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ASBESTOS EXPOSURE INFORMATION FOR CHLOR-ALKALI RELATED OPERATIONS

SUMMARY

Exposure data with respect to airborne asbestos fibers in the U.S. chlor-alkali related plants were compiled. Included manufacturing divisions are Texas, Louisiana, Western, and Michigan. The summary dates back to as far as 5 years, or more for some plants. The potential long-term (more than 1 hour) personal exposures to airborne asbestos fibers ranged from 0.014 to 0.46 fibers/cc on the plant average basis with an arithmetic mean of 0.10 fibers/cc on a total data basis (N=501). Geometric means from the same data base were less than 0.05 fibers/cc for 7 out of 9 cases on the plant average basis. The total number of personnel working in the chlor-alkali related productions in the Dow U.S. locations with potential exposures to asbestos are 308 as of May, 1986.

PURPOSE

Data regarding potential exposures to airborne asbestos fibers in chlor-alkali and its service plants were compiled to respond to a request of Dow asbestos task force. The compiled data base will be used as part of documents submitted to the EPA for the exemption of asbestos use in manufacturing the diaphragm of chlorine cells.

DATA BASE

The data used in this summary include all the monitoring results obtained mostly within the past 5 years at the chlor-alkali plants and the related service plants throughout Dow U.S.A. manufacturing locations: Texas, Louisiana, Western, and Michigan Division. All the

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divisions except for Michigan Division have currently operating chlor-alkali plants. Where there were few data within the scope of the past 5 years, old data dating back to 1974 for Michigan Division, 1978 for part of the Texas plants, and 1979 for Western Division were included.

Types of monitoring data include area and personal monitoring results with personal monitoring results divided further into groups of long-term potential exposures and short-term exposures. The "short-term" in this summary is defined as less than or equal to 1 hour.

The use of respirator was included in the summary as much as reported in the original documentations.

The number of employees presented is the current number of the people who work in the chlor-alkali related plants with potential exposures to asbestos. The number excludes those whose job is clerical or secretarial at the plants, for example, but includes any other plant personnel who may in fact have no contact with asbestos. It is estimated that approximately one quarter of the total number of personnel have real potential of exposures to asbestos.

RESULTS AND DISCUSSION

The monitored activities include debagging, drawing, pulping, and washing inside the cell service plant, transportation, storage, and housekeeping. A large portion of monitoring conducted at the chlor-alkali plants included pulping cells. Pulping is the task of adding asbestos to holes in the cell.

The summaries of the monitoring results are shown in Table 1 through Table 4. Both arithmetic means and geometric means were calculated with their related statistics. Arithmetic mean is greatly biased in representing a typical value for a group when there is a few large values in many small values. The values showing less than a detection limit assumed a value of half the detection limit in calculations.

It should be noted that different analytical procedures for asbestos were used. Louisiana, Michigan, Western Divisions used a phase contrast microscopic method while Texas Division used a Reichert Zetopan Optical microscope using Normarski interference contrast. The fiber detection capability of Normarski interference contrast could be less than a phase contrast.

Short-term sampling often focuses on exposures during short-term tasks which potentially expose employees to higher concentrations of

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asbestos than the background concentrations. For this reason, exposure measurements less than 1 hour needed to be classified separate from the long-term personal exposure data which better approximate time-weighted average (TWA) 8-hour exposure value. Use of respirators was more frequently documented in short-term exposure monitoring than long-term monitoring.

Respirators were worn during many short-term potentially high exposure tasks. Therefore, the exposure data presented should be interpreted as potential exposures.

The results of Louisiana Division asbestos monitoring were pooled based on the last 3 years and the last 5 years. In all the categories, the potential exposure levels for the last 3 years showed improvements.

The current number of personnel working in the chlor-alkali related plants are summarized in Table 5.


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TABLE 1. POTENTIAL EXPOSURE TO ASBESTOS: Texas Division (1978-1984)

Plant	Sample Type	Asbestos Concentration (fiber/cc)					N(e)	Respirator Use (%)	Reference
		Range	$\bar{X}$ (a)	σ (b)	GM (c)	GSD (d)			
Cell Services	A (f)	0.002-0.03	0.010	0.0091	0.0078	2.2	7	---	1
Cell Services	P (g)	0.008-0.02	0.014	0.0085	0.013	1.9	2	0	1
Cell Services	PS (h)	0.2-6.5	2.1	3.0	0.87	4.9	4	100	1
Chlorine	P	0.001-0.3	0.060	0.045	0.050	1.9	236	(100) (i)	2,3,4,5,6
Chlorine	PS	0.008-0.05	0.029	0.021	0.023	2.6	3	(100)	6
Oyster Creek	A	0.005-0.23	0.027	0.041	0.015	2.7	51	---	7,8
Oyster Creek	P	0.005-0.1	0.021	0.025	0.015	2.2	13	(100)	7,8,9
Oyster Creek	PS	0.01-1.09	0.087	0.17	0.041	3.1	40	(100)	8,9,10

(a) Arithmetic mean
 (b) Standard deviation
 (c) Geometric mean
 (d) Geometric standard deviation
 (e) Number of samples
 (f) Area sample
 (g) Personal sample (more than 1 hr)
 (h) Personal sample (less than or equal to 1 hr)
 (i) (Respirator use not documented).

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TABLE 2a. POTENTIAL EXPOSURE TO ASBESTOS: Louisiana Division (1981-1985)

Plant	Sample Type	Asbestos Concentration (fiber/cc)					Respirator Use (%)	Reference
		Range	$\bar{X}$ (a)	σ (b)	GM (c)	GSD (d)		
Cell Services	A ^(f)	0.001-6.36	0.20	0.59	0.042	5.9	---	11,12,14,15, 17,18
Cell Services	P ^(g)	0.005-1.82	0.19	1.82	0.026	3.7	10(22) (i)	11,12,14,15, 17,18
Cell Services	PS ^(h)	0.01-11.22	1.7	3.9	0.19	11	75(25)	11,12,17
Chlor-Alkali	P	0.005-0.7	0.083	0.14	0.034	3.8	67(33)	11,13,14,15, 16,19,21
Chlor-Alkali	PS	0.005-5.7	0.53	1.19	0.15	5.0	71(29)	11,13,14,15, 16,19,21
Chlorine	P	0.005-0.63	0.091	0.13	0.041	3.8	26(74)	11,13,14,15, 16,20,22
Chlorine	PS	0.005-1.69	0.21	0.37	0.084	3.9	53(47)	11,13,14,15, 16,20,22

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|----------------------------------|--|
| (a) Arithmetic mean | (f) Area sample |
| (b) Standard deviation | (g) Personal sample (more than 1 hr) |
| (c) Geometric mean | (h) Personal sample (less than or equal to 1 hr) |
| (d) Geometric standard deviation | (i) (Respirator use not documented). |
| (e) Number of samples | |

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TABLE 2b. POTENTIAL EXPOSURE TO ASBESTOS: Louisiana Division (1983-1985)

Plant	Sample Type	Asbestos Concentration (fiber/cc)					N(e)
		Range	$\bar{X}$ (a)	σ (b)	GM(c)	GSD(d)	
Cell Services	A ^(f)	0.001-6.4	0.20	0.62	0.036	6.0	139
Cell Services	P ^(g)	0.005-0.16	0.028	0.029	0.017	2.7	103
Cell Services	PS ^(h)	0.01-11.22	1.7	3.9	0.19	11	8
Chlor-Alkali	P	0.005-0.12	0.032	0.033	0.019	3.0	25
Chlor-Alkali	PS	0.02-2.0	0.29	0.53	0.11	3.9	15
Chlorine	P	0.005-0.38	0.051	0.092	0.023	3.2	16
Chlorine	PS	0.01-1.36	0.15	0.29	0.065	3.5	20
(a) Arithmetic mean	(f) Area sample						
(b) Standard deviation	(g) Personal sample (more than 1 hr)						
(c) Geometric mean	(h) Personal sample (less than or equal to 1 hr)						
(d) Geometric standard deviation							
(e) Number of samples							

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TABLE 3. POTENTIAL EXPOSURE TO ASBESTOS: Michigan Division (1974-1984)

Plant	Sample Type	Asbestos Concentration (fiber/cc)					N(e)	Respirator Use (%)	Reference
		Range	$\bar{X}$ (a)	σ (b)	GM(c)	GSD(d)			
Cell Services	A ^(f)	0.005-4.0	0.30	1.1	0.021	5.5	14	---	23, 24, 26, 27
Cell Services	P ^(g)	0.006-0.90	0.23	0.32	0.076	4.8	20	70(10) ⁽ⁱ⁾	23, 24, 26, 27
Cell Services	PS ^(h)	0.005-4.25	1.0	1.3	0.31	8.4	13	77(0)	24, 25, 26, 27
Chlor-Alkali	A	0.11-4.4	2.3	3.0	0.70	14	2	---	28
Chlor-Alkali	P	0.03-0.87	0.45	0.42	0.23	6.0	3	100	28
Chlor-Alkali	PS	0.07-0.29	0.18	0.16	0.14	2.7	2	100	28

- (a) Arithmetic mean
 (b) Standard deviation
 (c) Geometric mean
 (d) Geometric standard deviation
 (e) Number of samples
 (f) Area sample
 (g) Personal sample (more than 1 hr)
 (h) Personal sample (less than or equal to 1 hr)
 (i) (Respirator use not documented).

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TABLE 4. POTENTIAL EXPOSURE TO ASBESTOS: Western Division (1978-1985)

Plant	Sample Type	Asbestos Concentration (fiber/cc)				N(e)	Respirator Use (%)	Reference
		Range	$\bar{X}$ (a)	σ (b)	GM (c)	GSD (d)		
Cell Repair	A ^(f)	0.004-0.93	0.12	0.27	0.022	5.7	---	29,30,31,32
Cell Repair	P ^(g)	0.002-0.1	0.042	0.043	0.017	5.2	45	30,31,32
Cell Repair	PS ^(h)	0.005-16.1	0.49	2.4	0.043	5.3	46	29,31,32

(a) Arithmetic mean
 (b) Standard deviation
 (c) Geometric mean
 (d) Geometric standard deviation
 (e) Number of samples
 (f) Area sample
 (g) Personal sample (more than 1 hr)
 (h) Personal sample (less than or equal to 1 hr)
 (i) (Respirator use not documented).

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TABLE 5. NUMBER OF PERSONNEL WITH POTENTIAL EXPOSURE TO ASBESTOS
(MAY, 1986)

<u>Division</u>	<u>Process</u>	<u>Number</u>
Texas	Cell Services & Chlorine	97
	Oyster Creek	83
Louisiana	Cell Service	13 Dow
		18 Contractor
	Chlor-Alkali	32 Dow
		2 Contractor
	Chlorine	38 Dow
		2 Contractor
Western	Cell Repair	23
Michigan	Plant Closed	0
TOTAL		308

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