PRELIMINARY FINDINGS OF AN EPIDEMIOLOGIC STUDY OF TALC WORKERS

(INDUSTRIAL HYGIENE PORTION)

by

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INTRODUCTION

Talc, a magnesium silicate mineral, is mined in several geographic areas in the United States. The ore bodies examined in this study were Montana, Texas, and North Carolina. We examined seven (7) mines and eight (8) mills.

The purpose of the study was to characterize the talc, evaluate the workers' exposure, and ascertain the chronic effects of exposure (Table A). The environment of each facility was characterized as to total and respirable dust concentrations, percent (%) free silica, trace element concentrations, percent (%) fibrous minerals, calcite, and dolomite. Individual exposure was determined by personal respirable breathing zone samples on all participating employees. Estimates of exposure for each job were obtained from the personal samples.

The mines in Montana and Texas are typical open-pit operations, while the mine examined in North Carolina is underground employing square set timbers and stopes.

RESULTS

Personal respirable breathing zone samples (PRBZ) were collected from each participating employee and Time Weighted Averages (TWA) were obtained. The TWA's were utilized to derive geometric mean values for each job examined. These mean values were then used to develop cumulative exposures.

The time weighted averages for each employee were grouped together according to the actual job performed on the day of the study. The geo-

metric mean for each job classification was then calculated from the grouped TWA's.

The geometric mean for the dust levels in the mine and mill are presented by region (Table B & C).

Each ore body was analyzed for the following trace elements: Iron, Manganese, Calcium, Aluminum, Zinc, and Nickle (Table D). These trace elements were selected to compare the talc examined in this study with the talc examined in New York and Vermont.

Montana talc had the lowest concentrations of trace elements of the three regions examined. The trace element concentrations were slightly higher in North Carolina. Texas talc differed most significantly from the other regions by its extremely large concentration of calcium.

The mineral composition of bulk samples also indicated higher calcium value in the Texas. This talc had a much larger percentage of dolomite ($CaMg(C)_3$) and a slightly larger percentage of calcite ($CaCO_3$) than the other two regions (Table E).

Examination of bulk samples of talc from each region for free silica demonstrated the same trend as other contaminants (Table F). Montana talc had < .8% which was the limit of detection. North Carolina had a slightly higher percentage, while Texas had the highest observed silica content.

Respirable dust samples revealed the silica content in Montana and North Carolina to be generally below the limit of detection. The Texas talc had slightly higher levels of respirable silica.

Analysis for the presence of fibrous minerals was two-fold. The first analysis was with light microscopy utilizing phase contrast techniques.

Light microscopy was used as a screening tool to detect the presence of fibers. Further analysis of samples from each region was performed utilizing analytical transmission electron microscopy (Table G). Fibrous minerals were not detected in any samples of Montana talc.

There were two fibrous minerals identified in the Texas talc: tremolite and antigorite.

Antigorite, a serpentine mineral was the major constituent. The fibers of both minerals ranged from 0.5 to 3.0 μm in diameter and 4 to 30 μm in length.

The morphology of the North Carolina talc was identified as acicular. The acicular particles had aspect ratios ranging from 5 to 1 to 100 to 1 with some diameters $\lesssim$.1 μm. These acicular particles may have resulted from mechanical destruction of plates.

TABLE A

INDUSTRIAL HYGIENE CHARACTERIZATION OF TALC

I. Personal Respirable Breathing Zone Samples

II. Trace Element Concentration

III. Mineral Composition

IV. Fibrous Minerals

V. Free Silica

TABLE B

PERSONAL RESPIRABLE BREATHING ZONE SAMPLES
(AVG = GEOMETRIC MEAN)

Job	Avg (mg/m^3)	Variance	Number of Samples
Montana			
Bagger	2.8	1.9	29
Labman	.3	2.5	4
Fork Lift Op.	.5	1.8	5
Mill Operator	1.0	2.5	7
Laborer	1.4	2.0	6
Foreman	.6	2.8	14
Boiler Operator	.1	4.9	2
Front-End Op.	.8	6.1	14
Maintenance	.4	4.3	16
Welder	6.3	---	1
Wash Plant Op.	1.4	8.7	2
Sorter	1.6	2.3	50
Driller	.1	---	1
Truck Driver	.3	1.8	15
Miner	.4	1.9	2
Shovel Operator	.2	3.6	5
Calciner Operator	.6	---	1
	.86	.59	174
Texas			
Bagger	3.1	2.9	3
Stacker	1.6	---	1
Forklift Op.	2.3	1.5	2
Mill Operator	38.4	---	1
Laborer	1.3	4.5	10
Foreman	1.3	3.6	4
Front-End Op.	1.3	5.3	7
Maintenance	1.0	3.6	10
Sorter	.6	1.8	2
Driller	.7	2.0	2

TABLE B
(continued)

PERSONAL RESPIRABLE BREATHING ZONE SAMPLES
(AVG = GEOMETRIC MEAN)

Job	Avg (mg/m^3)	Variance	Number of Samples
Texas			
Truck Driver	.9	1.5	5
Miner	.1	1.5	2
Shovel Operator	.3	1.2	2
Calciner Operator	1.1	---	1
Crusher Operator	1.7	---	1
Welder	8.5	---	1
	1.08	.52	54
North Carlinia			
Bagger	.9	---	1
Mill Operator	.9	---	1
Laborer	.2	5.8	9
Foreman	.9	---	1
Maintenance	.03	5.8	2
Driller	.1	1.4	3
Hoist Operator	.1	2.2	2
Miner	.3	4.2	9
Grader	.4	4.8	7
Packer	1.2	---	1
Cutter	1.2	2.5	4
Rounder	.9	---	1
Officer Personnel	.1	16.5	3
	.21	.74	44
ALL REGIONS	.72	.68	275

TABLE C

SUMMARY OF RESPIRABLE DUST SAMPLES
(AVG = GEOMETRIC MEAN)

Region	Avg (mg/m^3)	95% Confidence Range of Mean
Montana		
Mill	1.1	.85 - 1.41
Mine	.66	.47 - .92
Texas		
Mill	1.56	2.54 - .96
Mine	.45	.18 - .71
North Carlina		
Mill	.26	.13 - .51
Mine	.14	.07 - .31

CONCLUSIONS

Mill - Baggers and Mill Operators had highest exposures.

Mine - Truck Drivers and Front-end Loader Operators had highest exposure.

TABLE D

TRACE METALS
(mg/m^3)

Montana

Iron	Manganese	Calcium	Aluminum	Zinc	Nickel
.05	<.01	.05	.2	<.01	<.01
		Limit of Detection			
.01	.01	.03	.1	.01	.01

North Carolina

Iron	Manganese	Calcium	Aluminum	Zinc	Nickel
.05	<.02	.05	.2	<.02	<.02
		Limits of Detection			
.02	.02	.02	.04	.02	.02

Texas

Iron	Manganese	Calcium	Aluminum	Zinc	Nickel
.5	<.08	8.0	.04	.08	<.08
		Limits of Detection			
.1	.08	.2	.2	.08	.08

TABLE E

MINERAL COMPOSITION OF BULK SAMPLES

AVERAGE PERCENTAGE (RANGE IN PARENTHESIS)

	Calcite	Dolomite
Montana	∠1	1
	(0-.8)	(0-3)
Texas	1	13
	(0-3)	(7-20)
North Carolina	0	3
	0	(1-4)

TABLE F

FREE SILICA BULK SAMPLES

Montana	∠.8% (Limit of Detection)
Texas	2.23%
North Carolina	1.45%

TABLE G

FIBROUS MINERALS

Montana

None Detected

Texas

Tremolite

Antigorite

North Carolina

Acicular Particles

NIOSH

PROCEEDINGS OF THE
FIRST NCI/EPA/NIOSH COLLABORATIVE WORKSHOP:
PROGRESS ON JOINT ENVIRONMENTAL AND
OCCUPATIONAL CANCER STUDIES

MAY 6-8, 1980

SHERATON/POTOMAC, ROCKVILLE, MARYLAND

The papers included in these Proceedings were printed as they were submitted to this office.

Appropriate portions of the discussions, working groups and plenary session were sent to the participants for editing. The style of editing varied, as could be expected. To the extent possible, we have attempted to arrive at a consistent format.

PROCEEDINGS OF THE FIRST NCI/EPA/NIOSH COLLABORATIVE WORKSHOP: PROGRESS ON JOINT ENVIRONMENTAL AND OCCUPATIONAL CANCER STUDIES

MAY 6-8, 1980

SHERATON/POTOMAC, ROCKVILLE, MARYLAND

Proceedings were developed from a workshop on the National Cancer Institute's, the Environmental Protection Agency's and the National Institute for Occupational Safety and Health's Collaborative Programs on Environmental and Occupational Carcinogenesis.

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