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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HAZARD EVALUATION AND TECHNICAL ASSISTANCE
REPORT NO. TA 78-4

SMITHSONIAN INSTITUTION
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Study Requested By:
Director, Office of Protection Services
Washington, D.C.

Report Prepared By:
Gary L. White
Industrial Hygienist
Industrial Hygiene Section
Hazard Evaluations and Technical Assistance Branch, Cincinnati, Ohio

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NTIS

I. SUMMARY

NIOSH conducted an environmental survey of the Smithsonian Institution's Silver Hill, Tract B facilities during November 8-9, 1977.

It has been determined, based on environmental sampling and work place observations at that time, and a second confirmation of the presence of asbestos in the insulation samples sent to NIOSH on January 12, 1978, that a potential health hazard to airborne asbestos fibers exists for anyone who may have to work in the buildings surveyed.

NIOSH recommends that occupational exposures to human carcinogens be kept as low as possible. The recommended standard for occupational exposure to asbestos is 100,000 fibers $>5\mu$ in length per cubic meter of air (Fibers/ M^3) for an 8-hour time-weighted average (TWA) daily exposure.

The recommended standard is intended to protect against noncarcinogenic effects and reduce the risk of asbestos-induced cancer.

Recommendations for control of asbestos exposures are contained in the text of this report.

II. INTRODUCTION

At the request of the Director, Office of Protection Services, Smithsonian Institution, the National Institute for Occupational Safety and Health (NIOSH), conducted an environmental evaluation of the Silver Hill, Tract B Butler buildings being turned over to the Smithsonian Institution by the Naval Oceanographic Office.

The purpose of the study was to assess the potential health hazards associated with the asbestos insulation lining the inside walls and ceilings of the buildings.

The study was conducted during November 8-9, 1977. This report presents the findings and conclusions of the NIOSH investigator.

III. EVALUATION

A. Description of Facilities

The Butler buildings are basically a corrugated sheet metal shed occupying approximately 4,000 square feet (sq. ft.), built in five bay sections. The buildings are lined with an asbestos containing insulation approximately 2 inches thick with no covering or coating over it.

Building A is composed of three adjoining Butler buildings for a total of 12,000 sq. ft. and Building B is two adjoining Butler buildings with 8,000 sq. ft.

The buildings contain two wall exhaust fans and two passive roof vents per Butler section. Each building has both vented and non-vented natural gas heaters and numerous roof suspended lamps and wall mounted fire extinguishers. The buildings also contain rest room facilities, office areas and large sliding doors at each end. The office in Building B has window air conditioning.

The insulation is flaking, peeling, and falling down in chunks throughout the buildings.

B. Toxic Effects^{1,2,3,4}

Asbestos is a fibrous mineral with excellent insulating properties. There are several types and compositions of the material called asbestos. Asbestos is capable of producing both malignant and nonmalignant respiratory diseases. The nonmalignant disease is called asbestosis and is characterized by interstitial fibrosis of the lung tissues. Asbestosis is a chronic disease whose fibrotic changes develop slowly over the years resulting in respiratory impairment and disability.

The malignant disease develops in different tissues and forms. It can develop in the pleural, peritoneal, or gastrointestinal tissues as tumors or mesotheliomas. The threshold of the carcinogenic response is unknown and the effects take many years to develop, and are fatal. There is no known "safe" exposure limit.

The effects of inhaled asbestos fibers* are potentiated by smoking and possibly other environmental agents.

C. Environmental Criteria

The following environmental criteria presently exist for occupational exposures to asbestos.

*A fiber is defined as a particle with a length to diameter ratio greater than or equal to 3:1.

<u>Source</u>	<u>TWA**</u>	<u>Fibers/M³* Ceiling***</u>	<u>Peak****</u>
NIOSH ²	100,000	-	500,000
ACGIH ⁵	5,000,000	-	-
OSHA ⁶	2,000,000	10,000,000	-
OSHA (Proposed) ²	500,000	5,000,000	-

*Fibers >5u in length per cubic meter air

**8-hour time-weighted average daily exposure

***value never to be exceeded

****peak value based on a fifteen minute sample

The NIOSH criteria are designed to protect the average worker against the noncarcinogenic effects of asbestos and reduce the risk of asbestos induced cancer. Although data exists that shows the lower the exposure, the lower the risk of developing cancer, there is no evidence that a "safe" level for exposure exists. Only a ban on the material could assure protection against the carcinogenic effects of occupational asbestos exposures.

D. Environmental Investigation

A total of 36 personal and general area samples for asbestos were collected on 0.8 micron (u) pore size AA Millipore* filters and MSA* Model G gravimetric pumps operated at airflows of 1.5 liters per minute (1pm). The filters were held in a three piece cassette and the entire filter face was exposed during sampling. Samples were taken during separate time periods under the three following conditions: (1) the undisturbed building, (2) during simulated rain, and (3) after simulated rain.

The samples, including three blank filters, were analyzed by phase contrast microscopy. The result of these samples and environmental conditions are presented in Tables I and II.

Four bulk samples, two of insulation and two of dust, from a desk in building A and a cabinet in building 10, were collected in glass scintillation vials. The insulation samples contained 30-40 percent asbestos and the dust less than 1 percent. Additional bulk samples of insulation material submitted by the Smithsonian on January 12, 1978, were analyzed by NIOSH and found to contain 40 percent chrysotile asbestos [$Mg_3Si_2O_5(OH)_4$]. All bulk samples were analyzed by x-ray diffraction, electron microscopy with elemental analysis, and phase contrast microscopy with polarizing and dispersion staining techniques.

A walk-through evaluation was also performed in other shop areas at the facility at the request of the Smithsonian.

IV. DISCUSSIONS/RECOMMENDATIONS

The data generated by this study indicates that in an undisturbed empty condition, the buildings had no detectable airborne asbestos, based on a two hour sample, except for one location. This sample (A-5) was in the area of a rest room where there was sporadic activity.

*Mention of Manufacturer's name does not constitute a NIOSH endorsement.

However, when a 1/2 to 3/4 hour rain was simulated, using fire hoses to spray water above the roof, the disturbance caused a significant increase in the airborne asbestos fiber concentrations. In addition, the monitoring of routine janitorial tasks indicated that in approximately two hours, the employee's TWA exposure was over 80 percent of the NIOSH 8-hour TWA daily exposure criteria. Also, a 3 1/2 hour personal sample of an employee of the Naval Oceanographic Office in Building C was approximately 4/10 of the NIOSH 8-hour criteria even though the employee spent at least half the time outside the building and no simulated rain had disturbed that building.

Samples obtained in the office areas also indicated that in 2-3 hours the concentrations had reached 30-50 percent of the 8-hour criteria even though there was minimal activity in the areas.

The investigator's personal sample was approximately 20 percent of the 8-hour criteria with only intermittent exposures of short duration over a five hour sample period.

It thus appears that disturbances and/or activities in or around these buildings generate significant concentrations of airborne asbestos due to disturbing the deteriorating insulation.

The concentrations could be expected to increase with more activities and with even a longer more uniform rain or wind storm. In addition, the values would have been considerably higher if full 8-hour samples had been taken rather than three differential time period samples. The differential time period samples did, however, reveal that disturbances and/or activities are the precipitating cause of the contaminant generation, and thus that as a work environment the potential for toxic exposure exists.

In order to protect the health and safety of the employees of these facilities under all conditions the following recommendations are made.

1. In that the buildings are presently unoccupied and their future functions uncertain, it would be most practical, economical, as well as safe, over the long run, to remove the insulation. The insulation could be removed in a variety of ways, one of which would be to use fire hoses to spray it down. This would also serve to control the airborne generation of fibers and the moist material would be easier to control. Any method used to remove and dispose of the material should meet all Department of Labor standards contained in 29 CFR 1910.1001. If water is used all appropriate precautions should be taken, particularly electrical and gas turn offs. It will also have to be warm enough so that the water doesn't freeze inside the building. All local, state and federal regulations should be followed in disposition of the material.

2. If the insulation is not removed, and for areas where it still is present, an environmental and medical surveillance program will have to be developed and must meet the specifics of 29 CFR 1910.1001 and should meet all NIOSH recommended criteria as contained in References 1 and 2.

3. The Smithsonian is encouraged to continue development of its health and safety programs and particularly the industrial hygiene program. To meet these goals, the Institution must rely on and continue to develop its inhouse expertise.

4. Industrial hygiene surveys should be performed in all areas of the Institution to identify problem areas and coordinate medical surveillance. One area for immediate attention is the shop areas at Silver Hill where solvents and dip tanks are in use. The silk screen cleaning room appears to have inadequate ventilation and the odors are quite strong and irritating. This area should be evaluated, including the employee exposures, and corrective actions taken as necessary.

The NIOSH investigator would like to thank all participants for the excellent cooperation and assistance received during the survey, and particularly the Protective Services and Mr. Harry Slatin.

V. REFERENCES

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VI. ACKNOWLEDGEMENTS

Originating Office:

Jerome P. Flesch
Acting Chief
Hazard Evaluations and Technical
Assistance Branch
Cincinnati, Ohio

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Laboratory Analysis:

Measurement Support Branch
Division of Physical Science and Engineering
Cincinnati, Ohio

Report Typed By:

Carol Goetz
Clerk Typist
Industrial Hygiene Section
Hazard Evaluations and Technical
Assistance Branch
Cincinnati, Ohio

TABLE I
RESULTS OF AIR SAMPLING FOR ASBESTOS
SILVER HILL BUTLER BUILDINGS
SMITHSONIAN INSTITUTION

November 8-9, 1977

A. Building A - Undisturbed, Relative Humidity - 90%, 72° F. Inside, N. Bay door partially open

<u>Sample Number</u>	<u>Time</u>	<u>Description</u>	<u>Results (Fibers/M³)*</u>
A-1	1335 - 1548	General Area (G.A.) S.W. corner Bay - 1	N.D. ¹
A-2	1336 - 1550	G. A. middle Bay -1	N.D. ¹
A-3	1337 - 1551	G. A. S.E. corner Bay -1	N.D. ¹
A-4	1338 - 1552	G. A. middle Bay -2	N.D. ¹
A-5	1340 - 1553	G. A. N.W. corner Bay -3	30,000
A-6	1341 - 1555	G. A. S.W. corner Bay -3	N.D. ¹
A-7	1351 - 1603	G. A. Desk, Office Bldg. A.	N.D. ¹
A-8	0821 - 1106	G. A. middle Bay -1	N.D. ¹
A-9	0822 - 1109	G. A. middle Bay -2	N.D. ¹
A-10	0824 - 1110	G. A. middle Bay -3	N.D. ¹

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B. Building B - Same conditions, S. Bay door open

<u>Sample Number</u>	<u>Time</u>	<u>Description</u>	<u>Results (Fibers/M³)*</u>
B-1	1345 - 1556	G. A. S.E. corner Bay -1	N.D. ¹
B-2	1346 - 1557	G. A. S.W. corner Bay -1	N.D. ¹
B-3	1347 - 1558	G. A. N.W. corner Bay -2	N.D. ¹
B-4	1348 - 1600	G. A. N.E. corner Bay -2, office	N.D. ¹
B-5	0853 - 1021	G. A. middle Bay -1	N.D. ¹
B-6	0855 - 1023	G. A. middle Bay -2	N.D. ¹

* Approximate total fibers > 5 μ in length per cubic meter air
1. Less than 4500 fibers per filter

TABLE II
RESULTS OF AIR SAMPLING FOR ASBESTOS
SILVER HILL BUTLER BUILDINGS
SMITHSONIAN INSTITUTION

November 9, 1977

A. Building A - Relative Humidity - 80%, 66° F., simulated rain¹

<u>Sample Number</u>	<u>Time</u>	<u>Description</u>	<u>Results (Fibers/M³)*</u>
A-11	0817 - 1322	Personal Sample (P.S.) Investigator	23,000
A-12	1058 - 1326	Office Desk Bldg. A. (heater on)	57,000
A-8B	1107 - 1152	G.A. middle Bay -1	N.D. ²
A-9B	1109 - 1151	G.A. middle Bay -2	N.D. ²
A-10B	1110 - 1150	G.A. middle Bay -3	75,000
A-8C	1152 - 1328	G.A. middle Bay -1	98,000
A-9C	1151 - 1329	G.A. middle Bay -2	100,000
A-10C	1150 - 1325	G.A. middle Bay -3	104,000
A-13	1107 - 1329	G.A. In front of Office Bay -2	Sample lost

B. Building B - Same conditions, simulated rain³

<u>Sample Number</u>	<u>Time</u>	<u>Description</u>	<u>Results (Fibers/M³)*</u>
B-7	0858 - 1059	P.S. Plumber	N.D. ²
B-8	0819 - 1237	G.A. Office Bldg. B	31,000
B-5B	1022 - 1101	G.A. middle Bay -1	N.D. ²
B-6B	1024 - 1104	G.A. middle Bay -2	N.D. ²
B-5C	1102 - 1236	G.A. middle Bay -1	120,000
B-6C	1104 - 1236	G.A. middle Bay -2	64,000
AB-1	1148 - 1320	P.S. Janitor - sweeps building regularly	32,000
C-1	0846 - 1202	P.S. Warehouseman Bldg.C (Naval Oceanographic office)	40,000

* Approximate total fibers >5 μ in length per cubic meter air.

1. Simulated rain for $\approx$ 45 minutes - sample B series during rain, sample C series after rain.

2. Less than 4500 fibers per sample.

3. Simulated rain $\approx$ 30 minutes.

The NIOSH Recommended Criteria for Occupational Exposures to Asbestos is 100,000 fibers >5 μ for an 8-hour time-weighted average daily exposure and a ceiling value of 500,000 fibers >5 μ for a fifteen minute exposure.

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15. Abstract (Limit 200 words) Personal and environmental air samples were analyzed for asbestos (1332214) at the Smithsonian Institution's Silver Hill, Tract-B facilities in Washington, D.C., during November 8 to 9, 1977. The evaluation was requested by management on behalf of an unspecified number of workers. Asbestos fiber concentrations ranged from less than 4,500 fibers to 120,000 fibers greater than 5 microns in length per cubic meter (f/cu m), compared with the OSHA standard of 2,000,000f/cu m for a time weighted average. The author concludes that a potential health hazard from asbestos exposure exists at these facilities. He recommends removal of the asbestos insulation in the buildings, implementation of an environmental and medical surveillance program if the insulation is not removed, and additional industrial hygiene surveys.

16. Document Analysis a. Descriptors

Hazards-confirmed, Health-surveys, Air-sampling, Asbestos-dust, Dust-exposure, Fibrous-bodies

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