NBSIR 83-2650 (R)

ASBESTOS SURVEY OF THE FEDERAL BUILDING AND COURT HOUSE AT 450 GOLDEN GATE AVENUE, SAN FRANCISCO, CALIFORNIA

FEBRUARY 1983

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epartment of Commerce
/ashington, D.C. 20234

Office of Design and Construction
Public Buildings Service
General Services Administration
Washington, D.C. 20405

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James H. Pielert

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
National Engineering Laboratory
Center for Building Technology
Washington, DC 20234

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Prepared for:
Public Buildings Service
Office of Design and Construction
General Services Administration
Washington, DC 20405

U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

Errata Sheet
NBSIR 83-2650

Asbestos Survey of the Federal Building and Court House
at 450 Golden Gate Avenue, San Francisco, California
James H. Pielert

page 4 Section 3.1, first paragraph, change "Myers" to "Meyer".

page 4 Section 3.1, third paragraph, second sentence
Replace with "Bulk samples were taken by collecting the loose fire-proofing into sample containers with screw-on lids."

page 4 Section 3.1, fourth paragraph, first sentence
Change "chryostile" to "chrysotile".

page 5 Third paragraph, change "module" to "modular".

page 5 Fifth paragraph (Boilers), change "a" to "provide".

page 11 Section 4., first paragraph
Change "Myers" to "Meyer".

page 12 Third paragraph, second sentence
Insert "a" between "of" and "fire".

page 21 (a) Definitions, change "chryostile" to "chrysotile".

page 21 (b)(2), change "an" to "any".

page 23 Section 4.2.4, first sentence
Replace with "A total of 51 air samples were taken in the building on 13 of the 20 floors."

page 23 Section 4.2.5, first sentence
Change "Buildings" to "Building".

page 23 Section 4.2.5, second sentence
Replace with "The highest fiber levels were found in Room 15219 where a space modification was underway; 0.03 f/cc in the center of the room and measurements of 0.02 f/cc and 0.04 f/cc from personal samples on GSA employees working in the room."[1/]

page 29 Option 5, Cost
Change $81,000 to $81,600.

page 29 Footnote, change "chrysolite" to "chrysotile".

page A-13 Delete "for" from figure title.

(over)

page B-1 Sample I.D. 3, change "Chrysolite" to "Chrysotile".

page B-1 Sample I.D. 3
Add "5% Non-fibrous" under results.

page B-1 Footnote 2, change "dryness" to "drying".

page C-2 Change "SAN 8012" to "SAN 9012".

page C-2 Change "760" to "<760" under Total Fibers per Filter for SAN 9012.

page C-2 Change "SAN 8013" to "SAN 9013".

page C-3 Change "2212" to "15219" under Room # for Sample SAN 9028.

page C-4 Add following preceding Sample #SAN 0038

Sample #	SAN 0037
Room #	15205
Location (Area)	International Trade Administration (top of file cabinet)
No. of Fibers Counted per 100 fields	2
AIR Total Fibers per Filter	3054
Fibers per cc of air	<0.01
Comments	Across from CSA Space Mod. Proj.

ABSTRACT

The report describes a study conducted by the National Bureau of Standards for the Public Buildings Service of the General Services Administration on the use of fireproofing suspected of containing asbestos in a Federal building. The report presents the results of physical inspections of selected portions of the building, application of bulk and air sampling techniques, and includes asbestos abatement options that GSA may wish to consider for reducing airborne asbestos fiber levels in the building.

Key words: asbestos; buildings; fireproofing; structure.

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1. PURPOSE OF STUDY AND APPROACH

The National Bureau of Standards (NBS) performed a study on the use of fireproofing suspected of containing asbestos in the Federal Building and Court House at 450 Golden Gate Avenue, San Francisco, California (henceforth referred to as the Federal Building) for the Public Buildings Service (PBS) of the General Services Administration (GSA). This particular building was selected for study by GSA.

The specific objectives of this project were to: (1) conduct a physical inspection of selected portions of the building, (2) conduct limited sampling activities, and (3) identify asbestos abatement options that GSA may want to consider in reducing airborne asbestos fiber levels in the building. The scope of this study was limited due to funding and time constraints and it was not possible to conduct an inspection of the entire building. The conclusions and options provided were developed within these limitations and it is recommended that a more in-depth study be conducted prior to implementation (see sections 5.0 and 6.0).

The approach used in this project was as follows:

A. conduct preliminary inspection of the Federal Building to gain knowledge of the construction types, physical condition of asbestos-containing material in selected areas, and collect related information needed for planning a more in-depth follow-up visit;

B. conduct follow-up inspection of the Federal Building, including the use of sampling techniques[1/], which may help define the level of airborne asbestos fiber contamination; and

C. summarize findings and identify options for GSA consideration which will reduce airborne asbestos fiber levels in the Federal Building.

Each of these will be discussed in detail in sections 3.0 through 6.0.

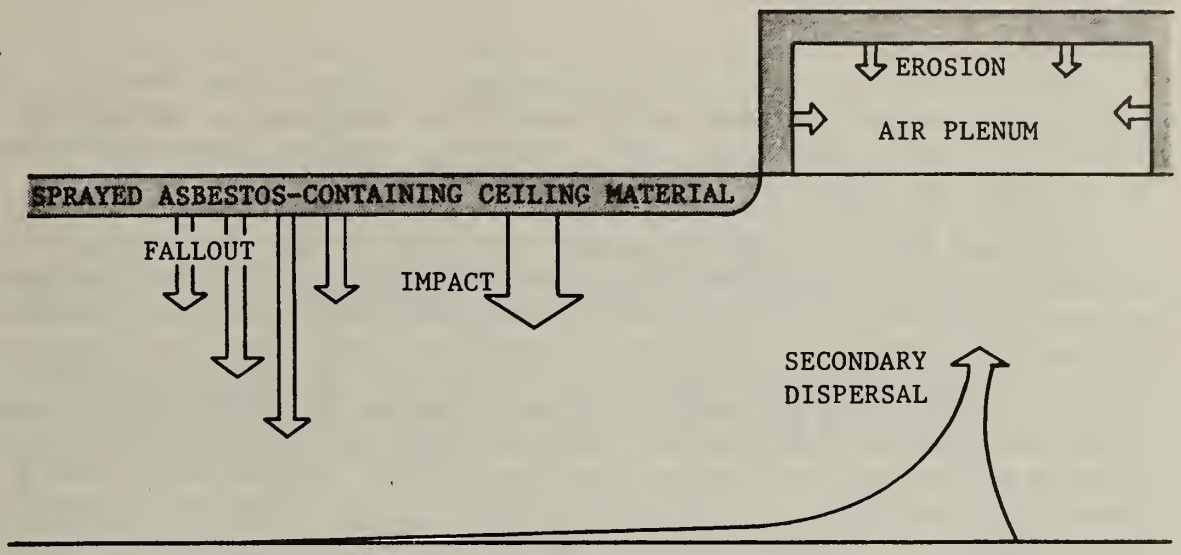
1/ See section 4.2.2 for the rationale for the selection of phase contrast microscopy as the method of measurement for air samples.

2. BACKGROUND INFORMATION

The concentration level of asbestos fibers present at any given time in a building which has sprayed asbestos-containing material is dependent on three generating mechanisms. These are discussed in the following paragraph taken from a NAVY publication[1/] and are illustrated in figure 1.

> "Circumstances that result in asbestiform fibers becoming airborne include fallout, impact, and reentrainment. Fallout is considered to be a result of aging and degradation of the bonding agents in an asbestos-containing material. Fallout is usually low level, continuous, and may increase with the age of the structure. It represents a source of fallen fibers which may accumulate over periods of time. Impact with asbestos-containing material may be intentional, accidental, capricious, or destructive. Specific actions include striking, cutting, or penetration of the material. Such contact disturbs the integrity of the matrix and results in fiber dissemination. Most friable forms of asbestos-containing material are readily susceptible to such damage or disturbance. Even spraying friable surfaces with sealants or paints causes fiber release. Reentrainment of fallen debris and asbestos dust by custodial activities such as dusting or sweeping will resuspend accumulated fibers in the atmosphere. Generally, the reentrainment effect is proportional to the level of activity in the facility."

1/ Management Procedure for Assessment of Friable Asbestos Insulating Material, Technical Report R883, Civil Engineering Laboratory, Naval Construction Battalion Center, February 1981.



MODE	CAUSES	FREQUENCY	FIBER RELEASE RATE
FALLOUT/ EROSION	AIR MOVEMENT, VIBRATION, DETERIORATION	CONSTANT	LOW
IMPACT	MAINTENANCE, ACCIDENTAL IMPACT	OCCASIONAL	HIGH
SECONDARY DISPERSAL	USUAL ACTIVITY CUSTODIAL SERVICE	FREQUENT	LOW TO HIGH

Figure 1. Mechanisms for generating airborne asbestos levels[1/]

1/ Taken from Management Procedure for Assessment of Friable Asbestos Insulating Material, Technical Report R883, Civil Engineering Laboratory, Naval Construction Battalion Center, February 1981.

3. PRELIMINARY INSPECTION

3.1 SCOPE

A preliminary visit was made to the Federal Building during the week of January 25, 1982 by NBS staff and an industrial hygiene consultant to NBS (A. F. Myers and Associates, Inc., McLean, Virginia).

Meetings were held with GSA personnel to discuss the use of asbestos-containing material in the building, the history of asbestos related activities such as abatement actions taken, proposed building modifications (e.g., installation of fire sprinkler system, new lighting system), and to review the structure and layout of the building. A visual walk-through survey of representative locations in the building was then conducted to assist in evaluating the overall extent and physical condition of suspected asbestos material and to evaluate building systems such as the heating, ventilating, and air conditioning (HVAC) system which may effect asbestos fiber distribution. Appendix A contains photographic documentation of this survey.

Bulk samples were taken in four areas of the building where damaged fireproofing was found for determining the type and quantity of asbestos present. Bulk samples were taken by collecting the loose fireproofing into a sample container with a screw-on lid. A fifth sample was taken from a fiberglass air filter in an outside air supply chamber to test for the presence of trapped asbestos fibers.

For the four bulk samples of loose fireproofing, one sample contained 35 percent chrysotile asbestos by weight and the other three samples were in the range of 5-10 percent chryostile. The sample with 35 percent chrysotile was taken from fireproofing lying on top of ceiling tiles in the corridor between rooms 8440 and 8450. There were no asbestos fibers detected on the air filter which was sampled. These results indicate that the asbestos content of the fireproofing is not uniform in the building. Appendix B contains locations where samples were taken, method used to analyze the samples, and results. However, because of the limited number of bulk samples taken, it is not possible to extrapolate the results to the entire building.

3.2 DESCRIPTION OF THE BUILDING

The Federal Building is located at 450 Golden Gate Avenue, San Francisco, California; construction was started in 1961 and completed in 1964. It is a multiple use building with office space for many U.S. government agencies. Building tenants include: Departments of Justice, Labor, Housing and Urban Development, and Interior; Federal Bureau of Investigation; Internal Revenue Service; Drug Enforcement Administration; Congressional Offices; Federal District Courts; and other Federal agencies. Approximately 4,500 people work in the building.

The building consists of approximately 1,250,000 gross square feet and 1,000,000 net square feet of usable space. The building at grade is approximately 50

ft (15.24 m) above sea level and is twenty (20) stories in height with a basement and sub-basement.

The geographical location of the building has a winter outdoor design temperature of +40°F and a summer design outdoor temperature of 74°F dry bulb and 63°F wet bulb. The degree days for heating are 3000 and full load cooling hours are approximately 400.

The building is a steel frame structure with composite floors constructed of light gage steel deck and cast-in-place concrete. The deck used was a standard structural deck with built-in wireways but no air movement cells. A schematic cross-section drawing of typical floor construction is shown in figure 2.

The lay-in ceiling lighting system installed in the finished spaces in the building is a 5 ft (1.52 m) long module type with pendant mounted standard GSA fluorescent light fixtures of the two-tube type. Some are 2 ft (0.61 m) and others are 4 ft (1.22 m).

The HVAC system is a four-pipe system consisting of six separate air handling systems providing air flow to all spaces in the building. The air handling systems are such that four of these systems feed down from the twentieth floor to the ninth and two systems feed up from the basement areas through the eighth floor. These systems are dual duct systems with separate steam heating coils and chilled water cooling coils in each system with duct mixing boxes as the terminal units. The system has the ability to cool or heat at any time that the air handling units are running. The portions of the HVAC system observed were consistent with the building drawings. A schematic drawing of a typical air handling system for occupied office areas is shown in figure 3.

Boilers - The boilers are fired by natural gas, and there are three of these boilers providing heat to all the air handling units as well as a make-up for domestic hot water and other uses.

Chillers - There are three centrifugal-type chillers providing cooling.

Cooling Towers - There are two wooden cooling towers on the roof of the building providing a source of heat rejection necessary for the chilled water system.

Courtrooms - Each courtroom has a separate air handling unit which is in the penthouse and feeds down to the courtrooms. The returns for these courtrooms are duct-connected to the main return air ducts.

The return air systems consist of a series of ceiling diffusers placed on a modular basis throughout office spaces and are open to the plenum above through a small sound attenuation chamber. Air that is supplied to the room through supply type diffusers goes back up into the plenum through these return air diffusers (figure 4). Return air is <u>not</u> ducted through the plenums where fire-proofing coats the structural steel and the underside of the floor deck. There are also small slots at each window to take the downdraft from the glass and feed back into the return system. The latter portion of the system is duct connected and this air does not return through the open plenum.

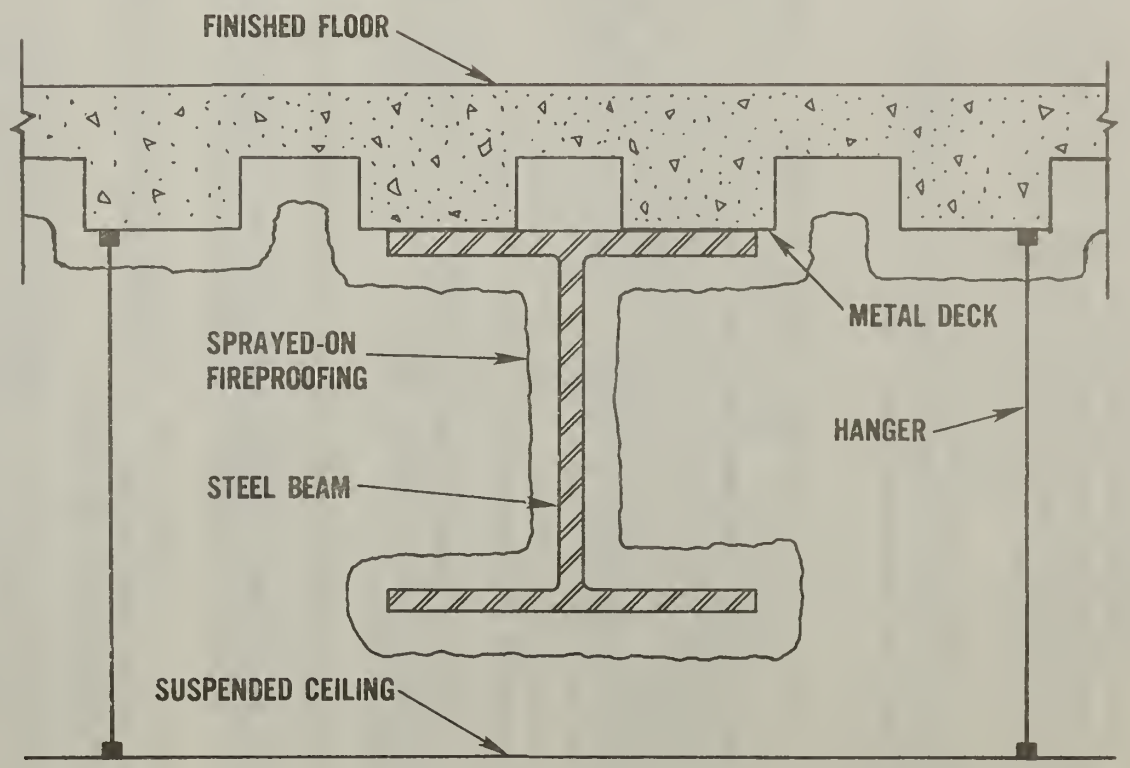


Figure 2. Schematic of typical composite steel/concrete floor construction

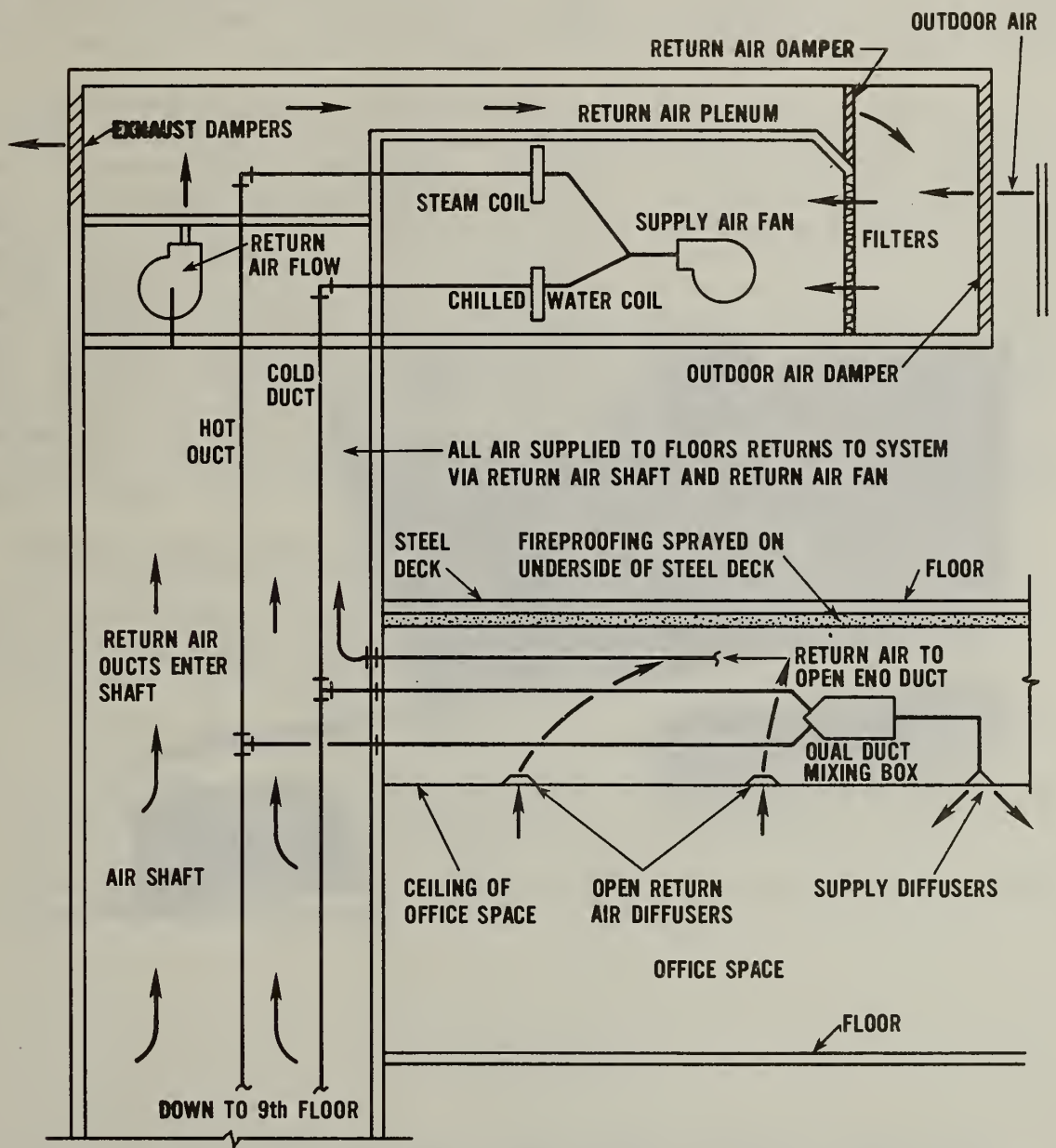


Figure 3. Schematic of typical air handling system

Figure 4. Air return diffusers with sound attenuation collar in ceiling above typical occupied space

3.3 DESCRIPTION OF FIREPROOFING[1/]

Fire protection of the structural steel members and the composite steel deck was obtained by a coating of fireproofing approximately 2 in (50.8 mm) in thickness. Where bulk samples of the fireproofing were taken, the fireproofing was found to contain asbestos. The fireproofing was oversprayed with a sealant to hold the fireproofing material in place. The initial sealant spray used was clear in color; later a blue pigment was added so application of the sealant could be verified by inspectors. Most areas observed showed the blue overspray.

The fireproofing is typically located above finished ceilings except where it is exposed in elevator machine rooms, telephone rooms, electrical closets, and other infrequently inhabited spaces. Appendix A illustrates the various applications of fireproofing and typical conditions encountered during the visual inspection. Most locations observed indicated a uniform application of fireproofing although some locations were observed where the application was uneven with the thickness varying between 1 in (25.4 mm) to over 3 in (76.2 mm). Visual examination indicated that the fireproofing was generally well adhered except in areas where damaged during building modifications. As defined by EPA[2/], the fireproofing was friable to the touch in that it could be "crumbled, pulverized, or reduced to powder in the hand." In some locations, pieces of fireproofing were observed lying on top of the tiles in the ceiling plenum. Such loss of fireproofing may have altered the design fire rating of structural beams and deck.

3.4 RESULTS OF PRELIMINARY INSPECTION

Based on the results of the preliminary inspection of the Federal Building discussed above, a more detailed follow-up study was recommended by NBS, including the following aspects:

1. An extensive walk-through inspection of typical areas of the building.

2. Use of an air sampling strategy to determine the asbestos content of the air during normal building activities.

3. Additional documentation of critical findings by photographs at locations where considered necessary.

1/ It should be emphasized that only a very small portion of the Federal Building was visually inspected; therefore, it is not possible to apply the observations noted to the entire building.

2/ Asbestos-Containing Materials in School Buildings: A Guidance Document-Part 1, U.S. Environmental Protection Agency, March 1979.

4. Additional fact-finding interviews with personnel involved with the initial building construction and GSA building maintenance and operations staff to ascertain facts regarding the actual construction materials and systems used in the building.

5. Identification of options for GSA's consideration which could be used to reduce airborne asbestos fiber levels in the Federal Building.

4. SECOND ON-SITE INSPECTION

Based on the results of the preliminary inspection, a detailed study plan was designed to achieve the objectives of the project. The Federal Building was revisited during the week of June 28, 1982 by staff of NBS and A. F. Myers and Associates (two Industrial Hygienists and a Mechanical Engineer). The following tasks were conducted:

A. a visual walk-through survey to select areas representative of typical building activities,

B. physical inspection of selected areas including two general office spaces, a courtroom, a mechanical room, the lobby, the penthouse, the main food service facility, the health clinic, and several representative areas where fireproofing was not enclosed behind ceilings, walls, etc.,

C. fact-finding interviews with GSA building maintenance and operations staff to ascertain additional facts about the building's construction and information pertaining to the selected areas,

D. determination of outdoor airborne fiber levels[1/] by air sampling in an air intake chamber of the HVAC system,

E. application of an air sampling strategy to assist in determining airborne fiber levels during normal building activities,

F. air sampling for fibers in representative locations in the ceiling return air plenum to ascertain fiber movement by the HVAC system,

G. determination of sample fiber concentrations in the air from selected areas where GSA maintenance and operations staff are engaged in work which may involve direct contact with materials containing asbestos, [2/] and

H. documentation of findings by photographs at locations where considered appropriate.

4.1 WALK-THROUGH SURVEY

Prior to the second visit to the building, plans, specifications, and space assignment drawings obtained during the preliminary visit were used to select representative areas of typical building activities for further evaluation.

1/ Fibers detected by phase contrast microscopy may or may not be asbestos (see section 4.2.2).

2/ The area sampled where renovation work was in progress did not involve direct contact with the fireproofing (see section 4.2.3).

A general floor-by-floor visual walk-through was conducted to select locations for subsequent detailed inspection and air sampling in (1) typical building areas, (2) areas where fireproofing damage was noted, and (3) an area where a major renovation project was in progress. The renovation area selected was Room 15219, vacated space once occupied by the Community Services Administration (CSA). This large space and a few adjacent offices were being altered for new tenants and the entire ceiling had been removed. This area and the exposed ventilation system were studied and the existing return air duct system was checked against the as-built drawings. Electrical work was in progress during the inspection and air sampling activities.

Figure 5 shows the air plenum area in Room 15219 with the suspended ceiling removed. Damage to fireproofing can be seen in figure 6 (addition of piping), figure 7 (addition of wall partitions), and figure 8 (addition of pipe hanger to beam flange).

Ceiling tiles were lifted in several areas of the building and the condition of the fireproofing noted. Figure 9 shows dislodged fireproofing remaining on suspended ceiling tiles after installation of fire sprinkler system adjacent to the Drug Enforcement Administration (Rooms 8440 and 8450).

Representative portions of the existing HVAC system throughout the building were inspected including mechanical rooms, air plenums, control rooms, fan rooms, etc. An evaluation was performed on the potential contribution made by the HVAC system to circulation of airborne fibers. The inspection of the return air duct system in Room 15219 showed that the existing system was constructed as depicted on the as-built drawings. Air is supplied to rooms through ceiling diffusers and returns to the open plenum through air diffusers located in the ceiling cavity (figure 4). The air then proceeds to open end return air ducts (figure 3) above the ceiling and then back to the air handling system via high velocity return air shafts. The high velocity shafts were visited at night while the HVAC system was not operating to determine the locations of exposed fireproofing and extent of damage These shafts contain structural steel members coated with fireproofing that are subject to high velocity air flow. Figure 10 shows pieces of fireproofing lying on the catwalk in the east end high velocity return air shaft (Room 13114 accessway). Dislodged pieces of fireproofing were observed lying on top of tiles in the ceiling return air plenum. This material was observed falling to the space below when these tiles were removed for access to the ceiling cavity. Fireproofing on steel members in the main kitchen area illustrated both natural deterioration (figure 11) and effects of physical damage (figures 12 and 13).

Fan rooms were examined to determine the type of air filtration system used. The filters used in the HVAC system are roll type filters. Telephone closets, elevator machine rooms,and electrical closets were checked on each typical floor for fireproofing applications.

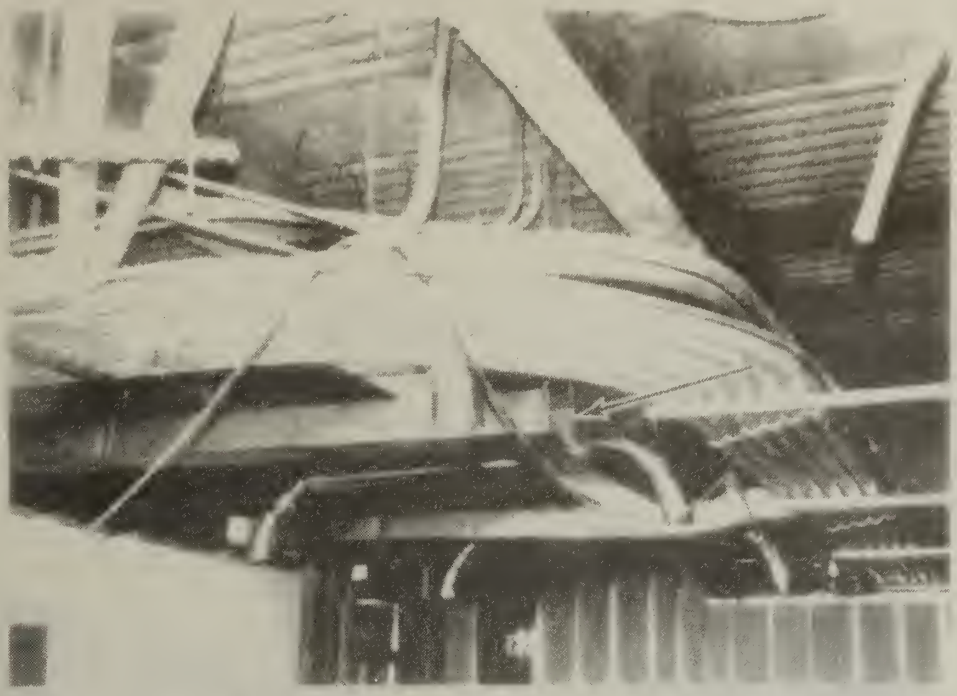


Figure 5. Air plenum area in Room 15219 with the suspended ceiling removed. (Note arrow pointing to open air return duct which collects return air in the open plenum)

Figure 6. Damage to fireproofing due to renovation of plumbing system in Room 15219

Figure 7. Damage to fireproofing due to addition of partition system in Room 15219

Figure 8. Damage to fireproofing due to addition of pipe hanger to beam flange adjacent to Room 15219

Figure 9. Pieces of fireproofing remaining on suspended ceiling after installation of fire sprinkler system (Rooms 8440 and 8450)

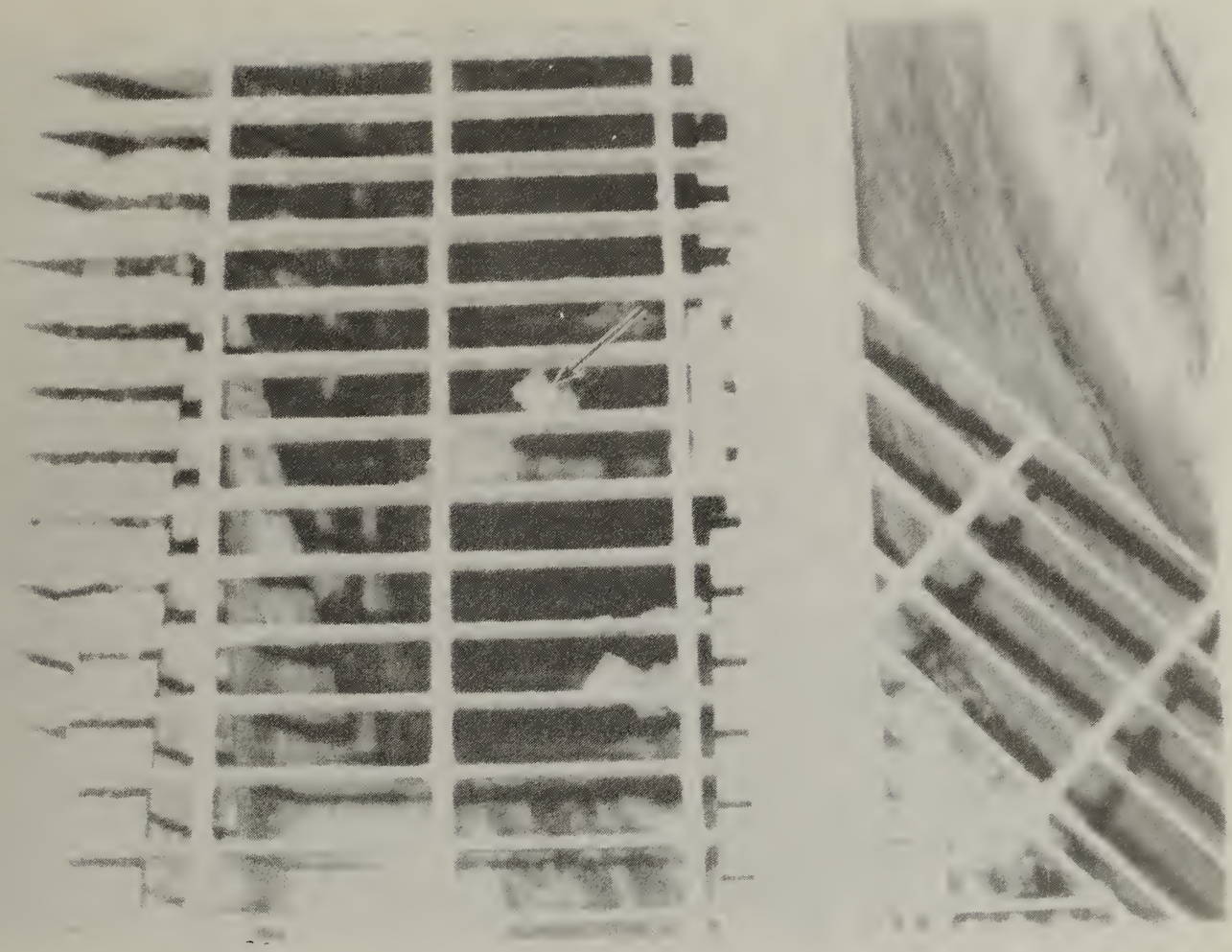


Figure 10. Fireproofing particles lying on the catwalk in the east end high velocity return air shaft (Room 13114 accessway)

Figure 11. Naturally deteriorating fireproofing on structural members in main kitchen storage Room 2212

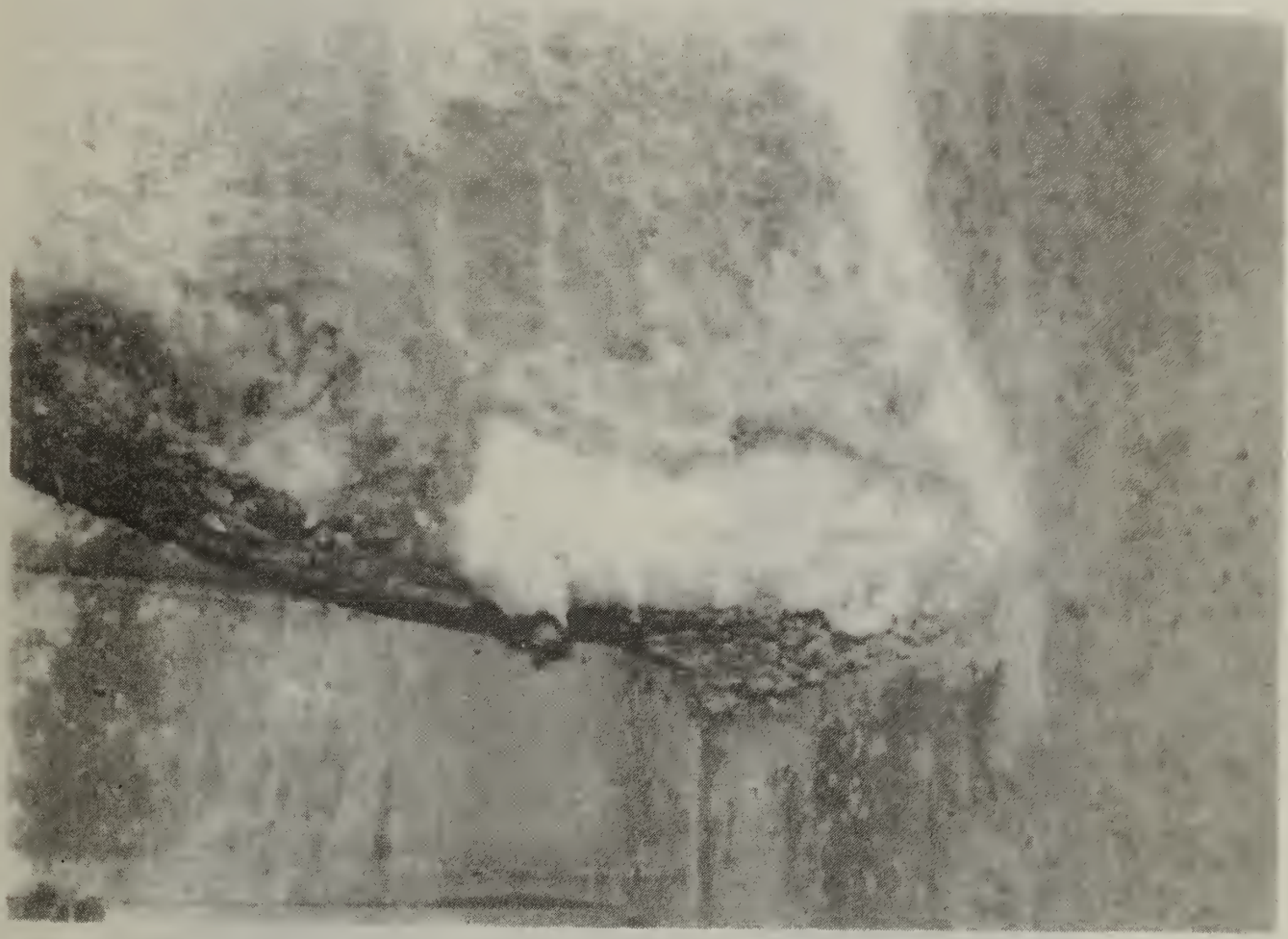


Figure 12. Physical damage to fireproofing on beam in Main Kitchen Storage Room 2212

Figure 13. Pieces of fireproofing on floor of Main Kitchen Storage Room 2212

4.2 AIR SAMPLING

4.2.1 Guidelines for Exposure Levels

Specific guidelines are not currently available for occupant exposure to airborne asbestos fibers in buildings having in-place materials containing asbestos (fireproofing, insulation, etc.) that are not being disturbed by maintenance, renovation, or removal activities. The U.S. Environmental Protection Agency (EPA) is currently working on such guidelines for schools which may have application to other public buildings.

The Occupational Safety and Health Administration (OSHA) has set the permissible exposure level for asbestos fibers at 2.0 fibers longer than 5 μm per cc of air (f/cc) on an 8 hour time-weighted average (TWA) basis for situations where work in the building disturbs the in-place materials containing asbestos.[1/] This permissible level applies to all building occupants, including office workers, maintenance and operation staff, and contractors. Additionally, OSHA has set the level above which a medical surveillance program (physical examinations) must be initiated at 0.1 f/cc on 8 hour TWA.[2/]

Specifically, section 1910.1001 of the OSHA regulations[1/] states:

> "(a) Definitions. For the purpose of this section, (1) "asbestos" includes chryostile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, (2) "asbestos fibers" means asbestos fibers longer than 5 micrometers."
>
> "(b)(2) Standard effective July 1, 1976. - The 8 hour time-weighted average (TWA) airborne concentrations of asbestos fibers to which an employee may be exposed shall not exceed two fibers longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section."
>
> "(b)(3) Ceiling concentration. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section."
>
> "(e) Method of measurement. All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400-450 x (magnification) (4 millimeter objective) with phase contrast illumination."

"Employee" is defined in section 1910.2(d) as: "'Employee' means an employee of an employer who is employed in a business of his employer which affects commerce."

1/ Code of Federal Regulations, Title 29, Part 1910.

2/ OSHA Instruction CPL 2-2.21A, February 18, 1981.

4.2.2 Selection of Method of Measurement

Application of phase contrast microscopy, specified in section 1910.1001(e) of Title 29, Code of Federal Regulations, as the method of fiber content measurement for air samples taken in an office environment which may have asbestos contamination, may not be appropriate for the following reasons. Phase contrast microscopy has limits on the fiber size range on which it can be used; only particles having a length-to-width (aspect) ratio greater than 3:1 and a length of 5 μm or greater are counted as fibers.[1/] Secondly, a study by the Mount Sinai School of Medicine points out that fibers other than asbestos (e.g., cellulose, glass fibers) which are likely to be present in ambient air would be counted as fibers by phase contrast microscopy.[2/] The report further states, "In occupational circumstances, where the majority of fibers are indeed asbestiform, this procedure (phase contrast microscopy) has practical utility." Finally, the measurement method would miss very thin asbestos fibers (<0.5 μm in width). For these reasons, the application of phase contrast microscopy as a measurement method in an office environment is questionable.

Current literature on asbestos measurement indicates that electron microscopy is the preferred method for the examination and identification of asbestos fibers of all sizes.[1/], [2/] In cases where the fiber size distribution falls below 5 μm, phase contrast microscopy will produce a zero fiber count for a sample, but the same sample may have a significant fiber count when examined by electron microscope. However, the cost of electron microscopy ($400 - $450 per sample) can be as much as 15 times greater than analysis by phase contrast microscopy ($25 - $30 per sample).

While there are no EPA or OSHA guidelines for measurement of airborne concentrations of asbestos fibers in public buildings where the asbestos-containing materials are not being disturbed, it was decided for this study to determine the fiber content of the air in the Federal Building based on the measurement method (phase contrast microscopy) noted in OSHA 1910.1001(e) of Title 29, Code of Federal Regulations. Limitations of phase contrast microscopy discussed above will be considered in evaluating the results and identifying asbestos abatement options. Electron microscopy was not used because of funding limitations.

1/ Management Procedure for Assessment of Friable Asbestos Insulating Material, Technical Report R883, Civil Engineering Laboratory, Naval Construction Battalion Center, February 1981.

2/ Asbestos Contamination of the Air in Public Buildings, William J. Nicholson, et al., Mount Sinai School of Medicine, Sponsored by U.S. Environmental Protection Agency, October 1975.

4.2.3 Sampling Procedures

The Federal Building was inspected while there were no activities which would disturb the asbestos-containing materials. Even in Room 15219, where a renovation was in progress, suspected asbestos-containing material was not being intentionally disturbed during the air sampling period.

Air samples taken in occupied locations were collected in accordance with the NIOSH Manual of Sampling Data Sheets, Sheet number 2, DHEW (NIOSH) Publication No. 77-159. Portable DuPont Model P2500 and P4000 and Spectrex Model PAS 3000 sampling pumps were used with open-faced 37 mm, 0.8 micrometer pore size mixed cellulose membrane filter cassettes for full work shift sampling. Pumps were calibrated as per the OSHA Industrial Hygiene Field Operations Manual, Volume V1, Chapter VIII-9 using a bubble meter before and after each sampling period.

Air samples in unoccupied locations, such as electrical closets and machine rooms, were collected using Millipore Catalog Number XX60-000-00 High Pressure Vacuum Pumps and collection media as specified on the NIOSH asbestos sampling data sheet. Pumps were calibrated as per the OSHA Industrial Hygiene Field Operations Manual using a precision rotameter before and after each sampling period. All air samples taken were collected on an 8 hour time-weighted average basis.

4.2.4 Sampling Locations

A total of 51 air samples were taken in the building on 8 of the 24 floors. The general office space sampled was Room 15205, occupied by the International Trade Administration, U.S. Department of Commerce. It was selected because of its close proximity to the ongoing major building modification project in Room 15219. Further samples were taken in other areas as deemed appropriate, such as return air shafts, several ceiling return air plenum locations, and a second general office space not near any project work (Room 7003). This office space was chosen both because it was on a zone of the HVAC system different than Room 15205, and it represented a typical office area of the building. Locations and summary of air sample results are presented in appendix C and copies of the reports are in appendix D.

4.2.5 Air Sampling Results

In summary, all air samples in the Federal Buildings were below the current limit of 2.0 f/cc established by OSHA for permissible employee exposure to airborne concentrations of asbestos fibers prescribed for occupational exposures where asbestos materials are disturbed. The highest fiber levels were found in Room 15219 where a space modification was underway; 0.01 f/cc in the center of the room and measurements of 0.01 f/cc and 0.04 f/cc from personal samples on GSA employees working in the room.[1/] As discussed previously, these employees

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1/ Personal samples were collected within the breathing zone of employees for 8 hours.

were doing electrical work and were not intentionally contacting the fireproofing.

In addition to the limitations of the selected measurement method, it must be emphasized that because of the limited number of air samples, it is not possible to extrapolate the results to the entire building.

5. SUMMARY AND FINDINGS

A. Fireproofing coats all structural steel and deck, including steel members in the high velocity vertical air return shafts. Asbestos was present in the fireproofing which was sampled.

B. There is evidence of damaged fireproofing, including dislodged material lying on tiles in the ceiling air return plenum (see figure 9).

C. Air samples collected and analyzed according to OSHA regulations (29 CFR 1910.1001) showed the presence of fibers below the current levels of 2.0 f/cc for airborne concentrations of asbestos fibers (see section 4.2.5). However, the phase contrast microscopy method used to count fibers: (1) cannot distinguish between asbestos and other fibers in ambient air, (2) counts only fibers greater than 5 μm in length and with aspect ratios greater than 3:1, and (3) cannot detect extremely thin (<0.5 μm in width) asbestos fibers. Based on the data collected in this study, it is not possible to quantify or extrapolate the level of airborne asbestos fiber contamination in the Federal Building.

D. Improved measurement of the asbestos fiber content of air can be achieved by the use of electron microscopy such as outlined in a provisional methodology prepared by EPA.[1/,2/]

1/ Electron Microscope Measurement of Airborne Asbestos Concentrations: A Provisional Methodology Manual, EPA Report No. 600/2-77-178, Environmental Sciences Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, 27711, Revised June 1978.

2/ Evaluating and Optimizing Electron Microscope Methods for Characterizing Airborne Asbestos, EPA Report No. 600/2-78-038, Environmental Sciences Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, 27711, June 1978.

6. OPTIONS FOR GSA CONSIDERATION

The following options have been developed for consideration by GSA if they deem it advisable to undertake a program to reduce the levels of asbestos in the air of the Federal Building.

The costs given are "ballpark" estimates (± 30 percent) and detailed design must be conducted for determining specific costs of the options for asbestos abatement in the building. Costs do not include associated costs of environmental controls (except asbestos removal), ceiling removal and replacement, and restoration of the design fire ratings. The costs also do not include expenses associated with relocation and operational disruption that may be encountered in implementing these options.

It will be necessary to completely inspect the entire building, including all remote spaces, to identify exposed fireproofing and its condition prior to implementing the options given below for asbestos abatement and control. This is required since the study discussed in this report included inspection of typical areas only.

Option 1 - *Duct-connect all existing ceiling return air diffusers to the open ended return ducts in the air return plenum.*

Discussion and Approach - The supply air from the central air handling system enters each room via a supply air ceiling diffuser of the perforated metal pan type located in the suspended ceiling. The air, after sweeping through the room, is returned via a diffuser type air return also located in the ceiling (figure 4). The supply air diffuser and the return air diffuser are of the perforated face type and are nominally 12 x 12 in (305 mm) throughout the building.

As the air passes through the return air diffuser, it enters an air plenum above the ceiling. There is a system of open ended return-air ductwork above this ceiling to pick up the return air and carry it to the return-air fans via vertical air shafts as shown in figure 5 and appendix E (figure E.4). Each ceiling return has a fiberglass box set over the top of it in the plenum for sound attenuation (figure 4). The boxes were to provide room-to-room attenuation in cases where ceiling-high partitions are installed to create separate rooms. The air passing through this plenum to the open ends of the return air ducts comes in direct contact with the fireproofing on the structural steel and deck and any that may have been dislodged and is lying on the ceiling panels.

In addition to the ceiling returns, there is a closed-duct system attached to the sill of each window to sweep away cold down drafts that may occur in the wintertime (appendix E, figure E.3).

Approach and Cost - The return air system can be duct-connected as shown in appendix E, thus preventing the return air passing through the ceiling space in contact with the fireproofing. This can be accomplished by attaching each existing ceiling return to the existing return air duct system as shown. An

8 in (203 mm) round collar can be attached to the existing diffuser to connect the 8 in (203 mm) round flex duct as shown in figure E.1 of appendix E. All open-end return air ducts would have to be blanked off and volume dampers would have to be inserted in branch ducts to allow the accomplishment of air balance. Figures E.2, E.3, and E.4 show duct configurations for typical building locations. Some additional return ducts would also have to be added as indicated. After all returns are duct-connected, it would be necessary to have an air balance contractor balance the entire return air system to appropriate quantities in each room.

The cost of duct-connecting the returns is estimated to be $116.00 per return and there are approximately 10,720 of these returns for a total estimated cost of $1,243,520. Because of open office configuration, it may be possible to delete some of the air returns in the final design. However, it should be recognized that the space may later be converted to a compartmentalized layout.

Option 2 - *Remove all dislodged fireproofing currently lying on top of ceiling tiles and in other areas where fallout exists by High Efficiency Particulate Absolute (HEPA)[1/] filter vacuum cleaning equipment.*

Discussion and Approach - Dislodged fireproofing in the ceiling plenum, if not removed, may be a continual source of asbestos fibers as maintenance and operation work is carried out in the space as was discussed in section 2.0. Also, material would fall into occupied space as ceiling panels are removed.

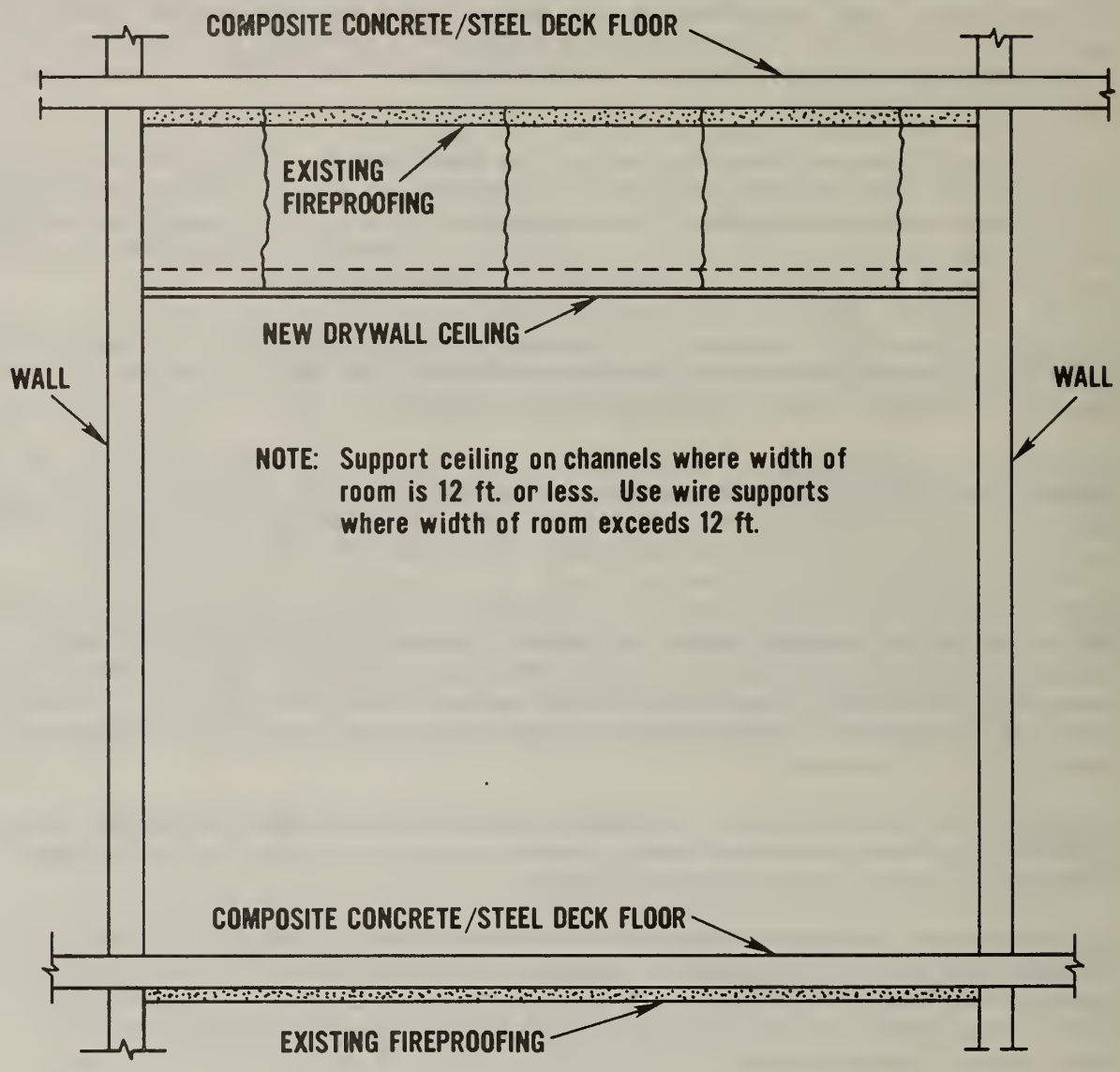
Cost - This can be accomplished as an independent operation or when the air return system in the air plenum is ducted (Option 1) which would minimize additional expenditure of money. If done separately, the actual cost of HEPA vacuuming of ceiling tiles would depend on the total area of tile vacuumed based on the results of the complete inspection of the entire building and labor rates of personnel.

Option 3 - *Provide ceilings in spaces closed off from the HVAC system where fireproofing is exposed, including elevator machine rooms, electric closets, telephone closets, and custodial closets.*

Discussion and Approach - Certain rooms throughout the building do not have ceilings and the fireproofing is exposed to the occupants of these rooms. Any material dislodged in these rooms may fall on the floor or directly on the occupants. Installation of a ceiling in these rooms as shown in figure 14 is considered to be feasible.

Approach and Cost - The cost of installing ceilings is estimated to be $10.00 per square foot average, and there is approximately 9,000 square feet for an estimated cost of $90,000.

1/ HEPA filters in conformance with ANSI Z9.2-1971, "Design and Operation of Local Exhaust Systems."



Section thru room showing method of installing ceiling where fireproofing is exposed to room (electrical closets, telephone closets and elevator rooms)

Figure 14. Method of installing ceiling where exposed fireproofing is present

Option 4 - *Cover all exposed fireproofing on steel structural members or walls which is: (1) susceptible to damage, and/or (2) located in high velocity vertical air return shafts.*

Discussion and Approach - There are some areas where structural steel with fireproofing is exposed such as the side walls in the upper elevator machine room (appendix A, figure A.17). In these cases, it is felt that the fireproofing can best be covered by attaching wire mesh and plastering over the wire mesh with cement plaster as shown in figure 15. The amount of exposed steel beams covered with fireproofing in the return air shafts is limited and should also be covered in a similar manner.

Cost - The fireproofing on the steel can be covered at a cost of approximately $10.00 per square foot of surface area of structural member. A detailed survey of the building would be required to determine the total area involved.

Option 5 - *Change existing HVAC filter banks to high efficiency types.*

Discussion and Approach - The existing HVAC fan system is equipped with roll-type filters and it is recommended that these filters be changed to high efficiency type (95 percent on particles of 0.3 μm or greater) as shown in figure E.5 of appendix E.[1/]

The location of the filters would stay the same. However, the filter frames would have to be modified to accept 12 in (305 mm) thick filters. After the completion of the installation of the high efficiency filters, the HVAC system would require rebalancing since pressure drop through the new filters would increase somewhat.

Cost - There is approximately 2,720 square feet of filter area and the cost of installing the 95 percent efficiency filters is estimated to be $30.00 per square foot of filter area, $30.00 x 2,720 = $81,000. This includes cost of new filters, support frame, and replacement fan blower motors, if required. Final design should consider the impact of such modifications on electrical power system, motor design, and possible increase in noise in the HVAC system. Adequate maintenance of these filters must be considered.

Option 6 - *Remove fireproofing only in areas where heavy physical damage has occurred, such as in areas of the Zone 3 Elevator Hoisting Room (appendix A, figure A.7). Specifically, fireproofing should be removed only in areas where damaged.*

Discussion and Approach - Removal of heavily damaged fireproofing should be done by a qualified contractor under prescribed environmental controls and in accordance with EPA 40 CFR, Part 61, OSHA 29 CFR 1910.1001, and applicable State and local regulations. Additional study will be required to identify areas

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[1/] These filters will not remove all asbestos fibers since chrysolite fibers have a minimum thickness of 0.02 to 0.03 μm.

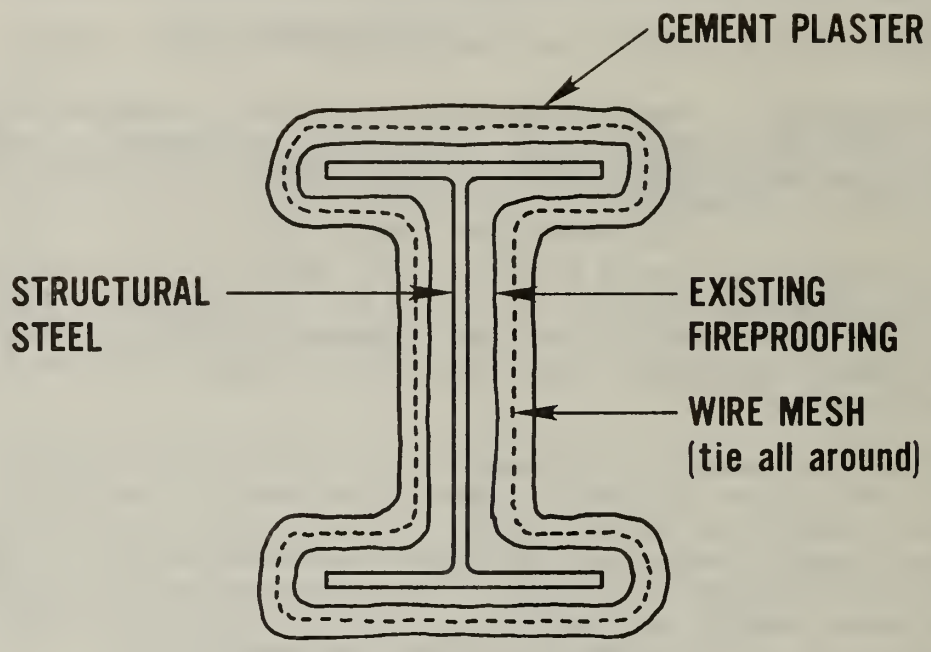


Figure 15. Detail showing method of covering structural steel where fireproofing is exposed to room

requiring removal. Where fireproofing is removed, it will be necessary to restore the fire rating.

Cost - The cost will vary depending on the total square footage removed and other factors. For example, actual costs for removal of asbestos material and replacement with acceptable alternatives may range between $7.00 and $20.00 per square foot.

Option 7 - *Develop a specification for use by both contractor and GSA personnel that will govern all future work around asbestos-containing material.*

Discussion - When such work is necessary, environmental controls must be exercised. The specification(s) should prescribe the techniques and methodologies for removing asbestos-containing material, for attachment of piping, ducts, etc., to structural members coated with fireproofing, and for patching of the dislodged fireproofing to retain the design fire rating. Requirements for protective clothing, respiratory protection, work area isolation, air monitoring, and clean-up and decontamination procedures should also be prescribed.

General Comments

1. The installation of a fire sprinkler system or any other major building modification requiring contact with fireproofing will have the potential for increased physical damage to asbestos-containing material and the release of airborne asbestos fibers. Optimally, the installation of a fire sprinkler system, duct-connection of air returns, and HEPA vacuuming of ceiling tiles could be accomplished simultaneously where feasible. This would achieve the lowest total cost and reduce logistical problems. The requirements of the proposed specification in Option 7 above must be firmly in force to keep environmental contamination to a minimum.

2. Logistical considerations associated with the potential asbestos abatement actions are not a problem in unoccupied spaces. The potential logistics problems in occupied spaces can be minimized by only taking such actions in one tenant office space (or floor, or zone) at a time. Action in a particular space should be taken in a logical sequence based on physical parameters such as layout of ventilation ductwork. Such an approach will keep the number of persons needed to be relocated at any one time at the lowest possible level.

3. Electron microscopy should be used for analysis of air samples taken prior to implementation of asbestos abatement options and after completion in order to have the most accurate assessment of effectiveness. This method allows specific identification of asbestos fibers in all size ranges. See section 5.0 for additional information.

APPENDIX A - PHOTOGRAPHIC DOCUMENTATION OF PRELIMINARY INSPECTION

Figure A.1. Federal Building and Court House, 450 Golden Gate Avenue San Francisco, CA.

Figure A.2. Room 20407C - Ceiling of outside air supply plenum fan room with no apparent damage to fireproofing.

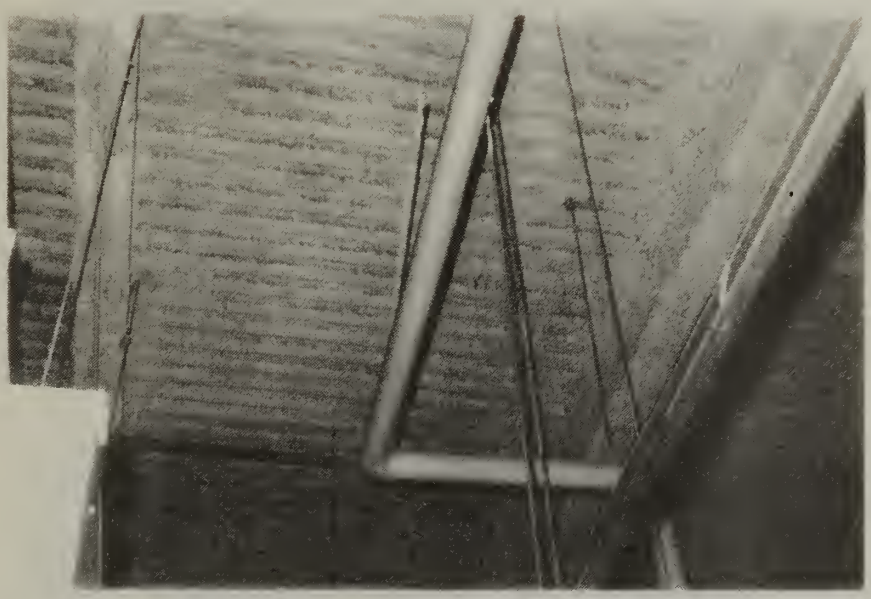


Figure A.3. Ceiling of equipment room of penthouse with no apparent damage to fireproofing (note original attachment of hangers to steel deck).

Figure A.4. Stairwell ceiling adjacent to penthouse with no apparent damage to fireproofing

Figure A.5. Ceiling of window cleaning equipment room with no apparent damage to fireproofing

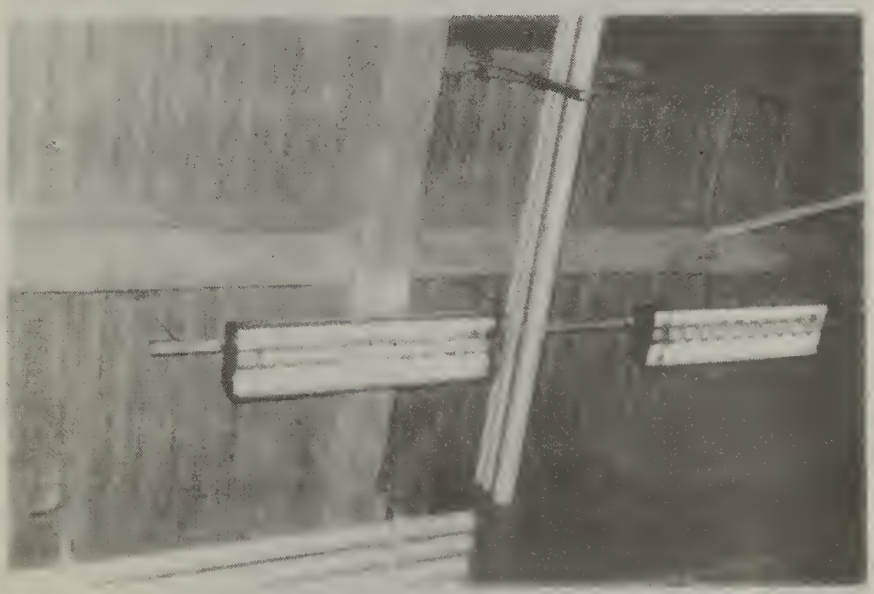


Figure A.6. Room 20408 - ceiling of electrical substation with no apparent damage to fireproofing

Figure A.7. Zone 3 elevator hoist room adjacent to roof - physical damage to fireproofing on beam caused by roofing contractor.

Figure A.8. Zone 3 elevator hoist room adjacent to roof - fireproofing removed from beam

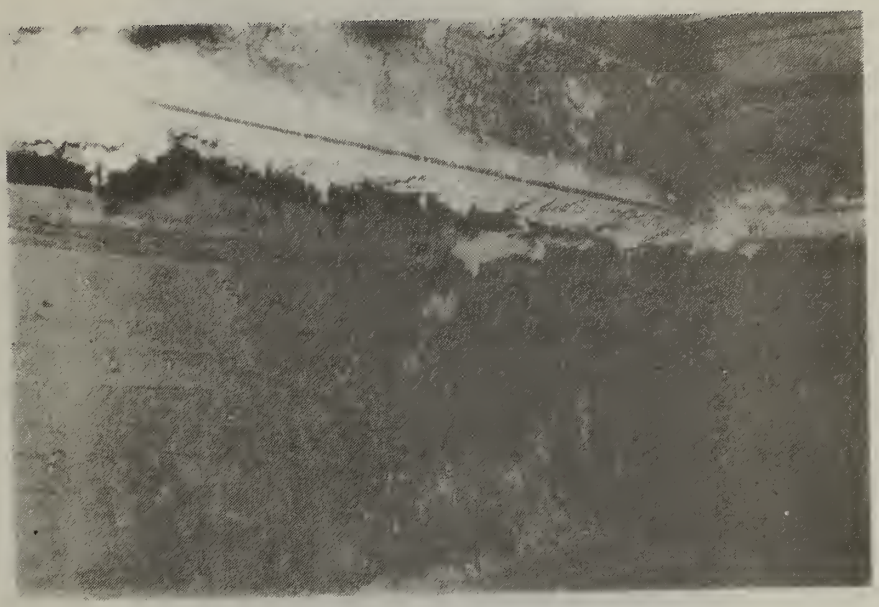


Figure A.9. Zone 3 elevator hoist room adjacent to roof - physical damage to fireproofing caused by roofing contractor

Figure A.10. Zone 3 elevator hoist room adjacent to roof - physical damage to fireproofing caused by roofing contractor.

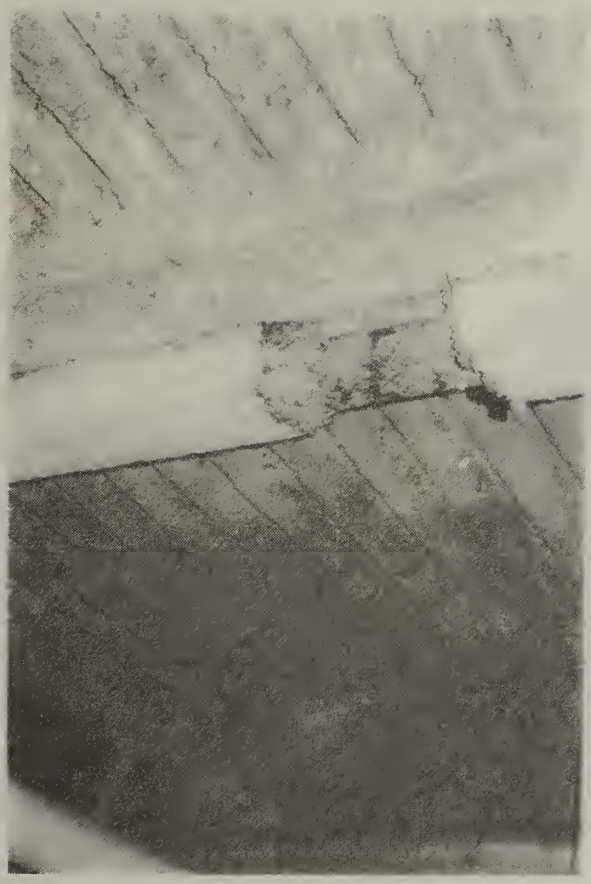


Figure A.11. Room 20408 - ceiling of electrical substation with portions of fireproofing removed from beam flange

Figure A.12. Room 11006 - ceiling of electrical closet with physical damage to fireproofing caused by installation of hanger

Figure A.13. Room 12207 - ceiling of zone 1 elevator machine room showing patching of fireproofing damaged during installation of hangers for ductwork

Figure A.14. Crawl space for courthouse ventilation off plenum stairwell #1 - patching of fireproofing following physical damage

Figure A.15. Room 18204 - ceiling of zone 2 elevator control room showing patching of fireproofing during electrical and plumbing modifications

Figure A.16. Room 18204 - beam in zone 2 elevator control room showing patching of fireproofing

Figure A.17. Upper elevator for machine room - damaged fireproofing on structural bracing members

APPENDIX B - ANALYTICAL RESULTS OF BULK SAMPLES

Analytical Results of Bulk Samples[1/]

Sample I.D.	Location	Results
1	Fallout inside crawl space for courtroom ventilation (duct supply and plenum off Plenum Stairwell Return #1)	10% Chryostile asbestos 88% Glass fibers 2% Non-fibrous
2	Zone 3 Elevator Hoisting Room	8% Chrysotile asbestos 90% Glass fibers 2% Non-fibrous
3	Sweeping from upper elevator machine Room	5% Chrysolite asbestos 85% Glass fibers 5% Cellulosic fibers Trace of synthetic fibers
4	Filter - Outside air supply chamber for west side of building	99% Glass fibers[2/]
5	Fallout above ceiling tiles in corridor between Room 8440 and 8450	35% Chrysotile asbestos 63% Glass fibers 2% Non-fibrous

1/ Bulk samples were analyzed by polarized light microscopy by a laboratory which participates in the RTI/EPA analytical proficiency program for bulk sampling analysis. EPA indicates that this laboratory has received a satisfactory rating for the last three rounds of the program. However, there may be variations from laboratory to laboratory in the results reported. For additional information see the paper "Preparation of Asbestos Standards for Methods Verification and Laboratory Evaluation" by Lentzen, Brantly, Gold, and Myers which appears in NBS Special Publication 619, "Asbestos Standards: Materials and Analytical Methods," March 1982.

2/ Analytical Procedure: An acetone extraction of the fibrous sample was done, the extract was evaporated by dryness and the residue analyzed by polarized light microscopy.

Result: 1% asbestos or not detectable. Some optically-active fibers were present but they were cellulosic fibers

APPENDIX C - SUMMARY OF AIR SAMPLING LOCATIONS AND RESULTS

Notes:

1. Fiber counts were determined by a laboratory accredited for asbestos under the Laboratory Accreditation Program of the American Industrial Hygiene Association. This accreditation was obtained by the laboratory's participation in the NIOSH Proficiency Analytical Testing Program (PAT). However, there may be variations from laboratory to laboratory in analyzing asbestos samples. For additional information see the paper "Membrane Filter Method: Statistical Considerations" by Chase which appears in NBS Special Publication 619, "Asbestos Standards: Materials and Analytical Methods," March 1982.

2. Air samples were analyzed by phase contrast microscopy which has the following limitations: (1) fibers detected may or may not be asbestos, (2) only fibers greater than 5 μm in length and with aspect ratios greater than 3:1 are counted, and (3) extremely thin (<0.5 μm in width) asbestos fibers would not be detected. See sections 4.2.1 and 4.2.2 for detailed discussion.

3. Bulk samples of fireproofing were not taken in areas where air sampling was carried out.

SAMPLING LOCATIONS AND RESULTS

Sample #	Room #	Location (Area)	No. of Fibers Counted per 100 fields	AIR Total Fibers per Filter	Fibers per cc of Air	Comments
SAN8001	2212	Main Kitchen - East End	3	4,580	<0.01	Asbestos covered
SAN8002	2212	Main Kitchen - West End	3.5	5,344	<0.01	Asbestos covered
SAN8003	5210	Medical Unit - Nurses Ofc (Trmt Room #2)	4	6,107	<0.01	Asbestos covered
SAN8004	5120	Medical Unit - Main Treatment Room	4	6,107	<0.01	Asbestos covered
SAN8005	20408	Electrical Substation (Paint Shop)	1	1,527	<0.01	Asbestos exposed
SAN8006	20408	Top of Spray Paint Booth	3	4,580	<0.01	Asbestos exposed
SAN8007	—	Crawl space above courtrooms - off plenum (Stairwell 1)	2	3,054	<0.01	Asbestos exposed
SAN8008	20407	Air Intake - fan rm - 20th Fl. (outside air)	4	6,107	<0.01	Contaminated sample
SAN8009	20407	Air Mixing Chamber 20th Fl. (beh. filters)	4.5	6,871	0.01	
SAN8010	corridor between 8440 & 8450	Air Plenum (above ceiling tiles, outside DEA lab)	2.5	3,817	<0.01	Large to very small particles present
SAN8011	—	Court Room #12	2	3,054	<0.01	Asbestos covered
SAN8012	—	Upper Elevator Machine Room	0	760	<0.01	Asbestos exposed
SAN8013	—	Court Rooms Air Handling Room	4	6,107	<0.01	Asbestos exposed
SAN9014	13114	East Return Air Shaft	5	7,634	0.01	Asbestos exposed
SAN9015	13313	West Return Air Shaft	0	<760	<0.01	Asbestos exposed
SAN9016	4114	East Return Air Shaft	0	<760	<0.01	Asbestos exposed
SAN9017	4313	West Return Air Shaft	0	<760	<0.01	Asbestos exposed
SAN9018	—	Zone 3 Elevator Hoisting Room	1	1,527	<0.01	Asbestos exposed
SAN9019	18204	Zone 2 Elevator Control Room	1	1,527	<0.01	Asbestos exposed
SAN9020	15219	CSA Space Modification Project (center of room)	36.5	55,728	0.03	Asbestos exposed. Highest area level found.

Sample #	Room #	Location (Area)	No. of Fibers Counted per 100 fields	AIR Total Fibers per Filter	Fibers per cc of Air	Comments
SAN9021	15219	CSA Space Modification Project (in area used as carpenter shop)	0	< 760	< 0.01	Asbestos exposed
SAN9022	15219	CSA Space Modification Project (in back hallway)	3.5	5,344	< 0.01	Asbestos exposed
SAN9023	15219	Electrician	4	6,107	0.02	Asbestos exposed Incidental contact with asbestos only
SAN9024	15219	Carpenter	9.5	14,504	0.04	Asbestos exposed Incidental contact with asbestos only
SAN9025	15219	Plumber	6	9,161	0.02	Asbestos exposed Incidental contact with asbestos only
SAN9026	15424	CSA Space Modification Project (office at end)	2	3,054	< 0.01	Asbestos exposed
SAN9027	15219	CSA Space Modification Project (outside work area, near plastic sheet barrier)	0	< 760	< 0.01	Asbestos covered
SAN9028	2212	CSA Space Modification Project (outside work area down corridor to men's room)	0	< 760	<0.01	Asbestos covered

Sample #	Room #	Location (Area)	No. of Fibers Counted per 100 fields	AIR Total Fibers per Filter	Fibers per cc of Air	Comments
SAN0038	15205	International Trade Administration (light fixture)	1	1,527	< 0.01	Across from CSA Space Mod. Proj. Asbestos covered
SAN0039	15205	International Trade Administration (hallway wall on file cabinet)	2	3,054	< 0.01	Across from CSA Space Mod. Proj. Asbestos covered
SAN0040	15205	International Trade Administration (air plenum in store room)	3	4,580	< 0.01	Across from CSA Space Mod. Proj. Asbestos covered
SAN0043	12207	Zone I Elevator Machine Room	2	3,054	< 0.01	Asbestos exposed
SAN0044	11207	Elevator Motor (Generator) Room	0	< 760	< 0.01	Asbestos exposed
SAN0045	13321	Air plenum - in outside hallway	2	3,054	< 0.01	Appeared clean
SAN0046	7209A	Air plenum -	0	< 760	< 0.01	Appeared clean
SAN0047	1431	Air plenum - in outside hallway	0	< 760	< 0.01	Small particles of asbestos present
SAN0048	4405	Air plenum	0	< 760	< 0.01	Medium particles of asbestos present
SAN1049	13402	Telephone closet	0	< 760	< 0.01	Asbestos exposed
SAN1050	13406	Electric closet	0.5	763	< 0.01	Asbestos exposed
SAN1051	5210	Health unit - air plenum in lobby	0	< 760	< 0.01	Appeared clean
SAN1052	13410	Air plenum - in outside hallway	0	< 760	< 0.01	Appeared clean
SAN1053	19303	Air plenum in outside hallway	0	< 760	< 0.01	Appeared clean
SAN2054	Lobby	Building Security Guard Desk	2	3,054	< 0.01	Asbestos covered
SAN2055	Lobby	Near courtroom security checkpoint	0	< 760	< 0.01	Asbestos covered
SAN2056	7003	HUD - middle of room	1.5	2,290	< 0.01	Asbestos covered
SAN2057	7003	HUD - top of file cabinet (N. side of room)	2	3,054	< 0.01	Asbestos covered
SAN2058	7003	HUD - near coat rack	2	3,054	< 0.01	Asbestos covered
SAN2059	7003	HUD - top of file cabinet (W. side of room)	1	1,527	< 0.01	Asbestos covered
SAN2060	Sub-basement	air intake - street level, SB east	0	< 760	< 0.01	
SAN2061	Sub-basement	air intake - street level, SB west	0	< 760	< 0.01	

APPENDIX D - ANALYTICAL RESULTS OF AIR SAMPLES

Notes:

1. Fiber counts were determined by a laboratory accredited for asbestos under the Laboratory Accreditation Program of the American Industrial Hygiene Association. This accreditation was obtained by the laboratory's participation in the NIOSH Proficiency Analytical Testing Program (PAT). However, there may be variations from laboratory to laboratory in analyzing asbestos samples. For additional information see the paper "Membrane Filter Method: Statistical Considerations" by Chase which appears in NBS Special Publication 619, "Asbestos Standards: Materials and Analytical Methods," March 1982.

2. Air samples were analyzed by phase contrast microscopy which has the following limitations: (1) fibers detected may or may not be asbestos, (2) only fibers greater than 5 μm in length and with aspect ratios greater than 3:1 are counted, and (3) extremely thin (<0.5 μm in width) asbestos fibers would not be detected. See sections 4.2.1 and 4.2.2 for detailed discussion.

3. Bulk samples of fireproofing were not taken in areas where air sampling was carried out.

analytics
P.O. Box 25249
Richmond, VA 23260

ANALYSIS REPORT

ANALYTICS NO. See Below
GROUP NO. 82-575
ACCOUNT NO. 63435
DATE July 12, 1982

Mr. Fred Stanley
A. F. Meyers & Associates
1317 Vincent Place
McLean, VA 22101

RECEIVED JUL 15 1982

SAMPLE TYPE: Cassettes for Fiber Count

DATE RECEIVED: 7-6-82

REMARKS: Field Area: 0.0056 mm^2 PRIORITY HANDLING: ___Yes _x_ No

Sample #	Analytics #	Total Fields Counted	# of Fibers Counted	Total Fibers per Filter	Sample Volume (L)	Fibers/cc
SAN 00 43	H008548-1	100	2	3,054	1,528.8	< 0.01
44	H008549-2	100	0	< 760	1,387.1	< 0.01
45	H008550-3	100	2	3,054	350.4	< 0.01
46	H008551-4	100	0	< 760	366.6	< 0.01
47	H008552-5	100	0	< 760	327.7	< 0.01
48	H008553-6	100	0	< 760	314.9	< 0.01
SAN 10 49	H008554-7	100	0	< 760	2,695.6	< 0.01
50	H008555-8	100	1/2	763	2,650.8	< 0.01
51	H008556-9	100	0	< 760	681.5	< 0.01
52	H008558-0	100	0	< 760	669.0	< 0.01
53	H008559-1	100	0	< 760	498.0	< 0.01
SAN 20 54	H008560-2	100	2	3,054	1,455.3	< 0.01
55	H008561-3	100	0	< 760	1,433.7	< 0.01
56	H008562-4	100	1 1/2	2,290	1,279.0	< 0.01
57	H008563-5	100	2	3,054	965.4	< 0.01
58	H008564-6	100	2	3,054	926.4	< 0.01
59	H008565-7	100	1	1,527	928.0	< 0.01
60	H008566-8	100	0	< 760	864.1	< 0.01
61	H008567-9	100	0	< 760	633.4	< 0.01
SAN 90 12	H008569-0	100	0	< 760	1,650.0	< 0.01
13	H008570-1	100	4	6,107	1,348.3	< 0.01
14	H008571-2	100	5	7,634	708.5	0.01 ± 0.01
15	H008572-3	100	0	< 760	632.1	< 0.01
16	H008573-4	100	0	< 760	594.6	< 0.01
17	H008574-5	100	0	< 760	597.2	< 0.01
18	H008575-6	100	1	1,527	1,780.0	< 0.01
19	H008576-7	100	1	1,527	1,747.2	< 0.01
20	H008577-8	100	36.5	55,728	2,195.2	0.03 ± 0.01
21	H008578-9	100	0	< 760	655.4	< 0.01

analytics
P.O. Box 25249
Richmond, VA 23260

ANALYSIS REPORT

ANALYTICS NO. See Below
GROUP NO. 82-575
ACCOUNT NO. 63435
DATE July 12, 1982

Mr. Fred Stanley
A. F. Meyers & Associates
1317 Vincent Place
McLean, VA 22101

SAMPLE TYPE: Cassettes for fiber count

DATE RECEIVED: 7-6-82

REMARKS: Field Area: 0.0056 mm_2 PRIORITY HANDLING: ____ Yes __x__ No

Sample #	Analytics #	Total Fields Counted	# of Fibers Counted	Total Fibers per Filter	Sample Volume (L)	Fibers/cc
SAN 90 22	H008580-0	100	3.5	5,344	659.3	< 0.01
23	H008581-1	100	4	6,107	362.9	0.02 ± 0.02
24	H008582-2	100	9.5	14,504	354.7	0.04 ± 0.04
25	H008583-3	100	6	9,161	390.2	0.02 ± 0.02
26	H008584-4	100	2	3,054	1,955.2	< 0.01
27	H008585-5	100	0	< 760	563.6	< 0.01
28	H008586-6	100	0	< 760	393.5	< 0.01
SAN Blank	H008587-7	100	0	< 760	NA	

James A. Calvin, CIH

RECEIVED JUL 0 8 1982

analytics

P.O. Box 25249
Richmond, VA 23260

ANALYSIS REPORT

ANALYTICS NO. See Below
GROUP NO. 82-566
ACCOUNT NO. 63435
DATE July 7, 1982

Mr. Fred Stanley
A. F. Meyer & Associates
1317 Vincent Place
McLean, VA 22101

SAMPLE TYPE: Cassettes for Fiber Count

DATE RECEIVED: 7-2-82

REMARKS: Field Area: 0.0056 mm^2 PRIORITY HANDLING: ___Yes __x__No
Ref: San Account

Sample #	Analytics #	Total Fields Counted	# of Fibers Counted	Total Fibers per Filter	Sample Volume (L)	Fibers/cc
SAN 8001	84150	100	3	4,580.	719.6	< 0.01
SAN 8002	84161	100	3.5	5,344.	752.3	< 0.01
SAN 8003	84172	100	4	6,107.	905.9	< 0.01
SAN 8004	84183	100	4	6,107.	854.2	< 0.01
SAN 8005	84194	100	1	1,527.	1,112.5	< 0.01
SAN 8006	84205	100	3	4,580.	889.7	< 0.01
SAN 8007	84216	100	2	3,054.	869.9	< 0.01
SAN 8008	84227	100	4	6,107.	824.6	< 0.01
SAN 8009	84238	100	4.5	6,871.	682.1	0.01 ± 0.01
SAN 8010	84249	100	2.5	3,817.	686.8	< 0.01
SAN 8011	84260	100	2	3,054	2,211.6	< 0.01

James A. Calpin (H.V.)

James A. Calpin, CIH

analytics
P.O. Box 25249
Richmond, VA 23260

ANALYSIS REPORT

ANALYTICS NO. See Below
GROUP NO. 82-576
ACCOUNT NO. 63435
DATE July 12, 1982

Mr. Fred Stanley
A. F. Meyer & Associates
1317 Vincent Place
McLean, VA 22101

RECEIVED JUL 15 1982

SAMPLE TYPE: Cassettes for Fiber Count

DATE RECEIVED: 7-6-82

REMARKS: Field Area: 0.0056 mm^2 PRIORITY HANDLING: ___Yes __x__No
Ref: SAN

Sample #	Analytics #	Total Fields Counted	# of Fibers Counted	Total Fibers per Filter	Sample Volume (L)	Fibers/cc
37	H008597-6	100	2	3,054	1,076	< 0.01
38	H008598-7	100	1	1,527	1,083	< 0.01
39	H008599-8	100	2	3,054	979.4	< 0.01
40	H008600-9	100	3	4,580	1,237.3	< 0.01

James A. Calpin, CIH

APPENDIX E - DETAILS SHOWING METHOD OF DUCTING AIR RETURN SYSTEM AND INSTALLATION OF HIGH EFFICIENCY FILTERS

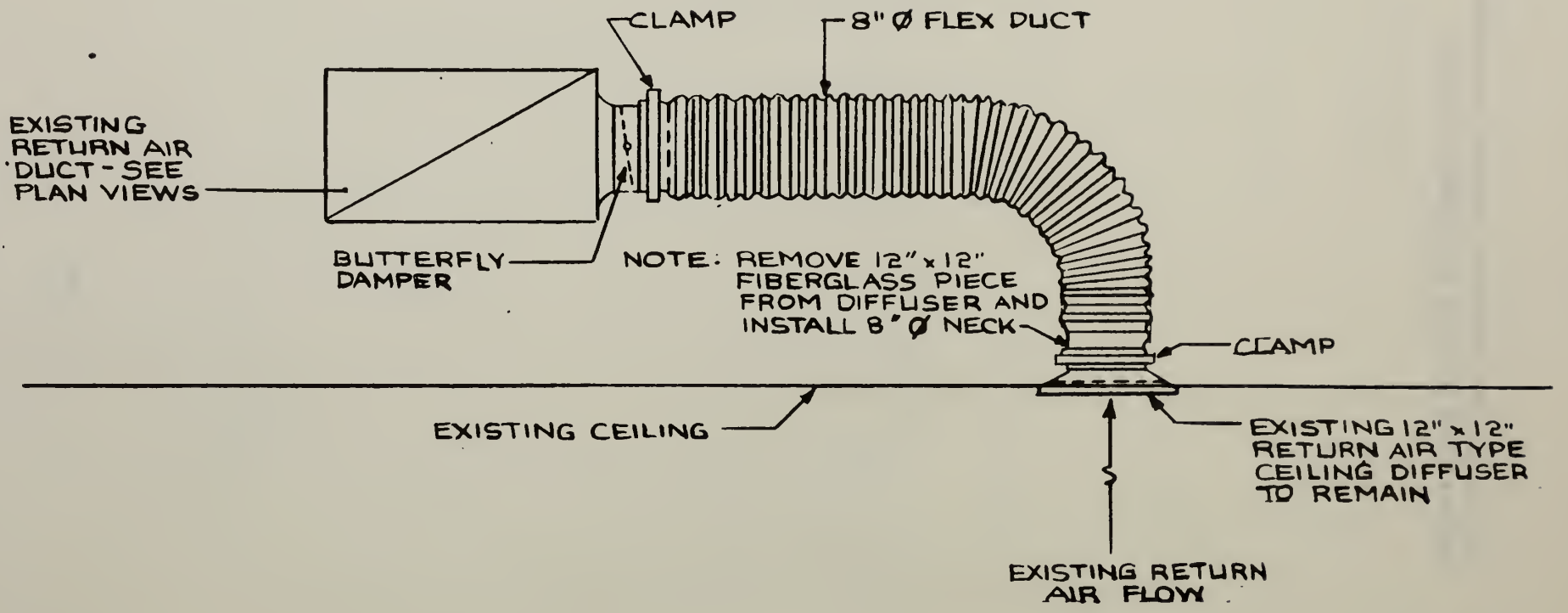
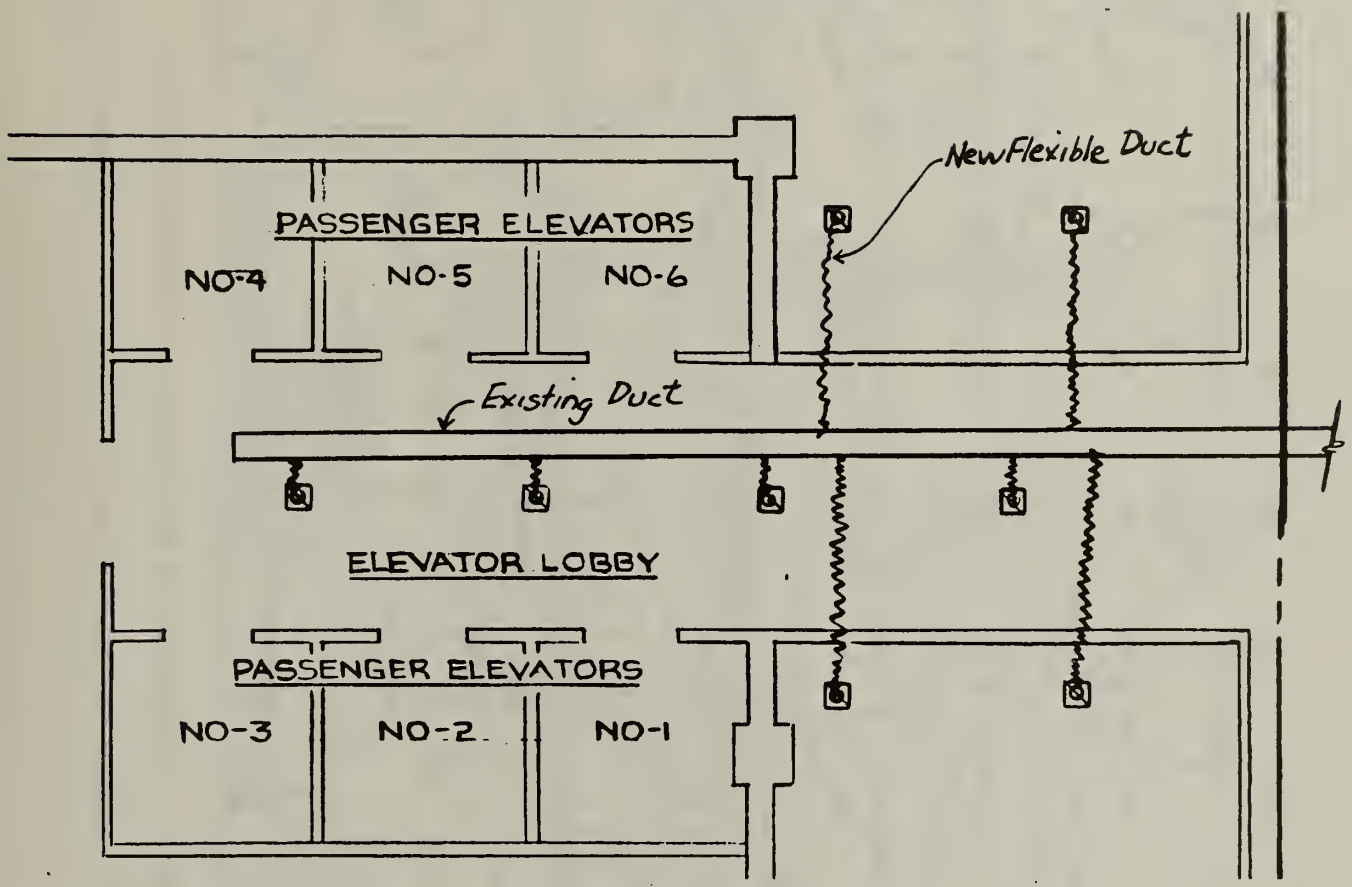
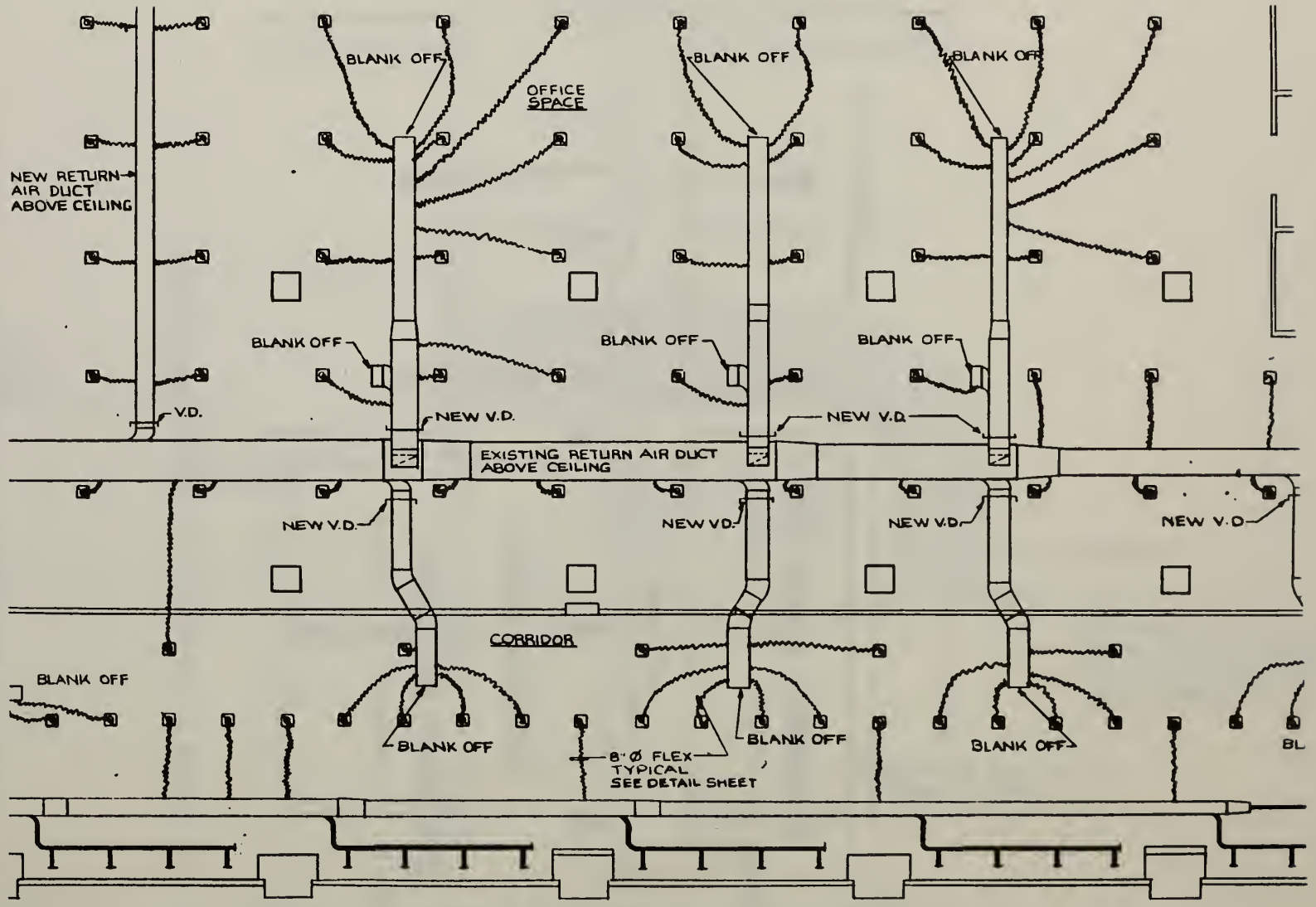


Figure E.1. Detail of connection of return air diffuser to existing return air duct



Note: See Figure E.1 for detail of ducting connections.

Figure E.2. Method of ducting air returns in elevator lobby areas



Note: See Figure E.1 for ducting connection details

Figure E.3. Method for ducting air returns along perimeter of building

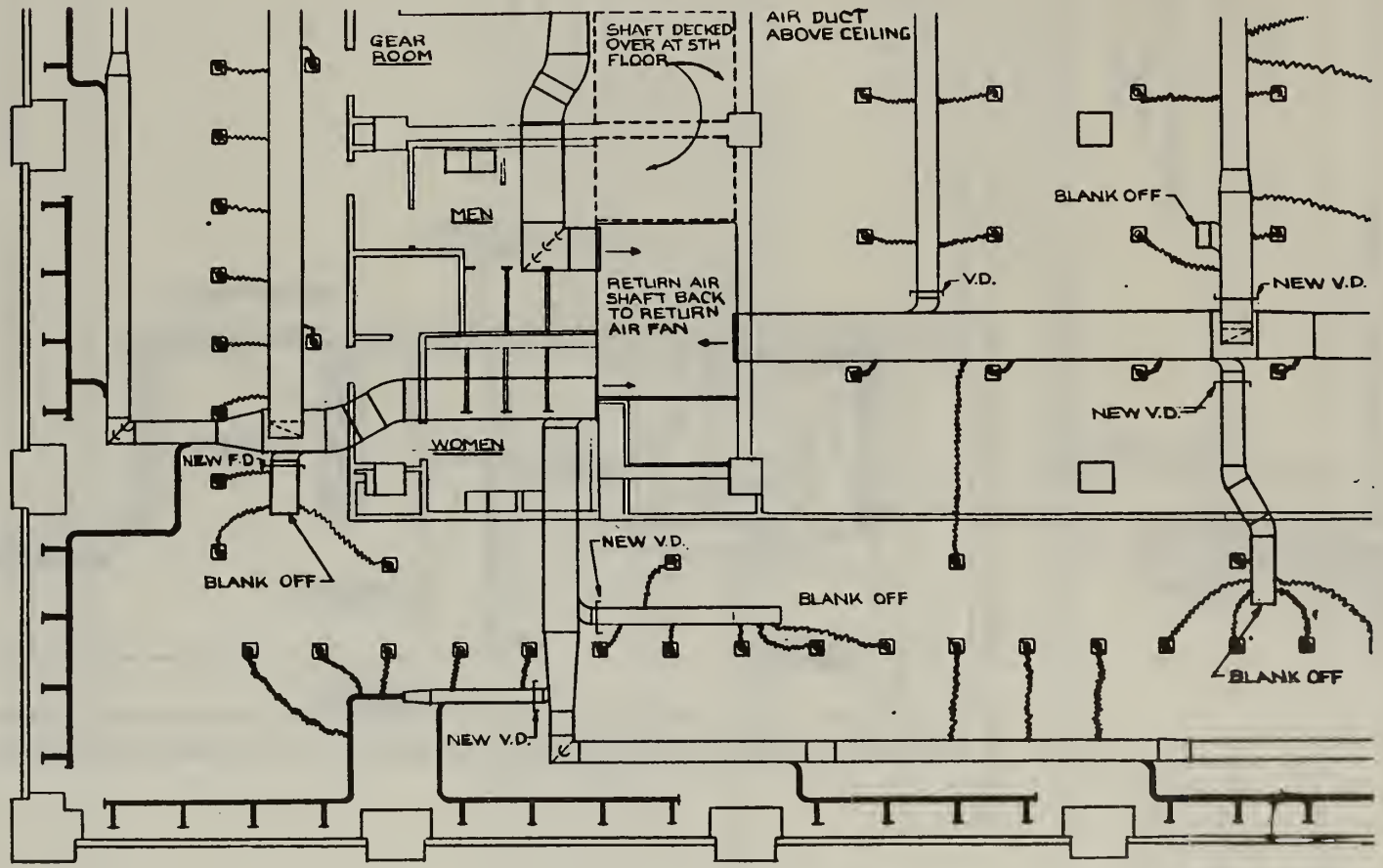


Figure E.4. Method for ducting air returns in corner section of building

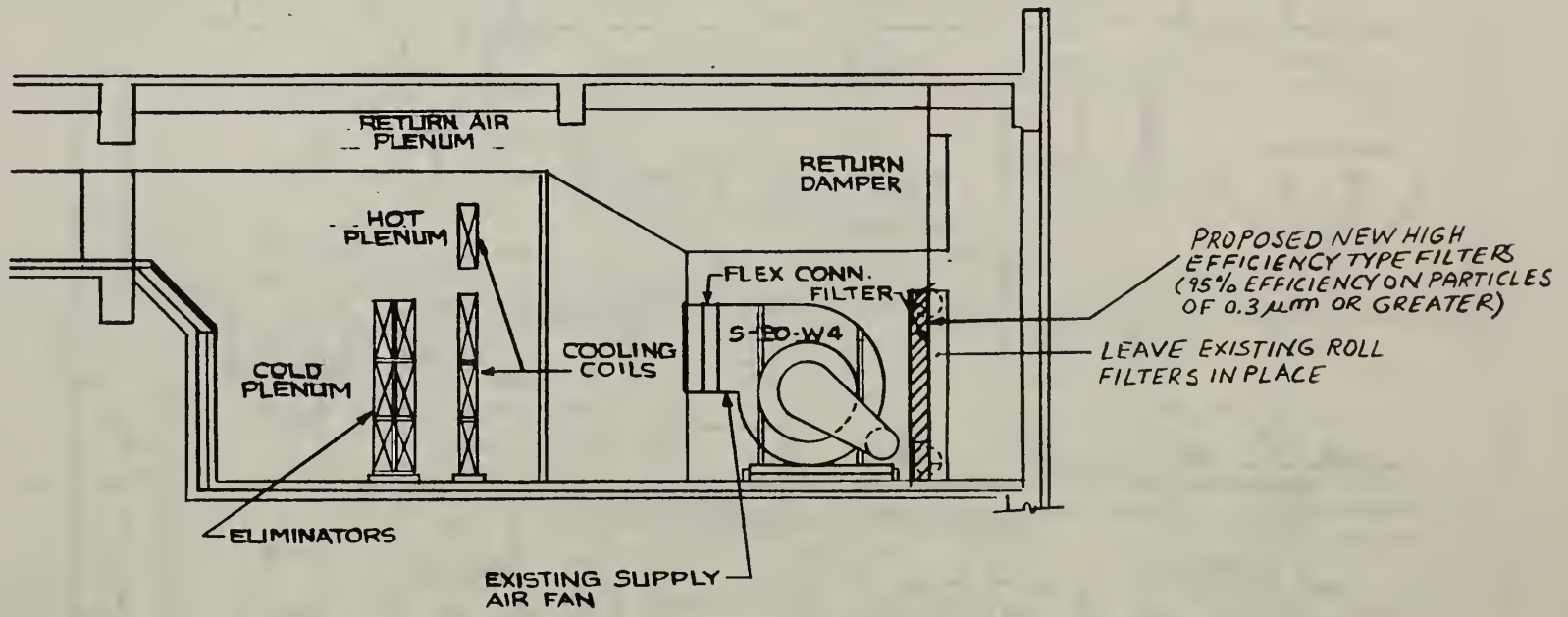


Figure E.5. Placement of new high efficiency air filters in HVAC system

NBS-114A (REV. 2-8C)

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5. AUTHOR(S)

James H. Pielert

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10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

The report describes a study conducted by the National Bureau of Standards for the Public Buildings Service of the General Services Administration on the use of fireproofing suspected of containing asbestos in a Federal building. The report presents the results of physical inspections of selected portions of the building, application of bulk and air sampling techniques, and includes asbestos abatement options that GSA may wish to consider for reducing airborne asbestos fiber levels in the building.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

asbestos; buildings; fireproofing; structures

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