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A Close Examination of the Surfaces of Asbestos Gasket Materials

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ABSTRACT

Gaskets containing asbestos are considered non-friable materials. However, a recently published study has shown that handling asbestos-containing gaskets can release asbestos fibers into the air especially when the gaskets are handled dry. A close examination of the surfaces of four unused gaskets showed that although most of the asbestos is bound within an organic binder, uncoated asbestos fibers were present on the surface and on the edges of the gaskets which would be released as free fibers with mild abrasion.

INTRODUCTION

In assessing the condition of asbestos-containing building materials (ACBM) for their potential to release asbestos fibers one fairly simple test is to determine whether or not the material is friable. If an asbestos-containing material (ACM) can be crumbled by hand pressure, the material is considered friable and certain precautions are advised when the material is handled. Chunks of fireproofing material which can be crushed to dust by hand are considered friable, but asbestos-containing sheet gasket materials which are composed of asbestos in an organic binder are not considered friable. However, friability may not be the only factor to consider when determining the potential for asbestos fiber release. If asbestos fibers are protruding from a product, mild abrasion may dislodge the fibers without reducing the product to dust.

A recent study found that asbestos fibers could be released from asbestos gaskets under certain conditions (1). The authors reported that the practice of dry removal of after-service sheet gaskets, followed by dry polishing of the seating surfaces with a power sander, could create short term asbestos exposure levels in excess of the Excursion Limit (0.1 fibers/cubic centimeter) established by the Occupational Safety and Health Administration (OSHA). The study showed that on-site fabrication (cutting) of sheet gaskets and handling new and after-service gaskets also released asbestos fibers into the air but at lower levels. Wetting the gaskets during handling was found to minimize the release of asbestos fibers.

ASBESTOS GASKETS

According to the United States Environmental Protection Agency (USEPA), 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 (2). Gaskets, often consisting of more than 70% chrysotile asbestos, are often used against alkaline, neutral or weak acid solutions. Blue asbestos (crocidolite) is often present in compressed sheet gaskets when pipes carry strong mineral acids. Sheet gaskets commonly used in condensate and steam lines such as are found in power plants are composed of chrysotile asbestos compressed sheet,

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with styrene butadiene rubber or other binder (3). Other organic binders used in making asbestos gaskets include natural rubber buna-S and buna-N synthetic rubbers (4), or neoprene (1).

MICROSCOPICAL EXAMINATION

In order to investigate the reason for the asbestos release during handling, four unused gaskets were obtained for microscopical examination. Two of the samples were circular gasket material (Figure 1) and two were flat samples. The gaskets were photographed as received and sections were carefully cut from each gasket under a High Efficiency Particle Absolute (HEPA) filtered exhaust hood. The sections were carbon coated and gold coated for examination by scanning electron microscopy (SEM) utilizing a Philips 525 SEM equipped with an EDAX PV9900 energy dispersive x-ray spectrometer (SEM-EDS). All imaging was performed on the flat surfaces and edges of the gaskets in an "as-received" condition. No abrasive materials were used to prepare the gaskets for SEM-EDS.

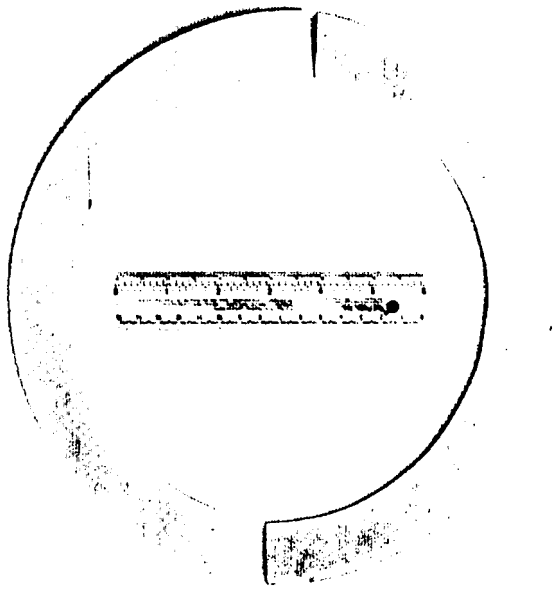


Figure 1. Photograph of an unused circular gasket after sections were removed. A six-inch (15 cm) ruler is shown for scale.

Chrysotile asbestos fibers were found protruding from the flat surfaces and edges of all four gaskets tested. Representative views of the flat and edge surfaces of a circular gasket and a sample of the flat gasket material are shown in Figures 2-13. The higher magnification images show that within the bundles and clumps of chrysotile mixed with the organic binder are thinner chrysotile fibers which are not coated by the binder. These inner fibers are available to be released into the atmosphere when abrasive activities are applied to the gasket surfaces.

CONCLUSIONS

The secondary electron images illustrate why, when working with sheet gasket materials under certain dry conditions, asbestos fibers can become airborne and create short-term exposures in excess of the OSHA Excursion Limit. Not all asbestos fibers are bound in the organic matrix. Documentation of asbestos fibers protruding from the surfaces of "non-friable" asbestos-containing gaskets reinforces the need to work with them under wet conditions to minimize fiber release.

References

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[Figures 2-13 follow on pp. 133-135.]



Figure 2. Secondary electron (SE) image of an outside edge of a circular gasket. Bar = 1 mm.



Figure 3. SE image showing chrysotile fiber bundles and chrysotile fibers protruding from the gasket edge shown in Figure 2. Bar = 0.1 mm



Figure 4. SE image showing a higher magnification view of a portion of the field in Figure 3. Bar = 10 micrometers.



Figure 5. SE image of a surface of a circular gasket. Bar = 1 mm.



Figure 6. SE image showing chrysotile fiber bundles and chrysotile fibers protruding from the circular gasket surface shown in Figure 5. Bar = 0.1 mm.



Figure 7. SE image showing a higher magnification view of a portion of the field in Figure 6. Bar = 10 micrometers.



Figure 8. SE image of an outside edge of a piece of gasket sheet material. Bar = 1 mm.



Figure 9. SE image showing chrysotile fiber bundles and chrysotile fibers protruding from the gasket material edge shown in Figure 8. Bar = 0.1 mm.



Figure 10. SE image showing a higher magnification view of a portion of the field in Figure 9. Bar = 10 micrometers.



Figure 11. SE image of a surface of a piece of gasket sheet material. Bar = 1 mm.



Figure 12. SE image showing chrysotile fiber bundles and chrysotile fibers protruding from the gasket sheet material surface shown in Figure 11. Bar = 0.1 mm.



Figure 13. SE image showing a higher magnification view of a portion of the field in Figure 12. Bar = 10 micrometers.