SECTION 15

EXPOSURE TO ASBESTOS FROM ASBESTOS GASKETS

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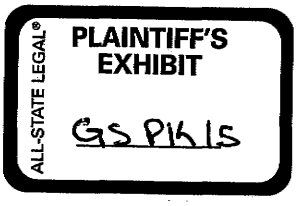

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Feature Article

Exposure to Asbestos from Asbestos Gaskets

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For more than 50 years, asbestos gaskets have been used in piping, valves, pumps, and other equipment to prevent leakage of fluids between solid surfaces. Although exposure data are available for workers in the gasket manufacturing industry, there are no published reports on asbestos exposures for gasket users. This article presents data on asbestos exposures during use and handling of asbestos gaskets in the oil and chemical industries. Users' time-weighted average exposures to asbestos during replacement of after-service gaskets, on-site fabrication (cutting) of sheet gaskets, and handling of new and after-service gaskets inside Gasket Trailers were all within the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit. The practice of dry removal of after-service sheet gaskets, followed by dry polishing of the seating surfaces with a power sander, could create a short-term asbestos exposure level in excess of the OSHA Excursion Limit. This type of potential, short-term, high exposure, however, can be eliminated simply by wetting the gaskets and seating surfaces prior to gasket replacement.

In July 1989, the U.S. Environmental Protection Agency (EPA) prohibited the manufacture, importation, processing, and distribution in commerce of most asbestos gaskets by 1994. EPA's decision to ban asbestos gaskets was based solely on exposure data obtained from the gasket manufacturers. However, asbestos gaskets will continue to be used for many years in the workplace as in-service gaskets are removed and existing supplies are installed. Data from this investigation suggest that asbestos gaskets can be safely handled if proper procedures are followed. **Cheng, R.T.; McDermott, H.J.: Exposure to Asbestos from Asbestos Gaskets. Appl. Occup. Environ. Hyg. 6:588–591; 1991.**

Introduction

Asbestos gaskets are used extensively in piping (flanges), valves, pumps, and other equipment to prevent leakage of fluids between solid surfaces. Its high physical strength, heat and chemical resistance, and reasonable cost make asbestos a good choice where these features are important. In July 1989, the U.S. Environmental Protection Agency (EPA) issued a final rule banning, in stages, the manufacture, importation, processing, and distribution in commerce of essentially all asbestos products.[1] EPA placed asbestos gaskets under a Stage 2 ban. The effective dates for the Stage 2 ban are August 25, 1993, for manufacture, importation, and processing and August 25, 1994, for distribution in commerce. EPA's decision to ban asbestos gaskets was based solely on exposure data at the asbestos gasket manufacturing facilities. A search of the literature showed no published studies reporting gasket users' asbestos exposures. Despite the EPA's recent action, asbestos gaskets will continue to be handled for many years in the workplace as in-service gaskets are replaced and inventories of the remaining asbestos gasket material are used. This article presents data on asbestos exposures during use and handling of asbestos gaskets in the oil and chemical industries. Some pumps contain asbestos in the packing material used to seal rotating shafts; these are not included in this study.

Types of Asbestos Gaskets

The following three types of gaskets are commonly used in the oil and chemical process plants:

- Sheet gaskets, which are typically 1/16 or 1/8 inch thick compressed asbestos sheets (containing at least 70% chrysotile asbestos) with Nitrile or Neoprene binder.
- Spiral wound gaskets, which consist of asbestos filler material compressed between Type 304 Stainless Steel spiral windings. The windings are held in place between an outside carbon steel compression centering ring and a Type 304 Stainless Steel inner ring. Spiral wound gaskets cost much more than sheet gaskets but provide greater sealability and better blow-out prevention.
- Metal-jacketed gaskets, which consist of compressed asbestos filler material held within or between metal jacketing. Metal-jacketed gaskets are primarily used in large heat exchangers or vessel manways.

Because the asbestos filler material in a metal-jacketed gasket is virtually enclosed by the metal jacket, asbestos exposure is not a problem for users of metal-jacketed gaskets. Therefore, the emphasis of this article is on spiral wound gaskets and sheet gaskets.

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TABLE I. Workers' Asbestos Exposures During Sheet Gasket Fabrication

Description of Gasket Fabrication Techniques	Sample Duration (min)	Concentration (fibers/cc)
Long-Term Samples		
Cutting with power shear and hammer punch	330	0.015
Cutting with power shear and wheel cutter	408	0.017
Cutting with knife on a lead surface table	490	0.012
Cutting with power shear and hammer punch	344	0.009
Cutting with power shear and scissors	470	0.001
Cutting with power shear and hammer punch	359	0.005
Cutting with wheel cutter and hammer punch	465	0.003
Short-Term Samples		
Cutting with a saber saw	55	0.39
Cutting with a saber saw	55	0.33
Cutting with power shear and wheel cutter	30	0.49
Cutting with power shear and wheel cutter	30	0.34

Spiral Wound Gaskets

Spiral wound gaskets come prefabricated from the manufacturers. Therefore, there are no asbestos exposures related to the on-site gasket fabrication or alteration. During gasket replacement, an after-service spiral wound gasket can be easily lifted from the seating surfaces. In fact, for a vertically installed spiral wound gasket, the old gasket would fall off by its own weight as soon as the seating surfaces are separated if the gasket was not held in place (Figure 1).

Before installing the new gaskets, workers may wipe the seating surfaces clean with a rag or may remove any corrosion with a wire brush. Consequently, asbestos fibers remaining on the seating surfaces are disturbed, resulting in a brief exposure to airborne asbestos. Two short-duration air samples were collected during replacement of two typical spiral wound gaskets in a piping system. The monitoring period covered the lifting and disposal of the old gaskets, wire brushing the surfaces of the flanges, and installing the new gaskets. Results show nondetectable airborne fiber levels (detection limit = 0.06 fiber/cc), indicating no worker exposure problem during the use and handling of spiral wound gaskets.

Fabrication of Sheet Gaskets

At oil refineries and larger chemical plants, asbestos sheet gasket materials are usually purchased in bulk sheets. These are later fabricated (cut) into gaskets of various sizes and shapes at the facility's machine shop. Various types of equipment and tools, including power shears, hammer punch, wheel cutter, knife, and saber saw, may be used in the fabrication process (Figure 2). Workers' asbestos exposures during fabrication of sheet gaskets are summarized in Table I. Seven full-shift, personal air samples collected during the days of sheet gasket fabrication showed that time-weighted average (TWA) exposure concentrations ranged from 0.001 to 0.017 fiber/cc, well within the 0.2 fiber/cc Permissible Exposure Limit (PEL) set by the Occupational Safety and Health Administration (OSHA).[2]

FIGURE 1. Replacing a spiral wound gasket.

FIGURE 2. Fabricating a sheet gasket

Method of Removal and Seating Surface Cleaning	Sample Duration (min)	Concentration (fibers/cc)
Dry removal: 2 valve gaskets, scraping/brushing	19	0.11
Dry removal: 1 pump gasket, scraping/brushing	46	0.19
Dry removal: 2 flange gaskets, scraping/brushing	55	0.33
Dry removal: 2 pipe flange gaskets, power sander	25	1.4
Wet removal: 1 pump gasket, scraping/brushing	30	< 0.06
Wet removal: 2 pipe flange gaskets, brushing	15	< 0.06

Four short-term air samples collected during the peak action period of gasket fabrication showed that short-duration exposures ranged from 0.33 to 0.49 fiber/cc, which were within the 1.0 fiber/cc OSHA Excursion Limit.[7] Although respiratory protection is not required at these exposure levels by the OSHA Asbestos Standard, workers are instructed to wear a half-mask HEPA respirator as a precautionary measure during fabrication of sheet gaskets.

Replacing Sheet Gaskets

The job of replacing sheet gaskets is generally a short-duration task, lasting from several minutes for replacing a small pipe flange gasket in the field to slightly under one hour for replacing a large-sized pump gasket in the shop. The sheet gaskets are under tremendous seating stress (e.g., 10,000 psi) during service, and they may be in contact with oxidizing or corrosive fluids. As the sealing surfaces are separated, sometimes the after-service sheet gasket tears, and pieces of the broken gasket material stick tightly to one or both of the seating surfaces. A flat screw driver, putty knife, or scraper is used to lift the broken gasket off the metal, followed by scraping, brushing, polishing, or even sanding to clean the seating surfaces before installing the new gasket (Figure 3). When this cleaning is done in dry conditions, asbestos fibers can become airborne to create a potential inhalation hazard. To guard against exceeding the OSHA PEL or Excursion Limit, or simply as a precautionary measure, workers should be required to wear a half-face HEPA respirator during dry removal of after-service sheet gaskets.

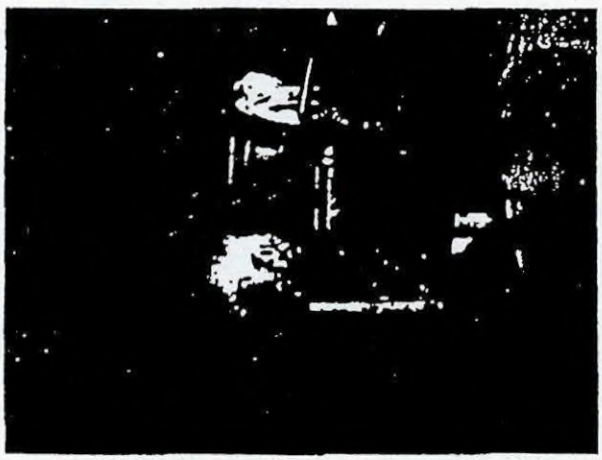

FIGURE 3. Brushing the gasket seating surfaces.

Workers' short-term asbestos exposures were monitored at four different refineries and chemical plants during removal of after-service sheet gaskets. Table II summarizes the monitoring results under two methods of gasket removal and seating surface cleaning, i.e., the old method of dry removal and dry surface cleaning and a new method of wet removal and wet surface cleaning. Short-term exposures during the old way of dry removal varied between 0.11 and 0.33 fiber/cc when surface cleaning was done with a scraper and/or with a wire brush. One air sample, collected during dry polishing of pipe flanges with a power sander, showed 1.4 fibers/cc for a task that lasted for 25 minutes. Although that particular air sample was collected in 1986 and was in compliance with the then applicable OSHA PEL of 0.2 fiber/cc (8-hour TWA), it would no longer meet the current 1.0 fiber/cc OSHA Excursion Limit.

A wet-work method was later established for the removal of after-service sheet gaskets. Typically, the wet-work procedure calls for the spraying of a solvent-based wetting agent (e.g., Chesterton 723 Sprasolvo Penetrating Oil) to wet the gasket and the seating surfaces before removing and cleaning (Figure 4). Monitoring results indicate that, when the wet method is employed, workers' short-term asbestos exposures were all below detection (detection limit = 0.06 fiber/cc). Because very little time and labor are involved, and a spray can of wetting agent is all the material that is required, the wet-work method for gasket replacement is well received by workers and by plant management.

Gasket Trailer Worker Exposure

At some of the larger petroleum refineries and chemical plants, gaskets of all types are kept in a special storage facility called the Gasket Trailer. The trailer is staffed by an attendant whose duties are to maintain an inventory of gaskets, to collect and dispose of used gaskets, and to distribute new gaskets to other workers. During unit shutdown and turnaround time, the attendant can be very busy as gaskets in many pieces of equipment are replaced. Six personal air samples were collected from Gasket Trailer attendants during two major shutdowns at an oil refinery.

FIGURE 4. Spraying a wetting agent.

Results show the trailer attendants' 8-hour TWA exposures ranged from 0.037 to 0.058 fiber/cc, well within the OSHA PEL.

Conclusions

Exposures to asbestos during on-site fabrication, handling, and replacement of gaskets can be maintained well below the OSHA PEL with good work practices. The past practice of dry removal of after-service sheet gaskets, followed by dry polishing of the seating surfaces with a power sander, could create a short-term exposure in excess of the OSHA Excursion Limit. This potential exposure, however, can be controlled by wetting the gasket and the seating surfaces prior to gasket replacement.

Recommendations

Asbestos gasketing materials play an important role where their special features are needed. Their use remains acceptable as long as they are still commercially available. Replacing after-service sheet gaskets and cleaning the seating surfaces under wet conditions minimizes fiber release. In addition, regardless of the exposure level, a half-face HEPA respirator should be provided as a precautionary measure when the seating surface cleaning involves brushing, polishing, or sanding, or when handling friable asbestos-containing waste gasket materials.

References

1. U.S. Environmental Protection Agency: 40 CFR Part 763, Asbestos: Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions; Final Rule. Fed. Reg. Vol. 54, No. 132 (July 12, 1989).
2. U.S. Department of Labor, Occupational Safety and Health Administration: 29 CFR Part 1926.58: Asbestos, Tremolite, Anthophyllite, and Actinolite. Fed. Reg. Vol. 51, No. 119 (June 20, 1988); amended in Fed. Reg. Vol. 53, No. 178 (September 14, 1988).

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