PLAINTIFF'S EXHIBIT
tabbies®
UC-21

"CALIDRIA" ASBESTOS RG-244

HEALTH AND OSHA INFORMATION

October 1, 1977

Union Carbide Corporation
Mining and Metals Division
"Calidria" Asbestos
Marketing and Technology Department
Niagara Falls, New York

INTRODUCTION

The Williams-Steiger Occupational Safety and Health Act was passed in 1970 with the stated objective of assuring every American worker a safe and healthy workplace. The first health standard promulgated under this act covered exposures to airborne asbestos and went into effect on June 7, 1972. OSHA proposed extensive revisions of the regulations on October 9, 1975. The proposal has been going through a variety of administrative procedures including feasibility and inflationary impact studies. The revised version is expected sometime in the first half of 1978.

Asbestos has received a great deal of attention and publicity in the last several years. Unfortunately, much of the media treatment of the subject has been emotionally oriented and distorted and, in some cases, bordering 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.

The information presented in this folder has been collected as a service to "Calidria" asbestos users. It is intended to help put both the health and OSHA compliance questions in a reasonable perspective. Included are:

1. A summary of the main provisions of the OSHA Asbestos Standard and a copy of the regulations.

2. Airborne asbestos fiber count data obtained by Union Carbide at a variety of industrial locations during the blending of RG-244 into polyester resin, the spraying of the asbestos containing resin, and the sanding and grinding of the finished parts.

3. Two pamphlets, "What You Should Know About Asbestos And Health" and "Asbestos and Health" published by the Asbestos Information Association/North America. The first is an employee oriented discussion of both health and OSHA while the second addresses the health question. Additional copies are available on request.

4. A Material Safety Data sheet and analytical data on "Calidria" asbestos.

OSHA REGULATIONS

Introduction

After extensive public hearings, a Federal standard for Exposure to Asbestos Dust was published in the Federal Register, Volume 37, No. 110 on Wednesday, June 7, 1972. A copy of this standard (1910.1001) is included with the literature at the back of this booklet.(1)

---

(1) Some states have established their own regulations and enforcement programs and have been certified by OSHA. Generally, these regulations are identical to 1910.1001 but occasionally there are important differences. This discussion applies only to the Federal standard. Information on any particular state is available upon request.

A 10823

Basically, the standard can be divided into the following five major categories:

1. Standards:

   Defines the allowable airborne asbestos fiber content in the workplace.

2. Monitoring:

   Defines the method of collecting samples and measuring the airborne fiber concentration.

3. Methods of Compliance:

   Defines acceptable procedures to met the allowable limits.

4. Medical:

   Specifies frequency and type of medical examinations required.

5. Warning Signs and Labeling:

   Specifies when warnings are necessary and the wording of such warnings.

The essential features of these categories are discussed in the remainder of this section. Before looking at these, however, it should be made clear that in the most basic sense the regulations require that every place of employment where asbestos is used must be monitored to determine the exposure level of airborne asbestos fibers. If the levels are well within the allowable limits, the only additional requirements are those relating to medical examinations. If the levels are not clearly within compliance, all provisions of the regulations apply. There has been a great deal of confusion on this distinction, occasionally even with OSHA field inspectors.

Standards

The present OSHA standards set a maximum exposure to airborne asbestos fiber of length longer that 5μ of:

1. An 8-hour, time-weighted average (TWA) of 2 fibers/cc.

2. A ceiling concentration of 10 fibers/cc.

Note particularly the use of the time-weighted average over the 8-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 the dumping time averaged with zero (or a very low background level) for the rest of the shift. This, obviously, tends to greatly reduce the 8-hour TWA.

A10824

Monitoring

The regulations require an initial monitoring to determine whether the workplace meets the required levels. Thus:

> "Within six months of publication of the regulations (June 7, 1972), every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine where every employee's exposure to asbestos fibers is below the prescribed limits."

Monitoring usually is done by the membrane filter/personal air sampler, which can be obtained from a number of manufacturers.

The personal air sampler draws workplace air onto a filter which collects the particulates and fibrous dust in the air. This filter is then placed under a microscope and the number of fibers counted. After the count is complete, the actual fiber concentrations, expressed as fibers per cubic centimeter of air, are calculated by formula.

After the initial monitoring, the regulations state:

> "...samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section."

The section that has been underlined shows that if the initial monitoring give levels that are well below the allowable limits and no change is made in the method of operation which would increase dust levels, no further monitoring is required. It is a good and recommended practice, however, to monitor at regular intervals to make sure that the limits are being met.

It should also be understood that you cannot be cited legally for exceeding the allowable limits on the basis of your own monitoring. OSHA must base any citations issued on their own tests.

Methods of Compliance

If monitoring shows a plant or operation to be in excess of the limits, a number of ways are prescribed to bring it into compliance. These include, but are not limited to, engineering controls such as isolation, enclosure, exhaust ventilation, and dust collection. Certain work and housekeeping practices and waste disposal procedures are specified. Respirators, special clothing, and change rooms are also required under certain conditions.

It is most important to understand that these compliance procedures are required only if the allowable airborne asbestos fiber limits are being exceeded or can be expected to be exceeded under reasonably foreseeable circumstances. They are not automatic requirements that apply wherever asbestos is present.

A 10325

Medical Examinations

Preplacement, annual, and termination medical examinations must be provided or offered by the employer for any employee "... engaged in occupations exposed to airborne concentrations of asbestos fibers." These medical records must be kept for 20 years and are available to the employee's physician.

This section has proved to be one of the most confusing in the regulations since it does not define any cutoff level below which examinations are not required. Finally, after five years of urging, OSHA issued a clarification. "Exposure to asbestos" is specified as any exposure which exceeds 0.1 fiber/cc >5μ in an 8-hour time-weighted average or a peak level greater than 0.5 fiber/cc >5μ based on a 15-minute sample period.

Caution Signs and Labeling

The regulations require that:

> "Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section."

Wording for the signs is also specified.

There have been some cases where the OSHA inspectors have taken this to mean signs are required at any location where asbestos is present, regardless of whether or not the exposure limits are exceeded. Although this is clearly incorrect, there has been a tendency to post the signs and not contest the citation.

The regulations also require that:

> "Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released."

Wording for these labels is also specified.

A10326

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/5

AIRBORNE ASBESTOS FIBER COUNTS

Introduction

This section presents air sampling data obtained in a variety of situations, mostly for typical industrial operations. All samples were collected on Millipore filters and counted at 400X with phase contrast illumination in accordance with OSHA procedures. Particles which satisfied the L/D >3 criteria but which, in the judgment of an experienced counter, could not possibly be asbestos were not included in the counts.

Presentation of Data

Table I shows "Calidria" asbestos RG-244 fiber counts obtained at 8 different polyester manufacturing plants. Typically, several hundred pounds of RG-244 are dumped into the thin tank in a 10-25 minute period. These samples obtained during the dumping operation thus represent ceiling concentrations. They would normally be averaged with considerably lower numbers for the remainder of the shift when asbestos is not being handled to arrive at the TWA. The highest fiber count found at these eight locations was 2.8 fibers/cc which is well below the allowable limit of 10 fibers/cc.

Table II shows the fiber counts at three of the same manufacturing locations at the empty bag collection point. These values are also quite low.

Table III shows airborne fiber counts for "small-scale" addition of RG-244 as occurs in a variety of compounding operations. The levels found ranged from 0.4 to 2 fibers/cc.

Table IV shows the airborne asbestos fiber count data obtained during the spraying of a variety of asbestos containing resins. Much of the data are for polyester resins, but epoxies and alkyds are also included. The asbestos content of the resins ranged from 0 to 12% by weight. The highest count obtained was 0.6 fiber/cc.

Polyester resin parts are often finished by sanding or grinding. Table V shows the airborne asbestos fiber counts obtained during a number of industrial finishing operations on resins with up to~3% asbestos. The highest reading obtained here was 0.4 fiber/cc.

Table VI gives the results for a laboratory study where resin plaques containing a variety of fillers were abraided with an electric hand grinder in a small closed room. Even under these extreme conditions, the fiber counts were quite low with 1.2 fibers/cc, the highest observed.

A 10827

AIRBORNE ASBESTOS FIBER COUNTS[1] -

"LARGE-SCALE" DUMPING OF RG-244 (~100-450 lb./Batch)

Plant	Data Reference	Description of Operation: Bags Dumped	Dump Time (Min.)	Sample Time (Min.)	Special Ventilation[2]	CEILING Concentration Fiber Count (Fibers/cc. >5u)
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
I	2119-8-9	13	8	8	None	0.4
J	2119-6-23	20	10	10	None	0.4
K	2119-12-9	34	72	72	None	0.9

[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 FIBER COUNTS -

EMPTY BAG REMOVAL

Plant	Data Reference	Description of Operation	Sample Time (Min.)	Fiber Count (Fibers/cc. >5u)
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
J	2119-6-23	Sample taken during bag disposal and clean up.	24	0.1

A 10828

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/7

TABLE III

AIRBORNE ASBESTOS FIBER COUNTS[1] - "SMALL-SCALE" DUMPING OF RG-244 (1-25 lbs./Batch)

End Use	Pounds Dumped	Dump Time (Min.)	Sample Time (Min.)	Special Ventilation[2]	Ceiling Concentration Fiber Count (Fibers/cc >5μ)
Furniture Molding	1	10	10	None	1.5
" "	12	2.5	2.5	None	1.1
" "	1	11	11	None	2.0
" "	6	8	8	Good Hood	0.9
Gel Coat Mfg.	9	25	25	None	0.7
" " "	3	3	3	None	1.2
Artificial Brick Mfg.	5	4	4		0.9
" " "	1.5	10	10	Good Hood	0.4
Roof Coating Mfg.	12	13	13	None	1.1
Gel Coat	10.5	13	13	None	0.3
Polyester	25	11	11	Outdoors	0.1
Epoxy	6.3	41	41	None	1.0
"	6.3	39	39	None	2.0
Gel Coat	20	10	10	None	0.6*
Putty	20	35	35	Exhaust Fan	2.1
"	20	34	34	Exhaust Fan	0.2
Sealant	15	19	19	None	0.2
Caulking Compound	6	3	3	None	0.5
" "	6	11	11	None	0.2
Patching Compound	3.3	10	10	None	0.7

[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.

* Sample taken during dump and bag disposal.

A 10829

TABLE IV

AIRBORNE ASBESTOS FIBER COUNTS -

SPRAYING OF RESIN BASED SYSTEMS CONTAINING ASBESTOS

Sample Designation	Commercial Application	Date	Binder	Approximate Wt. % Asbestos[1]	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Fiber Concentration (Fibers/cc >5 μ)
I - POLYESTER RESINS								
A. General Purpose Laminating Resins								
69	Boat manufacture.	12/7/72	General purpose laminating resin.	0.5	Air-supported chopper.	Operator spraying molds with resin & chopped glass.	24	0.6
L-13	"	10/31/74	"	0.5	"	Operator spraying resin & chopped fiber glass. (Includes roll-out time.)	16	0.1
N-28	"	"	"	0.5	"	Operator spraying resin & chopped fiber glass.	5	0.4
N-30	"	"	"	0.5	"	Operator spraying resin & chopped fiber glass.	4	0.4
N-34	"	10/8/74	"	0.5	"	Operator spraying mold with resin. (No glass.)	55	0
0	"	"	"	0.5	"	"	52	0.03
I-12	"	"	"	0.5	"	"	35	0.1
B. Chemical Resistant Resins								
J-21	Fiber-glass pipe manufacture.	8/13/74	Chemical resistant resin.	1.4	Airless.	Operator adjacent to automatic spray machine coating 28' mandrels.	23	0.1
H-26	"	"	"	1.4	"	Operator wiping mandrels. In area near spraying.	14	0.4
J-5	Ship coating.	10/3/74	Chemical resistant resin + chopped fiber glass.	0.7	Air-supported wand.	Roll-out man. In spraying area about 1/4 of time.	65	0.4
J-7	"	"	"	0.7	"	Operator spraying ship hull in dry dock.	41	0.4
H-28	"	"	"	0.7	"	"	23	0

[1] Based on total formulation as sprayed.

A10830

TABLE IV (continued)

AIRBORNE ASBESTOS FIBER COUNTS -

SPRAYING OF RESIN BASED SYSTEMS CONTAINING ASBESTOS

Sample Designation	Commercial Application	Date	Binder	Approximate[1] Wt. % Asbestos	Spray Gun Type	Operation	Sample Time (Min.)	Airborne Asbestos Fiber Concentration (Fibers/cc > 5μ
II - EPOXY RESINS								
A. Filled Epoxy								
K-8	Ship coating.	10/2/74	Epoxy primer.	1.5	Airless.	Operator spraying outside & under a ship.	33	0.2
K-10	"	"	"	1.5	"	"	8	0.2
M-10	"	"	High build epoxy.	0	Air supported.	Operator spraying side of ship from scaffold.	31	0.1
I-27	"	"	"	0	"	"	14	0.3
J-1	"	"	"	0	"	"	60	0.03
B. Epoxy - Coal Tar								
M-45	Coating dry dock.	10/1/74	Epoxy Coal-tar, solvent.	1	Airless.	Operator spraying side of dry dock from suspended platform.	11	0.2
M-1	"	"	"	1	"	Operator spraying side of dry dock from fixed scaffold.	38	
K-3	Coating pipe interiors.	"	"	1	Air-supported wand.	Operator spraying interior of 3", 6" and 12" diameter pipe.	37	0.1
III - ALKYD RESIN PAINT								
H-7	Painting building exterior	10/6/74	Alkyd resin.	12	Airless gun.	Operator spraying building exterior wall.	9	0
M-35	"	"	"	12	"	"	5	0.06

[1] Based on total formulation as sprayed.

A10851

TABLE V

AIRBORNE ASBESTOS FIBER COUNTS -

GRINDING AND SANDING OF RESIN-BASED SYSTEMS CONTAINING ASBESTOS

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

A10832

TABLE VI

AIRBORNE ASBESTOS FIBER COUNTS

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

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

A-03633

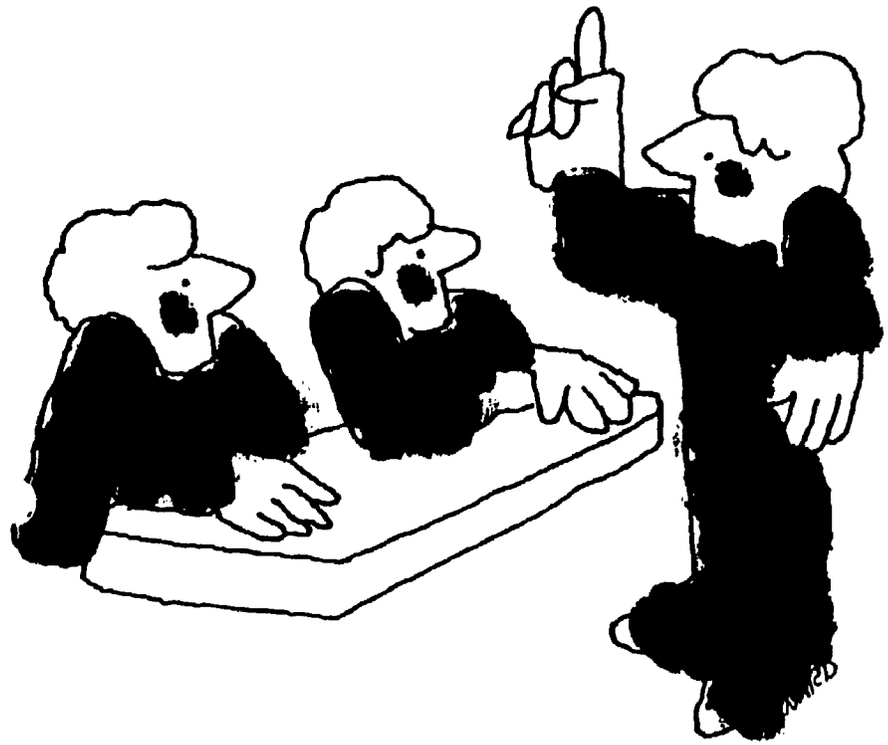
LITERATURE AND REGULATIONS

A 10834

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/13

What You Should Know About Asbestos And Health

A 10835



AIA
NORTH AMERICA

ASBESTOS INFORMATION ASSOCIATION
1745 Jefferson Davis Highway,
Arlington, Virginia 22202

5/9-79

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/14

Frankly Speaking

You certainly are important to your family and loved ones, and you are important to the company. It makes good sense for the company to do everything possible to protect you in your working environment, and for you to take every precaution to avoid possible hazards to your health.

If your work involves the use of asbestos or asbestos-containing products, you should be aware of:

- What the health hazards can be.
- What obligations your employer has to protect you.
- What you can do as an individual to protect your own health and that of your fellow employees.



These are the Facts

Exposure to asbestos fiber can increase the risk of developing certain diseases over a period of years. The four diseases associated with inhalation of asbestos fiber are: asbestosis — a non-malignant scarring lung condition; cancer of the lung, and to a lesser degree, cancer of the digestive tract; and mesothelioma — a rare cancer of the lining of the chest or abdominal cavities.

Reduction of asbestos dust exposure is at present the only known method of preventing disease among asbestos industry workers. Experience has shown that when dust levels are low, the risk to the worker and the incidence of asbestos-related disease is low.

Now . . . About Smoking

It has been established that cigarette smoking **greatly** increases the risk of developing lung cancer in persons exposed to asbestos. Some risk may also be present in nonsmoking asbestos industry workers.

A 16316



Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/15

If You Work in a Plant or Mine

Employees in asbestos mines, mills, or product manufacturing plants will be exposed to airborne asbestos fiber. But, when dust levels in mines, mills and factories are properly controlled, the asbestos content of the air will be low and within safe levels, and will not be a hazard to workers.



If You Work in Field Operations

Most finished asbestos-containing products, when correctly used, will not produce dust levels high enough to be a hazard to workers. In more than 90% of the asbestos-containing products made in the United States, the asbestos fibers are "locked in" the product by means of cement, plastic or other binders. Consequently, the fibers are not easily released into the air, except during sawing or certain other machining operations. The tear-out, removal or demolition of old asbestos-containing insulations also can release fibers. Such operations must be carried out with approved methods of dust suppression and control.

A 16837



Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/16

Regulations to Protect You

To insure the safety of all, occupational standards for exposure to asbestos dust have been established by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor. These standards are designed to protect you from exposure to potentially hazardous amounts of asbestos dust and are being carefully observed by the company.

Here is what these standards provide:

1 A SAFE WORKPLACE
Your employer is required to make sure that no employee is exposed to more asbestos dust than permitted by the government standard. Your company will exert every effort to keep levels not only below permissible limits, but as low as possible.

2 IN CASE OF RISK
If exposure limits are exceeded, the employee will be notified by his employer, and will be informed of the corrective measures being undertaken to reduce his exposure to permitted levels.

3 CORRECTIVE ACTION
Engineering controls and safe work practices will be the approved methods of correction.



4 IN THE MEANTIME
While corrective measures are being taken, the employee will be protected by other means, which may include the wearing of an approved respirator provided by his employer, or by shift rotation.

5 TEMPORARY MEASURES
The use of respirators or shift rotation to achieve proper dust control will be permitted only (a) during the time necessary to install engineering controls or to institute safe work practices, (b) in situations where such controls or practices are not technically feasible, or (c) in emergencies.

6 AND ONLY IF YOU PASS THE MEDICAL
No employee will be assigned to a task requiring the use of a respirator if his most recent yearly medical examination indicates that he would not be able to function properly while wearing one, or if the wearing of the respirator would create a hazard to the employee's health or safety.

7 SPECIAL PROTECTION WHEN NEEDED
Protective clothing, change rooms, and separate clothes lockers will be provided for employees in situations where exposure standards are exceeded.



A-3 3 6

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/17

8 CHECKING THE AIR

Monitoring of workplace air will be conducted by the employer to assure that government standards are being met. Employees may review results of the monitoring in their particular job areas.

9 SIGNS TO GUIDE YOU

Caution signs will be posted in work areas where airborne levels of asbestos may be in excess of the exposure limits, and where respiratory protection and special handling precautions are required. Employees should obey these signs at all times.

10 CAUTIONS ON PRODUCTS, TOO

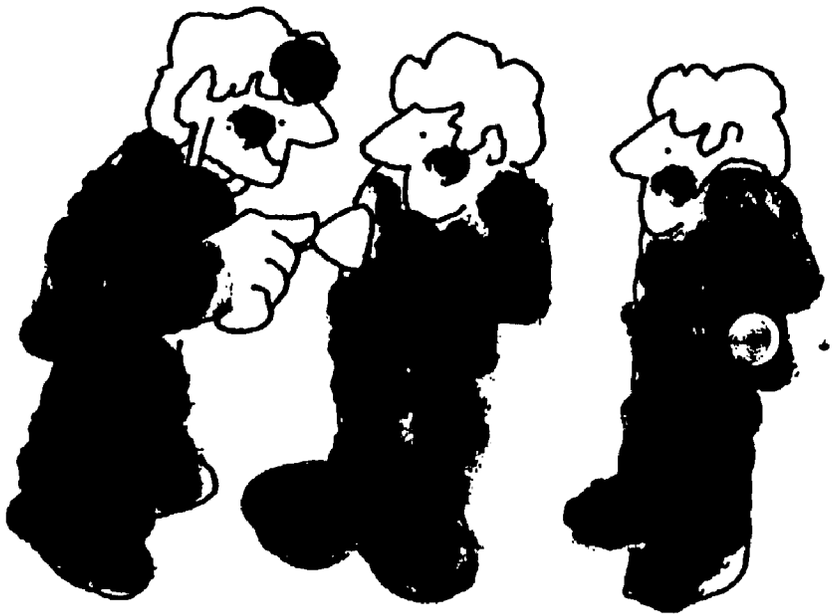
Caution labels will be placed on asbestos-containing products which, during any reasonably foreseeable use, handling, application, machining or disposal may release asbestos fiber into the air in concentrations that exceed the exposure limits.

11 ANNUAL CHECK-UPS

The employer, at no cost to the employee, will provide yearly medical examinations for employees exposed to asbestos dust. Pre-employment and termination medical exams also are provided.

12 COUNSELING AND RESULTS AVAILABLE

Results of each employee's medical examination will be reviewed with him by a physician, and, at the worker's request, his own medical exam records will be made available to his family physician.



And, Most Important . . .

On the advice of medical specialists: If you work with asbestos and you do smoke cigarettes, quit smoking! If you work with asbestos and do not smoke, don't start!

Your family and the company need you and your special abilities. Guard your health in every way, but particularly where cigarette smoking is concerned.

If you don't smoke cigarettes now and never have smoked them regularly, statistical studies show you have only a small risk of getting lung cancer as an asbestos worker.

After You Leave Work

You also should take precautions to prevent taking asbestos home on any work clothes or other materials in order to protect members of your family from possible exposure to asbestos dust.

To reduce the possibility of carrying asbestos fibers home on your person and clothing, facilities for showering and changing from work to regular clothes may be provided by your employer. Work clothing taken home for laundering should be carried in a closed bag or container and then washed separately from other family clothing.

Never take loose fiber home. Your family should not be needlessly exposed to asbestos dust through any carelessness on your part.



A-33

What Else Can You Do?

Industrial safety and health can never be the responsibility of only one person. Both you and your employer must work together to provide a safe and healthy environment.

- For safety in specialized areas, detailed work practices must be instituted to make sure we are complying with government regulations. As an employee, it is your duty to follow these work practices at all times. Never take shortcuts that may endanger your health and that of others.
- If you see a possible hazard that your employer may have overlooked, bring it to his attention.
- If you can suggest more efficient and safer work practices, do so. If you are not sure how to handle a material or perform an operation without creating dust, talk with your supervisor first.



REMEMBER

- Asbestos fiber may be hazardous to your health, and exposure to it, over a period of time, may increase your risk of developing asbestosis, cancer of the lung or digestive tract, or mesothelioma.
- Every precaution should be taken by you and your employer to keep dust levels low and to avoid unnecessary exposure.
- The asbestos industry is working hard to control dust exposure and to alert every worker to proper safety precautions. Government and company regulations designed to protect you and other workers against exposure to asbestos dust should be strictly followed by everyone.
- The vast majority of the thousands of finished asbestos products are not hazardous when properly handled or used, but workers who are engaged in their manufacture, fabrication or installation should be aware of possible dangers. Don't be careless — urge your fellow workers not to be.
- Asbestos is used in some 3,000 products daily throughout the world . . . products that help prevent and control fire in our homes, schools, factories, offices, hospitals and theaters . . . products that help stop our cars and trucks . . . products that save fuel and energy in this important time of conservation. If we are to continue making these much-needed products, it is important that you and your employer cooperate in maintaining the highest standards of safety and health on the job.

A 10340

Published by AsbestosClaims.Law
asbestosclaims.law/library/15306/19

ASBESTOS AND HEALTH

Asbestos, used since antiquity, has widespread and important applications in our modern technological society. Approximately 3,000 different products containing asbestos are in daily use throughout the world. Its increased use in the 20th century has lent urgency to the need to cope with occupational health problems related to the excessive inhalation of asbestos dust.

Such problems are not unique to the asbestos industry. Many substances and materials in common use today can be detrimental to the health and safety of industrial workers under uncontrolled conditions. A vital and widely used raw material, asbestos is but one of a number of potentially harmful substances used by industry.

Basically, the known facts about asbestos-related disease can be summed up as follows:

First, asbestos-related health risks today are almost exclusively confined to the occupational setting.

Second, the effects of excessive inhalation of asbestos are both time and dose related. This means that asbestos-related diseases may develop, generally, only after the inhalation of substantial amounts of asbestos dust over a substantial period of time. Thus, there are levels of exposure that will not result in any increased risk of disease.

Third, there is presently no evidence of risk to the general public from exposure to the minute amounts of asbestos that have been found in community air.

Fourth, because of the long latent period of asbestos-related disease, the disease being found today among some long-term industry employees is not an indication of present day conditions, but is a result of conditions existing decades ago, at a time when neither the industry, government, or the medical profession knew very much about the health effects of asbestos and even less about the proper means for their control.

These facts are well recognized by the asbestos manufacturing industry, which has made substantial progress over the years in protecting those who work with asbestos and in eliminating emissions of free asbestos fiber into the community air.

Known and Suspected Occupational Risks

There are three primary diseases known to be caused or exacerbated by prolonged and heavy inhalation of asbestos fibers. They are asbestosis, bronchogenic (lung) cancer, and mesothelioma. Prolonged heavy exposure does not necessarily result in disease and death—but there is little question that risks are significantly increased.

Asbestosis

This is an occupational disease characterized by lung scarring, and is one of the lung diseases called pneumoconioses. It is the most common of the three asbestos related illnesses and is found only among those who have worked regularly and continuously with asbestos under inadequately controlled conditions. The average time span from first exposure to the first clinical signs of asbestosis is 17 years, although some cases have been reported in as few as ten years.

Asbestosis is neither malignant nor necessarily fatal. Many asbestos workers with minor cases can and do continue to work and lead normal lives without difficulties. The asbestos

A 10841

industry has long recognized the risk of this disease and has implemented safeguards to protect workers' health.

As far as can be determined, asbestosis never has been found in the general public, even among people living in close proximity to asbestos mines and processing plants.

Bronchogenic (Lung) Cancer

A number of medical studies have linked heavy asbestos exposure with an increased risk of lung cancer. While lung cancer occurs far less frequently among asbestos industry workers than asbestosis does, under some circumstances it occurs more frequently than in the general population.

As with asbestosis, the amount of fiber to which an employee is exposed is an important factor in lung cancer development. A continuing study of workers in a British asbestos textile plant has shown that dust control measures, which had substantially reduced the incidence of asbestosis, also reduced the incidence of lung cancer among the workers to that existing in the general public. In addition, it is the considered opinion of many scientists that lung cancer will not develop in an employee if he did not first have asbestosis.

Unquestionably, factors other than heavy asbestos exposure are important in the causation of lung cancer among asbestos industry workmen. The most documented example is cigarette smoking. Studies conducted of as many as 17,500 asbestos insulation workers show that those who smoke have a much greater risk of contracting lung cancer than non-smokers in the general public, but that those asbestos industry workmen who do not now smoke cigarettes and who have never smoked regularly, have no greater risk of lung cancer than the average man-in-the-street who does not smoke.

Mesothelioma

This disease is an extremely rare cancer of the lining of the chest (pleura) or the abdominal cavity (peritoneum). It is found more frequently among those with occupational asbestos exposure than among the general population. It also has been found among people who, in the past, lived in close proximity to uncontrolled crocidolite asbestos plants or mines, and even, on rare occasions, in the households of employees who worked in crocidolite asbestos factories or mines and who presumably brought substantial quantities of this particular type of asbestos fiber into their homes on their work clothes. This has not been found to be the case with individuals exposed only to chrysotile asbestos, which accounts for 97% of the asbestos fiber used in the U.S. today.

Since the latent period for mesothelioma ranges from 30 to 45 years, it is impossible at this late date to determine precisely the exposure levels experienced by these "neighborhood" and "household" cases. However, they were probably quite high by today's standards. In any case, as technology was developed for the control of asbestos dust levels, both in the plant and out, those potentially hazardous conditions were eliminated.

A relatively small number of cases have also been reported among employees in shipyards and on construction projects who, while not working directly with asbestos, were exposed to heavy concentrations of airborne fiber by working in close proximity to those who did. Exposures of this type have been reduced by strictly enforced industrial safety devices and procedures.

The search for answers to the mesothelioma problem is complicated by a number of factors. In the first place, the number of cases being found, even today, is still relatively small. In all of Canada, for example, only 165 cases were reported in the ten-year period ending in 1968. Secondly, it appears highly likely that certain varieties of asbestos (crocidolite and amosite) are more likely to cause mesothelioma than others. Thirdly, its diagnosis and recognition are still considered problems among medical experts. It is also certain that

A 10842

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 21 of 35 asbestosclaims.law/library/15306/21

there are other causes of mesothelioma besides asbestos. Unfortunately, what those other causes might be is still unknown. Until these and other equally important factors are thoroughly investigated, the mesothelioma question will remain unresolved.

Other Tumors

Some researchers have reported higher-than-normal rates of gastrointestinal cancer among some heavily exposed industry groups. Other researchers have reported no increase of this type of cancer. The consensus of medical opinion is that the evidence is too scanty for a definitive conclusion.

Asbestos and the General Public

Medical reports of excess asbestos-related disease among occupationally exposed populations have been frequently cited by some writers, environmentalists, politicians and others as "proof" that the health of the general public is endangered by the minute amounts of asbestos dust being found in community air. "Neighborhood" and "household" cases of mesothelioma are cited extensively in this regard, as are the frequent reports of the findings of free asbestos fibers and so-called ferruginous bodies (which sometimes contain asbestos) in the lungs of some city dwellers at autopsy.

The truth is, however, that there is no evidence—either from experience or from scientific research—that anyone in the general public has ever contracted any asbestos-related disease from exposure to these minute amounts of airborne asbestos, which are many times lower than levels which have been demonstrated to result in no excess of disease in occupationally exposed populations.

This conclusion is supported by both the Asbestos Panel of the National Academy of Sciences' Committee on Biologic Effects of Atmospheric Pollutants, and the 33 member Advisory Committee on Asbestos Cancers of the International Agency for Research on Cancer, a division of the World Health Organization.

In its 1971 booklet, entitled "Asbestos: The Need For And Feasibility of Air Pollution Controls," the NAS Asbestos Panel, which consisted of seven of the nation's top experts on asbestos and health, stated that "there is no evidence that persons in the general population—without occupational, household or neighborhood exposures—have any increased risk of neoplasm, even though there may be ferruginous bodies or fibers in their lungs."

Warning against conclusions of the type frequently reached by the uninformed with regard to asbestos, the report further stated: "One cannot extrapolate from the mortality experience of, on the one hand, those who are directly and indirectly exposed to asbestos in their employment to, on the other hand, the general public, who have had moderate or slight exposures from ambient air."

The report concluded with the statement that "there is no evidence that the small numbers of fibers found in most members of the general population affect health or longevity."

The report of the IARC Advisory Committee represents the consensus of present world medical opinion on all aspects of the asbestos-health problem. Meeting immediately after the October 1972 Lyon Conference on the Biological Effects of Asbestos, the Committee, with representation from ten different countries, drafted the following opinions on asbestos-related disease and the general public:

Asbestosis: "There is at present no evidence of lung damage by asbestos to the general public. The amount of asbestos in the lungs of members of the general public is very small, compared to those occupationally exposed."

Lung Cancer: "The evidence . . . suggests that an excess lung carcinoma risk is not detectable when the occupational exposure has been low. These low occupa-

A 10843

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 22 of 35 asbestosclaims.law/library/15306/22

tional exposures have almost certainly been much greater than that to the public from general air pollution."

Mesothelioma: "There is no evidence of a risk to the general public at present."

Because of some recent controversy in the United States and Canada on this subject, the question was also examined whether there is any "evidence of an increased risk of cancer resulting from asbestos fibers present in water, beverages, food or in the fluids used for the administration of drugs." The answer of the Committee was: "Such evidence as there is does not indicate any risk."

While the conclusions of these two eminent scientific bodies should be reassuring to those concerned with the presence of minute amounts of asbestos in the ambient air, the asbestos manufacturing industry in the United States will continue in its efforts to reduce asbestos emissions so that potentially hazardous levels will never be permitted to develop in the future.

Asbestos and Health Research

Extensive medical and technical research into the health effects of asbestos and the proper means for their control is being conducted in laboratories throughout the world. A significant percentage of this research is being sponsored, co-sponsored or cooperated in by the world asbestos industry. In fact, two of the largest non-governmental sources of funds for asbestos-health research are the Institute of Occupational and Environmental Health (IOEH) in Montreal, which is sponsored by the Quebec Asbestos Mining Association, and the Asbestosis Research Council, sponsored by the British asbestos manufacturing industry. The results of research sponsored by these two agencies and also by individual companies acting independently have contributed significantly to our knowledge of the biological effects of asbestos.

In addition, industry environmental control experts are constantly working to develop new or improved methods of handling asbestos and asbestos-containing products safely.

Much has been learned about asbestos and health in a very short time—especially when you consider that the greater part of all medical information about asbestos-related disease is less than a decade old. According to Dr. Premysl Pelnar of the Institute of Occupational and Environmental Health, approximately 90 per cent of all information and data now available is the result of medical studies undertaken during the past ten years.

Much more is still needed: In late 1972, The International Agency for Research on Cancer made recommendations for further research and indicated priorities for work of immediate and long-term value. Emphasis was placed on epidemiological and pathological studies, and high priorities were urged for certain projects.

These included:

1. Usefulness of early detection in the prevention of progressive fibrosis and asbestos cancers and in the identification of hazardous conditions;
2. Assessment of excess cancer risks following exposure to only one variety of asbestos;
3. Amount and type of asbestos in the lungs of mesothelioma cases;
4. Secular changes in incidence of pleural and peritoneal mesotheliomas nationally and internationally;
5. Possible association between past exposure to asbestos and cancer of sites other than lung, pleura and peritoneum;
6. Relationship between asbestosis and risk of carcinoma.

The asbestos manufacturing industry will continue to support and cooperate in research projects of this nature. The Asbestos Information Association, for example, is presently

A 10844

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 23 of 35 asbestosclaims.law/library/15306/23

sponsoring a study at the Harvard School of Public Health on chest ausculation (breathing sounds) as an early detection device in the diagnosis of asbestos-related disease. While this needed additional information and data is being developed, the industry will take all steps necessary to assure a safe working environment for its employees and for applicators and fabricators of asbestos-containing products.

Asbestos Information Association
North America
1660 L Street, N. W.
Washington, D. C. 20036

A 10845

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He… Published by AsbestosClaims.Law
ACL Doc 15306 · Page 24 of 35 **asbestosclaims.law/library/15306/24**

Title 29—LABOR

Chapter XVII—Occupational Safety and Health Administration, Department of Labor

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Standard for Exposure to Asbestos Dust

On December 7, 1971, an emergency temporary standard concerning exposure to asbestos fibers was published in the FEDERAL REGISTER (36 F.R. 23207). In accordance with section 6(c)(3) of the Williams-Steiger Occupational Safety and Health Act of 1970, a notice of proposed rulemaking regarding a permanent standard for exposure to asbestos fibers was published in the FEDERAL REGISTER on January 12, 1972 (37 F.R. 466). The notice invited interested persons to submit both orally and in writing, data, views, and arguments concerning the proposal.

On or about January 24, 1972, the Advisory Committee on Asbestos Dust was established and requested to make written recommendations with regard to the proposed standard on asbestos. On or about February 1, 1972, the Department of Health, Education, and Welfare transmitted to the Secretary of Labor a criteria document containing Recommendations for an Occupational Exposure Standard for Asbestos by the National Institute for Occupational Safety and Health (NIOSH). Public notice was given of the receipt of the recommendations and their availability for inspection and copying. On or about February 25, 1972, the Advisory Committee on Asbestos Dust submitted its written recommendations to the Assistant Secretary of Labor for Occupational Safety and Health.

Pursuant to the notice of rule making, a hearing was held on March 14 through 17, 1972, for the purpose of receiving oral data, views, and arguments concerning the proposed standard. On or about March 31, 1972, the presiding hearing examiner certified to the Assistant Secretary of Labor for Occupational Safety and Health the record of the proceeding. The record includes prehearing written comments, a transcript of the oral presentations made at the hearing, and numerous exhibits received during the course of the hearing or within the period allowed after the close of the hearing.

The proposed standard dealt with (1) permissible concentrations of asbestos fibers; (2) methods of compliance; (3) warning signs; (4) monitoring; (5) medical examinations; and (6) recordkeeping. Each of these major proposals elicited comments, arguments, objections, and counterproposals. They all have been examined and considered.

1. *Acceptable concentrations of asbestos dust.* The proposed standard would limit occupational exposure to 8-hour time-weighted average (TWA) airborne concentrations of asbestos dust not exceeding five fibers longer than five micrometers per milliliter. Concentrations above five fibers but not to exceed 10 fibers (ceiling concentration) would be permitted up to 15 minutes in an hour, but for not more than 5 hours in any one 8-hour day.

NIOSH in effect has recommended that the five-fiber TWA and 10-fiber peak concentrations be permitted only for 2 years; thereafter, TWA concentrations should be not more than 2 fibers per cubic centimeter ($cm.^3$) of air, and peak concentrations should not exceed 10 fibers/$cm.^3$, with no time restriction. Numerous objections and counterproposals have been made, with regard to both the limits of asbestos fiber concentrations and the time periods to comply with them. Some, for example, have recommended return to a 12-fiber standard of an earlier day; i.e., a level adopted under the Walsh-Healey Public Contracts Act in 1969. Others have recommended a two-fiber standard to become effective in 6 months, then a one-fiber standard for 2 years, and finally a zero-fiber standard after 3 years. These recommendations give a fair indication of the wide spread of the counterproposals.

No one has disputed that exposure to asbestos of high enough intensity and long enough duration is causally related to asbestosis and cancers. The dispute is as to the determination of a specific level below which exposure is safe. Various studies attempting to establish quantitative relations between specific levels of exposure to asbestos fibers and the appearance of adverse biological manifestations, such as asbestosis, lung cancers, and mesothelioma, have given rise to controversy as to the validity of the measuring techniques used and the reliability of the relations attempted to be established. Because of the long lapse of time between onset of exposure and biological manifestations, we have now evidence of the consequences of exposure, but we do not have, in general, accurate measures of the levels of exposure occurring 20 or 30 years ago, which have given rise to these consequences. There are also controversies concerning the relative toxicity of the various kinds of asbestos, and varying hazards in different workplaces.

It is fair to say that the controversy has centered in the area between a two-fiber TWA concentration and five-fiber TWA concentration, with variations on the time needed for compliance. Many employers support a five-fiber TWA. Most medical opinion is divided between a two-fiber standard and a five-fiber standard.

In view of the undisputed grave consequences from exposure to asbestos fibers, it is essential that the exposure be regulated now, on the basis of the best evidence available now, even though it may not be as good as scientifically desirable. An asbestos standard can be reevaluated in the light of the results of ongoing studies, and future studies, but cannot wait for them. Lives of employees are at stake.

It is concluded that there should be one minimum standard of exposure to asbestos applicable to all workplaces exposed to any kind, or mixture of kinds, of asbestos. Reasons of practical administration preclude a variety of standards for different kinds of asbestos and of workplaces. Also, while the evidence tends to show that crocidolite, for instance, is more harmful than chrysotile, the evidence is not sufficient to establish separate standards for varieties of asbestos.

Because there must be one standard governing exposure to all varieties of asbestos, and in workplaces apparently more hazardous than others; because some present employees with regular exposure to asbestos have probably already accumulated great doses of asbestos fibers, due to higher levels of exposure in the past; because it appears that levels of exposure which may be safe with regard to asbestosis are not safe with regard to mesothelioma; because the statute requires the protection of every employee, even of one who may have regular exposure to asbestos during a working life which may reach, or even exceed, 40 years; and because of several other considerations which have been urged and are reflected in the record of the proceeding, the conflict in the medical evidence is resolved in favor of the health of employees. As of July 1, 1976, TWA concentrations of asbestos fibers longer than 5 micrometers will not be allowed to exceed two fibers/cc., with a ceiling value of 10 fibers/cc. The current TWA concentrations of five fibers, and

NOTE: The preamble to the "permanent" asbestos standard, issued June 7, 1972, is reproduced for information. It was not included in the republication of the standard on June 27, 1974, but directly relates, providing background considerations for OSHA's exposure to asbestos dust regulation.

A 13843

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 25 of 35 asbestosclaims.law/library/15306/25

ceiling concentrations of 10 fibers/cc, will be permitted until July 1, 1976, during what will be a transitional period deemed necessary to allow employers to make the needed changes for coming into compliance with the more stringent standard.

The record shows that the many work operations subject to the single asbestos standard (textile, manufacturing, industrial, and marine installation, etc.) will meet varying degrees of difficulty in complying with the standard. In some plants, extensive redesign and relocation of equipment may be needed. It appears, however, the delay in the effective date of the two-fiber standard will provide all employers a reasonable time to comply. At the same time, so long as the ceiling limit is complied with, no harm is reasonably expected to result from exposures during the transitional period.

2. *Methods of compliance.* It has been pointed out by many persons, that protection against asbestos fibers is best obtained by controlling the generation of fibers first, and secondly, by controlling the dispersion of released fibers into the ambient air of the workplaces. Therefore, the standard requires feasible technological controls and appropriate work practices as the primary means of compliance. Rotation of employees as a way of meeting the TWA concentration requirement is allowed only in stated exceptional circumstances, because, as a general rule, it would be difficult to implement. Personal protective equipment, such as respirators, cannot be relied upon because, among other reasons, they may be so uncomfortable as to be burdensome, except for short periods of time. Therefore, it is expected that respirators and shift rotation will be used during the period necessary to install engineering controls and to train employees in sound work practices, but, after technological compliance has been achieved, their use must be limited to special work situations and emergencies. Where both are practicable, shift rotation is required.

3. *Labeling.* The proposed standard stopped short of requiring labeling asbestos and asbestos-containing products. The proposed standard would have required only warning signs at locations where asbestos hazards are present. However, labeling, rather than warning signs, has proved to be a point of controversy. Both NIOSH and the Advisory Committee on Asbestos Dust recommended labels for asbestos products and containers, and these recommendations became very controversial in the course of the proceeding. Many counterproproposals have been made as to the language of the warning as well as to the products to be subject to the labeling requirements. Employers, in general, strongly contend that (1) finished products which effectively entrap asbestos fibers, so that these would not be released in the normal use of the products, should not be required to be labeled; and (2) words such as "danger" and "cancer" are unwarrantedly alarming.

Both contentions have merit, and the standard has been changed accordingly.

4. *Monitoring.* The proposed standard would have required personal monitoring and environmental monitoring. Many issues have been raised concerning the availability and reliability of measuring instruments, frequency of monitoring, and conditions in which monitoring should be required. The adopted standard takes the objections into consideration. It requires periodic monitoring at intervals no longer than 6 months, thus allowing considerable time and discretion, and prescribes the use of the membrane filter method, which is an acceptable method for determination of asbestos fibers.

It has also been recommended that employees or their representatives should have an opportunity to observe the monitoring. The recommendation has been accepted.

5. *Medical examinations.* The proposed standard would only require an appropriate medical examination on a periodic basis. The generality of the proposal has attracted many objections and also many helpful comments. The recommendations of NIOSH and of the Advisory Committee on Asbestos Dust were much more specific with respect to both frequency and type of medical examinations to be required. The comments vary as to the class of employees to be examined and as to the frequency of the examinations.

The adopted standard requires medical examinations both at the beginning and the termination of employments exposed to concentrations of asbestos fibers, and also requires annual medical examinations of every employee exposed to airborne concentrations of asbestos. It has been pointed out that in certain industries, such as construction, an employee may work for several employers during the same year. Accordingly, the standard does not require either preemployment, or termination, or periodic examinaton of any employee who has been examined in accordance with the standard within the past year.

One question which has been raised goes to whether the employer or the employee should be allowed to choose the examining physician. The standard gives the option to the employer. Since some employers already have a medical examination program in operation, and, also, have medical departments with some expertise in the diagnosis of abestos-related diseases, it seems more reasonable to permit them to utilize the present programs and expertise, than to permit an employee to choose a private general practitioner.

6. *Records.* The standard, as proposed and as adopted, requires maintenance of records of monitoring and of medical examinations. Most of the controversy in this area has revolved around the question whether an employer should be allowed to have access to the results of the required medical examinations. The apprehension of those who have argued against employer access is based on the expectation that some employers will use the medical examinations as a means of screening employment applicants, and worse, as grounds for discharging current employees, who show signs of being affected by exposure to asbestos. Since the purpose of the medical examinations is to monitor the health of employees exposed to the hazards of abestos, employees cannot in reason be granted the privilege of refusing to disclose to their employers results of occupational exposure. It does not make sense to require employers to provide medical examinations if they cannot know and use the results of the examinations. For these reasons the standard provides that employers may have a restricted access to some medical information.

On the other hand, there is no intention to allow employers to abuse medical information obtained pursuant to the Act, to the detriment of employees. Therefore, the administration of the medical records requirement will be closely watched, and, in cases of abuse, appropriate action will be considered.

The issues discussed above are believed to be the major ones. Numerous other issues have been raised in the rulemaking proceedings. Some have been referred to incidentally. Many recommendations, for instance, about work practices, are so obviously meritorious that their adoption needs no exposition here. Other recommendations and many objections have not been adopted for a variety of reasons which should be manifest. Several, for instance, have recommended the use of respirators only pursuant to a variance, or in cases of emergency and occasional short-term exposures. The recommendation with respect to variances undoubtedly has many merits, but is considered administratively impractical.

A 10847

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 26 of 35 asbestosclaims.law/library/15306/26

Title 29
Code of Federal Regulations
Parts 1900 to 1919

Revised as of
July 1, 1979

§ 1910.1001 Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers,

A 10848

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 27 of 35 asbestosclaims.law/library/15306/27

longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (*a*) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971, which is incorporated by reference herein.

(*b*) See § 1910.6 concerning the availability of ANSI Z9.2-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices*—(i) *Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) *Personal protective equipment*—(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by paragraphs (d)(1) (i), (ii), or (iii) of this section, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by paragraph (d)(1) of this section, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

A 1864-3

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 28 of 35 asbestosclaims.law/library/15306/28

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in paragraphs (d)(2)(ii) or (iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in paragraph (d)(2)(iii) of this section, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (*a*) The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2-1969, which is incorporated by reference herein.

(*b*) See § 1910.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(*c*) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering: (*a*) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of air-borne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*b*) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in paragraph (d)(4)(iii)(*a*) of this section to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made

A 10650

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 29 of 35 asbestosclaims.law/library/15306/29

by the membrane filter method at 400-450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring*—(1) *Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring*—(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring*—(i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by paragraph (f)(1) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by paragraph (g)(1)(i) of this section shall conform to the requirements of 20" × 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	¾" Sans Serif, Gothic or Block.
Avoid Breathing Dust	¼" Gothic.
Wear Assigned Protective Equipment.	¼" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¼" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels*—(i) *Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing

40-075 O—79——38

A 0351

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 30 of 35 asbestosclaims.law/library/15306/30

asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by paragraph (g)(2)(i) of this section shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping*—(1) *Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Employee access.* Every employee and former employee shall have reasonable access to any record required to be maintained by paragraph (i)(1) of this section, which indicates the employee's own exposure to asbestos fibers.

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 × 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 × 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall

A 10852

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 31 of 35 asbestosclaims.law/library/15306/31

include, as a minimum, a chest roentgenogram (posterior-anterior 14 × 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records*—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

[39 FR 23502, June 27, 1974. Redesignated at 40 FR 27973, May 28, 1975, and amended at 41 FR 11505, Mar. 19, 1976]

78

§ 1910.19 Special provisions for air contaminants.

(a) *Asbestos dust.* Section 1910.1001 shall apply to the exposure of every employee to asbestos dust in every employment and place of employment covered by §§ 1910.12, 1910.13, 1910.14, 1910.15, or 1910.16, in lieu of any different standard on exposure to asbestos dust which would otherwise be applicable by virtue of any of those sections.

Note: Following defines additional occupational areas affected by section 1910.19 above:

1910.12 - Construction Work (construction, alteration, and/or repair, including painting and decorating)
1910.13 - Ship repairing
1910.14 - Shipbuilding
1910.15 - Shipbreaking
1910.16 - Longshoring

Union Carbide trial exhibit UC-21: Union Carbide Marketing and Technology Dept., "Calidria" Asbestos RG-244 He... Published by AsbestosClaims.Law
ACL Doc 15306 · Page 32 of 35 asbestosclaims.law/library/15306/32

UNION CARBIDE Material Safety Data

September 1, 1976
UNION CARBIDE CORPORATION • 4625 ROYAL AVENUE • NIAGARA FALLS, NEW YORK • 14302
TELEPHONE: (716) 278-3376

PRODUCT: Chrysotile Asbestos **CHEMICAL FORMULA:** $Mg_6(OH)_8Si_4O_{10}$

TRADE NAMES: "Calidria" Asbestos

I. PHYSICAL DATA

BOILING POINT AND MELTING POINT: Not Pertinent

SPECIFIC GRAVITY (H_2O = 1): 2.45

VOLATILE CONTENT: Absorbed Water 1 – 4% By Weight. Structural Water Approximately 13% by Weight.

APPEARANCE: Pellets or Fine White Powder. No odor. Very Slight Solubility in Water.

II. HAZARDOUS INGREDIENTS

Asbestos contains no hazardous ingredients. However, the material itself can be hazardous under certain conditions. (See V below.)

III. FIRE AND EXPLOSION HAZARD DATA

NON-COMBUSTIBLE MATERIAL: No Fire or Explosion Hazard.

IV. REACTIVITY DATA

INERT MATERIAL: No Decomposition or Polymerization Conditions.

V. HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE TO AIRBORNE CONCENTRATION:

The current Occupational Safety and Health Standard (CFR 29, 1910.1001) contains the following exposure limits:

"The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed 2 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the membrane filter method at 400-450 X magnification (4 millimeter objective) phase contrast illumination. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method just noted."

EFFECTS OF EXPOSURE: CAUTION: Breathing asbestos may cause serious bodily harm.

EMERGENCY AND FIRST AID PROCEDURES: No acute toxicity. Use respirator if airborne asbestos fiber concentration exceeds OSHA limits.

VI. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Avoid inhalation of dust. Remove spilled material by vacuum cleaner or by water wash.

WASTE DISPOSAL:

Bags and waste and scrap materials should be disposed of in a manner which will avoid airborne concentrations of asbestos, such as the use of dust-tight trash bags or containers. Ensure that disposal complies with all applicable federal, state or local regulations.

A 10854

Union Carbide Corporation assumes no responsibility and makes no warranty, expressed or implied, representation, promise, or statement as to completeness, accuracy, or currency of any data provided.

VII. SPECIAL PROTECTION INFORMATION

VENTILATION:

Local exhaust for each operation is preferable. (See American National Standards Institute booklet, Z9.2 – 1971.) General area exhaust is acceptable. No special considerations.

PROTECTIVE GLOVES: None	EYE PROTECTION: None

RESPIRATORY PROTECTION (1)

The current Occupational Safety and Health Standard CFR 29, 1910.1001 contains the following requirements for respiratory protection.

AIRBORNE CONCENTRATION(2)		
8-HOUR EXPOSURE (3)	CEILING CONCENTRATION	MINIMUM REQUIRED MASK TYPE(4)
2 maximum	10 maximum	Not required when allowable limits are not exceeded.
20 maximum	100 maximum	Reusable or single use air purifying respirator.
200 maximum	1000 maximum	Powered filter positive pressure.
Over 200	—	Type C positive pressure, air supplied.

(1) Allowed only during the time required for installation of engineering controls, when engineering controls are not technically feasible or adequate, and in emergencies. Current OSHA standards require that no employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by the use of a respirator.

(2) Fibers per milliliter greater than 5 microns in length, as determined by the membrane filter method at 400-450X magnification (4 millimeter objective) phase contrast illumination.

(3) 8-Hour time-weighted average.

(4) Only masks certified by NIOSH as acceptable for the exposures encountered may be used.

OTHER PROTECTIVE EQUIPMENT:

If the ceiling concentration limit is exceeded, clothing providing whole body covering shall be supplied and its use required.

VIII. SPECIAL PRECAUTIONS

Every place of employment where asbestos fibers are released must be monitored to determine exposure levels. If the permissible time-weighted average and ceiling concentration limits are not exceeded, no special precautions are required except:

a) Bag damage and dusting should be minimized and dust inhalation avoided.

b) A comprehensive medical examination is required for any employee exposed to airborne fibers within 30 days of first such employment, annually thereafter and on termination of employment.

c) Personal work clothing can become contaminated with asbestos and may constitute an exposure hazard. Such clothing should be handled and laundered in a manner to avoid airborne concentrations of asbestos.

d) Substantial medical evidence indicates that smoking will increase the risk from asbestos exposure. Those working with asbestos should not smoke.

Where exposure limits may be exceeded, reference should be made to the regulation CFR 29, 1910.1001 for details on caution signs, monitoring, change rooms, protective clothing laundering and record keeping.

A 10851

CALIDRIA ASBESTOS RG-244

TYPICAL CHEMICAL ANALYSIS

Component	Weight %
MgO	38.2
SiO_2	46.1
Al_2O_3	0.2
Fe	1.4
Ca	0.025
Cd	<0.00002
Co	0.004
Cr	0.13
Cu	0.005
Mn	0.05
Ni	0.16
Se	<0.001
Loss on Ignition (CO_2 & H_2O)	12.7

TYPICAL SPECTROGRAPHIC ANALYSIS

Component	Detection Limit, Wt. %	Analysis, Wt. %	Component	Detection Limit, Wt. %	Analysis, Wt. %
Ag	0.001	N.D.(2)	Ni	0.003	0.08-0.8
Al	0.003	0.08-0.8	Os	0.03	N.D.
As	0.01	N.D.	P	0.08	N.D.
Au	0.002	N.D.	Pb	0.003	N.D.
B	0.006	N.D.	Pd	0.005	N.D.
Ba	0.003	N.D.	Pt	0.005	N.D.
Be	0.001	N.D.	Rb	N.A.(1)	----
Bi	0.005	N.D.	Re	0.03	N.D.
Ca	0.002	0.008-0.08	Rh	0.02	N.D.
Cb	0.006	N.D.	Ra	0.03	N.D.
Cd	---	<0.00002(3)	Sb	0.01	N.D.
Co	0.01	0.004-0.04	Sc	0.01	N.D.
Cr	0.003	0.02-0.2	Se	----	<0.001(3)
Cs	N.A.(1)	----	Si	0.001	Major
Cu	0.001	N.D.	Sn	0.002	N.D.
Fe	0.006	0.4-4.0	Sr	0.01	N.D.
Ga	0.01	N.D.	Ta	0.01	N.D.
Ge	0.005	N.D.	Te	0.05	N.D.
Hf	0.03	N.D.	Th	0.03	N.D.
Hg	0.02	N.D.	Ti	0.003	0.0008-0.008
In	0.03	N.D.	Tl	0.2	N.D.
Ir	0.03	N.D.	U	0.1	N.D.
K	N.A.(1)	----	V	0.003	N.D.
La	0.01	N.D.	W	0.01	N.D.
Li	0.1	N.D.	Y	0.01	N.D.
Mg	0.001	Major	Yb	0.01	N.D.
Mn	0.003	0.008-0.08	Zn	0.02	N.D.
Mo	0.003	N.D.	Zr	0.006	N.D.
Na	0.03	0.08-0.8			

(1) N.A. - Not analyzed.

(2) N.D. - Not detected.

(3) By chemical analysis.

A 10850