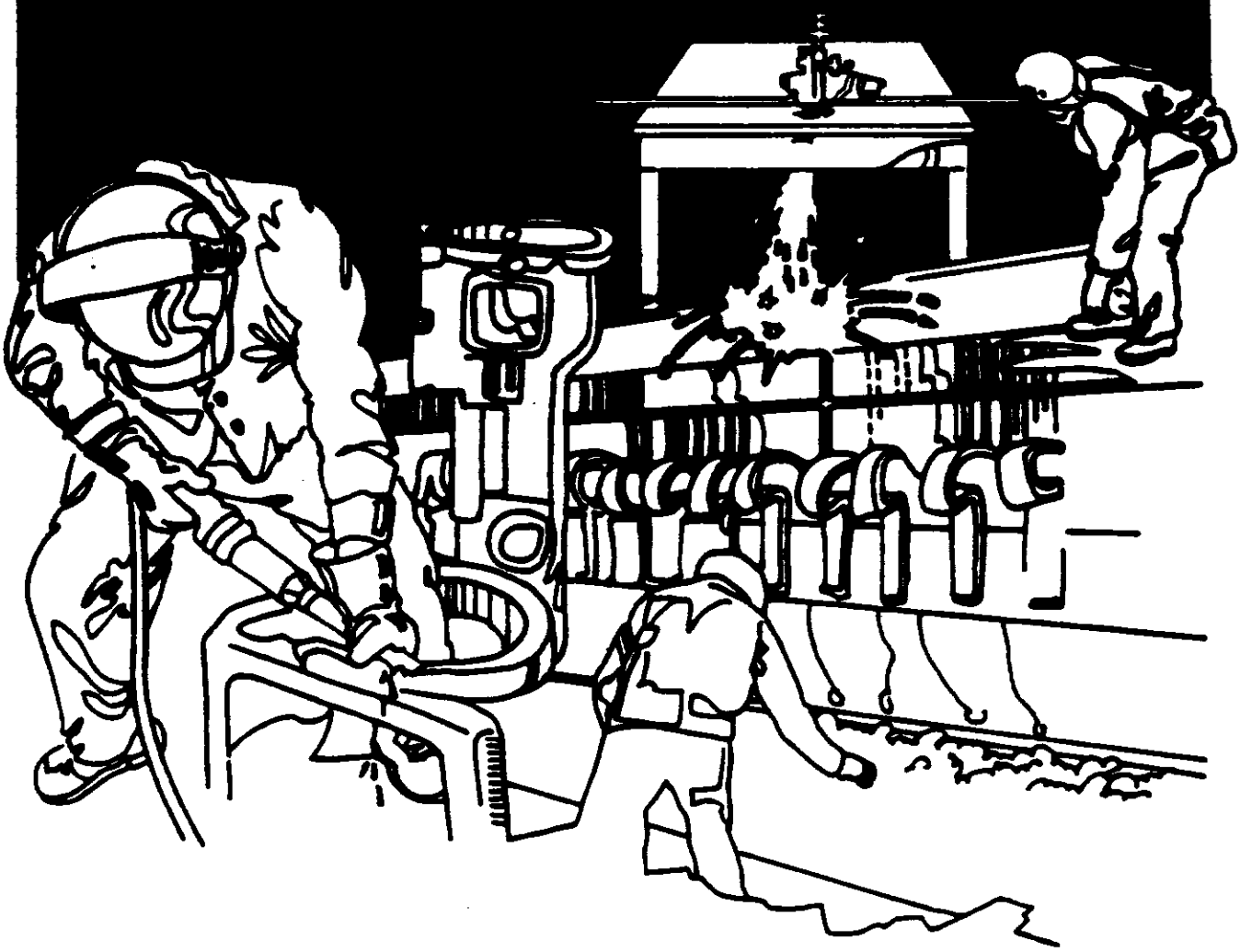
NIOSH



Health Hazard Evaluation Report

HETA 86-348-1756
J'LEEN LTD.
BOULDER, COLORADO

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 86-348-1756
December 1986
J'LEEN LTD.
BOULDER, COLORADO

NIOSH INVESTIGATORS:
Bobby J. Gunter, Ph.D.
Theodore W. Thoburn, M.D.

I. SUMMARY

In June, 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request from the owner of J'Leen LTD, Boulder, Colorado, to evaluate exposures to lead in a copper and lead glazing art studio.

On June 3, and June 12, 1986 an environmental and medical evaluation was conducted by NIOSH. The environmental evaluation consisted of measuring breathing zone and general room air concentrations of lead. Medical monitoring and evaluation consisted of blood-lead and free erythrocyte protoporphyrin (FEP) determinations on all (three) workers.

Seven air samples were collected for lead. Four of the seven exceeded the (OSHA) evaluation criteria of 0.05 milligrams per cubic meter (mg/M^3). The levels ranged from 0.01 to 0.26 mg/M^3 of lead with an average of 0.08 mg/M^3. The three workers blood lead concentrations were 7, 16, and 33 ug/dl, all within the OSHA regulatory limits of 50 ug/dl for medical removal and 40 ug/dl for returning to a job that involved lead exposure. One free erythrocyte protoporphyrin concentration (an indicator of lead absorption), 59 ug/dl, exceeded 50 ug/dl, the upper limit of "normal".

On the basis of environmental data, it was determined that a health hazard existed from over-exposure to lead during the process of coating the copper pieces with the powdered lead paint and then firing the pieces at 1700 degrees F. Recommendations for correcting this hazard are included in this report.

Keywords: SIC: 3999, artist, silkscreening, lead, blood lead, FEP.

II. INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) received a request in June 1986 from the owner of J'Leen LTD., a cottage industry located in Boulder, Colorado to evaluate lead exposures among family members that worked in an art studio.

The owner was telephoned upon receipt of the medical and environmental results. Copies of the blood lead levels and FEPs with an explanation of both were mailed to each worker on July 29, 1986.

III. BACKGROUND:

J'Leen LTD is a family owned and operated cottage industry that has been in operation about 5 years. Currently there are three workers; the mother, father, and daughter. Due to an increase in business, they may have to hire additional workers and that was the primary reason for this request.

Small defined pieces of copper metal are taken and placed under a silk screen with an artistic design pattern on the silk screen. Powdered paint containing 40 percent lead is sifted by hand through the silk screen onto the copper sheet under the screen. The pieces of copper are then placed into a muffle furnace operating at about 1700 degrees F.

The shop is very well insulated and has only one exhaust fan which cannot operate properly due to the negative pressure in the building. The fan speeds up when a door is opened indicating a negative pressure and a lack of dilution ventilation. The lead exposure comes from both lead dust and fumes.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Two breathing zone and five general room air samples were collected for lead analyses. These samples were collected on mixed cellulose ester membrane filters (AA) using vacuum pumps operated at 2.0 liters per minute. The analyses were done according to NIOSH P&CAM 173.

All three of the workers were interviewed.

B. Medical

All three workers had blood drawn for blood lead and FEP determination. Blood leads were determined utilizing anodic stripping voltammetry. FEP's were determined by photofluorometric techniques.

V. EVALUATION 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.

B. TOXICOLOGY AND MEDICAL CRITERIA FOR LEAD[1,2]

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 interferes with red blood cell production and can damage the kidneys, peripheral and central nervous systems, and the blood forming organs (bone marrow). These effects may be felt as weakness, tiredness, irritability, digestive disturbances, high blood pressure, kidney damage, mental deficiency, or slowed reaction times. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women.

Blood lead levels below 40 micrograms/deciliter (ug/dl) whole blood are considered to be levels which may result from daily environmental exposure. However, fetal damage in pregnant women may occur at blood lead levels as low as 25 ug/dl. Lead levels between 40-60 ug/dl in lead-exposed workers indicate excessive absorption of lead and may result in some adverse health effects. Levels of 60-100 ug/dl represent unacceptable elevations which may cause serious adverse health effects. Blood lead levels over 100 ug/dl are considered to be extremely dangerous and often these workers require hospitalization and medical treatment.

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. However, according to the standard, blood lead and protoporphyrin levels must be monitored at least every 6 months for workers exposed to air lead levels above 30 ug/M^3 for more than 30 days per year, and at least every 2 months if the worker's last blood lead was at or exceeded 40 ug/100 g whole blood. The standard also dictates that workers with blood lead levels greater than 60 ug/100 g whole blood must be immediately removed from further lead exposure if these levels are confirmed by a follow-up test. Workers with average lead levels of 50 ug/100 g or greater must also be removed. Removed workers have protection for wage, benefits, and seniority for up to 18 months or until they can safely return to lead exposure areas.

Free Erythrocyte Protoporphyrin (FEP) can be used to measure the degree of interference with hemoglobin production at the time the red cells are made. Although some diseases and iron deficiency anemia can cause a rise in FEP, in a healthy man working with lead, lead absorption is the most likely cause for such an increase. Further the FEP levels can be related to the average blood lead concentration over the past 3-4 months (the average life span of a red cell).[3] Normal values are below 50 ug/dl. The relationship between lead exposure and FEP is not particularly evident until elevated FEP levels are found. FEP essentially measures the same thing as the zinc protoporphyrin (ZPP) called for in the OSHA standard.

VI. RESULTS AND DISCUSSION

A. Environmental

Results of the environmental samples for inorganic lead are presented in table I. Airborne concentrations ranged from 0.01 to 0.26 mg/M^3. The average concentration was 0.08 mg/M^3. Five of the seven samples exceeded the evaluation criteria of 0.05 mg/M^3.

There was only one exhaust fan which was located in the wall above the muffle furnaces. This fan is not exhausting enough of the lead fumes and as a result levels of the lead increase as the use of the furnaces increase. There were no eating or drinking in the work areas.

B. Medical

The workers' blood lead concentrations were 7, 16, and 33 ug/dl. Although these are all within the current OSHA regulatory limits of 50 ug/dl for medical removal and 40 ug/dl for returning to a job that involves lead exposure, 33 ug/dl is well above the population mean and is unacceptably high for a pregnant woman. One FEP concentration, 59 ug/dl, exceeded 50 ug/dl, the upper limit of "normal".

VII. CONCLUSIONS

Based on the high environmental levels of lead, we concluded that a health hazard does exist at this facility. Five of the seven environmental samples exceeded the evaluation criteria. None of the blood lead levels exceeded the level requiring medical removal under the OSHA lead standard.

VIII. RECOMMENDATIONS

1. Better local exhaust ventilation should be installed in the vicinity of the muffle furnace.

2. All workers should continue to wear the respiratory protection with the ultra filters that prohibit the lead dust and fumes from entering the lungs.

3. Clean work habits should be taught to all new employees so they can eliminate the possibility of getting lead exposure.

IX. REFERENCES

1. Occupational Safety and Health Administration. OSHA Safety and Health Standards. 29 CFR 1910.1025. Lead. Occupational Safety and Health Administration, Revised 1983.

2. International Labor Office, Encyclopedia of Occupational Health and Safety, 3rd. (Revised) Ed. Geneva: International Labor Office. 1983. pp 1200-1205.

3. Alessio, L., Bertazzi, P.A., Monelli, O., Foa, V., "Free Erythrocyte Protoporphurin as an Indicator of the Biological Effect of Lead in Adult Males. II. Comparison between Free Erythrocyte Protoporphyrin and Other Indicators of Effect." International Arch. Occup. and Environ. Health. 37: 89-105 (1976).

X. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By:
Bobby J. Gunter, Ph.D.
Regional Industrial Hygienist
NIOSH, Region VIII
Denver, Colorado

Medical Assistance By:
Theodore W. Thoburn, Ph.D.
Medical Officer
NIOSH, Region VIII
Denver, Colorado

Originating Office:
Hazard Evaluation and Technical Assistance Branch (HETAB)
Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS)
NIOSH, Cincinnati, Ohio

Report Typed By:
Marile F. DiGiacomo
NIOSH, Region VIII
Denver, Colorado

XI. DISTRIBUTION AND AVAILABILITY

Copies of this 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), Springfield, Virginia. 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. J'Leen LTD.
2. U. S. Department of Labor/OSHA - Region VIII
3. NIOSH - Region VIII
4. Colorado State Department of Health
5. State Designated Agency

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

Table I

Breathing Zone and General Room Air
Concentrations of Lead at
J'Leen LTD.
Boulder, Colorado
June 3, 1986

Sample #	Job or Location	Sampling Time	mg/M^3 Pb
1	Owner (All Areas)	8:28a - 3:30p	0.26
2	Owner (All Areas)	8:30a - 3:31p	0.06
3	Area (Between kilns)	8:32a - 3:26p	0.03
4	Area (Prep Area)	8:34a - 2:39p	0.10
5	Area (Prep Area)	8:38a - 3:02p	0.01
6	Area (Prep Area)	8:38a - 3:05p	0.06
7	Area (Kiln Area)	8:38a - 3:28p	0.05
Evaluation Criteria			0.05
Laboratory Limit of Detection			0.002