

Marie.... Will you please call Dr. Rhode's secretary and find out if the attached is the version they have sent to Mr. Thurber - Mr. Thurber hopes they have sent it out. Then please advise Mr. Thurber.

Ev

I called at 12:05 and Mr. Dickson answered and said everyone is out to lunch - to try again around 1 PM. Thanks again.

UCC 010072

INTRODUCTION

Short fiber asbestos is used in a wide variety of coatings and laminating resins to impart critical viscosity properties when these materials are sprayed and to prevent sag during cure. This asbestos comes mainly from Canada and the New Idria deposit in California.

The Canadian asbestos occurs in nature as closely packed, parallel fibers formed in cracks in the surrounding rock. It is converted to the commercial product by a series of dry grinding, screening and air classification operations.

The California asbestos occurs in the form of entangled fiber bundles compacted into flakes containing 50-75% asbestos. Union Carbide, who supplies essentially all of the California asbestos used in this type of specialty application, uses a wet shearing and classification manufacturing process. The combined effect of the different natural form and the different processing shifts the fiber size distribution in the California "Calidria" (Union Carbide) products towards increased amounts of finer, narrower, and shorter fibers.

OBJECTIVE

The basic objective of this work was to make a direct comparison of Canadian and California "Calidria" airborne asbestos fiber concentrations during the mixing and spraying of ceiling texture paint. The concentrations of fibers both shorter and longer than 5μ were examined.

DESCRIPTION OF TEST OPERATIONS

Tests were carried out at two field locations in Los Gatos, CA. In each case, ceiling texture formulations containing roughly the same amounts of Canadian or California "Calidria" asbestos were sprayed by the same operator under the same conditions. The first series of tests was typical of the small, custom operator while the second was representative of large, "mass-production" type procedures and equipment.

In the first sequence, the operator added four 31-pound bags of dry spray texture paint containing ~5% of 7M05 Canadian asbestos into the top of a small "Spray Force" mixer-sprayer containing about 80 gallons of water. The mixed paint was pumped through a hose to a wand about 4' long with a nozzle on the side of the tip. Compressed air to atomize the liquid was supplied through a second hose.

During spraying, the operator walked slowly through each room with the nozzle pointed towards the ceiling and sweeping back and forth about 4-5 feet from the floor. A second man, designated as the wiper, assisted in moving the hose and immediately removed any overspray on the walls with a scraper about 18" wide.

Approximately half of the ceilings (484 ft^2) in a large single-story house were sprayed with the mixture containing Canadian asbestos. Total spraying time was about 12 minutes. The tank was then washed out and four bags of spray texture with 4% of California asbestos (Calidria HPO) instead of the Canadian were mixed and sprayed in the same way. The mixture ran out before the spraying was completed and two more bags were mixed. Total area covered was 650 ft^2.

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ACL Doc 18802 · Page 2 of 14 asbestosclaims.law/library/18802/2

Personal samples were taken on the operator during each main mixing and during each spraying sequence. The two bag supplementary mixing was not sampled. The wiper was sampled during each spraying. One area sample was taken in the opposite end of the house during the spraying of the Canadian containing material and the initial part of the California containing spraying operation.

The second test sequence was run at another location in Los Gatos with a large truck-mounted spray unit. Four bags of dry spray texture containing ~2% California asbestos (Calidria HPO) were added to the mixer which was already partially filled with the same blend. The ceilings in a complete house (~1300 ft^2) were sprayed. A 12-bag blend of the same texture blend containing ~2.5% Canadian 7M05 was then mixed and sprayed on the ceilings of a second house. These blends contained an additional pound of styrofoam and were thicker than that used in the first location. There was some problem with the spraying of the Canadian containing material and working pressure was reduced from 120 to ~70 psig.

Personal samples were collected on the spray operator during each mix and during each spraying sequence. Personal samples were collected on the wiper during each spraying.

SAMPLING AND COUNTING PROCEDURES

Throughout these tests, simultaneous air samples on the same operator were collected by the LFE Corporation* and by Union Carbide. Battery-powered air pumps were used to obtain all samples on Millipore membrane filters of 0.8 micron porosity. Dust counting was carried out independently by both laboratories in accordance with OSHA Regulation 1910.001 using the Bayer, Zumwalde and Brown phase contrast procedure. In the Union Carbide counts, the field area was 0.0062 mm^2 and at least 100 fields were counted in each sample. It should be noted that all data are presented are ceiling rather than time-weighted average fiber counts.

In addition to the regular OSHA counts, Union Carbide read the samples for the mixing and spraying operator at 1000X under phase contrast illumination with oil immersion. These counts were made immediately following the standard OSHA counts and utilized the same sample mount. Fiber sizes down to about 1μ in length were counted. Field area was 0.0009 mm^2 and at least 100 fields were counted in each sample.

Transmission electron microscope techniques were also used to measure the fiber size distributions for one spraying sample containing each type of asbestos. For these counts, the filter was carefully removed from the holder and cut in half with a scalpel. It was then carbon coated and 8-10 sections selected randomly over the filter were placed in grid mounts ~1/8" in diameter. The Millipore filter was dissolved away with acetone. Twenty squares in each mount were scanned at 1400X magnification. The area of each grid square was about 0.008 mm^2. Any fibers found were photographed, measured, and checked for structure by selected area electron diffraction at ~15,000X.

* LFE Corporation, Environmental Analysis Laboratories, 2030 Wright Avenue, Richmond, California 94804. The LFE industrial hygiene laboratory is certified by the American Industrial Hygiene Association.

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ACL Doc 18802 · Page 3 of 14 asbestosclaims.law/library/18802/3

RESULTS AND DISCUSSION

The results of the standard OSHA type fiber counts by the two laboratories are listed in Table I. The overall agreement between laboratories is excellent. The Union Carbide results, however, are consistently a moderate amount higher. These are industrial samples with low levels of asbestos fiber amid substantial amounts of background dust. The Union Carbide numbers reflect a conscious effort to make certain that all particles which could possibly be asbestos were counted. Some non-asbestos fibers were undoubtedly included in the results reported.

The range of airborne fiber concentrations given in Table I for each type of asbestos during the dry mixing and during the spraying operations have been summarized in the table that follows. As the data show, the levels are low for both operations. The range of airborne concentrations for the two types of asbestos overlaps in each operation tested. There is clearly no difference between these types of asbestos for airborne concentrations of asbestos fibers longer than 5μ.

Ceiling

	Airborne Asbestos Fiber Concentration (Fibers/cc LONGER than 5μ)			
	Dry Mixing of Spray Texture		Spraying	
	UCC	LFE	UCC	LFE
Canadian Asbestos (Grade 7M05)	0.6-3.2	0.5-2.4	0.8-1.6	0.3-0.7
California Asbestos (Calidria HPO)	1.5-2.7	1.1-1.8	0.5-0.9	0.2-0.6

The personal samples for the mixing and spraying operator in each set of tests were also counted at 1000X under phase contrast illumination using oil immersion. At this magnification, the operator was able to distinguish particles and to judge whether they met the L/D>3 criteria down to lengths of approximately one micron. The results are shown in Table II. The regular OSHA counts at 400X from Table I have also been included for comparison.

Compare, first, the concentrations of fibers longer than 5 microns as counted at 400 and 1000X. The counts obtained at the higher magnification range from 1.3 to 2.6 times those at 400X and average a factor of 1.8 times. Since more detail can be seen at 1000X, it is reasonable that higher counts are obtained. Considering the variability in this type of counting, particularly when applied to mixed dust samples like these, the internal consistency found here is excellent.

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ACL Doc 18802 · Page 4 of 14 asbestosclaims.law/library/18802/4

The data for the concentrations of fibers shorter than 5μ given in Table II are summarized for each operation in the following table categorized by asbestos type.

	Airborne Asbestos Fiber Concentration (Fibers/cc SHORTER than 5μ)	
	Dry Mixing of Spray Texture	Spraying
Canadian Asbestos (Grade 7M05)	1.6-10.9	5.7-7.4
California Asbestos (Calidria HPO)	5.0-5.7	2.3-3.5

Although the dry mixing results for the texture paint that contained Canadian asbestos show a substantial spread, the average for the two tests is 6.2 fibers/cc. This is quite close to the range of 5.0-5.7 fibers/cc found for the same operation with the texture paint containing the California asbestos. In the spraying tests, the material containing the California asbestos gave concentrations about half that of the Canadian material. In view of the limited number of tests run and the uncertainties in counting procedures of this type, the results are considered to be good evidence that the California asbestos does not have any greater tendency than the Canadian asbestos to yield finer fibers when dry mixed or sprayed.

The samples collected in the operator's breathing zone during the first set of spraying tests were also examined with a transmission electron microscope at 1400X. All particles with an L/D ratio greater than 3 were magnified to ~15,000, photographed, measured, and checked for crystal structure identification with selected area electron diffraction. The results are shown in Table III.

In general, it was found that very few of the fibers seen gave electron diffraction patterns characteristic of chrysotile asbestos, i.e. only 3 out of 26. Where patterns were obtained, they came from the extreme tips of the particles. This lack of pattern could be due to fibers being too thick for the beam to penetrate or because the resin binder had formed a coating. Probably both factors contributed. In order to avoid instrument contamination, however, no attempt was made to burn away any coatings that may have been present.

Visually it appeared that the majority of the fibers listed in Table III had the distinctive appearance of chrysotile asbestos. If it is assumed that all of the fibers where the length was defined were asbestos,

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ACL Doc 18802 · Page 5 of 14 asbestosclaims.law/library/18802/5

the corresponding airborne concentrations will be:

	Airborne Asbestos Fiber Concentration (fibers/cc)	
	SHORTER than 5μ	LONGER than 5μ
Canadian Asbestos (Grade 7M05)	0.13	0.15
California Asbestos (Calidria HPO)	0.22	0.11

It is immediately evident that these concentrations are an order of magnitude lower than the optical counts. This difference is at least in part due to the better resolution at both 1400 and 15,000X on the electron microscope. With this instrument, it was easy to distinguish fibers from clumps and chunks of finely divided plastic and other solids.

The key point, however, is that the concentrations for both types of asbestos throughout the fiber size range are extremely low. Considering the very small number of possible fibers found, there is no evidence of any difference between the two types of asbestos in the tendency to produce fibers shorter than 5μ.

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ACL Doc 18802 · Page 6 of 14 asbestosclaims.law/library/18802/6

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ACL Doc 18802 · Page 7 of 14 **asbestosclaims.law/library/18802/7**

TABLE I

SUMMARY OF AIRBORNE ASBESTOS FIBER COUNTS

CALIFORNIA VS. CANADIAN ASBESTOS

Sample No.	Air Sample Time	Minutes	Operation Description	Airborne Asbestos Fiber Concentration (Fibers/cc > 5μ) By Union Carbide	By LFE[1]	
1ST TEST SEQUENCE						
Canadian Asbestos (7M05)						
B-08	8:26-8:36am	10	Personal sample. Operator mixing 4 bags of ceiling spray. Contained ~5% of Canadian grade 7M05 asbestos, limestone, Calif. talc, kaolin clay and polystyrene aggregate. Actual handling of asbestos took about 2 minutes. Remainder of time used in wetting and mixing.	3.2	0.6[2]	(11)
				-	2.4[2]	(11) Downstream area sample during mix
B-02	8:40-8:56am	16	Personal sample: Operator during spraying of Canadian containing blend. Sprayed for ~10 minutes.	1.6	0.5	(12)
B-07	8:40-9:00am	20	Personal sample. Helper wiping overspray off walls.	0.8	0.3	(12)
B-04	8:50-9:07am	17	Area sample. In opposite end of house during spraying of Canadian containing material, between operations, and the start of the California containing material.	0.4	-	
California Asbestos (California HPO)						
B-03	8:56-9:04am	8	Personal sample. Operator mixing 4 bags of ceiling spray. Contained ~4% of California HPO. Other ingredients same as for sample B-08.	2.7		
B-05	9:04-9:19am	11	Personal sample. Operator spraying texture containing HPO.	0.9	1.8	(25)
-	9:15-9:16am	-	Operator mixed two bags of HPO based material. This operation was not sampled by UCC.	-		
B-06	9:02-9:26am	24	Personal sample. Helper wiping overspray off walls.	0.6	0.2	(25)
2ND TEST SEQUENCE						
Canadian Asbestos (7M05)						
B-69	2:21-2:35pm	14	Personal sample. Spray operator mixing 12 bags of ceiling spray containing ~2.5% Canadian grade 7M05 asbestos. More styrofoam than AH samples. Other ingredients the same. Actual dumping took ~10 minutes.	0.8	0.5	(10)
B-89	2:36-3:12pm	36	Personal sample. Spray operator adjusting sprayer and spraying second house with ceiling texture containing Canadian asbestos. About 27 minutes actual spraying.	1.0	0.7	(35)
B-100	2:25-3:16pm	51	Personal sample. Wiper during spraying of Canadian asbestos containing texture. (Second house.)	0.7	0.6	(22)
California Asbestos (California HPO)						
B-67	1:30-1:53pm	23	Personal sample. Spray operator mixing four bags of ceiling spray containing ~2% HPO. (More styrofoam than AH samples.) Other ingredients same as B-08. Actual dumping took ~3 minutes.	1.5	1.1	(6)
B-19	1:53-2:30pm	27	Personal sample. Operator spraying one house (~18 minutes spraying.)	0.9	0.3	(22)
B-97	2:00-2:34pm	34	Personal sample. Wiper during spraying of HPO containing texture. (First house.)	0.8	0.8	(22)

[1] Samples taken on same operator with separate pumps. Actual sample times varied slightly with LFE times shown in parenthesis.

[2] Filter operated closed face by mistake.

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TABLE II

COMPARISON OF AIRBORNE FIBER SIZE DISTRIBUTION

Ceiling Airborne Asbestos Concentration - Fibers/cc

Operation	Magnification → / Fiber Size →	LFE Tests 400X >5μ	UCC Tests 400X >5μ	UCC Tests 1000X <5μ	UCC Tests 1000X >5μ	UCC Sample No.
Mixing Dry Spray Texture						
Canadian Test #1		2.4(1)	3.2	10.9	4.3	B-08
Canadian Test #2		0.5	0.8	1.6	1.0	A-69
California Test #1		1.8(2)	2.7	5.0	6.6	B-03
California Test #2		1.1	1.5	5.7	2.6	A-67
Spraying Texture Paint						
Canadian Test #1		0.5	1.6	7.4	3.3	B-02
Canadian Test #2		0.7	1.0	5.5	1.8	A-89
California Test #1		-	0.9	2.3	2.3	B-05
California Test #2		0.3	0.9	3.5	1.3	A-19

(1) Downwind of mixing operation.

(2) Includes both mixing and spraying.

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ACL Doc 18802 · Page 9 of 14 asbestosclaims.law/library/18802/9

TABLE OF CONTENTS

Section	Page
SUMMARY AND CONCLUSIONS	1
INTRODUCTION	1
OBJECTIVE	1
DESCRIPTION OF TEST OPERATIONS	1
SAMPLING AND COUNTING PROCEDURES	2
RESULTS AND DISCUSSION	3
ACKNOWLEDGEMENTS	6
TABLES	7,8,9

Union Carbide trial exhibit UC-4209: H. B. Rhodes, Comparison of Airborne Asbestos Concentrations: Canadian a… Published by AsbestosClaims.Law
ACL Doc 18802 · Page 10 of 14 **asbestosclaims.law/library/18802/10**

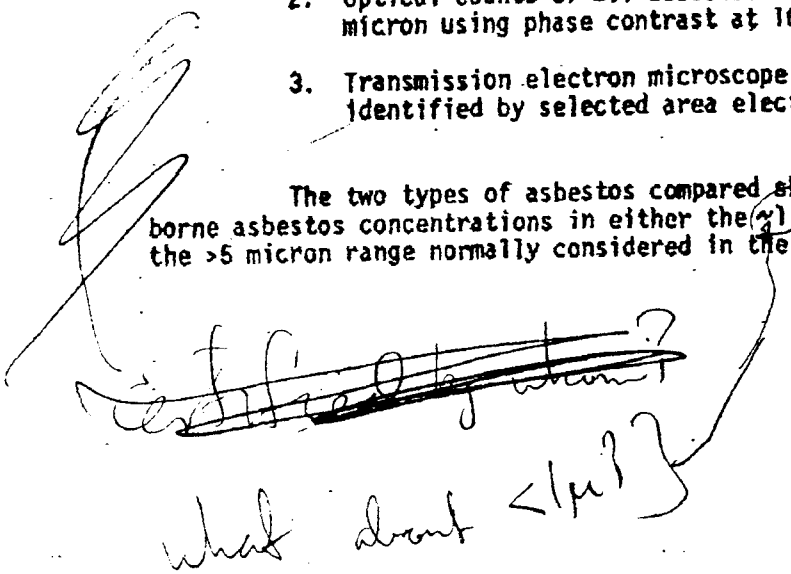
SUMMARY AND CONCLUSIONS

Short fiber asbestos from Canada and highly refined asbestos produced in California by Union Carbide Corporation are used to give key viscosity properties to a wide variety of coatings and laminating resins. The two sources differ in the form of the asbestos ore and in the processing used to manufacture the finished product. These differences shift the fiber size distribution in the California product towards narrower, finer, and shorter fibers.

The object of this work was to compare the airborne asbestos fiber concentrations that occur during the field mixing and application of ceiling texture paints containing 2-5% levels of each of these types of asbestos. Field samples were collected at two construction sites in California and were subjected to the following analyses:

1. Standard OSHA counts at 400X by both Union Carbide and a certified industrial hygiene laboratory, LFE Incorporated.
2. Optical counts of all asbestos fibers longer than about one micron using phase contrast at 1000X.
3. Transmission electron microscope counts at 1400X with fibers identified by selected area electron diffraction.

The two types of asbestos compared showed no difference in the airborne asbestos concentrations in either the 1 to 5 micron size range or in the >5 micron range normally considered in the OSHA regulations.



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ACL Doc 18802 · Page 11 of 14 asbestosclaims.law/library/18802/11

Samples to Mr. Sinclair

Comparison of Airborne Asbestos Concentrations - Canadian and California Asbestos Based Ceiling Texture Sprays

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ACL Doc 18802 · Page 12 of 14 asbestosclaims.law/library/18802/12

Union Carbide trial exhibit UC-4209: H. B. Rhodes, Comparison of Airborne Asbestos Concentrations: Canadian a...
ACL Doc 18802 · Page 13 of 14

UCC 010084

TABLE III

SUMMARY OF FIBER SIZE MEASUREMENTS

Sample Identification	Measurements(1) Grids	Squares	Fiber Size Length (μ)	Fiber Size Diameter (μ)	Chrysotile by Diffraction	Notes
Spraying Texture Paint Containing ~5% Canadian Asbestos (UCC Sample B-02)	8	20	1	0.2	No	
			3	0.6	No	
			3	0.6	No	
			3.5	0.6	No	
			4	1	Yes	
			4.5	0.3	No	
			6	2.3	Yes	
			7	0.3	No	Tapered
			8	1	No	
			9	0.8	No	
			~10	0.2	No	Twisted
			10	1.3	No	
			25	0.2	No	
			Spike from particle		Yes	
			Cluster of fibers ~0.1 to 0.2μ diameter.		No	
Spraying of Texture Paint Containing ~4% California Asbestos (UCC Sample B-05)	7	20	1.8	0.4	Yes	
			2.3	0.3	No	
			2.3	0.4	No	
			4	0.6	No	
			~4	~0.6	No	Size estimated, no photograph.
			~4	~0.7	No	
			>10	0.5	No	Ran off grid square.
			20	1.0	No	
			25	0.6	Yes	
			2 Spikes from particle ~2μ	-	No	Tapered
			>3	0.3	No	Under platelet.

(1) Area per square ~0.008 mm^2.

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