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UNION CARBIDE
THE DISCOVERY COMPANY

Calidria ASBESTOS
UNION CARBIDE CORPORATION • MINING & METALS DIVISION • P.O. BOX 579 • NIAGARA FALLS, N. Y. 14302 • TEL: 716-278-3376

July 7, 1975

Mr. Doug Merrill
Technical Director
Paco Textures Company
909 Old County Road
San Carlos, CA 94070

Dear Doug:

A copy of our regular dust count report for the Los Gatos spraying tests is enclosed. I understand that you have already received the results of the LFE tests from Dr. Oberg.

You may be interested in the report, "Comparison of Airborne Asbestos Concentrations - Canadian and California Based Ceiling Texture Sprays," which is also enclosed. This is a more detailed analysis of the results prepared in conjunction with our efforts to get amendments to the Marks bill.

Thank you very much for the time and effort made by you and your associations to make it possible to obtain this data.

Very truly yours,

H. B. Rhodes

H. B. Rhodes
Technology Manager

HBR:cjb
Enclosures

CC: Mr. T. P. Norris (2)

PLAINTIFF'S EXHIBIT 44

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

H. B. Rhodes
B. L. Ingalls

Union Carbide Corporation
Metals Division
Niagara Falls, New York

June 24, 1975

KMX 01996

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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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 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.

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, Zummalde 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.

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.

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.

	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 HP0)	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.

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 HP0)	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,

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.

ACKNOWLDEGMENTS

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