U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 80-51-709

CF&I STEEL CORPORATION
PUEBLO, COLORADO

JULY 1980

I. SUMMARY

In February 1980 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate overexposure to lead (Pb) in the steel production scrap yard area at CF&I Steel Corporation, Pueblo, Colorado (Standard Industrial Classification Code [SIC] 3310). Breathing zone air samples were taken on all workers for lead, iron oxide, magnesium (Mg), and manganese (Mn) determinations. Blood samples were taken on all workers for lead determination.

Twenty-two percent (22%) of the lead air samples and 33% of the iron oxide fume air samples taken exceeded the Occupational Safety and Health Administration (OSHA) lead standard of 0.05 mg/M^3 and the 1979 ACGIH Threshold Limit Value of 5.0 mg/M^3 for iron oxide. None of the manganese and magnesium samples exceeded the 1979 ACGIH Threshold Limit Value (TLV) or the OSHA standards.

All blood samples were analyzed for lead. The highest value found was 34 micrograms of lead per deciliter of whole blood (34 ug Pb/dl). The remaining workers had levels ranging from 9 ug Pb/dl to 28 ug Pb/dl, which are within the acceptable range.

On the basis of these environmental and medical data, it was concluded that a potential health hazard existed from overexposure to lead and iron oxide. Recommendations on work practices and biological monitoring procedures necessary to control these hazards are included on pages 4-5.

II. INTRODUCTION

NIOSH received a request from United Steelworkers of America Local Union 2102 at CF&I Steel Corporation in Pueblo, Colorado, to determine if there was a health hazard from lead exposure during the oxygen acetylene cutting of scrap steel.[1] An environmental and biological survey was conducted on February 11-13, 1980, to evaluate potential overexposure. Environmental and medical data were discussed with union and plant representatives in March 1980.

III. BACKGROUND

The steel production scrap yard department of CF&I Steel receives scrap steel from suppliers as well as other departments within the steel mill. Workers monitored during the evaluation use oxygen acetylene cutting to reduce the size of scrap steel so that it will be suitable to feed into a furnace.

IV. METHODS AND MATERIALS

A. Environmental

Lead, iron oxide, manganese, and magnesium air samples were collected on 37 mm AA filters using vacuum pumps operated at 1.5 liters per minute and analyzed by NIOSH Method P&CAM No. 173.

B. Medical

Venous blood samples were obtained in vacuum tubes containing EDTA. These blood samples were then refrigerated until analyzed. Blood lead levels were analyzed by the Delves' cup atomic absorption technique.

V. EVALUATION CRITERIA

A. Environmental

Two sources of criteria were used to assess workroom concentrations of air contaminants: (1) recommended threshold limit values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1979; (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910), January 1978.

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[1]Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 19 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative to employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

	Permissible Exposure Limits 8-Hour Time-Weighted Exposure Basis (mg/M^3)
Lead.....	0.05 (OSHA)
Iron Oxide.....	5.0 (TLV)
Manganese.....	1.0 (TLV)
Magnesium.....	10.0 (TLV)

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

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

B. Toxicological

Lead -- Inhalation of lead dust and fumes is the major route of lead exposure in industry. A secondary source of exposure may be from lead dust contamination on food, cigarettes, or other objects. Once absorbed lead is excreted from the body very slowly. The absorbed lead 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 ug/100ml whole blood are considered to be normal levels which may result from daily environmental exposure. However, fetal damage in pregnant women may occur at blood lead levels as low as 30 ug/100ml. Lead levels between 40-60 ug/100ml in lead exposed workers indicate excessive absorption of lead and may result in some adverse health effects. Levels of 60 to 100 ug/100ml represent unacceptable elevations which may cause serious adverse health effects. Levels over 100 ug/100ml are considered dangerous and often require hospitalization and medical treatment.

The new OSHA standard for lead in air in most workplaces is 50 ug/M^3 on an eight-hour time-weighted average for daily exposure. For this particular industry the current standard is 50 ug/M^3. The new standard also dictates that in four years workers with blood lead levels greater than 50 ug/100ml must be immediately removed from further lead exposure and in some circumstances workers with lead levels less than 50 ug/100ml must also be removed. At present medical removal is necessary at blood lead levels of 70 ug/100 grams of whole blood or greater. Removed workers have protection for wage, benefits, and seniority until they can return to lead exposure areas.

Manganese -- Chronic manganese poisoning is a clearly characterized disease which results from the inhalation of fumes or dust of manganese. The central nervous system is the chief site of damage. If cases are removed from exposure, some improvement frequently occurs. However, there may be some residual disturbance in gait and speech. When the disease is well established, the result is permanent disability.

Magnesium -- Magnesium oxide fume is a mild irritant of the eyes and nose. Experimental subjects have developed metal fume fever when exposure levels exceed 10 mg/M^3. There are no reports of metal fume fever from industrial exposure. (Reference 1)

Iron Oxide -- Iron oxide is relatively non-toxic. Chronic exposures to high concentrations do cause a disease called siderosis. The main complication of this disease is that it prevents getting a good X-ray of the lungs in case another lung disease occurs. Siderosis does not decrease pulmonary function or cause any other metabolic disturbances. However, the irritative effects of iron oxide and the other welding fumes may cause other lung diseases, e.g. bronchitis.

VI. RESULTS

A. Environmental Results

Twenty-two percent (22%) of the lead samples and 33% of the iron oxide samples taken in the plant exceeded the evaluation criteria. Iron oxide breathing zone air samples ranged from 1.1 mg/M^3 to 13.6 mg/M^3. Lead breathing zone air samples ranged from .01 mg/M^3 to .79 mg/M^3. Magnesium and manganese breathing zone air samples ranged from .01 mg/M^3 to .08 mg/M^3. None of the manganese and magnesium samples exceeded the evaluation criteria. The results may be reviewed in Table 1.

All the acetylene cutting of scrap metal is performed outside. Therefore, air movement has a definite effect on the concentrations of breathing zone contaminants found.

B. Biological Results

Lead was analyzed in 33 blood samples (this included a management official, a union official, and a NIOSH control) by two different laboratories. None of these samples exceeded the OSHA standard of 40 micrograms Pb/dl of whole blood. The highest value found was 34 mg Pb/dl. The mean blood lead found from one laboratory was 19.1 mg Pb/dl and the average of the other laboratory was 13.1 mg Pb/dl. Results of blood lead determinations may be reviewed in Table 2.

The extremely low levels of blood leads were due to low exposure and proper use of respiratory protection. All welders were wearing NIOSH approved respirators and cartridges. The workers were practicing good hygiene and were aware of the toxic effects of lead.

VII. RECOMMENDATIONS

1. No eating, drinking, smoking, or snuff usage should be allowed in the work area.

2. The respirator program in use at the time of this survey should be continued and efforts should be made to improve this program in the areas of fitting and changing of soiled cartridges.

3. Every worker should shower before leaving work. Each worker should be provided with two lockers--one for street clothes and one for work clothes.

4. The blood monitoring program presently used by CF&I Steel should be continued.

5. An adequate washing facility should be installed for workers to clean hands before eating. This was not present during this evaluation.

VIII. REFERENCES

1. Proctor, N.H. Chemical Hazards of the Workplace, J. P. Lippincott Company, 1978, pp. 314-315.

IX. AUTHORSHIP AND ACKNOWLEDGMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Service, 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. CF&I Steel Corporation.
2. United Steelworkers of America.
3. United Steelworkers of America Local Union 2102.
4. U.S. Department of Labor/OSHA - Region VIII.
5. NIOSH - Region VIII.
6. Colorado Department of Health
7. State Designated Agency

For the purpose of informing all 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 1

Breathing Zone Air Concentrations of Iron Oxide, Lead, Magnesium, and Manganese of Scrap Yard Burnermen

CF&I Steel Corporation
Pueblo, Colorado

February 13, 1980

Sample Number	Sampling Time	mg/M^3			
		Iron Oxide	Lead	Magnesium	Manganese
65	7:24 AM - 2:40 PM	1.1	0.01	0.01	0.01
82	7:19 AM - 1:30 PM	13.6	0.03	0.01	0.07
67	7:31 AM - 2:30 PM	2.6	0.04	0.02	0.02
63	7:32 AM - 2:45 PM	6.3	0.06	0.07	0.07
62	7:26 AM - 2:28 PM	4.6	0.18	0.05	0.04
66	7:25 AM - 2:38 PM	2.0	0.01	0.02	0.02
53	7:37 AM - 2:47 PM	5.6	0.19	0.02	0.04
55	7:40 AM - 2:37 PM	1.6	0.02	0.02	0.01
61	7:22 AM - 1:38 PM	10.3	0.01	0.01	0.08
71	7:36 AM - 2:50 PM	12.7	0.01	0.03	0.08
80	7:12 AM - 2:40 PM	5.5	0.03	0.02	0.05
83	7:20 AM - 2:30 PM	2.2	0.01	0.02	0.02
54	7:33 AM - 2:28 PM	2.6	0.79	0.09	0.04
70	7:20 AM - 2:40 PM	4.7	0.03	0.05	0.07
51	7:28 AM - 2:41 PM	4.3	0.01	0.03	0.04
81	7:14 AM - 2:45 PM	3.8	0.01	0.02	0.03
59	7:34 AM - 2:40 PM	2.3	0.004	0.01	0.02
64	7:30 AM - 2:41 PM	2.9	0.01	0.02	0.03
EVALUATION CRITERIA		5.0	0.05	10.0	1.0
LABORATORY LIMIT OF DETECTION mg/sample		0.001	0.002	0.001	0.001

TABLE 2

Blood Lead Values of Scrap Yard Burnermen

CF&I Steel Corporation
Pueblo, Colorado

February 11, 1980

Sample No.	ug Pb/dl Laboratory No. 1	Laboratory No. 2
1	24	14
2	21	12
3	23	11
4	18	10
5	17	8
6	26	13
7	19	11
8	18	10
9	14	25
10	14	11
11	9	16
12	28	19
13	25	17
14	23	16
15	17	10
16	20	11
17	34	23
18	16	10
19	28	23
20	22	18
21	22	11
22	16	7
23	22	16
24	17	11
25	14	11
26	14	7
27	13	17
28	16	14
29	21	14
30	26	13
31	9	9
32	12	7
33	12	6
MEAN	19.1	13.1