UC 149.2

UNION CARBIDE

INTERNAL CORRESPONDENCE

PLAINTIFF'S EXHIBIT
UC-538

MINING AND METALS DIVISION • P. O. BOX 579, NIAGARA FALLS, NEW YORK 14302

To (Name) Mr. W. C. Thurber
Division UCC Metals Division
Location 38th Floor
270 Park Avenue
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Date April 8, 1975

Originating Dept. "Calidria" Asbestos

Answering letter date

Copy to Messrs. R. E. Byrne, Jr.
J. L. Myers
File✓

Subject Backup Information - Marks
Bill Discussion

The information package we discussed is attached. It is intended to answer the questions raised by Drs. Selikoff and Wright and to give you a comprehensive picture of the facts as we have them. Our available sanding and grinding data have also been added. When you have had a chance to review this, let us discuss what parts of it we may want to transmit to Senator Marks in writing.

As the medical experts become involved, it is important to keep in mind that all of our tests are based on OSHA fiber counts. All particles which meet the L/D >3 and L >5μ criteria which, in the judgment of an experienced counter, could possibly be asbestos were counted as such. There is good evidence but not proof that many but not necessarily all of the particles reported as asbestos are glass chips or other extraneous "fibrous" particles. We can argue that in many cases the counts reported are too high but our supporting evidence at this time is a little weak to argue that they are generally zero. As you also know, we did not pursue the EM work and look for fibers shorter than 5μ and resin particles with fibers sticking out. Our case is going to have to stand or fall on the OSHA procedure.

Turning to specifics, each of the four tables submitted previously has been expanded to include area and background sample results. Some data on the spraying of gel coats containing no asbestos have also been added. Unfortunately, the area type samples were generally obtained to provide exposure levels outside the "active" area to facilitate TWA estimates or to check against extraneous fibers being counted as asbestos. They usually shed little light on the duration of dust in the area. My own opinion is that we could possibly select some that are helpful but the total group adds little and detracts from clarity.

Supplemental details for each set of tests are provided. Unfortunately, once past the wall and ceiling texture data, each test sequence was enough different to require separate treatment. This information is presented in approximately the following format:

1. Application details - commercial or simulated, and type of use.

2. Spraying details - gun type and how operated plus comments on occupational and environmental exposure.

3. Finishing details - How the particular article is finished, i.e., sanded, ground or not abraded. Our data from field and laboratory tests is introduced as part of Table III on polyesters. We may want to put this together as a separate presentation.

4. Long-term exposure.

The last item, long-term exposure, is easy to discuss but hard to define quantitatively. The approach taken is that the sanding and grinding data remove a substantial depth of material in a very short time. If the total fibers found is averaged over several years, the level should be indistinguishable from background.

Overall, the discussion addresses all of the points you raised except the question of droplet size and persistence. With so many different liquids and spray types, I do not know how to get a handle on this quickly but will keep looking.

We are awaiting word from Al Harvey on their sanding data. They should be of some help on the wear question.

The information from the AIA/NA on the Yale case is also enclosed. This looks very much like the situation in California that was reported in great detail at the Industrial Hygiene conference in Miami last year. Asbestos is mixed with enough water to make a thick paste and it is sprayed onto a ceiling. The water evaporates, leaving a mat of essentially pure asbestos without any binder. The California people had great difficulty finding any fiber counts above background while Yale reports 18 fibers/cc. If you take an unbound asbestos mat and rub it hard enough, there is no reason to disbelieve that a count this high could be obtained. The obvious point is that this is the extreme case of unbound asbestos and is just not relevant to the situation we are considering.

I will let you know right away if any new information turns up.

Harry

H. B. Rhodes

HBR:cjb
Attachments

I. Water-Based Systems with Water-Soluble Binders

Binders:

Type: Starch, polyvinyl alcohol, soya protein, or equivalent.

Content: Typically 6-8% by weight of the dry formulation before mixing with water, 2-4% as sprayed.

Main Uses: Interior wall and ceiling texture sprays.

(Where texture is applied to walls it must be covered with at least one coat of a latex or oil-based paint.)

Asbestos Content: Up to 3% by weight of the total formulation as sprayed.

Supporting Data: Table I.

TABLE I

WATER-BASED SYSTEMS

WITH WATER-SOLUBLE BINDERS

Sample Designation	Commercial Application	Date	Binder	Approx.[1] Conc. % by Wt. Asbestos	Spray Gun Type	Operation	Sample Time (Min.)	Asbestos Airborne Concentration (Fibers/cc >5μ)	Comments	Sample Designation	Description	Sample Time (min.)	Airborne Asbestos Concentration (Fibers/cc >5μ)
- INTERIOR TEXTURE SPRAYS													
Location A													
32	Ceiling spray.	6/14/73	Soya protein.	2	Air supported	Operator applying ceiling spray to condominium apts.	71	0.01	All three 0.1 values should have been reported as <0.1. "Less than" sign omitted when final table prepared.	142	outside On a balcony during ceiling spray operation.	10	0.2
88	"	"	"	2	"	Operator wiping walls after ceiling spray.	66	0.01					
3	Wall spray.	"	Starch.	2	"	Operator applying wall spray to condominium apts.	51	0.3, 0.8	Filter loaded with paint. Difficult to read.	37	On outside balcony during wall spray operation	5	0.0
36	"	"	"	2	"	Operator carrying hose during wall spraying.	34	0.0 0.0	asbestos probable talc.				
Location B													
20	Ceiling spray.	-	"	1	"	Operator spraying ceiling of condominium.	14	0.5		81	Background. Before spraying.	39	0.2
28	"	-	"	1	"	" "	15	0.8		94	In room. 5' from floor. Immed. after spraying	15	0.7
84	"	-	"	1	"	"	15	0.6		12	Same location as #94, next time period.	33	0.5
										62	In room. (Closed). Immediately after spraying.	16	0.8
131	Wall spray.	-	"	2	"	Operator spraying walls of condominium.	21	1.6	High pressure air used for complete coverage.	9	Same location as #62, next time phd.	35	0.5
100	"	-	"	2	"	" "	32	1.1		101	In room. After spraying.	16	0.5
										116	Same location as 101.	16	0.2
Location C													
C-1	Ceiling spray.	10/2/74	"	1	"	Operator applying ceiling spray to home.	19	0.5			No area samples Taken.		
C-2	"	"	"	1	"	Operator "wiping" walls after ceiling spray.	22	0.2					
C-3	Wall spray.	"	"	2.5	"	Operator applying wall spray to home. Full coverage.	24	0.07					
C-35	"	"	"	2.5	"	Operator spraying glitter. Immediately after ceiling sprayed.	26	0.0					
Location D													
D-60	Ceiling spray.	12/4/73	"	1	"	Operator applying ceiling spray to condominium apts.	20	0.5					
D-64	"	"	"	1	"	Operator "wiping" walls after ceiling spray.	24	0.7	error in reporting.	B-710	In central room of adjacent apartment. Not sprayed.	74	0.2

[1] Based on total formulation as sprayed.

SUPPLEMENTAL INFORMATION

Water-Based System with Water-Soluble Binders

1. The data are all from commercial finishing operations at four condominium locations in Florida.

2. Typically the rooms are sprayed in convenient groups of 20-30. Ceilings are sprayed first, followed by walls. It takes 5-10 minutes per application per room.

3. The spray operator walks from room to room. He is accompanied by one or two men who handle the hoses and who scrape off any wet overspray.

4. Spraying is done with a wand about 4' long. Liquid spray is pumped from a tank outside the building. Compressed air is used to atomize and spray the liquid. The gun tip is relatively large so although there is some overspray in the immediate vicinity of the operator, this is not a "misty" operation like certain types of high pressure paint spraying.

5. This kind of spraying is usually contracted on a fixed fee basis so the operator moves rapidly and spends as much time in the actual spraying step as possible. This tends to total 4-6 hours per day since considerable time is spent on movement to the field location, set-up, and moving from building to building. The operator exposures shown thus represent ceiling values that would be reduced somewhat as time-weighted averages.

6. Spraying occurs for a limited time at each location. There is thus no problem that concentration will build up with time.

7. In these operations the window openings are usually masked. Occasionally the fast-moving operator will hit a window area and spray will be momentarily visible outside.

   The limited data available from locations A, B and D, show no difference between interior and exterior background counts. They also suggest that the level in the room drops rapidly towards the same background level.

8. The ceiling contains shredded styrofoam or vermiculite texturing material and is in finished form as soon as it has dried. It is not subjected to abrasion during finishing or in subsequent use. It may, at some future date be sprayed with paint for decorative purposes.

9. The wall texture is not sanded and since it has a water-soluble binder, must be finished with a water resistant coating. This should largely prohibit asbestos release by wear.

10. Conceivably, at some future date, a home-owner would try to remove the wall texture by sanding. This would be a monumental job and would probably ruin the paper coating on the wallboard. We have never heard of this being done since it would be easier and cheaper to replace the wallboard.

TABLE II

WATER-BASED SYSTEMS

WITH LATEX BINDERS

ple ation	Commercial Application	Date	Binder	Approx.[1] Conte Wt. % Asbestos	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Concentration (Fibers/cc)(µ)
INTERIOR COATINGS								
cation A								
8	Wall and Roof Spray.	10/5/76	Vinyl Latex.	3.2	Air supported.	Operator spraying vertical wall panel.	15	0.0
9	"	"	"	3.8	"	"	82	0.2
0	"	"	Acrylic latex	0	"	"	8	0.2
cation B								
9	Roof spray.	9/30/76	Acrylic latex.	0.2	Airless.	Operator spraying downward onto a large roof.	28	0.0
-10	"	"	"	0.2	"	"	94	0.0
-11	"	"	"	0.7	"	"	60	0.1

[1] Based on total formulation as sprayed.

Comments	Sample Designation	Description	Sample Time (min.)	Airborne Asbestos Concentration (f.a/cc, 7.5 µ)
	J-11	Area sample, 50' from spraying, corresponds to H-6 and J-8.	83	0.0
	I-32	Area sample. Same as J-11.	60	0.0
	M-41	Area samples ~50 away, crosswind during spraying.	78	0.0
	M-46		60	0.03
Omitted in error.	M-60		50	0.0

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SUPPLEMENTAL INFORMATION

Water-Based System with Latex Binders

1. The products tested at Location A are normally used for wall and ceiling coatings in mobile homes.

2. This test (Location A) simulated the commercial operation with several 4' x 8' panels leaned against a building and coated with a commercial, pot-type, air-supported spray gun.

3. Spraying for this application is done for short, occassional periods so there is no problem with extended time buildup. The operator exposures found represent ceiling values which would give substantially lower TWA values.

4. These are finished coatings as applied and are not sanded or ground in the finishing operation.

5. The product tested at Location B was a roof coating used on top of urethane foam insulation. Samples were collected during a commercial application.

6. Spraying for this application is done continuously over about 6 hours of an 8 hour shift. The coating is pumped through a hose to an airless gun with a large tip. The operator walks backwards swinging the gun back and forth to coat an area about 4 feet wide. There is little or no misty overspray.

7. Operator samples were collected over a 90 minute period and are considered to be a reasonable representation of exposure condition.

8. The coating is finished as applied and is subject only to future weathering.

9. In both of these uses the maximum reading obtained was 0.2 fiber/cc and in one place this occurred the material being sprayed contained no asbestos. This type of product cannot be considered an occupational or environmental hazard.

III. Resin-Based Systems

Binders:

Type: Polyester resins, alkyd resins, epoxy resin alone or in combination with coal tar or equivalent resin.

Content: Range from ~6% in zinc-rich primer to ~49% for heavily filled alkyd to 99+ for polyester laminating resins.

Main Uses: Fiber glass reinforced boats, pipes, shower stalls, and similar articles.

Maintenance coatings for steel and concrete.

Intumescent and zinc-rich paint.

Exterior alkyd paints.

Asbestos Range: Up to 12% by weight of the total formulation as sprayed.

Supporting Data: Table III.

TABLE III — RESIN-BASED SYSTEMS

Sample Designation	Commercial Application	Date	Binder	Approx.[1] Conc. % Asbestos	Spray Gun Type	Operation	Sample Time (Min.)	Asbestos Airborne Concentration (Fibers/cc >5μ)	Comments	Sample Designation	Description	Sample Time (min)	Airborne Asbestos Concentration (f./cc/ >5μ)
I - POLYESTER RESINS													
A. General Purpose Laminating Resins													
Location A													
96	Boat manufacture.	12/7/72	General purpose laminating resin.	0.5	Air-supported chopper.	Operator spraying molds with resin & chopped glass.	24	0.6	Continuous spraying	60	Area sample. 15' from boat. Passageway	18	0.7
96	"	"	Gel coat resin.	0.0	Airless	Operator coating molds with gel coat.	17	0.4	Note: 0.0 Asbestos in resin.	70	Area sample. 20' from boat. Passageway	18	0.8
Location B													
B-13	"	10/31/74	"	0.5	Air-Supported Chopper.	Operator spraying resin & chopped fiber glass. (Includes roll-out time.)	16	0.1	Includes rollout time. Would be about 0.4 for spraying time only. (Filter = 0.4)				
B-28	"	"	"	0.5	"	Operator spraying resin & chopped fiber glass.	5	0.4					
B-30	"	"	"	0.5	"	Operator spraying resin & chopped fiber glass.	4	0.4	Total operating time 3 hrs.	J-22	Area sample. 8' from boat.	4	0.0
N-14	"	"	Gel Coat Resin	0.0	Airless	Operator coating molds with gel Coat.	5	0.0	Note: 0.0 Asbestos in resin.	N-38	Area sample. 2' from boat	5	0.0
Location C													
B-34	"	10/8/74	"	0.5	"	Operator spraying mold with resin. (No glass.)	55	0	~90 minutes operation sampled. N-14 & N-40 are parallel samples. Continuous spraying.	No area sample collected			
B-40	"	"	"	0.5	"	"	53	0.03					
J-12	"	"	"	0.5	"	"	38	0.1					
O-8	"	"	Gel coat resin.	0.0	Airless	Operator coating mold with gel coat	8	0.0	4 Laminates total operation. Samples collected only during actual sprayings.				
M-41	"	"	"	"	"	"	8	0.0		N-41	Area sample, 10' from mold.	14	0.0
M-31	"	"	"	"	"	"	13	0.0					
O-2	"	"	"	"	"	"	16	0.0					
B. Chemical Resistant Resins													
Location D													
J-21	Fiber-glass pipe manufacture.	8/13/74	Chemical resistant resin.	1.4	Airless.	Operator adjacent to automatic spray machine coating 28' mandrels.	23	0.1	Samples collected at same Time. Different locations.	No area samples collected.			
B-25	"	"	"	1.4	"	Operator wiping mandrels. In area near spraying.	14	0.4					
Location E													
J-5	Ship coating.	10/2/74	Chemical resistant resin & chopped fiber glass.	0.7	Air-supported wand.	Roll-out man. In spraying area about 1/4 of time.	65	0.4	2½ hours of operation covered.	M-27	Area sample. 25' from nose of ship. Upwind.	71	0.1
J-7	"	"	"	0.7	"	Operator spraying ship hull in dry dock.	41	0.4		J-10	Same location as M-27	47	0.4
B-26	"	"	"	0.7	"	"	23	0					

[1] Based on total formulation as sprayed.

TABLE III (continued)

RESIN BASED SYSTEMS

Sample Location	Commercial Application	Date	Binder	Approx. Conc. Wt. % Asbestos[1]	Spray Gun Type	Operation	Sample Time (Min.)	Asbestos Airborne Concentration (Fibers/cc >5μ)	Comments	Sample Designation	Description	Sample Time (m.a.)	Airborne Asbestos Concentration (fibers/cc >5μ)
- EPOXY RESINS													
A. Filled Epoxy													
location F	Ship coating.	10/2/74	Epoxy primer.	1.8	Airless.	Operator spraying outside & under a ship.	33	0.2	Limited mist and over spray	J-1	Area sample. 30' upwind.	60	0.03
Health													
N-10	•	•	•	1.8	•	•	8	0.2					
N-10	•	•	High build epoxy.	0	Air supported.	Operator spraying side of ship from scaffold.	31	0.1	Considerable mist & overspray.				
I-27	•	•	•	0	•	•	14	0.3					
M	—	—	—	—	—	—	~~60~~	~~0.01~~	Area sample - Included in error.				
B. Epoxy - Coal Tar													
location G	Coating dry dock.	10/1/74	Epoxy Coal-tar, solvent.	1	Airless.	Operator spraying side of dry dock from suspended platform.	11	0.2	Basically duplicate samples	M-47, Area sample. 50' upwind.		40	0.0
N-1	•	•	•	1	•	Operator spraying side of dry dock from fixed scaffold.	36	0					
location H	Coating pipe interiors.	•	•	1	Air-supported vand.	Operator spraying interior of 3", 8" and 12" diameter pipe.	37	0.1	Spraying intermittent. Area continuous.	M-30	Area sample. 50' away. Cross wind.	80	0.03
Tar coating										L-5	Same as M-30	39	0.2
I - ALKYD RESIN PAINT	Tar Coating												
location I	Painting building exterior.	10/6/74	Alkyd resin.	12	Airless gun.	Operator spraying building exterior wall.	9	0		N-43	Area sample. 4' from wall. Before spraying.	72	0.0
										N-9	Same as N-43. During spraying.	24	0.0
N-36	•	•	•	12	•	•	5	0.05		N-37	Same as N-43. After spraying	21	0.0

[1] Based on total formulation as sprayed.

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SUPPLEMENTAL INFORMATION

Resin-Based Systems

I. POLYESTER RESINS

A. General Purpose Laminating

1. The data are all from commercial polyester boat manufacturing locations in Florida.

2. Two types of spraying operation are represented:

   a. Laminating operations where resin and usually chopped glass are sprayed simultaneously. In the more typical operations, spraying lasts 2-4 minutes followed by 10-20 minutes of roll-out. In some large shops, the spray man moves from part to part spraying largely continuously.

   b. Gel coating of molds with an airless gun. Spraying is continuous until the mold coating is completed. No glass is used. This is a very misty operation. With smaller parts, it is done in a ventilated booth. Large boats are sprayed on the floor.

3. For laminating operations, two types of sample have been collected, one where the sample was taken while only the gun was operating and one where a complete spraying and roll-out sample was collected on the same filter.

   Location A was a very large shop where the operator moved from location to location spraying almost continuously. At Location B, the first sample (L-13) was taken over a complete cycle in a fixed position while N-28 and N-30 covered just the spraying. These data suggest that fibers are collected on the filter only during the spraying. The spraying level of 0.4 fibers is in good agreement with the 0.6 found for Location A. At Location C, another largely continuous spraying operation without chop was tested. The levels are all very low and the change from 0 to 0.1 fiber/cc is not considered to represent a buildup with time.

   Taken together, these data suggest that a fiber level around 0.5 fiber/cc with most of the fibers probably glass exists during the operation of the chopper and the level drops rapidly to 0.1 fiber/cc or less when the chopper is shut off. While this picture is in accord with common sense, there are just not enough data to push it where we may have to defend it as valid scientific proof. In this connection, note that N-28 and N-30 show only 1 fiber in 100 fields.

4. The gel coating operation usually involved essentially continuous spraying until the mold was coated to the desired thickness. With one exception (Location A), all of the personal and area counts taken during the gel coating operation were zero. This is generally

lower than the levels for the laminating resins and could be due to the lack of asbestos in the resin and/or to the fact that a chopper was not in operation on the gun. With the analytical techniques used, there is no way to distinguish with certainty between the two. For simplicity and to avoid the need to add the foregoing discussion, the gel coat data were not included in the original table submitted. They still seem to be more of a complication than a help. Since they do not contain asbestos anyway, it is valid to omit them from a short summary.

5. The laminating operation is usually carried out in a large building with numerous doors and some fan ventilation. There is little overspray and visible emissions to the outside air do not occur or are, at most, infrequent.

6. The gel coating operation used to coat large molds can cause the whole end of the shop to fade out in a haze. Based on styrene TLV's, it is almost certainly a hazard in itself. Visible emissions to the outside air do occur.

   For smaller parts, an enclosed hood is frequently used. This often discharges a mist to the atmosphere.

7. The molded fiber glass parts are generally ground or sanded at some time during finishing. Data taken during this type of operation for five commercial operations including boat manufacture are shown in Table V. The highest number found in 15 tests was 0.4 fiber/cc >5μ.

   This type of operation may be done indoors but for large objects is frequently carried out in the open. It is an extremely dusty operation but the asbestos is a very minor contributor.

8. A laboratory study with asbestos levels up to 18% by weight has also been carried out. A sample plaque about 1/2" thick was clamped to a bench in the center of an 8'x8'x8.5' closed room. A substantial portion of the plaque was ground away. Personal and area samples were taken during and after grinding. Results are shown in Table VI.

   Under these extreme conditions, the highest fiber count obtained was 1.2 fibers/cc. These data also show that the dust tends to be heavy and settles rapidly.

9. These data in Tables V and VI illustrate the level of asbestos fiber counts that are obtained with fiber that is wetted with a strong, thermoset resin binder when substantial quantities are abraded away in time periods that are all less than one hour. None of the applications covered so far and to be covered in Table III are subjected to serious abrasion during their normal lifetime. If the fiber levels observed are averaged not over a few minutes but over a five or ten year period, they become vanishingly small.

B. Chemical Resistant Resins

1. The commercial application for Location D is the coating of a mandrel upon which fiber glass pipe is spiral wound. The finished product is generally used in oil field applications.

2. The mandrels (approx. 28' long) are rotated in a jig while an automatic spray head travels along it at a fixed rate.

3. This operation is indoors and hooded underneath. It normally takes place for approximately one hour per shift so the levels represent ceiling concentrations. The samples cover a typical operation for one shift so there is no buildup question.

4. Fiber release during finishing for this location is shown in Table V, 1929-82-3 and is low.

5. The commercial application for Location E is the deposition of a coating on the portion of a large vessel that falls below the water line. It is carried out in drydock with a number of portable spray units.

6. The operator sprays a section of the vessel approximately 5' x 10'. He then waits while the material is rolled out. Spraying is done with a wand about 6' long.

7. The samples shown were collected only during the actual spraying operation and thus reprent ceiling concentrations. A total elapsed time of about 2-1/2 hours was covered and there was no change in concentration with time.

8. There was noticeable overspray during this operation but it appeared to be largely floating glass flakes plus resin droplets that settled rapidly.

9. Lifetime of the coating varies but it is claimed to be many years. The reasoning stated in part I-A - 9 applies to gradual loss.

II. EPOXY RESINS

A. Filled Epoxy

1. Location F is the commercial application of epoxy maintenance coatings to a 200' ocean-going vessel.

2. The operator moves under the ship and around the sides on scaffolding. Spraying is continuous until the entire ship, or a substantial portion thereof, is covered. A man can complete the job in 30-60 minutes. Movement is rapid over a wide area so no buildup with time would be expected.

3. The asbestos containing epoxy was sprayed with an airless gun with a relatively large tip so overspray was limited. The other coating, containing no asbestos, was applied with an air supported gun and was quite misty.

4. The fiber contents measured represent ceiling values and would be considerably lower on a TWA basis.

5. The asbestos containing primer is covered by other paint which will protect it from wear.

B. Epoxy-Coal Tar

1. Location G was the commercial application of a maintenance coating to a large drydock under construction.

2. The operator moved an airless gun back and forth across the surface of the dock while he was moved via a suspended platform or walked along scaffolding. There was considerable visible fine mist overspray.

3. Spraying of this type is limited to the area that can be cleaned by sandblasting the previous day so seldom lasts more than 1-2 hours. Values measured thus represent ceiling concentrations.

4. This is a finished maintenance coating so is subject only to gradual weathering.

5. Location H was the commercial application of the same product as Location G as an interior coating on 3" to 12" diameter pipe.

6. Spraying was done with a typical air supported gun on a wand about 4' long. The operator moved this slowly inside the pipe.

7. The sample was collected only during the spraying operation so it represents a ceiling concentration. This operation is quite rapid relative to the other parts of the manufacturing process and is only done intermittently for periods of an hour or two.

III. ALKYD-RESIN PAINT

1. This material is used as a finish coat on the exterior of buildings. The test was run under commercial conditions but was not at a construction site.

2. Spraying was done with an airless gun with the operator walking slowly along the side of the building.

3. The time spent spraying on commercial jobs will vary widely. The value found may be taken on a conservative basis as a TWA.

4. This coating is not sanded but is subject to weathering over a period of years.

Added Note:

The marine coatings described in this section could be subjected to removal by sandblasting for maintenance purposes. This would take place under industrial conditions and there is no reason to expect that asbestos fiber counts would differ materially from those shown in Tables V and VI.

IV. Asphaltic and Coal-Tar Based Systems

Binders:

Type: Cutback and emulsified asphalt and coal-tar materials or equivalent.

Content: Typically~45%.

Main Uses: Automotive undercoating and sound deadener, roof coatings, foundation coatings.

Asbestos Content: Up to 15%.

Supporting Data: Table IV.

TABLE IV

ASPHALTIC AND COAL-TAR BASED SYSTEMS

Sample Identification	Commercial Application	Date	Binder	Approx.[1] Conc. % Asbestos	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Concentration (Fibers/cc) 5μ	Comments	Sample Designation	Description	Sample T. at (Min.)	Airborne Asbestos Concentration (Fibers/cc >5μ)
Section A	Auto undercoating (Sound deadener)	10/74	Cut back asphalt	15	Airless.	Operator spraying on auto body.	7	0.2	Area samples contain operator	M-13	Area Sample 7' from Spraying	7	0.0
M-31	"	"	"	15	"	"	6	1.5		M-39	" " " " "	6	0.6
Section B	Fibrated Roof Coating.	9/26/74	"	8	Air supported.	Operator spraying against vertical steel surface.	-	0.02					
Flintkote	"	10/11/74	"	8	"	" "	-	0.11					
	"	9/26/74	"	8	Airless	" "	-	0.03					
	"	10/11/74	"	8	"	" "	-	0.07					
Section C	Emulsified asphalt fibrated roof coating.	12/18/74	Steam refined, emulsified asphalt.	3	Air supported	Operator spraying against vertical steel surface.	43	0.16					
	"	"	"	3	Airless	" "	23	0.17					

[1] Based on total formulation as sprayed.

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SUPPLEMENTAL INFORMATION

Asphaltic and Coal-Tar Based Systems

1. Location A is a commercial application of an automobile sound deadener.

2. The deadener is sprayed with an airless gun to the underside of an automobile. It is done in a confined area about the size of a large garage. Normally, it is essentially a continuous operation but at the time of our test only two cars were sprayed.

3. Sample M-31 is unique in that it is the only sample in the whole sequence of tests where a substantial number of fibers that were clearly asbestos were found. It is suspected that at the high, 15%, asbestos level used, we ran across a lump of unwetted asbestos. The other sample was low but we were unable to extend the test long enough to determine how often an unwetted dump might occur. In any case, the level was still only 1.5 fibers/cc for a short time.

4. This coating is complete as applied and is not sanded.

5. Long-term exposure and weathering is the only way the undercoating would release asbestos and the quantity of coating removed would be expected to be small.

6. Locations B and C are tests run by Flintkote. They were carried out by spraying the two products downward into a drum with two types of gun.

7. In the application of roof coating, the spraying can be carried out for varying parts of shifts so the measured values can be taken as a conservative measure of TWA. The tests at each location were run in sequence on the same spot so there is no evidence of concentration buildup with time.

8. These coatings are finished as applied and are not sanded. They are normally subjected only to weathering.

TABLE V

AIRBORNE ASBESTOS FIBER COUNTS -

GRINDING AND SANDING OF RESIN-BASED SYSTEMS CONTAINING ASBESTOS

Sample Designation	Commercial Application	Date	Resin	Asbestos Type	Asbestos Approx. Wt. %	Operation	Sample Time (Min.)	Airborne Asbestos Fiber Concentration (Fibers/cc >5μ)
I. THERMOSET RESIN (Polyester)								
--	Molding furniture parts	3/15/72	Polyester	RG-244	0.05	Operator hand sanding small parts.	45	0.002
--	"	"	"	"	0.05	Operator running power sander with integral hood.	45	0.002
1929-40-4	"	12/6/72	"	"	0.3	Operator sanding and grinding molded parts. Good hood & ventilating system on grinder.	23	0.3
1929-82-3	Fabrication of reinforced fiber glass pipe.	2/27/73	Polyester	RG-144	2-3	Operator pulls pipe along line. Saws off end with circular saw.	19	0.1
1929-82-4	"	"	"	"	2-3	Same operation as 1929-82-3.	49	0.1
1929-82-5	"	"	"	"	2-3	Operator removing end of pipe with scarfing machine.	45	0.04
I-13	"	8/13/74	"	RG-244	1.4	Operator shaping end of pipe with bell & spigot machine.	16	0.3
I-6	"	"	"	"	1.4	Operator cutting off pipe end and light grinding on exterior surface.	17	0.2
I-26	Fabrication of FRP tanks and pipe.	8/13/74	Polyester	RG-244	1.5	Operator grinding inside of 13' I.D. x 26' tank.	16	0.4
6-8	"	"	"	"	1.5	Continuation of same operation as I-26.	5	0.3
I-39	"	"	"	"	1.5	Operator grinding edges of miscellaneous small parts.	25	0.3
1929-84-4	Production of artificial bricks.	3/8/73	Polyester	RG-244	2.0	Operator cutting with sabre saw.	44	0.1
1929-84-5	"	"	"	"	2.0	Operator trimming with sabre saw.	39	0.2
8-20	Production of fiber glass boats.	11/26/74	Polyester	RG-244	0.5	Operator grinding inside of boat hull.	11	0.0
8-25	"	"	"	"	0.5	Operator grinding.	4	0.0

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TABLE VI

AIRBORNE ASBESTOS FIBER COUNTS

GRINDING OF RESIN PLAQUES CONTAINING ASBESTOS IN A SMALL (8'x8'x8.5') CLOSED ROOM

Plaque Composition							Airborne Asbestos Fiber Concentration (fibers/cc >5μ)		
							During Grind (7 Min.)		After Grind (90 Min.)
Resin		Chrysotile		Fiber Glass	Sisal	Lime-stone	Operator Personal Sample	Sample from 5 Ft. Level Room Corner	Sample from 5 Ft. Level Room Corner
Type	Wt. %	Type	Wt. %	Wt. %	Wt. %	Wt. %			
Polyester	79.2	RG-244	0.8	20.0	-	-	0.0	0.0	0.0
Polyester	99.2	RG-244	0.8	-	-	-	0.0	0.0	0.0
Polyester	98.0	RG-244	2.0	-	-	-	0.0	0.2	0.01
Polyester	96.0	RG-244	4.0	-	-	-	0.7	1.2	0.01
Epoxy	76.0	RG-144	4.0	20.0	-	-	0.2	0.2	0.05
Polyester	35.0	RG-110	5.0	10.0	10.0	40.0	0.6	1.2	0.02
Polyester	35.0	RG-110	10.0	10.0	10.0	35.0	0.0	0.0	0.0
Polyester	30.0	SG-200	18.0	-	2.0	50.0	0.3	0.9	0.06

A-08644

GREENWICH TIME, FRIDAY, NOVEMBER 22, 1974

Yale Probe Of Cancer Eyes Asbestos Ceilings

By DAN HALL
Associated Press Writer

NEW HAVEN (AP) — A research team at Yale University is studying commonly sprayed asbestos ceilings to determine if they cause cancer.

The studies may eventually have widespread impact because of fears among a number of scientists that at least one type of cancer can develop from asbestos exposure far below current federal limits, according to Dr. Robert N. Sawyer, a physician in Yale University Health Services.

Sprayed-asbestos ceilings came into common use in the mid-1950s and were installed widely in this country until the late 1960s, when dangers of the substance became apparent, he said Thursday in an interview.

The Yale art and architecture building, dedicated in 1963, is one of the numerous buildings which contain the sponge-like ceilings that slowly shed asbestos. But they can emit clouds of the substance when knocked or disturbed.

That type of ceiling was outlawed by federal authorities in 1971. Common ceiling tiles are not affected by the regulation.

Recent studies by other researchers show a strong relationship between asbestos fibers in the air and cases of mesothelioma, rare cancerous tumors in the lining of the lungs or stomach, Sawyer said.

The tumors, which in nearly all cases have contained asbestos fibers, apparently take two or three decades to develop, adding to the difficulty of tracing their source, he said.

"Although of low probability, initiation of malignancy is possible with single, small exposure to asbestos," he reported recently to Yale officials.

He said there did not seem to be any danger of asbestos or "white lung" disease, which also are related to asbestos.

As a result of the findings, Yale has placed tight restrictions on activities in the so-called A&A building. The school wants to reduce the amount of minute asbestos particles in the air well below limits set by the Occupational Health and Safety Act (OHSA). Controlled tests showed a person bumping against the low ceiling could inhale more than three times the maximum allowable amount.

The building's 52,000 books have been thoroughly cleaned and moved to another building.

Asbestos exposure levels at all stages of the moving operation are being documented. It is believed to be the first time a large-scale removal of sprayed asbestos will be studied so carefully, Sawyer said.

A team of five persons headed by Peter Tveskov, assistant manager of physical plants, has been working for several months developing the safest removal method.

On Thursday results from experiments using "wet water" with high penetrating power showed that soaking the ¾-inch-thick ceilings would be a safe and workable way to proceed.

The university is expected to close the building during the 3½-week Christmas recess while the 70,000 square feet of suspended ceilings in the nine-floor building are removed by workers wearing goggles and breathing masks.

The asbestos and sheet rock supporting it will be sealed in containers to prevent it from escaping into the air. They will be buried in a remote location that has not yet been chosen, Sawyer said.

"Once you go in and disturb that monster in there, he lashes out with his tail," Sawyer said. "Our problem is getting in without awakening him."

The threat posed by the asbestos ceilings was studied in 1971 by state inspectors. But the building was declared safe on the basis of tests on the undisturbed air, Yale researchers said.

A rash of complaints about eye irritation this year among users of the building, particularly in the library, prompted officials to test again.

Some of the eye cases turned out to be conjunctivitis, an irritation of the mucous membrane of the eye.

Protected researchers, using special pumps that simulate a person's breathing, found that a person who bumped against a ceiling, some of which are little higher than seven feet, breathed in a concentration of 18 asbestos fibers per cubic centimeter, according to Yale safety manager Victor Osborne.

The level was less than one fiber per cubic centimeter in undisturbed areas.

The current OSHA limit is five fibers. It will soon be reduced to two.

Because of those findings, all ceiling work such as installation of lights has been stopped and dusting is done with chemically treated cloths. Special high-efficiency vacuum cleaners, worth $700 each, are used for cleaning.

Although initial disclosure of the ceiling danger resulted in widespread "paranoia" among people using the A&A building regularly, it has almost disappeared, Osborne said.

"People in the building have been just fantastic," he said.

Sawyer and the others are collecting information about asbestos exposure in the building under different conditions for future study. The question remains, however, of how little exposure should be considered dangerous.

"I don't believe in the OSHA limits," Sawyer said.

Other studies indicate the exposure level related to mesothelioma may have a "very low threshold, if any," he said.

"If my suspicions are correct, the effects are going to be monumental," Sawyer added.

While some sprayed-asbestos ceilings in large buildings are high enough not to pose a serious danger, the Yale researchers said some have been already removed as safety precautions.

The University of California at Los Angeles stripped asbestos ceilings from 800 of its dormitory rooms in 1971.

"Even if not a danger to occupants, it's a danger to maintenance workers who have to go through it and demolition teams who will eventually take down the buildings," Sayer said.

THE CHARLESTON DAILY MAIL
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NOV 19 1974

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SPRAY-ON ASBESTOS

303

Building Material Said Cancer Risk

By THOMAS HINE
Knight News Wire

NEW HAVEN, Conn.—A material used in the construction of thousands of buildings from 1958 to the early 1970s has been found to be a cancer risk by a team of researchers at Yale University.

As a result, they have ordered that one of the most influential buildings of the 1960s, the Yale Art and Architecture Building be completely stripped of a spray-on material containing asbestos fibers which had been used on the building's ceiling.

This follows an earlier instance at the University of California, where, although conditions were not measured at levels high enough to be classified under federal regulations as hazardous, ceilings were removed from 800 dormitory rooms.

Spray-on materials containing asbestos have not been used in most other major cities since 1971 because research then showed that it presented a severe health hazard during construction, especially to workmen. It had been assumed until now, however, that there was no hazard to persons who worked or lived in the completed building.

Prior to 1971, the material was very popular as insulation, fireproofing and soundproofing. In 1970, for example, it was used in more than half the buildings constructed in the United States.

It had been assumed, however, that there is no hazard to users of the buildings in which the material was used.

At the Yale Art and Architecture Building, Dr. Robert Sawyer found that activities within the building cause an asbestos fall-out, often at very hazardous levels, which could jeopardize students and maintenance employes.

Sawyer says he is not concerned with abestosis, or "white lung," a disease that frequently afflicts those who work in asbestos plants. Rather, the danger is of mesuthelious, a malignant cancer of the lung and abdominal cavity.

This generally strikes 20 or more years after first exposure to the asbestos, and no "safe" level of exposure to asbestos has yet been determined.

Some activities at the Yale building, such as dusting library books, changing light fixtures and slamming doors were found to have triggered concentrations of asbestos in the air in excess of amounts allowed by new federal regulations that will take effect in January 1976.

The building was one of the most copied buildings of the 1960s. The work of architect Paul Rudolph and completed in 1963, aspects of the forceful reinforced concrete complex have appeared in many buildings since.

It has been widely disliked by its users. In 1969, large parts of it were destroyed by a fire that is generally agreed to have been arson. The ceilings in the portion burnt were replaced with a similar material which does not contain asbestos.

41-102B NATIONAL
SAFETY NEWS
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JAN 1975

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203

Yale attacks asbestos problem—Yale University, New Haven, CT, has embarked on an asbestos removal program that could cost as much as or more than $800,000.

The project is to remove sprayed asbestos from the ceilings of the Art and Architecture Building, using a super wetting agent, called "wet water." (Cost: 250 gallons at $18-25 per gallon or up to $5,000.)

Victor Osborne, safety manager, says that disposal costs could reach $50,000, and that removal costs, including those for labor and temporary lighting, could reach $750,000.

The program was launched after Osborne, using a personal body monitor, found the levels were well over federal allowances (18 fibers per cc, as compared to federal TLV's of five per cc now and two per cc by January 1976). This indication of danger was compounded by the facts that eye irritation was so chronic and severe that the Art and Architecture Librarian had to be kept from the building, and that maintenance personnel were probably exposed to higher levels than those indicated on the monitor.

Joining Mr. Osborne in Yale University's concern are: Robert N. Sawyer, M.D., Department of Preventive and Occupational Medicine; Peter Tveskov, Associate Manager, Physical Plant; Severio Fodero, Administrative Associate, University Health Services.

Mr. Osborne is not only concerned with removing this hazard, he is in charge of developing the techniques for its safe removal and disposal.

NOV 24 1974

NEW HAVEN REGISTER
New Haven, Conn. 12/1
PM-107,564 S-124,798

Yale To Remove Dangerous Asbestos In Rudolph Buildin

By CAROLYN SUSMAN
Staff Reporter

A wetting agent so powerful that only one pint is used in 300 gallons of water will be tried Tuesday as a means of removing the sprayed asbestos ceilings in the Yale University Art and Architecture building.

The agent, known as "wet water," has already been used in weaker solution (eight ounces to two and one-half gallons regular water) and worked well. The more potent solution is being tried to see if it is more effective.

Yale safety manager Victor Osborne says at least 250 gallons of the less powerful solution would be needed to remove the asbestos at a cost of $18-$20 a gallon. Osborne said that disposal of the asbestos, which has been linked to cancer, could cost over $50,000 and that removal of the substance from the entire building, including costs for temporary lighting and labor, could reach $750,000.

The extensive revamping of the building has been ordered since the discovery of very high levels of asbestos particles during normal cleaning activities at the building.

Osborne has been involved with problems at the structure for over three years since complaints about the crumbling ceilings at the building were being filed regularly back in 1971.

Tests conducted then found asbestos levels weren't hazardous, but only the air was being measured. Tests later conducted by Osborne, wearing a personal body monitor to measure exposure directly on individuals, found levels well over federal allowances.

In the Art and Architecture library, a prime target of the asbestos-removal program, Osborne's monitor registered over 18 fibers per cubic centimeter of air. The current federal limit (considered too high by experts) is five fibers per cubic centimeter and that will be reduced to two fibers in January, 1976.

"We put it (a monitor) onto a librarian and he got almost one fiber per cubic centimeter just doing normal (non-cleaning) work. The problem for maintenance people is they get a heck of a lot more (exposure) than the average person," Osborne explained.

About two months ago, the building was closed from 2 to 7 a.m., the hours maintenance and custodial work might be done. Osborne monitored the operations and made sure any workers were fully protected from the falling and crumbling ceilings by special clothing.

"It's not hazardous to occupy the building," Osborne stressed. The basic problem is the low ceilings began flaking, particularly in the library, when books were grabbed off the top shelves, when light fixtures were changed, or when custodians dusted.

Osborne said the ceilings were sealed with latex paint at one point and that "worked out fine" until concern began to grow about the asbestos menace. That was compounded by complaints of eye irritations by people who worked in the building.

Asbestos contains unusual chemical and physical properties and is considered one of the prime industrial causes of cancer in the world.

About 70 per cent of the ceiling area of the building, estimated at 70,000 square feet, is covered with the sprayed asbestos compound.

Robert Kaufmann, art and architecture librarian, has been kept out of the building because of chronic eye irritations strongly linked with the flaking asbestos. Noted scientists and doctors claim that there isn't any safe level yet known of exposure to the substance.

Malignancies linked to asbestos may take 20 years to develop and continued exposure isn't required. Renowned asbestos researcher Dr. Irving Selikoff of Mt. Sinai School of Medicine in New York says all unnecessary exposure should be avoided.

In fact, Selikoff told a Stratford audience last week of a case where a worker had only six weeks exposure to the asbestos, but developed cancer of the lung because "that dust was exposing his lungs for 20 years."

Efforts to remove the ceilings at the art and architecture building will probably be the first of such a large scale where the substance will be removed without contaminating anyone. Removal techniques are being developed by Osborne.

The asbestos will be sprayed with the wet water and taken off as it becomes "gushy", Osborne said. It will be placed in 55-gallon drums and taken to a site in New York city which is licensed to handle and dispose of the materials.

Asbestos fallout

Building faces $200,000 job of removing asbestos ceilings

Almost 40,000 sq ft of sheetrock ceiling panels sprayed with asbestos must be removed from a multi-use building because of the health threat posed by falling asbestos particles and asbestos dust circulating in the ventilation system.

More than 52,000 books must first be removed before the panels can be taken out of the first floor library of Yale University's art and architecture building in New Haven, Conn. The job of cleaning and moving the books to a safer building and dismantling the ceiling panels in the library and the building's auditorium, studio and exhibit areas will cost at least $200,000.

It has not been decided whether to install a new acoustical ceiling or to leave exposed the prestressed concrete floors. A new library ventilation system, probably using air ducts, will have to be installed to replace the 10-in. plenum system now above the sheetrock panels that are mounted on furring channels. Incandescent lighting equipment built into the ceiling will also have to be replaced.

The asbestos flaking was first noticed several years ago. A commercial sealant was applied to the ceilings this year but is apparently ineffective. The Asbestos Information Association, a New York City-based organization of eight asbestos products manufacturers, recommends sealing asbestos-sprayed ceiling panels to prevent flaking and the resultant asbestos dust.

The falling asbestos particles have been linked to chronic eye irritations in at least three library users, and the custodial staff is now wearing protective face masks. Flaking of spray-applied asbestos and the resultant dust that circulates in air-ventilation systems may pose a cancer threat, according to the National Institute for Occupational Safety and Health.

The ribbed concrete building was designed by architect Paul Rudolph, New Haven, in a pinwheel plan of overlapping and interpenetrating platforms. The building has seven stories and 36 different levels with ceiling heights from 7.5 ft in the library to 28 ft in other areas.

The same problem of flaking of spray-applied asbestos was experienced this year at the University of California at Los Angeles. Asbestos finish had to be scraped from ceilings in 800 rooms in two dormitories at a cost of $250,000.

41-68F TECHNICAL SURVEY
WKLY.

OCT 12 1974

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303) •Optimum sulfate content of portland cements (a standard stepwise multiple regression algorithm was used to calculate the optimum sulfate content. While the equations developed are not generally applicable to all plants and all mix designs, the approach is valuable in plant control) (11a). .....Falling asbestos particles and asbestos dust from asbestos-sprayed ceiling panels are circulating in the ventilation system of a Yale U bldg, reportedly posing a health hazard. Close to 40,000 sq-ft of the ceiling must be removed. The flaking became apparent several yr ago. A commercial sealant applied to the panels this yr proved ineffective (12a).

u/news

by Fred Strebeigh

Clean Sweep: Getting Asbestos Out of the A&A

For the second time in five years the students and facilities at the building will be scattered to different parts of the campus. A fire in June, 1969, burned out three floors of the nine-floor, 36-level building, closing it for a year of repair. Now most of the building will be closed again, in successive stages, while workers wearing goggles and respirators remove 70,000 square feet of asbestos ceiling material.

Asbestos is now known to be a cause of cancer and for some time has been known to cause a scarring of the lungs called asbestosis, which in its extreme form is the "white lung" experienced by asbestos factory workers. A continuing study—using pioneering methods which should be widely applicable elsewhere—by Dr. Robert N. Sawyer, a physician in the University Health Services, has shown that workers and perhaps occasional users of the building are exposed to amounts of asbestos exceeding federal Occupational Safety and Health Act (OSHA) limits.

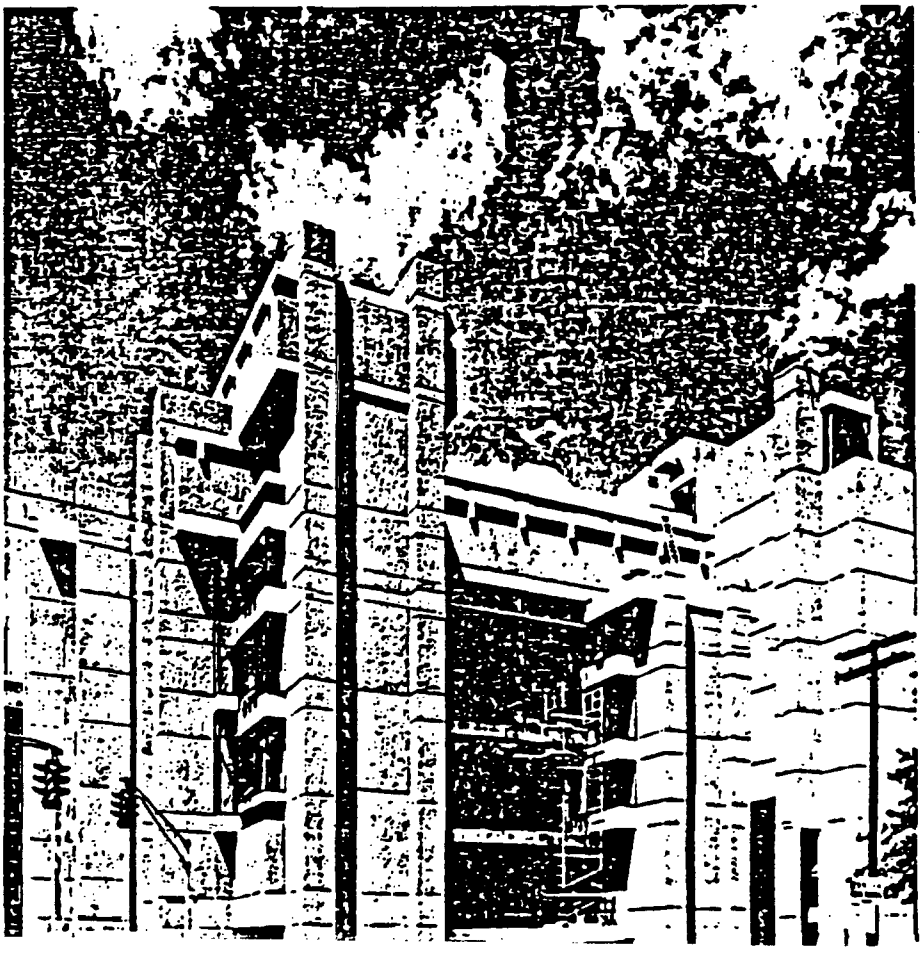
Removal of the asbestos—a fire and sound retardant which was sprayed into place in the late stages of the building's construction—will cost a minimum $250,000 and might reach $750,000, according to John F. Embersits, director of University Operations.

Thus still another chapter has begun in the building's history of costliness and

1963, was featured as a cover story and hailed as a major event by most American architectural magazines. Under A. Whitney Griswold, president of Yale, who had urged the University to "trust the creative spirit and impulse of the greatest architects of our generation," Yale had become a showpiece of modern architecture. Its jewels included Louis Kahn's Art Gallery, Eero Saarinen's Ingalls Rink, and Gordon Bunshaft's Beinecke Rare Book Library.

The Art & Architecture Building, completed soon after Griswold's death, was the last building he had commissioned. Paul Rudolph, one of the country's most original architects and then chairman of Yale's Department of Architecture, had created the $3 million building, it was said, to serve as a challenge and inspiration to students of architecture and as a unifying structure for all art students at Yale.

Almost immediately it became clear that the building was more challenge than inspiration. The floor-to-ceiling windows didn't open, and some had to be washed by men in bosun's chairs lowered from the roof—bringing the cost of a win-



dow-washing to about $2,000, according to Mr. Embersits. There was no large service elevator linking the building's many levels, and moving large or heavy objects was further impeded by constricted stairways. And a print-making instructor, who had told Rudolph that his students needed an open and well-lit space, found himself consigned to "a bloody dungeon" in the basement.

Numerous improvements in lighting and alteration of interior spaces have been demanded in the building—which since 1963 has cost the University about $500,000 for changes and extraordinary maintenance, such as window washing, according to Mr. Embersits.

In view of all the complaints over the years, Dr. Sawyer was not surprised that he received what he called "cease and desist" orders when he first went to the administration in February to report his suspicion that aspects of the building—particularly the asbestos—might be endangering workers there.

"I was told," he said, "not to waste my time over there"—that a study had been done by the State in 1971 and had shown negligible results. That study had used asbestos fiber counters placed in a room overnight to monitor fallout from the ceiling. "I had no axe to grind," Dr. Sawyer says. "I didn't go in looking for trouble. The trouble was coming to us here at the Health Service. We were getting a lot of complaints."

One complaint came from a librarian in the art library, who had chronic conjunctivitis—an irritation of the mucous membrane of the eye—and who told Sawyer of two similar cases on the staff. Dr. Sawyer also learned that the director of the library, Robert Kaufmann, was suffering from an eye injury he had received away from work but which was failing to heal. Yale physicians examined his eye and found what they thought might be asbestos fibers.

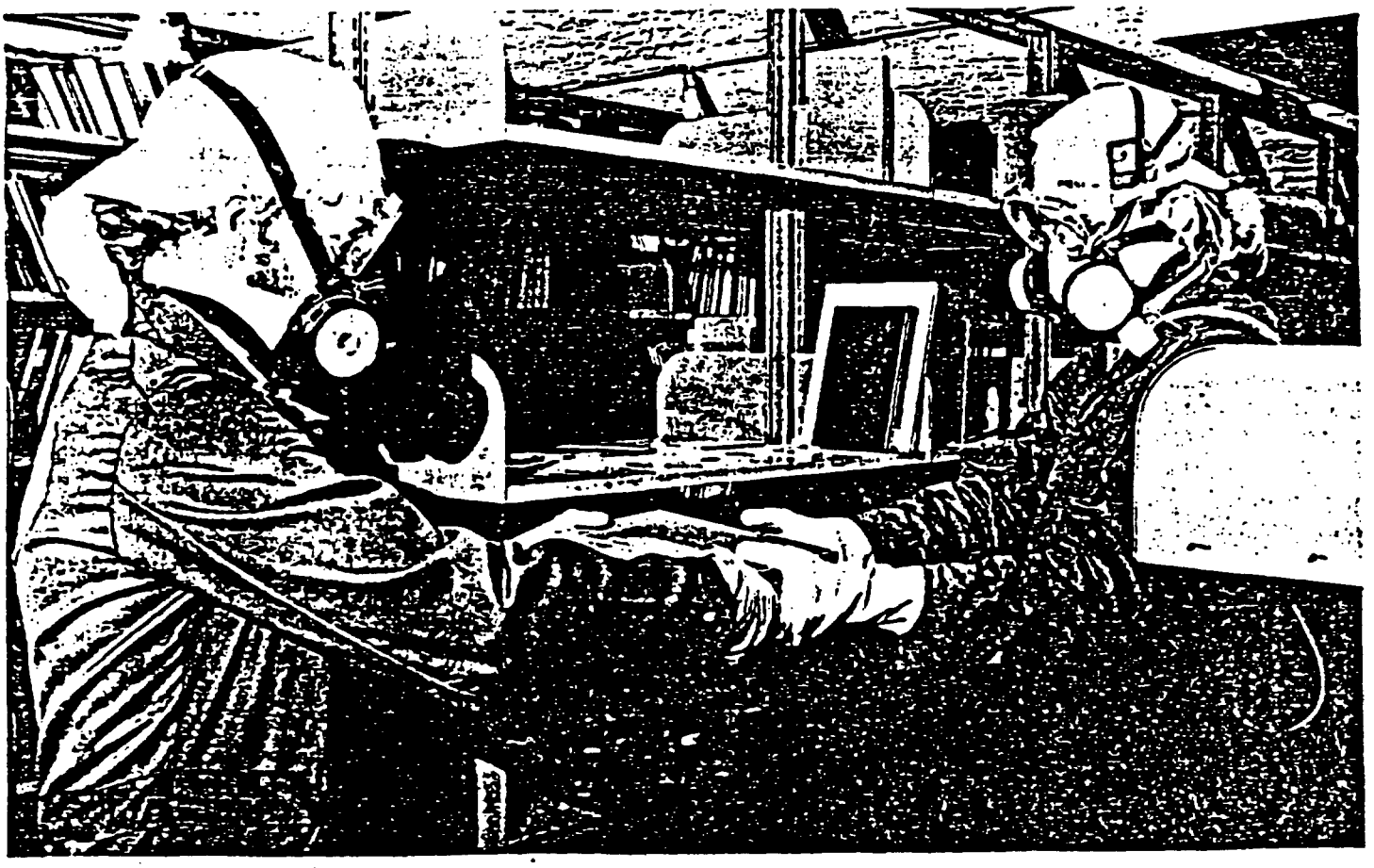
But Dr. Sawyer's main contributions were to realize—a discovery apparently made for the first time—and to document that a maintenance worker bolting a light fixture into the ceiling, or a librarian handling asbestos-coated books, would inhale more fibers than the state's fiber monitor did while sitting in a quiet room.

Under his direction, people equipped with protective respirators and "personnel monitors"—filtered pumps which simulate normal breathing rates—performed dusting and cleaning chores and recorded asbestos fiber counts well in excess of the OSHA limits. When Dr. Sawyer presented these data to Yale administrators, their reaction was "Wow! Of course!" and he was on his way to his present status as Yale's asbestos czar. Now he is called on to oversee even routine maintenance, like changing light bulbs.

While Dr. Sawyer is apparently the first to correctly analyze and document the extent to which different activities in a building affect the amount of asbestos that a person inhales, Yale is not the first and certainly not the last institution faced with the problem and a need to monitor it. Sprayed-on ceilings have been used in thousands of buildings, and Dr. Sawyer speculates that the degree of danger varies considerably according to such factors as ceiling height and changes in humidity level.

The University of California at Los Angeles, for instance, faced a similar problem with asbestos ceilings in 800 dormitory rooms. Quiet room monitoring showed an asbestos level similar to that found during the 1971 monitoring at Yale. Nevertheless the asbestos was removed. The university did not attempt to document the asbestos level during activities such as cleaning.

"We're developing knowledge and expertise in an area that I believe is going



Workers in art and architecture library stacks (photo above) remove books from asbestos-dust-covered shelves, prior to vacuum cleaning (right).

to have tremendous importance," Dr. Sawyer says. "We've outstripped many so-called experts already in what we've done—our study has shown a quantum leap in understanding from the 1971 study." He expects that the greatest value of the work done at the Art & Architecture Building will be in reports on Yale's new monitoring and removal techniques, which will be published and made available all over the country. "I'd hate to be putting so much time into this if it were only a brush fire," he says.

On Aug. 20 Dr. Sawyer submitted a 16-page interim report documenting possible health hazards in addition to asbestos in the building—undrinkable water, bird cadavers in the ventilation system, low railings and low ceilings.

"Considering the height and accessibility of unprotected hard objects, light fixtures, open electrical sockets, railings, ledges and open louvers," he wrote, "it is our serious opinion that physical danger exists for adults taller than 6'2" and children below the age of 10." The report urged corrective measures, including the removal of asbestos from the entire building. Most of the recommendations have been accepted and work begun. The asbestos problems, however, cause the most difficulty and anxiety—particularly because, Dr. Sawyer says, the levels at which it is dangerous are still being defined.

One study, for example, by a physician at Mt. Sinai Hospital in New York, published in September, reported a high incidence of apparently asbestos-related lung scarring and cancerous tumors known as mesotheliomas in the families of workers who many years ago had been employed in a New Jersey asbestos factory. It suggested that even very moderate and short-term exposure can, after a waiting period of 10 to perhaps 40 years, result in serious illness.

That study has prompted labor leaders to call for a reduction to virtually zero in the OSHA-allowed maximum limit. It is now defined as five fibers per cubic centimeter of air and will be reduced to two fibers per cubic centimeter in 1976. Dr. Sawyer's study found that light dusting stirred up a count of 5.3 fibers, while a worker who hit the ceiling while cleaning was exposed—for a short time—to a count of 18.3 fibers.

Work is now well under way (*see photos*) on the year-long project of scouring the building. The first element to go is the 52,000-volume library, which will be vacuum-cleaned, book-by-book, and removed to the Cross Campus Library. The equipment includes two $700 vacuum cleaners with absolute filters of a type developed for gathering moon dust from space capsules. Workers are wearing respirators for vacuuming, and when they begin to pull down ceiling panels Dr. Sawyer says they will use masks hooked to an air compressor.

Dr. Sawyer has been relieved of all other health service responsibilities and to be on hand at all hours for cleaning has had a bed in the building's guest suite made up for him. He has taken over Paul Rudolph's old office—where there is no asbestos—for his equipment.

The new frustration over the building has again focused attention, perhaps unfairly, on its architect. The charge has been frequently repeated that, as one high Yale administrator put it, "the problem with the A & A is that Rudolph was his own client."

Mr. Rudolph, who says he has "become very emotional about that particular building," disagrees. "I certainly didn't think I had a free hand," he recalled in an interview last week. "There were building committees and buildings-and-grounds people. It seemed to me at the time that there were enough people looking over my shoulder at Yale.

"And I certainly had no idea at the time that there was a health problem involving asbestos. Maybe other people did, but I don't really think so. I certainly don't think if anybody had ever said, 'You know this is a potential health hazard,' I would ever have put it in. Even I."

Alvin Eisenman, a member of the building committee for the A & A, believes that one reason why the ceilings were never questioned is that the committee was never told about them, but he adds that "this business of blaming Rudolph has gone too far. The main problem with the building probably was that there wasn't anyone really strong on the building committee."

Because of the extreme frustration and anxiety, there has even been talk around the University of possible legal action.

While the work of many people has once again been disrupted at the Art & Architecture Building, for others it is a question of degree. "Some students come into the library with handkerchiefs tied over nose and mouth," one librarian said, "while some come in to study and smoke three packs of cigarettes in a night and don't seem to worry about asbestos."