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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 78-33-506

GRAND JUNCTION STEEL FABRICATING COMPANY
GRAND JUNCTION, COLORADO

JULY 1978

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Grand Junction Steel Fabricating Company on January 30 through February 2, 1978. At the time of this evaluation breathing zone air samples were taken on workers for lead, manganese, iron oxide fume, total fluoride, methyl ethyl ketone (MEK), isopropanol, and toluene. Concentrations of MEK, isopropanol, toluene, total fluoride, and manganese were all well within the most recent evaluation criteria. Overexposures to iron oxide fume existed in 6 out of 39 samples (15%). Confidential employee interview forms were completed on 32 workers. Nineteen of the workers had neither complaints nor symptoms. Thirteen of the workers had complaints that may or may not have been related to their work exposures. These complaints consisted of coughing, sinus problems, bronchitis, nasal congestion, headaches, sore feet, and burning eyes. Most of these same workers were also heavy smokers. Based on the confidential employee interviews and the number of welders exposed to high concentrations of iron oxide fume, a potential health hazard existed at the time of this survey.

II. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information 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. Grand Junction Steel Fabricating Company
2. United Steelworkers of America - Pittsburgh
3. United Steelworkers of America - Grand Junction
4. U.S. Department of Labor/OSHA - Region VIII
5. NIOSH - Region VIII

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.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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.

NIOSH received such a request from the United Steelworkers of America in Grand Junction, Colorado, to evaluate potential exposures associated with the welding of sheet and angle iron in the production of a variety of products such as steel oil tank batteries, steel parts for power plants, and large steel beams for the construction of buildings and bridges.

IV. HEALTH HAZARD EVALUATION

A. Processes Evaluated

The Grand Junction Steel Fabricating Company manufactures steel products such as oil tank batteries, large beams for building, and parts for power plants. The sheets of steel are cut using an oxygen acetylene cutting torch. This is usually done on the outside of the building. The parts are then transported inside the building where they are welded and made into the finished product. The areas of concern during this evaluation included oxygen acetylene cutting, welding, and painting.

B. Evaluation Design

There are approximately 100 workers in the specific areas of this request. All welders and cutters were monitored. Only two men were painting, and both of these workers were monitored. A large number of the workers were interviewed, and questions were directed at work history and specific complaints related to welding fume exposures.

C. Evaluation Methods

All iron oxide, manganese, and total fluoride samples were collected on 37 millimeter filters using pumps operated at 1.5 liters per minute. The iron oxide, manganese, and lead samples were run by atomic absorption spectroscopy. Total fluoride was analyzed according to Physical & Chemical Analysis Method No. 117. MEK, isopropanol, and toluene were analyzed by gas chromatography in

accordance with NIOSH Method No. 127. There was no local exhaust ventilation in this facility. Ventilation was provided by opening of doors and a couple of large exhaust fans in the roof.

D. Criteria for Assessing Concentrations of Air Contaminants

Three sources of criteria are generally 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), 1977; (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 2920), January 1976; and (3) NIOSH criteria for recommended standards. NIOSH criteria and ACGIH TLVs represent the most recent and relevant recommendations and are given prominence in this evaluation.

	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M3)		
Substances	TLV	Current OSHA Standard	NIOSH Criteria For Recommended Standard
Lead	0.15	0.2	0.1*
Manganese	5.0"C"	---	---
Iron Oxide	5.0	---	---
Total Fluoride	2.5	2.5	2.5
MEK	590.0	---	---
Isopropanol	980.0	980.0	980.0
Toluene	375.0	750.0	375.0
Welding Fumes**	5.0		

mg/M3 = approximate milligrams of substance per cubic meter of air

"C" = ceiling value and should never be exceeded

* = OSHA has proposed, and NIOSH supported, lowering the lead standard to 0.1 mg/M3

**= not otherwise classified

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.

E. Toxicology

Lead--prolonged exposures to lead or its inorganic compounds from inhalation or ingestion of vapor, fume, or dust results in

gastrointestinal disturbances such as anorexia, weight loss, malnutrition, colic, constipation, and abdominal discomfort and tenderness. Neurologic symptoms can include weakness, lassitude, tremor, insomnia, and motor weakness that may include paralysis of the extensor muscles of the wrists and ankles. Encephalopathy can result with the most severe lead exposures.

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 disturbances in gait and speech. When the disease is well established, the result is permanent disability.

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.

Total Fluoride--chronic exposure to total fluoride may cause anorexia, nausea, vomiting, constipation, weight loss, weakness, shortness of breath, and stiffness of joints. It may also produce fluorosis. (reference 1)

MEK--is irritating to the nose and eyes. At concentrations over 590 milligrams per cubic meter, eye and liver damage may occur. Relatively few reports show serious ill effects from its use. (reference 2)

Isopropanol--overexposures to isopropanol are rare. Isopropanol acts as a local irritant and in high concentrations as a narcotic. It can cause corneal burns and often eye damage. It is not considered an important industrial toxic hazard.

Toluene--is slightly irritating to the eyes and mucous membranes. It is toxic by ingestion, inhalation, and skin absorption. Acute poisoning from toluene vapors is rare. Inhalation of 200 parts per million for an 8-hour period will cause impairment of coordination and reaction time. Toluene produces narcosis. There have been reports of chronic poisoning described as anemia and leucopenia. Biopsy showed bone marrow hypoplasia. (reference 3)

F. Environmental Results and Discussion

Results of the environmental samples showed that workers were overexposed to iron oxide fume. All other environmental measurements were well within the most recent evaluation criteria. For a detailed

description, please refer to Tables I through IV. Thirty-two workers were interviewed. Analyses of this data showed that some of the welders did have complaints that were compatible with overexposure to welding fumes.

G. Conclusions

Results of environmental data illustrate that 15% of the workers were overexposed to iron oxide fume. Worker interviews, plus worker exposure to iron oxide fume, indicate there was a potential health hazard to welders at the time of this evaluation.

V. RECOMMENDATIONS

1. Engineering controls such as local exhaust ventilation and/or electrostatic precipitators as appropriate should be provided to reduce welding fume exposures to acceptable levels.

2. The respirator used in the paint booth area should be cleaned and maintained.

3. Eating Should be prohibited in the work area.

VI. REFERENCES

1. Plunkett, E. R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, p. 188-190.

2. American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Substances in Workroom Air, third edition, p. 29, 1971.

3. Sax, N. Irving. Dangerous Properties of Industrial Materials, fourth edition, Van Nostrand Reinhold Company, p. 1174, 1975.

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TABLE I

Breathing Zone Air Concentrations of
Manganese and Iron Oxide Fume

Grand Junction Steel Fabricating Company

February 3, 1978

Sample Number	Location	Job Classification	Time of Sample	Manganese (mg/M3)	Iron Oxide Fume (mg/M3)
26	Fabrication	Foreman	6:43 AM- 3:15 PM	0.05	0.64
27	"	Welder	6:45 AM- 3:17 PM	0.46	2.9
28	"	"	6:46 AM- 3:26 PM	0.22	3.52
29	Outside	Cutter	6:48 AM- 2:56 PM	0.003	0.3
30	Fabrication	Welder	6:50 AM- 3:08 PM	0.11	1.8
31	Outside	Cutter	6:52 AM- 2:55 PM	*	0.15
32	Welding	Welder	6:53 AM-12:32 PM	*	*
33	Fabrication	*	6:54 AM- 3:15 PM	0.12	2.14
34	"	"	6:55 AM- 3:25 PM	0.07	1.4
35	"	Foreman	6:56 AM- 3:03 PM	0.05	0.80
40	"	Lead Man	7:00 AM- 3:18 PM	0.10	0.83
37	"	Welder	7:01 AM- 3:18 PM	0.15	2.0
45	Outside	Cutter	7:02 AM- 2:55 PM	0.004	0.15
1	"	Welder	7:03 AM- 3:09 PM	0.10	2.1
140	Fabrication	"	7:03 AM-12:42 PM	2.98	12.71
23	"	"	7:05 AM-12:46 PM	2.03	15.76
16	Outside	Cutter	7:05 AM- 2:56 PM	0.03	2.84
2	All Areas	"	7:09 AM- 2:56 PM	0.02	0.50

3	Fabrication	Welder	7:10 AM- 3:08 PM	0.47	3.53
4	Welding	"	7:11 AM- 3:10 PM	0.09	1.29
5	"	"	12:35 PM- 3:12 PM	3.64	24.19
6	Fabrication	"	12:42 PM- 3:16 PM	0.87	9.13
7	Welding	Maintenance	7:02 AM- 3:25 PM	0.50	2.9
24	Grinding	Grinder	7:02 AM- 3:08 PM	0.10	1.25
230	Structural	Welder	7:04 AM- 3:11 PM	0.47	4.9
5	"	"	7:05 AM- 3:02 PM	5.3	21.1
10	"	"	7:07 AM- 3:28 PM	0.17	1.15
3	Outside	Flame Cutter	7:08 AM- 2:32 PM	*	0.10
16	Fabrication	Welder	6:46 AM-12:30 PM	0.06	1.3
13	"	Metal Saw Opr.	6:47 AM- 3:23 PM	0.008	0.24
6	Structural	Fitter-Welder	6:48 AM- 3:13 PM	0.05	1.04
11	Fabrication	Punch & Layout	6:49 AM- 3:21 PM	0.20	2.7
17	Structural	Welder	6:55 AM- 3:20 PM	0.21	4.2
14	Fabrication	"	6:55 AM- 3:06 PM	0.06	1.4
25	Machine Shop	Machinist	6:58 AM- 3:30 PM	0.003	0.1
15	Fabrication	Laborer	6:59 AM- 3:10 PM	0.1	1.3
12	Structural	Welder	7:00 AM- 3:21 PM	0.08	1.42
9	Plate Shop	"	7:01 AM-10:45 AM	0.1	1.16
8	Tank Shop	"	7:02 AM- 3:30 PM	0.18	7.38
		EVALUATION CRITERIA		5.0	5.0
		LABORATORY LIMIT OF DETECTION		0.002	0.005

* = below laboratory limit of detection

TABLE II

Breathing Zone Air Concentrations of
MEK, Isopropanol, and Toluene

Grand Junction Steel Fabricating Company

February 3, 1978

Sample Number	Location	Job Classification	Time of Sample	MEK	Isopropanol (mg/M3)	Toluene
CT 1	Paint Shop	Painter	7:25 AM-3:15 PM	80	*	*
CT 2	" "	"	7:13 AM-9:00 AM	16	*	1.3
CT 3	" "	"	7:25 AM-3:15 PM	10	*	1.4
CT 4	" "	"	12:34 PM-3:16 PM	5	*	1.3
CT 5	" "	"	12:35 PM-3:16 PM	5	*	*
		EVALUATION CRITERIA		590	980	375
		LABORATORY LIMIT OF DETECTION		0.01	0.01	0.01

* = below laboratory limit of detection

TABLE III

Breathing Zone Air Concentrations of
Total Fluoride

Grand Junction Steel Fabricating Company

February 3,1978

Sample Number	Location	Job Classification	Time of Sample	Total Fluoride (mg/M3)
07	Welding	Maintenance	7:02 AM-3:25 PM	0.07
22	"	Fabricator	6:44 AM-3:19 PM	0.26
21	"	Welder	6:50 AM-3:26 PM	0.02

EVALUATION CRITERIA	2.5
LABORATORY LIMIT OF DETECTION	0.0025 mg/sample

TABLE IV

Breathing Zone Air Concentrations of
Lead

Grand Junction Steel Fabricating Company

February 3, 1978

Sample Number	Location	Job Classification	Time of Sample	Lead (mg/M3)
38	Fabrication	Sanding Old Paint	7:03 AM-3:16 PM	*
4	"	Painter	7:04 AM-3:11 PM	*
19	"	Painter	7:04 AM-3:15 PM	*
		EVALUATION CRITERIA		0.1
		LABORATORY LIMIT OF DETECTION		0.005 mg/sample

* = below laboratory limit of detection