



THE DOW CHEMICAL COMPANY

MIDLAND, Michigan
June 24, 1969

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REPORT BC T2.1-1-64: "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"

Please note the following corrections in the above report dated March 21, 1969, by R. A. DeGesero.

Page 6: Line 5, change 4.0 mppcf to 4.2 mppcf.

Page 7: Line 10, erase 0.037 under the last column entitled Time-weight Factor: Asbestos.

Page 8: Line 7, erase 0.176 under the last column entitled Time-weight Factor: Asbestos.

Line 14, erase 0.162 under the last column entitled Time-weight Factor: Asbestos.

Line 22, change the last entry in the last column entitled Time-weight Factor: Asbestos, from 4.5 to 4.2 mppcf.

The above alterations in no way affect the conclusions or recommendations of this report.

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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

File: T2.1-1-64
Date: March 21, 1969
By: R. A. DeGesero

Signed Roy A. De Gesero Date March 24, 1969

Checked A R Hoyle Date March 24, 1969

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

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.

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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.

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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:

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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?	<table border="0"> <tr> <td>Kaylo:</td> <td>16 men</td> </tr> <tr> <td>Fiberglas:</td> <td>14 men</td> </tr> <tr> <td>High temp.:</td> <td>11 men</td> </tr> <tr> <td>Superpower:</td> <td>6 men</td> </tr> <tr> <td>Mag oxide:</td> <td>2 men</td> </tr> <tr> <td>Aircell:</td> <td>2 men</td> </tr> </table>	Kaylo:	16 men	Fiberglas:	14 men	High temp.:	11 men	Superpower:	6 men	Mag oxide:	2 men	Aircell:	2 men
Kaylo:	16 men												
Fiberglas:	14 men												
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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:

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

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

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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 4.5 mppcf (outdoor operations).

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	.8	34.9	19.6-6.14	---
Cut	Air cell	5.5	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	0.037
	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	2.4-24.6	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	0.201

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</u> (mppcf)		<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	0.176
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	0.162
	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	2.4-24.6	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

= 4.5

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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 precedes 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 the 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