FILE NAME: Brakes (BRK)

DATE: 198c

DOC#: BRKмлл

DOCUMENT DESCRIPTION: D2Ø Ly†2 .22]fŜú π t№ŜØŜyűλy∃ !ăōŜăú2ă 5λăŜl·äŜ !Y2y∃ !dzű2 aŜŎKl·yλŎă

PREVENTING ASBESTOS DISEASE AMONG AUTO MECHANICS

I. MECHANICS' EXPOSURE TO ASBESTOS

Friction materials, such as brake linings and clutch facings, often contain asbestos. Millions of asbestos fibers can be released during brake and clutch servicing (1-8). Grinding and bevelling friction products can cause even higher exposures (1,8). Like germs, asbestos fibers are small enough to be invisible and they can remain and accumulate in the lungs. When you see a dust cloud during brake work, you are seeing clumps containing thousands of fibers. Most of the smaller fibers will not show up with the methods commonly used for measuring asbestos levels in the air, such as the method used to determine compliance with the OSHA asbestos standard, since most asbestos fibers in brake dust are too small to be measured by these methods (1-3,5-8).

Asbestos released into the air lingers around a garage long after a brake job is done and can be breathed in by everyone inside a garage, including customers. While lowering exposure lowers risk, there is no known level of exposure to asbestos below which health effects do not occur (9-12). The EPA has proposed phasing out the use of asbestos products. In situations where asbestos exposures cannot be eliminated entirely, they should be reduced to the lowest possible level (9,13).

Asbestos can be carried on work clothing, contaminating the family car and home. This can cause asbestos disease among family members. An ordinary house vacuum cleaner cannot collect these asbestos fibers, since its filter is not fine enough to trap them. In fact, an ordinary house vacuum cleaner is likely to stir these fibers up and and scatter them into the air.

Asbestos can also get on a mechanic's hands and be swallowed when eating or smoking a cigarette. This is a particularly difficult problem for mechanics, since they often get grease on their hands and asbestos fibers can stick to the grease.

II. HEALTH EFFECTS OF ASBESTOS EXPOSURE

Until the use of asbestos products is phased out, the best way of limiting health damage to workers exposed to asbestos is to

use proper controls. It is not possible to predict whether an individual person exposed to asbestos will later develop asbestos-related disease. But studies of disease patterns among large groups of workers exposed to asbestos make general observations possible. The following can be the consequences of inadequate prevention:

Asbestosis

Asbestos exposure can cause scar tissue to form in the lungs. This is a very gradual process that usually takes many years before its effects are noticed. This scarring is called asbestosis. It causes gradually increasing shortness of breath. A person with this disease must breathe harder and deeper to get his or her breath because the scar tissue makes it harder for oxygen to get into the blood stream. This scarring is caused by repeated exposures to asbestos and is permanent. Nearly one half of mechanics who work for many years without proper control measures can develop this scarring (7,14).

Cancer

1. Mesothelioma

Mesothelioma is a type of fatal cancer of the lining of the chest or abdominal cavity. It can be caused by very low exposures to asbestos. This cancer has occurred among brake mechanics (15-20), their wives (20), and their children (21).

2. Lung Cancer

Lung cancer is currently responsible for the largest number of deaths from exposure to asbestos (22). Even short-term occupational exposures have been shown to increase the risk of lung cancer (22-24). Each added exposure increases the risk of cancer. Like asbestos, smoking can independently cause lung cancer, increasing the risk by about 10 times. When smokers are exposed to asbestos, the risks do more than add together; they actually multiply. For example, asbestos insulators who smoke have a lung cancer risk over fifty times higher than nonsmokers without asbestos exposure. However, stopping smoking greatly reduces this risk, even if a person has smoked for many years. Smokers who have been exposed to asbestos should be especially encouraged to stop smoking. The extent of risk of lung cancer among mechanics is not now known; but, given the known lung cancer risk among other groups exposed to asbestos, caution is necessary.

3. Other Cancers

Other cancers which appear to be caused by asbestos include cancer of the voice box (25,26) and of the stomach and large intestine (27, especially page 315).

Latency Period

It usually takes 15 to 30 years or more for cancer or asbestos lung scarring to show up after exposure. (Scientists call this the latency period.) Until then, the victim often feels fine. This gives a false sense of security. For example, if one touches a hot stove, one gets burned right away. With asbestos, the damage isn't obvious until many years later. This false sense of security can easily lead a worker and/or supervisor to follow work practices which can cause harmful exposures, since they are not aware that disease may develop later.

III. MEDICAL TESTS

Medical tests only discover asbestos-related disease after it has developed. In some cases, where the condition may be curable, especially with asbestos-related cancers of the large intestine and voice box, early detection can be very important.

Asbestosis

Asbestosis, or lung scarring from asbestos, is permanent and cannot be treated. It is diagnosed by chest x-rays, breathing tests (called lung or pulmonary function tests), and/or listening to the lungs, together with a history of exposure to asbestos. Very early asbestosis may be missed by these techniques. Early asbestosis is difficult to see on a chest x-ray and is best evaluated by a doctor who has experience and/or specialized training with asbestosis. (This type of specialist is called a "B reader" of x-rays.)

Lung Cancer

Very often lung cancer from asbestos has already spread by the time it can be seen on a chest x-ray or by tests of the phlegm. This is why more frequent tests for lung cancer do not help the average person who develops this cancer to live longer. Lung cancer is thus a condition needing prevention more than early detection and cure.

Intestinal Cancer

Cancer of the large intestine can often be detected early by yearly exams of the rectum and sigmoid area, with a hemoccult test for blood in the stool. Early detection and treatment of this condition can result in cure.

Voice Box Cancer

Voice box cancer can often be discovered at a curable stage by a medical exam. It may show up as hoarseness that does not go away in a few weeks.

IV. EXTENT OF EXPOSURE DURING BRAKE AND CLUTCH MAINTENANCE

Using a compressed air hose to clean drum brakes can release up to 16 million asbestos fibers in the cubic meter of air around a mechanic's face (1).* Even hitting a brake drum with a hammer can release over a million asbestos fibers (4). Much less dust from asbestos-lined disc brake pads will settle on disc brakes, but some dust can get on a mechanic's hands and into the garage air during maintenance. The asbestos fibers released from brake and clutch work can be scattered throughout a garage, where they can present a hazard for months or years.

Because of this, many garages are now turning to newer methods for brake cleaning. However, some of these newer methods may actually contribute to the problem. For example, millions of asbestos fibers can be released from drum brakes with these methods:

Wiping with a dry rag or brush (1-3).

Wiping with a wet rag or brush (2,3). The water doesn't prevent scattering of much of the asbestos, and when the rag dries or is shaken, asbestos is spread around the garage.

Liquid squirt bottles or solvent sprays (3). The water or solvent under pressure scatters much of the asbestos, and when it dries the asbestos is still all over the surrounding work surfaces. Brake cleaning equipment using these methods with a brush or squirt gun is likely to have the same problems. In fact, measurements from one manufacturer using a liquid spray system showed that over a million fibers can be released near a mechanic's face (28). Using a specially designed low-pressure spray and properly collecting and disposing of contaminated liquid may prevent some asbestos from spreading around the garage. Some recirculating wet method equipment uses a solvent to collect brake dust into a tray. If the solvent evaporates from the tray, normal air currents easily lift the asbestos fibers back into the air.

Using a garden hose may prevent some brake dust from becoming airborne, but this can easily contaminate the garage floor or other work areas by scattering the asbestos.

Using a standard shop vacuum cleaner. A shop vacuum cleaner can spread asbestos about a garage as much as does a compressed air hose (6: using a shop vacuum cleaner raised asbestos concentrations in adjacent bays to levels greater than those found using a compressed air hose). A shop vacuum cleaner filter is not fine enough to collect asbestos fibers.

All of these brake cleaning methods can release enough asbestos into a garage (6,29) so that an average of over one million of the larger fibers could be breathed each day by workers in that garage. These brake cleaning methods can also cause customers to be exposed, since asbestos from brake work can be spread 75 feet away from the mechanic (1).

When grinding is done to renew used brake block linings, concentrations of up to seven million asbestos fibers per cubic meter can be released. Bevelling new linings can release concentrations of up to 72 million fibers and light grinding of new linings of up to 4.8 million fibers (7).

V. CONTROLLING EXPOSURES

NIOSH, OSHA, and EPA recommend that where asbestos exposures cannot be eliminated, they must be controlled to the lowest level possible (9,13). Effective containment prevents problems associated with housekeeping and with stirring up settled dust (13). The best approach is to contain brake dust and prevent its release into a garage.

Brake Cleaning

Enclosure equipment for brake cleaning is available, which slips easily over the brake assembly and forms a tight seal against the backing plate. A compressed air system can then be used inside this type of enclosure system for good brake cleaning without exposing the brake mechanic or others Clear plastic

**These are the larger fibers measured by common methods for counting asbestos fibers. The very small ones are far more numerous, but can be only be seen with the electron microscope.*

walls or windows allow easy visibility of the work being done. Brake dust is sucked into a vacuum cleaner equipped with a special filter called a HEPA or "high-efficiency particulate air" filter. Only this type of filter can capture the small, invisible asbestos fibers. Non-permeable glove attachments on some equipment allow a mechanic to do work inside the enclosure without getting asbestos on the hands. If glove attachments are available only as an option, this option should be selected.

How to Use Enclosure Equipment for Cleaning Drum Brakes

Steps for using this type of equipment on drum brakes are simple:

1. Check that the hose is securely fastened to the HEPA vacuum container and to the brake enclosure. Also check that the vacuum container seals and clips are in proper functioning order according to the manufacturer's instructions.
2. Remove the wheel.
3. Turn on the asbestos vacuum cleaner.
4. Place the enclosure over the drum, making sure it forms a tight seal behind the backing plate.
5. Place hands into the attached rubber gloves.
6. Remove the brake drum. Some equipment allows use of a hammer or other tools inside the enclosure for drums that are hard to remove.
7. Blow dust off the drum and brake assembly using the air gun attachment inside the enclosure.
8. Blow dust off all inside surfaces of the enclosure towards the vacuum exit using the air gun attachment inside the enclosure.
9. Remove the enclosure and turn off the vacuum cleaner.

If grease accumulates on the inside surfaces of the enclosure, clean according to the manufacturer's instructions with a soft cloth and with the vacuum running. Dispose of the cloth according to OSHA regulations (30). This cloth should not be handled with bare hands.

Disc Brakes

For disc brakes, vacuum the pads, rotor, and caliper directly with a crevice attachment and avoid handling them before vacuuming.

Filter Change and Waste Disposal

Asbestos vacuum cleaners have several filters. Changing filters and disposing of asbestos waste can release dangerous concentrations of asbestos unless done properly. Some equipment allows for filter or collection bag change while the vacuum motor is running. This draws loose brake dust into the vacuum collector and away from the mechanic, reducing the risk of exposure. Some equipment has a renewable main filter that can be cleaned repeatedly without opening the vacuum cleaner. Ideally, all vacuum equipment should be designed to prevent opening the vacuum chamber when the vacuum motor is turned off, since opening the chamber can cause release of collected asbestos into the air.

Always follow the manufacturer's instructions for filter or collection bag change. Request a demonstration and practice session from the manufacturer to go through all steps for equipment use and filter or collection bag change, until each person who is to use this equipment is completely familiar with these procedures. Place the filter or collection bag directly into a 6 mil (heavy) plastic bag and double tie. Place the bag directly into a 55-gallon drum or similar leakproof, air-tight container designated for asbestos waste according to OSHA regulations (30) and mark it as follows:

CAUTION
Contains Asbestos Fibers
Avoid Breathing Dust
Breathing Asbestos Dust Can Cause Lung Disease and Cancer

Keep this drum for asbestos waste locked between filter or collection bag changes. Transport and disposal of asbestos waste should be done only by individuals familiar with procedures for handling asbestos waste in accordance with EPA's asbestos disposal guidance (31).

Clutch Repair

Significant exposure can also occur during clutch repair. Since a mechanic's head is typically under the clutch assembly during clutch repair, asbestos often falls on a mechanic's face and clothing. Enclosure equipment with a HEPA vacuum cleaner to prevent this exposure is under development.

Non-Asbestos Brake Linings

The use of non-asbestos friction materials is increasing. Available information suggests that none of these substitute materials is as dangerous as asbestos. Unless a mechanic is certain before brake work starts that a particular vehicle's brakes are not lined with asbestos, it should be assumed for the sake of caution that there is asbestos in the brake dust. In addition, friction materials often contain adhesives, toxic metals, and other hazardous chemicals which can harm the body (2). Thus, even for non-asbestos friction products, an enclosure system can control exposures to materials which may be harmful.

What to Look for in Enclosure Equipment for Brake Cleaning

Recommended features to look for in selecting enclosure equipment include:

1. Features which prevent hand contact with asbestos, including rubber (or other non-permeable) gloves to cover both hands. Look for attached gloves with no spaces for leakage. If attached gloves are not standard with the equipment, they should be selected as an option.

2. Enclosures large enough to fit around the biggest size brake drums likely to be encountered to prevent exposure during drum removal.

3. Reports of air sampling with analysis by transmission electron microscopy that show no release of asbestos fibers when using this equipment during brake maintenance. This helps ensure against design defects.

4. A sturdy seal behind the backing plate to prevent leakage during blow out.

5. A pressure gauge or manometer indicating when vacuum filter change or cleaning of renewable filter is needed. This helps ensure effective suction during use.

6. Safety of filter change or renewable filter cleaning. Ideally, future models of these devices will have a feature that prevents opening the filter housing while the vacuum motor is switched off.

Enclosure system manufacturer information is discussed in references 32-35.

Machining and Bevelling

Whenever possible, pre-ground, installation-ready brake linings and clutch facings should be used. If friction materials must be arced, this should be done by lathe-turning at low speed, rather than by grinding. Linings should not be ground to fit brake systems for which they were not designed. Where friction materials must be machined, bevelled, or lathe-turned, adequate local exhaust ventilation equipment connected to a HEPA vacuum collector should be used to prevent mechanic exposure and shop contamination. Such equipment should be designed and set up by a professional ventilation engineer, using specifications such as those found in the American Conference of Governmental Industrial Hygienists' ventilation manual (36) as a minimum design standard. There must be a comprehensive asbestos control and monitoring program where machining, bevelling, or lathe-turning is done (30).

Special Areas for Brake Work

Eating, drinking, and smoking should not be done in an area where brake work is done. Mechanics should wash their hands and face before eating and wash all exposed skin and change clothes before going home. If possible, work clothes should be laundered at special facilities equipped to wash clothing contaminated with asbestos. Smokers should be urged to quit and, if necessary, be provided assistance in entering a smoking cessation program. Accidental spillage of brake dust should be promptly vacuumed with a HEPA vacuum.

VI. RESPIRATORS

The National Institute for Occupational Safety and Health (NIOSH) recommends the use of engineering controls and good work practices as the primary means of reducing exposures (9,13). Proper use of a respirator specially recommended for asbestos (37) when using the brake cleaning methods described in Part IV of this guidance can only protect a mechanic while the respirator is being worn. Since any of the brake cleaning methods described in Part IV could contaminate a garage with brake dust, mechanics and other employees would have to wear such a respirator all day to be protected. In addition, effective respirator use requires a complete respiratory protection program, including worker training, medical evaluations, proper respirator selection and maintenance, fit testing, and periodic inspections. Furthermore, NIOSH and EPA recommend only certain air-supplied respirators for asbestos exposure (37). These respirators could be very cumbersome in a garage setting.

Air-purifying respirators with HEPA cartridges may be appropriate for secondary protection during floor cleaning, filter or collection bag changing, and waste disposal. Air-purifying respirators with HEPA cartridges should be used only as a precaution against the accidental disturbance of asbestos, and not as a substitute for effective engineering controls. It should be noted that, while NIOSH and EPA do not recommend the use of air-purifying respirators with HEPA cartridges in asbestos environments, various existing regulations currently allow their use.

Additional Information

This guidance was prepared to support technical materials being developed by the Federal Brake Mechanic Education Program under EPA's Asbestos Action Program. The following are additional sources of information on asbestos:

EPA Regional Asbestos Coordinators

(CT, MA, ME, NH, RI, VT)
EPA Region I
JFK Federal Building
Boston, Mass. 02203
(617) 223-0585

(NJ, NY, PR, VI)
EPA Region II
Woodbridge Avenue
Edison, N.J. 08837
(201) 321-6668

(DE, MD, PA, VA, WV)
EPA Region III
Curtis Building
6th and Walnut Streets
Phila., Penna 19106
(215) 597-9859

(AL, FL, GA, KY,
MS, NC, SC, TN,)
EPA Region IV
345 Courtland St., N.E.
Atlanta, Georgia 30365
(404) 881-3864

(IL, IN, MI, MN, OH, WI)
EPA Region V
230 S. Dearborn St.
Chicago, Ill. 60604
(312) 886-6003

(AR, LA, NM, OK, TX)
EPA Region VI
Internfirst II Bldg.
1201 Elm Street
Dallas, Texas 75270
(214) 767-2734

(IA, KA, MO, NE)
EPA Region VII
726 Minnesota Ave.
Kansas City,
Kansas 66101
(913) 236-2835

(CO, MT, ND, SD, UT, WY)
EPA Region VIII
One Denver Place
999 18th St., Suite 1300
Denver, Colorado 80202
(303) 293-1730

(AZ, CA, HI, NV, CM,
American Samoa, Guam)
EPA Region IX
215 Fremont Street
San Francisco, CA 94105
(415) 974-8588

(AK, ID, OR, WA)
EPA Region X
1200 6th Avenue
Seattle, Wash. 98101
(206) 442-2870

EPA TSCA Assistance Office

(202) 554-1404

Consumer Product Safety Commission

For information on asbestos in consumer products or homes
(800) 638-2772

NIOSH

National Institute for
Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, Ohio 45226
(513) 533-8323

U.S. Occupational Safety and Health Administration

OSHA Office of Information and
Consumer Affairs, Room N-3637
200 Constitution Avenue, N.W.
Washington, D.C. 20210
(202) 523-8151

References

1. Rohl, A.N., Langer, A.M., Wolff, M.S., and Weisman, I. Asbestos Exposure during Brake Lining Maintenance and Repair. Environmental Research 12:110-128. 1976.

2. NIOSH. Report 32.4 Industrial Hygiene Summary Report of Asbestos Exposure Assessment for Brake Mechanics. November 22, 1982.

3. PEI Associates. Asbestos Dust Control in Brake Maintenance. EPA Office of Pesticides and Toxic Substances Contract No. 68-02-3976. September 30, 1985.

4. GCA Corporation. Asbestos Product Test Results. EPA Office of Pesticides and Toxic Substances Contract No. 68-02-3168. February 1980.

5. Hatch, D. Possible Alternatives to Asbestos as a Friction Material. Annals of Occupational Hygiene 13:25-29. 1970.

6. Knight, K.L. and Hickish, D.E. Investigations and Alternative Forms of Control for Dust Generated during Cleaning of Brake Assemblies and Drums. Annals of Occupational Hygiene 13:37-39. 1970.

7. Lorimer, W.V., Rohl, A.N., Miller, A., Nicholson, W.J., and Selikoff, I.J. Asbestos Exposure of Brake Repair Workers in the United States. Mount Sinai Journal of Medicine 43:207-218. 1976.

8. Rohl, A.N., Langer, A.M., Klimentidis, R., Wolff, M.S., and Selikoff, I.J. Asbestos Content of Dust Encountered in Brake Maintenance and Repair. Proceedings of the Royal Society of Medicine 70:32-37. 1977.

9. NIOSH-OSHA Asbestos Work Group. Workplace Exposure to Asbestos: Review and Recommendations. DHHS (NIOSH) Publication No. 81-103. November 1980.

10. OSHA. Occupational Exposure to Asbestos: Emergency Temporary Standard. Federal Register Vol. 48, No. 215. November 4, 1983.

11. National Research Council. Asbestiform Fibers: Nonoccupational Health Risks. National Academy Press. 1984.

12. Chronic Hazard Advisory Panel on Asbestos. Report to the U.S. Consumer Product Safety Commission. July 1983.

13. NIOSH. Statement of the National Institute for Occupational Safety and Health. Public Hearing on Occupational Exposure to Asbestos. June 21, 1984.

14. Nicholson, W.J. Investigation of Health Hazards in Brake Lining Repair and Maintenance Workers Occupationally Exposed to Asbestos. NIOSH Contract No. 210-77-0119. February 1983.

15. McDonald, A.D., Harper, A., El Attar, O.A., and McDonald, J.C. Epidemiology of Primary Malignant Mesothelial Tumors in Canada. Cancer 26:914-919. 1970.

16. Greenburg, M. and Lloyd Davies, T.A. Mesothelioma Register 1967-68. British Journal Of Industrial Medicine 31:91-104. 1974.

17. Newhouse, M.L. and Thompson, H. Mesothelioma of the Pleura following Exposure to Asbestos. British Journal of Industrial Medicine 22:261-269. 1965. (Table on p. 269, case #58.)

18. NIOSH. Asbestos: Asbestos Exposure during Servicing of Motor Vehicle Brake and Clutch Assemblies. Current Intelligence Bulletin 5. August 8, 1975.

19. Langer, A.M. and McCaughey, W.T.E. Mesothelioma in a Brake Repair Worker. Lancet 8307:1101-1103 November 13, 1982.

20. Ziem G. Three case reports of mesothelioma in brake mechanics. In: Castleman, B. Asbestos: Medical and Legal Aspects. Harcourt Brace Jovanovich. 1984. (Four additional cases in mechanics and a case in a mechanic's wife in publication.)

21 Yorkshire Television. "Alice: A Fight for Life." July 14, 1982. (Mesothelioma in a ten-year old son of brake mechanic described and filmed.)

22. EPA. Asbestos; Proposed Mining and Import Restrictions and Proposed Manufacturing Importation and Processing Prohibitions. Federal Register Vol. 51, No. 19. January 29, 1986.

23. Seidman, H., Selikoff, I.J., and Hammond, E.C. Short-term Exposure to Asbestos and Long Term Observation. Annals of the New York Academy of Sciences 330:61-90. 1979.

24. EPA. Support Document for Final Rule on Friable Asbestos-Containing Materials in School Buildings: Health Effects and Magnitude of Exposure. January 1982.

25 Stell, P.M. and McGill, T. Asbestos and Laryngeal Cancer. Lancet 7826:416-417. August 25, 1973.

26. Shettigara, P.T. and Morgan, R.W. Asbestos, Smoking and Laryngeal Carcinoma. Archives of Environmental Health 30:517-519. 1975.

27. Selikoff, I.J. and Lee, D.K. Asbestos and Disease. Academic Press. 1978.

28. National Loss Control Service Corportation. Report of Industrial Hygiene Study for Ammco Tools, Inc. 1978.

29. Data from reference 3 show TWA levels with these methods at about 200,000 fibers per cubic meter. The average worker doing light to moderate work, such as a mechanic, breathes ten cubic meters of air during an eight-hour work day, thus inhaling about two million asbestos fibers daily. Rohl's data (reference 1) shows that levels twelve feet away using a dry brush were the same as using a compressed air hose. His data also show shop contamination of 100,000 fibers per cubic meter at distances of up to 75 feet from the site of compressed air use, and other measurements indicating significant scatter.

30. OSHA. 29 CFR 1910.1001.

31. EPA. Asbestos Waste Management Guidance - Generation, Transport, Disposal. EPA/530-SW-85-007. May 1985.

32. Nilfisk. Nilfisk Asbesto-Clene Systems; Rohl, A. Letter to Robert Magdelain, April 11, 1979, on air sampling during equipment use with transmission electron microscopic analysis reporting virtual elimination of asbestos levels; Nilfisk instructions for use; Nilfisk Simplifies the Safe Collection and Disposal of Toxic, Hazardous, and Nuisance Waste Materials. Nilfisk of America, Inc., 300 Technology Drive, Malvern, Pennsylvania 19355 (215) 647-6420.

33. Clayton Associates. Asbestos in Automotive Shops; Rohl, A. Letter to Jim Clayton, October 12, 1984, on air sampling during equipment use and filter change using transmission electron microscopic analysis reporting virtual elimination of asbestos levels; Asbestos and You. Clayton Associates, Inc., P.O. Box 589, 30 Southard Avenue, Farmingdale, New Jersey 07727 (201) 938-6700.

34. Control Resource Systems. CRSI 2000 and CRSI Labmaster Vacuums, Brakemaster enclosure system description. Control Resource Systems, Inc., 670 Mariner Drive, Michigan City, Indiana 46360. (219) 872-5591.

35. Hako Minuteman. Hako Minuteman Asbestos Brake Drum Vacuum System. Hako Minuteman, Inc., 111 South Route 53, Addison, Illinois 60101 (312) 627-6900.

36. American Conference of Government Industrial Hygïenists. Industrial Ventilation: A Manual of Recommended Practice. 18th Edition. ACGIH. Page 5-128. 1984.

37. NIOSH. Guide to Respiratory Protection for the Asbestos Abatement Industry. EPA/560-OPTS-86-001. April 1986. This contains NIOSH's most extensive recommendations for a program of respiratory protection against asbestos.

☆ U.S. GOVERNMENT PRINTING OFFICE. 1987 - 716-002 - 1302/60616