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Report for MVA Project No. 0765
Asbestos Fiber Release
During the Removal of a Sheet Gasket

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Abstract

Asbestos sheet gasket material used between piping flanges is generally considered to be a non-friable material unless cut or torn. In a controlled area, personal and area air samples were collected before and during the removal of asbestos sheet gasket material and wire-brushing of the pipe flange. The results of this study show asbestos fibers can be released into the air during the procedures for the removal of asbestos sheet gasket material and wire-brushing of the flange. Cleaning of the area with a broom after removal also increased airborne fiber concentrations. Air concentrations were measured by phase contrast microscopy to be from 0.1 to 6 fibers/cc and by transmission electron microscopy in the range of 3.9 to 62 fibers/cc for asbestos fibers of all sizes.

Introduction

Most piping systems, especially in industrial and maritime facilities, use gaskets to seal joints. The gaskets may contain asbestos fibers as part of their composition. Periodically, a pipe connection must be broken at the flanges and the old gasket removed. This effort may require a simple scraping with hand tools or may need the assistance of power tools to clean-up the flange.

Asbestos Sheet Gasket Material

According to the U.S. Environmental Protection Agency (EPA), gaskets are materials used to seal one compartment of a device from another in applications such as engine and exhaust manifolds. Asbestos gaskets are used mainly to seal connections and prevent leakage of fluids between solid surfaces. Gaskets, often consisting of more than 70% chrysotile asbestos, are used against alkaline, neutral or weak acid solutions. Crocidolite containing gaskets have been used against harsher acid solutions. Sheet gaskets are composed of chrysotile asbestos compressed into a

sheet with styrene butadiene rubber or other binder. Other organic binders used in making asbestos gaskets include natural rubber, buna-S and buna-N synthetic rubbers, or neoprene.

Study Design

Asbestos-containing materials are common in industrial sites and on ships and because a maintenance activity often involves the disturbance of more than one material, it is difficult to assess the contribution, if any, of a particular ACM to the overall airborne asbestos concentration. To determine the possible contribution of an asbestos gasket only during removal, special precautions were taken to isolate the removal activity from other activities that might have contributed airborne asbestos from other sources.

Study Site

The study was conducted in a warehouse in Norcross, Georgia. An asbestos abatement type enclosure was built for the study to isolate the testing from any other source of asbestos and to prevent any fiber release from contaminating the building. The containment barriers in the area consisted of three layers of 6-mil polyethylene plastic sheets on a wooden frame and three layers of 6-mil polyethylene plastic on the floor. The containment area (8 ft by 8 ft) was completely contained within a larger containment area. The study area had a two High Efficiency Particulate Absolute (HEPA) air filtration device (AFD) used to clean the area of particulate including asbestos before the gasket removal activity. In the outer area the AFD operated throughout the test.

Study Procedures

The study consisted of the collection of air samples before, during, and after a gasket removal activity. A valve that had been used in a steam line onboard a ship was used for the experiment. The valve assembly had two sets of flanges with a gasket between each set of flanges. According to the retired steamfitter performing the gasket removal the valve assembly probably carried 40 to 75 pound steam through it. The temperature in the valve could have reached about 300° F. Gaskets were removed from both sides of the valve.

The removal was separated into two activities with separate air samples being collected during each activity. The flanges were first scraped with a putty knife or screw driver to remove the majority of the gasket material. The flanges were then wire brushed with an air powered drill to remove the residual gasket material adhering to the flanges. The drill was a Campbell Hausfeld Model TL1006 drill that has a maximum speed rating of 2500 RPMs.

Prior to starting the study, three (3) area air samples were collected to determine the background level of asbestos in the air of the study area using aggressive sampling and operating the drill for approximately two minutes before starting the air samples. The sampling cassettes were located on the walls at the breathing zone, five feet from the floor. Area air samples were collected during the sheet gasket removal in the same locations as each of the background air samples, approximately five feet from the gasket removal activity. The person doing the gasket removal was fitted with two personal air sampling devices.

All personnel inside the study area were protected by air purifying respirators and complete head and body coverings. The decontamination system consisted of a changing room outside the testing area, and a clean suit-up room. The decontamination system was used each time a person exited the study area and the overall containment area.

Analytical Methods

Air samples were analyzed by the standard phase contrast microscopy (PCM) method NIOSH 7400 using the "A" counting rules.

Although the phase contract microscope enhances the analyst's ability to see fibers over other types of light microscopes, the standard procedure involves does not involve identification steps which specifically determine how many of the fibers counted are actually asbestos. Because sheet gasket material is known to contain other types of fibers, some of the samples were prepared for further study by transmission electron microscopy (TEM). The samples were prepared and analyzed using the International Standards Organization (ISO) Direct preparation counting procedure. This TEM analysis method identifies asbestos fibers on the basis of morphology, crystal structure

and x-ray elemental analysis. On one sample during each activity, all asbestos fibers longer than 0.5 µm were counted by TEM so that a total asbestos concentration could be determined. In other samples only those fibers longer than 5 µm and wider than 0.25 µm were counted to provide an asbestos count equivalent to the PCM data.

Polarized light microscopy (PLM) was used to determine the type of asbestos in the sheet gasket material. A friability test was performed on the samples of gasket material removed from the flanges. The EPA friability test is a field test in which an attempt is made to crumble the ACM by hand. If the material produces dust when crumbled by hand, it is considered friable. The EPA distinquishes friable from non-friable ACM in their regulations on handling asbestos products. Friable ACM is considered more of a potential hazard than non-friable material.

Results

The results of the air monitoring are shown in Table 1. During the sheet gasket removal activity, which lasted approximately 34 minutes, the asbestos fiber level for the person removing the packing was 1.86 fibers/cc (PCM) time weighted for the period of removal. It should be noted that only fibers greater than 5.0 µm are counted using the PCM method. The area samples collected in the vicinity of the sheet gasket cutting activity showed levels of fibers elevated over the background levels. The TEM analysis results are also shown in Table 1. Chrysotile fibers were identified as the primary type of fiber. The TEM fiber counts ranged from 3.9 to 62 fibers per cc for asbestos fibers of all sizes above 0.5 µm in length. A list of flow rates and air volumes for the cassettes is given in Table 2.

Polarized light microscopic analysis showed the sheet gasket to be approximately 80% chrysotile (Appendix C).

The gasket materials removed from the valve flanges were dry and friable.

Conclusions

Asbestos sheet gasket, although not considered friable in original, unused condition, can release asbestos fibers into the air during removal operations both when

hand methods are used and when air-powered wire-brushing is done. Clean-up following the removal may resuspend dust containing asbestos into the air .

Recommendations

The results of these tests suggest that asbestos sheet gasket material, although not considered as a friable ACM when new, should be considered as such during removal activities, especially if a powered brushing device is involved.

Table 1

Summary of Air Sampling Results
for Gasket Removal

MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, GA 30093
(404) 662-8509

Activity	PCM* (f/cc)	TEM** (s/cc)
Background	0.004	<0.02
Hand Scraping	0.14	3.9
Power Wire Brushing	6.8	62
Hand Scraping and Power Wire Brushing	2.1	20
Broom Sweeping of Area After Removal	5.5	44

* Phase Contrast Microscopy counts fibers greater than 5 µm in length and greater than 0.25 µm in diameter.

** Transmission Electron Microscopy identifies and counts asbestos fibers greater than 0.5 µm in length and greater than 0.02 µm in diameter.

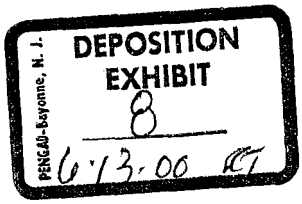

Table 2
Summary of Results – PCM Data
MVA, Inc.
5500 Oakbrook Parkway, Suite 200
Norcross, GA 30093
(404) 662-8509

Project Name: Gaskel Removal Experiment Project No.: 0765

Method: 7400"A"
Filter Area: 385 mm^2
Retc. Area: 0.00833 mm^2

Sample No.	Date	Sample Location/ Description	Average Flow (L/Min)	Duration (Min)	Volume (L)	Fibers Counted	Fields Counted	Concentration* Density f/mm^2	Result f/cc
1 - D4037	12/29/93	Background; in NW corner of work area	9.8	157	1539	19.5	100	21.0	0.005
2 - D4038	12/29/93	Background; in NE corner of work area	9.8	157	1539	12	100	12.0	0.003
3 - D4039	12/29/93	Background; in SE corner of work area	9.8	157	1539	23	100	25.2	0.006
4 - D4040	12/29/93	Area; in center of work area; during scrape	0.9	16	14.4	3	100	<7.0	<0.19+
5 - D4041	12/29/93	Personal; left side; during scrape	1.2	16	19.2	8.5	100	7.8	0.18
6 - D4042	12/29/93	Personal; right side; during scrape	1.2	16	19.2	7.5	100	6.8	0.13

*The average value of the two blank samples (2 fibers/100 fields) was subtracted from the total fiber count for calculation of the fiber concentrations.

+The number of fibers counted in sample no. 4 was less than the estimated limit of detection (LOD) for the method, which is a filter loading of 7 f/mm^2. The airborne fiber concentration is calculated using the LOD; thus the reported value should be considered higher than the true concentration.

IWA = Inside Work Area OWA = Outside Work Area O.L. = Over Loaded D = Damaged PF = Pump Failure NA = Not Applicable

Table 2
Summary of Results – PCM Data
MVA, Inc.
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Norcross, GA 30093
(404) 662-8509

Project Name: Gaskel Removal Experiment Project No.: 0765

Method: 7400"A"
Filter Area: 385 mm^2
Retc. Area: 0.00833 mm^2

Sample No.	Date	Sample Location/ Description	Average Flow (L/Min)	Duration (Min)	Volume (L)	Fibers Counted	Fields Counted	Concentration* Density f/mm^2	Result f/cc
7 - D4043	12/29/93	Area; in center of work area; during wire brush	0.9	12	10.8	101.5	100	119.4	4.3**
8 - D4044	12/29/93	Personal; left side; during wire brush	1.2	4	4.8	78	100	88.8	7.1**
9 - D4045	12/29/93	Personal; right side; during wire brush	1.2	4	4.8	70.5	100	82.2	6.6
10 - D4046	12/29/93	Personal; left side; during scrape and wire brush	1.2	14	16.8	89.5	100	105.0	2.4**
11 - D4047	12/29/93	Personal; right side; during scrape and wire brush	1.2	14	16.8	68	100	79.2	1.8**
12 - D4048	12/29/93	Area; NW corner of work area; during scrape and wire brush	5	37	185	73	100	85.2	0.18**
13 - D4049	12/29/93	Area; NE corner of work area; during scrape and wire brush	5	32	160	67.5	100	78.8	0.19**

*The average value of the two blank samples (2 fibers/100 fields) was subtracted from the total fiber count for calculation of the fiber concentrations.

**Samples 7, 8 and 10 through 14 are heavily loaded with particulate which could result in the lack of detection of fibers.

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Table 2
Summary of Results – PCM Data
MVA, Inc.
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Norcross, GA 30093
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Project Name: Gasket Removal Experiment Project No.: 0765

Method: 7400"A"
Filter Area: 385 mm^2
Relc. Area: 0.00833 mm^2

Sample No.	Date	Sample Location/ Description	Average Flow (L/Min)	Duration (Min)	Volume (L)	Fibers Counted	Fields Counted	Concentration* Density f/mm^2	Result f/cc
14 - D4050	12/29/93	Area; on south center wall; during scrape and wire brush	5	37	185	51.5	100	59.4	0.12**
15 - D4051	12/29/93	Area; center of work area; during sweeping	0.9	5	4.5	78.5	100	91.8	7.9
16 - D4052	12/29/93	Personal; left side; during sweeping	1.2	5	6	73.5	100	85.8	5.5
17 - D4053	12/29/93	Personal; right side; during sweeping	1.2	5	6	75	100	87.6	5.6
18 - D4058	12/29/93	Blank, field	NA	NA	NA	3.5	100	4.2	NA
19 - D4059	12/29/93	Blank, sealed	NA	NA	NA	0.5	100	0.6	NA

*The average value of the two blank samples (2 fibers/100 fields) was subtracted from the total fiber count for calculation of the fiber concentrations.

**Samples 7, 8 and 10 through 14 are heavily loaded with particulate which could result in the lack of detection of fibers.

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