

PLAINTIFF'S EXHIBIT

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Biochemical Research Laboratory

The Dow Chemical Company

1070

A SURVEY AND EVALUATION OF PIPE
COVERERS' EXPOSURES TO DUSTS FROM
ASBESTOS CONTAINING INSULATION
MATERIALS ENCOUNTERED DURING
ROUTINE PIPE COVERING OPERATIONS
WITHIN THE MIDLAND LOCATION OF
THE DOW CHEMICAL COMPANY

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PROBLEM

Supervision requested that the Environmental Research Laboratory survey and evaluate current levels of pipe coverer's exposures to dusts from asbestos-containing insulation materials commonly used within the Midland location.

CONCLUSIONS

1. The present Threshold Limit Value (TLV) for asbestos of 5 mppcf will remain in force until 1971. Barring information to the contrary, the TLV will then be lowered to 2 mppcf (million particles per cubic foot).

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2. Men are encountering time-weighted exposures to dusts from insulation materials containing asbestos approaching but not exceeding the present TLV of 5 mppcf.

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3. Men are encountering time-weighted exposures to dusts from insulation materials containing asbestos exceeding the proposed TLV of 2 mppcf.
4. If exposures are to be reduced to within tentatively accepted levels (2 mppcf) either the use of asbestos-containing insulation materials must cease, or pipe coverers must be protected through effective use of approved respiratory devices and/or local ventilation.

RECOMMENDATIONS

1. Pipe coverers should be educated to the true hazards associated with the several types of insulating materials they presently use.
2. Pipe coverers should be made aware of the several ways of protecting themselves during unavoidable, potential exposures to dusts containing substances known to be highly toxic, such as asbestos.
3. In the future, pipe coverers should be educated to the true hazards associated with any new types of insulation materials to be used, prior to use.

PRESENTATION OF DATA

Indoor pipe covering operations were surveyed from 12/24/68 to 1/22/69. Outdoor pipe covering operations were surveyed from 2/20/69 to 3/5/69. Air samples to account for "miscellaneous" portions of the pipe covering functions were obtained from 3/1/69 to 3/5/69.

Sampling and Analysis

A total of 141 breathing zone samples were collected in midget impingers and analyzed employing standard light field microscopy techniques for determining dust concentrations from insulating materials containing asbestos. Concentrations found in samples were expressed in terms of millions of particles per cubic foot of air (mppcf), according to the following formula.¹

$$\text{mppcf} = \frac{(\text{mean particles/quarter field}) \times 4 \times 1000 \times \text{sample volume}}{\frac{\text{liters}}{\text{min.}} (\text{pump flow}) \times \text{minutes} \times 3.51 \times 10^{-2} \frac{\text{ft}^3}{\text{liter}}}$$

¹Patty, F. A., INDUSTRIAL HYGIENE AND TOXICOLOGY, Vol. I. Second Revised Edition, p. 198.

The means and ranges of concentrations found during sampling are listed in Table 1.

Job Analysis and Description

An environmental job analysis provides an estimate of the frequency and duration of men's exposures to dust concentrations surveyed. The job analysis expresses as per cent of the day (% day) the probable time distribution of pipe covering operations, averaged over several months. On any given day the pipe coverer's routines can be expected to vary from the estimate.

The job analysis reconciled input from discussions with pipe coverers and supervision, observations during sampling, estimates provided by an industrial engineering time study, and a questionnaire filled out by the pipe coverers. A sample questionnaire is found on page 1 of the Appendix.

The questionnaire requested that men estimate the per cent of time per day they spent working with the most common insulating materials. Men's averages were converted into ratios of time spent (% day) per operation and material, and are listed in Table 1.

Thirty-two per cent (26 men) of the Midland coverers responded. Responses concerning rarely used materials (e.g., cork, styrofoam, some putty adhesives, etc.) were set aside. Other information furnished by the coverers included:

Average age: 40 years
 Years covering within Dow: 18
 Years covering outside Dow: 0
 Wear respirator? Yes: 17 men; No: 9 men
 Which material(s) are the dustiest?
 Kaylo: 16 men
 Fiberglas: 14 men
 High temp.: 11 men
 Superpower: 6 men
 Mag oxide: 2 men
 Aircell: 2 men

Time-Weighting Exposures

Men's exposures to dusts from asbestos-containing insulation materials were estimated by "time-weighting." The exposure frequency and duration (% day) to each material is multiplied by the mean concentration in air of each material, giving a set of "time-weighted factors." The "factors" (product of % day x mean concentration) are then added up for the eight hour day:

$$\text{Time-Weighted Exposure} = \sum_{i=0}^{100\%} \% \text{ day} \times \text{concentration}$$

$$\text{or, } \sum_{i=0}^{100\%} = (\text{time-weight factors})$$

Table 1 lists the % day, mean concentrations found, time-weighted factors and ranges for each material encountered in the listed operations. The time-weighted exposures to dusts from asbestos containing materials were 4.9 mppcf (indoor operations) and 4.2 mppcf (outdoor operations).

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Table 1. TIME-WEIGHTED EXPOSURES OF PIPE COVERERS TO DUSTS FROM ASBESTOS CONTAINING MATERIALS

<u>Operations</u>	<u>Materials</u>	<u>% Day</u>	<u>Concentrations (mppcf)</u>		<u>Time-weight Factor: Asbestos</u>
			<u>Mean</u>	<u>Range</u>	
Remove	Air cell	1.2	11.4	0.3-24.9	0.137
	Kaylo	1.6	11.2	3.7-20.5	0.179
	Mag oxide	0.2	2.8	1.8-4.6	0.006
	Fiberglas	2.0	13.7	1.2-33.7	---
Mix	No. 1 Plus	1.6	13.4	2.2-30.5	0.219
	Armentite	0.1	9.6	2.7-13.5	0.010
	Superpower	0.8	34.9	19.6-6.14	---
Cut	Air cell	5.9	3.0	0.6-6.2	0.177
	Kaylo	8.8	11.7	4.9-23.1	1.030
	Fiberglas	2.2	1.7	0.8-2.6	---
	Others	0.6	--	---	---
Apply	Air cell	15.8	5.7	0.2-16.4	0.901
	Kaylo	19.9	5.7	0.4-22.3	1.123
	Fiberglas	4.5	2.4	1.2-3.8	---
	Others	2.6	--	---	---
	No. 1 Plus	4.8	9.6	1.1-39.5	0.461
	Armentite/ Superpower	2.4	2.1	0.9-3.9	0.050
Clean up removed covers		3.0	8.5	2.4-24.5	0.255
Stocking; get new covers		2.0	1.0	0.1-2.3	0.020
Move to job, set up		5.0	2.0	1.4-2.9	0.100
Breaks, lavatory		15.0	1.4	0.1-3.9	0.201

Time-weighted exposure to
asbestos containing dusts
(indoor) in mppcf

= 4.9

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Table 1. CONTINUED

<u>Operations</u>	<u>Materials</u>	<u>% Day</u>	<u>Concentrations (mppcf)</u>		<u>Time-weight Factor: Asbestos</u>
			<u>Mean</u>	<u>Range</u>	
Remove	Air cell	1.2	5.2	5.1-5.2	0.062
	Kaylo	1.6	9.0	3.6-14.0	0.144
	Fiberglas	2.0	10.0	5.5-20.2	---
	Others	0.2	--	---	---
Mix	No. 1 Plus	1.6	9.6	5.9-12.5	0.154
	Armentite	0.1	17.0	14.1-21.6	0.017
	Superpower	0.8	21.3	13.1-25.4	---
Cut	Air cell	5.9	2.5	0.9-3.4	0.148
	Kaylo	8.8	9.4	6.3-7.4	0.827
	Fiberglas	2.2	2.5	1.4-3.8	---
	Others	0.6	--	---	---
Apply	Air cell	15.8	1.5	0.3-3.5	0.237
	Kaylo	19.9	9.2	1.9-17.9	1.831
	Fiberglas	4.5	3.6	1.6-6.7	---
	Others	2.6	--	---	---
	No. 1 Plus	4.8	1.4	0.3-2.3	0.067
	Armentite/ Superpower	2.4	5.2	3.5-7.9	0.125
Clean up removed covers		3.0	8.5	3.4-24.6	0.255
Stocking; get new covers		2.0	1.0	0.1-2.3	0.020
Move to job, set up		5.0	2.0	1.4-2.9	0.100
Breaks, lavatory		15.0	1.4	0.1-3.9	0.210

Time-weighted exposure to
asbestos containing dusts
(outdoor) in mppcf

= 4.2

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Threshold Limit Values (TLV)

A TLV describes that time-weighted concentration of a material to which men can be repeatedly exposed for eight hours with no adverse effects on health. A TLV indicates a mean concentration which can be exceeded, provided there are corresponding exposures lower than the TLV.

At present the TLV for dust containing asbestos is 5 mppcf using standard light microscopy techniques. Based on best current information, the proposed TLV of 2 mppcf would provide better protection. A two year trial period preceeds acceptance of proposed TLV's. In 1971, 2 mppcf will be the TLV for asbestos, unless better information during the interim casts doubt upon the proposed figure.

This report evaluated current exposures using the proposed standard of 2 mppcf if the material in question had even trace (<5%) asbestos content. Manufacturers were consulted regarding the composition of the insulating product(s) found in common usage. The following table lists these materials and the per cent asbestos plus the appropriate TLV for that material.

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Table 2. MATERIALS MOST COMMONLY USED FOR FIRST TEN MONTHS OF 1968

<u>Tradename (and Manufacturer)</u>	<u>Use</u>	<u>% Composition</u>		<u>Threshold Limit Value (mppcf)</u>
		<u>Asbestos</u>	<u>Inerts</u>	
No. 1 Plus (BEH Company)	Adhesive	<5-7%	95% mineral wool	2.0
Superpowerhouse (BEH Company)	Adhesive	0%	100% mineral wool	50.0
Armentite (Johns-Manville Corporation)	Adhesive	100%	0%	2.0
Air cell (Carey Company)	Covers	80%	20% (?)	2.0
Mag Oxide (85%) (Carey Company)	Covers	15%	85% MgO	2.0
Fiberglas (Owens-Corning)	Covers	0%	100% amorphous silicates	50.0
Kaylo (Owens-Corning)	Covers	~5%	95% diatomaceous calcium silicates	2.0

DISCUSSION

Men were found to be working almost exclusively with asbestos-containing materials. Their time-weighted exposures to dusts from the asbestos-containing materials were in excess of the proposed TLV of 2.0 mppcf and barely under the present TLV of 5 mppcf. Steps should be taken to lower the time-weighted exposures to within proposed acceptable limits.

Several means of reducing the time-weighted exposures are apparent:

1. Cease using asbestos-containing materials. If use of asbestos-containing materials was stopped, exposures would be reduced to acceptable levels, even though some low-level exposure would be experienced until presently installed coverings have been replaced due to natural attrition.
2. Effective use of approved respiratory devices. Respiratory protection is practical for jobs which are of short duration and infrequent occurrence. It can be seen from Table 1 that jobs requiring respiratory protection are neither infrequent nor of short duration. Men encounter greatest exposures during the cutting and applying of Air cell and Kaylo. These two operations are done for 50% of the day -- sometimes 100% of the day. Many other operations listed in Table 1 could require

use of respiratory devices. Attempts to lower exposures to 2 mppcf by using respirators seem futile.

3. Use local ventilation. This method would be effective if the ventilation could be kept close to the dust source. Pipe coverers' work routines make this difficult; e.g., working aloft, or in cramped areas.

In the event new types of covering materials are used, men should be instructed regarding the toxic properties of the materials and the hazards associated with using the material. Protective measures to prevent or lower undesirable but unavoidable exposures to the material should be well understood. Any education effort must precede or be concurrent with first usage of new materials.

During this survey, most men voiced strong objection to fiberglass, asserting that fiberglass insulation materials were far more hazardous than asbestos insulation materials. This contention is not supported by 25 years available field experience and independent laboratory testing on fiberglass.

The Environmental Research Laboratory will survey and evaluate upon request any proposed types of insulating materials and relate their usage to the health hazards associated with these materials.

APPENDIX
ENVIRONMENTAL RESEARCH QUESTIONNAIRE

Please answer the following questions as completely as possible, using average estimates.

Name _____ Man # _____ Age _____

Number of years with Dow _____ Number of years covering pipe _____

Do you wear a respirator? Yes _____ No _____ What make _____

If yes, list those operations during which you wear a respirator _____

What per cent of the day is this? _____

Have you covered pipe or handled covering materials outside of Dow? _____

Yes _____ No _____ If yes, how long did you cover pipe? _____

Answer the following if they apply to you.

How much time per day do you:

(a) Remove old fiberglass covers? _____

(b) Remove other types of covers? _____

List other types you remove: _____

(c) Mix "plus one" webbers? _____ Other adhesives? _____

(d) Use power saws? _____

List what you cut with a power saw: _____

(e) Use hand saws? _____

List what you cut with a power saw: _____

How much time per day do you:

(a) Work with "air cell" _____

(b) Work with "Kaylo" _____

(c) Work with "Hi-temp" _____

(d) Work with fiberglass _____

Which job(s) do you consider most dusty? _____

How often do you do this job(s)? _____

UNIT INDEX

Pipe covering operations were surveyed and evaluated.

Men received time-weighted exposures to asbestos near the present Threshold Limit Value of 5 mppcf and in excess of the tentatively proposed Threshold Limit Value of 2 mppcf. Steps should be taken to reduce exposures to the proposed new standard.

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