

FILE NAME: Flooring (FLR)

DATE: 1985

DOC#: FLR024

DOCUMENT DESCRIPTION: Journal Article - Asbestos Fibers Release
from VA Tile

BC Note (attached to
next page)

1985 floor tile
removal w/ PCM
and TEM data

Asbestos Fibers Release from VA Tile

How much asbestos is released into the air during standard dry removal of vinyl asbestos floor tile? This question has been debated by flooring contractors, asbestos consultants and school building officials for some time. A recent test conducted by the DeKalb County, Georgia School System produced interesting results. Floor covering replacement for a 15-year old elementary school was scheduled and offered an excellent opportunity to investigate the release of asbestos fibers during the process of removing old vinyl asbestos tile. A classroom in the school was selected as a test area and a flooring contractor was authorized to remove the old floor and install a new Type IV Vinyl Composition floor covering in the room using standard floor removal and replacement procedures.

Prior to beginning the removal, a test procedure was developed for determining fiber release¹. The procedure called for pre-removal and post-removal monitoring using both phase contrast procedures and transmission electron microscopy procedures². Samples were to be taken at a flow rate of 16 liters per minute and at a total volume of 2,400 liters. Filters for phase contrast analysis were standard Millipore filters while those for electron microscopy were Nucleopore. All filters were 37 mm diameter filters. All sampling was done using aggressive techniques.

Pre-removal sampling in the room produced a level of 0.01 fibers/cc using phase contrast test (P&CM 239) and no asbestos fibers were detected in the TEM test. Since no asbestos fibers were present in the classroom, no outside ambient air test was conducted. The 2" x 12" x 1/8" floor tile was then removed using spud hoes and an electrical powered vibrating floor tile spud. Removal was accomplished in approximately three hours. Air samples were then collected before the new tile was installed. The phase contrast test con-

by: John Jenkins

showed a fiber level of 0.08 fibers/cc. The TEM test showed a level of .0838 fibers/cc with a weight of 0.5695 nanograms per cubic meter. Analysis of the fiber size showed that all fibers were less than 5 microns in length and that 60% of the fibers were approximately .05 microns in diameter with approximately 40% being 0.1 microns in diameter. All asbestos fibers were chrysotile.

The classroom was closed off to permit settling in the room and then cleaned to remove residual fibers. TEM testing confirmed that the room was clean.

A sample of the removed tile was subjected to analysis by optical microscope using polarized light and dispersion staining techniques. This analysis indicated an asbestos content of less than 1%. This percentage was not consistent with the tile manufacturer's reported mixtures and not consistent with the post-removal fiber count. Tile manufacturers report that mixtures normally contain ten to fifteen percent chrysotile asbestos. A recheck of the sample using an optical microscope and polarized light did not confirm the reported content so additional procedures were used for testing the

bulk sample. A portion of the same was crushed to a powder and dispersed in distilled water³. The large particles were allowed to settle and a drop of the suspension was placed on a TEM grid and dried. Analysis of this grid verified that the tile probably contained at least 10% asbestos, which is consistent with the manufacturer's statements and also supports the measured levels in the air after removal.

The DeKalb County School System is aware that air monitoring is not an exact science and for this reason determined to repeat the test on a second classroom in the same school. The procedures utilized in the second test were the same as those employed for the first test. The pre-removal test confirmed that no asbestos fibers were present and therefore no outside ambient test was conducted.

Floor tile removal procedures were the same as those used in the first test. It was noted that during this removal the classroom windows were open and that the classroom door to the corridor was also open. The phase contrast reading for the post-removal air monitoring was 0.009 fibers/cc. The TEM reading was .2384 fibers/cc with a mass of 26109.3 nanograms per cubic meter. The micrograph below illustrates the wide dispersion of fiber sizes in the sample analyzed by TEM methods.

CONDENSED DATA

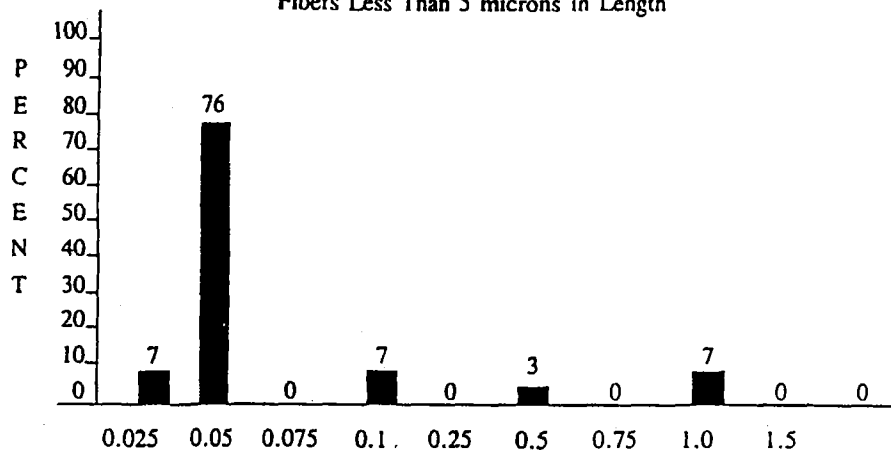
1. Number of Asbestos Fibers analyzed	40
2. Number of Nonasbestos Fibers analyzed	50
3. Number of Ambiguous Fibers analyzed	0
4. Asbestos type:	Chrysotile
5. Concentration of Asbestos Fibers (fibers/cc) or (million/m ³)	0.2382
6. Percentage of concentration due to Asbestos Fibers ≥ 5 μm (microns) in length	27.500%
7. Mass of Asbestos Fibers (nanograms/m ³)	26109.3
8. Percentage of mass due to Asbestos fibers equal to or greater than 5 μm in length	99.6626%

Comments: Nonasbestos fibers present were Gypsum, Glass and Fiber.

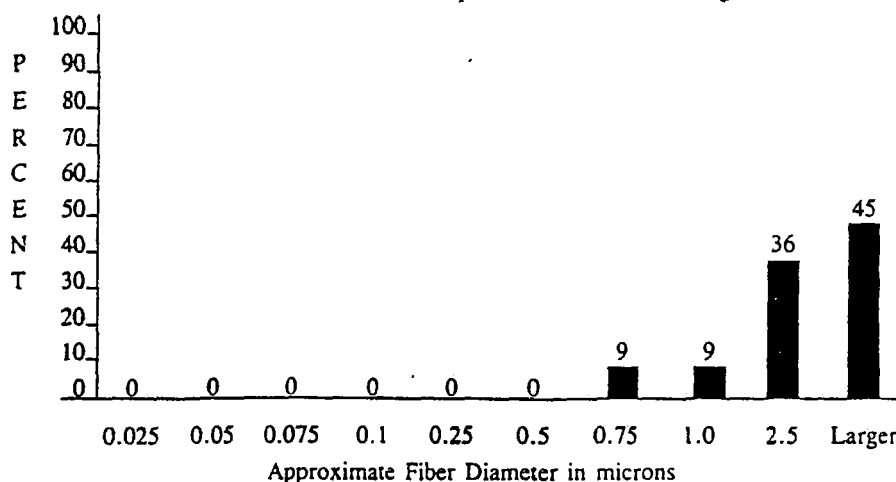
CONTINUATION OF ASBESTOS RELEASE FROM VA TILE

CHRYSOTILE

Fibers Less Than 5 microns in Length



Fibers Greater Than or Equal To 5 microns in Length



Because of the air circulation from the classroom to the corridor during the second removal, a decision was made to test the air in the corridor outside of the classroom. This test using TEM procedures indicated a fiber count of 0.0558 fibers/cc of chrysotile asbestos. The mass of the fibers in this sample was only 0.0854 nanograms per cubic meter. All of the fibers collected in this sample were less than 5 microns in length with 50 percent of the fibers having a diameter of 0.025 microns and the remaining 50 percent having a diameter of 0.5 microns. No phase contrast test was conducted in this area.

Both the classroom and the adjoining areas were thoroughly cleaned and checked to confirm that they were suitable for occupancy prior to being released to the school system for use. The tests conducted are obviously not

fully laboratory controlled tests, but are certainly indicative of the problems relating to tile removal. The following conclusions were reached based on the results of the test:

1. A significant amount of asbestos fiber is released during removal of vinyl asbestos tile using conventional tile removal methods.
2. Fiber control methods such as damp removal or isolation of areas by plasticizing and use of appropriate respirators should be used for tile removal.
3. Areas subjected to contamination by tile removal using uncontrolled methods should be thoroughly cleaned and tested prior to being returned to use.

The DeKalb School System expects to do additional investigative work in order to determine the most econom-

ical method of removing tile safely. Investigations will probably be conducted on damp removal methods and area isolation and cleaning procedure

*Test procedures developed by Southern Engineering Company. Sampling performed by Southern Company, 18 Peachtree Street, N.W., Atlanta, Georgia 30367-8301, John M. Jenkins, Vice President.

*Laboratory testing by Electron-Microscopy Service Laboratories, Inc., 108 Haden Avenue, Westmont, New Jersey 08108, Dr. Peter Frasca, Ph.D., Director.

*Sample test procedure by Georgia Tech Research Institute, Georgia Institute of Technology, Atlanta, Georgia 30332, James L. Hubbard, Senior Scientist.

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