INDUSTRIAL HYGIENE REPORT
ASBESTOS

at

Jaquays Mining Corporation
1219 South 19th Avenue
Phoenix, Arizona 85009

SURVEY CONDUCTED BY:
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DATE OF SURVEY:
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REPORT WRITTEN BY:
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Industry-wide Studies Branch
Division of Surveillance, Hazard Evaluations and Field Studies
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Cincinnati, Ohio

PURPOSE OF SURVEY:	This survey was conducted to determine the current exposure levels of asbestos fibers >5 µm in length to workers in an asbestos processing mill.
EMPLOYER REPRESENTATIVE CONTACTED:	D.W. Jaquays, President Jaquays Mining Corporation
EMPLOYEE REPRESENTATIVE CONTACTED:	No Union Representation
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	1499

Mention of a manufacturer's name or product does not constitute endorsement by the National Institute for Occupational Safety and Health.

ABSTRACT

An industrial hygiene survey of an Arizona asbestos ore processing mill was conducted on January 16, 1980. Personal air samples were collected using battery operated pumps and membrane filters. TWA exposures to the foreman and millwright were 1.8 to 1.7 fibers >5 µm in length per cc of sampled air (fibers/cc), respectively. TWA exposures to three laborers were 2.9, 1.9, and 2.1 fibers/cc. Recommendations were made to institute effective engineering controls and work practices and a respiratory protection program.

INTRODUCTION

A major objective of the National Institute for Occupatio... and Health (NIOSH) is to determine environmental exposure... populations through research, surveys, and industrywide s... cordingly, NIOSH conducted an industrial hygiene survey a... asbestos ore processing mill to characterize airborne asb... sure to the mill operators.

DESCRIPTION OF FACILITY AND WORKFORCE

The Jaquays Mining Corporation mill in Globe, Arizona has ... cessing asbestos ore at this location since about 1960. T... is housed in a one-story building with dimensions of 150 ... feet. The mill is located on several acres of desert prop... the surrounding area consisting of undeveloped desert lan... for the Mountain View Trailer Park located nearby. There ... asbestos-sand tailings dump of about 40,000 tons in back ... The mill normally employs a workforce of seven which inclu... plant manager, a foreman, a millwright, and four laborers. ... ees work a single shift 5 days per week.

DESCRIPTION OF PROCESS

The chrysotile asbestos ore is mined at Jaquays El Dorado ... is located about 35 miles north of Globe, Arizona and tra... (about 17 tons per day) to the mill by truck. The mill bu... divided into two sections; one section contains the wareh... a fiber bagging unit while the other section is utilized f... screening, and sand bagging operations. The raw ore is du... a primary jaw crusher where it is reduced in size to 3/4 ... meter. This product is moved by a conveyor system through ... of secondary roll mills and screens which reduce the mate... four smaller sized fibrous products. These four final pro... each classified by grade as follows: raw crude, sand, 3Z, ... The finished products of each grade are collected at the... completion points and conveyed through ducts to bagging u... of the products was dispensed in 100 pound quantities int... shipping/storage bags that were sealed after filling. The ... ducts were then stored in the warehouse for commercial sa...

DEVELOPMENT OF ENVIRONMENTAL CONTROLS

Compliance sampling for airborne asbestos dust has been co... since 1972, first by the Mining Enforcement and Safety Adm... (MESA) and now by the Mine Safety and Health Administratio... According to MSHA inspectors, environmental controls (i.e. ...

enclosures, exhaust ventilation, etc.) have been installed within the mill on an as-needed basis in order to reduce airborne asbestos dust levels to meet the MESA or MSHA standards in effect at that particular time.

One of the initial dust control methods was the construction of a wall to partition the milling and processing area from the warehouse and storage area. At a later date the wall was improved by installing closure doors to completely isolate both areas and thereby prevent air mixing. Further improvements in dust control followed with the installation of vacuum dust collectors at the milling and bagging operations. These collectors utilize filtering bags to trap the dust collected by the vacuum fans; subsequently, additional bags were installed to increase dust collection. Presently there are five vacuum collector fans for the milling and bagging process and one for the warehouse.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE, AND SAFETY PROGRAMS

NIOSH-approved respirators for asbestos dusts are available to all employees working in the mill. However, there is no formal respirator program for cleaning and maintenance of the respirators, fit-testing, etc.

DESCRIPTION OF SURVEY METHODS

Personal air samples were collected in the breathing zones of the foreman, millwright, and three laborers with MSA Model G personal sampling pumps using Millipore type AA, 37mm diameter, 0.8 μm pore size, membrane filters at a sampling flow rate of 2.0 liters per minute. General area samples were collected by the same procedure but were placed at different locations within the mill and warehouse to determine asbestos fiber background concentrations. The filters were changed periodically during the work shift to prevent the overloading of dust on the collection media. Analysis of the membrane filters for asbestos fibers was conducted in accordance with the procedures outlined by the Occupational Safety and Health Administration (OSHA)[1] and the NIOSH Manual of Analytical Methods P&CAM #239.[2] These procedures require the counting of fibers ($\geq$ 3:1 length to width ratio) greater than 5 micrometers in length utilizing phase contrast optical microscopy at a magnification of 400-450X.

In addition to membrane filter sampling a continuous Fibrous Aerosol Monitor[3] that is currently under development by NIOSH was also used. The instrument provided a fiber concentration read-out every 10 minutes in fibers greater than 5 μm in length and greater than 0.1 μm in diameter per cc documenting fibrous aerosol background levels.

Bulk samples of each product were collected and characterized by dispersive staining optical microscopy and by transmission electron microscopy.[4] Both of these analytical methods indicated positive identification of chrysotile asbestos.

RESULTS

On the day of the survey, the ore processing began at 8:00 a.m. and was completed by 10:46 a.m. The milling system was then shut down. During this time only 4000 pounds of finished products were bagged. The remainder of the work shift was spent in preparing skids of bagged product for shipment and in performing general plant cleaning and maintenance tasks.

The results of the personal and general area samples collected at the mill are shown in Table 1. During the 8 hours of sampling inside the plant the time-weighted average (TWA) asbestos exposure for the foreman was 1.8 fibers/cc >5 μm in length (fibers/cc) and for the millwright was 1.7 fibers/cc. The TWA exposures of the three laborers during the same period were 2.9, 1.9, and 2.1 fibers/cc, respectively. The TWA asbestos levels for the general area samples collected during the work shift were 0.8 fibers/cc in the warehouse and storage area, 0.7 fibers/cc near the break area, 2.9 fibers/cc in the 3Z bagging area, and 1.7 fibers/cc in the milling room.

The read-outs obtained from the Fibrous Aerosol Monitor (fibers greater than 5 μm in length and greater than 0.1 μm in diameter on the day of the survey generally agreed with the filter samples collected and are reported in Table 2. Read-outs taken in the 3Z bagging area during ore processing ranged from 1.10 to 6.30 fibers/cc. Two readings taken in the mill area after mill shut-down were 1.78 and 2.10 fibers/cc. A reading taken in the mill office during ore processing was 0.75 fibers/cc.

DISCUSSION

According to the Mine Safety and Health Administration there are currently six locations in the United States in which asbestos is mined (Figure 1). Employed in these mines and the mills that process the ore are approximately 400 workers. In addition there is a larger worker population being potentially exposed to asbestos while employed in an estimated 1300 other mines and mills. Based on current environmental studies of workers involved in hard rock and talc mining, asbestos has often been observed as a contaminant in airborne concentrations that exceed recommended health standards.

The first suspicion of chrysotile asbestos and its toxicological significance was recognized in 1935.[5,6] Since then, mortality studies of asbestos manufacturing, insulating, mining, and shipyard workers

have provided the most concrete evidence concerning an association between lung cancer, and pleural and peritoneal mesotheliomas with exposure to asbestos. Available data show that the lower the asbestos exposure, the lower the risk of developing asbestosis and cancer. Excessive cancer risks and other asbestos-related diseases, however, have been demonstrated at all fiber concentrations, and a linear relationship appears to best describe the shape of the dose-response curve. In addition, studies of duration of exposure suggest that even at very short exposure periods (1 day to 3 months) significant disease can occur. The significance of the health data strongly suggests that where asbestos exposures can not be eliminated, they must be controlled to the lowest level possible.

CONCLUSION AND RECOMMENDATIONS

The airborne chrysotile asbestos sampling conducted at the mill shows that two of the 5 workers monitored had exposures exceeding the current MSHA TWA standard. This standard states:

> "The 8-hour time-weighted average (TWA) airborne concentration of asbestos fibers to which any employee may be exposed shall not exceed 2 fibers, longer than 5 micrometers in length, per cubic centimeter of air (fibers 5 m/cc). The ceiling airborne concentration to which no employee may be exposed is 10 fibers/ 5 m/cc."

Furthermore, all TWA fiber concentrations for samples collected during the survey exceeded the proposed OSHA TWA standard of 0.5 fibers/cc and the NIOSH recommended TWA standard of 0.1 fibers/cc.

There are data that show that the lower the exposure, the lower the risk. Excessive cancer risks have been demonstrated at all fiber concentrations studied to date. Evaluation of all available human data provides no evidence of a threshold or for a "safe" level of asbestos exposure.[7] In this regard, it is recommended that exposures to asbestos be reduced as much as possible through effective engineering controls and work practices. Likewise, in the interim, all personnel working in the mill or warehouse should wear NIOSH-approved respiratory protection for asbestos dusts (see Attachment 1). A personnel respiratory protection policy should continue at least until airborne concentrations have been demonstrated to be below NIOSH's exposure recommendations. To prevent accidental dispersion of asbestos outside of the workplace employees should be provided the opportunity to shower and change clothes upon leaving the worksite.

REFERENCES

1. Occupational safety and health standards for general industry (29 CFR Part 1910. Promulgated by the Occupational Safety and Health Administration, U.S. Dept. of Labor. Commerce Cleaning House, Inc.; 1979:283-285.

2. NIOSH Manual of Analytical Methods. U.S. Dept. of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health; Vol. 1, 1977.

3. Lilienfeld, P.; Elterman, P.B. Development and fabrication of a prototype fibrous aerosol monitor (fam). U.S. Dept. of Health, Education, and Welfare, Public Health Service, National Institute for Occupational Safety and Health; December 1977: 72 p.

4. Zumwalde, R.D.; Dement, J.M. Review and evaluation of analytical methods for environmental studies of fibrous particulate exposures. U.S. Dept. of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health; May 1977: 66 p.

5. Lynch, K.M.; Smith, W.A. Pulmonary asbestos-iii, carcinoma of the lung in asbestosis-silicosis. Am. J. Cancer 24:56-64; 1935.

6. Gloyne, S.F. Two cases of squamous carcinoma of the lung occurring in asbestosis. Tubercle 17:5-10; 1935.

7. Revised recommended asbestos standard. U.S. Dept. of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, December 1976: p. 92.

Table 1

Fiber Air Sample Results of Survey
Conducted at the Jaquays Asbestos Mill on 1/16/80
(Globe, Arizona)

Sample Description	Sampling Time (min.)	Sampling Rate (liter/min.)	Sample Volume (liters)	Sample Concentration Fibers/cc*
Personal				
Foreman	73	2.0	146	4.0
Foreman	107	2.0	214	2.9
Foreman	126	2.0	252	1.7
Foreman	167	2.0	334	0.3
				TWA = 1.8
Millwright	70	2.0	140	3.6
Millwright	102	2.0	204	3.4
Millwright	126	2.0	252	0.8
Millwright	169	2.0	338	0.6
				TWA = 1.7
Laborer	62	2.0	124	3.6
Laborer	103	2.0	206	5.1
Laborer	124	2.0	248	2.4
Laborer	173	2.0	346	1.6
				TWA = 2.9
Laborer	61	2.0	122	4.6
Laborer	107	2.0	214	1.7
Laborer	122	2.0	244	2.7
Laborer	170	2.0	340	0.4
				TWA = 1.9
Laborer	62	2.0	124	3.4
Laborer	115	2.0	230	3.5
Laborer	117	2.0	234	1.5
Laborer	171	2.0	342	1.1
				TWA = 2.1
General Area				
Warehouse & Storage Area	422	2.0	844	0.8
Break Area	417	2.0	834	0.7
3Z Bagging Area	130	2.0	260	2.9
Milling Room	117	2.0	234	1.7

TWA = Time-Weighted Average for period of time sampled.
* Greater than 5 μm in length with at least a 3:1 length to width ratio.

Table 2

Continuous Fibrous Aerosol Monitor Readings
at the Jaquays Asbestos Mill on 1/16/80
(Globe, Arizona)

Time On	Time Off	Instrument Location	Instrument Readout Fibers/cc*
0812	0822	Mill Office	0.75
0835	0845	3Z Bagging Area	6.30
0846	0856	3Z Bagging Area	3.60
0857	0907	3Z Bagging Area	2.90
0908	0918	3Z Bagging Area	3.36
0919	0929	3Z Bagging Area	3.51
0940	0950	3Z Bagging Area	3.87
0953	1003	3Z Bagging Area	1.48
1005	1015	3Z Bagging Area	3.42
1020	1030	3Z Bagging Area	4.27
1031	1041	3Z Bagging Area	1.10
1044	1054	Milling Area**	2.10
1056	1106	Milling Area	1.78

* Greater than 5 μm in length and 0.1 μm in diameter.
** Mill shut down at 10:46a.m.

FIGURE 1

ACTIVE ASBESTOS MINES IN THE UNITED STATES

State and Company	County	Mine Name	Type
Arizona:			
Jaquays Mining Corp.	Gila	Chrysotile	Chrysotile
California:			
Atlas Asbestos Corp.	Fresno	Santa Cruz	Chrysotile
Calaveras Asbestos Ltd.	Calaveras	Copperopolis	Chrysotile
Union Carbide Corp.	San Benito	Santa Rita	Chrysotile
North Carolina:			
Powhatan Mining Co.	Yancey	Hippy	Anthrophyllite
Vermont:			
Vermont Asbestos Group Inc.	Orleans	Lowell	Chysotile

1978	Active Operations			Number of Miners		
	UG	SF	ML	UG	SF	ML
	1	7	5	16	267	126

NOTE: Personal communication with MSHA (1979)