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CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HAZARD EVALUATION AND TECHNICAL ASSISTANCE
REPORT NO. TA 77-68

McDANIEL ART STUDIO
CINCINNATI, OHIO

JUNE 1978

Study Requested By:
McDaniel Art Studio
3824 Dakota Street
Cincinnati, Ohio 45229

NIOSH Project Officer:
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16. Abstract (Limit: 200 words) In response to a request from the McDaniel Art Studio, located in Cincinnati, Ohio, an investigation was made of possible hazardous working conditions at the site, specifically the exposure to dust during sculpturing. Air sampling revealed potential dust exposures as high as 50mg/m3 of total dust while using a powered disc grinder to sculpt. The sculpting process involved grinding with a 6 inch electric disc grinder or using such hand tools as files and chisels. The sculptor used primarily limestone, marble, talc, and onyx, working about 6 hours per day. The talc (14807966) sculpting stone showed the presence of asbestos (1332214) on bulk analysis. The sculptor wore safety glasses with side shields and an appropriate, approved respirator. An industrial vacuum cleaner was used for dust cleanup. The author recommends that the sculptor continue to use the NIOSH approved respirator and that, if possible, the disc grinder not be used on potential asbestos sources such as serpentine (50555) and talc. Wet working of the stone would reduce the dust levels significantly. Several precautionary measures are listed from a publication dealing the health risks associated with common art and hobby materials.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Author, TA-77-68, Region-5, Dust-control, Hazards-Confirmed, NIOSH-Technical-Assistance-Report, Sculptors, Artists, Asbestos-dust, Talc-dust, Respiratory-protective-equipment

c. COSATI Field/Group

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I. SUMMARY

A recent survey at the McDaniel Art Studio included air sampling to determine the potential for hazardous dust exposures to the sculptor. The air sample results indicated potential exposures as high as 50 mg/M^3 of total (respirable and non-respirable) dust while using a powered disc grinder to sculpt. Bulk sample analyses of talc sculpting stone showed the presence of asbestos. Air samples for asbestos showed air concentrations below the NIOSH recommendation while the sculptor was using hand tools to sculpt talc. The sculptor was diligent as to the wearing of a NIOSH certified respirator and consequently was most likely not over-exposed to rock dust. Recommendations directed towards both the sculpting and hand crafting of jewelry are presented in the text of this report.

II. INTRODUCTION

On several occasions during the latter part of 1977 (October 28, November 2 and 3, December 2) the National Institute for Occupational Safety and Health (NIOSH) conducted air sampling at the McDaniel Art Studio in order to determine the extent of a sculptor's exposure to dust while using both powered and hand tools to sculpt rock. In addition, a walk-through survey was made in an area where a small amount of jewelry is hand crafted. This study was done at the request of the studio owners who were concerned about the health implications of: 1) exposures to rock dust, and 2) exposures to materials used in the handcrafting of jewelry.

III. EVALUATION

A. Facility and Process Description

There are two separate work areas at the studio where the art work is conducted. One of the work areas is a rather typical residential basement wherein a certain amount of jewelry is hand crafted. This work area measures about 25 feet by 35 feet, has five small ground level windows, and is heated by a common natural gas furnace. There are no exhaust fans or other such devices to provide air flow through the basement. The jewelry making process consists mostly of hand soldering with gold and silver foils and using enamel paints for decorative purposes. The enamels are baked on the jewelry (pendants, etc.) using a small electric kiln at temperatures varying from 1500°F to 2000°F. Baking times are less than five minutes. As might be expected, there is a fair variety of materials used in the jewelry making process: i.e., solder, several fluxes, and different enamels. Considering the small amounts of materials used and the short exposure times (2 or 3 hours/day), it was judged that air sampling to define exposures was not necessary since concentrations of any airborne contaminants would be minimal. A silver soldier was analyzed for cadium content (none was detected).

However, it is felt that a continuing vigilance for toxic substances and heedfulness of good work practices on the part of the involved individuals, is well advised. General recommendations directed towards this goal are presented in a later section of this report.

The sculpting is done either outside, immediately in front of the overhead door of a 2-stall garage or within a room of about 120 square feet which has been partitioned off within the garage. The interior room, used mostly during the colder weather, is heated with a portable electric heater. The sculpting process consists of grinding with a 6-inch electric disc grinder or using such hand tools as files and chisels. The materials most usually worked with are limestone, marble, talc, and onyx. The sculptor works about six hours per day on an average. While working with the minerals, the sculptor wears safety glasses with side shields and an appropriate "NIOSH" approved respirator. An industrial vacuum cleaner is used for dust cleanup purposes although sweeping (with a sweeping compound) may be done if necessary.

B. Methods

Personal and fixed location air samples for respirable dust and respirable free silica were collected using tared 37 mm diameter polyvinyl chloride filters encased in 2-piece plastic cassettes. The cassettes were preceded by 10 mm diameter nylon cyclones to provide the separation of the respirable dust. Airflows were maintained at 1.7 liters per minute (lpm) using personal air sampling pumps. The respirable dust was determined by weight increase of the filters while the respirable free silica was determined by an X-ray diffration technique (NIOSH Method P & CAM 259).

Several samples for total airborne dust were collected in the same manner as for the respirable dust samples except for: 1) the 10 mm cyclone was not included in the sampling train, and 2) a flow rate of 2.0 lpm was used for sample collection. The total dust was determined by the weight increase of the filters.

Two air samples for asbestos determinations were collected while the sculptor was using hand tools to work with talc. These samples were collected using 37 mm diameter mixed cellulose ester membrane filters (open face cassettes) and personal air sampling pumps operating at 2.5 lpm. The filters were analyzed by phase contrast microscopy (NIOSH Method P & CAM 239).

Several bulk samples of rock dust were analyzed for free silica (quartz and cristobalite) using X-ray diffraction (NIOSH Method P & CAM 109). Two bulk samples of talc dust were analyzed for asbestos content again using X-ray diffraction. The bulk sample of silver solder was analyzed for cadmium using an atomic absorption spectroscopy technique.

C. Criteria

1. Physiological Effects

Exposure to excessive amounts of free silica may produce irreversible lung damage and fibrosis, known as silicosis. The clinical signs of silicosis are not unique. The symptoms may include cough, sputum production, progressive dyspnea, wheezing, and repeated non-specific chest infections. Impairment of pulmonary function may be progressive. In individual cases there may be little or no decrement in pulmonary function or symptoms where only simple discrete nodular silicosis (simple silicosis) is present. The two main threats posed by simple silicosis are an increased susceptibility to tuberculosis and development of complicated silicosis with massive fibrosis of lung tissue. Massive fibrosis may develop in about 20-30 percent of subjects with simple silicosis even in the absence of further exposure to dusts containing free silica. In addition, it has been found that the mortality of foundrymen with simple silicosis is double that of coal workers with similar radiographic category of disease. Simple silicosis should not be considered as entirely benign. Occasionally, exposures to very high concentrations of free silica may result in an acute, rapidly developing silicosis which is associated with severe respiratory failure and death.[1]

It is well accepted today that inhalation of asbestos fibers may lead to asbestosis (a lung disorder) or carcinoma of the lung. Asbestosis is often described as being a diffuse fibrosis of the lungs (unlike nodular silicosis) resulting from a number of years of inhalation of asbestos fibers. The frequency with which asbestosis occurs is related to the magnitude and duration of exposures and possibly to the size and type of fibers. The carcinomas associated with asbestos exposure are a bronchial carcinoma and a malignant mesothelioma of the peritoneum or pleura. There is a long latent period (years) between exposure to asbestos and development of a tumor with the exposure/disease relationship not being well defined.

2. Environmental Standards

The primary sources of environmental evaluation criteria considered for this study were 1) NIOSH criteria documents, 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. Only the criteria or standards considered most applicable are listed as follows:

Substance	8-Hour Time Weighted Average (TWA) Exposure Limit
Respirable Free Silica (NIOSH)	0.05 mg/M^3
Respirable Dust (TLV)	see note below
Total Airborne Dust (TLV)	see note below
Asbestos (NIOSH recommendation)	0.1 fibers/cc
Asbestos (OSHA legal standard)	2.0 fibers/cc

The TLV's for "respirable" dust and "total" dust are calculated by the following formulas:

$$\text{Respirable Dust} = \frac{10}{\%\ \text{Free Silica} + 2}\ \text{mg/M}^3$$

$$\text{Total Dust} = \frac{30}{\%\ \text{Free Silica} + 3}\ \text{mg/M}^3$$

As seen by these equations, the environmental limit for either "respirable" or "total" dust can vary by sample, according to the percent of free silica. Since the free silica was present in less than 1 percent for all samples of this study, the environmental limit for respirable dust would be 5.0 mg/M^3 and that for total dust would be 10.0 mg/M^3.

D. Results and Discussion

The results of the personal air sampling for dust (Table 1) show that use of the disc grinder produces air concentrations of total and respirable dust which are in excess of the environmental limits for human exposure. The total dust concentration of 51.0 mg/M^3 exceeded the environmental criteria of 10.0 mg/M^3 (8-hour TWA) significantly, while the respirable dust concentration of 5.6 mg/M^3 approximated the environmental criteria of 5.0 mg/M^3 (8-hour TWA). The respirable free silica concentrations were less than the limit of detection because the materials being worked on did not contain free silica to any degree (Tables 1 and 3). Should work be done on rock which contains a significant amount of free silica, the dust exposures to the sculptor would be more serious.

The results of air sampling for asbestos fibers, while using hand tools to work with talc, show air concentrations below the NIOSH recommended standard. However, asbestos is a recognized carcinogen and needless exposures should be avoided. When the disc grinder is used to work with talc containing asbestos, it is possible that asbestos exposures to the sculptor would exceed the environmental criteria of 0.1 fibers/cc. Two talc bulk samples showed small amounts of asbestos (Table 3). Neither of the talc bulk samples showed trace metals or free silica and were essentially pure talc (magnesium silicate).

E. Recommendations

1. It is recommended that the sculptor continue to use the NIOSH approved respirator when sculpting, particularly when using the disc grinder.

2. If at all possible, the disc grinder should not be used on such potential sources of asbestos as serpentine and talc.

3. If a method of "wet-working" the stone could be devised, significant reductions in potential dust exposures would be achieved. Likewise, an extractor hood such as that shown on Attachment 1 would significantly lower airborne dust levels when using the disc grinder.

4. The Art Hazards Information Center in New York City has published recommendations directed towards minimizing health risks associated with common art and hobby materials.[5] These methods are quoted below as it is felt that they represent a nice summary of methods by which artists and other craftsmen can reduce the health risks associated with commonly used art and hobby materials.

a) Find out what's in the material you're using. If the substance is toxic, check into alternate materials or methods. Alternatives are sometimes less convenient or more expensive, but health benefits should be considered.

b) Use chemicals in a form least capable of getting into the body. When possible, use a liquid form rather than an aerosol, a solid rather than a powder. Aerosols reduce liquids and solids to finer particles. Finer particles are more toxic because they can get into the lowest portion of the lungs and be carried throughout the body.

c) An open window is not adequate ventilation when working with solvents. An open window or door with an exhaust fan is needed to clear the air. Another window or door should be open to allow fresh air to enter. If this arrangement is not possible, the craftsman and anyone else in the work area should wear an organic vapor mask. Whenever possible, work outdoors.

d) Good housekeeping procedures are for health safety as well as esthetics. Many dusts contain chemicals which can be harmful when inhaled or brought in contact with the skin. Sweeping stirs up dusts. Damp mop or vacuum often both while working and when finished. Clean spills and dispose of chemical soaked rags or newspapers immediately. Brushes soaking in open containers of solvents can cause problems.

e) Never eat or smoke while working with craft materials. Accidental ingestion of chemicals is possible and many craft substances are highly inflammable.

f) Kitchen utensils should not be used for mixing or storing chemicals. Porous surfaces can hold enough dangerous particles to be dangerous even though the surface looks clean.

g) Store materials in adequately labeled, tightly covered containers. Avoid storing any flammable, volatile or toxic substances, particularly if they could be discovered and abused by children.

h) Protect hands with gloves that allow the "feel" needed but are impervious to the materials being used. It's best to cover hair and wear a long-sleeve shirt or smock. Leave protective clothing in the work area rather than in the hamper with the family laundry.

i) Wash hands thoroughly and frequently with soap and water, cleaning well under fingernails. Do not use solvents for cleaning hands.

j) If you use flammable substances, have the proper fire extinguisher on hand.

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VI. REFERENCES

1. Morgan, W.K.C., and Seaton, A., Occupational Lung Diseases, W. B. Sanders Co., Philadelphia, pp. 80-111, 1975.

2. NIOSH Revised Recommended Asbestos Standard. U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, December 1976. DHEW (NIOSH) Publication No. 77-169.

3. Threshold Limit Values for Chemical Substances in Workroom Air by ACGIH for 1977. American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio 45201.

4. U.S. Department of Labor. Occupational Safety and Health Administration. Occupational Safety and Health Standards (29 CFR 1910) OSHA 2206 (Revised January 1976) p. 99.

5. Cincinnati Enquirer Daily Newspaper, Cincinnati, Ohio, January 12, 1978.

Table 1

Results of Air Sampling for Total and Respirable Dusts

McDaniel Art Studio
Cincinnati, Ohio

Date	Time of Sampling	Type of Sampling	Sample Conditions	Total Dust (mg/M^3)*	Respirable Dust (mg/M^3)	Respirable Free Silica (mg/M^3)
10-28-77	1018-1355	Personal	Using disc sander to grind marble	-	5.6	N.D.**
10-28-77	1018-1355	Personal	Using disc sander to grind marble	50.6	-	
10-28-77	1040-1400	Fixed Location	Approx. 6 ft. from work table	-	0.3	N.D.
10-28-77	1040-1400	Fixed Location	Approx. 6 ft. from work table	2.2	-	
11-02-77	0840-1240	Personal	Using disc sander & hand tools - talc	-	3.8	N.D.
11-02-77	0855-1255	Fixed Location	Approx. 2 ft. from work table	-	2.9	N.D.
11-02-77	0855-1255	Fixed Location	Approx. 2 ft. from work table	39.0	-	
11-03-77	0917-1555	Personal	Hand tools - filing & chiseling of talc	-	0.3	N.D.
11-03-77	0928-1555	Fixed Location	Approx. 6 ft. from work table	-	0.05	N.D.
11-03-77	0930-1555	Fixed Location	Approx. 6 ft. from work table	0.1	-	
Environmental criteria (ACGIH-TLV) for an 8-hour TWA				10.0	5.0	
Environmental criteria (NIOSH) for an 8-hour TWA						.050

* mg/M^3 = milligrams of dust per cubic meter of air

**N.D. = None detected

The limit of detection for the free silica was 0.03 mg per sample (filter).

Table 2

Results of Air Sampling for Asbestos Fibers

December 2, 1977

McDaniel Art Studio
Cincinnati, Ohio

Time of Sampling	Type of Sample	Sample Conditions	Asbestos Concentrations (fibers/cc)*
0917-1048	Personal	Using hand tools - filing & chiseling on talc	0.04
0921-1049	Fixed Location	Sampler located approx. 5 feet from work table	0.03
OSHA legal standard for an 8-hour TWA			2.0
NIOSH proposed standard for an 8-hour TWA			0.1

*Fibers greater than 5μ in length per cubic centimeter of air.

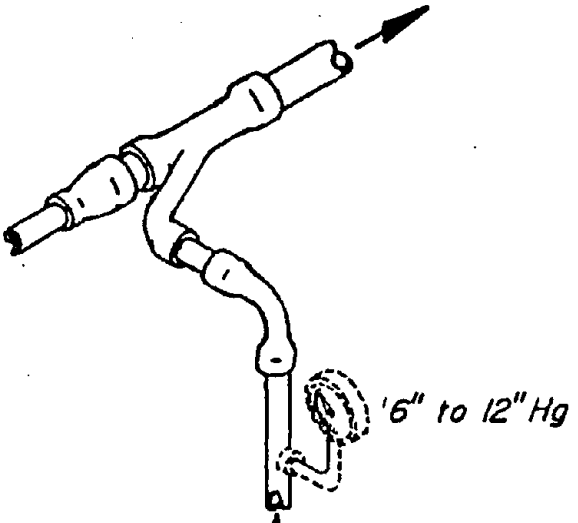
Table 3

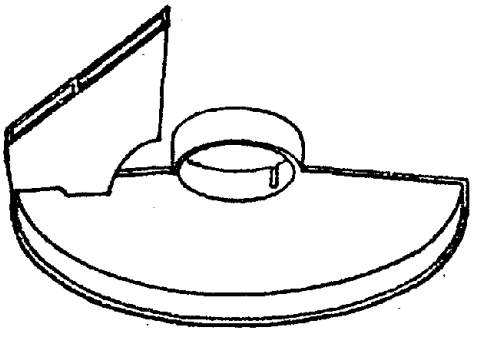
Results of Bulk Sample Analyses for Free Silica and Asbestos

McDaniel Art Studio
Cincinnati, Ohio

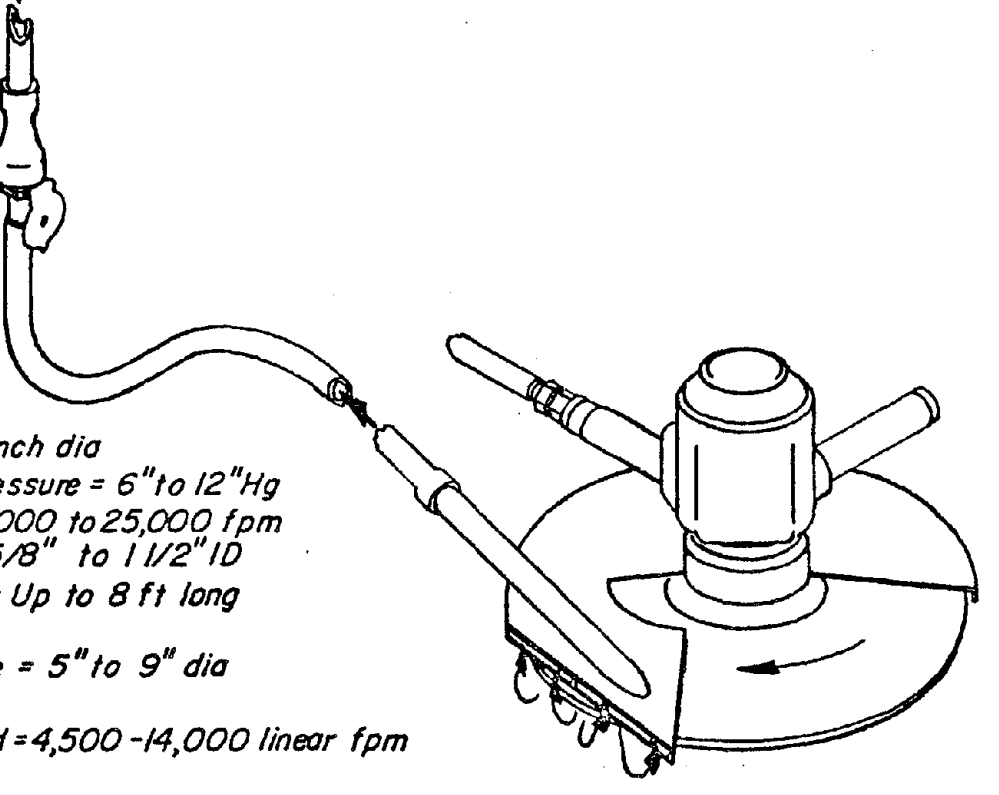
Sample Description	% Free Silica	% Asbestos
Limestone	<1.0%	----
Marble	<1.0	----
Onyx	<1.0	----
Talc #1	<1.0	*
Talc #2	<1.0	*

*Chrysotile asbestos was not present, however Tremolite and/or actinolite (2 amphiboles of asbestos) were present





Bottom view of extractor hood



Q = 10 - 30 cfm/inch dia
Branch static pressure = 6" to 12" Hg
Slot velocity = 10,000 to 25,000 fpm
Flexible hose = 5/8" to 1 1/2" ID
Extension hose = Up to 8 ft long

Sanding disc size = 5" to 9" dia

Peripheral speed = 4,500 - 14,000 linear fpm

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

EXTRACTOR HOOD FOR DISC SANDER

DATE 1-72	VS-805