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DOW CHEMICAL U.S.A.

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TEXAS DIVISION
FRIEDMONT, TEXAS 77541

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ENVIRONMENTAL HEALTH REPORT

EVALUATION OF EMPLOYEE EXPOSURES
TO ASBESTOS AT CHLORINE PLANT SERVICES
A-1000 AND A-700

FILE NO. A10-2416

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Summary

Monitoring was conducted from February-October, 1983, at Chlorine Plant Services, A-1000 and A-700, to evaluate employee exposures to asbestos. With the exception of slurry preparation at A-1030, all employee excursion and time-weighted average exposures to asbestos were within acceptable levels. Because of the ventilation system (and better exposure control) at A-702, it is recommended that all slurry be prepared at this facility, if possible. Alternatively, similar engineering controls should be installed at the A-1030 location.

Employees should be informed of the results of this survey, and the informing documented.

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INTRODUCTION

A survey was conducted from February - October, 1981, at Chlorine Plant Services, A-1000 and A-700, to evaluate employee exposures to asbestos.

PROCESS & JOB DESCRIPTIONS

See Appendix C

MONITORING METHODOLOGY

Asbestos samples were collected by A. J. Tolbert of Chlorine Plant Services. The samples were collected on cross-hatched cellulose acetate filters (Millipore MAWG 03700), using Bendix BOX-44 air sampling pumps to draw approximately two liters per minute of air across the filters. The pumps were calibrated before and after use with a calibrated Gilmont rotameter, S/N B3978. Sampling times ranged from 15 minutes to 7 hours, depending on the job or area being monitored.

Analyses were performed at Analytical Services, B-1225. The samples were prepared by placing a section of filter on a microscope slide containing a few drops of clearing solution (dimethylphthalate, diethyloxalate, and millipore filter), covering, and warming the slide slightly to aid dissolution of the sample filter. The fibers were then counted using optical microscopy.

EVALUATION CRITERIA

Industrial hygiene guides (IHG's) are concentrations of airborne substances to which nearly all employees may be repeatedly exposed throughout a working lifetime without adverse effect. They are based on industrial handling experience and on experimental animal toxicological studies. IHG's do not represent fine lines between safe and dangerous exposures; rather they are intended for use as guides for evaluating occupational exposures and for plant design. For asbestos fibers, IHG's are expressed as the number of asbestos fibers per cubic centimeter of air (# fibers/cm³). An asbestos fiber is defined as a particle greater than or equal to 5 microns in length.

Most IHG's are expressed as time-weighted average (TWA) concentrations for 8-12 hour work days and 40 hour work weeks. For many substances, higher excursion levels are allowed for specified time limits, provided that the TWA limits are not exceeded.

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EVALUATION CRITERIA (continued)

The IHG's for asbestos differ, depending on the type of fiber. The IHG's for the types of asbestos used at Chlorine Plant Services are as follows:

Type Asbestos	Industrial Hygiene Guide (fibers/cm ³)	
	8-hour	Excursion
Chrysotile (white asbestos)	2.0	10.0
Crocidolite (blue asbestos)	0.2	1.0
Mixture (75% white, 25% blue)*	0.6	3.0

- * Since both types of asbestos fibers exhibit similar consequences of overexposure, it is necessary to consider their combined effects when evaluating monitoring results. A sample calculation for determining the mixture IHG is shown in Appendix D.

Effective November 4, 1983, the Occupational Safety and Health Administration (OSHA) set an Emergency Temporary Standard for asbestos, limiting employee 8 hour time-weighted average exposures to 0.5 asbestos fibers/cm³ of air. All future monitoring results should be evaluated against this standard.

RESULTS AND DISCUSSION

Estimated employee 8 hour time-weighted average (TWA) exposures to asbestos are calculated in Table 1, on the basis of employee time distributions and the summarized asbestos monitoring results shown in Table 2. The 8 hour TWA exposure levels for the Class I and Class II Operators were found to be within acceptable levels, with the exception of the exposure to the Class II Operator on days slurry was prepared at A-1030 (an infrequent job performed on an "as-needed" basis). The average 8 hour exposure to the Class II Operator on slurry preparation days at A-1030 was 0.8 fibers/cm³, or approximately 1 1/3 times the IHG of 0.6 fibers/cm³. All other 8 hour average exposures to employees at Chlorine Plant Services were 0.1 fibers/cm³ or less.

Summarized asbestos monitoring results are shown in Table 2, with individual personnel and area monitoring results given in Appendices A and B, respectively. Only one of the six job procedures monitored, making asbestos slurry at A-1030, resulted in (potential) employee exposures to asbestos in excess of acceptable levels (respiratory protection is required).

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RESULTS AND DISCUSSION (continued)

The average employee exposures to asbestos while preparing slurry at A-1030 was 6.5 fibers/cm³, approximately twice the excursion IHG of 3 fiber/cm³. The next highest employee excursion exposures occurred during slurry preparation at A-702, with average (potential) exposures of 1.5 fibers/cm³, or one-half of the excursion IHG. All other excursion and TWA exposures to employees were 0.3 fiber/cm³ or less, well within acceptable levels. All area levels of asbestos measured under normal operating conditions averaged 0.03 fibers/cm³ or less, or 5% or less of the IHG.

CONCLUSIONS AND RECOMMENDATIONS

Employee 8 hour TWA exposures to asbestos at Chlorine Plant Services were within acceptable levels, with the exception of the Class II Operators' exposures on days slurry was prepared at A-1030. Similarly, all employee excursion exposures to asbestos were within acceptable levels, except for the slurry preparation job at A-1030. All area concentrations of asbestos were well within allowed levels.

It is recommended that slurry preparation at A-1030 be discontinued, if possible, and all slurry be prepared at the A-702 facility. Alternatively, engineering controls should be installed at A-1030 to reduce potential employee exposures to asbestos. The ventilation system at A-702 has reduced employee exposures to approximately one-fourth of those at the A-1030 facility, which has no ventilation system. In the interim, employees should continue to wear approved respiratory protection when performing this procedure at A-1030 until monitoring shows that the potential exposure levels have been reduced to less than 3 fiber/cm³.

While employee exposures to asbestos were within allowed levels during slurry preparation at A-702, it is recommended that required use of respiratory protection be continued, since the potential exists for much higher exposures in the event of an equipment malfunction or process upset. In the interest of keeping employee exposures to asbestos as low as is practicable, it is also recommended that employees continue to wear respiratory protection for those jobs and areas where it is currently utilized.

Employees should be informed of the results of this survey, the potential effects of overexposure to asbestos, methods of exposure control, and the proper care and use of protective equipment. This informing should be documented.

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TABLE 1
CHLORINE PLANT SERVICES, A-1000 AND A-700
ESTIMATED EMPLOYEE 8-HOUR AVERAGE EXPOSURES TO ASBESTOS

JOB CLASSIFICATION	JOB PROCEDURE/LOCATION	AVERAGE TIME/SHIFT (HOURS)	AVERAGE ASBESTOS CONC. (FIBERS/CM ³)
Class I Operator (A-702)	Making slurry	0.5	1.5
	Cathode weighing/working in storage area	1	0.002
	Working in draw vat area	1.5	0.007
	Removing stiffening bath	2	0.008
	Control room, etc.	1	0.007
	Estimated 8 hour exposure-----		0.1
Class II Operator (A-1020, A-1022)	Cell Assembly (includes "stabling")	7	0.02
	Lunch, control room, etc.	1	--
	Estimated 8 hour exposure-----		0.10
Class II Operator (A-1000, A-1022)	Making slurry*	1	6.5
	Working in area of draw vat*	6	0.007
	Control room, lunch, etc.	1	--
	Estimated 8 hour exposure-----		0.6
Class II Fork Truck	Unloading asbestos van	0.5	0.2
	Working in other plant areas	7.5	--
	Estimated 8 hour exposure-----		0.01

Industrial Hygiene Guide-----0.6 fibers/cm³ air

* These jobs are performed non-routinely on an "as-needed" basis. Respiratory protection worn during slurry preparation procedures. Since the Class II Operator prepares slurry very infrequently, the Cell Assembly assignment is the best representation of the overall exposure level.

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APPENDIX A
CHLORINE PLANT SERVICES, A-1000 AND A-700
1983 ASBESTOS PERSONNEL MONITORING RESULTS

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EMPLOYEE	MASTER NUMBER	JOB PROCEDURE/LOCATION	DATE	PROCEDURE/SAMPLING TIME (MINUTES)	ASBESTOS (FIBERS/CM ³)
		A-702 - making slurry	2-10-83	25	0.5
	135400	"	2-14-83	25	2.1
	136572	"	2-14-83	25	1.1
	138294	"	2-15-83	25	1.2
	136459	"	2-15-83	20	1.5
	136459	"	3-1-83	15	0.6
	138294	"	5-9-83	17	2.7
	135395	"	5-10-83	17	2.9
	136615	"	5-12-83	19	0.8
	136615	"	5-13-83	14	1.7
	135395	"	5-19-83	21	0.9
	137631	"	5-20-83	25	2.6
	136615	"	5-23-83	14	1.9
	135400	"	6-10-83	21	1.0
	136615	"			
				AVERAGE-----	1.5
		A-702 - loading elevator with bagged asbestos	5-10-83	12	0.3
	135395	"	5-12-83	18	0.05
	135395	"	5-13-83	17	0.5
	138272	"	5-19-83	25	0.3
	137631	"	5-20-83	21	0.8
	138272	"	5-23-83	17	0.2
	135395	"	6-10-83	17	0.2
				AVERAGE-----	0.3
		A-1000 - making slurry	5-9-83	30	8.1
	135626	"	5-10-83	20	10.2
	135626	"	5-11-83	37	3.9
	135626	"	5-12-83	50	5.5
	135626	"	5-13-83	55	5.7
				AVERAGE-----	6.5

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APPENDIX A (continued)
CHLORINE PLANT SERVICES, A-1000 AND A-700
1981 ASBESTOS PERSONNEL MONITORING RESULTS

EMPLOYEE	MASTER NUMBER	JOB PROCEDURE/LOCATION	DATE	PROCEDURE/SAMPLING TIME (MINUTES)	ASBESTOS (FIBERS/CM ³)
	135656	A-702 - removing stiffening rods	3-2-83	160	0.02
	136259	"	7-16-83	59	0.002
	137631	"	7-16-83	32	0.005
	135656	"	7-16-81	59	0.005
				AVERAGE	0.008
	136259	A-1022 - stabling cells	3-25-83	180	0.05
	136572	"	3-25-83	180	0.05
	136208	"	8-5-83	35	0.01
	135905	"	8-5-83	35	0.006
	138292	"	8-5-83	33	0.02
	138072	"	8-5-83	35	0.005
				AVERAGE	.02
	135296	Unloading asbestos van	5-25-83	15	0.00
	135296	"	7-16-83	16	0.02
				AVERAGE	0.02

Industrial Hygiene Guide (8 hour)-----0.6 fibers/cm³
(exposure)-----1.0 fibers/cm³

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APPENDIX B
CHLORINE PLANT SERVICES, A-1000 & A-700
ASBESTOS AREA MONITORING RESULTS - 1983

JOB PROCEDURE/LOCATION	DATE	SAMPLING TIME (MINUTES)	ASBESTOS (FIBERS/CC)
A-702 - draw vat area (east)	4-20-83	420	0.01
" " (north)	4-20-83	420	0.006
" " (west)	4-20-83	420	0.002
" " (south)	4-20-83	420	0.008
		AVERAGE-----	0.007
A-702 - cathode storage area	4-25-83	420	0.002
" " "	4-25-83	420	0.003
" " "	4-25-83	420	0.004
" " "	4-25-83	420	0.004
		AVERAGE-----	0.003
A-702 - next to bonding oven	10-12-83	420	0.006
" " "	10-14-83	420	0.006
" " "	10-14-83	420	0.008
" " "	10-14-83	420	0.005
" " "	10-14-83	420	0.005
		AVERAGE-----	0.006
A-702 - control room	10-10-83	450	0.002
" " "	10-11-83	480	0.002
" " "	10-12-83	420	0.020
		AVERAGE-----	0.007
A-701 warehouse (asbestos storage)	10-11-83	480	0.01
" " "	10-12-83	420	0.07
" " "	10-14-83	420	0.01
" " "	10-14-83	420	0.01
		AVERAGE-----	0.03
A-1000 - office area	10-10-83	450	0.2 *
" " "	10-11-83	480	0.01
Next to road	10-11-83	480	0.002
" " "	10-12-83	420	0.01
" " "	10-14-83	450	0.003
		AVERAGE-----	0.01

Industrial Hygiene Guide (8 hour)-----0.0 fibers/cc
(excursion)-----3.0 fibers/cc

* Results suspect - filter appeared contaminated

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CHLORINE PLANT SERVICES
PROCESS AND JOB DESCRIPTIONS

Chlorine Plant Services provides a variety of service functions for the chlorine plants. Major services are as follows:

Assembling and dismantling cells -- A-1020, A-1022

Preparing asbestos slurry -- A-702, A-1030 (back-up)

Drawing diaphragms with asbestos slurry --- A-702,
A-1022 (back-up)

Rinsing oil off cathodes with 10% NaOH --- A-1000

Seal back of ATC's (anode terminal cells) with
Derakane and sand ---- A-1000

Transport cells and cell parts within and out of the
Texas Division

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CHLORINE PLANT SERVICES

Job duties at Chlorine Plant Services are organized (in general, by building assignment).

Class I Operator -- A-702, A-701 (Acct. 5022)

In general, rotates weekly among 3 jobs:

"Board Operator"

- spends 90-95% of time at control board for operating equipment to make slurry and for drawing vat
- samples asbestos slurry:
 - bulk slurry after a batch is prepared
 - vat slurry at beginning and end of "draw"
- analyzes samples for percent solids and "freeness"

"Front Operator"

- makes asbestos slurry once/day (2 employees):
 - one loads bags of asbestos (12) onto elevator, using fork truck (downstairs)
 - other employee opens bags and pours contents into mixing tank, seals empty bags in plastic bag, and puts in asbestos dumpster (wears disposable coveralls and dust mask)
- straightens pockets on undrawn diaphragms (cathodes) to line up with raker in drawing vat
- pumps Kynar, Triton, Antifoam, & slurry into vat
- loads & unloads cathodes from vat (using crane)
- oversees operation of drawing vat
- unbolts "draw pan" and puts cathodes in bonding oven
- washes down vat area daily

"Back Operator"

- weighs bare and loaded cathodes
- unloads bonding oven
- uses impact wrench to remove stiffening bars from drawn and loaded cathodes (sprays with kerosene to keep asbestos "dust" to a minimum)
- measures thickness of bonded asbestos on cathodes (15 minutes/cathode, 4 times/day)
- performs miscellaneous fork truck work
- cleans building with sweeper a couple of times/week.

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Class II Operator --- A-1022, A-1030 (Acct. 5023)

- assembles chlorine cells:
 - cleans anodes (scrape rust off copper clips)
 - "stabs" cells by dropping cathodes into cell body
 - runs air permeability tests on cells
 - puts cell putty and rubber around edges, gluing with small amount of epoxy resin
 - 5-10 days/series of cells
 - 53 projections are to build 1 series (60 cells)/1-2 months
- disassembles chlorine cells (a series at a time) which are removed from service in chlorine plants
 - removes cathodes from bodies, salvageable ones are sent to Cathode Cleaning Facility at OCU
 - salvageable bodies go to Louisiana Division
- as back up for A-702, prepares asbestos slurry in mix room, A-1030
 - opens and dumps bags of asbestos in mixing tank
 - disposes of empty bags in asbestos dumpster
- seals back of anode terminal cells (ATC) with Derakane/sand mixture
 - 1 steps: mix and pour Derakane into ATC, add sand when Derakane is tacky
 - takes about 8 hours, employee exposure time is 2-3 hours
 - 2 - 3 times/year

Class II Fork Truck Operator - Shipping & Receiving (Acct 5020)

- uses fork truck to transport goods around and between A-700 and A-1000 blocks
- unloads asbestos bags from railcars into A-701 warehouse and transports asbestos to A-1030 slurry room as needed

Crane Operator Cab -- A-1022 (Acct. 5023)

- operates overhead crane in assembling ("stabbing") and disassembling cells

Chief Material Handling Technicians - Shipping and Receiving (Acct. 5020)

- use trucks to transport goods to and from chlorine plants, Cathode Cleaning Facility, etc.

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File A15-1-10

APPENDIX D

CALCULATING IHC'S FOR MIXTURES OF ASBESTOS ---- EXAMPLE

<u>TYPE ASBESTOS</u>	<u>% IN MIXTURE</u>	<u>IHC (8 HOUR)</u>
Chrysotile	75	2.0 fibers/cm ³
Crocidolite	25	0.2 fibers/cm ³

$$\begin{aligned} \text{IHC for mixture} &= \frac{1}{\frac{\text{fraction 1}}{\text{IHC 1}} + \frac{\text{fraction 2}}{\text{IHC 2}}} \\ &= \frac{1}{\frac{.75}{2.0} + \frac{.25}{0.2}} \end{aligned}$$

$$\text{IHC for mixture} = 0.6 \text{ fibers/cm}^3 \text{ of air}$$

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