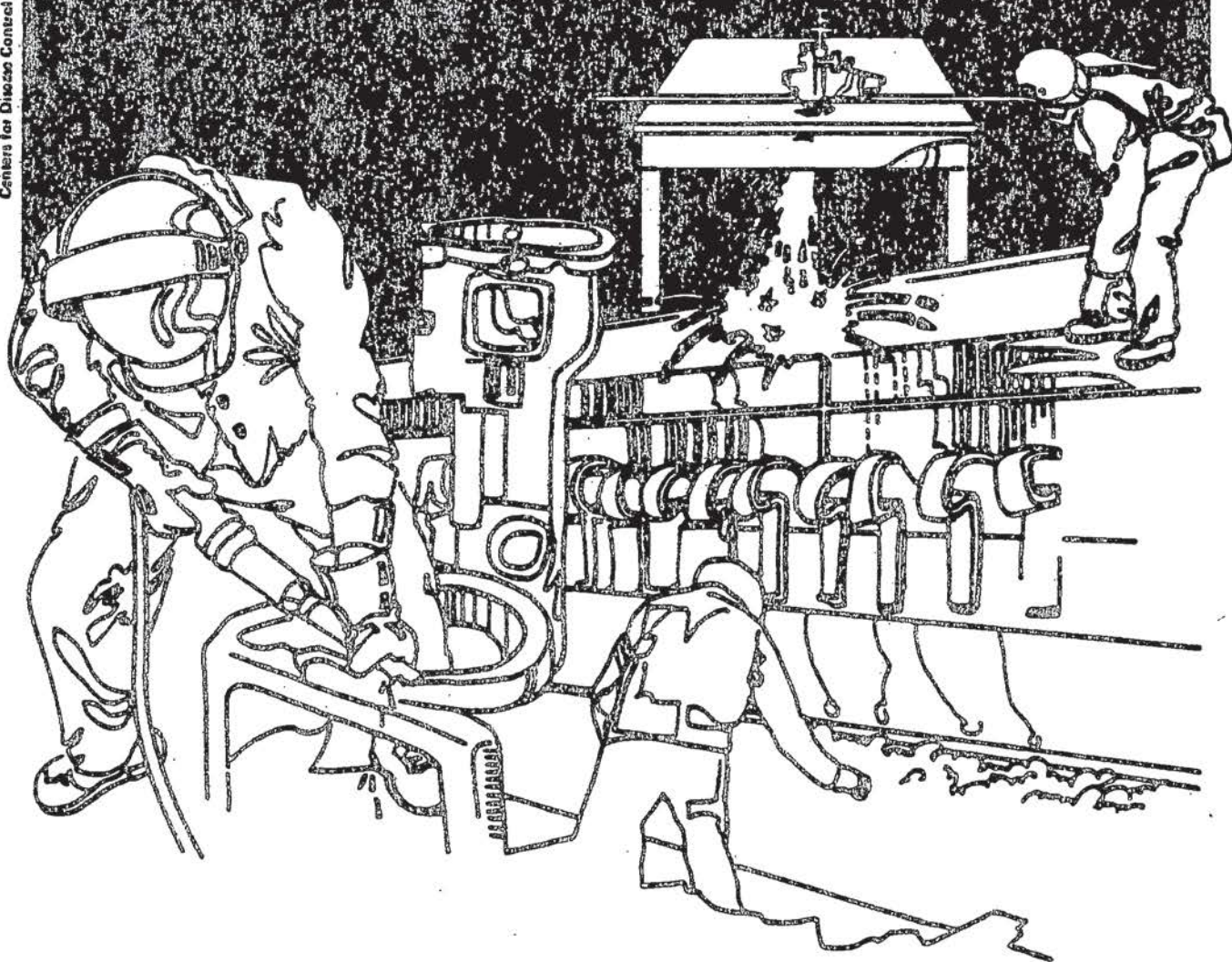


NIOSH



Health Hazard Evaluation Report

HETA 84-186-1777
SANCAP ABRASIVES, INC.
ALLIANCE, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 84-186-1777
FEBRUARY 1987
SANCAP ABRASIVES, INC.
ALLIANCE, OHIO

NIOSH INVESTIGATORS:
Matthew A. London, M.S.
Raymond Ruhe, I.H.
Cheryl Lucas, I.H.
Gary M. Liss, M.D.

I. SUMMARY

In February 1984 the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Chemical Workers Union (ICWU) for a Health Hazard Evaluation (HHE) at Sancap Abrasives, Inc. in Alliance, Ohio. Concerns included respiratory symptoms possibly due to exposure to silica dust, and neurologic symptoms, including memory loss and disorientation, possibly due to exposure to aluminum oxide dust.

An initial survey was conducted May 7-9, 1984. This survey consisted of environmental air monitoring and a questionnaire survey of 35 employees. The environmental air samples were collected for respirable and total particulate (dust), aluminum, and free silica. The survey found 8-hour time-weighted average (TWA) exposures for respirable particulate concentrations ranging from 0.09 to 0.79 milligrams per cubic meter of air (mg/m^3). The total particulate concentrations ranged from 0.29 to 4.58 mg/m^3 8-hour TWA. By comparison, the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Value (TLV) is 5 mg/m^3 for respirable particulates and 10 mg/m^3 for total particulates. The Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for total particulates is 15 mg/m^3 . Results of 20 personal air samples for aluminum concentrations ranged from less than detectable to 0.02 mg/m^3 . The ACGIH TLV is 10 mg/m^3 . The amounts of free silica in all 20 personal air samples were below the limit of detection. The amounts of quartz and cristobalite in two bulk samples of aluminum oxide, analyzed using X ray diffraction, were also below the limit of detection. Results of all personal samples were within the environmental criteria used. No sampling for neurotoxic agents was conducted, as no such agents were identified in the workplace.

Subsequently, NIOSH investigators conducted a medical screening survey May 20-23, 1985. One hundred sixteen of 127 (91.3%) employees who had worked ten or more years in Sancap's Coated Abrasives Division participated in the study, which consisted of chest X ray and spirometry.

One of 113 (0.9%) workers with X ray had possible radiologic evidence of silicosis. Five (4.4%) workers had pleural changes which are not indicative of silica exposure, but could have a number of causes, including asbestos exposure. No known source for such exposure was identified. One of the five workers also had apparent restrictive impairment of the lungs (consistent with pneumoconiosis) based upon pulmonary function test (PFT) results. Three additional workers had evidence of either restrictive impairment, or both restrictive and obstructive impairment, based upon the PFT results.

Given that this group of 116 workers had worked an average of 21.6 years (10 years minimum) in the Coated Abrasives Division at Sancap and that only one worker had a chest X ray which was possibly indicative of silicosis, it does not appear that silica exposures at Sancap were of sufficient concentration to pose a serious risk of causing silicosis. Recommendations are made in Section VIII of this report.

KEYWORDS: SIC 3291 (abrasive products) silicosis; pneumoconiosis; asbestos; restrictive lung disease; obstructive lung disease; respirable and total particulate; aluminum; and free silica.

II. INTRODUCTION

In February 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Health and Safety Department of the International Chemical Workers Union (ICWU) for a Health Hazard Evaluation (HHE) at Sancap Abrasives, Inc. in Alliance, Ohio. Concerns included respiratory symptoms possibly due to exposure to silica dust, and neurologic symptoms, including memory loss and disorientation, possibly due to exposure to aluminum oxide dust.

An initial survey was conducted May 7-9, 1984. This visit consisted of: an opening conference; a walk-through evaluation of the manufacturing areas; industrial hygiene sampling for silica dust; and a questionnaire survey of 35 employees.

The results of that survey were incorporated into an Interim Report which was distributed to all concerned parties in March 1985.

On the basis of the results of the initial survey, NIOSH investigators conducted a medical screening survey from May 20-23, 1985. Any employee who had worked ten or more years in Sancap's Coated Abrasives Division was eligible for this screening, which consisted of chest X ray and spirometry (lung function testing). Notification letters of individual test results were sent to the 116 study participants on February 7, 1986, as well as to two individuals with less than ten years' seniority, who were given the tests upon their request.

III. BACKGROUND

Sancap Abrasives, Inc. manufactures six different types of coated abrasives (commonly known as sand paper), including aluminum oxide, flint, silica, zirconium, garnet, and silicate.

The plant was opened in 1947 by a different owner, and was purchased by Sancap in 1978.

Flint, which contains silica, was used an estimated 6-8 days per year from 1947 until its discontinuance in 1984. The use of silica as an abrasive was also apparently discontinued, though that issue was disputed by the union. An industrial hygiene survey conducted by an ICWU industrial hygienist in February 1983 described the use of amorphous silica, as well as flint, at that time.

The Coated Abrasives Division consists of three departments; Making, Converting, and Shipping. There are approximately 20 employees in the Making department where the grains of abrasives are applied to heavy-weight paper with various types of adhesives and then dried in large ovens.

The Converting department has 70 employees who cut the coated paper into various shapes and sizes.

The Shipping department has 8 employees who ship the finished product to the customers.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Personal air samples for respirable and total particulate were collected on pre-weighed FWSB filters using a battery-powered pump at a flow rate of 1.7 liters per minute (LPM). Filters were set in 10mm nylon cyclone separators to obtain respirable particulate samples. The total weight of each sample was determined by weighing the sample plus the filter on an electrobalance and subtracting the previously determined tare weight of the filter. The tare gross weighings were done in duplicate.

Ten personal air samples for aluminum were collected on each of two days in the Abrasives Division on pre-weighed FWSB filters using a battery-powered pump at a flow rate of 1.7 LPM. The samples were analyzed for aluminum by atomic absorption spectroscopy using NIOSH Method P&CAM 173.

Ten personal air samples for respirable free silica were collected on each of two days in the Abrasives Division on pre-weighed FWSB filters using a battery-powered pump at a flow rate of 1.7 LPM. NIOSH Method P&CAM 259 was used to analyze the samples with the following modifications: 1) filters were dissolved in tetrahydrofuran rather than being ashed in a furnace; 2) standards and samples were run concurrently and an external calibration curve was prepared from the integrated intensities, rather than using the suggested normalization procedure.

Two bulk samples of aluminum oxide were collected in the Abrasives Division and analyzed for quartz and cristobalite using X ray diffraction. The samples were ground and passed through a 400 mesh screen prior to analysis. Two milligram portions of the samples were weighed onto FWSB filters in duplicate. NIOSH Method P&CAM 259 was used to analyze the samples with modifications.

No environmental sampling for neurotoxic agents was possible, as none were found to be in use.

B. Medical

The May 1984 survey included the administration of a questionnaire to 35 employees. This questionnaire consisted of: basic demographic questions; a medical history; smoking history; work history; and symptom questions dealing primarily with respiratory, irritative, and neurologic complaints. Of the 35 participants, 20 were people selected by the union because they had reported health problems, and the other 15, selected by NIOSH, were evenly divided among three seniority categories: less than 10 years, 10-20 years, and greater than 20 years.

The May 1985 survey involved the administration of a chest X ray and spirometry on all current employees with at least ten years of work in Sancap's Coated Abrasives Division. Basic demographic information, a smoking history, and a work history were obtained from each individual, as well. The chest X rays were to be used to assess the prevalence and severity of silicosis among long-term workers at Sancap. Each X ray was subsequently read independently by two "B readers", radiologists trained and certified in the use of the 1980 Revision of the International Labour Organization's (ILO) Classification System.¹ Where there was disagreement between the two "B readers" on the assessment of an individual X ray, that X ray was then sent to a third "B reader." The majority or consensus interpretation of the X ray was then accepted.

The spirometry (lung function testing) was performed by a second NIOSH technician, using an Ohio Medical Model 822 dry rolling seal spirometer attached to a Spirotech 200 B dedicated computer. Equipment and test procedures conformed to the American Thoracic Society's criteria for screening spirometry.²

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures. The environmental criteria for the substances evaluated are listed at the end of Table I.

B. Medical

Pulmonary function testing (PFT) results for each individual are compared to age-, sex-, race-, and height-specific predicted values which have been compiled in large-scale studies.³ Measurements obtained from an individual's test include: forced expiratory volume in one second (FEV₁), forced vital capacity (FVC), and the ratio of those two measurements (FEV₁/FVC). A result is considered abnormal if the FEV₁ or the FVC is less than 80% of the predicted value, or if the FEV₁/FVC ratio is less than 0.70.

Silicosis is a form of diffuse interstitial pulmonary fibrosis resulting from the deposition of respirable crystalline silica in the lung.⁵ Conditions of exposure may affect both the time of onset and severity of silicosis. Although the disease usually occurs after 15 or more years of exposure,^{6,7} some forms of silicosis with latency periods of only a few years or less are well recognized and are associated with intense exposures to very fine dust high in free silica content, such as silica flour.^{8,9}

Early, simple silicosis usually produces no symptoms. In the early stages of silicosis, abnormal pulmonary function may not yet be evident, although decreased FVC may be noted.⁵ However, both acute and complicated silicosis (PMF) are associated with shortness of breath, intolerance for exercise, and a marked reduction in measured pulmonary function. Diagnosis is based on a history of occupational exposure to free silica and the characteristic appearance of a chest radiograph. Respiratory failure and premature death may occur in advanced forms of the disease. No specific treatment for silicosis is available, and the disease may progress even after a worker is no longer exposed to silica. Further, continued exposure to silica of a worker who already has silicosis increases the likelihood that the worker will develop progressively more advanced disease.

VI. RESULTS

A. Environmental

The survey found 8-hour time-weighted average (TWA) exposures of respirable particulate concentrations for twenty samples ranging from 0.09 to 0.79 milligrams per cubic meter of air (mg/m^3). The total particulate concentrations from twenty samples ranged from 0.29 to 4.58 mg/m^3 8-hour TWA. By comparison, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for respirable particulates is 5.0 mg/m^3 , and that for total particulates is 10 mg/m^3 . The Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limit (PEL) for total particulates is 15 mg/m^3 . Results of 20 personal air samples for aluminum concentrations ranged from less than detectable (0.005 mg/m^3) to 0.02 mg/m^3 . The ACGIH TLV is 10 mg/m^3 . The amounts of free silica in all 20 personal air samples were below the limit of detection (0.01 mg/m^3). The amounts of quartz and cristobalite in two bulk samples of aluminum oxide, analyzed using X ray diffraction, were also below the limit of detection (0.01 mg/m^3). Results of all personal samples collected at Sancap Abrasives, Inc. on May 8-9, 1984 were within the environmental criteria used (Table 1).

In the Converting Department, results of the fifteen personal breathing zone (PBZ) samples for respirable particulate ranged from 0.10 to 0.79 mg/m³, total particulate ranged from 0.29 to 4.58 mg/m³, aluminum ranged from less than the limit of detection (0.005 mg/m³) to 0.02 mg/m³, and total free silica was less than the limit of detection (0.01 mg/m³).

In the Making Department, results of the two PBZ samples for respirable particulate ranged from 0.29 to 0.33 mg/m³, total particulate ranged from 0.66 to 1.38 mg/m³, aluminum ranged from 0.01 to 0.02 mg/m³, and total free silica was less than the limit of detection (0.01 mg/m³).

Results of the three PBZ samples taken at a knife sharpener and a fork truck operator for respirable particulate ranged from 0.25 to 0.46 mg/m³, total particulate ranged from 0.55 to 1.60 mg/m³, aluminum ranged from less than the limit of detection (0.005 mg/m³) to 0.01 mg/m³, and total free silica was less than the limit of detection (0.01 mg/m³).

B. Medical

1. May 1984 Questionnaire Survey

Eighty percent of the 35 questionnaire respondents stated that they had experienced at least one of the symptoms listed in Table II during the previous month. Eye irritation was the most frequently reported symptom (43% of respondents). Shortness of breath was reported by 37% of the people, as was blurred vision. Dizziness was reported by 34%. Memory loss and disorientation were each reported by 11%.

2. May 1985 Chest X ray and Spirometry Survey

One hundred sixteen of 127 (91.3%) eligible employees participated in the May 1985 follow-up survey. All had both a chest X ray and spirometry except for three individuals who refused to be x-rayed. The non-participants included eight refusals, two people on sick leave, and one person on vacation. Two workers with less than 10 years' tenure in the Coated Abrasives Division were included in the medical testing, upon their request. Their results are not included in this report, although they were sent individual notification letters.

The demographics of the participants were as follows (Tables III and IV): 67.2% male; 94.8% Caucasian, 3.5% black, 1.7% American Indian/Alaskan native; mean age of 49.9 years, range of 31 - 66 years; mean tenure at the plant of 21.6 years, range of 11 - 37 years.

a. Chest X ray

Eighty-four (74.3%) of the 113 participants had an X ray with no abnormal findings. No one had parenchymal opacities consistent with silicosis, although one worker had eggshell calcification of the hilar lymph nodes, which could be indicative of a number of conditions, including silicosis.⁵ Five people (4.4%) had diffuse pleural thickening, pleural plaque, and/or pleural calcification. The pleural changes were bilateral in four cases, one of which involved only the costophrenic angles. Pleural changes can have a number of causes, including asbestos exposure.⁵ Bilateral pleural changes are more suggestive of asbestos exposure than are unilateral changes.

The remaining 23 people (20.4%) had an X ray with one or more incidental finding, that is, some finding not indicative of pneumoconiosis.

b. Pulmonary function testing

Ninety-three (80.2%) of 116 workers who underwent pulmonary function testing had normal test results (Table V). Three (2.6%) workers had evidence of restrictive impairment (defined as less than 80% of predicted Forced Vital Capacity [FVC] based on age, race, sex, and height). Ten (8.6%) workers had evidence of obstructive impairment (defined as an FEV_1/FVC ratio less than 70%, with FVC at least 80% of predicted). One (0.9%) worker had evidence of both obstructive and restrictive impairment (FVC less than 80% of predicted and FEV_1/FVC ratio less than 70%). Nine (7.8%) workers had invalid, non-interpretable pulmonary function test results. PFT results are invalid when they are not sufficiently consistent or reproducible to allow proper interpretation.² This can sometimes be the result of an impairment which makes reproducible efforts difficult or impossible to attain.

Regression analysis was performed, examining the possible relationship between FVC percent of predicted (an indicator of restrictive lung disease) and two factors, duration of employment and cumulative cigarette exposure (pack-years). Correlation was very low, $r^2 = 0.02$, $p = 0.45$.

VII. DISCUSSION AND CONCLUSIONS .

No environmental sample result exceeded any of the evaluation criteria, and no free silica was found in any sample collected during May 8-9,

1984. It appears that the use of silica-containing abrasives was most likely discontinued some time in 1983 or early 1984.

The medical evaluation showed one worker with radiologic changes possibly suggestive of silicosis. Five workers had pleural changes which are not suggestive of silicosis, but which could have been due to asbestos exposure.⁵ One of those five workers, as well as three other workers, had pulmonary function test (PFT) results indicative of apparent restrictive lung disease (consistent with pneumoconiosis). That worker who had both pleural changes and abnormal PFT results was the only worker with either pleural changes or PFT evidence of restrictive disease who gave a history of occupational asbestos exposure prior to employment at Sancap.

To the best of our knowledge, asbestos has never been used in any production-related capacity at this plant. However, no assessment was made of the current or historical presence of asbestos for such purposes as pipe insulation or fireproofing.

Given that this group of 116 workers had worked an average of 21.6 years (10 years minimum) in the Coated Abrasives Division at Sancap and that only one worker had a chest X ray which was possibly indicative of silicosis, it does not appear that silica exposures at Sancap were of sufficient concentration to pose a serious risk of causing silicosis.

The one worker with possible silicosis had worked 19 years in Coated Abrasives (compared to the mean tenure of 21.6 years for the study group as a whole). He worked as a slitter operator at Sancap, and reported no other jobs where exposure to silica, asbestos, or any other fibrogenic dust was likely to have occurred.

No potential exposure to any neurotoxic agent at Sancap Abrasives was found. Further reports of transient or persistent memory loss should be catalogued, to better allow the investigation of any possible workplace association.

VIII. RECOMMENDATIONS

Given that no exposure to silica has existed at Sancap Abrasives for 2-4 years, no related medical recommendations are offered at this time. However, if the use of silica-containing abrasives resumes at Sancap, annual medical examinations should be made available to all workers who worked in the Coated Abrasives Division for a total of at least 10 years when silica was used. These examinations should include at least items 1-4, which follow.⁸

1. Comprehensive work and medical histories to evaluate both exposure and also signs and symptoms of respiratory disease;

2. A 14 X 17 inch posteroanterior chest radiogram, preferably interpreted using the 1980 ILO U/C classification;
3. Pulmonary function tests, including measurements of forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1). The ratio of FEV_1/FVC should be calculated, as well as the predicted values of FEV_1 and FVC, based upon each worker's age, sex, race, and height.
4. It is very important that workers be properly notified of their X ray and other medical findings. Workers with demonstrable silicosis should be provided with a forthright and fully accurate assessment of their situation. In such notification, workers should be informed of the stage of their silicotic lesions, and of the meaning of that staging.
5. To allow a more clear identification of neurologic symptoms and possible workplace etiologies, further reports of transient or persistent memory loss should be catalogued, including the times of onset and disappearance, jobs performed that day, recent occupational exposures, and medicines taken.

IX. REFERENCES

1. International Labour Organization. Guidelines for the use of ILO International Classification of Radiographs of Pneumoconiosis. [Occupational Safety and Health Series, no. 22 (revised)]. Geneva: International Labour Office, 1980.
2. American Thoracic Society. ATS statement -- Snowbird workshop on standardization of spirometry. Am Rev Respir Dis 1979;119:831-8.
3. Knudson RJ, Slatin RC, Lebowitz MD, Burrows B. The maximal expiratory flow-volume curve. Normal standards, variability and effects of age. Am Rev Respir Dis 1976;113:587-600.
4. Lanese RR, Keller MD, Fole MF, Underwood EH. Differences in pulmonary function tests among whites, blacks, and American Indians in a textile company. J Occup Med 1978;20:39-44.
5. Parkes WR: Occupational Lung Disorders, 2nd ed. Chapter 7: Diseases Due to Free Silica. London: Butterworths, 1982.
6. Theriault GP, Peters JM, Fine LJ: Pulmonary function in granite shed workers of Vermont. Arch Environ Health 28:18-22, 1974.
7. Theriault GP, Peters JM, Johnson WM: Pulmonary function and roentgenographic changes in granite dust exposure. Arch Environ Health 28:23-27, 1974.

8. National Institute for Occupational Safety and Health: Current Intelligence Bulletin No. 36, Silica Flour: Silicosis (Crystalline Silica). Cincinnati: U.S. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health, 1981.
9. Banks DE, Morring KL, Boehlecke BA: Summary reports...Silicosis in the 1980's. Amer Industr Hyg Assoc J 42:77-79, 1981.
10. Kilburn KH: Cigarette smoking does not produce or enhance the radiologic appearance of pulmonary fibrosis. Amer J Industr Med 2:305-308, 1981.
11. Sepulveda M-J, Merchant JA: Roentgenographic evidence of asbestos exposure in a select population of railroad workers. Amer J Industr Med 4:631-639, 1983.
12. Landrigan PJ, Lewis FA, Cherniack MG, Catlett LR: Health Hazard Evaluation Report No. 82-302-1461, East Penn Foundry, Macungie, Pennsylvania. Cincinnati: Nat. Inst. for Occ. Safety and Health, May 1984.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared by:

Matthew A. London, M.S.
Medical Officer
Medical Section

Raymond L. Ruhe
Industrial Hygienist
Industrial Hygiene Section

Field Assistance:

Cheryl Lucas, I.H.
Medical Section

Gary M. Liss, M.D.
Medical Section

Originating Office:

Hazard Evaluations and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations, and Field Studies

Report Typed By:

Ottavia Frey

XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Sancap Abrasives, Inc.
2. International Chemical Workers Union, Health and Safety Dept.
3. International Chemical Workers Union, Local 411
4. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

Personal Breathing Zone Concentration of Respirable and Total Dust, Aluminum, and Free Silica

Sancap Abrasives, Incorporated
Alliance, Ohio
HETA 84-186
May 1984

Job/Location	Dept.	Date	Sample Time	Sample Volume (liters)	Respirable Particulate (mg/m ³)	Total Particulate (mg/m ³)	Aluminum (mg/m ³)	Total Free Silica (mg/m ³)
Sand Blaster	Converting	5-8-84	0604-1412	830	0.24	0.75	0.01	LD
Press Operator	"	5-8-84	0607-1414	830	0.10	0.39	LD**	LD
Sand Blaster	"	5-8-84	0710-1510	816	0.16	2.87	0.01	LD
Slitter Operator	"	5-8-84	0713-1513	816	0.09	0.59	0.01	LD
Reslitter Operator	"	5-8-84	0718-1518	816	0.39	2.84	0.02	LD
Bliss Press Operator	"	5-8-84	0723-1523	816	0.33	2.29	0.01	LD
Precision Slitter	"	5-8-84	0727-1527	816	0.11	0.58	0.01	LD
Ream Cutter	"	5-8-84	0731-1531	816	0.13	3.21	0.01	LD
Grain Operator	Making	5-8-84	0755-1530	773	0.33	1.38	0.02	LD
Knife Sharpener	Maintenance	5-8-84	0803-1440	675	0.46	1.60	0.01	LD
Press Operator	Converting	5-9-84	0618-1418	816	0.13	0.37	LD	LD
Slitter Operator	"	5-9-84	0707-1447	782	0.13	0.29	LD	LD
Sand Blaster	"	5-9-84	0713-1452	780	0.79	4.58	0.02	LD
Reslitter Operator	"	5-9-84	0717-1511	805	0.32	3.49	LD	LD
Bliss Press Operator	"	5-9-84	0722-1509	793	0.23	1.73	LD	LD
Slitter Operator	"	5-9-84	0725-1507	785	0.10	0.70	LD	LD
Ream Cutter	"	5-9-84	0735-1505	765	0.12	0.44	LD	LD
Grain Operator	Making	5-9-84	0743-1443	714	0.29	0.66	0.01	LD
Knife Sharpener	Maintenance	5-9-84	0750-1430	680	0.25	1.53	0.01	LD
Fork Truck Operator	"	5-9-84	0758-1431	668	0.25	0.55	LD	LD
Limit of Detection					0.01mg	0.01mg	0.004mg	0.015mg
Environmental Criteria: (time-weighted average 8-hour exposure)								
ACGIH Threshold Limit Value (mg/m ³)					5	10	10	0.3
OSHA Standard (mg/m ³)					5	15	none	10/(%SiO ₂ +2)
NIOSH Recommended Exposure Limit (mg/m ³)					-	-	-	0.050

* mg/m³ - Milligrams of dust per cubic meter of air sampled

** LD - Less than detectable limits

TABLE II

Symptom Frequencies
n=35Sancap Abrasives, Incorporated
Alliance, Ohio
HETA 84-186
May 1984

Symptom	Frequency
Memory Loss	4 (11%)
Excessive Fatigue	14 (40%)
Disorientation	4 (11%)
Altered Judgment	1 (3%)
Difficulty Using Hands and Legs	4 (11%)
Difficulty With Speech	2 (6%)
Blurred Vision	13 (37%)
Dizzy Spells	12 (34%)
Cough	11 (31%)
Shortness of Breath	13 (37%)
Phlegm	10 (29%)
Nose Bleeds	5 (14%)
Nose Irritation (sneezing)	13 (37%)
Eye Irritation (burning, tearing)	15 (43%)
Dry, Sore Throat	14 (40%)

TABLE III

Demographics -- Race and Gender

Sancap Abrasives, Inc.
Alliance, Ohio
HETA 84-186
May 1985

Race	Gender		Total
	Male	Female	
Caucasian	76 (65.5%)	34 (29.3%)	110 (94.8%)
Black	1 (0.9%)	3 (2.6%)	4 (3.4%)
Am. Indian/ Alaska Native	1 (0.9%)	1 (0.9%)	2 (1.7%)
Total	78 (67.2%)	38 (32.8%)	116

TABLE IV

Age, Duration of Employment

Sancap Abrasives, Inc.
Alliance, Ohio
HETA 84-186
May 1985

	Mean Years \pm Standard Deviation	Range (years)
Age	49.9 \pm 8.6 years	31.5 - 66.6
Duration of Employment	21.6 \pm 6.9 years	11 - 37

TABLE V

Pulmonary Function Test (PFT) Results

Sancap Abrasives, Inc.
Alliance, Ohio
HETA 84-186
May 1985

Pulmonary Function Test Results	Number of People
Normal	93 (80.2%)
Restrictive *	3 (2.6%)
Obstructive **	10 (8.6%)
Both***	1 (0.9%)
Invalid ****	9 (7.8%)
Total	116

* Restrictive impairment is indicated by forced vital capacity (FVC) less than 80% of that predicted on the basis of age, sex, height, and race.

** Obstructive impairment is indicated by an FEV_1/FVC (forced expiratory volume in one second divided by forced vital capacity) less than 70% with FVC at least 80% of predicted.

*** Both restrictive and obstructive impairment are indicated when FVC is less than 80% of predicted and the FEV_1/FVC ratio is less than 70%.

**** Test results are invalid when they are not consistent or reproducible enough to be properly interpreted. This can sometimes be the result of an impairment which makes a reproducible effort difficult or impossible to attain.