FILE NAME: Brakes (BRK)

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TABLE 21.—WORKER EXPOSURE DATA FOR AUTOMOTIVE BRAKE AND CLUTCH REMANUFACTURING

Job classification/process	Mean 8-hour TWA exposure (f/cc)	Standard deviation	Number of observations	Source of data
Dry mechanical	0 05	0 06	[1] 112	RTI survey[2]
Dry mechanical	.12	.11	[3] 23	OSHA MIS.
Other	.08	.10	[4] 56	Do.

[1] Data on the number of samples were not provided. This figure is the number of workers represented by the data.
[2] Plants designated as "tt," "uu," "vv," "xx," "zz," "GH," and "KL."
[3] Data on 24 observations were available for the years 1979 through 1984. One outlier was omitted (1.6 f/cc) since all of the other observations were 0 5 f/cc or below.
[4] Data on 58 observations were available. Two outliers were omitted (1.1 f/cc and 1.0 f/cc) since all of the other observations were 0.4 f/cc or below.

Source: U S Department of Labor, OSHA, Office of Regulatory Analysis, as derived from RTI survey

Service Industries

Automotive Brake and Clutch Repair. Workers who repair brakes and clutches made with asbestos may be exposed because brakes and clutches deteriorate with wear, thereby resulting in friable asbestos. Asbestos dust present on these automotive parts is easily disturbed and becomes airborne during the repair and removal of the linings. Exposures above 0.2 f/cc are particularly prevalent when compressed air is used to clean the linings. These exposures can be significantly reduced, however, by using solvent mists on the linings and then wiping them off, or by using vacuums to remove the dust.

OSHA determined that it is feasible for this industry to meet the 0.2 f/cc. This determination is based primarily on data obtained from the OSHA MIS compliance data base and from a November 22, 1982, study by the National Institute for Occupational Safety and Health (NIOSH) [Report No. 32.4]. The OSHA data contained 47 observations from the period 1979 through 1984, with a mean 8-hour TWA exposure of 0.03 f/cc and a standard deviation of 0.14 f/cc. In addition, the NIOSH study demonstrated that average exposures were below 0.1 f/cc when using either the solvent mist or the high-efficiency particulate air (HEPA) vacuum systems. Thus, OSHA determined that the 0.2 f/cc is feasible in this sector.

Shipbuilding and Repair. Current shipbuilding activities should not generate any worker exposure to asbestos because the use of asbestos has been phased out of this type of construction. The greatest potential for asbestos exposure is during the removal, or "rip-out," of old asbestos material. Rip-out often requires sawing, tearing, cutting, and scraping to remove existing asbestos materials, and these activities frequently occur in confined spaces. Additional sources of asbestos exposure for a small number of shipyard workers occur during operations such as gasket cutting. OSHA believes that these additional exposures can be kept below the PEL of 0.2 f/cc through the use of ventilation and wet methods, which have been used successfully in other industries.

OSHA, however, anticipates problems in controlling exposures during major rip-out operations. These operations involve the removal of asbestos from large areas such as machinery rooms or engine rooms. The particular constraints of the shipbuilding/repair work environment limit the use of traditional engineering controls. Safety rules restrict the number of hoses, pipes, and other equipment that can pass through certain bulkhead openings below deck. The confined spaces in ships impede the use of even portable ventilation equipment in certain areas. In addition, wetting agents are not permitted for rip-out activity in nuclear reactor compartments because of the fear of contamination.

For example, in testimony at the formal hearings, Mr. James R. Thorton of the Newport News Shipbuilding Drydock Co. presented exposure data collected during major rip-outs of reactor compartments where the use of water and saturating agents was restricted. These data show that 41 percent of the exposures were greater than 2.0 f/cc, and another 32 percent were between 0.5 f/cc and 2.0 f/cc [Hearing Transcript of June 25, 1984, p. 79]. The Federal Employees Metal Trades Council [Exhibit 158–6] submitted to the record other monitoring results of major asbestos rip-outs in the reactor compartment of nuclear submarines. These data showed similar exposure levels, with 40 percent of the exposures greater than 2.0 f/cc and 10 percent between 0.5 f/cc and 2.0 f/cc. Thus, OSHA concludes that the 0.2 f/cc PEL is not feasible during asbestos rip-outs of nuclear components without the use of respirators.

According to Mr. Thorton, the exposure results for major asbestos rip-outs of non-nuclear components (where wetting agents can be used) show that 5 percent of the exposures are greater than 2.0 f/cc, and 28 percent are between 0.5 f/cc and 2.0 f/cc. One of the respondents ("QR") to the RTI survey reported exposures ranging from less than 0.02 f/cc to 0.5 f/cc for the wet removal of pipe wrap, wallboard, and gasket materials. The respondent stated that PEL of 0.2 f/cc can be attained during these small-scale or "minor rip-out" operations by using wet removal practices. OSHA has thus determined that the 0.2 f/cc PEL is feasible for certain minor rip-outs in non-nuclear vessels, but that respirators will be needed during major rip-outs in non-nuclear vessels.

Construction

New Construction. Although concerns about the potential health hazards of asbestos exposure have curtailed its use substantially in recent years, a number of asbestos materials are still used in new construction. These products include A/C pipe and sheet, vinyl/asbestos floor tile, and asphalt roofing felts and coatings.

A/C Pipe. In a study [Exhibit 84–279] performed in 1977 for the A/C Pipe Producers Association, Equitable Environmental Health, Inc., (EEH) collected short-term personal samples to evaluate exposure during various operations that might be performed in the field on A/C pipe, using different types of equipment. For example, while unloading pipe at the site and laying pipe in the trench, the highest TWA concentrations reported were 0.03 f/cc and 0.02 f/cc, respectively. These data suggest that there is little potential for exposure in these operations and that no specific controls are necessary to keep exposures below the 0.2 f/cc PEL.

When installing A/C pipe, however, it may be necessary to cut, machine, or tap the pipe at the work site, which may expose workers to airborne asbestos fibers. Although the current trend is for more of these activities to be performed by the manufacturer rather than in the field [Exhibit 333, Sections G,O,Q], cutting and machining are associated with potentially high exposures. Joe Jackson of the Association of A/C Pipe Producers (AACPP) noted, however, the feasibility of installing A/C pipe with exposures below the PEL of 0.2 f/cc. In pre-hearing written testimony he stated as follows:

> Workers following AACPP's recommended work practices could almost always ensure that they would avoid peak exposures in excess of 0.75 f/cc over 15 minutes, while eight-hour time-weighted average exposures would remain at 0.3 f/cc or below. [Exhibit 91–16, Section 0, p. 12.]

Appendix E to § 1910.1001—Interpretation and Classification of Chest Roentgenograms—Mandatory

(a) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on a Roentgenographic Interpretation Form. *Form CSD/NIOSH (M) 2.8.

(b) Roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(c) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO–U/C International Classification of Radiographs for Pneumoconioses, 1980.

Appendix F to § 1910.1001—Work Practices and Engineering Controls for Automotive Brake Repair Operations—Non-Mandatory

This appendix is intended as guidance for employers in the automotive brake and clutch repair industry who wish to reduce their employees' asbestos exposures during repair operations to levels below the new standard's action level (0.1 f/cc). OSHA believes that employers in this industry sector are likely to be able to reduce their employees' exposures to asbestos by employing the engineering and work practice controls described in Sections A and B of this appendix. Those employers who choose to use these controls and who achieve exposures below the action level will thus be able to avoid any burden that might be imposed by complying with such requirements as medical surveillance, recordkeeping, training, respiratory protection, and regulated areas, which are triggered when employee exposures exceed the action level or PEL.

Asbestos exposure in the automotive brake and clutch repair industry occurs primarily during the replacement of clutch plates and brake pads, shoes, and linings. Asbestos fibers may become airborne when an automotive mechanic removes the asbestos-containing residue that has been deposited as brakes and clutches wear. Employee exposures to asbestos occur during the cleaning of the brake drum or clutch housing.

Based on evidence in the rulemaking record (Exs. 84–74, 84–263, 90–148), OSHA believes that employers engaged in brake repair operations who implement any of the work practices and engineering controls described in Sections A and B of this appendix may be able to reduce their employees' exposures to levels below the action level (0.1 fiber/cc). These control methods and the relevant record evidence on these and other methods are described in the following sections.

A. Enclosed Cylinder/HEPA Vacuum System Method

The enclosed cylinder-vacuum system used in one of the facilities visited by representatives of the National Institute for Occupational Safety and Health (NIOSH) during a health hazard evaluation of brake repair facilities (Ex. 84–263) consists of three components:

(1) A wheel-shaped cylinder designed to cover and enclose the wheel assembly;

(2) A compressed-air hose and nozzle that fits into a port in the cylinder; and

(3) A HEPA-filtered vacuum used to evacuate airborne dust generated within the cylinder by the compressed air.

To operate the system, the brake assembly is enclosed in a cylinder that has viewing ports to provide visibility and cotton sleeves through which the mechanic can handle the brake assembly parts. The cylinder effectively isolates asbestos dust in the drum from the mechanic's breathing zone. The brake assembly isolation cylinder is available from the Nilfisk Company [1] and comes in two sizes to fit brake drums in the 7-to-12-inch size range common to automobiles and light trucks and the 12-to-19-inch size range common to large commercial vehicles. The cylinder is equipped with built-in compressed-air guns and a connection for a vacuum cleaner equipped with a High Efficiency Particulate Air (HEPA) filter. This type of filter is capable of removing all particles greater than 0.3 microns from the air. When the vacuum cleaner's filter is full, it must be replaced according to the manufacturer's instruction, and appropriate HEPA-filtered dual cartridge respirators should be worn during the process. The filter of the vacuum cleaner is assumed to be contaminated with asbestos fibers and should be handled carefully, wetted with a fine mist of water, placed immediately in a labelled plastic bag, and disposed of properly. When the cylinder is in place around the brake assembly and the HEPA vacuum is connected, compressed air is blown into the cylinder to loosen the residue from the brake assembly parts. The vacuum then evacuates the loosened material from within the cylinder, capturing the airborne material on the HEPA filter.

The HEPA vacuum system can be disconnected from the brake assembly isolation cylinder when the cylinder is not being used. The HEPA vacuum can then be used for clutch facing work, grinding, or other routine cleaning.

B. Compressed Air/Solvent System Method

A compressed-air hose fitted at the end with a bottle of solvent can be used to loosen the asbestos-containing residue and to capture the resulting airborne particles in the solvent mist. The mechanic should begin spraying the asbestos-contaminated parts with the solvent at a sufficient distance to ensure that the asbestos particles are not dislodged by the velocity of the solvent spray. After the asbestos particles are thoroughly wetted, the spray may be brought closer to the parts and the parts may be sprayed as necessary to remove grease and other material. The automotive parts sprayed with the mist are then wiped with a rag, which must then be disposed of appropriately. Rags should be placed in a labelled plastic bag or other container while they are still wet. This ensures that the asbestos fibers will not become airborne after the brake and clutch parts have been cleaned. (If cleanup rags are laundered rather than disposed of, they must be washed using methods appropriate for the laundering of asbestos-contaminated materials.)

OSHA believes that a variant of this compressed-air/solvent mist process offers advantages over the compressed-air/solvent mist technique discussed above, both in terms of costs and employee protection. The variant involves the use of spray cans filled with any of several solvent cleaners commercially available from auto supply stores. Spray cans of solvent are inexpensive, readily available, and easy to use. These cans will also save time, because no solvent delivery system has to be asembled, i.e., no compressed-air hose/mister ensemble. OSHA believes that a spray can will deliver solvent to the parts to be cleaned with considerably less force than the alternative compressed-air delivery system described above, and will thus generate fewer airborne asbestos fibers than the compressed-air method. The Agency therefore believes that the exposure levels of automotive repair mechanics using the spray can/solvent mist process will be even lower than the exposures reported by NIOSH (Ex. 84–263) for the compressed-air/solvent mist system (0.08 f/cc).

C. Information on the Effectiveness of Various Control Measures

The amount of airborne asbestos generated during brake and clutch repair operations depends on the work practices and engineering controls used during the repair or removal activity. Data in the rulemaking record document the 8-hour time-weighted average (TWAs) asbestos exposure levels associated with various methods of brake and clutch repair and removal.

NIOSH submitted a report to the record entitled "Health Hazard Evaluation for Automotive Brake Repair" (Ex. 84–263). In addition, Exhibits 84–74 and 90–148 provided exposure data for comparing the airborne concentrations of asbestos generated by the use of various work practices during brake repair operations. These reports present exposure data for brake repair operations involving a variety of controls and work practices, including:

- Use of compressed air to blow out the brake drums;
- Use of a brush, without a wetting agent, to remove the asbestos-containing residue;
- Use of a brush dipped in water or a solvent to remove the asbestos-containing residue;
- Use of an enclosed vacuum cleaning system to capture the asbestos-containing residue; and
- Use of a solvent mixture applied with compressed air to remove the residue.

Prohibited Methods

The use of compressed air to blow the asbestos-containing residue off the surface of the brake drum removes the residue effectively but simultaneously produces an airborne cloud of asbestos fibers. According to NIOSH (Ex. 84–263), the peak exposures of mechanics using this technique were as high as 15 fibers/cc, and 8-hour TWA exposures ranged from 0.03 to 0.19 f/cc.

[1] Mention of tradenames or commercial products does not constitute endorsement of recommendation for use.

Dr. William J. Nicholson of the Mount Sinai School of Medicine (Ex. 84–74) cited data from Knight and Hickish (1970) that indicated that the concentration of asbestos ranged from 0.84 to 5.35 f/cc over a 60-minute sampling period when compressed air was being used to blow out the asbestos-containing residue from the brake drum. In the same study, a peak concentration of 87 f/cc was measured for a few seconds during brake cleaning performed with compressed air. Rohl et al. (1976) (Ex. 90–148) measured area concentrations (of unspecified duration) within 3–5 feet of operations involving the cleaning of brakes with compressed air and obtained readings ranging from 6.6 to 29.8 f/cc. Because of the high exposure levels that result from cleaning brake and clutch parts using compressed air, OSHA has prohibited this practice in the revised standard.

Ineffective Methods

When dry brushing was used to remove the asbestos-containing residue from the brake drums and wheel assemblies, peak exposures measured by NIOSH ranged from 0.61 to 0.81 f/cc, while 8-hour TWA levels were at the new standard's permissible exposure limit (PEL) of 0.2 f/cc (Ex. 84–263). Rohl and his colleagues (Ex. 90–148) collected area samples 1–3 feet from a brake cleaning operation being performed with a dry brush, and measured concentrations ranging from 1.3 to 3.6 f/cc; however, sampling times and TWA concentrations were not presented in the Rohl et al. study.

When a brush wetted with water, gasoline, or Stoddart solvent was used to clean the asbestos-containing residue from the affected parts, exposure levels (8-hour TWAs) measured by NIOSH also exceeded the new 0.2 f/cc PEL, and peak exposures ranged as high as 2.62 f/cc (Ex. 84–263).

Preferred Methods

Use of an engineering control system involving a cylinder that completely encloses the brake shoe assembly and a High Efficiency Particulate Air (HEPA) filter-equipped vacuum produced 8-hour TWA employee exposures of 0.01 f/cc and peak exposures ranging from nondetectable to 0.07 f/cc (Ex. 84–263). (Because this system achieved exposure levels below the standard's action level, it is described in detail below.) Data collected by the Mount Sinai Medical Center (Ex. 90–148) for Nilfisk of America, Inc., the manufacturer of the brake assembly enclosure system, showed that for two of three operations sampled, the exposure of mechanics to airborne asbestos fibers was nondetectable. For the third operator sampled by Mt. Sinai researchers, the exposure was 0.5 f/cc, which the authors attributed to asbestos that had contaminated the operator's clothing in the course of previous brake repair operations performed without the enclosed cylinder/vacuum system.

Some automotive repair facilities use a compressed-air hose to apply a solvent mist to remove the asbestos-containing residue from the brake drums before repair. The NIOSH data (Ex. 84–263) indicated that mechanics employing this method experienced exposures (8-hour TWAs) of 0.8 f/cc, with peaks of 0.25 to 0.68 f/cc. This technique, and a variant of it that OSHA believes is both less costly and more effective in reducing employee exposures, is described in greater detail above in Sections A and B.

D. Summary

In conclusion, OSHA believes that it is likely that employers in the brake and clutch repair industry will be able to avail themselves of the action level trigger built into the revised standard if they conscientiously employ one of the three control methods described above: the enclosed cylinder/HEPA vacuum system, the compressed air/solvent method, or the spray can/solvent mist system.

Appendix G to § 1910.1001—Substance Technical Information for Asbestos—Non-Mandatory

I. Substance Identification

A. Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals that are included in this group are chrysotile, crocidolite, amosite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos.

B. Asbestos, tremolite, anthophyllite, and actinolite are used in the manufacture of heat-resistant clothing, automative brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos is also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

C. The potential for a product containing asbestos, tremolite, anthophyllite, and actinolite to release breatheable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

D. Permissible exposure: Exposure to airborne asbestos, tremolite, anthophyllite, and actinolite fibers may not exceed 0.2 fibers per cubic centimeter of air (0.2 f/cc) averaged over the 8-hour workday.

II. Health Hazard Data

A. Asbestos, tremolite, anthophyllite, and actinolite can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

B. Exposure to asbestos, tremolite, anthophyllite, and actinolite has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rare cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

III. Respirators and Protective Clothing

A. Respirators: You are required to wear a respirator when performing tasks that result in asbestos, tremolite, anthophyllite, and actinolite exposure that exceeds the permissible exposure limit (PEL) of 0.2 f/cc. These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos, tremolite, anthophyllite, and actinolite exposure, or where engineering controls are not feasible to reduce asbestos, tremolite, anthophyllite, and actinolite exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos, tremolite, anthophyllite, and actinolite fiber concentrations do not exceed 2 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not permitted to be used for asbestos, tremolite, anthophyllite, and actinolite work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every 6 months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

B. Protective Clothing: You are required to wear protective clothing in work areas where asbestos, tremolite, anthophyllite, and actinolite fiber concentrations exceed the permissible exposure limit (PEL) of 0.2 f/cc to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos, tremolite, anthophyllite, and actinolite removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

IV. Disposal Procedures and Cleanup

A. Wastes that are generated by processes where asbestos, tremolite, anthophyllite, and actinolite is present include:

1. Empty asbestos, tremolite, anthophyllite, and actinolite shipping containers.

2. Process wastes such as cuttings, trimmings, or reject material.