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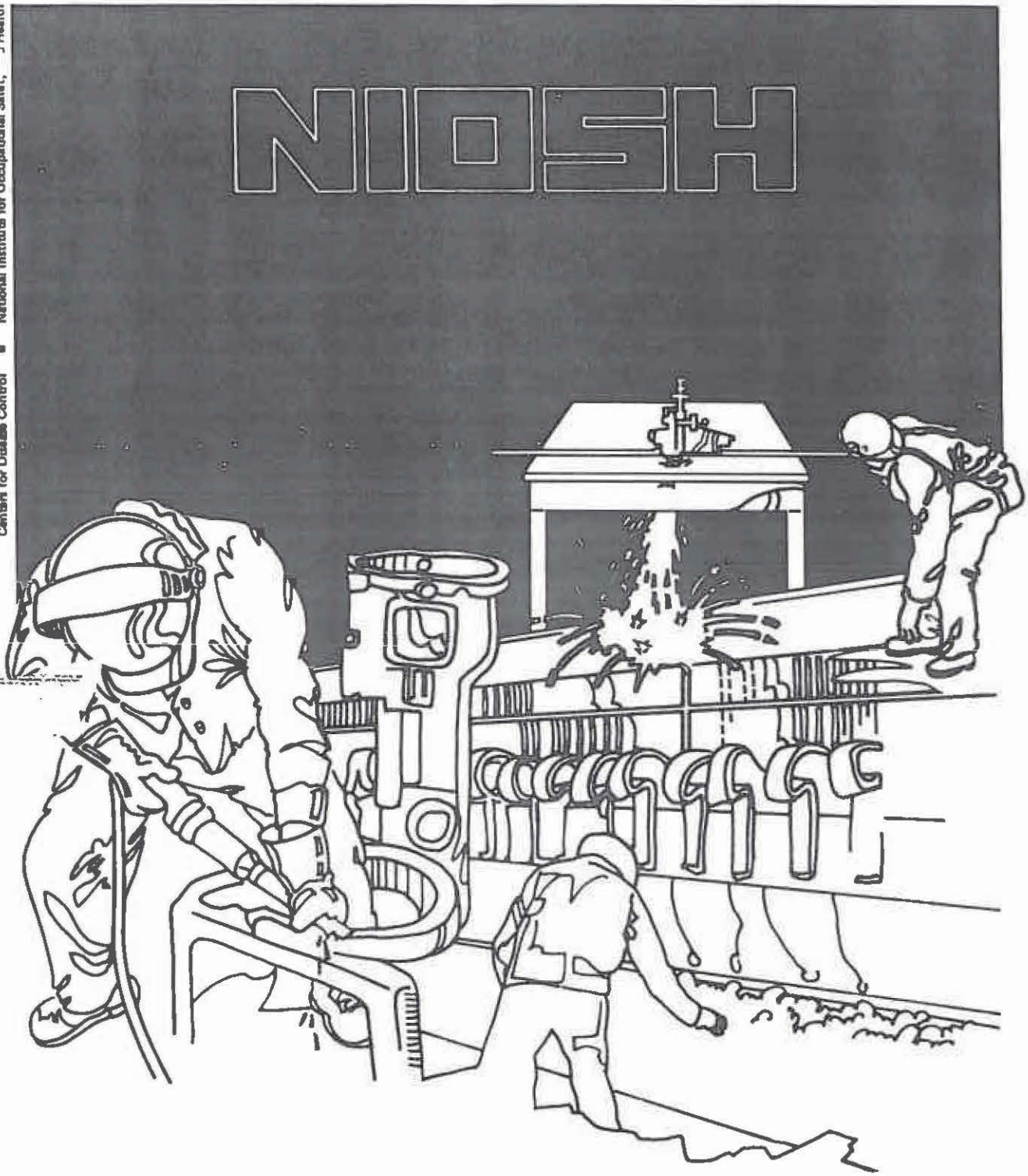

Health Hazard Evaluation Report

HETA 81-365-1083
STUDIO 311
NOVATO, CALIFORNIA

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.

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STUDIO 311
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NIOSH INVESTIGATOR:
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I. SUMMARY

In May 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from a jeweler who operates a shop in the basement of his home. The requestor sought information concerning the storage and handling of chemicals, the effectiveness of the existing ventilation system, and an analysis of several talc samples for possible asbestos contamination.

NIOSH conducted an initial survey on June 8, 1981 and a follow-up survey on July 27, 1981. Five bulk samples (3 talc, 1 satin cast and 1 ceiling sample) were collected and analyzed for asbestos and crystalline silica. No asbestos was identified in any of the samples; however, quartz (2.7 percent) was found in one talc sample. The satin cast sample (similar to plaster of paris) contained quartz (25 percent) and cristobalite (14.8 percent).

Since the workload (25-40 hours per week) varies weekly, many steps of the jewelry making process were scheduled during the follow-up survey and these included: metal weighing and casting, stripping, grinding and buffing, soldering and wax injection. No environmental air samples were collected because the jeweler performs a variety of tasks during the day thus his exposure is short-term.

The jeweler is exposed to metal fumes during metal casting because there is no local exhaust ventilation system and no respiratory protective equipment is donned by the worker.

Smoke tubes were used to characterize the collection efficiency of the engineering controls. The local exhaust hood used to control talc exposure during dusting of rubber molds appeared to work properly; however, the canopy exhaust hood used to control chemical vapor exposures during electropolishing was not effective. The slightest side draft allowed chemical vapors to escape.

Based on observations, it is believed that the worker is being exposed during casting and electropolishing (stripping). No engineering controls were used to collect metal fumes during casting, and the canopy exhaust hood was not effective in collecting the chemical vapors generated during electropolishing. Recommendations, to reduce worker exposures during casting and stripping, are incorporated in the body of the report.

KEYWORDS: SIC 3911 and 3961 (JEWELERY, PRECIOUS AND NON-PRECIOUS METALS) metal casting, grinding, buffing, electropolishing, soldering, wax injection.

II. INTRODUCTION

In May, 1981 an evaluation request was submitted to NIOSH by a custom jewelry tradesman who operates a one-person shop in the basement of his home. The requestor asked for advice and technical assistance regarding the following subjects: analysis of talc and other materials for asbestos contamination, information concerning ventilation of his shop and guidelines concerning the handling and storage of chemicals (acids and solvents).

NIOSH conducted an initial environmental survey on June 8, 1981 and a follow-up survey on July 27, 1981. Several bulk samples were collected during both surveys, and the laboratory results were reported to the requestor as soon as they were available.

III. BACKGROUND

A. Work Area Description

Studio 311 has been operational for about two years. The owner works 25-40 hours per week depending on his workload. His personal protective equipment consists of the following: safety glasses with either clear or didymium lens, rubber gloves and rubber apron.

The jewelry making process consists of several steps: metal weighing and casting, stripping, jewelry grinding and polishing, soldering and wax injection. Not all of these operations are performed daily; consequently, the owner scheduled his workload so that most phases of the process could be observed during the follow-up survey.

1. Metal Weighing and Casting.

   The process begins with weighing of different types of metals (e.g., copper, zinc, gold, silver, or platinum) after which it is melted and cast. The jeweler noted that the melting of brass (copper-zinc combination) produces the worst smelling fumes. The metals are melted in a crucible using an oxygen-propane torch. This process is not ventilated. The molten alloy is poured into a pre-heated stainless steel flask which contains the investment (plaster of Paris) mold. The flask is placed in a spring driven centrifugal casting machine. The molten metal is poured into the flask and the centrifugal force draws the molten alloy into the mold. After casting, the investment is removed from the cast using a mild acid cleaner called VEST-OFF ®.

2. Stripping (Electropolishing or Reverse Plating).

   Stripping is done to remove oxides from jewelry. Metal cleaning is usually done after casting, heat application or soldering. Some of the stripping solutions include cyanide based materials. Other chemicals used to do general cleaning (oxide and flux removal) includes sulfuric acid, hydrochloric acid, ammonium sulfate or sodium bisulfate. The stripping solutions are heated during the electropolishing process. An exhaust canopy hood is positioned

about ten inches above a three burner stove to collect stripping vapors.

3. Jewelry Grinding and Buffing.

   Jewelry grinding is either done using a hand held electric grinder or a bench mounted grinder. A movable eye shield, attached to a work table, can be moved to any position when hand grinding. A duel-wheel bench mounted grinder/buffer is also used. The grinder has an eye shield, local exhaust ventilation, and a dust collector.

4. Soldering.

   All parts to be soldered are first cleaned in a boric acid and denatured alcohol solution. A fluoride flux is used to coat the gold and silver pieces prior to soldering. The jeweler solders about one hour per week.

5. Wax Injection.

   An air pressure wax injector is used to fill rubber molds. Each of the molds are dusted with a talc powder to prevent sticking. A local exhaust duct was installed subsequent to the initial survey to collect excess talc powder.

6. Other.

   One process not observed is the use of satin cast which is similar to plaster of paris. The powder is mixed with water into a slurry and used to encase wax molds.

B. Environmental Design

Bulk samples of talc, satin cast and one ceiling sample were collected and sent to NIOSH laboratories to be analyzed for asbestos and crystalline silica. The lower limit of quantification is estimated to be 1.5 percent for a two milligram portion for both polymorphs of crystalline silica.

No environmental air samples were collected because the jeweler performs a variety of tasks during the workday thus his exposure is short-term.

MSA smoke tubes were used to characterize the collection efficiency of engineering controls.

IV. EVALUATION CRITERIA

There are several criteria which can be used to evaluate the toxic air contaminants of the employee's work environment: (1) NIOSH Criteria Documents for a Recommended Occupational Health Standard; (2) Proposed and Recommended Threshold Limit Values (TLV's) as suggested by the American Conference of Governmental Industrial Hygienists; (3) The California OSHA Standards.

For the purpose of this evaluation, only bulk samples were collected and analyzed for asbestos and crystalline silica. There are no bulk sample criteria for these contaminants. Bulk sample analysis are simply a tool to determine whether personal breathing zone samples should be collected. There are, however, recommended criteria and/or standards which are used to determine a workers' chemical exposure. The NIOSH recommended limit for asbestos is 0.1 fibers per cubic centimeter of air (fibers/cc), based on a time-weighted average (TWA) over a work shift or a ceiling concentration of 0.5 fibers/cc, based on a 15 minute sample. The NIOSH recommended TWA for crystalline silica is 50 micrograms per cubic meter (50 ug/m^3).

A. Toxicological Effects

1. Asbestos

Overexposure to asbestos fibers can cause asbestosis as well as other lung ailments. Asbestosis is a chronic lung ailment which can result in shortness of breath due to fibrotic changes and scarring of lung tissue. Usually there is a period of 10 to 35 years before this chronic lung ailment will become manifiest. Other effects from inhalation of asbestos fibers are the asbestos-related neoplasms. A high incidence of lung cancer is associated with persons who are exposed to asbestos and smoke cigarettes. Additionally, mesothelioma (a cancer of the thin membranes which line the chest and abdomen) are associated with asbestos exposure.

2. Crystalline Silica

The primary health effects associated with inhalation of free silica is a form of pheumonconiosis (dusty lung) termed silicosis. Onset of this malady may vary from several years to twenty years or more. The percent of free silica present in the environment generally determines the course of this disease. As the silicon dioxide is deposited into the lungs, the silica stimulates production of fibrotic nodules. The nodules in turn compress the alveoli (air sacs) thereby decreasing the lung function and producing restrictive type pulmonary disease.

Early silicosis termed "simple silicosis" is normally diagnosed by chest x-ray examination. Individuals with this disease are usually asymptomatic, and lung function impairment is non-existent. As the severity of silicosis increases, the symptoms become prevalent and these are marked by intolerance to exertion, episodes of coughing, and production of a thick sputum. Silicosis of this severity is diagnosed as "conglomerate silicosis" which is irreversible. Conglomerate silicosis incapacitates the affected worker regardless of termination of exposure.

V. RESULTS AND DISCUSSION

As stated in the introduction, NIOSH was requested to analyze several bulk samples for asbestos contamination and to evaluate the overall operation. Three talc samples were analyzed for asbestos and crystalline silica. No asbestos was identified; however, one talc sample (supplier-Conley Casting) was found to have 2.7 percent quartz. The satin cast sample was analyzed for the same contaminants. No asbestos was identified, but quartz (25 percent) and cristobalite (14.8 percent) were both identified. Also a ceiling sample was analyzed for asbestos and none was found.

The initial survey was only a cursory investigation because the requestor had very little work scheduled that day. However, based on observations and discussions with the requestor, it was recommended that he obtain a portable eye wash fountain and copies of the material safety data sheets for his chemical inventory. Also, the requestor was concerned about asbestos and crystalline silica contamination of the talc powder used to dust rubber molds and the satin cast used to encase rubber molds. It was recommended that he install a local exhaust duct with bag filters to control talc dust exposure. Subsequent to this investigation a portable eye wash fountain was purchased, a local exhaust system was installed and the requestor attempted to obtain copies of the appropriate material safety data sheets.

A follow-up survey revealed several potential problems. Although the quantities of chemicals used is small, some of the chemicals were not properly protected from falling off the shelf. Also, the chemicals were not stored by class or type, i.e., stripping salts, caustics, solvents and acids were all stored together.

Metal casting is done in an insulated wooden box which is open on top. The melting of metals produces a fume which is inhaled by the worker. Smoke tubes were used to characterize the collection efficiency of the canopy exhaust hood used in the electropolishing process. The canopy exhaust hood did not appear to be effective in collecting chemicals vapors. The slightest side draft allowed the chemical vapors to escape the canopy hood.

It should be noted that the requestor periodically baby sits for his children while he is working in his shop. Even though the child is kept in a playpen while in the work area, there is risk of exposure to the child or other members of the family who visit the shop.

VI. CONCLUSION

In conclusion, asbestos was not detected in any of the bulk samples, but crystalline silica (quartz and cristobalite) was detected in several talc samples. The worker is no longer presumed to be at risk of exposure to talc powder during dusting of rubber molds because the recently installed local exhaust system is controlling talc dust.. However, the worker is being exposed to metal fumes during casting and chemical vapors during electropolishing. Furthermore, there is a risk of exposure to other members of the family while they visit the shop or while they are upstairs in the house. In order to prevent further worker exposure, the following recommendations should be heeded.

VII. RECOMMENDATIONS

Although specific levels of exposure were not made during the follow-up evaluation, several processes were observed and found to be clear sources of exposure. Several recommendations are made to assist the jeweler to protect himself while working:

1. Local exhaust ventilation should be installed to collect metal fumes during casting.

2. The canopy exhaust hood used for electropolishing needs side shields to increase the collection efficiency. Also, the canopy and exhaust duct should be resistant to acid vapors and mist.

3. Similar chemicals should be stored together to prevent a more serious chemical hazard in case of breakage or spillage.

VIII. REFERENCES

(1) NIOSH Manual of Analytical Methods, DHEW (NIOSH) Publication No. 79-144.

(2) Criteria for a Recommended Standard . . . Occupational Exposure to Asbestos, Revised Recommended Standard, DHEW (NIOSH) Publication No. 77-169.

(3) Criteria for a Recommended Standard . . . Occupational Exposure to Crystalline Silica, DHEW (NIOSH) Publication No. 75-120.

(4) What You Should Know About Health and Safety in the Jewelry Industry, Jewelers Health and Safety Research Group, Providence, R.I., 1980. 35 pp.

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and 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 Road, Springfield, VA 22151. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Studio 311 - Novato, California
2. California - Occupational Safety and Health Administration
3. U. S. Department of Labor - Region IX
4. U. S. Department of Health and Human Services

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

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