17506A-SS

W. R. GRACE & CO.

CONSTRUCTION PRODUCTS DIVISION

STATEMENT

FOR DELIVERY BEFORE:

ENVIRONMENTAL PROTECTION AGENCY HEARING

CONCERNING:

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

TO BE HELD:

COMMENCING THE 15TH DAY OF FEBRUARY 1972

IN LOS ANGELES, CALIFORNIA

7506B

PURPOSE

The purpose of W. R. Grace & Co., Construction Products Division ("Grace") in submitting this statement at this hearing of the Environmental Protection Agency ("EPA") is to request the EPA to clarify its proposed National Emissions Standards for Hazardous Air Pollutants relating to asbestos published in the December 7, 1971 issue of the Federal Register so as to clearly establish that the spray application of plaster fireproofing containing less than 12% asbestos by weight is not a prohibited activity.

It is Grace's belief that proposed standard Section 61.22(e) prohibiting "the spraying of any product which contains asbestos on any portion of a building or structure" or "in an area directly open to the atmosphere" is in reaction to growing concern relating to asbestos emissions from spray-applied asbestos fireproofing.

Grace shares this concern, a concern which it has long had. Grace believes, however, that the proposed standard prohibiting the "spraying of any product which contains asbestos" is much broader than necessary to protect the public from the hazards said to be posed by asbestos

emissions and is based on the assumption that "spray-applied asbestos fireproofing" and "the spraying of any product which contains asbestos" mean the same thing. It is therefore important to clearly differentiate between plaster fireproofing containing asbestos and spray-applied asbestos fireproofing.

SPRAY-APPLIED ASBESTOS FIREPROOFING

Spray-applied asbestos fireproofing at which in Grace's judgment the proposed standard is aimed is commonly 33% asbestos by weight. The asbestos is generally combined with mineral wool fibers and inorganic binders. The fibrous mix is then dumped dry into a hopper which fluffs the dry material. This dry material is then blown in a dry state to the point of application where it emerges from a nozzle which may be 2-3" in diameter. At the nozzle a water spray is introduced and the dry fibrous material is blown through the spray causing the mix to be wetted and propelled to the surface to be coated.

Because of this spray method, the fact that the wetted fibers are lightweight and the spray pattern quite broad, the opportunity for emission of asbestos fiber into the atmosphere in the application of spray-applied asbestos fireproofing is high.

In addition, not only can overspray and rebound of spray-applied asbestos fireproofing become airborne in application, but overspray quickly dries out and it too can become airborne. (Attached hereto are photographs showing the application of spray-applied asbestos fireproofing.) (Exhibit A)

PLASTER FIREPROOFING

For about 10 years Grace has been promoting a method of fireproofing buildings with a process in which the fireproof materials are premixed in a slurry form prior to application.

This plaster fireproofing basically is composed of vermiculite, gypsum, and less than 12% asbestos by weight in each 50-lb. bag. Each bag is then placed into a hopper with about 50 quarts of water. The mix is blended into a wet plaster slurry and pumped through a hose to the point of application where it is sprayed in a tight pattern by use of air pressure from a nozzle having a 3/8" to 1/2" diameter orifice onto the surface to be fireproofed. This wet material then sets to a hard plaster having a density of 20 pounds per cubic foot. Likewise because this wet material is up to three times heavier than the wet spray-applied asbestos fireproofing, any overspray or rebound does not become airborne

but falls to the floor and hardens. Attached are photographs showing the application of plaster fireproofing. (Exhibit B)

In this regard we would like to call attention to the "Background Information -- Proposed National Emissions Standards for Hazardous Air Pollutants" published by EPA in December, 1971 (EPA Background Information). On page 7 it is stated that: "The proposed ban on the spray application of products that contain asbestos is based upon experience with spray-fireproofing operations wherein efforts to control emissions by the use of containment and good housekeeping practices have repeatedly failed."

It is our belief that the above statement refers to spray-applied asbestos fireproofing (see Exhibit A). The reason for our belief is that the rebound and overspray from plaster fireproofing lend themselves to good housekeeping methods because the hardened overspray can simply be gathered into a pile for proper disposal.

A more concise comparison of spray-applied asbestos fireproofing and plaster fireproofing is attached to this statement as Exhibit C.

ASBESTOS FIBER EMISSIONS
FROM PLASTER FIREPROOFING

On the same day that EPA published its proposed

National Emissions Standards for Hazardous Air Pollutants, there appeared in the Federal Register an emergency standard for exposure to asbestos dust published by the Department of Labor pursuant to the Occupational Safety and Health Act of 1970 ("OSHA"). This standard which is Section 1910.93a states in part: "The 8-hour time-weighted average airborne concentration of asbestos dust to which employees are exposed shall not exceed 5 fibers per milliliter greater than 5 microns in length, as determined by the membrance filter method at 400-450 X magnification (4 millimeter objective) phase contrast illumination." In order to determine concentrations of airborne asbestos fibers during and after the application of plaster fireproofing in the fireproofing of structural steel, observations were made at three construction sites in the San Francisco, California area on May 26, May 28, and June 4, 1970. Consideration was given to the actual and potential exposure of (a) workmen carrying out the spray operation, (b) workers in allied trades nearby, and (c) the general public. These observations were made by the highly respected Tabershaw-Cooper Associates and a report of their air sampling findings appears as Exhibit D. Substantially the same methods of asbestos fiber detection recommended by Section 1910.93a of the OSHA emergency standard for exposure to asbestos dust quoted above were employed.

The Tabershaw-Cooper observations indicated that the occupational exposures to workmen who were operating the spray nozzles applying plaster fireproofing were not above the recommended threshold limit values for asbestos published in Section 1910.93a. In fact, of the numerous samples taken, only one sample higher than this level was found. Concentrations dropped off rapidly in the adjacent areas. Tabershaw-Cooper reported that expressed uniformly as fibers per liter, exposures of spray crews in all except the one case mentioned above were well below the threshold limit values; workers in adjacent areas of the same buildings were exposed to concentrations from 1/10 to 1/5000 of this value; individuals on other floors of the buildings and in the building vicinities had transitory exposures ranging from 1/100 to 1/5000 of the threshold limit value, ambient air levels in the Bay Area were from 1/500 to less than 1/5000 of this value.

In addition, Grace itself has taken similar asbestos fiber detection observations at construction sites where plaster fireproofing was being applied. These observations were taken during July and September 1970 at Omaha, Nebraska; Bethpage, New York; and here in Los Angeles, California, using the same recommended membrance filter method. Samples from these locations were analyzed for Grace by Werby Laboratories Inc. of Boston, Massachusetts. The results are attached. G (~~Exhibit E~~) part of our submission.

A review of these results clearly shows that in all cases the fiber counts were considerably below the threshold limit values for asbestos established pursuant to OSHA. We would like to further point out that the fiber count data in the Werby analysis consists of all fibers and is not limited to asbestos alone.

In your propcsed "National Emission Standards for Asbestos", Section 61.22(e)(3), it is stated that fibers may be emitted to outside air if a fabric filter of the type described in Section 61.23(d) is in use. We have been advised that this filter would limit fibers' emissions to the atmcsphere to approximately 0.5 to 1.5 fibers greater than 5 microns in length per milliliter of air sampled. You will note that in both the Tabershaw-Cooper and the Werby findings set out in Exhibits D and E, all observations corresponding to outside air sampling are below the fabric filter standards and this in cases where no filters were in use.

As to the question of whether or not there are fiber emissions of asbestos from plaster fireproofing after it has been put in place, we would like to refer you to an analysis of air samples taken by Tabershaw-Cooper Associates at the request of the Bechtel Corp. in San Francisco in September, 1970, in which it is concluded:

"The conclusion of the above test program was that the maximum concentrations of asbestos fibers found in the sampling locations were approximately 2 1/2 fibers per liter. As a comparison reference, the normal atmospheric concentration of fibers in the Bay Area varies from 0 to 10 fibers per liter.

"Based upon the enclosed report the concentrations of asbestos fibers in your building are on the low side of the normal ambient concentrations found throughout the Bay Area."

This report upon which the conclusion is based is attached to this statement as Exhibit F.

As to the durability of plaster fireproofing, you will note in a test performed by the Boyle Engineering Laboratory for us in April, 1964, plaster fireproofing was exposed to a high velocity air stream (over 100 miles per hour) for 87 consecutive hours and no erosion occurred. A report of this test is attached as Exhibit G.

AVAILABLE SUBSTITUTES

In the EPA Background Information it is stated that asbestos-free substitute materials are available for sprayed asbestos fireproofing for a cost no higher than 15% of asbestos-containing fireproofing materials. Grace does not deny that such materials are available. In fact, Grace itself manufactures and sells substitute materials. However, Grace wishes to point out to you that at least as of this date none

of the nonasbestos fireproofing materials approved by Underwriters' Laboratories, Inc. have achieved full equivalency with the asbestos-containing materials previously approved by UL.

The area where full equivalency has not been obtained is in the ability of the nonasbestos-containing fireproofing materials of the types here under discussion to remain in place during fire exposure as long as the asbestos-containing materials. This bonding ability is an essential parameter of these types of fireproofing products. In our judgment, the ability of the asbestos-containing materials to bond to the structure for a longer period of time than the nonasbestos-containing materials gives asbestos-containing materials a certain margin of safety which even if only once required would be worth their use.

At this time we and others are in the process of experimenting with, and researching for, materials which will be fully equivalent to the present asbestos-containing fireproof materials, but having even less asbestos emissions and in some cases no asbestos emissions. Grace's efforts will continue until such time as fully equivalent new plaster type materials are developed.

GENERAL OBSERVATION

Earlier in this statement Grace alluded to the broad scope of the proposed National Emission Standards and in this connection Grace would like at this time to make a general observation.

The aim of the proposed standards, as they concern asbestos, is to control the level of asbestos emissions. Emission limits are specified for the numerous uses and applications of asbestos. We feel that EPA activities in this are appropriate.

However, we feel strongly that the absolute prohibition of spray application of "any product which contains asbestos" is arbitrarily severe and inconsistent with the objectives of EPA.

This is because the proposed regulation would prohibit materials otherwise acceptable simply because they contain asbestos, even though the use of the material would result in airborne asbestos far below the level acceptable for all other products formulated with asbestos. Moreover, by specifying "asbestos" instead of "commercial asbestos", the regulation could even be interpreted as prohibiting the spraying of materials containing minute traces or stray amounts of asbestos.

We feel that it is not the intention of EPA to establish a standard so arbitrarily severe. We believe the regulation was written in its proposed form because of the failure to differentiate between spray-applied asbestos fireproofing and plaster fireproofing.

CONCLUSION

Grace recognizes and approves of the general desire to limit asbestos fibers in the ambient air. This desire should be weighed in each instance against the benefit to be gained by prohibiting a specific activity. In our judgment, the benefit to be gained by prohibiting the use of plaster fireproofing is not commensurate with the continued benefits to the public in having a plaster fireproofing containing asbestos available for use. Especially is this so in a context where there is no data that defines the excess risk, if any, to the public from exposure to asbestos fibers in ambient air and where asbestos fiber emissions attributable to the use of plaster fireproofing are in our judgment less than the point of references presently established by EPA and OSHA.

Accordingly, Grace hereby proposes the following modification to Subpart B - National Emission Standards for Asbestos:

"A new subparagraph (n) shall be added to Section 61.21 as follows:

"(n)" 'Plaster fireproofing' means any direct-to-steel fireproofing product containing less than 12% asbestos

by weight which is mixed, pumped and spray-applied in slurry form and wich after application hardens into a plaster with a density of 18 lbs. per cubic foot or more."

Sections 61.22(e)(1) and 61.22(e)(2) shall be modified by deleting the phrase:

"The spraying of any product which contains asbestos"

and inserting in lieu thereof in each case the phrase:

"The spraying of any product, except plaster fire-proofing, which contains commercial asbestos."

Section 61.22(e)(3) shall be modified by deleting the phrase:

"Emissions of particulate matter from spraying of any product which contains asbestos."

and inserting in lieu thereof the phrase:

"Emissions of particulate matter from spraying of any product, except plaster fireproofing, which contains commercial asbestos."

We wish to thank you for the opportunity you have given us to make our views known. If there is any other information which you may require, we will be pleased to provide it.

rw
2/23/72

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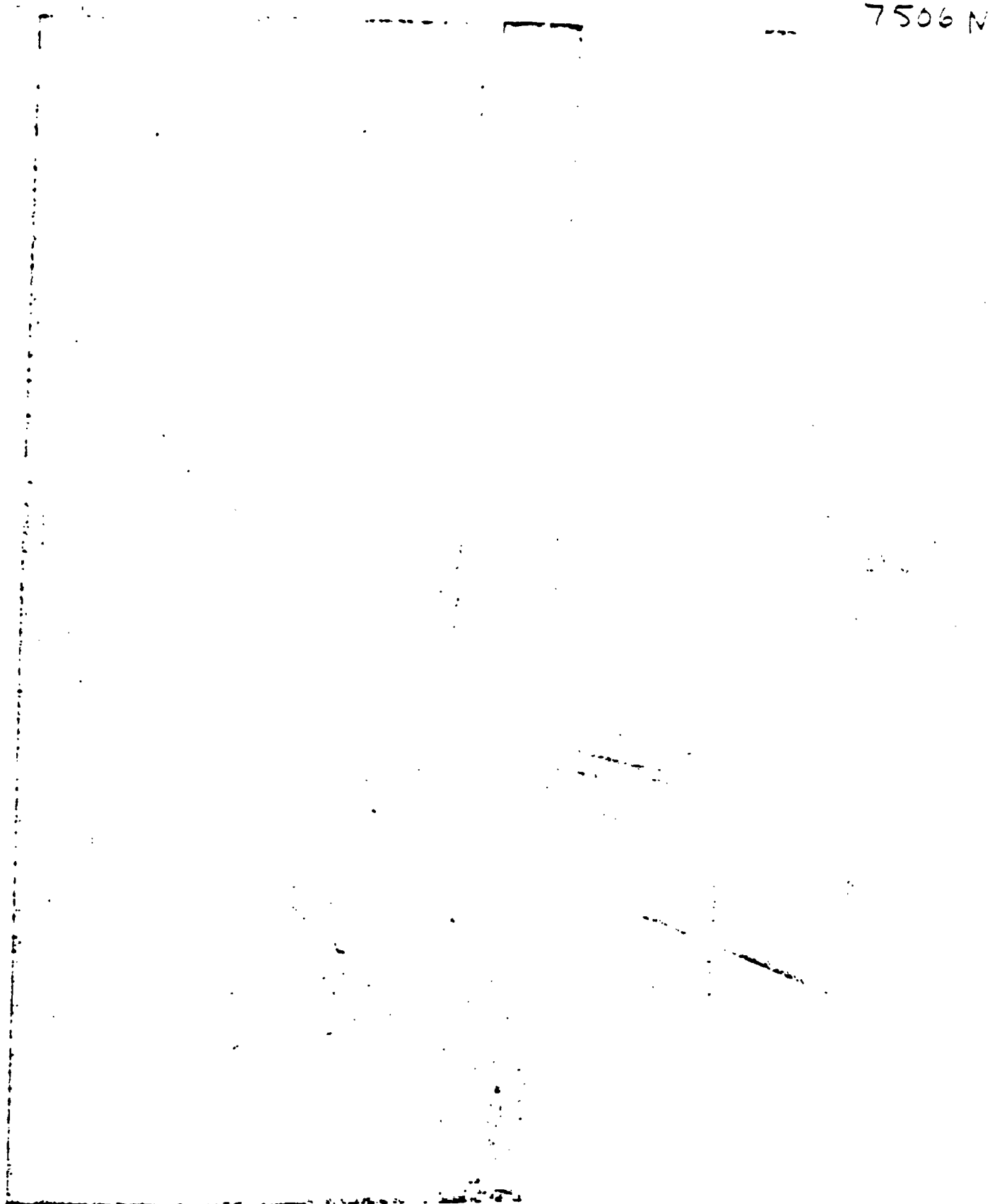

EXHIBIT A

Application of spray-applied asbestos fireproofing.

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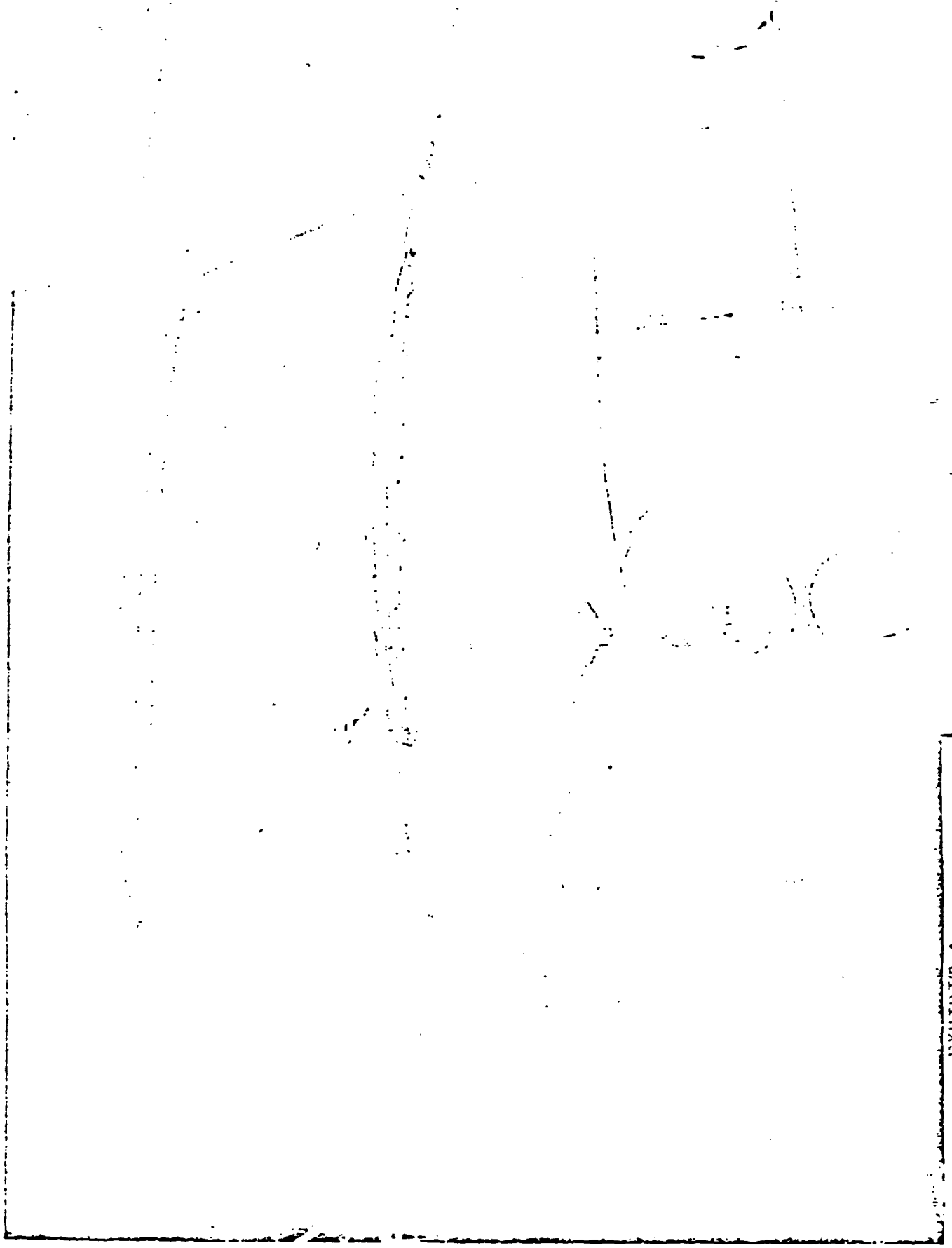


EXHIBIT A

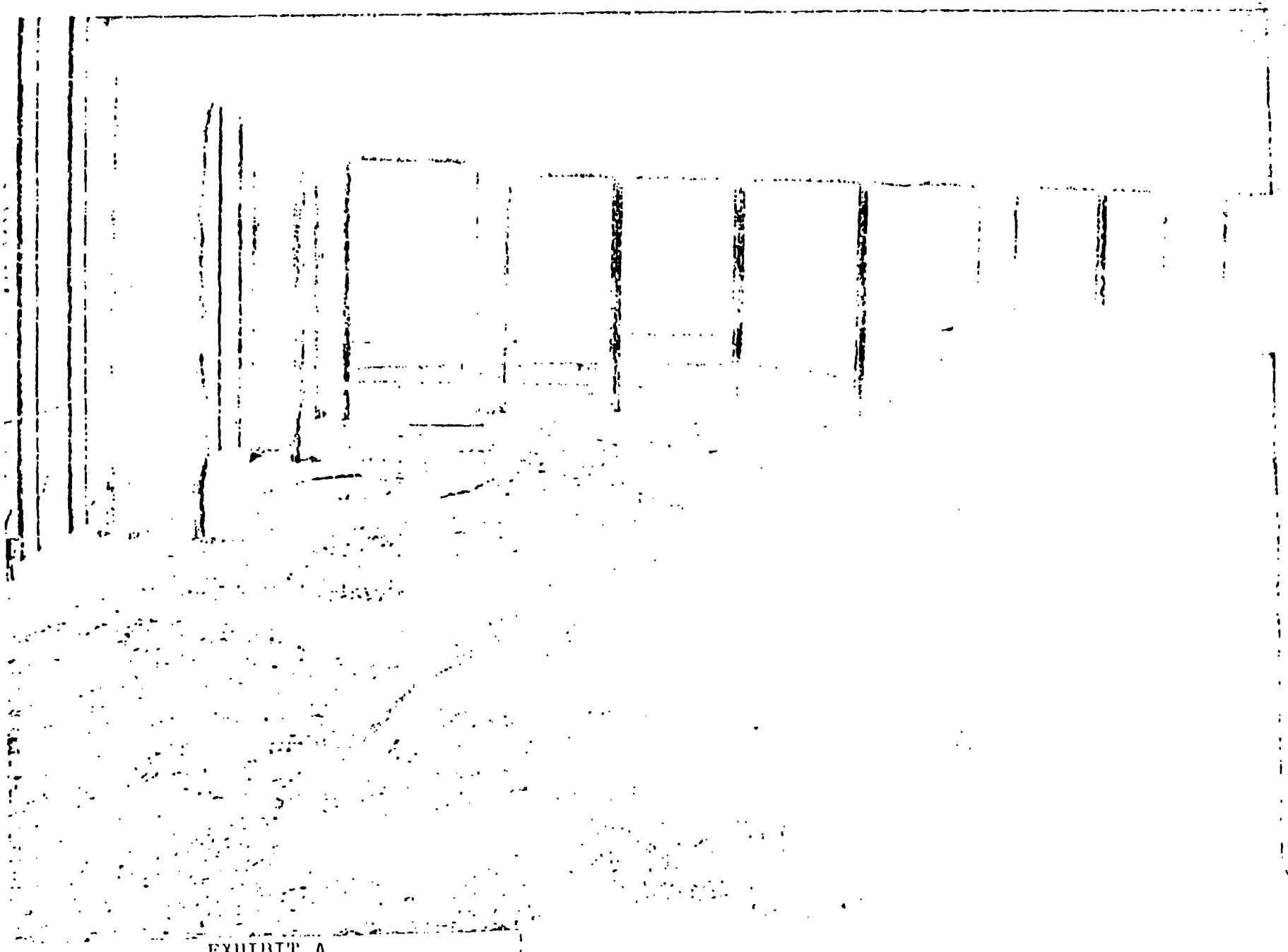


EXHIBIT A

Spray-applied asbestos fireproofing in

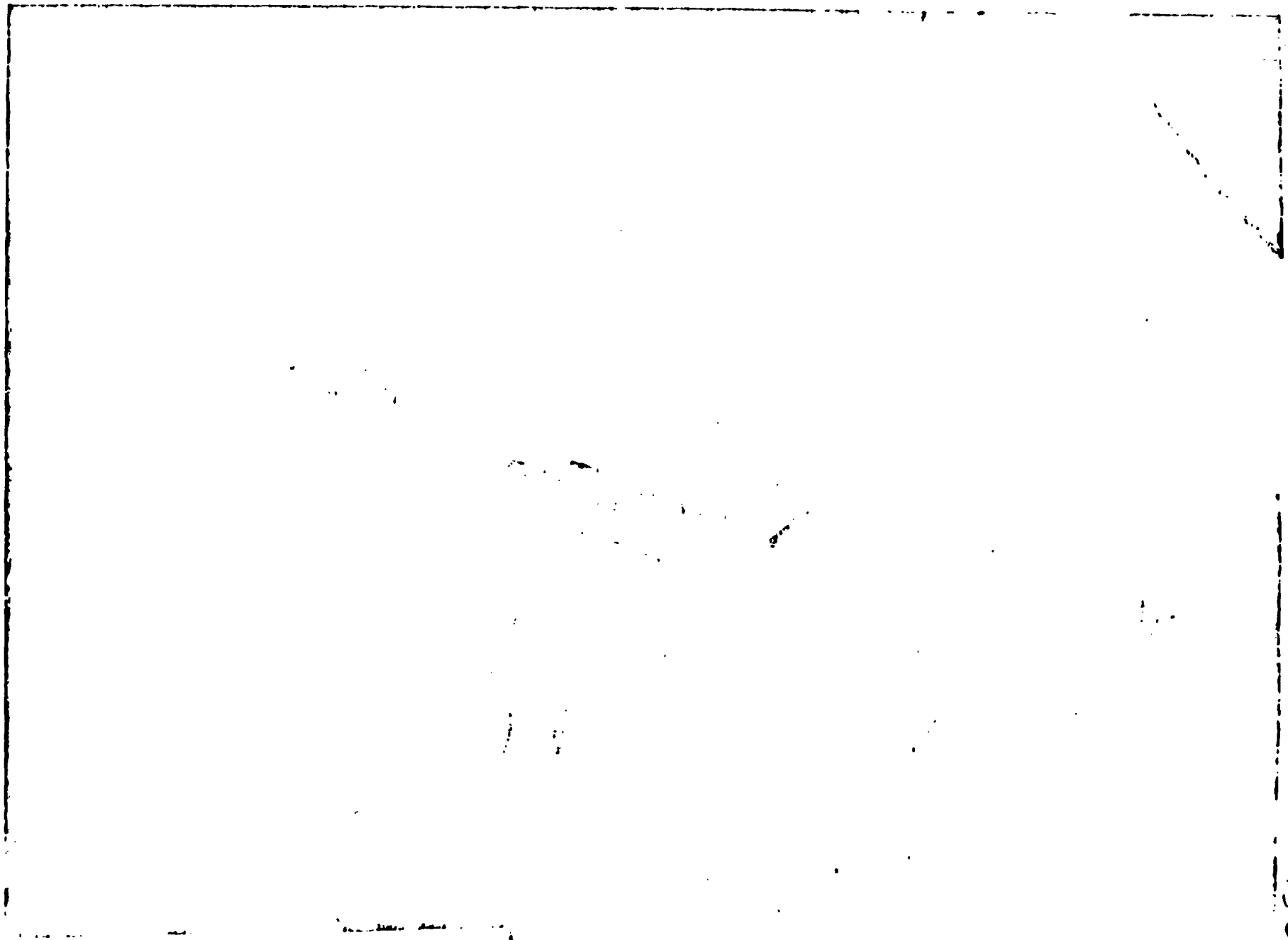
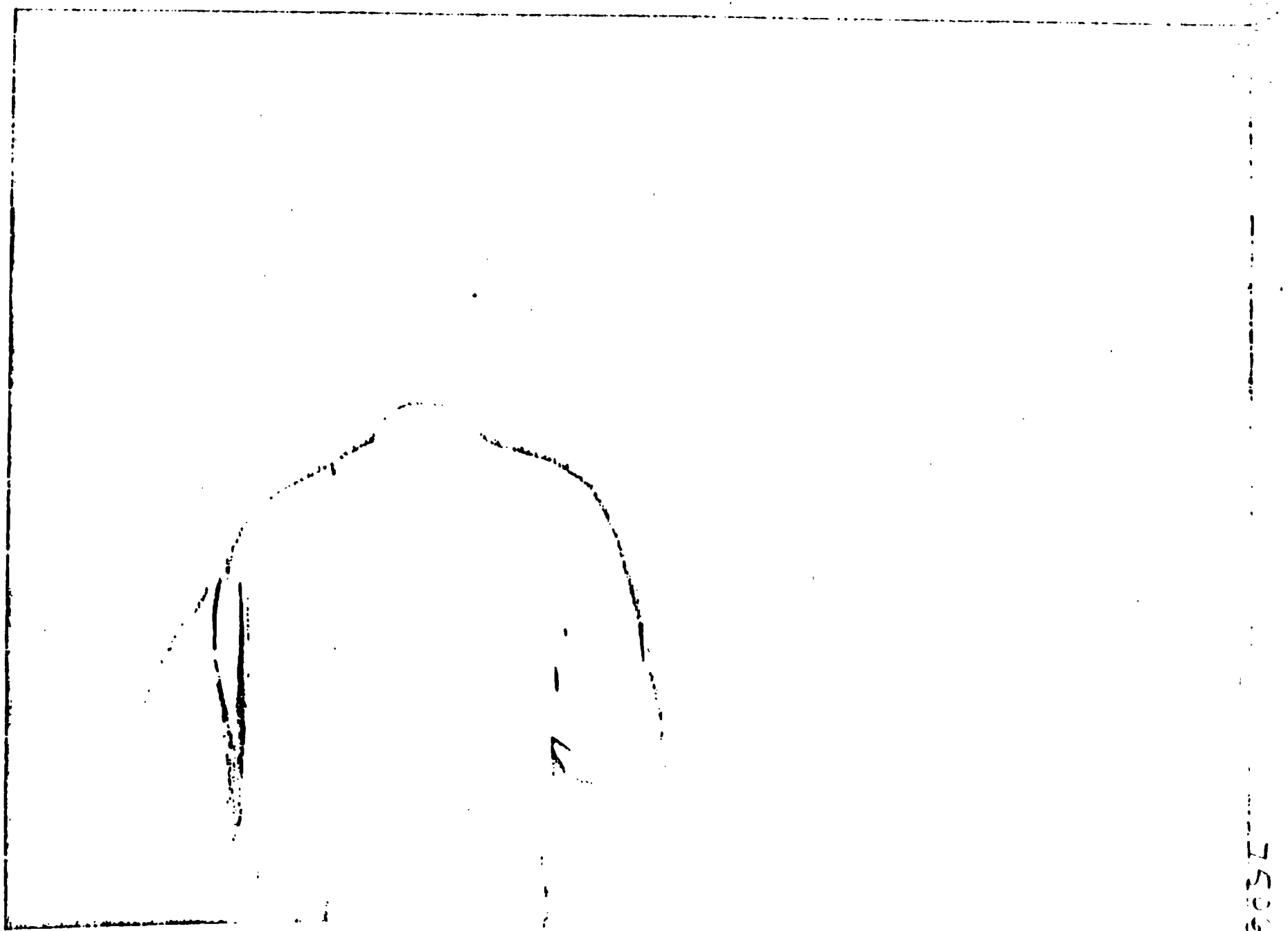


EXHIBIT B

Mixing plaster fireproofing into



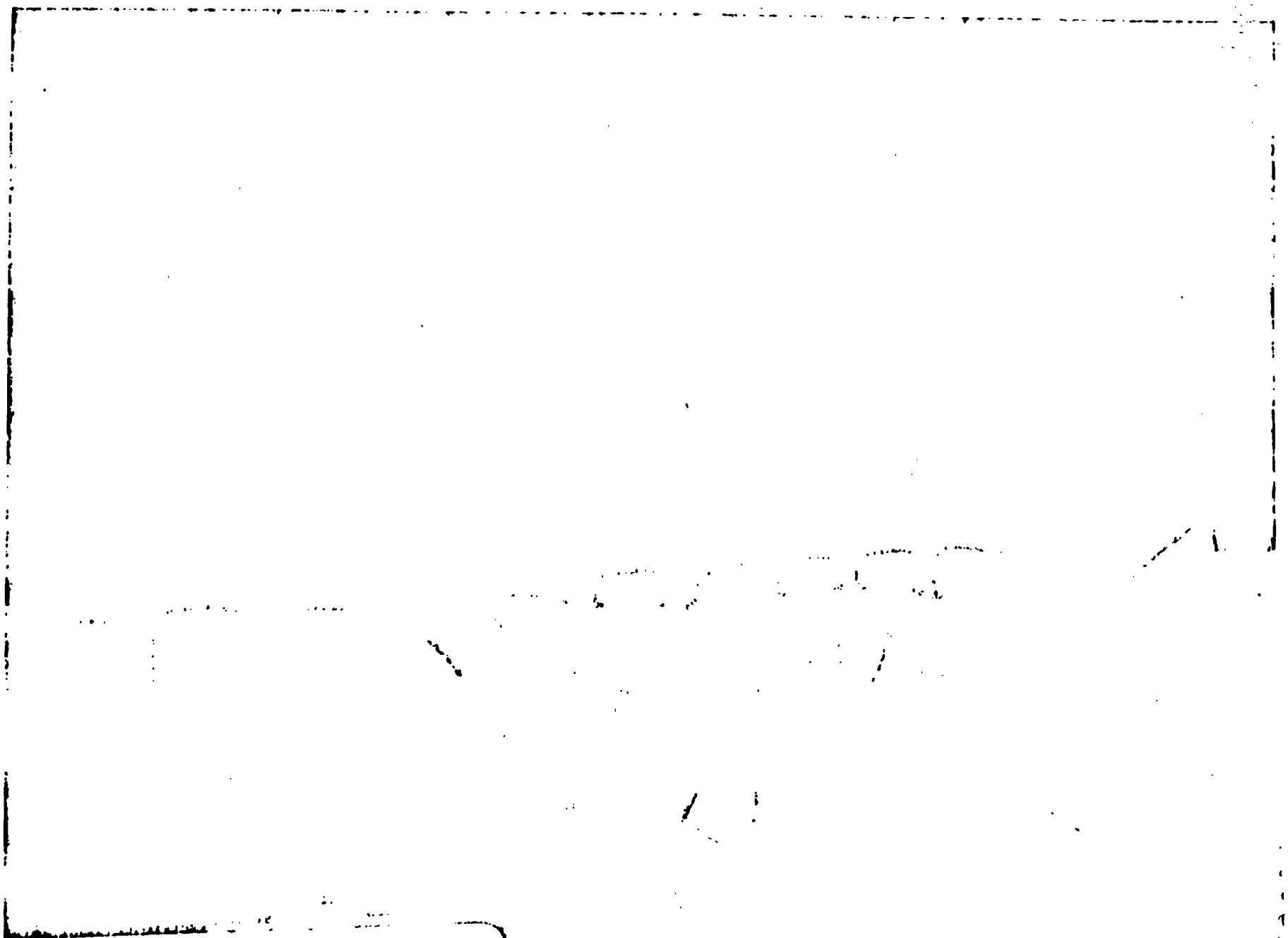


EXHIBIT B

EXHIBIT D

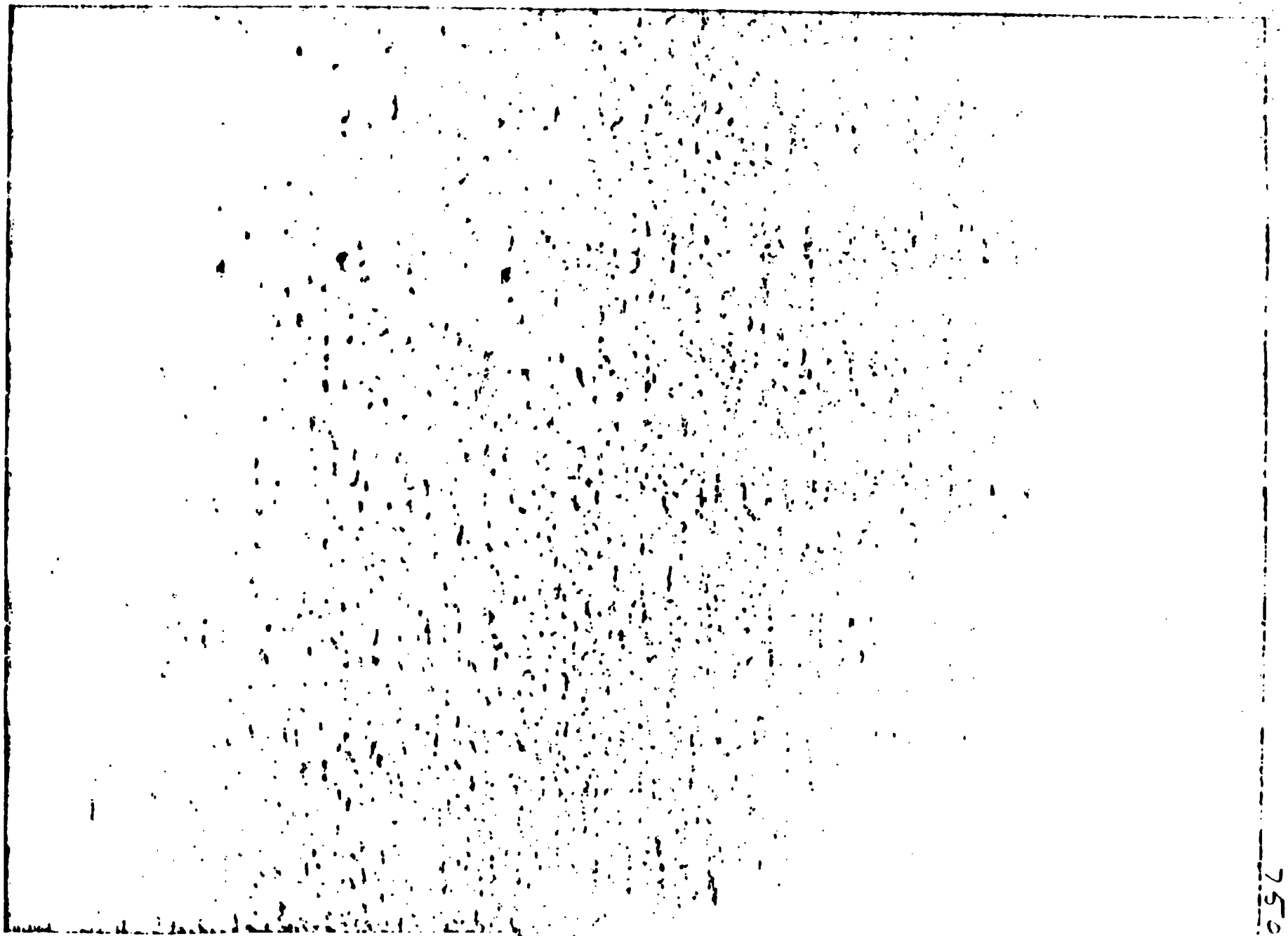


EXHIBIT B

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EXHIBIT C

PLASTER FIREPROOFING V. SPRAY-APPLIED ASBESTOS FIREPROOFING

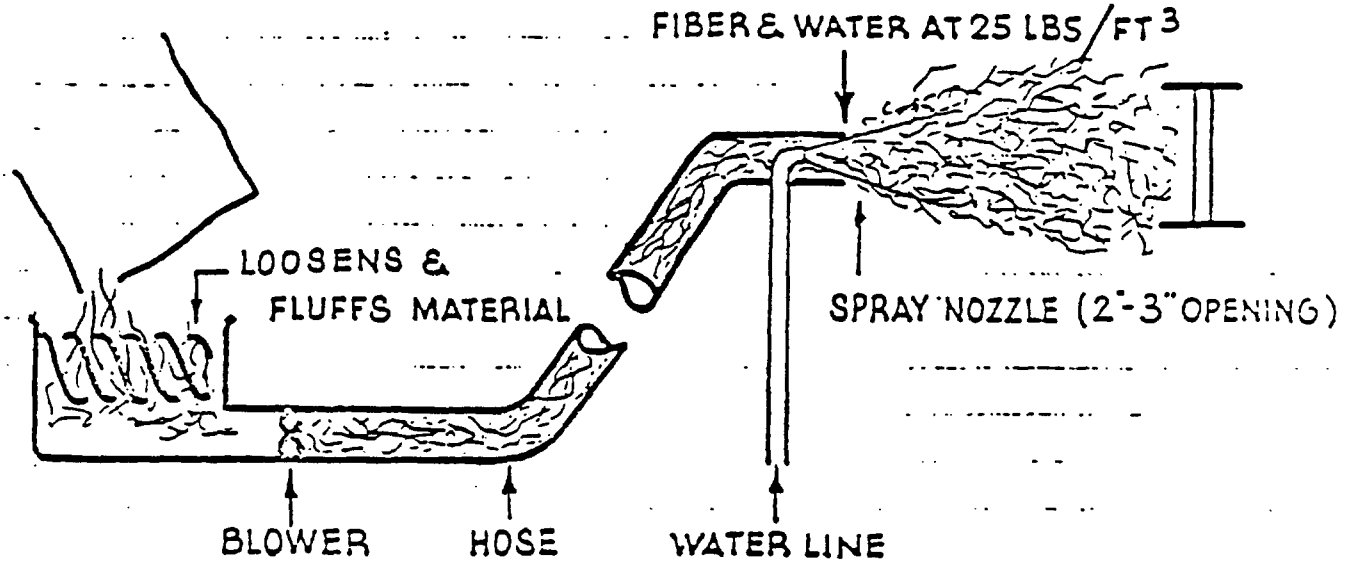
		Plaster	Sprayed Fiber
(1)	Formulation (dry ingredients)	Max 12% asbestos by weight	approximately 33% asbestos by weight
(2)	Mixing (opening bag)	dry ingredients dumped into hopper containing water (additional water added as needed)	dumped into hopper (dry) no water added
	(Mixer)	mixer forms wet plaster	mixer fluffs dry material
(3)	Pumping	wet slurry pumped	dry ingredients blown
(4)	Spraying	slurry sprayed wet (under directional air pressure)	dry spray w/small amounts of water to mix with dry fibers at nozzle end
(5)	Waste	overspray and/or rebound is in "wet" condition	fibers from overspray become airborne when dry
		sets to hard plaster	upon drying, easily swept or blown away
(6)	In-Place (drying)	sets to hard plaster consistency (20 lbs. per cu. ft.)	light density (7-15 lbs. per cu. ft.)
		passes 100 mph air erosion test	remains relatively loose and soft

EXHIBIT C

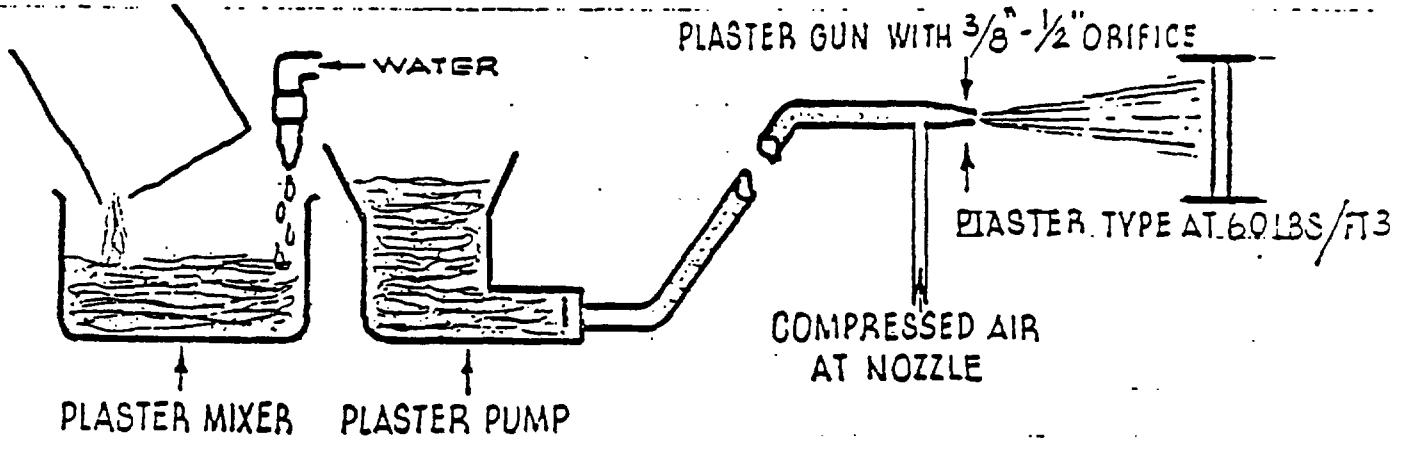
PLASTER FIREPROOFING V. SPRAY-APPLIED ASBESTOS FIREPROOFING

		Plaster	Sprayed Fiber
(1)	Formulation (dry ingredients)	Max 12% asbestos by weight	approximately 33% asbestos by weight
(2)	Mixing (opening bag)	dry ingredients dumped into hopper containing water (additional water added as needed)	dumped into hopper (dry) no water added
	(Mixer)	mixer forms wet plaster	mixer fluffs dry material
(3)	Pumping	wet slurry pumped	dry ingredients blown
(4)	Spraying	slurry sprayed wet (under directional air pressure)	dry spray w/small amounts of water to mix with dry fibers at nozzle end
(5)	Waste	overspray and/or rebound is in "wet" condition	fibers from overspray become airborne when dry
		sets to hard plaster	upon drying, easily swept or blown away
(6)	In-Place (drying)	sets to hard plaster consistency (20 lbs. per cu. ft.)	light density (7-15 lbs. per cu. ft.)
		passes 100 mph air erosion test	remains relatively loose and soft

SPRAY-APPLIED ASBESTOS FIREPROOFING



PLASTER FIREPROOFING CONTAINING ASBESTOS



ZONOLITE

CONSTRUCTION PRODUCTS DIVISION

Excerpts From Tabershaw-Cooper Associates Report

Dated July 15, 1970

ASBESTOS FIBER CONCENTRATIONS IN AIR FROM SPRAY FIREPROOFING OPERATIONS USING ZONOLITE PRODUCTS

In order to determine concentrations of airborne asbestos during and after the application of vermiculite-asbestos cement materials in the fireproofing of structural steel, observations were made at three construction sites in San Francisco on May 26, May 28 and June 4, 1970. Consideration was given to the actual and potential exposures of (a) workmen carrying out the spray operation, (b) workers in allied trades nearby, and (c) the general public.

Sites studied. Three spray operations were surveyed: (1) the Embarcadero Center, where Mr. G. Connell was spray contractor; (2) the P.G. and E. Headquarters Building, where the spray contractor was C & R Plastering, Inc. (Mr. Rasmussen); and (3) the Hilton Towers, where Mr. G. Connell was also the contractor.

Methods. Airborne fiber concentrations were determined by drawing air through Millipore type AA filters, with 0.8u mean pore size. Samples were taken in the breathing zones (Bz) of men working with the material and at various locations surrounding the operations. Air flows ranged from 0.11 cubic feet per minute (cfm) in breathing zones to 1.8 cfm in areas more distant. Portions of the filters were mounted on slides, and the fibers in 100 microscopic fields counted, using phase contrast microscopy at a magnification of 430x. The numbers of asbestos fibers seen were converted to concentrations, expressed in fibers per milliliter of air, by taking into account the area counted, the flow rate, and the sampling time.

GRACE

DATA FROM TABERSHAW-COOPER ASSOCIATES

EMBARCADERO CENTER AIR SAMPLES
(5/26/70)

Area	Asbestos Fibers Total f/ml	f/ml (>5u)
Spray operator's breathing zone	7.96	6.54
Spray operator's breathing zone	2.63	2.18
Spray operator's breathing zone (held near back of head to protect face of filter)	3.56	3.18
Stage mover's breathing zone	1.86	1.55
Area near spray (1-50 ft. distant, some direct spray on filter)	0.030	0.028
Background area, 43rd floor (air flow post spray-encrusted drapes)	0.020	0.016
Investigator's breathing zone	0.79	0.60
Mixing operator's breathing zone	0.775	0.710

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DATA FROM TABERSHAW-COOPER ASSOCIATES

PG & E BUILDING AIR SAMPLES
(5/28/70)

Area	Asbestos Fibers Total f/ml	f/ml (> 5 μ)
Spray operator's BZ	3.32	2.91
Spray operator's BZ	3.15	2.64
BZ of investigator, close to spray stage, walking with hod-carrier	0.16	0.14
Area, ± 40 feet upwind of single stage (air flow variable)	0.13	0.11
Area, ± 40 feet downwind of stage (air flow variable)	0.25	0.23
Mixing operator's BZ (wind away from)	0.50	0.42
Mixing operator's BZ (wind toward)	1.42	1.25
Mixing area (between two mixing operators)	1.09	0.98
Mixing area (between two mixing operators)	1.34	1.14
Background, 1 floor below spray operations, most air flow not through the building to filter, but variable.	0.014	0.011
Area, between two stages (current to pump cut off at variable times, total flow through filter uncertain)	0.038	0.036
Area, ± 30 feet from stages (2)	0.071	0.061
Area, ± 35 feet from stage, (air flow in area uncertain and variable)	0.36	0.34

DATA FROM TABERSHAW-COOPER ASSOCIATES

HILTON TOWERS AIR SAMPLES
(6/4/70)

Area	Asbestos Fibers Total f/ml	f/ml (> 5 u)
Spray operator's BZ	2.48	2.20
Hod Carrier's BZ	0.49	0.33
Upwind of stage	0.0007	0.0007
Downwind of stage	0.0147	0.0137
Upwind of 35th floor - Background (Prob. non-iso-kinetic flow at filter face; validity as a final measure of fiber background level?)	none seen	none seen
Downwind of 17th floor (four floors below spray operators)	0.0017	0.0017
Mixing operator's BZ	1.61	1.45
Mixing operator's BZ	0.55	0.50
Mixing Area	0.43	0.38

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HILTON TOWERS, STREET AREA

AMBIENT AIR SAMPLING RESULTS

DATA OBTAINED BY
TAKERSHAW-COOPER ASSOC.

(FIBERS/ML)

	Up-wind	Sensi-tivity	Down-wind	Sensi-tivity
Morning				
Stat'y,	0.024	0.005	0.016	0.016
Moving	0.014	0.005	0.042	0.009
Afternoon				
Stat'y.	0.077	0.009	0.015	0.005
Moving	0.009	0.005	0.005	0.005

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AIR FIBER CONTENT MEASUREMENTS ON MONO-KOTE

THE "MEMBRANE FILTER METHOD OF ATMOSPHERIC SAMPLING" WAS EMPLOYED

FIRST NATIONAL - OMAHA, 10th FLOOR

AREA	FIBERS OVER 5 Micron/cc
Spray, 1-3' Overhead and Vertical	0.7
Mix	0.9
Outside	1.1

LABORATORIES • INC.
Consulting and Analytical Chemists
88 Broad Street • Boston 10 • Massachusetts • HUbbard 2-0739

7506E

July 16, 1970

Samples of : 37 MM. MEMBRANE FILTERS

Marked : FOR MICROSCOPIC ANALYSES (Phase Contrast Method at 430X)

Submitted by : Construction Products Division
W.R.Grace & Co.
Cambridge,Massachusetts 02140

Note: Values Reported Are Based Upon an Assumed Sampling Volume Equal to 180,000 CC.

SAMPLE MARKED	TOTAL FIBERS PER CC.	FIBERS GREATER THAN 5 MICRONS PER CC.
FN #1	1.1	0.7
FN #2	1.2	0.9
FN #3	1.4	1.1

WERBY LABORATORIES, INC.

Russell T. Werby, Director

750GF

AIR FIBER CONTENT MEASUREMENTS ON MONO-KOTE

THE "MEMBRANE FILTER METHOD OF ATMOSPHERIC SAMPLING" WAS EMPLOYED

GRUMMAN AIRCRAFTS DATA PROCESSING RESEARCH CENTER IN BETHPAGE, N.Y. (Lowrise)

AREA	FIBERS OVER 5 Micron/cc
Spray, 10' Overhead	2.6
Spray, 3' Overhead	1.1
Mix	1.3
General Area	0.4

Werby LABORATORIES • INC.
Consulting and Analytical Chemists
88 Broad Street • Boston 10 • Massachusetts • Liberty 2-0739

750666

July 16, 1970

Samples of : 37 MM. MEMBRANE FILTERS

Marked : FOR MICROSCOPIC ANALYSES (Phase Contrast Method at 430X)

Submitted by : Construction Products Division
W. R. Grace & Co.
Cambridge, Massachusetts 02140

Note: Values reported are based upon an assumed sampling volume equal to 180,000 CC.

SAMPLE MARKED	TOTAL FIBERS PER CC.	FIBERS GREATER THAN 5 MICRONS PER CC.
L. I. # 1	5.7	2.6
L. I. # 2	1.4	1.1
L. I. # 3	1.8	1.3
L. I. # 4	0.4	0.4

WERBY LABORATORIES, INC.

Russell T. Werby, Director

Werby LABORATORIES • INC.
Consulting and Analytical Chemists
88 Broad Street • Boston 10 • Massachusetts • Liberty 2-0739

7506

September 28, 1970

Samples of : 37 MM. MEMBRANE FILTERS

Marked : For Microscopic Analyses (Phase Contrast Method at 430X)

Submitted by : Construction Products Division
W. R. Grace & Co.
62 Whittemore Ave.
Cambridge, Mass. 02140

SAMPLE MARKED	TOTAL FIBERS PER CC.	FIBERS GREATER THAN 5 MICRONS PER CC.
L.A. - 8 (M-K Spray Operation)	2.0	1.1
L.A. - 9 (M-K Mixer Operation)	1.9	0.7
L.A. - 10 (M-K Mixer Operation at Convention Center)	1.4	0.8
L.A. - 11 (M-K Spray at Nozzle, Convention Center)	1.1	0.5

WERBY LABORATORIES, INC.
Russell T. Werby, Direct

ROBERT A. MANKO
ESTABLISHED 1966
1115 INDIANA STREET, P. O. BOX 77205
SAN FRANCISCO, CA 94107
(415) 282-9300

September 3, 1970

File No. H 1302-E1

Report No. 1713

BECHTEL CORPORATION
50 Beale Street
San Francisco, California

ATTENTION: MR. ROBERT M. GILMORE

SUBJECT: ANALYSIS OF AIR SAMPLES, BECHTEL BUILDING

At your request, we have evaluated the concentrations of asbestos fibers in the Fifty Beale Street Building. The objectives of our investigation are as follows:

Determine the concentration of asbestos fibers in a typical work area.

Determine if these fibers are originating from outside sources or inside sources.

Provide initial measurements of fiber background counts.

Provide initial measurements of fiber erosion from the air plenums spaces.

After discussions with your personnel and review of the duct system layout, the following locations were sampled.

1. Building roof, West side 30th story level.
2. Outside air supply entry, 14th floor Mechanical Room.
3. Behind the air supply filters, 14th floor Mechanical Room.
4. Air duct, Room A-13 16th floor.
5. Return air duct to 14th floor Mechanical Room.

Details of the exact sampling location, particle analysis, and test results are presented in the enclosed report from our consultants, Tabershaw-Cooper Associates.

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The conclusion of the above test program was that the maximum concentrations of asbestos fibers found in the sampling locations was approximately 2½ fibers per liter. As a comparison reference, the normal atmospheric concentration of fibers in the Bay Area varies from 0 to 10 fibers per liter.

Based upon the enclosed report the concentrations of asbestos fibers in your building are on the low side of the normal ambient concentrations found throughout the Bay Area.

ABBOT A. HANKS
TESTING LABORATORIES

[signature]
FRANCIS M. [illegible], C.E.

ml
cc: (6) w/enclosures

Tabershaw-Cooper Associates
2185 Milvia Street, Berkeley, California 94704
MAILING ADDRESS: P.O. Box 772
C. Tabershaw, M. D.
A. Cooper, M. D.
Telephone
(415)

7506K

DATE: September 1, 1970

TO: Abbot A. Hanks

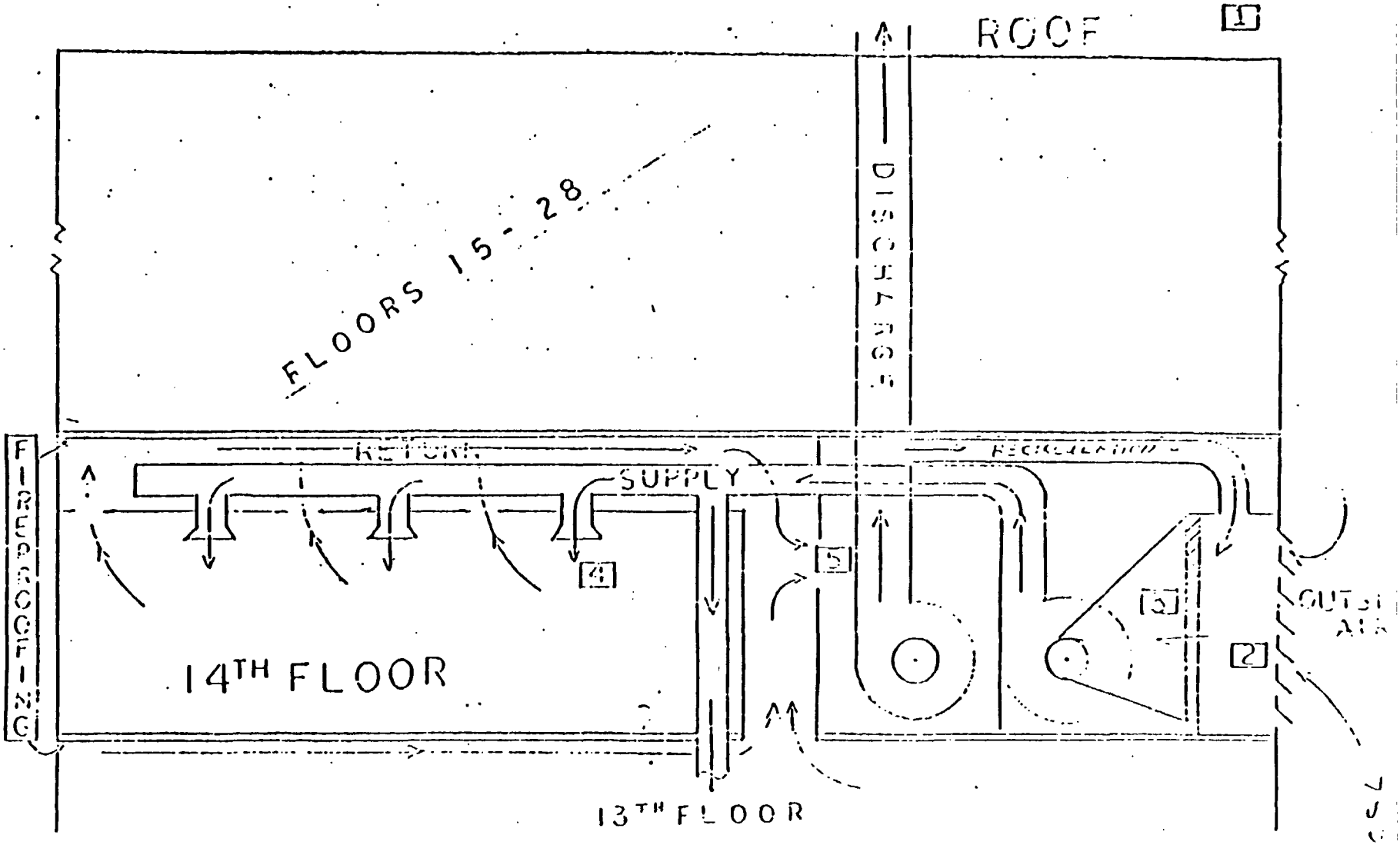
FROM: Tabershaw-Cooper Associates

RE: Analysis of air samples collected in the Bechtel Corporation Headquarters Building, San Francisco, California.

During the period July 6 to 13, 1970, air samples were taken at several points within the air moving system in the Bechtel Building, 50 Beale Street, San Francisco, California. The purpose was to determine if asbestos fibers were being added to the moving air stream in its passage over asbestos-containing sprayed fireproofing material. The fireproofing material (a cementitious type, supplied by Zonolite Division of W.R. Grace) had been applied to structural steel members of the building during construction, about 1966. Contact of the moving air stream with the fireproofing material is limited to the space between the structural and suspended ceiling on each floor of the building; this space is used as the air return "duct."

Air samples were taken at four locations within the air stream supplied to, and returned from, the occupied rooms on the 13th and 14th floors of the building, and from a location on the roof of the building. The sampling locations were: (1) On the west edge of the building roof at the 30th story level; (2) at the supply entry to the 13th and 14th floor ventilation system, on the northwest corner of the14th floor; (3) on the downstream side of the filter through which the mixed recirculated (75%) and outside (25%) air was passed before entering the ventilation system; (4) at the supply duct outlet in room A-13; (5) at the duct through which the accumulated return air from the 13th and 14th floors was returned to the 14th floor mechanical room for eventual discharge or recirculation. Figure 1 shows (schematically) these sampling locations.

BECHTEL BLDG. - SAMPLING LOCATIONS



Sampling and Analysis

All samples were taken by drawing air through Millipore organic membrane filters, 47mm in diameter, with 0.8mm mean pore size, at a flow rate of 0.8 cubic feet per minute. The filter holders were placed in the moving air streams at points where the linear air velocities matched the filter face velocity within ±25%. The filter holder at the rooftop sampling station was faced into the prevailing westerly wind. Air samples were taken daily at each location during two time periods: 10:00 A.M. to 3:00 P.M. ("AM" samples), sample volume 240 cubic feet or 6790 liters or 6.79 cubic meters; and 9:00 P.M. to 5:00 A.M. ("PM" samples), 384 cubic feet or 10,870 liters or 10.87 cubic meters. Exceptions were the first and last days of sampling; on the former (July 6) only the PM sample was taken, on the latter (July 13) only the AM sample was taken.

Analysis of the dust samples collected on the membrane filters was by the method recommended by the United States Public Health Service for the determination of asbestos fibers. A portion of the membrane filter was placed on a microscope slide, cleared by the addition of a drop of a mounting medium matching the index of refraction of the filter, and covered with a cover slip. The mounted filter was then examined with phase contrast microscopy at a magnification of 430X; 100 random microscopic fields (defined by a Porton eyepiece reticle) were so examined, and all fibers counted and placed in size categories. The location of each fiber was marked, and the slide was transferred to the petrographic microscope, where (also at a magnification of 430X) the fibers were identified. The identification in this case was limited to deciding whether or not the fiber in question was asbestos. The numbers of asbestos fibers seen were converted to concentrations, expressed in fibers per liter of sampled air, by taking into account the area counted, the flow rate, and the sampling time.

A secondary analysis was the determination of the gravimetric concentrations of all particulate matter. The filters were weighed (± 0.005 mg) before and after exposure; the change in weight was divided by the number of cubic meters of air which had passed through the filters, and the results expressed as micrograms of particulates per cubic meter of air.

Results

The results of the air sampling program are given numerically in Table I, and shown graphically in Figures 2 and 3. The two columns for each sampling location in Table I give the asbestos fiber concentration during the specified time periods, followed by the gravimetric concentration of total particulates. Figures 2 and 3 show the ranges and means of the asbestos and total particulate concentrations.

Discussion of Results

The concentrations of asbestos fibers and total particulates found at all points within this system are within the range we have come to expect as "normal" in extensive studies of asbestos fiber content of ambient air in the Bay Area. This range is usually from 0 to 10 fibers per liter, although concentrations as high as 70 fibers per liter have been found in San Francisco.

If fireproofing were contributing markedly to the particulate burden of the moving air stream, one would expect that air after passage through the system would contain more asbestos fibers as related to total particulate mass than would ambient or post-filter air. Even though the fireproofing is of low asbestos content (5-10%), it is still relatively rich in asbestos compared to other structural elements of the building and most community sources of airborne particulates. The absence of such a differential increase suggests that the fireproofing in the building was not a major contributor to dust in the air stream.

Asbestos fiber concentrations in the return air stream correlated poorly with gravimetric concentrations of total particulates (fig. 4). Therefore the relatively simple procedure for measuring total particulate burden cannot be used as an indicator of asbestos concentration.

and total partic[illegible] (in mg/m³)

	Roof Air		Entry Air		Filtered Air		Room A-13 Outlet		Return Air	
	Fibers/ liter	mg/m³	f/l	mg/m³	f/l	mg/m³	f/l	mg/m³	f/l	mg/m³
7/6/70										
AM	---	---	---	---	---	---	---	---	---	---
PM	0.3	39	0.3	61	0.4	19	0.4	17	0.6	21
7/7/70										
AM	1.4	62	1.0	91	0.5	69	0.7	40	2.7	55
PM	0.3	21	---	---	0.7	39	1.2	30	1.5	19
7/8/70										
AM	1.5	15	1.7	81	1.0	7	1.7	74	1.5	147
PM	0.6	9	0.6	9	0.8	18	0.3	51	0.6	28
7/9/70										
AM	2.5	103	1.2	11	1.5	74	2.5	96	2.5	143
PM	1.4	12	1.1	44	0.8	44	0.9	51	0.6	60
7/10/70										
AM	1.7	37	2.0	29	2.2	18	2.2	70	1.7	7
PM	1.5	14	1.2	131	0.9	87	0.2	39	0.6	39
7/11/70										
AM	1.0	11	1.7	18	0.3	15	0.7	99	0.7	7
PM	0.6	16	0.6	14	0.6	25	---	---	0.2	64
7/12/70										
AM	1.2	70	0.7	66	1.0	63	0.7	11	0.5	15
PM	0.5	83	1.7	165	0.5	9	0.6	62	0.6	57
7/13/70										
AM	2.0	107	---	---	0.3	88	1.5	---	1.5	74
PM	---	---	---	---	---	---	---	---	---	

Bechtel Building - Asbestos Fiber Concentrations

Means and Ranges

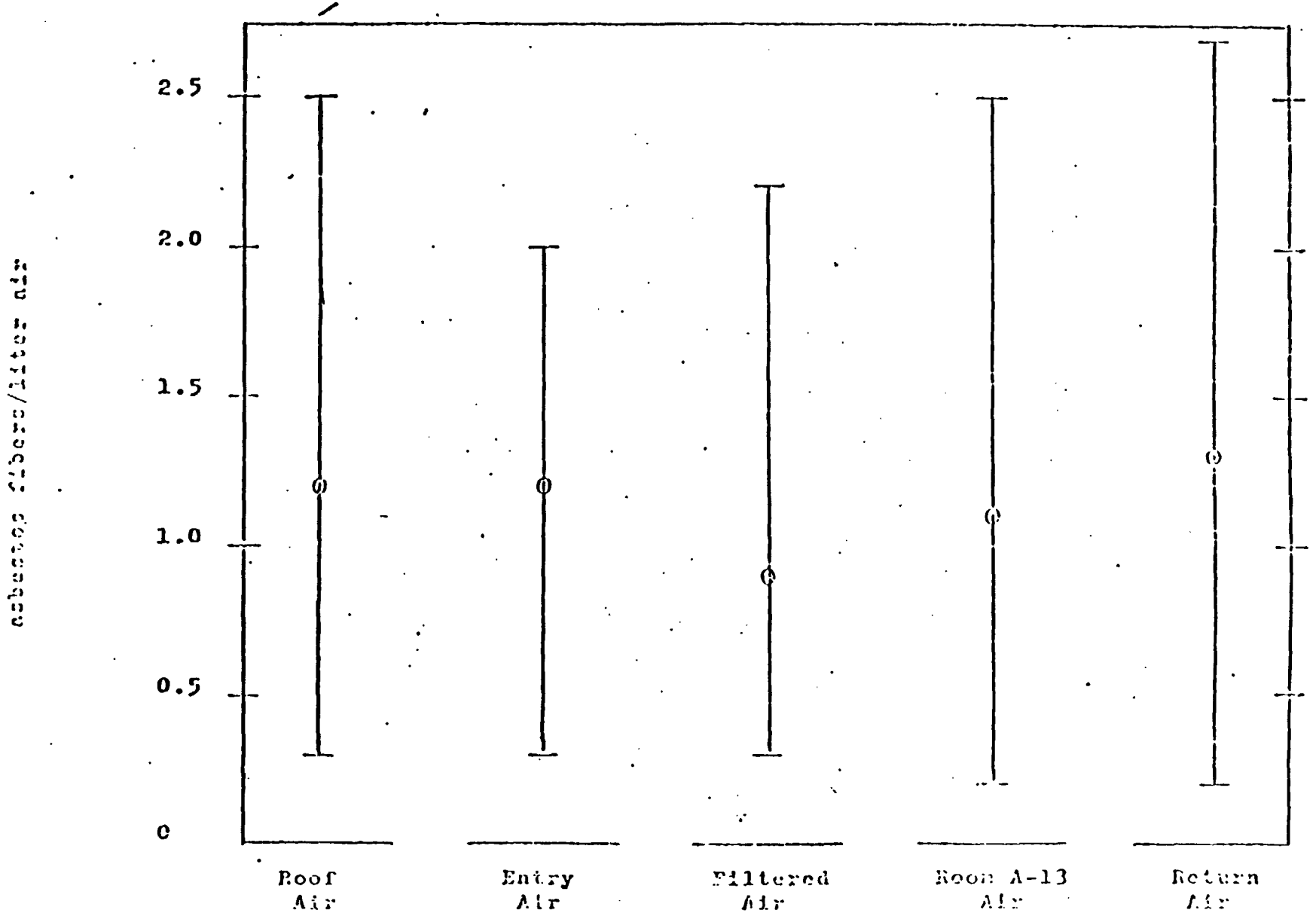
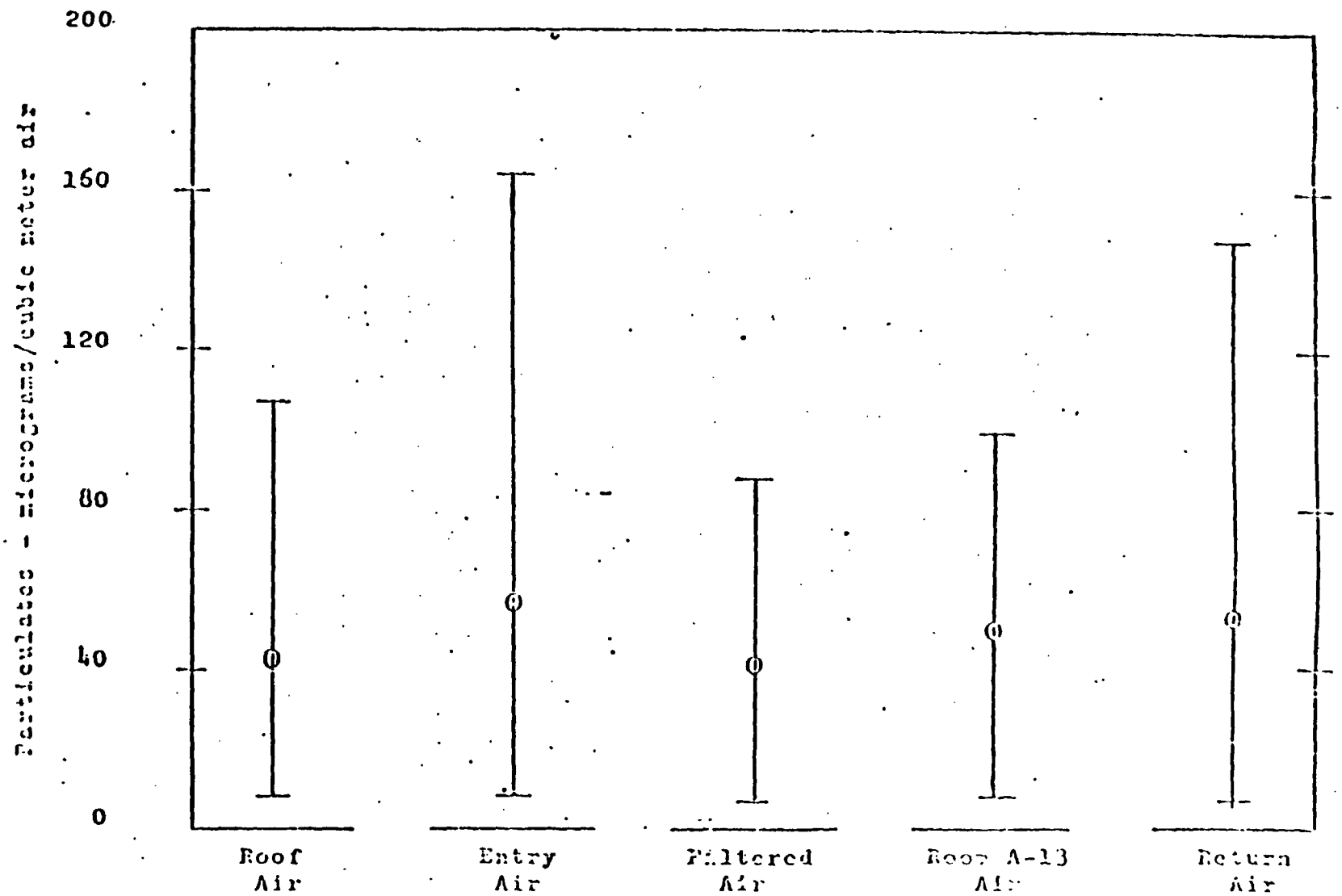


Figure 3

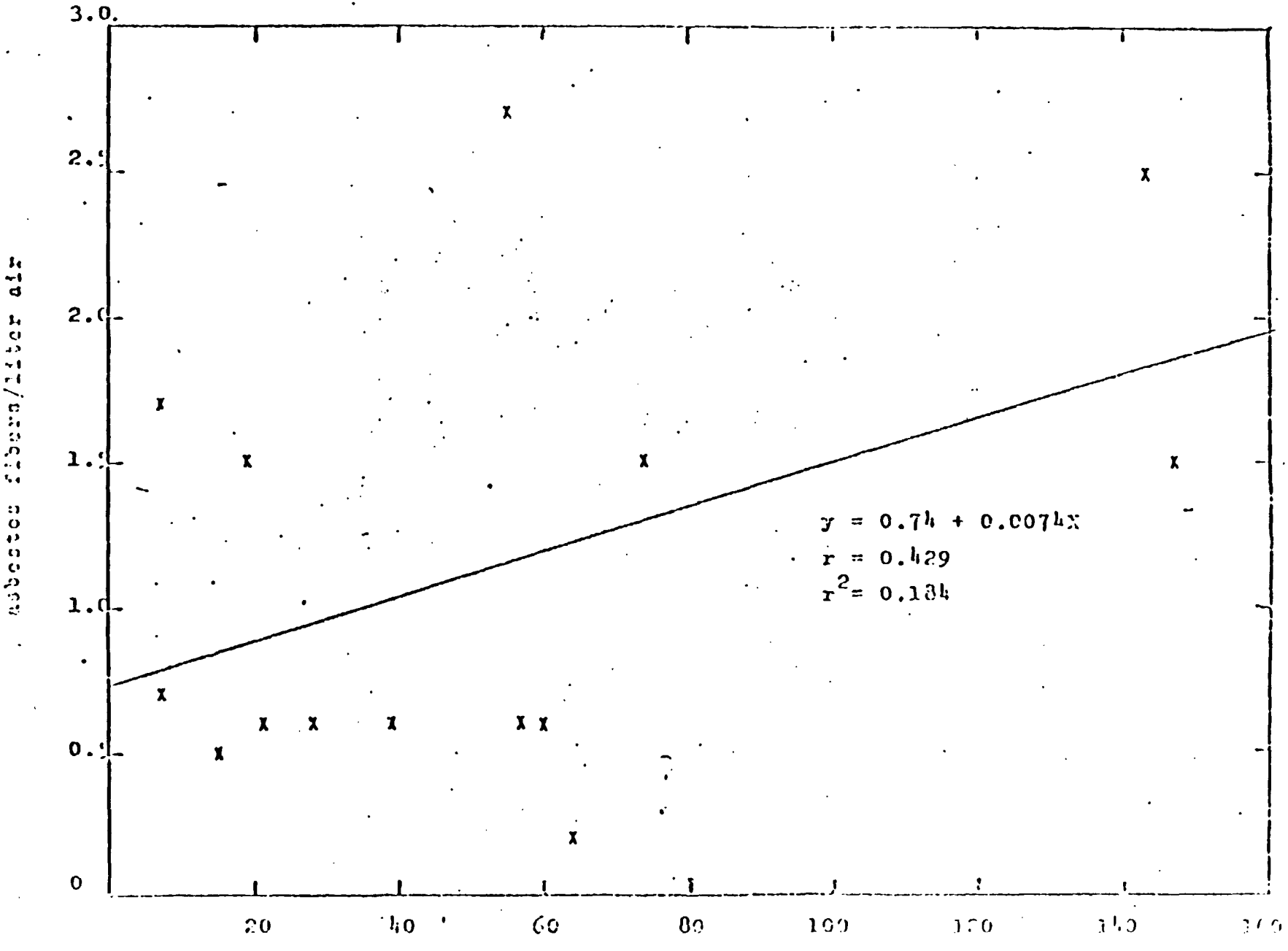
Bechtel Building - Total Particulate Concentrations

Means and Ranges



Bechtel B ng - Return Air

Correlation of asbestos fiber concentration
and total particulate concentration



Conclusion

The concentrations of airborne asbestos fibers found in the air supply and return system of the Bechtel Building are at the low end of the range of concentrations found in outside air.

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9/1/70