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SEAGULL INDUSTRIES
WEST PALM BEACH, FLORIDA
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NIOSH INVESTIGATOR:
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I. SUMMARY

In February 1989, the National Institute for Occupational Safety and Health (NIOSH) received a request from the management of Seagull Industries for the Disabled, Inc. to evaluate exposures to silica dust and lead paints in the ceramics area, and to solvents in the assembly building.

On April 5, 1989, an industrial hygiene survey was conducted at the facility. The evaluation consisted of measuring breathing zone air concentrations of lead dust and respirable silica in the ceramics area, and solvent vapors during the cleaning of the printing press at the assembly building. Settled dust was also collected from the painters' table tops to measure lead content.

Airborne lead concentrations were extremely low, ranging from 0.9 to 1.8 micrograms per cubic meter of air (ug/m^3). However, the settled dust on the painters' table tops was 10% lead, posing some concern for accidental ingestion.

Silica exposures in the ceramics polishing area were more significant with measurements of 48 and 64 ug/m^3 for the 6-hour work period. If these exposure measurements are adjusted to an 8-hour time-weighted average, the levels would equate to 36 and 48 ug/m^3, slightly less than the NIOSH recommended exposure limit of 50 ug/m^3. Solvent vapor concentrations were minimal during the cleaning of the printing press, probably due to this process being done out of doors with good natural ventilation.

On the basis of the industrial hygiene data, it appears the silica dust levels in some cases approach or exceed the NIOSH recommended limit. Although airborne lead dust levels were low, the presence of significant lead on table tops may pose a hazard through accidental ingestion. Recommendations are provided in section VIII of this report to control silica and lead exposures and to reduce fire hazards associated with flammable solvents.

KEYWORDS: SIC 8331 (job training and vocational rehabilitation services), ceramics, lead, silica, quartz, solvents.

II. INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) received a request in February 1989 from the management of Seagull Industries to evaluate exposures to silica dust and lead paints in the ceramics area, and to solvents in the assembly building. This request was prompted by an audit from the Commission on Accreditation of Rehabilitation Facilities, which recommended silica and lead monitoring.

Environmental monitoring was conducted on April 5, 1989. Air sampling results were reported in a letter in June 1989.

III. BACKGROUND

Seagull Industries for the Disabled, Inc. is a private, non-profit corporation in West Palm Beach, Florida providing job training and employment, primarily for the mentally retarded. The worker trainees are referred to as "clients". There is also a staff of teachers and vocational instructors who work with the clients, train them, and supervise their activities. The facility is engaged in a number of enterprises, including product assembly, packaging and shipping, and production and painting of ceramic art objects. A small hand-operated printing press is also used in one area. It is cleaned by a single worker at the end of the day using solvents.

The evaluation dealt primarily with the ceramics shop and exposure to silica and lead. The clay is purchased pre-mixed and already blended into water. Therefore, there is no exposure to dry ingredients used as raw materials in the clay. The clay slurry is dispensed through a hose into molds which are held together by bands. The job titles of these workers are pourers and banders. When the clay sets up (de-waters), the clay forms are removed from the molds. The polishers then smooth the molded items by hand using wet sponges or pads. At times, the polishers file the molded pieces with a metal file, creating considerable clay dust at their work tables. On the day of our visit, 3 clients were working in the pouring area, and 4 in polishing.

After polishing, the molds are fired in a kiln. After firing, the painting is done by hand using brushes. Most paints contain fritted lead, designed to be fired in kilns, producing a smooth, lustrous finish. Fifteen to twenty clients work as painters.

Several operations in the assembly building use substances containing organic solvents. Based upon the quantity and frequency of use, the primary exposure potential appeared to be the cleaning of a small printing press at the end of the workday. Ventilation of the ceramics area is primarily provided through open doors and wall mounted exhaust fans. The press cleaning is conducted outdoors in the lunch/break area.

IV. EVALUATION DESIGN AND METHODS

Worker exposure to air contaminants was evaluated by personal breathing zone sampling. A small battery-powered air pump was worn on the worker's belt and connected via plastic tubing to a filter (or other collector) attached to clothing near the worker's mouth.

Respirable silica sampling was accomplished by drawing the air at a rate of 1.7 liters per minute (Lpm) first through a 10-mm nylon cyclone to remove the larger, non-respirable particles, then through a 5-micrometer pore size polyvinyl chloride membrane filter held in a 2-piece plastic cassette. The filter samples were analyzed in the laboratory for quartz and cristobalite using X-ray diffraction according to a modified version of NIOSH Analytical Method 7500.([1])

Lead sampling was accomplished by drawing air at a rate of 1.0 Lpm through a 0.8-micrometer pore size cellulose ester membrane filter held in a 3-piece plastic cassette. The filter samples were analyzed for lead in the laboratory by means of atomic absorption spectroscopy according to NIOSH Analytical Method 7082.([1])

Due to the short duration of the printing press cleaning, solvent vapors in the air were sampled at a rate of 1 Lpm through a glass tube containing 150 milligrams of activated charcoal. The charcoal tube samples were analyzed at the laboratory by desorbing the collected organics with carbon disulfide and injecting the extracts into a gas chromatograph/mass spectrometer for identification and quantitation of each major compound.

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),([2]) and 3) the U.S. Department of Labor (OSHA) occupational health standards.([3]) 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 exposure limits, 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 employers are 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.

LEAD[4]

Inhalation (breathing) of lead dust and fume is the major route of lead exposure in industry. A secondary source of exposure may be from ingestion (swallowing) of lead dust deposited on food, cigarettes, or other objects. Once absorbed, lead is excreted from the body very slowly. Absorbed lead can damage the kidneys, peripheral and central nervous systems, and the blood forming organs. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women.

Blood lead levels below 40 ug/deciliter whole blood are considered to be normal levels which may result from daily environmental exposure. The Occupational Safety and Health Administration (OSHA) standard for lead in air is 50 ug/m^3 calculated as an 8-hour time-weighted average for daily exposure[4]. The standard also dictates that workers with blood lead levels greater than 50 ug/deciliter must be immediately removed from further lead exposure and, in some circumstances, workers with lead levels of less than 50 ug/deciliter must also be removed. Removed workers have protection for wage, benefits, and seniority for up to 18 months until their blood levels decline to below 50 ug/deciliter and they can return to lead exposure areas.

SILICA

Silicosis is a form of diffuse interstitial pulmonary fibrosis resulting from the deposition of respirable crystalline silica in the lung. Conditions of exposure may affect both the occurrence and severity of silicosis. Although it usually occurs after 15 or more years of exposure, some forms with latent periods of only a few years are well recognized and are associated with intense exposures to respirable dust high in free silica[5]. Early, simple silicosis usually produces no symptoms. However, both acute and complicated silicosis (progressive massive fibrosis) are associated with shortness of breath, intolerance for exercise, and a marked reduction in measured pulmonary function. Diagnosis is most often 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. Individuals with silicosis are also at increased risk of contracting tuberculosis. No specific treatment is available, and the disease may progress even after a worker is no longer exposed to silica.

SOLVENT VAPORS

Due to the very low levels of solvent vapors detected, the toxicity of individual components is not discussed here. Evaluation criteria for major components are provided in Table 3.

VI. RESULTS AND DISCUSSION

A. Silica

Results of air sampling for respirable dust and silica are shown in Table 1. Respirable dust concentations were quite low in general, ranging from 0.1 to 0.6 mg/m^3; however, silica was present in the form of quartz (no cristobalite was detected), and respirable quartz concentrations ranged from none detected to 64 ug/m^3 during the 6-hr sampling period when work was actually being performed. If adjusted to an 8-hr time-weighted average (upon which standards are based), the 64 ug/m^3 would be reduced to 48 ug/m^3. NIOSH's recommended exposure limit is 50 ug/m^3.

The 64 ug/m^3 level was measured for a polisher. Although polishing is usually done with wet sponges or pads, this polisher at times used a metal file, creating considerable clay dust. Settled dust on work surfaces in the pouring and polishing area averaged 6.2% quartz.

B. Lead

The results of air sampling for lead dust are shown in Table 2. Concentrations in air were very low, ranging from 0.9 to 1.8 ug/m^3. The OSHA permissible exposure limit is 50 ug/m^3. Based upon the measurements made on the day of this survey, there was no health hazard from inhaling lead dust.

Settled dust and paint flakes on the painters' table tops averaged 10% lead content, which could be carried on the hands and arms of the painters. At lunch time, the painters did not wash their hands before eating. Most brought sandwiches which, of course, they ate with their hands. This situation causes some concern about accidental ingestion of lead. It would probably be prudent to have the blood lead levels of the painters tested.

From a health and safety standpoint, the best solution would be to replace the fritted lead paint with a non-lead type of paint, if feasible.

C. Solvents

A variety of products containing organic solvents are used in the assembly building. However, based upon the quantity and frequency of use, it was judged that the highest exposure would be likely during the daily cleaning of a small hand-operated painting press. This was done at the end of the day in the outdoor area used for breaks and lunch.

Material safety data sheets (MSDSs) for chemical products were not maintained by Seagull Industries. Therefore, the content of the solvents was not known. A bulk air sample was collected from the vapor space above the liquid solvents in their containers. This sample was analyzed by gas chromatography and mass spectrometry to identify the

vapor components. Based on these results, the quantity of each major component in a personal air sample from the cleaning operation was determined. Results are shown in Table 3. The amount detected for each component was less than 1% of the exposure limit. This cleaning was done outdoors with good natural ventilation.

Fire hazards associated with solvent usage were observed. Solvents were stored in glass jars, rather than approved solvent safety containers. Solvent-soaked rags were sometimes stored in cardboard boxes where they could catch fire.

VII. CONCLUSIONS

Lead levels in the air were not excessive, but poor sanitation and housekeeping practices could lead to accidental ingestion. Silica levels may occasionally approach or exceed NIOSH recommended limits. Fire hazards associated with solvent storage were present.

VIII. RECOMMENDATIONS

1. Painters should be trained to wash their hands before eating to prevent accidental ingestion of lead.

2. Blood lead levels in the painters should be measured to detect any elevated absorption. Levels below 20 micrograms of lead per deciliter of blood (ug/dl) are considered normal background levels in the general U.S. population. Levels between 20 and 40 are considered normal for an occupationally exposed population, but subsequent retesting would probably be prudent to insure that levels remain below 40. According to the OSHA lead standard, blood sampling should be done at least every 2 months when a worker's level exceeds 40 (medical consultation should also be sought to determine whether the worker should be removed from a lead-exposure job and whether medical care is needed).

3. In view of the silica sampling results, respiratory protection at least equivalent to NIOSH-approved single-use particulate respirators (dust masks) should be used by polishers. Polishing using metal files should be done under a hood.

4. Because settled dust on work surfaces in the pouring and polishing area averaged 6.2% quartz, dry sweeping or other processes which might resuspend this dust should be avoided. Wet wiping, mopping, or vacuuming should be used for cleanup.

5. Solvents should be stored in approved types of safety containers. Solvents should be stored in a locked area to prevent accidental poisoning. Cleaning rags containing solvents should be stored in a metal can with a self-closing lid. Solvents containing the more toxic components, such as methylene chloride, should be replaced, when possible, by safer substitutes.

6. The facility should develop a hazard communication program meeting the requirements of the OSHA standard, 29 CFR Part 1910, Section 1910.1200. The most applicable provisions include maintaining a material safety data sheet (MSDS) for each chemical product (obtained from the manufacturer or supplier), labelling of hazardous substances, and communication of the hazards to the employees.

IX. REFERENCES

1. National Institute for Occupational Safety and Health, NIOSH Manual of Analytical Methods, 3rd ed., Cincinnati, Ohio. DHHS (NIOSH) publication no. 84-100, 1984.

2. American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1988-1989, Cincinnati, Ohio, 1988.

3. General Industry OSHA Safety and Health Standards, Title 29, Code of Federal Regulations, Part 1910, U.S. Department of Labor, Occupational Safety and Health Administration, Revised, January 1989.

4. Occupational Safety and Health Administration. Occupational exposure to lead–final standard. Federal Register 1978 Nov 14:53007.

5. Ziskind M, Jones RN, Weill H. Silicosis, state of the art. Am Rev Respir Dis 1976;113:643.

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are temporarily available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 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 the NIOSH Publications Office at the Cincinnati, Ohio address. Copies of this report have been sent to:

A. Seagull Industries for the Disabled, Inc.
B. U. S. Department of Labor, OSHA - Region IV
C. Appropriate health and safety agencies of the State of Florida

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

TABLE 1

Respirable Dust and Respirable Quartz Concentrations

Seagull Industries
West Palm Beach, Florida
HETA 89 - 142
April 5, 1989

Job Description	Sample No.	Sample Time	Air Vol. (liters)	Respirable Dust Concentration (mg/m^3)	Respirable Quartz Concentration (ug/m^3)
Clay Pourer/ Mold Bander	5172	0832-1506 (394 mins.)	668	0.19	N.D.
Polisher	5179	0900-1507 (367 mins.)	622	0.10	64
Mold Bander	5177	0905-1510 (365 mins.)	621	0.60	48
Polisher/ also helped clean pouring area	5178	0907-1503 (356 mins.)	606	0.05	N.D.
Evaluation Criteria			N/A	50 (Refer to quartz)	(NIOSH)

N.D.: none detected
mg/m^3: milligrams of dust per cubic meter of air
ug/m^3: micrograms of dust per cubic meter of air
The lowest quantity detectable (limit of detection) for quartz was 25 ug/m^3 (in a 600 liter air sample).

TABLE 2

Lead Sampling Results

Seagull Industries
West Palm Beach, Florida
HETA 89-142
April 5, 1989

Job Description	Sample No.	Sample Time	Air Volume (liters)	Lead Concentration in Air (ug/m^3)
Painter	Pb-1	0815-1457 (402 mins.)	405	0.94
Painter	Pb-2	0816-1458 (402 mins.)	403	0.92
Painter	Pb-3	0823-1504 (401 mins.)	402	1.8
Painter	Pb-4	0830-1505 (395 mins.)	396	0.88
Painter	Pb-5	0906-1506 (360 mins.)	358	1.0
Evaluation Criterion			50	(OSHA)

ug/m3: Micrograms of lead per cubic meter of air

TABLE 3

Solvent Vapor Sampling Results

Seagull Industries
West Palm Beach, Florida
HETA 89-142
April 5, 1989

Chemical Sampled	Sample No.	Sampling Period	Air Vol (liters)	Concentration (ppm)	Evaluation Criteria
n-Butyl Alcohol	CT-2	1435-1504 (29 mins)	29	0.20	50 (OSHA)
Ethyl Alcohol	CT-2	1435-1504 (29 mins)	29	3.1	1,000 (OSHA)
Methyl Isobutyl Ketone (MIBK)	CT-2	1435-1504 (29 mins)	29	0.10	50 (NIOSH)

These sampling results represent worker exposure while cleaning the printing press in the outdoors.

ppm: parts of vapor per million parts of air, by volume