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SAFETY AND ENVIRONMENTAL HEALTH UNIT
MONTGOMERY COUNTY PUBLIC SCHOOLS

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ATTACHMENTS:

1. TABLES OF RESULTS
2. HARD COPIES OF LABORATORY ANALYSIS REPORTS

A. F. MEYER AND ASSOCIATES, INC.

1. INTRODUCTION:

Per your request, on October 19, 1989 A. F. Meyer and Associates, Inc. (AFMA) performed a limited study to determine asbestos fiber release, if any, from routine buffing and stripping of vinyl asbestos floor tiles. The study was performed by John B. Love and Reynolds B. Renshaw in classroom 18 at the Sligo Middle School in Montgomery County, Maryland. Southern Insulation, a licensed asbestos abatement firm performed the buffing and stripping operations. Samples of the 9" x 9" vinyl floor tiles indicated they contained 5% chrysotile asbestos in the tiles themselves and 10% chrysotile asbestos in the mastic used to adhere the tiles to the concrete floor of the school.

This study is very limited and must not be construed as being all inclusive as to asbestos exposures encountered by custodial and maintenance staff, students, teachers, and the general public in schools generated from routine buffing and stripping of asbestos-containing floor tiles. It was intended to provide an indication of whether or not there is a potential to release asbestos fibers from the tiles during buffing or stripping. It was also intended to provide a foundation for further investigation if warranted based on its outcome.

2. PROCEDURES USED:

The approximate size of classroom 18 was 30 feet by 28 feet (840 square feet). This part of the school was unoccupied at the time of the study. Prior to the buffing and stripping operations, the classroom was totally isolated from the rest of the school by constructing a containment consisting of two layers of 6 mil plastic sheeting on the walls and a three-stage decontamination facility connected to the area. A high efficiency particulate air (HEPA) exhaust unit was placed inside the classroom. The exhaust unit was operated at a low setting so as not to provide rapid air exchange and filtration. The purpose of the unit was to create a slight negative pressure differential relative to adjacent areas of the school so fiber release would not occur outside the contained classroom.

After total isolation of the area and prior to performing the floor maintenance, all surfaces within the classroom were pre-cleaned via wet methods using amended water. All floor maintenance supplies (i.e. buffing/stripper solutions and pads) were provided by Channel 4 and Montgomery County janitorial staff. Buffing and stripping procedures were discussed at length with maintenance staff prior to conducting the study. For the purposes of this study the following buffing and stripping methods were employed:

METHOD 1 - BUFFING

Buff with standard red buffing pad and standard buffing solution. (Duration - approximately 45 minutes).

METHOD 2 - STRIPPING

Strip floor using standard stripping mixture mopped on and standard black stripping pad. Mop with clean water twice afterwards. (Duration - approximately 70 minutes).

METHOD 3 - STRIPPING

Strip floor using a fine mist spray of stripper solution and standard black stripping pad. Mop with clean water twice afterwards. (Duration - approximately 70 minutes).

During all floor maintenance operations, persons performing the work were full-body protective (Tyvek) suits and full-face respirators equipped with filters designed for protection against airborne asbestos dust/fibers. Workers and survey persons, using appropriate procedures, entered and exited the work area through the decontamination facility. Once all buffing and stripping operations were complete and the study concluded, the floor was mopped and waxed to ensure any remaining dust or fibers would not become airborne once the containment was dismantled and the area re-occupied

3. SAMPLING PROTOCOL AND ANALYTICAL METHODS:

Bulk samples were collected from the water used during pre-cleaning, the water and stripper mix mopped up after the final stripping method, the buffing (red) and stripping (black) pads used, and from the residual dust remaining on the tiles after the final stripping and mopping method. General area air samples were collected in the classroom prior to the buffing and stripping work, during each method used, and under aggressive sampling conditions using a leaf blower after the final stripping and mopping method and before re-waxing the floor. Two samples were collected during each sampling period, one located approximately two feet from the floor and the other approximating breathing zone level, or five feet above the floor. One eight-hour air sample was collected from the workers' breathing zone. Two general area air samples were collected outside the contained classroom at the entrance to the decontamination facility. General air samples were collected with high volume line operated sampling pumps at a flow rate of 8.5 - 8.7 liters per minute (lpm). The worker breathing zone air sample was collected using a battery operated personal sampling pump at a flow rate of 2.4 lpm. All sampling pumps were calibrated before and after each sampling period.

Bulk samples were analyzed using Polarized Light Microscopy (PLM) and Transmission Electron Microscopy (TEM). Air samples obtained from inside the classroom prior to, during, and after the buffing and stripping operations were collected on 0.45 micron pore size mixed cellulose ester membrane filters with 50 mm non-conductive extension cowls. These samples were analyzed using Transmission Electron Microscopy (TEM). The outside general area and worker breathing zone air samples were collected on 0.8 micron pore size mixed cellulose ester membrane filters with 50 mm non-conductive extension cowls. These samples were analyzed using Phase Contrast Microscopy (PCM). The general area samples outside the contained classroom were also analyzed by TEM. (For specific methods of analyses used please see the attached tables).

4. LIMITS FOR AIRBORNE ASBESTOS:

a. Except for abatement activities, there are no exposure standards for non-occupational settings.

b. There are standards for general air quality after completion of an abatement or response action and before re-occupation of the areas involved. These standards are based on the analysis of a minimum of five samples collected within the work area after abatement is complete. Samples analyzed using phase contrast microscopy must all demonstrate concentrations less than 0.01 fibers per cubic centimeter (f/cc). Samples analyzed using Transmission Electron Microscopy (TEM) must have an average of less than 70 structures per square millimeter or not be statistically significantly different (higher) than 5 samples collected from outside the contained work area.

c. The EPA's Worker Protection Rule 40 CFR Part 76 3.121 has been extended to employees of local education agencies who perform operations, maintenance, and repair (O & M) activities involving asbestos-containing material. Under the rule, the permissible exposure limit for asbestos based on an eight-hour time weighted average is 0.2 fibers per cubic centimeter (f/cc) with an action level of 0.1 f/cc.

5. RESULTS OF SAMPLING:

a. Analysis results of the sample collected from the water used during pre-cleaning indicated asbestos was present. Results of the sample collected from the stripper and water mix after the stripping operations showed close to two times that of the water used during precleaning. In both instances, asbestos structures detected were all less than 10 micrometers in length. Consequently, the reported concentration of structures greater than 10 micrometers in both samples was less than 122.7 million structures per liter (MILL STR/L).

b. Analysis results of the bulk sample collected from the residue on the buffing (red) pad indicated a trace of chrysotile asbestos.

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c. Analysis results of the bulk sample collected from the residue on the stripping (black) pad indicated 1% chrysotile asbestos.

d. Analysis results of the bulk sample collected from the remaining residue on the floors after the final stripping method indicated a trace of chrysotile asbestos.

e. Results of the air sample collected from the workers breathing zone yielded a concentration of 0.013 fibers per cubic centimeter as an eight-hour time weighted average.

f. General area air samples collected inside the contained classroom before any buffing or stripping operations were performed (background) indicated airborne fiber densities of 30.5 and 45.8 structures per mm^2 (0.01 and 0.015 structures per cc).

g. General area air samples collected inside the work area during buffing operations performed showed airborne fiber densities of 15.3 and 45.8 structures per mm^2 (<0.01 and 0.015 structures per cc).

h. General area air samples collected within the contained classroom during the first stripping operation (Method #2) showed airborne fiber densities of 91.6 and 229.0 structures per mm^2 (0.029 and 0.072 structures per cc).

i. General area air samples collected within the contained classroom during the second stripping operation (Method #3) yielded airborne fiber densities of 236,167.6 and 276,316.1 structures per mm^2 (77.5 and 89.2 structures per cc). It should be noted that these samples could not be analyzed by standard TEM analysis because of excessive loading on the filters. The samples were prepared by low-temperature plasma ashing and aqueous redeposition due to overloading of the filters. Complex asbestos structures consisting of multiple fibers may have disaggregated during sample preparation. Consequently, asbestos structure counts may be biased high.

j. General area air samples collected using aggressive sampling techniques after the final stripping operation indicated airborne fiber densities of 137.4 and 183.2 structures per mm^2 (0.045 and 0.06 structures per cc).

k. All asbestos sample analysis results are outlined in the attached Tables 1 and 2.

6. CONCLUSIONS:

a. Again, this study has limitations and cannot be used to definitively quantify general occupant and maintenance staff exposure levels to asbestos from floor tile maintenance activities in all situations. It applies only to conditions encountered and techniques used at the time of sampling.

b. Concentrations found in the workers breathing zone during this study did not exceed the existing permissible exposure limit nor the action level outlined in the EPA's Worker Protection Rule. The sampling and analytical method required for worker exposure monitoring detects all fibers with characteristics of asbestos fibers and which are greater than 5 microns in length. Levels found however, do warrant consideration when assessing overall asbestos exposures to employees involved in routine operations, maintenance and repair activities.

c. Airborne asbestos fiber densities or concentrations found in the general air within classroom 18 prior to the buffing and stripping operations did not exceed filter background levels (70 s/mm^2) when analyzed using TEM.

d. General area air samples collected during buffing operations did not exceed filter background levels when analyzed using TEM.

e. General area air samples collected during stripping operations and under aggressive sampling techniques after all stripping was done did significantly exceed filter background levels when analyzed using TEM. It appears that airborne asbestos structure densities started to increase during the first stripping method (stripping mixture mopped on and using standard black stripping pad) and elevated tremendously during the second stripping method (fine mist spray of stripper solution and using standard black stripping pad). Aggressive sampling conducted after the second or final stripping method and after the floor was mopped showed that airborne asbestos structure densities returned to levels near those experienced during the first stripping method. This leads us to believe that stripping asbestos-containing floor tiles using semi-wet techniques has a far greater potential for releasing airborne asbestos than stripping methods employing wet or very wet methods. It should be noted that of the general area air samples collected inside the classroom during these operations, nearly all asbestos structures found were less than 5 microns in length.

f. Based on the air sampling, it is the opinion of this study that asbestos fibers or structures were released from the floor tiles and became airborne during the stripping operations performed. The levels found were above levels considered acceptable for determining the completion of a response or abatement action and before re-occupancy of such affected areas.

g. The degree of health risk associated with the levels of airborne asbestos found cannot be accurately ascertained without further investigation and exposure monitoring.

7. RECOMMENDATIONS:

a. Consistent with EPA's guidance document 560/5-85-024 Guidance for Controlling Asbestos-Containing Materials in Buildings ("Purple Book") paragraph 3.3.3, avoid removing, sanding or stripping floor tiles containing asbestos. If tiles are removed, do not sand asbestos backing material remaining on the floor.

b. Implement interim policies in regards to the above until such time that further investigation is performed and more scientific data becomes available or until specific guidance is issued by the appropriate regulatory agencies.

c. If asbestos-containing floor tiles must be stripped, use only wet stripping methods. Institute appropriate engineering controls, work practices, air monitoring, and employee protection programs. Assess exposures to workers during stripping and consider these exposures in overall exposure assessments of employees involved in routine operations, maintenance, and repair activities.

d. Considerable attention should be lent to the potential for fiber release during asbestos-containing floor tile maintenance operations. EPA's involvement and participation is imperative in affording an adequate assessment of exposure potentials. Appropriate regulatory guidance for local education agencies must be disseminated at the earliest possible date.

ATTACHMENT 1

TABLES OF RESULTS

Asbestos Air Sampling Results
Sligo Middle School, Montgomery County, Maryland
WRC-TV Washington

TABLE #1

TRANSMISSION ELECTRON MICROSCOPY (TEM)

SAMPLE #	SAMPLE DATE	SAMPLE LOCATION	SAMPLE VOLUME IN LITERS	TEM ANALYSIS OF AIRBO FIBER DENSITY IN S/FF
JLC4101988931	10/19/89	Pre-sample - background classroom 18	1199.8	45.8
JLC4101988932	10/19/89	Pre-sample - background classroom 18	1278.0	30.5
JLC4101988906	10/19/89	Work area - Method #1 @ 5'	1199.8	45.8
JLC4101988905	10/19/89	Work area - Method #1 @ 5'	1278.0	15.3
JLC4101988906	10/19/89	Work area - Method #2 @ 2'	1199.8	91.6
JLC4101988907	10/19/89	Work area - Method #2 @ 5'	1278.0	229.0
JLC4101988908	10/19/89	Clean area - outside decon entrance	1479.0	122.1
JLC4101988909	10/19/89	Work area - Method #3 @ 2'	1174.0	236,167.6
JLC4101988910	10/19/89	Work area - Method #3 @ 5'	1192.0	278,316.1
JLC4101988912	10/19/89	Clean area - outside decon entrance	1662.0	30.5
JLC4101988913	10/19/89	Post-strip - pre-wax aggressive @ 2'	1166.0	183.2
JLC4101988914	10/19/89	Post-strip - pre-wax aggressive @ 5'	1183.0	137.4

PHASE CONTRAST MICROSCOPY (PCM)

SAMPLE #	SAMPLE DATE	SAMPLE LOCATION	SAMPLE VOLUME IN LITERS	PCM ANALYSIS OF AIR FIBER DENSITY IN F/
JLC4101988908	10/19/89	Clean area - outside decon entrance	1479.0	17.8
JLC4101988911	10/19/89	Personel - workers breathing zone	1152.0	39.5
JLC4101988912	10/19/89	Clean area - outside decon entrance	1662.0	22.5
JLC4101988919	10/19/89	Blank		NFO

< = Less than NFO = No Fibers Observed S/MM2 = Structures per square millimeter S/CC = Structures per c
F/MM2 = Fibers per square millimeter F/CC = Fibers per cubic centimeter

ANALYSIS: Air samples were analyzed using Transmission Electron Microscopy (TEM) EPA level II (YAMATE Microscopy (PCM) NIOSH 7400 A (as modified by OSHA/EPA counting rules). Samples were anal accredited laboratory.

* These samples were prepared by low-temperature plasma ashing and aqueous redeposition due to overloading of e structures consisting of multiple fibers may have disaggregated during sample preparation. Consequently, con high.

Asbestos Bulk and Water Sampling Results
Sligo Middle School, Montgomery County, Maryland
WRC-TV Washington

TABLE #2

BULK SAMPLES

SAMPLE #	SAMPLE DATE	SAMPLE LOCATION	PCM ANALYSIS OF BULK SAMPLES EXPRESSED IN PERCENT ASBESTOS	ANALYTICAL DESCRIPTION
JLC4101988901	10/18/89	Red floor tile - classroom 18	5.0	Chrysotile
JLC4101988901	10/18/89	Red floor tile mastic	10.0	Chrysotile
JLC4101988902	10/18/89	Tan floor tile - classroom 18	5.0	Chrysotile
JLC4101988902	10/18/89	Tan floor tile mastic	5.0	Chrysotile

SAMPLE #	SAMPLE DATE	SAMPLE LOCATION	TEM ANALYSIS OF BULK SAMPLES EXPRESSED IN PERCENT ASBESTOS	ANALYTICAL DESCRIPTION
JLC4101988915	10/19/89	Black pad used during Method #2	1	Chrysotil
JLC4101988916	10/19/89	Red pad used during Method #1	Trace	Chrysotil
JLC4101988918	10/19/89	Residual dust on floor after Method #3	Trace	Chrysotil

WATER SAMPLES

SAMPLE #	SAMPLE DATE	SAMPLE LOCATION	TOTAL STRUCTURE CONCENTRATION (MILL STR/L)	<1MM STR (#)
JLC4101988903	10/19/89	Water used during pre-cleaning	9666.4	<12
JLC4101988917	10/19/89	Water used during floor cleaning after final stripping Method #3	14491.6	<12

< = Less Than > = Greater Than NFO = No Fibers Observed MILL STR/L = Million Structures per Liter

ANALYSIS: Water samples were analyzed using Transmission Electron Microscopy (TEM) EPA method 600/4- using Polarized Light/Dispersion Staining (PLM) 40 CFR Part 763 App.A to Subpart F, and T EPA Level II, a semi-quantative adaptation. Samples were analyzed by R. J. Lee Group, an

VINYL ASBESTOS FLOOR TILE STUDY

ROUTINE BUFFING AND STRIPPING OPERATIONS

FOR

WRC-TV WASHINGTON

NOVEMBER 6, 1989

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THIS REPORT WAS PREPARED BY JOHN B. LOVE.

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THE COOPERATION AND ASSISTANCE OF WRC-TV WASHINGTON, SOUTHERN INSULATION, AND THE MONTGOMERY COUNTY PUBLIC SCHOOLS IN THE STUDY COVERED BY THIS REPORT IS MUCH APPRECIATED.