PLAINTIFF'S EXHIBIT DOW-285

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Biochemical Research Laboratory

The Dow Chemical Company

EXPOSURES TO ASBESTOS DUST ENCOUNTERED IN THE CHLORINE CELLS MAINTENANCE AREA, 295, 236, 137 AND 261 BUILDINGS

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Signed Roy A. DeGesero Date September 9, 1969

Checked H S Hoyle Date 9-9-69

PROBLEM

Supervision requested that the Environmental Research Laboratory survey and evaluate exposures to asbestos encountered by personnel during several operations in the Chlorine Cells area, 295, 236, 137 and 261 Buildings.

CONCLUSIONS

1. The present TLV (Threshold Limit Value) for asbestos exposure is 5 mppcf (million particles per cubic foot). By 1971, barring information to the contrary, the TLV will be lowered to 2 mppcf. The proposed TLV should be observed.

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2. The northern end of 295 Building (cell repair and screen making) is an area of potential asbestos exposure. The southern end of 236 Building (chipping and cell repair area) is an area of potential asbestos exposure. Other buildings reviewed in the Chlorine Cell Complex (261, 137) lack significant potential for asbestos exposure.

3. In 295 Building, personnel in the job classifications Cell Maintenance Man and Diaphragm Puller receive time-weighted exposures to asbestos in excess of the present and proposed TLV's for asbestos (5 mppcf and 2 mppcf, respectively). The time-weighted exposures for these job classifications are

Diaphragm Puller	-- 9.4 mppcf
Cell Maintenance "weigher"	-- 6.3 mppcf
Cell Maintenance "set-up men"	-- 2.7 mppcf

These exposures are unacceptable and must either be reduced to within the proposed health standard of 2 mppcf by lowering concentrations of asbestos-containing dust in air, or approved respirators must be worn.

4. "Spares" in 295 Building are receiving time-weighted exposures of 1.7-9.4 mppcf, depending on whom they substitute for. The yearly average time-weighted exposure is 5.0 mppcf, assuming "Spares"

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substitute equally for the Diaphragm Pullers, Set-Up Men, Repair Men and Weighers in the course of a year's work. This exposure is unacceptable and must either be reduced to within the proposed health standard of 2 mppcf by lowering concentrations of asbestos-containing dust in the air, or approved dust respirators must be worn.

5. Personnel in 295 Building who are receiving time-weighted exposures within the proposed TLV of 2 mppcf include:

Senior Cell Shop Mechanic	--	1.1 mppcf
Journeyman Cell Mechanic	--	1.1 mppcf
Foreman, Crew Leader	--	1.1 mppcf
Cell Maintenance "repair men"	--	1.7 mppcf
Plasterer	--	1.3 mppcf

No health hazard is anticipated at these time-weighted levels of exposure to asbestos.

6. The Liquid Chlorine Operator, Assistant Operator and Hydrogen Operator in 295 Building can receive exposure to asbestos during a daily mixing operation. Based on concentrations found to be typical of mixing operations, no hazard to health from asbestos exposure is anticipated in light of the brief exposure time (at most 20 minutes per day).

7. The following job classifications in 236 and 137 Buildings were examined for potential asbestos exposure: Plant Mechanic (295, 137 Buildings), Electrode Maker (261 Building), Resin Protector Fabricator (236 Building), Cell Welder (236 Building), Special Welder (236 Building) and Electrician (295, 137 Buildings). Asbestos exposures encountered by personnel in these classifications are small, and asbestos is not used in their work areas to any great extent. No hazard to health from asbestos exposure is anticipated for personnel in these job classifications.

RECOMMENDATIONS

1. Personnel in the Chlorine Cells area who are currently receiving time-weighted exposures to asbestos-containing dust in excess of 2.0 mppcf should be required to use approved respiratory protection until other means of lowering exposures can be found (e.g., ventilation improvement, changing work procedures, etc.), or some material can be substituted for asbestos which does not present the pulmonary hazards of asbestos.

2. Bags and drums of asbestos should not be allowed to release asbestos fibers to the room air. If possible, asbestos should be weighed out and handled within a suitable exhaust hood. Bags and drums should be kept sealed and covered when not in use.

3. Supervision should request asbestos manufacturers use packages which do not allow leakage of asbestos. The burlap bags allow visible amounts of asbestos to escape from the bag when bags are jarred or placed near open doors, etc.

4. The practice of sitting on bags of asbestos in 295 Building should be discouraged. Fibers of asbestos were seen to leak out of the burlap bags when men sat on the bags.

5. Good housekeeping is essential in safe handling of asbestos fibers. Spills should be cleaned up at once. Vacuum cleaning is preferred to sweeping with a broom. Supervision should determine whether an industrial vacuum cleaner is feasible in 295 Building or insist that prior to broom sweeping the spills be thoroughly wetted with water to minimize dustiness.

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6. All personnel who have occasion to use asbestos should be informed of the hazards of the material and learn correct procedures for handling asbestos fibers so as to prevent high dust levels. An educational effort concerning use of approved* respiratory protection should be undertaken or continued, especially in areas of major exposures.

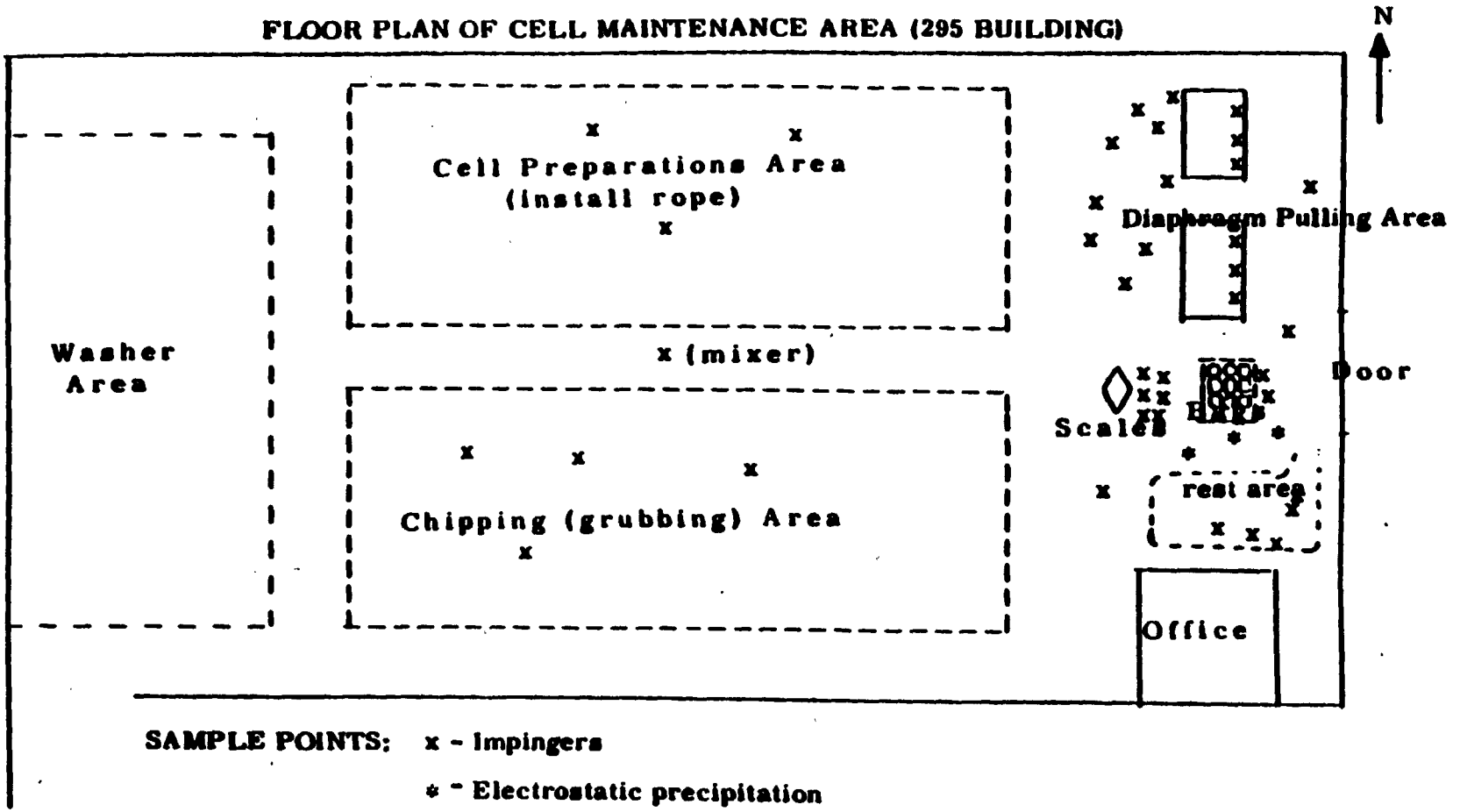
7. Any upgrading in ventilation, procedures, or handling of materials should be evaluated by the Environmental Research Laboratory to ascertain the effectiveness of such changes in terms of lowering exposures to asbestos dust.

PRESENTATION OF DATA

A total of 36 breathing zone impinger samples and 3 electrostatic precipitator samples were collected in 295 Building on May 13, May 14, May 15, and May 27, 1969. Three breathing zone impinger samples were collected in 236 Building on August 4, 1969. The enclosed Floor Plan shows sampling points in 295 Building.

*U.S. Bureau of Mines approved respiratory protection available at the Safety Department, 400 Building, include the "Dustfoe" 66 and Suregard R2090 cartridge respirators which remove the respirable range of dust. Respirators must be properly fitted.

FLOOR PLAN OF CELL MAINTENANCE AREA (295 BUILDING)



SAMPLE POINTS: x - Impingers

* - Electrostatic precipitation

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Impinger samples have been collected and evaluated using standard light-microscopy techniques. Concentrations of asbestos-containing dust are expressed as millions of particles per cubic foot of air (mppcf). Electrostatic precipitator samples have been analyzed for concentration (mg/m^3) and crystalline composition (X-ray diffraction). Table 1 indicates that asbestos (serpentine) is the chief crystalline constituent.

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Table 1. X-RAY DIFFRACTION ANALYSIS OF CRYSTALLINE MATTER IN THE BREATHING ZONE, 295 BUILDING.

Crystalline Material	Sample A	Sample B	Sample C
Serpentine (asbestos)	chief constituent	chief constituent	chief constituent
Calcite	5-15%	5-15%	10-20%
Quartz	5%	5%	5-10%
NaCl	10-15%	5-10%	10-20%
$Mg(OH)_2$	---------- possible trace in each sample ----------		

*Note that no value can be determined as to the amount of crystalline material and noncrystalline material present. The samples could, however, be as much as 50% noncrystalline.

Sample	Concentration (weight/vol of air)
A	1.0 mg/m^3
B	0.7 mg/m^3
C	0.7 mg/m^3

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Job Evaluation

An estimate of the effects on health of exposure to asbestos requires knowledge of both the concentration of dust and the length of time a man encounters such concentrations. Supervision and men define their activities by work areas to account for the eight hour day. The enclosed Industrial Hygiene Job Analysis tables list concentrations and exposure times for those job classifications which show significant potential for asbestos exposure.

The job classification Cell Maintenance Man has been subclassified into individual activities. The "weigher" in 295 Building weighs out asbestos and assists the Diaphragm Puller. "Set-up men" remove screens from the cement rabbits, transport the screens to the Diaphragm Puller, cut and install asbestos rope, mix, and plaster asbestos cement onto cells. "Repair men" may work in either 295 or 236 Buildings. Repair men's greatest exposure to asbestos is encountered during a chipping operation called "grubbing." Pneumatic chisels are used to rout dried cement, asbestos rope and putty off the cement forms, or "rabbits."

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Exposures

An exposure describes the time-weighted eight hour average concentration of asbestos-containing dust encountered by personnel in

the job classification being evaluated. Concentration and time of exposure vary independently of each other as the activity or location of work changes. Time-weighting integrates these two variables by summing the products of (concentration x time) for each change in area or activity according to the formula:

$$\text{8 hr time-weighted exposure} = \frac{1}{480 \text{ min}} \sum_{i=0}^{n} (\text{conc.} \times \text{time})_i =$$

for n different areas or activities.

The following table lists the time-weighted exposures for several job classifications in the Chlorine Cells area.

Building(s)	Job Classification	Time-Weighted Exposure to Asbestos (mppcf)
295, 236	Senior Cell Shop Mechanic	1.1
295, 236	Journeyman Cell Shop Mechanic	1.1
295	Foreman, Crew Leader	1.1
295	Plasterer	1.3
236, 295	Cell Maintenance "repair man"	1.7
295	Cell Maintenance "set-up man"	2.7
295	Cell Maintenance "weigher"	6.8
295	Diaphragm Puller	9.4
295	"Spares"	1.7-9.4*

*5.0 average

Several other job classifications in the Chlorine Cells area were reviewed for potential asbestos exposure. Either there was no potential or very low potential for the job classifications mentioned below, so time-weighting was dispensed with.

Building(s)	Job Classification
263	Resin Protector Fabricator
295, 137	Plant Mechanic
261	Electrode Maker
236	Cell Welder
236	Special Welder
295, 137	Electrician

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Health Standards

A Threshold Limit Value (TLV) describes that eight hour time-weighted exposure to asbestos a man can repeatedly encounter for his entire work career with no adverse effect on health. The TLV is a time-weighted average. Exposures may exceed the TLV for brief time periods, provided such excesses are matched by periods when the exposure is correspondingly below the TLV. The present TLV for asbestos is 5.0 mppcf by impinger sampling techniques. The American Conference of Governmental Industrial Hygienists (ACGIH), which formulates the

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[redacted] mppcf to provide better protection for asbestos workers. Barring evidence to the contrary, the TLV of 2.0 mppcf will go into effect in 1971.

"Spares," the Diaphragm Puller, Weigher and Set-Up Men receive time-weighted exposures in excess of the proposed TLV. A potential hazard to the health of individuals in these classifications exists. The other personnel in Chlorine Cells are exposed to less than 2 mppcf (time-weighted), and no hazard to their health is anticipated.

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DISCUSSION

Asbestos concentrations vary considerably near the tanks in 295 Building. Depending on the operation, concentrations range from 0.5-40.8 mppcf. The following table lists the operations, concentration means and concentration ranges of breathing zone impinger samples near the tanks.

Operation	No. of Samples	Dust Concentration (mppcf) Range	Mean
Sweep floors near bags	3	27.1-34.4	29.8
Swab excess wet asbestos off screens	8	0.5-30.0	16.3
Weigh out asbestos	6	4.3-40.8	15.1
Slurry asbestos and caustic	6	4.2-34.2	13.4
"Breaks" area	7	0.5-19.8	7.3

Concentrations of dust in the breathing zone caused by broom sweeping could be lowered if spills were wetted or vacuumed instead of being swept up dry. Use of suitable ventilation near the tanks would lower concentrations of dust in the breathing zone during the swabbing off of wet slurry and during slurrying of asbestos and caustic. Suitable ventilation at the scales would help lower dust concentrations in the breathing zone during weigh out operations. The concentrations measured in the breaks area would be lowered by adherence to both of the above suggestions.

Dust levels in the breaks area averaged 7.3 mppcf. This figure includes times when work has ceased at the tanks and scales. Data suggests that dust remains airborne in the breaks area and is added to as dust from other sources in the area (bags, spills) becomes airborne when men walk across spills or sit on bags. Concentrations of dust in the breaks area would be lower if spills were promptly vacuumed up, if bags were stored in a ventilated area and/or a better package were used, and men did not sit on burlap bags of asbestos.