimize release of asbestos fibers to the workplace atmosphere

It may well prove to be a false sense of security to assume that mineral wool, fiber glass or ceramic wool are "safe" vis-a-vis asbestos. As our technology improves in the development of better and better synthetic inorganic fibers, and as fibers approximating the size and chemical composition of naturally-occurring asbestos fibers are produced, these also may possess fibrogenic and even carcinogenic potential We would be well advised to exercise the same precautions in handling these products reinforced with mineral wool or fiber glass as in the case of asbestos.

How are Levels of Exposure Determined?

The accepted technique for evaluating or ascertaining level of exposure is to collect all of the fibers in a known amount of air by passing that air through a filter and subsequently, by microscopic counting methods, determining the numbers of actual fibers collected in the employees breathing zone in order that the fiber concentration can be related to the individual Once a determination has been made on the level of asbestos to which an employee is exposed, qualification for a medical surveillance program can also be evaluated

According to the OSHA Sampling Method for Asbestos, the samples must be collected across the face of a Millipore Type AA cellulose acetate filter at a sampling rate of 2 liters/min. Duration of the sample will depend upon the relative concentrations of asbestos and extraneous matrix material in the air at the time of sampling

Attempting to conform rigidly to OSHA's recommended sampling time of 15 minutes minimum duration (in order to determine violations of the

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ceiling exposure limit) may result in the loss of an important sample because the microscopist simply cannot get a realiable count on the heavily built-up fiber sample on the filter face Sampling in high visible dust areas should always be started at 2-4 min., then 5-7 min., 8-12 min. and finally 15 min to minimize loss of samples, particularly if the sampling site is several hundred miles from the counting lab, or more importantly, if the samples taken are representative of an event not likely to be repeated on a planned schedule.

Any industrial hygienists, environmentalists, or analysts who are responsible for the calibration of the personnel sampling pumps, collecting the samples in the workplace, and counting the fibers collected on the sampling filters should be aware of and take steps to minimize the errors which can occur at various stages of sampling and analysis:

1. Altitude corrections. A pump calibrated at sea level and used at 4,000 ft above sea level may be off in the actual volume by 5 percent.

2. Cassette orientation. A sampling cassette resting against a worker's uniform or clothing at the lapel will have a different fiber distribution across the fiber face than one located in the breathing zone but away from the uniform

3. Ester mixture. The ester mixture used to dissolve away the filter in the counting procedure should be of a consistent concentration and saturated with filter so as to minimize errors in masking fibers with a liquid of similar refractive index.

4. Counting. Counts run on wedges cut from the same filter may vary by as much as plus or minus 30-40 percent

5. Microscope. Although many microscopes can meet the requirement of phase contrast illumination at 400-450X magnification, microscope resolution varies considerably from brand to brand.

6. Eye. Problems of resolution are not just limited to the microscope. The eyes of different "counters" can also vary. To minimize this error, the same individual(s) should always make the counts.

All of these errors can total (by compounding) plus or minus 40-50 percent, which means that in order for an inspector to cite a violation of the TWA portion of the present asbestos standard and have it stand up in court, the TWA should be at least 7.0-7.5 fibers/cm^3 greater than 5 microns in length. For the ceiling limit, the values would have to be 14-15 fibers/cm^3 greater than 5 microns in length for, by definition, a 15-minute sample. Conversely, in order for an employer to demonstrate compliance with these limits, typical workplace environmental levels would have to be 2.5-3.0 fibers/cm^3 respectively.

Asbestos Control Methods

Various methods of control have been applied successfully to handling or working with asbestos products to either minimize or eliminate worker asbestos exposure in the workplace. These include, but are not limited to:

1. Wet methods. Wetting down asbestos-reinforced insulations prior to demolition or rip-out and, to some extent, reapplication will reduce airborne asbestos levels in the breathing zone of affected workers by 80-85 percent, according to a 1970 publication entitled *Asbestos Exposure and Control at Puget Sound Naval Shipyard* by Mangold, Beckett, and Bessmer

The new proposed regulations on asbestos by the Environmental Protection Agency for building demolition and renovation stipulate wet-down practices as the asbestos control method of choice (the only exclusion being contractors who renovate or demolish buildings in subfreezing temperatures). Unfortunately, alternatives are not permitted, as the proposed regulations now read, to minimize damage to electrical equipment or to other water-sensitive equipment.

2. Substitution. Asbestos fiber substitutes (e.g., mineral wool, ceramic wool, and fiber glass), both alone, in mats or fluff, or as reinforcing fibers in friable magnesia or calcium silicate insulations can be used. Use of nonfibrous talcs, etc., represents other materials which, in most cases, will suffice.

To reiterate, however, these synthetic inorganic fiber substitutes may

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NIOSH Awards Research Contract

THE Stanford Research Institute, Menlo Park, Calif., has been awarded a 22-month research contract by the National Institute for Occupational Safety and Health (NIOSH). The purpose of this study is to examine the mortality experience of individuals who were employed in the Northwest plywood, pulp, and paper industries for at least 12 months between 1946 and 1960.

In particular, the contractor will assess if these employees experienced an excess mortality due to malignant disease. Where available, mill employment records will be analyzed, along with other sources of information. Association, company, union, NIOSH, and Stanford Research Institute representatives met in Cincinnati, Ohio to discuss research procedures.

Dr. Bobby F. Craft, division director of NIOSH, advised that NIOSH has a $50 million budget and 850 people for programs and project plans. The Northwest Plywood, Pulp, and Paper Mortality Study is one of 50 projects administered by the NIOSH Cincinnati office, which has a staff of 150. Dr Craft indicated that Leo Sanders is the contracting officer for the Northwest Study

Cynthia Robinson, NIOSH epidemiologist, and Dr. William Gaffey, contractor with SRI, reviewed the NIOSH study protocol Robinson reported that the study will include collecting personnel information from mill records and characterizing a mill environment by industrial hygiene survey. Dr. Gaffey reported that the cohort size would be 5,000, rather than 20,000 people as specified in the original study. Dr. Craft further indicated that the tripartite group would receive quarterly progress reports and that a meeting of this group would be held to review the study results prior to release.

It's scheduled to take about two years to complete under a $135,000 NIOSH contract. ▫

Asbestos

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have the same potential for inducing exposure-related disease as with asbestos.

3. Ventilation Two types of ventilation are usually available for control of occupational health hazards: a) general ventialtion, and b) local exhaust ventilation. Because of the potentially grave consequences of exposure and all the unknowns as to the precise level of asbestos fibers in the air which is safe to breathe without developing a mesothelioma 20-40 years later, general ventialtion in the control of asbestos is not an acceptable control method (within technical reason and economical feasibility). Local exhaust ventialtion, on the other hand, is an excellent control method for capturing asbestos fibers at the point of origin.

For high velocity mechanical operations on asbestos-containing products (drilling, sawing, and routing), the high velocity/low volume concept of dust control (as advocated by Hoffman Dust Control Systems) offers the best means, both economically and technically, for controlling the dust emissions from the power tool. In all cases where a local exhaust ventialtion system is used for control of asbestos-containing dusts, a baghouse should be included in the system. Cyclones, even high efficiency cyclones in series, are not efficient enough to control the emissions to the "no visible emissions" requirement of the EPA standard.

4. Handling practices. While this may seem so insignificant as not to warrant mention, employees handling asbestos-containing materials (especially dry) in a proper manner can reduce their exposures sufficiently by this route, in conjunction with other engineering controls, to comply with the OSHA standard.

5. Isolation. Control by isolation or enclosure is another way of minimizing or eliminating employee asbestos exposures in the workplace. This method has proven effective in control of carcinogen exposures and radiation (ionizing) exposure.

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Wood Dust, will be published next month.

Most Accidents Result from Commonplace Situations

ANYONE undertaking a review of the investigation reports received this year could not help but note two striking situations:

1. The injuries we have sustained have not been the by-products of major or disastrous events. The disabling injuries we have had, as serious as some of them have been, have not been associated with such potentially disastrous situations as runaway reactions, vessel ruptures, large volume vapor emissions, flammable liquid spills, or large scale process failures.

2. The accidents we have had that have accounted for our injuries have been the by-products of pedestrian, everyday kinds of malfunctions and malpractices. As personally severe as many of the injuries have been, they have not been the product of unusual, unpredictable, or exceptional events.

They have been the by-products of situations such as:

- failure to apply an established procedure.
- improvising because of an inadequate design.
- getting caught in moving equipment.
- shortcutting lockout procedures.
- employing a questionable practice because a safer alternative had not been established.

Stated in the cold, seemingly harsh and impersonal language of analysis, the second striking fact about the accidents we are having is that they are commonplace accidents. They are the products of ordinary, nonexceptional situations.

It is not the tigers that have been troubling us: the high pressure processes, the tremendous quantities of flammables, and the massive operations. These have not been the source of our disabling injuries Our high hazard installations, materials, and jobs are recognized as extremely hazardous. Therefore we know what is required to keep them in control and we take that extra effort to control them. We control them because they are obvious and because there is an awareness of the disastrous results should we fail.

There is good news in this fact There is also good news in the fact that the accidents we are having are the consequences of commonplace conditions and commonplace conduct Accidents that are the product of common failures, common neglect, and common events are more controllable. Therefore, they should be easier to correct.

There is unfortunate news in this fact, as well. It is our familiarity with material and jobs that makes us tend to neglect them. It is the minor task, the daily operation, and the repetitive performance that we neglect

- the sampling job we do four times each day
- the drums we open
- the vehicles we operate
- the hand tools we use
- the floors we walk over
- the stairs we descend.

These conditions, these little "ordinary dogs", the ones that are the easiest to defend ourselves against, are the ones that jump up and bite us

We are aware of the tigers The tigers are caged, but the dogs still run loose.

Accident Information
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