FILE NAME: Packings and Gaskets (PAG)

DATE: 1978

DOC#: PAG005

DOCUMENT DESCRIPTION: Book Excerpt - Asbestos and Disease

ENVIRONMENTAL SCIENCES

An Interdisciplinary Monograph Series

Editors: Douglas H. K. Lee, E. Wendell Hewson, and Daniel Okun

A complete list of titles in this series appears at the end of this volume.

Asbestos and Disease

By

Irving J. Selikoff

Director, Environmental Sciences Laboratory
Mount Sinai School of Medicine of the City University of New York
New York, New York

Douglas H. K. Lee

Consultant, Mount Sinai School of Medicine of the City University of New York
New York, New York
formerly Associate Director, National
Institute of Environmental Health Sciences
Research Triangle Park
North Carolina

with the active collaboration of

Henry A. Anderson	E. Cuyler Hammond	Coleman B. Rabin
Philip Chahinian	Duncan A. Holaday	Arthur N. Rohl
Jacob Churg	Milton Kannerstein	Robert J. Schnitzer
Susan Daum	Arthur M. Langer	Herbert Seidman
Theodore Ehrenreich	Ruth Lilis	Yasunosuke Suzuki
Alf Fischbein	William J. Nicholson	Alvin S. Teirstein

Mount Sinai School of Medicine of the City University of New York
New York, New York



Academic Press
New York San Francisco London 1978
A Subsidiary of Harcourt Brace Jovanovich, Publishers

Because of the manifold ways in which asbestos is processed or used, the specific methods appropriate to control will vary with the situation. Here we will simply point out the basic principles, illustrate them with some particular applications, and describe various procedures ranging from substitute materials to education. Several methods will need to be applied in combination to meet a specific situation. Industrial hygiene handbooks describe the various techniques in detail. The United States publications most frequently consulted in the compilation of this chapter are "Control Techniques for Asbestos Air Pollution"—U.S. Environmental Protection Agency 1973 (231); "Industrial Ventilation–A Manual of Recommended Practice"—American Conference of Governmental Industrial Hygienists (11); "The Industrial Environment–Its Evaluation and Control"—National Institute for Occupational Safety and Health, 1973 (540). Similar texts are published in other countries.

SUBSTITUTION OF LESS HAZARDOUS MATERIALS

What might be regarded as the first principle of prevention, the substitution of less hazardous for hazardous materials, is apt to encounter two major limitations in practice. The user, on the one hand, will want assurance that the substitute is going to do its job; the health specialists, on the other, will want to be certain that the substitute really is free from significant hazard. More than once it has transpired that the frying pan had been abandoned for the fire, to the chagrin of all concerned. Then, of course, there is always the question of costs: the relative cost of the two materials and the cost of making changes in manufacture and use. There are some aspects of asbestos fibers, such as fire resistance and mechanical stability, that are not so far as well exhibited by proposed substitutes, and a decision is often necessary as to whether these properties are really needed in a particular use. A good illustration of what can and cannot be done by way of substitution is given in Table 20-1 taken from a British naval publication (522). A similar situation is reported for United States naval shipyards (67).

The trade journal *Asbestos* indicated in 1972 that glass fiber is used as a substitute in heat insulation where light weight and high strength are needed, but that it is not a satisfactory replacement in friction materials, in asbestos-cement products, or in some highly specialized electrical insulation materials (36). Silicone products, organic compounds, and plastics are used as alternate materials in certain applications; calcium silicate, diatomite, and magnesia can reduce requirements for asbestos in some products. New types of heat-resistant plastics are being substi-

TABLE 20-1
Progress in Introducing Substitutes for Asbestos-containing Materials Specified by the Navy Department (522)

Application	Asbestos material	Progress in introduction of substitute materials
Thermal insulation in machinery spaces	Calcium–silicate sections and plastic	Now supplied asbestos-free and recognizable by its yellow or pink color. All calcium–silicate should be cut off ship so far as is practicable (Note: Calcium–silicate containing up to 14% asbestos is colored white).
	Amosite–asbestos sections and plastic	No longer used, replaced by calcium–silicate. A large number of existing ships are insulated with amosite; delagging operations will involve the full implementation of D.C.I. 510/69.
	Self-setting finishing cement for high temperature insulation BD2 cement	An asbestos-free substitute is now specified.
	New-tempheit	Deleted from specifications. Replaced by calcium–silicate.
	Asbestos cloth	Glass–cloth is now specified. Dust emitted from this cloth is an irritant but not a health hazard. Work is continuing to make this cloth less objectionable to handle.
	Asbestos rope and twine	Deleted from specifications. Glass is now specified.
	Asbestos mattresses	Mattresses of rocksil fiber covered with glass–cloth are now approved and in supply.
Local protection against fire	Asbestos millboard (very little used)	Deleted from specifications.

TABLE 20–1 (*Continued*).

Application	Asbestos material	Progress in introduction of substitute materials
	Asbestos cloth (more frequently used)	Dust suppressed cloth is now specified. No prospect seen of finding a substitute fire resistant material. Main applications are hangar fire curtains, curtains in magazines, and protection in way of welding and burning operations. Magazines will be separately compartmented in new construction and at long refits of existing ships. Glass–cloth is not acceptable for these usages.
Fire protection in magazines where jet efflux presents a potential hazard	Durestos (resin-bonded asbestos fiber)	No substitute material suitable for this purpose. Material is supplied by manufacturer to exact sizes required. There is therefore no health hazard in shipyard application.
Thermal insulation of hull structure	Sprayed limpet asbestos Blue-block asbestos or Amosite board	Deleted from specifications. Mineral fiber marine board, which is asbestos-free, is now specified. Any ships still insulated with sprayed limpet asbestos will require full implementation of D.C.I. 510/69 for delagging operations.
	Asbestos fiber and cloth for pipe covering	Deleted from specifications. Replaced by polyurethane or mineral fiber preformed sections with canvas covering, which are all asbestos-free.
Acoustic insulation of hull structure	Paxtiles, Paxfelt, Paxmarine	Deleted from specifications. Existing stocks are being kept for small repairs only. Replaced by mineral fiber resin bonded slab, which is asbestos-free.
	Amosite asbestos	Deleted from specifications. Replaced by mineral fiber marine board.
	Limpet asbestos board	Deleted from specifications. Replaced by perforated PVC sheet (Darvic).
High temperature jointing and packing materials	Asbestos fiber Compressed asbestos fiber	No substitute heat resistant material. No health hazard in forms used in shipyard applications.
Bearing materials brake linings	Asbestos reinforced plastics	No substitute wear-resistant material. No health hazard except if these materials are ground or worked (no known requirement for this).
Bathroom and galley deck coverings	Neoprene terrazzo	Asbestos-free neoprene terrazzo now available. Dockyards and overseers have been informed that this is the only acceptable material.
Partition bulkheads	Compressed asbestos sandwiched between metal, plywood, plastic sheets, etc. e.g. Marinite, Solastos	Deleted from specifications which now state that materials containing asbestos are not to be used. Steel, aluminum, or plywood will generally be used pending investigations into alternative asbestos-free materials.
Covers to bunk, settee and seat locker cushions and mattresses in submarines	Asbestos cloth (untreated, i.e. not dust-suppressed)	Deleted from specification. Fire retardant foam mattresses now approved.

493. McClure, H. M., and Graham, C. E., Malignant uterine mesotheliomas in squirrel monkeys following diethylstilbesterol administration. *Lab. Anim. Sci.* **23**, 493 (1973).
494. McCrone Associates, "Dispersion Staining" (Offset). Chicago, Illinois (undated).
495. McCullagh, S. F., The biological effects of asbestos. *Med. J. Aust.* **II**, 45 (1974).
496. McDonald, A. D., and McDonald, J. C., Epidemiological surveillance of mesothelioma in Canada. *Can. Med. Assoc. J.* **109**, 359 (1973).
497. McDonald, A. D., and McDonald, J. C., Epidemiology of mesothelioma from estimates of incidence. *Prev. Med.* (in press).
498. McDonald, J. C., Cancer in chrysotile mines and mills. *In* "Biological Effects of Asbestos" (P. Bogovski *et al.*, eds.), IARC Sci. Publ. No. 8, p. 189. IARC, Lyon, 1973.
499. McDonald, J. C. *et al.*, Mortality in the chrysotile asbestos mines and mills of Quebec. *Arch. Environ. Health* **22**, 677 (1971).
500. McDonald, J. C. *et al.*, The health of chrysotile asbestos mine and mill workers of Quebec. *Arch. Environ. Health* **28**, 61, (1974).
501. McEwen, J. *et al.*, Mesothelioma in Scotland. *Br. Med. J.* **IV**, 575 (1970).
502. McGowan, L., Bunnag, B., and Arias, L. F., Mesothelioma of the abdomen in women. Monitoring of therapy by peritoneal fluid study. *Gynecol. Oncol.* **3**, 10 (1975).
503. McPheeters, S. B., A survey of a group of employees exposed to asbestos dust. *J. Ind. Hyg. Toxicol.* **18**, 229 (1936).
504. Meikeljohn, A., The origin of the term "pneumonokoniosis." *Br. J. Ind. Med.* **17**, 155 (1960) [transl. of Zenker (808a)].
505. Merchant, J. A. *et al.*, The HL-A system in asbestos workers. *Br. Med. J.* **I**, 189 (1975).
506. Merewether, E. R. A., "Annual Report, Chief Inspector of Factories and Workshops for England and Wales." HM Stationery Office, p. 63. London, 1933–1934.
507. Merewether, E. R. A., A memorandum on asbestos. *Tubercle* **15**, 69 (1933–1934).
508. Merewether, E. R. A., A memorandum on asbestos (3rd install.). *Tubercle* **15**, 152 (1933–1934).
509. Merewether, E. R. A., "Annual Report of the Chief Inspector of Factories." HM Stationery Office, London, 1947.
510. Merewether, E. R. A., and Price, C. V., "Report on Effects of Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry." HM Stationery Office, London, 1930.
511. Merliss, R. R., Talc-treated rice and Japanese stomach cancer. *Science* **173**, 1141 (1971).
512. Meurman, L. O., "Asbestos bodies and pleural plaques in a Finnish series of autopsy cases." *Acta Pathol. Microbiol. Scand., Suppl.* **181** (1966).
513. Meurman, L. O., Pleural fibrocalcific plaques and asbestos exposure. *Environ. Res.* **2**, 30 (1968).
514. Meurman, L. O., Kiviluoto, R., and Hakama, M., Mortality and morbidity among the working population of anthophyllite asbestos miners in Finland. *Br. J. Ind. Med.* **31**, 105 (1974).
515. Miller, A. *et al.*, "Nonspecific" interstitial pulmonary fibrosis—association with asbestos fibers detected by electron microscopy. *N. Engl. J. Med.* **292**, 91 (1975).
516. Miller, J., and Wynn, W. H., A malignant tumour arising from the endothelium of the peritoneum, and producing a mucoid ascitic fluid. *J. Pathol.* **12**, 267 (1908).
517. Miller, K., Harington, J. S., and Macnab, G., Effects of asbestos on macrophages in culture. *S. Afr. Med. J.* **46**, 819 (1972).
518. Miller, L., Smith, W. E., and Berliner, S. W., Tests for the effect of asbestos on benzo (a) pyrene carcinogenesis in the respiratory tract. *Ann. N. Y. Acad. Sci.* **132**, 489 (1965).

519. Mills, R. G., Pulmonary asbestosis. Report of a case. *Minn. Med.* **13**, 495 (1930).
520. Milne, J., Fifteen cases of pleural mesothelioma associated with occupational exposure to asbestos in Victoria. *Med. J. Aust.* **II**, 301 (1969).
521. Milne, J. H., Thirty-two cases of mesothelioma in Victoria, Australia: A retrospective survey related to occupational asbestos exposure. *Br. J. Ind. Med.* **33**, 115, (1976).
522. Ministry of Defense (Navy), "Working with Asbestos," N/L 90/66. Min. Defence, Labour Div. (Naval), London, 1970.
523. Moolten, S. E., Industrial pneumoconiosis in New Jersey. *J. Med. Soc. N. J.* **66**, 557 (1969).
524. Morgan, A., and Cralley, L. J., Chemical characteristics of asbestos and associated trace elements. *In* "Biological Effects of Asbestos" (P. Bogovski *et al.*, eds.), IARC Sci. Publ. No. 8, p. 113. IARC, Lyon, 1973.
525. Morgan, A., Holmes, A., and Gold, C., Studies of the solubility of constituents of chrysotile asbestos in vivo using radioactive tracer techniques. *Environ. Res.* **4**, 558 (1971).
526. Morgan, C., Trouble in the auto repair shop. *Job Safety Health* Dec., 21 (1976).
527. Morgan, W. K. C., and Seaton, A., "Occupational Lung Diseases." Saunders, Philadelphia, Pennsylvania, 1974.
528. Mortimer, R. H., and Campbell, C. B., Asbestos exposure and pleural mesotheliomas. *Med. J. Aust.* **II**, 720 (1968).
529. Moskowitz, R. L., Talc pneumoconiosis: A treated case. *Chest* **58**, 37 (1970).
530. Mossman, B. T., and Craighead, J. E., Interaction of crocidolite asbestos with the mucociliary epithelium of the respiratory tract. *Proc. Am. Assoc. Cancer Res.* **17**, 88 (1976).
531. Müller, H., Pleural calcification in pulmonary asbestosis. *Radiol. Diagn.* **3**, 33 (1962).
532. Murphy, R. L. H., and Ferris, B. G., Manifestations of asbestosis v. duration of exposure and age. Personal communication (1967).
533. Murphy, R. L. H. *et al.*, Floor installation as a source of asbestos exposure. *Am. Rev. Respir. Dis.* **104**, 576 (1971).
534. Murphy, R. L. H. *et al.*, Effects of low concentrations of asbestos: Clinical, environmental, radiologic and epidemiological observations in shipyard pipe coverers and controls. *N. Engl. J. Med.* **285**, 1271 (1971).
535. Murphy, R. L. H. *et al.*, Low exposure to asbestos. Gas exchange in ship pipe coverers and controls. *Arch. Environ. Health* **25**, 253 (1972).
536. Nakamura, I., Clinical and pathological studies of pulmonary asbestosis. *J. Nara Med. Assoc.* **18**, 455 (1967).
537. National Board of Occupational Safety and Health (Sweden), "Asbest." Arbetarskyddsstryelsens Anvisningar No. 52. Stokholm, 1975.
538. National Institute for Occupational Safety and Health, "Determination of Magnitude of Exposure to Asbestos Fibers Associated with a Woman's Coat Containing 8% Asbestos," NIOSH Rep. 223. NIOSH, Washington, D.C., 1971.
539. National Institute for Occupational Safety and Health, "Criteria for a Recommended Standard—Occupational Exposure to Asbestos," HSM72-10267. Dept. of Health, Education and Welfare, Washington, D.C., 1972.
540. National Institute for Occupational Safety and Health, Sampling air for particulates. *In* "The Industrial Environment—Its Evaluation and Control" (NIOSH), p. 139, US Govt. Printing Office, Washington, D.C., 1973.
541. Navrátil, M., and Trippé, F., Epidemiological study of pleural calcifications in persons living in the area close to an asbestos factory. *Pneumoconiosis, Proc. Int. Conf., 4th, 1971* p. 277, Apimondia Pub. House, Bucharest (1971).