PLAINTIFF'S EXHIBIT
Union Carbide 225

Calidria ASBESTOS
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UNION CARBIDE
THE DISCOVERY COMPANY

THE SAFE USE OF "CALIDRIA" RG-244

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1. Introduction

Asbestos has received a great deal of attention and publicity in the last several years and has become the first substance covered by new OSHA health regulations. Unfortunately, much of the media treatment of the subject has been emotionally oriented and distorted and in some cases has bordered on the sensational and untrue. Many users of asbestos and products containing asbestos have been mislead regarding the safety of asbestos and what is needed to comply with the OSHA requirements.

This summary has been prepared to present the question of asbestos toxicology in logical perspective. It covers asbestos toxicology in general and the key features of the OSHA regulations. Dust count data are presented for polyester manufacturing plants using RG-244 and for fabricators during the spraying of the resin and the grinding of the resultant laminates. The current status of the silica regulations is noted. Dust control methods are summarized.

2. Asbestos Toxicology

Asbestos is a generic term covering six naturally occurring fibrous minerals. It includes chrysotile, crocidolite, amosite, anthophyllite, tremolite, and actinolite. Chrysotile is by far the most widely used variety and accounts for more than 95% of world production. It is the only type produced in substantial quantities in the United States and Canada. Also of commercial importance are crocidolite and amosite from Africa and anthophyllite from Finland.

It is accepted that asbestos, like many other foreign bodies, can cause disabling lung damage which for asbestos is commonly referred to as asbestosis. It is important to note, however, that asbestosis and statistical excess occurrences of bronchogenic carcinoma (lung cancer), the two most common asbestos-related diseases, have occurred only in workers with long-term exposures to massive concentrations of asbestos dust. The risk of this type of exposure is usually in asbestos mines and mills and in large manufacturing operations that use quantities such as 20,000-30,000 pounds per day. Long-term, massive exposures are, of course, not typical of polyester resin manufacturing operations utilizing RG-244 where only 300-400 pounds are dumped a couple of times a day.

Much has also appeared in the public press regarding the relationship between asbestos and mesothelioma, a rare type of cancer of the pleura. In almost all cases where there is a strong statistical relationship between mesothelioma and the inhalation of asbestos, crocidolite and/or amosite have been involved. Where asbestos exposure has been limited to chrysotile asbestos (RG-244 is chrysotile) there is strong evidence that no excess mesotheliomas will occur.

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Finally, there is no evidence that the general public is in any danger from the amount of asbestos fiber in the community air. The U.S. National Academy of Science states in an October 1971 publication, "Asbestos - The Need For And Feasibility of Air Pollution Controls:"

> "at present, there is no evidence that the small number of fibers found in most members of the general population affect health or longevity."

This does not, however, preclude the need for definition and control of man-made emissions into the atmosphere. The current OSHA regulations relating to the work area and the forthcoming EPA regulations protecting the atmosphere are intended to provide this control.

3. OSHA Regulations

After extensive hearings, a new standard for Exposure to Asbestos Dust was published in the Federal Register, Volume 37, No. 110 on Wednesday, June 7, 1972. The basic exposure standard is an 8-hour time-weighted average (TWA) of 5 fibers, longer than 5 micrometers, per cubic centimeter of air. The fiber limit is to be reduced to 2 on July 1, 1976. A peak concentration of 10 fibers per cc is not to be exceeded at any time.

Note particularly the use of the time-weighted average over the eight-hour shift. An operator performing one or two short additions of RG-244 per shift, as is typical of polyester producers, would have his exposure during this dumping time averaged with zero (or a low-background level) for the rest of the shift. It is important that this concept be understood for interpreting the effect of intermittent exposures.

Improper interpretation of the regulations has created many misconceptions about the equipment and procedures needed to use asbestos. If exposure limits are not exceeded, there are no further compliance requirements except for medical examinations. Interpreted literally, medical examinations are required for all employees in any "occupation exposed to airborne concentrations of asbestos fibers." Some definition of "exposed" is necessary since evidence indicates that small amounts of asbestos fiber have existed in the atmosphere for millions of years. The source of these fibers would be from the weathering of naturally occurring surface outcrops. In its criteria document on asbestos, NIOSH recommended that "exposed to asbestos" be defined as "average exposures above one fiber per cc or peak exposures above five fibers per cc." A number of large asbestos users have adopted this as a guideline in their operations.

Respirators and special clothing are required in the construction trade for the spray application of insulation and fireproofing materials, and for the removal of such materials. This special protection is not required for any other use of asbestos unless exposure limits are exceeded. This is also true for other items such as specially equipped tools, product limitations, change rooms, clothes laundering and waste disposal.

4. "Calidria" RG-244 in Polyester Resin

During the last six months, Union Carbide has made asbestos dust count measurements at eight major polyester processing plants. Counts have also been made during the spraying of resin containing RG-244 and during the sanding and grinding of parts produced from such resin. In all cases, sampling and counting were done with the equipment and techniques prescribed in the OSHA regulations.

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Resin Compounding Operations:

In the manufacture of polyester resin with RG-244 as the thixotropic agent, 10-50 bags of RG-244 are normally dumped into the resin in the thin tank. This gives a concentration in the resin of 0.5-1%. Typically, the dump takes place over a 10-30 minute period several times a day.

The results of dust counts taken in the breathing zone of the operator at eight manufacturing locations are shown in Table I. Samples were collected during the dumping of the bags of RG-244 and represent ceiling concentration (not TWA) fiber counts. Examination of the data shows that in all cases the asbestos dust levels were far below the allowable ceiling concentration of 10 fibers/cc. >5μ prescribed in the OSHA regulations.

Normally, the operator makes only one such dump in his 8-hour shift so that the peak levels shown would be averaged with much lower values in finding his time-weighted-average (TWA) exposure. For example, if the operator were exposed to the highest level found, i.e., 2.8 fibers/cc., for even as much as one half hour during the dumping operation and to a background level of 0.5 fibers/cc. for the other seven and one half hours of his shift, his time-weighted average would be:

$$TWA = \frac{(0.5)(2.8) + (7.5)(0.5)}{8} = 0.7 \text{ fibers/cc. } >5\mu$$

This is well below both the current 5 fibers/cc. and the 1976 level of 2 fibers/cc.

The OSHA regulations prescribe special precautions for the disposal of empty asbestos bags and containers if in any reasonably foreseeable use and handling dust levels above the allowable limits will be generated. In two of the plant surveys, dust counts were made during the handling of the empty RG-244 bags. The results given in Table II show levels well below the OSHA limits. As with the dumping data given previously, these values were obtained during active handling of the bags and would represent peak rather than time-weighted average exposure.

All of the data presented in Table I and II indicate that "Calidria" RG-244 asbestos as typically handled in polyester manufacturing, gives dust levels well below OSHA limits. As long as this is true, dust masks, protective clothing, change rooms, warning signs, and special bag disposal are not required. Dust monitoring is required to determine that levels are within the OSHA standards.

Spraying Polyester Resin Containing RG-244:

It would not be expected that spraying a liquid resin containing 0.5-1% of "Calidria" RG-244 would create any airborne asbestos dust. Samples were collected during a spraying operation; and no asbestos fibers were found.

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TABLE I

AIRBORNE ASBESTOS DUST COUNTS(1) DURING DUMPING OF RG-244

Plant	Data Reference	Description of Operation: Bags Dumped	Dump Time (Min.)	Sample Time (Min.)	Special Ventilation(2)	CEILING Concentration Fiber Count (Fibers/cc. >5μ)
A	---	10	10	10	None	0.7
B	1929-46-2	14	9	9	None	1.2
C	1929-30-2	15	21	21	Hood over thin tank opening	0.7
D	1929-56-1	36	12	12	None	2.4
E	1929-50-3	15	8	8	None	0.5
F	1929-26-3	45	20	20	None	1.6
G	1929-24-2	10	24	24	Hood over mixing area	0.8
H	1929-16-1	28	15	15	None	2.8

(1) All samples collected in the breathing zone of the operator dumping the RG-244.

(2) Special ventilation refers to dust collection equipment at or near the dumping area that is specifically intended for dust control during the dumping operation. All plants had varying measures of overall building ventilation.

TABLE II

AIRBORNE ASBESTOS DUST COUNTS DURING EMPTY BAG REMOVAL

Plant	Data Reference	Description of Operation	Sample Time (Min.)	Fiber Count (Fibers/cc. >5μ)
A	---	Sample taken 3 feet above waste disposal drum for empty bags. (During dumping.)	10	0.4
B	1929-40-3	Directly over empty bag stacking area. Taken during dump.	23	0.6
B	1929-40-5	Empty bag storage area. Taken during dump as bags were put in.	24	0.4

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Sanding and Grinding of Polyester Resin Containing RG-244:

The main use of thixotropic polyester resin in the United States is in the manufacture of fiberglass reinforced boats, shower stalls, and other similar large objects. These products contain 10-30% fiberglass and the remainder is mainly resin. The overall laminate thus generally contains only 0.4-0.7% of RG-244.

In the manufacture of such objects, the edges and some portion of the surface are generally sanded or ground with a rotary disc grinder. This generates a cloud of visible dust and it is necessary to determine whether any free asbestos fiber is present in the cloud. To check this, samples were collected at four locations during the sanding or grinding of finished polyester parts. The results, given in Table III, show no free asbestos fibers in any of the operations.

All of these data are based on Millipore filter counts by the OSHA procedure. In addition to this, larger samples of airborne dust were collected during Operation K and were studied by special staining and microscopic techniques with various types of illumination at magnifications up to 1000X. These, too, failed to reveal any free asbestos fiber.

These data essentially confirm that polyester resin containing the usual levels of RG-244 will not yield asbestos fiber counts exceeding the allowable values.

5. Silica Toxicology

Silica, including amorphous silica, is a "target" hazard of the U.S. Occupational Safety and Health Administration. The "Criteria Document," which is the first step in updating the regulations on silica, is in the late stages of preparation by the National Institute of Occupational Safety and Health (NIOSH). The current exposure limit (TLV) for amorphous silica is 20 million particles per cubic foot.

6. Dust Control

Although the data presented herein indicate that RG-244, as it is typically handled in polyester manufacturing, generally gives dust levels within the OSHA standards, asbestos is an emotional subject; and the lowest practical levels are most desirable.

The best control measure for this type of operation is an exhaust collar or duct at the top of the mixing tank, so situated to create a vacuum at the manhole where the thixotrope is added. The exhaust system should be equipped with a filter to prevent the discharge of dust into the atmosphere. A system of this type should also reduce styrene fumes in the work area.

An alternate procedure is an exhaust hood over the dumping port. Union Carbide uses this type of hood in their manufacturing plant bagging operations. A face velocity for the open hood of 300 fpm and duct velocities in the range of 2500-3500 fpm work well for asbestos fibers.

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TABLE III

AIRBORNE ASBESTOS DUST COUNTS(1) MADE DURING SANDING OR GRINDING OF POLYESTER PARTS CONTAINING RG-244

Plant	Data Reference	Description of Operation	Sample Time (Min.)	Special Ventilation(2)	CEILING Concentration Fiber Count (Fibers/cc. > 5μ)
I (Furniture Molder)	1929-40-4	Operator sanding finished polyester furniture parts containing ~0.5% RG-244.	23	Hood directly over grinding area.	0
J (Boat Yard)	1929-42-7	Operator edge grinding on hull containing ~0.5% RG-244. (~20% fiberglass)	12	None (Outdoors)	0
K	---	Operator edge grinding on part containing ~0.7% RG-244, 20% fiberglass.	13	None (Closed room 8'x8' 8'.)	0
(Furniture Molder)	---	Operator hand sanding polyester parts containing ~0.05% RG-244. General area sample.	45	None	<0.01
L (Furniture Molder)	---	Large power sander smoothing polyester parts containing ~0.05% RG-244.	45	Integral hood	<0.01

(1) Unless otherwise noted, all samples collected in the breathing zone of the operator during the sanding or grinding of parts containing "Calidria" RG-244.

(2) Special ventilation refers to dust collection equipment at or near the dumping area that is specifically intended for dust control during the dumping operation. All plants had varying measures of overall building ventilation.

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For small operations, an air- or fluid-operated aspirator with a flexible pickup hose can be used to remove the thixotrope from bags. This would preclude the need for cutting the end of the bag completely open, and would eliminate the subsequent dumping and bag-shaking operation. The dust from the discharge of an air-operated aspirator would, of course, require adequate collection.

Empty bags can be disposed of by packaging them in plastic bags. Each bag of RG-244 is over-slipped with a polyethylene bag which can be used for this purpose. Larger plastic bags are commercially available if the RG-244 bags are not saved. Waste bags can subsequently be burned or given to a regular trash pickup service.

Dust which accumulates on tanks, floors, etc. should be removed with a vacuum hose or washed down with water. Blowing with air can only relocate the dust and may cause airborne concentrations to exceed the prescribed limits.

Excessive dust can be created by poor work or housekeeping practices. Workers should be instructed to handle dusty materials with care and to avoid undue creation of dust by shaking bags, throwing them, etc. Respirators can be worn if desired and should be approved for the dust encountered. Except for special circumstances, respirators cannot be used to achieve compliance with OSHA regulations.

Additional information about the safe use of RG-244 can be obtained by calling 716-278-3376 or writing:

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