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IDENTIFICATION AND CONTROL OF ASBESTOS EXPOSURE

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Identification and Control of Asbestos Exposures

The unique physical and chemical characteristics of asbestos along with its abundance as a natural resource has contributed much to technological advances since the beginning of the century. This is especially true of industrial fiber technology which has had a tremendous growth since the 1940's.

From data developed through epidemiologic and laboratory research it is now apparent that special health problems may be associated with exposure to designated fibers and that the biologic response to some fibers may be quite distinct from that of particulates of the same chemical composition but of random spherical shape.

The biological consequences of fibers in the lungs must be determined and understood for establishing rational control standards. It is equally important that knowledge of the control of fibers in our environment be developed and applied. Otherwise, adverse experiences from health problems associated with the use of asbestos may inadvertently deprive us of the benefit of this natural resource and also cast a shadow that could impede future advancements in the application of fiber technology.

Identification and Measurement of Exposure to Asbestos

Numerous analytical techniques are available for identifying and distinguishing the physical and chemical characteristics of fibers. Because of the minute size of individual respirable fibers, often under 1 micron in diameter, and the similar characteristics of many of the fibers, as in the amphibole group, one technique by itself is seldom definitive in identifying individual fibers.

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The ubiquitous nature of respirable fibrous materials has been recently

reported (1.2). Mineral fibers may be present and dominant in a number of ores of commercial value, i.e., various forms of asbestos, or may be present in lesser but appreciable amounts in commercial minerals such as talcs and clays.

No problem is generally involved in the identification and measurement of air-borne levels of fibers associated with an industrial process where they are a dominant part of the mineral involved, such as asbestos. This is not true in instances where the fiber is present to a lesser extent in the mineral being processed, where more than one type of mineralogy may be present in the formation of the ore, or where mixtures of minerals may be processed. Without such knowledge supported by definitive identification and measurements, unsuspected hazards may be present from air-borne exposure to fibrous minerals. Conversely, the mere presence of fibers is not indicative that a hazard exists.

Analytical techniques useful in identifying individual fibers include electron microscopy and diffraction, emission and atomic absorption spectrophotometry, electron microprobe and laser microprobe in conjunction with a time of flight mass spectrometer and neutron activation analytical procedures. The use of such techniques requires specialists in the instrumentation involved and is time consuming and costly. This data however, provides an indispensable bridge of knowledge on the physical and chemical nature and relationship of fibers in the air at industrial operations. Less complicated methods of measurement can then be applied as an index of exposure upon which rational standards can be based.

This aspect of knowledge is especially important since past research (3) has shown that asbestos fibers differ greatly from one type to another in their chemical

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composition and the extraneous metals associated with the ores. Also, due to their hardness, the fibers may abrade and become contaminated with the metal alloys in which they are processed. The above analytical techniques are useful in determining the changing milieu of the fiber during processing.

Research over the past several years in the United Kingdom and the United States has shown that air-borne fiber levels are a much better index of exposure to asbestos than is an over-all particulate exposure since the ratio of fibers to over-all particulates in the air may vary greatly depending on the nature of the process and the materials involved. Revised standards for asbestos exposures in these countries (4,5) also stipulate methods for the collection and measurement of air-borne samples. The procedures (6,7) state that the samples should be collected on membrane filters and, after subsequent treatment, the fibers should be counted using phase contrast microscopy at 400x magnification.

Direct measuring dust counters that are capable of discriminating between different particle size ranges have been used to measure asbestos dust levels (8). When such an instrument is used it is essential that the ratio of the asbestos fibers to the over-all particulates remain relatively constant. These instruments should be frequently correlated and calibrated against data using the membrane filter and phase contrast microscopy method of fiber measurement. The main advantages of the automated dust counters over the manual method are in their saving of manpower and their capability of giving immediate data for assessing the proper functioning of dust

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control procedures.

Control of Asbestos Exposures

Special precaution should be taken to prevent exposure to asbestos fibers when they are handled in a loose (unbound) form. Such operations include mining, milling, shipping and warehousing, processing into products, and mixing and blending asbestos fibers with other materials. No special problem is normally encountered when the asbestos is firmly bound with other materials, i.e., vinyl asbestos tile, plastics, cement products, etc., except when these materials are reshaped or are diminuted and the fibers may become liberated, free, and released through friction, destruction, deterioration and the like.

The control of air-borne asbestos fiber is not greatly different from that of other particulates having a similar aerodynamic size, though special problems and technologies may be involved in processing and handling the fibers. The basic principles of preventing exposures to asbestos include exhaust ventilation, enclosure and isolation of exposures, wet methods, good housekeeping and maintenance, worker education, good work and sanitation habits, and supplimentary personal respirator protection where indicated. Asbestos should be handled and processed with adequate controls to prevent community contamination.

Exhaust ventilation is the control of choice since the asbestos fiber is captured before it can disseminate and contaminate the immediate and adjoining work areas. Requirements have been established for the proper ventilation design, fiber capture and carrying velocities, and enclosed baghouse collecting systems (9,10,11,12).

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Special attention should be given to the ventilation system because of the abrasive nature of the asbestos fibers.

Enclosure and isolation has many applications in the control of asbestos dust. This is especially true in the batch making and handling of loose asbestos, i.e., wetting of asbestos in bags before emptying, dumping and blending operations, etc. This precaution is extremely important in the handling of solid waste containing asbestos. Enclosure and isolation of the operation also prevents the dissemination of the fiber into other areas where workers not related to the operation may be unsuspectedly exposed.

Wet methods, where feasible, are an effective way of controlling dust. Examples include mixing, drilling, sawing, sanding, clean-up, and the like. Special precaution must be taken to assure that the sludge is handled properly and is not allowed to dry and become redisseminated into the air.

Good housekeeping and maintenance are essential where asbestos is handled and processed. Without such a program, a hazard may exist in an otherwise well constructed and operated plant. Elements of good housekeeping and maintenance include: (1) repairing leaks and improperly operating equipment, (2) immediate cleaning up of spills, (3) routine cleaning of all in-plant areas including floors, structural members, and equipment using vacuum cleaning and water, and, (4) cleaning of areas outside the plant and keeping dust allayed using water.

Worker education is often neglected as an effective way of minimizing dust exposure. A worker who is knowledgeable of the hazards associated with his job is

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more motivated to protect himself from related injurious agents. Workers should be instructed in the proper use of equipment and in good practices in the handling of material with which they are working.

Good work and sanitation habits are needed to complement other methods of preventing exposure to asbestos and other materials associated with its processing. Without good work habits, excessive dust can be created at operations otherwise adequately provided with dust control or where further dust control is unnecessary. Work clothing may become contaminated and provide a continuing source of exposure during the work shift. Excessive asbestos dust on the skin for prolonged periods favors skin irritation and penetration by the fiber. Workers should be instructed in the proper procedures for the performance of their jobs and in the observance of good sanitation practices while on the job.

Personal respiratory protection is an effective way of preventing exposure to dust where heavy intermittent levels are encountered and other means of protection are not feasible. Examples are equipment breakdown and maintenance and repair operations. When respirators are used, they should be approved for the exposures encountered. A routine program should also be formulated for selecting, issuing, fitting, cleaning, inspecting, and maintaining the respirators.

SUMMARY

Asbestos can be used safely in modern industrial technology if adequate precautions are taken to prevent excessive and unsuspected exposures. The following control program is recommended where loose asbestos is encountered:

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(1) Recognized engineering control procedures to prevent the dissemination of dust into the air should be used where loose asbestos [illegible] processed [illegible] other materials, or disposed of to ensure that exposure [illegible] within [illegible] limits and that other adjoining sites do not become [illegible].

(2) Asbestos should be packed in containers that [illegible] resistant to breakage, and which can be maintained in a clean condition during shipping, [illegible] and subsequent use.

(3) Storing of asbestos should be of such nature and in such [illegible] to minimize subsequent breakage of bags. Spillage from broken bags and adjacent areas should be vacuum cleaned immediately to prevent dispersion of the asbestos.

(4) Bags containing asbestos should be clearly marked and should have labels cautioning against breathing dust from the bags.

(5) All processing, handling, and dust control equipment should be maintained and kept in good repair.

(6) A rigid housekeeping program should be enforced.

(7) Asbestos waste should be disposed in a manner to prevent contaminating other areas in its handling or to prevent subsequent redispersion into the air.

(8) A worker education program should be established. Workers should be made aware of the danger of breathing asbestos dust, the proper use of equipment and controls, and of good sanitation and work habits.

(9) Approved respiratory protective equipment should be used where high intermittent exposures to asbestos occur and other means of controlling the exposure

are not feasible. A special program should be established for training, fitting, inspecting, and maintaining the respirators in satisfactory condition.

(10) Where excessive contamination of the work clothing is potential, workers should wear special clothing which should be changed at the end of the workshift and handled in a manner to prevent release of dust into areas outside the facility.

(11) Washroom facilities should be available where indicated, and special protective clothing should be used to prevent excessive contamination of the skin with asbestos fibers.

(12) The air in areas occupied by workers handling asbestos should be routinely monitored to assure that control procedures are adequate and that air-borne levels of asbestos dust are within safe limits.

(13) Workers handling asbestos should receive periodic medical examinations.

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