U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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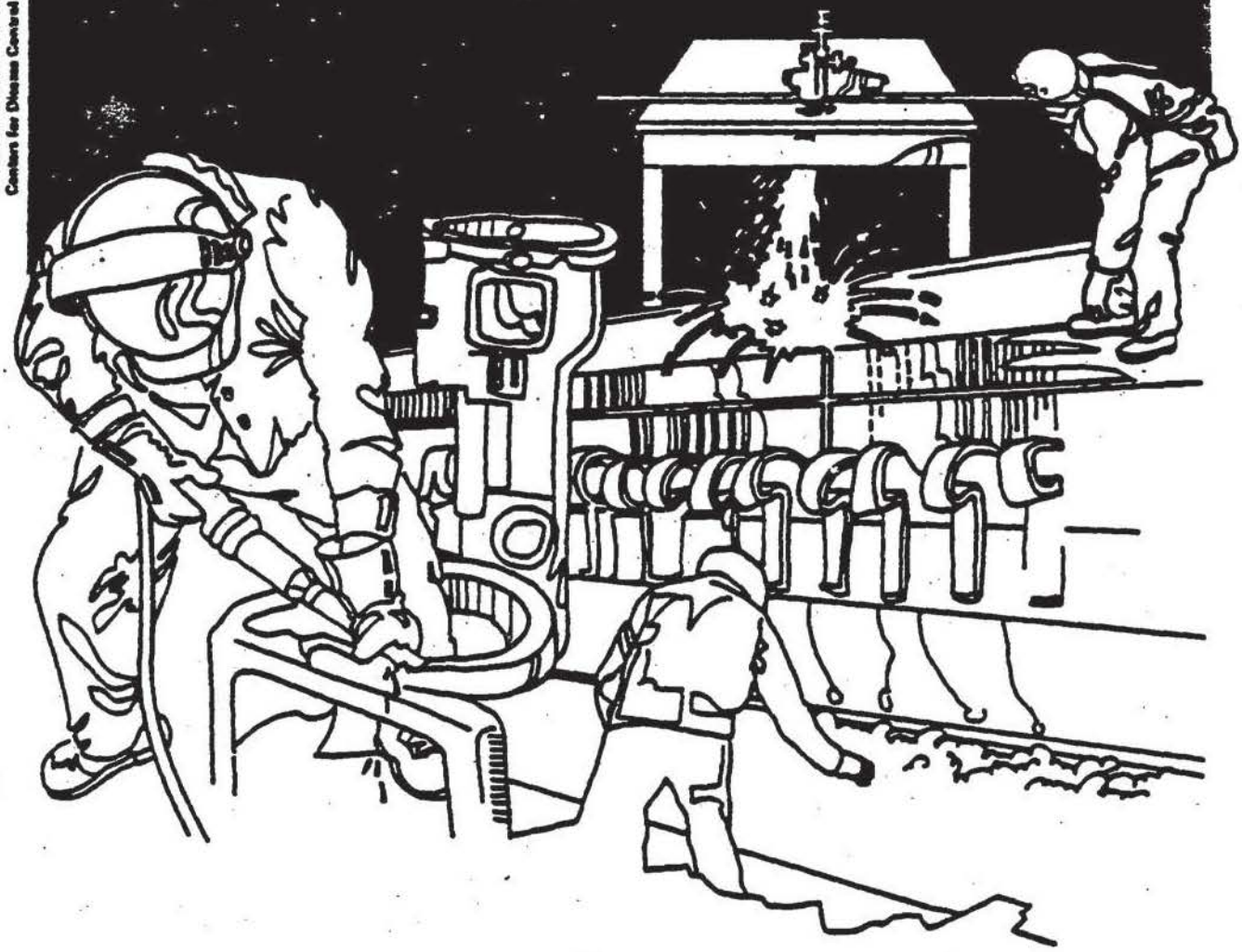
NIOSH



Health Hazard Evaluation Report

HETA 85-170-1643
C F & I STEEL
PUEBLO, 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 85-170-1643
DECEMBER 1985
C F & I STEEL
PUEBLO, COLORADO

NIOSH INVESTIGATOR:
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1. SUMMARY

In February 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from Local 2102 of the United Steel Workers of America, Pueblo, Colorado, to evaluate lead exposures to foundry workers at C F and I Steel, Pueblo, Colorado.

On June 11, 1985, a NIOSH investigator conducted an environmental investigation to determine exposures to lead, chromium, nickel, and arsenic among the foundry workers. The delay in performing this evaluation was due to the foundry furnace not working for two months. A medical evaluation of these workers was not performed since the company has a good program for biological monitoring of workers for these elements and informs each worker of the medical results.

The day shift was the most active and was the shift monitored during this evaluation. Three breathing zone and four general room air samples were collected and analyzed for lead, chromium and nickel. All chromium and nickel concentrations were below the laboratory limits of detection of 0.005 and 0.003 mg/sample respectively. Two of the three breathing zone samples taken for lead exceeded the evaluation criteria of 0.05 mg/M^3. The furnace operator's sample showed an exposure of 0.06 mg/M^3 and his helper showed 0.07 mg/M^3. The other five samples were below the evaluation criteria. For the two samples which were analyzed for arsenic, both were below the laboratory limits of detection.

All workers in areas where lead exposures are possible wear respiratory protection. Review of the respirator program indicated that it complies with the Occupational Safety and Health Administration (OSHA) standards outlined in 1910.134. Review of company medical records for blood lead showed all workers to be within normal levels.

On the basis of environmental data, it is concluded that a health hazard from exposure to lead existed at the time of this survey. Strict adherence to the respirator program should prevent workers from breathing excessive levels of lead.

Keywords: SIC 3321 Gray Iron Foundries, lead, arsenic, nickel, chromium

II. INTRODUCTION

In February 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Steel Workers of America Local 2102 who work at C F and I Steel Pueblo, Colorado, to evaluate lead exposures in the furnace area of the foundry.

Due to the furnace not working for several months, the study by NIOSH was delayed. Results of the air monitoring were received in July 1985 and were immediately discussed by telephone with both union and management.

III. BACKGROUND

This foundry melts metal from areas of the steel mill that are being dismanteled and mixes it with scrap metal from other sources and produces a large ingot molds used in the electric arc furnace department located in another area of the steel mill. The foundry building is almost 100 years old, with very high ceilings and lots of open doors.

IV. ENVIRONMENTAL DESIGN AND METHODS

All workers in the furnace area were monitored for lead, chromium and nickel. Samples were collected on AA filters using vacuum pumps operated at 1.5 to 2.0 liters per minute. Samples were analyzed by aspiration Atomic Absorption Spectrophotometry using NIOSH Method No. 173.

V. EVALUATION CRITERIA

A. Environmental

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 solely 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.

	Permissible Exposure Limits Mg/M^3 8-Hour Time-Weighted Exposure Basis		
	NIOSH	OSHA	TLV
lead	0.05	0.05	0.15
chromium	0.025	0.1c	0.5
nickel	0.015	1.0	0.5
arsenic	0.002c	0.01	0.2

c - Ceiling concentration and should never be exceeded.

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

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.

Chrome (metal) (3) - The most toxic route of entry is by inhalation -- followed by percutaneous. Chrome (metal) is very corrosive and is a strong sensitizer. Perforation of the nasal septum is seen frequently. Adequate ventilation and frequent monitoring of the work environment is necessary to prevent overexposures. Neither eating nor smoking should be allowed in the work area. Workers who have been sensitized should be removed from the exposure.

Nickel (4, 5) - Exposures to nickel are commonly found in welding procedures. The most toxic route of entry is by inhalation. Nickel is an irritant, sensitizer, and carcinogen. Signs and symptoms of nickel overexposures include gingivitis, stomatitis, and metallic taste. Acute symtoms include metal fume fever and nickel itch. Dermatitis with eczema may occur later. Carcinoma of the nasal sinuses and lungs may result from chronic exposure.

Arsenic (6, 7, 8) - NIOSH has recommended that airborne concentrations of inorganic arsenic be controlled to prevent exposures in excess of 0.002 mg/M^3. For the purposes of the recommended standard, arsenic is defined as elemental arsenic and all of its inorganic compounds. To determine the extent of worker exposures, a 15 minute sampling period is advised for avoidance of spurious sampling results produced by natural "background" concentrations (not to be confused with the traditional "ceiling" designation occasionally assigned to some of the more toxic chemicals which require 15 minute exposure determinations). The recommended standard was designed to protect workers from the possible development of lymphatic and (arsenic-related) respiratory cancer. This relationship has been suggested by numerous studies of working populations.

The OSHA standard for inorganic arsenic is 0.01 mg/M^3, as averaged over an 8 hour work shift.

VI. RESULTS AND DISCUSSION

Seven air samples were collected for lead, chromium, and nickel analysis. Two of three breathing zone samples collected for lead exceed the evaluation criteria of 0.05 mg/M^3. All analysis for chromium and nickel were below the laboratory limits of detection. Two filters were analyzed for arsenic, both were below the laboratory limits of detection. Two over-exposures to lead were found during this evaluation. The two overexposed workers were wearing adequate respiratory protection. Workers' blood lead values according to company medical results were below 40 ug/100 whole blood.

VII. RECOMMENDATIONS

1. Because there continues to be a potential for excessive lead exposure in this department, it is important that work practices to reduce likely lead exposure be followed faithfully, particularly keeping smoking material out of the work area and any other areas that might be contaminated with lead dust. It would probably be valuable to have refresher sessions on appropriate work practices every few years in addition to instructing new workers in the department on appropriate practices.

2. No eating, drinking, or smoking should be allowed while on the job.

3. Hands should be washed thoroughly before eating and smoking.

4. Showers should be taken and clothes changed after each work shift.

5. Monitoring of workers for lead exposure should be continued.

VIII. REFERENCES

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IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. 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 Serivce (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. C F & I Steel Co.
2. Union Local 2102 United Steel Workers of America
3. U.S. Department of Labor/OSHA - Region VIII
4. NIOSH - Region VIII
5. Colorado Department of Health
6. State Designated Agency

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

Breathing Zone and General Room Air Concentrations
of Lead, Chromium, and Nickel in the Foundry at
C F and I Steel
Pueblo, Colorado
June 11, 1985

Sample #	Job	Sampling Time	Lead	Mg/M^3 Chromium	Nickel
35	Furnace Operator	5:25a - 1:15p	0.06	*	*
46	Furnace Helper	5:27a - 1:15p	0.07	*	*
31	Foreman	5:28a - 1:15p	0.03	*	*
41	General Room	5:40a - 1:17p	0.03	*	*
42	General Room	5:50a - 1:25p	*	*	*
43	General Room	5:52a - 1:25p	0.006	*	*
39	Lunch Room	5:58a - 1:30p	*	*	*
Evaluation Criteria			0.05	0.025	0.015
Laboratory Limit of Detection mg/Sample			0.005	0.005	0.003

* - Not Detected