TESTIMONY CONCERNING
POSSIBLE CHANGES IN THE
HEALTH AND SAFETY CODE SECTION 25910
AS PERMITTED BY SB-1591

Prepared for a Public Hearing
Before the Occupational Safety
and Health Standards Board
on November 8, 1978 in
Sacramento, California

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SUMMARY AND CONCLUSIONS

In 1974 a bill prohibiting the spraying, after July 1976, of any substance containing any amount of asbestos in or upon a building or other structure during its construction, alteration or repair was passed by the legislature. A single exception, for cold process cutback asphaltic roof coatings, was provided. A second bill, enacted in 1976, provided a two-year exemption from the ban for Portland cement plaster containing less than one-half of one percent asbestos and for certain products similar to cold-process cutback asphaltic roof coatings which contained encapsulated asbestos fibers bound within the finished product from manufacture through application. Finally, a third bill (SB-1591) was adopted this year which directs the Occupational Safety and Health Standards Board to consider whether exemptions should be continued and, if so, to promulgate appropriate regulations.

This presentation addresses only the questions in the Notice of Hearing which relate to asphaltic coatings and products with encapsulated fibers. The widespread uses and valuable contributions made by the products are described. Airborne asbestos fiber concentrations are presented from 34 locations covering spraying, removal, and abrasion operations for a variety of products. These data demonstrate that the ceiling concentrations are far below the 10 fiber/cc >5μ allowed, and the time-weighted average concentrations are well below the more stringent maximum limit of 1 fiber/cc >5μ imposed by SB-1591.

Documentation is presented that extensive and generally unsuccessful efforts have been made to find substitutes for asbestos. It is also shown that the value of the products affected is about $9,000,000 per year, so the economic impact of a ban would be substantial.

On the basis that these products are useful and valuable to our society, that the potential worker exposures have been shown to be well within the limits specified by SB-1591 (as well as within the limits permitted for other non-sprayed asbestos-containing products under present DOSHA Asbestos Regulations), that there are no suitable substitutes generally available, and that the economic effect of a ban would be substantial, it is requested that the continued use of asphaltic-based coatings and other products containing encapsulated asbestos fibers be permitted.

Specific wording suggesting a maximum allowable TWA exposure of 1 fiber/cc >5μ and incorporating the other provisions of SB-1591 into Section 5208, Title 8 is presented for consideration by the Standards Board.

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A. BACKGROUND

In 1974 a bill introduced by Senator Marks was enacted which prohibited, after July 1, 1976, the "spraying of any substance containing any amount of asbestos in or upon a building or other structure during its construction, alteration or repair." This bill was prompted by the spraying of asbestos building insulation materials in the San Francisco Bay area.

For this type of application, dry asbestos mixed with other mineral ingredients was delivered to the construction site in bags. It was then applied to the structure in two ways:

1. Sprayed in the dry form with a simultaneous spray of water so that it was deposited as a wet mat on the surface.

2. Premixed with water and sprayed as a thick slurry.

By either method, the handling of the dry asbestos-containing materials produced clouds of airborne dust in the immediate vicinity of the mixing operation and in the general area of the building being insulated. After the insulation material dried, it became friable, i.e., could be reduced to a powder by hand pressure. It is highly possible that substantial concentrations of airborne fiber would be released during maintenance, renovation or demolition operations of buildings and structures insulated in this manner.

No one objected to the banning of this particular use of asbestos. Exposures were difficult to control, could be high, and under certain conditions, could occur during the service life of the product. The Federal Environmental Protection Agency promulgated a similar ban on the spraying of friable asbestos insulation materials in April of 1973. Manufacture of such products had generally ceased prior to the Federal action.

The Marks bill was so broadly drawn that it banned not only this inappropriate use of asbestos but also a number of other important construction products wherein the asbestos fiber is wetted and encapsulated in a permanent binder or is present only in very small amounts. Fiber released during application and subsequent use of these latter types of products is non-existent or extremely small. It is worth noting that the Marks legislation contained one exception, cold process cutback asphalt roofing products, which is a typical example of the kind of products covered by this presentation.

As more information showing very low worker exposure became available in 1975 and 1976 attempts were made in the legislature to modify the Marks bill to permit the continued use of these important products containing bound and encapsulated asbestos. In 1976 a bill introduced by Senator Presley was passed which provided a two-year exemption (until July 1978) from the ban for certain of these products and for Portland cement plaster that contained less than one-half of one percent asbestos. The two-year limit was a compromise to allow the manufacturers more time to search for substitute materials and for the Department of Health and others to obtain more definitive exposure data. The manufacturers of the affected products agreed at that time to provide suitable sites for DOH testing of fiber release.

A. BACKGROUND (Cont'd.)

The subject of exemptions was again addressed in the legislature in late 1977 and early 1978. It soon became evident that the legislature was a difficult place for objective consideration of this complex technical issue. The Standards Board, who has technical resources and capabilities, was clearly a more appropriate agency to act on the matter.

A compromise bill, SB-1591, co-authored by Senators Marks, Gregorio, and Presley, was passed which transfers responsibility for the matter to the Standards Board. SB-1591 places certain specific limitations, beyond those already contained in Section 5208, Title 8, on regulations relating to exempted products, as follows:

1. The maximum allowable 8-hour time-weighted average exposure cannot exceed one-half of the present level of 2 fibers/cc longer than 5 micrometers, i.e., 1 fiber/cc $>5\mu$.

2. The fiber concentration restriction applies not only to the spray application of the product but also throughout its use and disposal.

B. SCOPE OF THIS PRESENTATION

SB-1591 relates to three different types of products:

1. Portland cement plaster containing less than one-half of one percent asbestos.

2. A variety of products where the asbestos is wetted and encapsulated in a permanent binder. These fall into two related groups:

    a. Interior and exterior coatings and laminating resins containing encapsulated asbestos fibers bound within the finished product from manufacture through application.

    b. Cold-process cutback and emulsified asphalt coatings.

3. Any substance which contains less than one-quarter of one percent asbestos which occurs solely as a result of naturally occurring impurities in the substance or its components.

This presentation covers the encapsulated products in Item 2 above and will address questions 3, 4, and 5 in the Notice of Public Hearing dated August 8, 1978, as follows:

B. SCOPE OF THIS PRESENTATION (Cont'd)

"3. If exemptions for any substances containing asbestos are granted by the Board, at what level should the time-weighted average concentrations limits or ceiling concentration limits be set? (Section 25910(b)(3);(c)(3); and (d)(3).)

4. Upon what basis, if any, should products containing "encapsulated asbestos fibers" be exempt? (Section 25910(c)(1).)

5. Upon what basis, if any, should "cold-process asphalt roof coatings" be exempt? (Section 25910(c)(1).)"

The applications, characteristics, and quantities of the various products of interest are described and the status of the search for substitute materials is shown. Airborne fiber exposure data collected at 34 locations are presented to demonstrate that the fiber counts are consistently below both those allowed for other asbestos-containing products under DOSHA regulations and the more stringent limitations imposed by SB-1591. On this basis, suggested changes to Section 5208, Title 8, to permit continued use of these products are presented.

C. PRODUCT USE INFORMATION

a) Roof Coatings

Many commercial and industrial buildings constructed today are topped with "built-up" asphaltic roofing. In the installation of these roofs a layer of hot tar or asphalt is mopped or brushed onto the roof and covered with a layer of building felt. The process is repeated until the required number of layers has been installed. The roof joints and flashings are sealed with thicker asphaltic-based "plastic cement" applied with a trowel.

In this type of installation the asphaltic compound generally does not contain asbestos or other mineral additives. The building felt may or may not include asbestos, and the trowelable sealer will generally have asbestos as an important viscosity control additive.

For proper application, the asphalt is heated to 450-500°F and is then hauled to the roof in drums or pails. It is difficult and dangerous to handle and is too hazardous to spray. The heating is done in kettles which may emit smoke and fumes that are potentially harmful to the environment. Environmentally acceptable kettles are expensive and difficult for the smaller contractors to obtain.

As an alternative to heating, cold asphalt can be diluted or "cutback" with a solvent or emulsified with water to reduce the viscosity so that the material can be spread on the roof. Such products are termed "cutback" or emulsified asphalt coatings. These products require no heating and can be applied by spraying or rolling. They were used in the past mainly for maintenance and repair of existing roofs; but, with increased labor costs and improvements in spray equipment, they

C. PRODUCT USE INFORMATION (Cont'd.)

a) Roof Coatings (Cont'd.)

are now finding much wider use in new construction. Spraying is about ten times as fast as hand application, gives a more uniform coating and permits pumping of material to the roof instead of using drums or pails of hot asphalt.

The amounts of the various roofing products sold in California in 1975 are listed in the table below. Of the 8,042,000 gallons used, it is estimated that most of the black emulsions and cutbacks and about one-half of the aluminized products contain asbestos, that is, about 4,300,000 gallons. Product value for this portion of the total is about $5,000,000 per year. Most of these materials are sprayed.

1975 SALES DATA[1]
(in thousands of gallons)

Company	Black Cutbacks	Black Emulsions	Primers	Aluminum Pigmented	Plastic Cements	Other
A	214	Neg.	143	165	33	1328
B	412	138	19	291	737	-
C	160	1800	35	140	290	420
D	150	0	40	75	250	30
E	67	941	0	37	127	0
Totals	1003	2879	237	708	1437	1778

"(1) Consideration of Model Organic Solvent Rule Applicable to Architectural Coatings, State of California Air Resources Board, June 1977, Table VII-7, p-61."

The asbestos content of these products varies from 4-13% by weight. The base asphalt is in the form of an emulsion containing about 45% water or cutback which contains about 40% organic solvent. The water or solvent evaporate during cure to leave an asbestos content ranging from about 6-20% by weight in the cured coating.

b) High-Performance and Specialty Industrial and Trade Coatings and Resins

This broad group includes a wide variety of high-performance and/or corrosion resistant coatings generally applied to metal, concrete, or wood. High-build vinyl, epoxy, and epoxy-coal tar based coatings, zinc-rich primers and block and foundation coatings are typical of this group. Some typical formulations of high-performance industrial coatings are shown in Table I in the Appendix.

These products are used in shipyards, power plants, oil refinery and building construction and maintenance, oil and gas storage tanks, barges, off-shore drilling rigs, and in general, on almost any

C. PRODUCT USE INFORMATION .(Cont'd.)

b) High-Performance and Specialty Industrial and Trade Coatings and Resins (Cont'd

structure that is subject to corrosion or requires water resistance. In addition to the main types of sprayed materials just described, there are a variety of polyester resins used to provide such things as corrosion resistant linings for chemical process tanks and in the manufacture of fiberglass boats, tub-and-shower stalls, and similar glass-reinforced products.

Approximately $4,000,000 per year of asbestos-containing coatings of the type described are used in California each year. These coatings are generally applied by spraying due to the nature of the surfaces coated and the high labor costs for other application methods. Typical application rates are shown below and it is evident that the use of a brush results in a very substantial addition to the cost.

Conventional Air-Supported Spraying	-	1000 $ft.^2/hr.$
Airless Spraying	-	2000 $ft.^2/hr.$
Brush	-	200 $ft.^2/hr.$

The products described in this section contain 0.5-3% asbestos by weight as sprayed and up to 5% by weight in the cured coating.

D. AVAILABILITY OF SUBSTITUTE MATERIALS

In developing regulations for the control of potentially harmful materials, an important consideration is the availability of substitutes. However, substitutes must be proven harmless (or clearly less harmful) and economically competitive, and must perform the functions of the original material and impart the desired properties to the final product. It is equally important that any substitute whose use is, in effect, mandated by regulation be generally available and be thoroughly demonstrated as practical in actual commercial operations.

Asbestos consists of fine, hair-like fibers which, when dispersed in a liquid, form a loosely-connected network which could be described as a three-dimensional spiderweb. This network initially thickens the liquid; but, when the liquid is pumped through a spray nozzle, the network comes apart and the liquid is thin enough to pass easily through the nozzle. When the liquid spray reaches a solid surface, the fiber network immediately reforms and thickens the liquid to prevent sag or run-off. The asbestos fiber network in the sprayed product also provides a bridging effect over irregularities in the base surface, adds strength and toughness to the cured coating, and imparts a certain amount of fire resistance in some compounds. There are no generally recognized and acceptable substitutes for asbestos fibers which so effectively perform the functions described above.

D. AVAILABILITY OF SUBSTITUTE MATERIALS (Cont'd.)

Since many fillers are less expensive than asbestos, the search for alternatives has been ongoing for many years, not necessarily prompted by the asbestos/health question or regulatory activity. However, these factors have clearly intensified the evaluation of substitutes in recent years.

Some organic thickeners have been evaluated as asbestos replacements, but most work has been concentrated on other naturally-occurring fiber-like materials and man-made fibrous products such as fiberglass and mineral wool. Efforts to replace asbestos have been largely unsuccessful because the substitutes usually cause a substantial loss of functional properties and/or an increase in product or installation cost. Few manufacturers of the products under consideration desire to use asbestos in the present climate of concern over the asbestos/health relationship if a suitable substitute is available. An asbestos-free product with even approximately equivalent cost/performance would have a considerable advantage in the marketplace. The lack of such products is prime evidence that asbestos is an important and necessary raw material.

Five specific statements on substitutes are provided in Attachment I. Three of these, including the conclusions of the Federal EPA, relate to a recent rulemaking on spraying of asbestos-containing materials and were obtained from the official record of the EPA proceedings. Two were prepared specifically for this hearing.

E. WORKER EXPOSURE TO AIRBORNE ASBESTOS FIBERS

Exposure to asbestos in the workplace is measured in terms of the concentration of asbestos fibers longer than five micrometers per cubic centimeter of air. To make the measurement, the fibers are collected on a filter and are counted with a microscope at 400 to 450X magnification.

a) Sources of Exposure Data

Data on worker exposure during spraying and renovation or demolition operations involving the products described herein are available from a variety of sources. These include:

1. Responses to a Federal Environmental Protection Agency proposal to modify spraying regulations (CFR-42, No. 41 - Wednesday, March 2, 1977).

2. A paper presented to the Society of Plastics Engineers.[1]

3. A cooperative Government-Industry study on sandblasting of a maintenance coating which was carried out by the California State Department of Health and is reported as Attachment II.

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(1) "Consumer Safety in Plastics Systems Containing Bound Asbestos Fibers," H. B. Rhodes, Union Carbide Corporation. Presented at the Society of Plastics Engineers, Inc., NATEC Meeting, Denver, Colorado, November 9, 1977.

E. WORKER EXPOSURE TO AIRBORNE ASBESTOS FIBERS (Cont'd.)

a) Sources of Exposure Data (Cont'd.)

All of the data presented are results from personal samples collected in the worker's breathing zone, and most were obtained under routine commercial operations.

b) Presentation of Results

The airborne asbestos fiber counts for over 100 individual samples collected at 34 locations are listed in Tables II through VII and in Attachment II. These results are summarized in the table below and are shown graphically in Figure 1.

For this summary, the data have been grouped by two main product types, Roofing Materials and Coatings and Resins. Each type is further subdivided by the operation being tested, i.e., spraying or tear-off or abrasion of the cured products. The range of fiber counts and arithmetic average are shown for each product type. The arithmetic average represents actual exposures during equipment operation and would be the maximum exposure if the operation was performed by the same worker for an entire eight-hour shift. However, spraying, as an example, is a very rapid operation covering 1000 to 2000 square feet per hour. A worker would normally perform this operation for only a few hours, or less, in a working day. Therefore, a worker's actual TWA exposure would be reduced by whatever fraction of the day the equipment is not in operation. For purposes of this presentation, it was considered appropriate to use the arithmetic average (which would be the higher number) rather than calculate TWA's for the entire shift.

c) Discussion of Results

It is clearly evident from Figure 1 that none of the individual samples even remotely approach the allowable ceiling limit of 10 fibers/cc >5μ. The highest value of 1.6 fiber/cc >5μ occurred during the sandblasting test and the next highest value was only 0.6 fibers/cc >5μ, a factor of nearly 20 below the established limit. Similarly, the arithmetic average values were well below the 2 and 1 fiber/cc >5μ limits prescribed by DOSHA and SB-1591 respectively.

The sandblasting study reported in Attachment II is particularly important to the present rulemaking since it represents an extreme test of the extent of fiber release from non-resilient coatings.(1) The entire coating is removed and reduced to a powder by the high-energy action of the blasting.

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(1) Note: Sandblasting is not applicable to resilient materials such as roof coatings which must be removed by other means.

SUMMARY

AIRBORNE ASBESTOS FIBER CONCENTRATIONS - SPRAYING AND ABRASION OF PRODUCTS CONTAINING WETTED AND BOUND ASBESTOS FIBERS

	Weight % Asbestos		Number of Locations Tested	Number of Samples Collected	Airborne Asbestos Concentration (Fibers/cc >5μ)		Data Reference
	As Sprayed	After Cure			Range	Arithmetic Average	
ROOFING MATERIALS							
Spraying							
Cutback Asphalt	5.8-7.7	9.7-12.8	3	5	0.003-0.09	0.04	Tables II & III
Asphalt Emulsion	2.8	5.1	2	3	0.01-0.3	0.1	Table II
Tearoff & Replacement	(1)						
Built-up Roofing	-	-	8	<13	0.0-0.6	0.1	Table IV
	2.8-7.7	5.1-12.8	13	<21+	0.0-0.6		
COATINGS AND RESINS							
Spraying							
Epoxy and Epoxy-Coal Tar Coatings	1-1.5	1.3-1.9	3	5	0.0-0.2	0.1	Table V
Chemical Resistant Polyester Coatings	0.7-1.4	0.7-1.4	2	5	0.0-0.4	0.3	Table V
Alkyd Solvent Coatings	6	10	1	2	0.0-0.06	0.03	Table V.
Vinyl and Acrylic Latex Coatings	0.6-3.7	1.1-6.7	3	8	0.0-0.2	0.04	Table V
Polyester Laminating Resins	0.5	0.5	3	7	0.0-0.6	0.2	Table VI
	0.5-6.0	0.5-10	12	27	0.0-0.6	0.15[2]	
Abrasion							
Polyester Laminating Resins - Grinding	0.5-3.0	0.5-3.0	5	12	0.0-0.4	0.2	Table VII
Vinyl Latex Coating - Sanding	0.6	1.1	1	4	0.0-0.3	0.1	Table VII
Epoxy Maintenance Coating - Sandblasting	-	2.1	1	39	<0.1-1.6	0.3-0.4 (0.1-0.3)[3]	Attachment II
	0.6-3.0	1.1-3.0	7	55	0.0-1.6		

(1) Results include both the tear-off of old roofing and replacement with the asphaltic materials applied by spraying techniques.

(2) Overall average of 27 samples.

(3) Eight-hour time-weighted averages.

E. WORKER EXPOSURE TO AIRBORNE ASBESTOS FIBERS (Cont'd.)

c) Discussion of Results (Cont'd.)

The subject of this test was a 40 foot diameter by 25 foot high metal tank that was spray painted in 1973 with an epoxy-based primer containing 2.1% by weight asbestos. The test was carried out in January 1978 so the coating was thoroughly cured. Two professional sandblast operators removed all of the paint on the vertical surfaces, one blasting for nearly six hours and the other for about two hours. They were assisted by a hose tender who kept the blasting equipment filled with sand and helped in the movement of the hoses. In accordance with California regulations, the two blasting operators wore respirators with an external air supply in addition to full protective hoods. Therefore, the data do not represent their actual asbestos exposure but only what it would have been without the required protective equipment.

Even under these extreme conditions the maximum concentration found at any time was only 1.6 fibers/cc >5μ. The arithmetic average concentrations were only 0.3 to 0.4 fibers/cc >5μ and eight-hour time-weighted averages, which are more directly related to statutory requirements, were even lower at 0.1 to 0.3 fiber/cc. As might be expected, the values obtained in the other sanding and grinding operations, where the rate of energy input was lower, gave considerably lower peak and average values. (0.4 ceiling, 0.1-0.2 arithmetic average.)

The arithmetic average dust counts show a generally random variation between a virtually undetectable level and 0.4 fibers/cc >5μ. There does not appear to be any trend with the amount of asbestos in the product, the type of product, of the type of operation. The asbestos content of the product does not appear to be critical as long as the asbestos is sufficiently wetted and is encapsulated.

F. BASIS FOR CONTINUED USE OF PRODUCTS

As noted earlier, the Standards Board has specifically requested comments on what basis should be used for product exemption and, if exempted, appropriate ceiling and time-weighted average exposure limits. The air sampling data for a wide variety of products and operations show that these products consistently result in exposures that are both well below those allowed for non-sprayed asbestos-containing products by the present DOSHA Asbestos Regulations and also well below the more stringent requirements set by SB-1591. These data demonstrate that special regulations for these products are not needed.

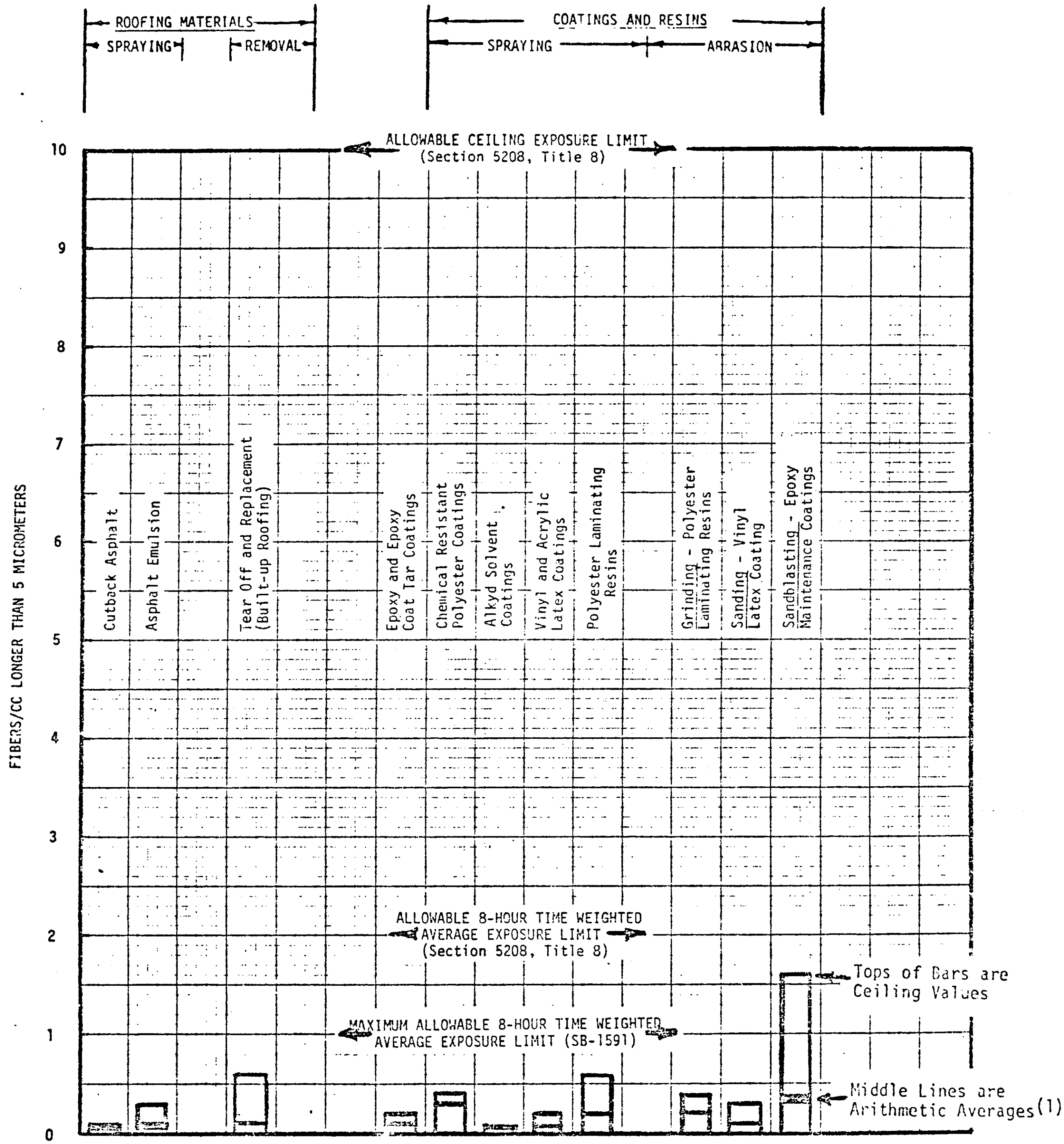
Extensive and generally unsuccessful attempts have been made to find substitutes for asbestos. Economic considerations are substantial in that about $9,000,000 per year of such products are manufactured and used in California.

SUMMARY

AIRBORNE ASBESTOS FIBER CONCENTRATIONS -

SPRAYING AND REMOVAL OF PRODUCTS

CONTAINING WETTED AND BOUND ASBESTOS FIBERS



No. of Locations	3	2	8	3	2	1	3	3	5	1	1	34
No. of Samples	5	3	>13	5	5	2	8	7	12	4	39	103
% Asbestos by Wt.												
As Sprayed	5.8 - 7.7	3	--	1 -1.5	0.7-1.4	6	0.6-3.7	0.5	0.5-3	0.6	--	0.5-7.7
After Cure	9.7 - 12.8	5	--	0.7-1.4	0.7-1.4	10	1.1-6.7	0.5	0.5-3	1.1	2.1	0.5-12.8

FIGURE 1

(1.) Arithmetic average of all samples collected for each product group. Since these operations are generally intermittant, the corresponding 8-hour time-weighted averages would be lower.

F. BASIS FOR CONTINUED USE OF PRODUCTS (Cont'd.)

In answer to questions 3, 4, and 5 posed by the Standards Board, exemptions should be continued for the types of products discussed herein because:

1. They perform a valid and useful service.
2. They can be used at exposures well within those specified by the legislature.
3. No suitable substitutes are generally available.
4. Substantial economic considerations are involved.

G. SUGGESTED CHANGES IN SECTION 5208, TITLE 8

A suggested format to incorporate the legislation contained in SB-1591 into the present asbestos regulations in Title 8 is presented in this section. This format is compatible with a similar treatment of the other two product categories under consideration in the manner indicated. Specific recommendations are confined to the product types covered in this presentation.

A new subparagraph (l) is added to Section 5208 as follows:

(l) Spraying of Asbestos-Containing Materials.

(1) Except as provided in subdivisions (2), (3) and (4) of this subparagraph, no person shall cause or permit the spraying of any substance containing any amount of asbestos in or upon a building or other structure during its construction, alteration or repair.

(2) Insert wording to provide a specific exemption for Portland cement plaster (if the Board decides that such an exemption is appropriate.)

(3) Exterior and interior coatings and laminating resins containing encapsulated asbestos fibers bound within the finished product from manufacture through application, and asphalt roof coatings, shall be exempt from the prohibitions of subdivision (1) of this paragraph.

(4) Insert wording to provide a specific exemption for substances containing asbestos which occurs solely as a result of naturally occurring impurities in the substance or its components (if the Board decides that such an exemption is pparopriate.)

G. SUGGESTED CHANGES IN SECTION 5208, TITLE 8

(5) During any use, spraying, application, handling, storage, repair, disposal, processing, or transportation of such products, the person who causes or permits such acts pursuant to an exemption granted in subdivisions 2, 3 or 4 of this paragraph, shall comply with the provisions of Section 5208, Title 8, California Administrative Code as it exists on the effective date of the amendments to this paragraph enacted by the Statues of 1978 or may, thereafter be amended. The time-weighted average concentration limits for employee exposure to airborne asbestos fibers arising from any use, spraying, application, handling, storage, repair, disposal processing, or transportation pursuant to exemptions granted under subsidivisons 2, 3, or 4 of this paragraph shall be no higher than the level contained in Subparagraph (A), paragraph (1), subdivision (g) of Section 5208, Title 8, California Administrative Code, as it exists on the effective date of the amendments to this section enacted by the Statutes of 1978 or as such regulations may, thereafter, be amended.

Substitutes

TABULAR DATA

Tables I - VII

TABLE I

REPRESENTATIVE FORMULATIONS (1)

HIGH PERFORMANCE INDUSTRIAL COATINGS

	High-Build Vinyl Maintenance Paints				Primers		Coatings		Zinc Rich Primers	
	Red Lead Primer	Shipbottom Antifouling	White Anticorrosive Primer	White Topcoat	With Vinyl	With Vinyl & Epoxy	Roof or Flat	General Purpose Vertical	Alkyl Silicate	Vinyl
BINDERS										
Vinyl Resin	13.18	2.49	21.90	15.66	12.8	8.8				9.02
Coal Tar					12.8	8.8	51.02	27.97		
Epoxy Resin						5.9	10.20	20.12		
Polyamide Resin						3.0		9.26		
Rosin		9.75								
Silicate									8.20	
SOLVENTS	63.49	18.80	52.51	54.57	42.5	40.5	35.71	15.68	30.10	44.36
ASBESTOS (As sprayed)	1.96	1.39	0.92	1.05	0.3	0.6	0.52	1.21	0.67	0.21
PLASTICIZERS AND OTHER NON-VOLITALE ORGANICS	1.36	2.27	3.92	4.17	3.2	2.6	2.55	1.01	-	0.34
MINERAL FILLERS										
Zinc Dust									61.03	45.42
Red Iron Oxide										0.65
Talc					28.4	29.8				
Red Lead	20.01									
Cuprous Oxide		63.30								
TiO_2			11.53	10.95						
Zinc Phosphate			9.22							
Magnesium Silicate								24.75		
Clay				13.60						
(1)Wt. % Asbestos - After Cure	5.37	1.71	1.93	2.31	0.52	1.01	0.81	2.84	0.96	0.38

TABLE II

AIRBORNE ASBESTOS FIBER CONCENTRATIONS SPRAYING OF FIBRATED ROOF COATINGS (1)

Date	Binder	Approximate Wt. % Asbestos		Airborne Concentration (Fibers/cc >5μ)		
		As Sprayed	After Cure	Total	(2) Background	From Spraying
9/25/74	Cutback Asphalt	7.7	~12.8	0.023	0.02	0.003
				0.026	0.02	0.006
10/9/74	Cutback Asphalt	7.7	~12.8	0.11	0.038	0.072
				0.065	0.038	0.027
12/10/74	Asphalt Emulsion	2.8	~5.1	0.16	0.15	0.01
				0.17	0.15	0.02
5/19/76	Asphalt Emulsion	2.8	~5.1	0.80	0.50	0.3

(1) Data from a response by the Flintkote Company to "Changes in the National Emission Standards for Hazardous Air Pollutants" (40 CFR, Part 61) proposed by the EPA (42 CFR No. 41, p. 12122, March 2, 1977. Commercial conditions simulated.

(2) Background before start of spraying test.

TABLE III

AIRBORNE ASBESTOS CONCENTRATIONS
SPRAYING OF CUTBACK ASPHALTIC*

Binder	Weight % Asbestos As Sprayed	Cured	Sample Time (Hours)	Airborne Asbestos Concentrations (Fibers/cc 5)
Cutback Asphalt	~5.8	9.7	5.7(1)	0.09(2)
Cutback Asphalt	~5.8	9.7	7.2	0.15(2)

(1) 260-265 gallons sprayed.

(2) Sample possibly contaminated with background non-asbestos fibers from the roof.

*Data from response by Texas Refinery Corporation to "Changes in the National Emission Standards for Hazardous Air Pollutants" (40 CFR, Part 61) proposed by the EPA (42 CFR No. 41, p. 12122, March 2, 1977.

TABLE IV

AIRBORNE ASBESTOS FIBER CONCENTRATIONS TEAR-OFF AND APPLICATION OF BUILTUP ROOFING(*)

Date	Location	Operation	Airborne Asbestos Concentration (Fibers/cc >5μ)
3/14/74	Wisconsin	New Application	0.2 - 0.6
4/10/74	Indiana	Tear-off	0.1 - 0.4
5/21/74	Pennsylvania	Tear-off and Replace	0.0 - 0.2
7/25/74	Indiana	Tear-off and Replace	0.1 - 0.3
11/20/74	Colorado	New Application	0.1 - 0.2
12/16/75	Colorado	New Application	<0.1
8/16/76	Indiana	Tear-off and Replace	0.0
8/16/76	Indiana	New Application	0.0

(*) Data from response by the Johns-Manville Corporation to "Changes in the National Emission Standards for Hazardous Air Pollutants" (40 CFR, Part 61) proposed by the EPA (42 CFR No. 41, p. 12122, March 2, 1977)

TABLE V

AIRBORNE ASBESTOS FIBER CONCENTRATIONS

SPRAYING OF HIGH-PERFORMANCE INDUSTRIAL AND TRADE COATINGS

Sample Designation	Commercial Application	Date	Binder	Approx. Wt. % Asbestos As Sprayed	Approx. Wt. % Asbestos After Cure	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Concentrations (Fibers/cc >5μ)
A. Epoxy									
K-3	Ship coating.	10/2/74	Epoxy	1.5	1.9	Airless	Operator spraying outside & under a ship.	33	0.2
K-10	"	"	"	1.5	1.9	"	"	8	0.2
M-45	Coating dry dock	10/1/74	Epoxy + Coal Tar	1	1.3	Airless	Operator spraying side of dry dock from suspended platform.	11	0.2
M-1	"	"	"	1	1.3	"	Operator spraying side of dry dock from fixed scaffold.	38	0
K-3	Coating pipe interiors.	"	"	1	1.3	Air-supported wand.	Operator spraying interior of 3", 6" and 12" diameter pipe.	37	0.1
B. Chemical Resistant Polyester									
J-21	Fiber-glass pipe manufacture. (Mandrel coating)	8/13/74	Chemical resistant resin.	1.4	1.4	Airless	Operator adjacent to automatic spray machine coating 28' mandrels.	23	0.1
H-26	"	"	"	1.4	1.4	"	Operator wiping mandrels. In area near spraying.	14	0.4
J-5	Below waterline. Ship coating.	10/3/74	"	0.7	0.7	Air-supported wand.	Roll-out man. In spray area about 1/4 of time.	65	0.4
J-7	" "	"	"	0.7	0.7	"	Operator spraying ship hull in drydock.	41	0.4
M-28	" "	"	"	0.7	0.7	"	"	23	0.0

TABLE V (Continued)

AIRBORNE ASBESTOS FIBER CONCENTRATIONS

SPRAYING OF HIGH-PERFORMANCE INDUSTRIAL AND TRADE COATINGS

Sample Designation	Commercial Application	Date	Binder	Approx. Wt. % Asbestos As Sprayed	Approx. Wt. % Asbestos After Cure	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Concentrations (Fibers/cc >5μ)
C. Alkyd Resin									
H-7	Painting building exterior.	10/6/74	Alkyd resin	6	10	Airless gun.	Operator spraying building exterior wall.	9	0
M-35	"	"	"	6	10	"	"	5	0.06
J-11	Painting(1) building interior.	3/8/77	Vinyl-Acrylic Latex	0.6	1.1	Airless gun.	Operator spraying interior walls.	23	0.03
J-7	"	"	"	0.6	1.1	"	"	23	0.06
J-87	Painting(1) building exterior.	"	"	0.6	1.1	"	Operator spraying exterior walls.	16	0.00
F-48	"	"	"	0.6	1.1	"	"	16	0.04
D. Latex Based									
H-5	Wall and Roof Spray.	10/4/74	Vinyl latex	3.7	6.7(2)	Air supported.	Operator spraying vertical wall panel.	15	0.0
J-3	"	"	"	2.8	5.1(2)	"	"	12	0.2
M-43	Roof Spray.	9/30/74	Acrylic latex.	0.7	1.3(2)	Airless	Operator spraying downward onto a large roof.	28	0.0
M-49	"	"	"	0.7	1.3(2)	"	"	14	0.0

(1) Commercial conditions simulated.

(2) Calculated on the basis of 45% water loss or cure.

"Consumer Safety in Plastics Systems Containing Bound Asbestos Fibers," Paper presented at the Society of Plastics Engineers, Inc. NATEC Meeting - Denver, Colorado, November 8-10, 1977 by Harrison B. Rhodes.

TABLE VI

AIRBORNE ASBESTOS FIBER COUNTS - SPRAYING OF LAMINATING RESIN

Sample Designation	Commercial Application	Date	Binder	Approx. Wt. % Asbestos As Sprayed	Approx. Wt. % Asbestos After Cure	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Concentration (Fibers/cc >5μ)
69	Boat Manufacture	12/7/72	General pupose polyester resin	0.5	0.5	Air-supported chopper	Operator spraying resin and chopped fiberglass.	24	0.6
L-13	Boat Manufacture	10/31/74	General purpose polyester resin	0.5	0.5	Air-supported chopper	Operator spraying resin and chopped fiberglass.	16	0.1
N-28	" "	"	"	"	"	"	"	5	0.4
N-30	" "	"	"			"	"	4	0.4
N-34	Boat Manufacture	10/8/75	General purpose polyester resin	0.5	0.5	Airless	Operator-spraying resin only. No fiberglass.	55	0.0
N-40	" "	"	"	"	"	"	"	53	0.03
I-12	" "	"	"	"	"	"	"	35	0.1

"Consumer Safety in Plastics Systems Containing Bound Asbestos Fibers," paper presented at the Society of Plastics Engineers, Inc. NATEC Meeting, Denver, Colorado, November 8-10, 1977 by Harrison B. Rhodes.

TABLE VII

AIRBORNE ASBESTOS FIBER COUNTS-

GRINDING AND SANDING OF POLYESTER RESIN-BASED SYSTEMS CONTAINING ASBESTOS

Sample Designation	Commercial Application	Date	Asbestos Type	Asbestos Approx. Wt. % As Sprayed	Asbestos Approx. Wt. % After Cure	Operation	Sample Time (Min.)	Possible Airborne Asbestos Fiber Concentration (Fibers/cc >5.)
1. THERMOSET RESIN (Polyester)								
1929-82-3	Fabrication of reinforced fiberglass pipe.	2/27/73	RG-144	2-3	2-3	Operator pulls pipe along line. Saws off end with circular saw.	19	0.1
1929-82-4	"	"	"	2-3	2-3	Same operation as 1929-82-3.	49	0.1
1929-82-5	"	"	"	2-3	2-3	Operator removing end of pipe with scarfing machine.	45	0.04
I-13	"	8/13/74	RG-244	1.4	1.4	Operator shaping end of pipe with bell & spigot machine.	16	0.3
I-6	"	"	"	1.4	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	RG-244	1.5	1.5	Operator grinding inside of 13' I.D. x 26' tank.	16	0.4
G-8	"	"		1.5	1.5	Continuation of same operation as I-26.	5	0.3
I-39	"	"		1.5	1.5	Operator grinding edges of miscellaneous small parts.	25	0.3
1929-84-4	Production of artificial bricks.	3/8/73	RG-244	2.0	2.0	Operator cutting with sabre saw.	44	0.1
1929-84-5	"	"	"	2.0	2.0	Operator trimming with sabre saw.	39	0.2
N-20	Production of fiberglass boats.	11/26/74	RG-244	0.5	0.5	Operator grinding inside of boat hull.	11	0.0
N-25	"	"	"	0.5	0.5	Operator grinding.	4	0.0
B. VINYL LATEX RESIN(2)								
J-33	Sanding of vinyl latex paint.	3/8/77	T-135	0.6	1.1	Operator handsanding overhead panel.	12	0.3
R-43	"	"	"	0.6	1.1	"	11	0.06
J-35	"	"	"	0.6	1.1	Operator handsanding wall panel	16	0.1
J-4	"	"	"	0.6	1.1	"	16	0.0

(1) Consumer Safety in Plastics Systems Containing Bound Asbestos Fibers," paper presented at the Society of Plastics Engineers, Inc. NATEC Meeting, Denver, Colorado, November 8-10, 1977 by Harrison B. Rhodes.

(2) Commercial conditions simulated.

ATTACHMENT I

Statements on the Availability of Substitutes for Asbestos

ITEM I

Excerpts from response by the Johns-Manville Corporation to "Changes in the National Emission Standards for Hazardous Air Pollutants (40 CFR, Part 61) proposed by the EPA (42 CFR No. 41, p. 12122, March 2, 1977):

"Asbestos is used in asphalt coatings for three reasons. First, to add body or enhance the rheology of the coating, especially the thixotropic characteristics. Other fibers, such as fibrous glass, do not have sufficient bulk to serve as an adequate substitute. Second, since many of the applications for asphalt coatings involve outdoor exposure, the fibrous nature of asbestos provides superior weather resistant characteristics. Third, the low cost of asbestos in relation to the value added is superior to other mineral fillers, and essential in the manufacture of asphalt coatings, which are generally low cost products. A J-M Technical Bulletin describing the use of asbestos fiber in asphalt coatings has been provided as Attachment I."

Chrysotile Asbestos Fiber
Chrysotile Technical Bulletin

Asphalt Coatings

Asphalt coatings represent a line of products which have a variety of end uses in the industrial, automotive and construction industries. They are produced for such varied uses as protective coatings for metals and tanks, insulation for pipes and tanks, sound deadeners, sealants and undercoatings for automobiles and roof coatings, flashing cements and tile cements in construction. One type is made from an asphalt cut back with kerosene or mineral spirits used as a solvent and the other with an asphalt emulsion in water.

Purpose of Asbestos

The primary purpose of asbestos in coatings is to enhance the rheology of the system and especially the thixotropic characteristics. Since many of the uses involve outdoor exposure the excellent weathering resistance imparted to the coating by asbestos is essential and its fibrous nature provides the desired viscosity characteristics. The low cost of asbestos in relation to the value added is essential in these low cost products.

Formulations

Because of the variety of products and the number of producers there are unlimited formulations. The major components are:

Cutback Products	
Cutback Asphalt	—30-80%
Asbestos	—10-15%
Limestone or Slate Fluor	—15-30%
Dispersant	— 1%
Emulsion Products	
Emulsion Asphalt	—55-80%
Asbestos	—10-15%
Limestone	— 5-15%
Dispersant	— 1%

Aluminum paste is added to give a reflective coating; granulated cork for insulation.

Manufacturing Process

The manufacturing process consists of mixing and packaging and the sophistication will depend on the size of the operation. Mixing is accomplished in horizontal mixers of the helical type or vertical or horizontal mixers with paddle blades. Most of the time the dry ingredients are added to the cutback asphalt and mixing is continued until a homogeneous mix is obtained. In some cases the order of mixing may be reversed or only some of the dry ingredients mixed initially.

When mixing is complete the unit is emptied into packages which may vary from one and five gallon pails to barrels. Some products, especially those used in airless spray operations, require straining before packaging.

Recommended Fiber Grades

7M05	7RF02
7R05	7TF1
7T05	7TF02
7MF5	

> **CAUTION**
> Contains Asbestos Fibers — Avoid Creating Dust — Breathing Asbestos Dust May Cause Serious Bodily Harm

The physical (or chemical) properties of Johns-Manville Chrysotile Asbestos Fiber represent typical average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Check the Johns-Manville district office to assure current information.

ATTACHMENT I

Johns-Manville JM
Asbestos Fiber Sales • P.O. Box 5108 • Denver, Colo 80217 • (303) 770-1000
Canadian Johns-Manville Co., Ltd • Asbestos Fiber Division • P O Box 1500 • Asbestos, Quebec, Canada J1T 3N2 (819) 879-5433

<u>ITEM 2</u>

Excerpts from the response by Texas Refinery Corporation to "Changes in the National Emission Standards for Hazardous Air Pollutants" (40 CFR, Part 61) proposed by the EPA (42 CFR No. 41, p. 12122, March 2, 1977):

"These coatings are used in spray applications because of convenience, safety and the ability to get a uniform coating. Spray application of these coatings is convenient since the containers of coatings are left on ground level and pumped through hoses to the spray nozzle on the roof. It takes fewer persons to spray a roof than to apply it by hand in the same time period, and containers do not have to be lifted to the roof, emptied by hand and the empty containers lowered from the roof along with other equipment necessary to apply by hand. Spray applications are safer due to the fact, as mentioned previously, that the only appratus needed to be raised to the roof is the spray hose and nozzle while the heavy containers of coatings are left on ground level; not as many workers are needed up on the roof and therefore are not taking risks of falling; and less waste is generated since no rags or brushes are used. Also, most roofs develop low spots during aging which will result in a heavier deposit of coating in the low spots than in the high spots when the coatings are applied by hand. These heavier deposits will cause problems with the efficiency of the roof which will result in workers having to return to the roof for patching work. This in turn results in added expense and re-exposure of workers to safety hazards. A spray application usually results in a uniform layer of coating over the roof regardless of any indentions or low spots on that roof.

Our company has investigated several types of asbestos substitutes for use in these coatings and found none to be satisfactory. Several types of clay thickeners, including Attapulgite, ground cork, styrofoam, ground rubber, vermiculite and Feldspar have been investigated and found to lack the characteristics necessary to impart strength to the coating. Polyethylene fiberous powders were tried and found to dissolve in the solvent system and/or not to impart fire resistance or strength necessary to the coating. Hemp and other organic fibers were investigated and found not to impart biological resistance necessary to prevent attack of the coating or fire resistance. A ceramic fiber was tested and found to give strength, fire resistance and biological resistance to the coatings. However, a problem with settling of the coatings over a period of time was noted; the ceramic fiber is not widely available and is very expensive. The ceramic fiber we have tested from Babcock and Wilcox is selling for $0.80 per pound in carloads while asbestos is obtained in carloads at $0.0955 per pound. Also, since this branched, soft, fairly long ceramic fiber has only been found available from the one supplier, it is doubtful whether or not supply would be adequate for complete substitution - industry wide. Substituting the ceramic fiber for up to 10.5% asbestos used in these coatings, cost increase to these products would be substantial. If the coating materials which we produce have to be deleted from the line due to no acceptable asbestos replacement, figures from fiscal year 1976 show that 5,588 million dollars in revenue will be lost annually by our company."

ITEM 3

Excerpts from "Amendments to Asbestos Standard" (40 CFR, Part 61) promulgated by the EPA (43 CFR, No. 118, p. 26372, 26373, June 19, 1978):

"Several commenters, however, requested that EPA exempt from the spraying restrictions certain bituminous- and resinous-based asbestos-containing coatings. These coatings are typically used as roofing compounds, waterproofing of insulation exposed to the weather, automobile undercoatings, and industrial maintenance coatings.

Based on information supplied by the commenters, there are no acceptable substitutes available for these uses of asbestos. Among the most likely substitutes which have been investigated are glass, cotton, wood cellulose, mineral wool, hemp, and other types of inorganic and organic fibers; gelling and thickening agents; clay thickeners, including attapulgite; ground cork; styrofoam; ground rubber; vermiculite; feldspar; polyethylene fibrous powders; and ceramic fibers. Generally, these substitutes have been found to be unacceptable because of unsatisfactory durability; insufficient bulk; unsatisfactory qualities related to fibrous reinforcing, homogeneity, and adhesiveness; agglomeration during spraying; and settlement in the container over time. Furthermore, if asbestos fibers are released during application of the coatings, during their service life, or during demolition or renovation, the fibers will not remain airborne because they are encapsulated by droplets of the binder and are too heavy to remain suspended.

Because there do not appear to be acceptable substitutes available and any beneficial environmental impact resulting from the prohibition of this use of asbestos would be negligible, the spraying of materials in which the asbestos fibers are encapsulated by a bituminous or resinous binder and which are not friable after drying is exempt from the provisions of §61.22 (e) of the promulgated amendments."

FLINTKOTE

DATE March 8, 1978

SUBJECT C-13-C4 WITH & WITHOUT ASBESTOS

TO Mr. Jim Hay FROM John Tamanen

Asbestos is used in asphalt emulsions to provide reinforcement and aid in fire retardancy. Asbestos has high water or oil absorption, does not melt and will not burn or contribute to a fire.

Organic fibers such as cellulose, polyethy lene, nylon or polyester as well as fiber glass or mineral wool, can be used to make fibrous asphalt emulsion products. They can be used in combinations or alone but none have the same characteristics as asbestos. Organic and some mineral fibers will melt or burn at elevated temperatures, generally have a low water or oil absorbancy and can contribute as fuel to a fire.

We have made a few samples of C-13-C4 using blends of fiber glass and organic fibers. They do show some promise as far as manufacturing procedures and workability are involved. Further work is needed to determine storage stability, weathering characteristics and fire retardancy.

John Tamanen

John Tamanen

JT:rb

cc: Mr. W. Bradley

FORM 682 M

ITEM 5

Chevron

Chevron Research Company

A Standard Oil Company of California Subsidiary
576 Standard Avenue, Richmond, CA 94802

J. H. Macpherson
Vice-President

September 19, 1978

Mr. Harrison B. Rhodes
Union Carbide Corporation
Metals Division
P.O. Box 579
Niagara Falls, New York 14302

Dear Mr. Rhodes:

We understand that you plan to testify at the November 8, 1978, public hearing of the Occupational Safety and Health Standards Board relating to asbestos-containing products. In response to your request for information on substitutes for asbestos, we have the following comments:

For several years now we have been actively searching for an asbestos replacement in our asphalt-based coatings. We have evaluated a variety of materials, but so far have found none that has the same cost/performance effectiveness as asbestos in our products.

Asbestos fibers serve two purposes in our coatings:

1. It gives the freshly applied coating a thixotropic consistency that allows the buildup of a thick film without sagging.

2. It reduces the alligatoring of the asphalt film.

We have tried various pigments and gelling agents. Pigments, such as mica, talc, slate flour, and carbon black, by themselves do not provide the thixotropic characteristics desired. Thickening agents do impart thixotropic structure to the liquid; but they do not give the same sag resistance and film build.

Polyethylene and polypropylene fibers also have been evaluated. These are advertised as asbestos substitutes. However, some of them could not be mixed into the coatings because of incompatibility. Others did not have the required sag resistance. The storage stability of the coatings made with these materials was also a problem. Due to cost and application problems, asphalt-polymer combinations have been eliminated as practical coatings.

We expect to continue the evaluation of various materials as asbestos substitutes. However, at present we have no practical substitute for asbestos in our coatings.

Very truly yours,

J W Macpherson

Sandblasting Report

ATTACHMENT II

California Department of Health
Report on Sandblasting of a Maintenance
Coating Containing Asbestos

Due to logistics problems the final version of this report was not received in time to be included. It will be submitted directly to the Executive Officer of the Standards Board for attachment to this report.