DETERMINATION OF ASBESTOS LEVELS IN A PUBLIC BUILDING LOCATED IN TOWSON, MARYLAND

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INTRODUCTION

At the request of Mr. Barry I. Castleman, Baltimore County Health Department, Baltimore, Maryland, the Division of Field Studies and Clinical Investigations, National Institute for Occupational Safety and Health (NIOSH) has evaluated the potential for exposures to asbestos in a public building located at York Road and Bosley Avenue, Towson, Maryland. Said evaluation is reported herein and includes asbestos determinations of bulk ceiling samples received from Mr. Castleman and airborne samples collected at the building by Mr. Kenneth M. Wallingford, NIOSH, on March 27, 1973.

DESCRIPTION OF BUILDING

The building in question is located at York Road and Bosley Avenue, Towson, Maryland, which is in the suburbs of Baltimore. The building has two levels, with the ground level housing the local fire department and the basement level housing the Bureau of Civil Defense. The building was constructed in 1953; however, the ceiling material suspected of containing asbestos was not installed until March, 1966. This material was installed on the ceiling of the basement level to help alleviate a heat problem caused by the heating plant located on

the ground floor directly above the civil defense offices. The fact that the building has no air conditioning system created almost unbearable working conditions prior to the installation of the material onto the ceiling.

The John Hampshire Company of Baltimore applied the material, which is labeled as "Spraycraft Asbestos Fiber", in two layers. One thick layer (one inch in depth) was applied against the original ceiling surface and a thinner layer (1/4 inch in depth) was applied over the outer surface of the first layer, probably to act as a binder.

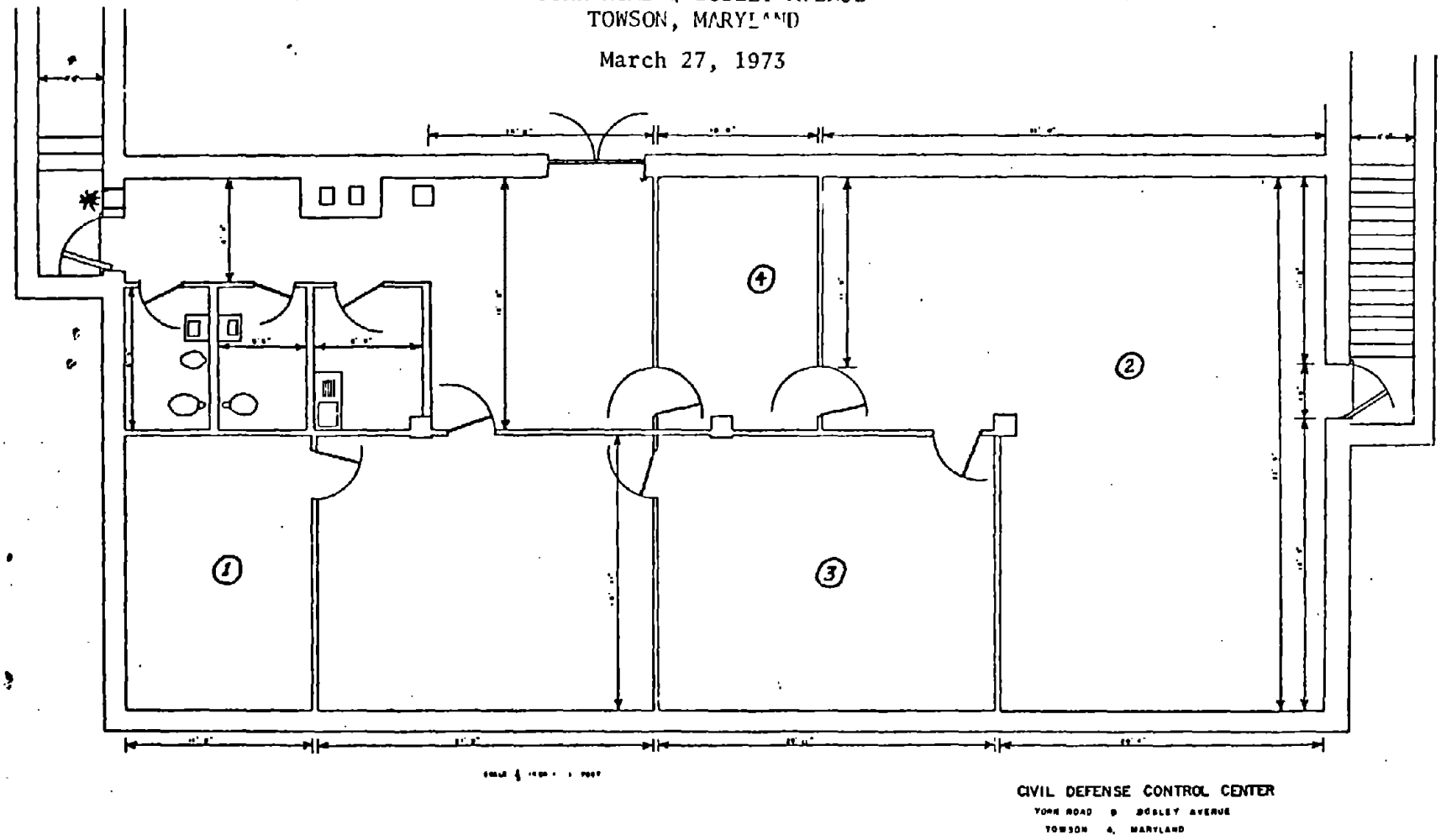
The ceiling is not suspended and is approximately nine feet above floor level. The ceiling with the applied material covers the entire office area of the civil defense headquarters, which is divided into six smaller rooms (Figure 1).

The ventilation system for the basement area is of a forced-air type with a filter for the incoming air but no filter for the exhausted air. The ventilation exhaust is located approximately six feet above the floor by the entrance door to the offices. As mentioned earlier, there is no air conditioning system.

FIGURE 1

BASEMENT FLOOR OF BUILDING
YORK ROAD & BOSLEY AVENUE
TOWSON, MARYLAND

March 27, 1973



* Location of Ventilation System Exhaust

There are seven people employed by the Bureau of Civil Defense, all of which act in administrative capacities and work in the six rooms and, therefore, are continuously exposed to possible hazards posed by the asbestos in the ceiling covering material.

SAMPLING AND ANALYTICAL PROCEDURES

The bulk ceiling samples obtained from Mr. Castleman were analyzed by an analytical laboratory within NIOSH and the Battelle Memorial Institute, Columbus, Ohio, for a quantification of the asbestos content. The NIOSH laboratory utilized an x-ray diffraction technique that followed the procedure of grounding the sample in ethanol and placing a small portion of the resultant mixture on a silver membrane filter for scanning by the x-ray equipment. The technique is not necessarily specific for asbestos determination. Transmission electron microscopy was utilized by Battelle and, as such, is described in Attachment I. This procedure is specific for determination of chrysotile asbestos.

The airborne samples were collected in four representative locations of the civil defense offices (Figure 1). Two samples were collected simultaneously at each location for about six hours at a sampling rate of approximately seven liters per minute. The samples were collected on 0.8μ AA millipore filters with 1/4 h.p. gast pumps being utilized as the vacuum source.

All four sets of two samples were placed in the center of the rooms where located and approximately three feet above floor level. Set #1 (samples 1 and 2) was placed in the radio-communications room. This room is used for emergency communications and is not in normal everyday use. Set #2 (samples 3 and 4) was located in the operations room where there is always one employee present. Set #3 (samples 5 and 6) was located in the director's office. Generally, the director is the only employee present in this room. Set #4 (samples 7 and 8) was located in a partitioned room opposite the director's office. There is normally one employee working in this room.

Analysis of the collected airborne samples was done by an optical count method using standard phase contrast microscopy at a magnification of 400X. This method is similar to that recommended by the United States Public Health Service.[1]

SAMPLING RESULTS AND DISCUSSIONS

The NIOSH laboratory analysis of the bulk ceiling sample, utilizing x-ray diffraction, showed an asbestos content of 27 percent, by weight. As was mentioned previously, this analysis does not necessarily represent chrysotile content but could also indicate the presents of other asbestos

material such as serpentine. However, the Battelle analysis utilizing electron microscopy, which is specific for chrysotile and is considered to be an accurate and acceptable method, showed an asbestos (chrysotile) content of 34 percent, by weight. This, of course, is in the range estimated by the x-ray diffraction technique. The electron microscope analysis also showed an uneven distribution of asbestos fibers throughout the sample, which could indicate that other bulk samples may show much different asbestos contents.

The results of the airborne samples as collected in the four locations are presented in Table 1. The concentrations ranged from 0.0 to 0.0031 fibers/ml for fibers greater in length than 5μm, with a mean concentration of 0.0011 fibers/ml. In comparison to present Occupational Safety and Health Administration (OSHA) occupational health standards (5 fibers/ml as an existing 8-hour exposure standard and 2 fibers/ml to be effective in July 1976), the measured concentrations are quite low. This indicates that <u>if the OSHA standards are protective of health</u>, there appears to be no health hazard due to asbestos exposures under the conditions that existed during the March 27 sampling survey. Of course, it must be remembered that the OSHA standards apply to occupational settings and are not meant to be applied to the general public in a non-industrial setting.

TABLE 1

RESULTS OF AIR SAMPLES FOR FIBER COUNT IN PUBLIC BUILDING
AT
YORK ROAD AND BOSLEY AVENUE
TOWSON, MARYLAND

March 27, 1973

SAMPLE #	*LOCATION*	*TOTAL AIR VOLUME LITERS*	*FIBERS >5μm IN LENGTH*	
			AVERAGE COUNT	*CONCENTRATION FIBERS/ML*
1	Radio Communications	2410.99	0.02	0.0000
2	Radio Communications	2410.99	0.01	0.0000
3	Operations Room	2449.92	0.08	0.0028
4	Operations Room	2433.76	0.05	0.0014
5	Director's Office	2248.08	0.01	0.0000
6	Director's Office	2463.70	0.02	0.0000
7	Administrative Office	2267.2(	0.05	0.0015
8	Administrative Office	2232.15	0.08	0.0031
	MEAN CONCENTRATION			*0.0011*

Microscope and Miscellaneous Counting Data:

Type of Microscope:	Olympus Phase Contrast
Objective:	40X acromatic, N.A.=0.65
Condenser:	Abbe type fitted with green filter
Eyepieces:	10X Huygenian with "Porton" recticle
Filter Area:	$855mm^2$
Counting Field Area:	$0.00739mm^2$
Blank Count:	0.02 fibers >5um in length

Based on the evidence presented by the analyses of the bulk ceiling samples, it is apparent that there is considerable potential for exposures to asbestos either from material flaking off the ceiling or flaking, etc. during maintenance operations that may occur in the building. With this potential for more severe employee exposures to asbestos than were determined during the subject survey and the lack of evidence of whether or not chronic exposures to low level concentrations of asbestos fibers may cause adverse health effects, it would seem prudent that appropriate measures be taken to eliminate the possible asbestos exposures in the subject building.

CONCLUSIONS AND RECOMMENDATIONS

1. The material that was applied to the ceiling of the basement floor in the subject building in March, 1966, contains approximately 30 percent, by weight, chrysotile asbestos.

2. Air sampling results of a March 27, 1973, survey of the subject building indicate that airborne levels of asbestos are quite low in comparison to present OSHA occupational health standards.

3. Since there is a potential for flaking of the ceiling material and subsequent employee exposures to higher airborne asbestos levels than were determined during the subject survey, it is recommended that

appropriate actions be taken to limit the possibility of asbestos release from the ceiling by applying a sealant material to the present ceiling, applying a new ceiling over the existing one or removing the existing asbestos containing material, if possible. If the second alternative is choosen, appropriate precautions must be taken for employee and general public protection during future maintenance or demolition operations concerning the ceiling.

Worker protection and appropriate asbestos handling procedures during application of the sealant or removing of the existing material also should be considered. Such protection and procedures that can be used are stated in the OSHA occupational health asbestos standard (29CFRPart 1910.93a) and the U.S. Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants (40CFRPart 61, Subpart B).

Until such time as corrective measures are taken, continual observations of the condition of the ceiling should be made so that minimal or no exposures are assured.

It is understood that the Baltimore County Health Department concurs in the stated recommendations as is evidence by their interoffice correspondence dated March 12, 1973 (Attachment II) which was written prior to the sampling survey reported herein.

REFERENCES

1. Edwards, G.H. and J.R. Lynch, "The Method Used by the Public Health Service for Enumeration of Asbestos Dust on Membrane Filters". Ann. Occup. Hyg., Vol. II, pp.1-6, 1968.

ATTACHMENT I

Transmission Electron Microscopy For Asbestos Air and Source Samples

This description of the methodology is presented in sufficient detail so that other laboratories, even though not completely familiar with the techniques employed, could follow the procedure and obtain satisfactory analytical data.

A. Sampling

(1) Collect air samples on Millipore type HA 47 mm, 0.45 µm pore size filter disks held in a Clean Room Monitoring Filter Holder (Millipore Cat. No. XX 50 047 40) supplied with a 5 liter/min limiting orifice.

(2) Connect the above filter holder to a vacuum pump capable of maintaining a pressure drop of at least 8 pounds per square inch at a flow rate of 5 liters per minute.

(3) Carry out sampling for the desired monitoring period.

(4) Record of volume of the air sampled.

(5) Remove filter from filter holder and store in clean petri dish.

B. Sample Preparation

(1) Handle specimen in a clean laboratory environment. Class 100 or better.

(2) Take 1/2 of filter (Step 5 of A), fold and put in the bo tom of Pyrex test tube (1.5 cm x 9 cm). (See Note 1.)

(3) Put test tube in a low temperature asher for 2 hours or until sample is completely ashed. (Low temperature asher from Tracerlab LTA 600.)

(4) Remove test tube, add 5 ml of filtered deionized water and 2 ml of 10 percent Aerosol OT (Fisher So-A-292).

(5) Treat ultrasonically for 5 minutes in ultrasonic generator (Branson Ultrasonic Corporation - Sonogen T-32) to disperse and suspend the ash.

(6) Centrifuge sample at 800 g for 20 minutes.

(7) Decant supernatant liquid into 100 ml graduate cylinder and hold.

(8) Resuspend the residue and repeat steps 4, 5, and 6 above; decant and combine supernatant liquid into 100 ml graduate as in step 7, dilute to 100 ml with filtered deionized water and mix thoroughly.

(9) Tap 30 ml and 70 ml aliquots and filter each through a 25 mm, 0.45 μm pore size filter (see Note 2).

C. Preparation of Specimen For Electron Microscopy

(1) Vapor deposit ≈ 200 Å layer of carbon over the prepared samples distributed uniformly on Millipore filter [B (9) above].

(2) Cut out 5 x 5-mm pieces of filters bearing the redistributed ashed and carbon-coated particulates.

(3) Dissolve the cellulose acetate Millipore filter substrate using a petri dish approximately one half filled with acetone.

(4) Aspirate the carbon film bearing the ashed redistributed particles into a medicine dropper along with a few drops of the acetone used to dissolve the Millipore filter.

(5) Hold the medicine dropper vertically until the carbon film falls to the opening of the medicine dropper.

(6) Deliver a drop of acetone containing the carbon film to the surface of water held in another petri dish (≈ one half full).

(7) Pick up the now flattened and floating carbon film from the surface of the water on a 200 mesh copper electron microscope support grid.

D. Examination of Specimen in the Electron Microscope

(1) Place specimen in electron microscope specimen holder and examine systematically for asbestos particles at a magnification of 30,000X with a 100-kv beam (see Note 3).

(2) Count fibers per grid opening on at least 5 openings to get data on average number of fibers per opening.

E. Preparation of Standards

(1) Simulate the sample conditions by ultrasonically suspending known quantities of asbestos (10.0 µg, 0.1 µg, 0.01 µg, and 0.001 µg).

(2) Dry filtered preparation and ash the preparation in the low temperature asher for 2 hours.

(3) Resuspend the ash in 5 ml of filtered deionized water plus 2 ml of 10 percent Aerosol OT and subject the resulting suspension to ultrasonic dispersal treatment for 5 minutes as was done in B (5) above.

(4) Refilter on a 25-mm Millipore filter and allow to dry.

(5) Proceed through the entire procedure for "Preparation of Specimen for Electron Microscope" and "Examination of Specimen in the Electron Microscope" (under C and D).

F. Analysis of Microscope Data

(1) Compare fibers per opening for samples to comparable data for standards to obtain µg asbestos per sample.

(2) Translate the µg asbestos per sample into µg asbestos/ cubic meter.

Note 1. The portion of a filter to process is arbitrary. A second portion may need to be selected to adjust for the amount of particulates finally deposited for the microscopic examination.

Note 2. Use filtering apparatus supplied by the Millipore Corporation, Catalog No. XX 10 025 00, connected to a laboratory aspirator or vacuum pump.

Note 3. Initially examine the specimen prepared from the 30 ml aliquot. If the asbestos particles are too sparse, use the 70 ml aliquot for the analysis.

ATTACHMENT II

BALTIMORE COUNTY, MARYLAND

INTER-OFFICE CORRESPONDENCE

TO Mr. Walter D. Hyle, Jr., Director, Civil Defense Date March 12, 1973

FROM Thomas H. Devlin

SUBJECT ASBESTOS CEILING IN CIVIL DEFENSE HEADQUARTERS

Due to a mix up in our filing system, a copy of a memorandum from Mr. Barry Castleman's inspection and recommendations concerning this problem has just come to my attention.

Mr. Castleman noted that the ceiling surface was made of asbestos insulation which had been sprayed on about seven years ago. There is a possibility that large chunks could fall out of such a ceiling, thus endangering the employees.

The measures recommended for the present are:

1. Spray a sealant to the entire ceiling surface.
2. Restrict the use of the Civil Defense offices to personnel who have been there for months in the past. This means no training exercises, long meetings, or newly hired personnel in the area until repairs are made.
3. Workers wearing dust masks then thoroughly vacuum all air circulation ducts and furniture surfaces, and bag the dust in sealed plastic bags, marked: "Hazardous dust, asbestos. Do not open." The bags should be disposed of in a landfill, not an incinerator.
4. Install a lower ceiling of non-asbestos materials as close against the asbestos surface as possible, supported separately.

When this work is complete, there should be no asbestos surface exposed to the room air.

Thomas H. Devlin
Director
BUREAU OF ENVIRONMENTAL SERVICES

THD/ca
CC--Mr. William L. Phillips

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15. Supplementary Notes

16. Abstract (Limit: 200 words) In response to a request from the Baltimore County Health Department, a study was made of possible exposures to asbestos (1332214) in a public building in Towson, Maryland. Determinations were made of asbestos in bulk ceiling samples and airborne samples. The building had two levels. The ground level houses the local fire department and the basement level houses the Bureau of Civil Defense. Asbestos was applied to the ceiling of the basement level to help alleviate a heat problem caused by the heating facility located on the ground floor, directly above the civil defense offices. The material, Spraycraft Asbestos Fiber, was applied in two layers. The x-ray diffraction study of the bulk ceiling sample indicated a chrysotile (12001295) asbestos content of 27 percent, by weight. Concentrations in airborne samples ranged from 0.0 to 0.0031 fibers/milliliter, which were quite low compared to the 1976 standard 8 hour exposure of 2 fibers/milliliter. Due to the potential for flaking of the ceiling material with subsequently increased employee exposure, the authors recommend that appropriate action be taken to prevent this from occurring.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Author, Asbestos-products, Construction-materials, Indoor-air-pollution, Air-contamination, Mineral-dusts, Airborne-fibers

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