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
HE 79-58-681

EAZ-LIFT SPRING, INC.
ELKHART, INDIANA

APRIL 1980

I. SUMMARY

On February 28, 1979, authorized representatives of Unit Steelworkers of America, Local No. 15483, requested a health hazard evaluation at EAZ-Lift Spring Corporation. The request alleged employee exposure to contaminants generated during arc-welding operations.

NIOSH conducted an environmental survey of the arc-welding operation on March 29-30, 1979. Personal air samples were obtained for determination of the following contaminant levels: carbon monoxide, total (welding) particulate, chromium, copper, iron oxide, manganese, and vanadium pentoxide.

Although concentrations of all welding contaminants were below evaluation criteria, two of the four exposures to total welding particulate approach the 5 mg/M^3 criteria. Three out of six welders and the heat treating operator complained of upper respiratory tract irritation.

On the basis of the data obtained in this investigation, NIOSH determined that the potential for welder overexposure to total welding particulate may exist. Recommendations designed to alleviate this potential exposure hazard are incorporated in detail on page 6.

II. INTRODUCTION

On February 28, 1979, authorized representatives of United Steelworkers of America, Local No. 15483, requested a health hazard evaluation at EAZ-Lift Spring, Inc. (SIC 3799)* The purpose of the study was to evaluate complaints of arc-welder (SIC 7692) exposure to welding fumes and forge operator exposure to burnt oil fumes generated during heat treating operations (SIC 3398). A NIOSH initial environmental survey was conducted on March 29-30, 1979, to assess welder exposure to total welding particulate, carbon monoxide, iron oxide, chromium, copper, manganese oxide, and vanadium pentoxide. The heat treating operation was shut down the day the survey was conducted and as a result, NIOSH personnel were unable to assess operator exposure to oil mist and oil decomposition products.

III. BACKGROUND

The plant is engaged in the manufacture of towing hitches for trailers. Their products include hitches, undercarriages, and sway control bars. The areas of concern include the welding area and the heat treating area.

The welding area is located in the center of a building 300 feet by 80 feet. The area is partitioned into ten smaller areas, five to a side. Gas metal arc-welding is performed in nine booths: three booths are set up for flux cored arc-welding performed under an atmosphere of argon (98%); six booths are set up for consumable wire electrode welding performed under an atmosphere of carbon dioxide. With the exception of spring bar parts, which are welded infrequently, all steel used in the operation is mild steel. Table 1 depicts the composition of the electrodes used at the time of the survey.

The heat treating area is located adjacent to the welding area. Thirty-five mild steel spring bars are heat treated in an open hood gas fired furnace at 1600° F for approximately 2.5 hours. The bars are manually transferred to a conveyor line and fed into an oil quench tank. The bars are quench-hardened for five minutes, conveyed out of the oil, and manually removed and stacked. The bars are then placed in a second furnace where they are "tempered." The total exposure time of the operator to oil mist is less than two hours per day.

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* 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 an 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.

On September 9, 1977, a survey team from NIOSH conducted a previous health hazard evaluation at EAZ-Lift Spring, Inc. Airborne concentrations of contaminants from the welding operation, notably iron particulate, were collected in the workers' breathing zone. The airborne contaminant concentrations measured were found to be within acceptable limits of exposure with the exception of two workers who exceeded the recommended criteria for total welding particulate. The NIOSH investigators concluded that the potential for overexposure of employees to welding contaminants existed in this welding operation. Recommendations for the alleviation of this hazard were presented in the Health Hazard Evaluation Determination Report No. 77-117-444.

NIOSH Interim Report #1 provided the preliminary results of the initial survey and was sent to union and management representatives in June, 1979.

IV. METHODS AND MATERIALS

Total (welding) particulate and inorganic samples were collected on 37mm diameter polyvinyl chloride copolymer filters held in closed-face cassettes and attached via tygon tubing to battery powered air sampling pumps operating at flow rates of approximately 1.5 liters per minute. The weights of the samples were determined by subtracting the pre-sampling weight from the post-sampling weight of the filter. Inorganic samples were analysed by atomic absorption spectrophotometry.

Colorimetric detector tube tests for carbon monoxide were conducted with a National Draeger* detector tube system.

NIOSH personnel conducted eight confidential employee interviews.

V. EVALUATION CRITERIA

A number of sources recommend airborne levels of substances under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Such airborne levels are referred to as standards or threshold limit values (TLV's). It is believed that concentrations below these limits represent conditions under which nearly all workers may be repeatedly exposed 8-10 hours per day, 40 hours per week, without suffering adverse health effects. Due to variations in individual susceptability, a small percentage of workers may experience effects at levels at or below the threshold limit; a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction.

*Mention of commercial names or products does not constitute endorsement by NIOSH.

The environmental evaluation criteria used for this study are presented in Table 2. Listed in this table, for each substance, are the recommended environmental limit, the source of the recommended environmental limit and the current OSHA standard.

VI. RESULTS AND DISCUSSION

In response to the recommendations presented in the November, 1977, NIOSH Determination Report, management had eliminated the unnecessary twists and turns in the ductwork connecting the main duct to the welding hoods. A 4000 cubic foot per minute radial blade fan was added to the system to service two welding booths.

The nine 0.5 ft^2 flanged local exhaust hoods were replaced by eight canopy, two slotted box, two box hoods, and one flexible 6 inch diameter round duct exhaust. The 1977 NIOSH survey established that the average cubic feet per minute "pulled" by the 0.5 ft^2 flanged hood was approximately 440 cfm. The average cfm "pulled" by the canopy, slotted box, and box hood was determined to be 1200 cfm., which represents a substantial increase in the quantity of air pulled. Yet, from an industrial hygiene viewpoint, canopy hood mechanical ventilation is not the recommended control of choice for welding operations. A slot mechanical ventilation system designed to exhaust at the point of generation is a more acceptable control method.[5]

Detector tube measurements for carbon monoxide (CO) were below the NIOSH criteria. The measurements were taken inside the welding helmet during welding and showed levels of below 5 parts per million (ppm).

Results of the personal air samplings of flux core and wire welders revealed levels which were below evaluation criteria, these are shown in Table 2. Total (welding) particulate levels ranged from 0.47 mg/m^3 to 4.9 mg/M^3, while the average exposure was 3.2 mg/M^3 (evaluation criteria: 5.0 mg/M^3).

Iron oxide fume levels ranged from 0.81 to 2.6 mg/M^3, while the average exposure was 1.7 mg/M^3 (evaluation criteria: 5 mg/M^3).

Manganese fume levels ranged from 0.009 to 0.16 mg/M^3, while the average exposure was 0.083 mg/M^3, (evaluation criteria: 1 mg/M^3).

Copper fume levels from the two core wire welding ranged from none detected to 8.1 micrograms per cubic meter (ug/M^3) (evaluation criteria 100 ug/M^3).

No vanadium or chromium was detected from the core wire welding.

The results of the eight confidential employee interviews revealed that 50% of the welders complained of upper respiratory irritation with aftermaths such as sinusitis or nose bleeding. A heat treating operator complained of irritation to his sinuses from the oily smoke.

There are five factors which may influence a welders exposure: 1) type of steel being welded; 2) type of electrode being used; 3) size of the piece being welded, i.e., in relation to the distance the job is from the exhaust ventilation; 4) the amount of welding required per piece; and 5) the welder's technique, i.e., how close he gets to the welding point, whether or not he moves the welding point as close to the exhaust ventilation is possible.

The fact that two of the four samples approached the total particulate criteria and 3 of the 6 welders complained of upper respiratory irritation indicates that the potential for overexposure may exist. It is conceivable that variation in any of the above factors could cause exposures to exceed the recommended criteria.

NIOSH investigators were unable to conduct a followup environmental evaluation due to the fact that production at EAZ-Lift Inc. was substantially reduced after the March, 1979 initial survey. Only three welders were being employed full time in comparison to seven or more at the time of the initial survey. This reduction in the number of welders would enhance the effectiveness of the ventilation system and reduce exposure levels to welding fumes. The heat treating operation, which at the time of the initial survey was running on a daily basis, was run on a very infrequent basis (once, every other month). On October 18, 1979, the plant manager and union requestor indicated that production was still at reduced levels and would be further reduced in the upcoming months.

On October 19, 1979, a letter was sent to the union requestors confirming that field activity on the NIOSH evaluation was to be discontinued and if production of the towing hitches returned to normal or near normal levels, initiation of another health hazard evaluation request would be in order.

VII. CONCLUSIONS

1. Management modified and improved the local exhaust ventilation servicing the welding booths in response to the recommendation presented in the November 1977, NIOSH Determination Report. The March 29, 1979 NIOSH survey revealed that the potential for welder exposure still existed. This observation was supported by the following facts:

   a. Half of the welders interviewed complained of upper respiratory tract irritation.

   b. Welding fume total particulate levels inside the welding helmets approached the 5 mg/m^3 evaluation criteria in 50% of the welders monitored.

2. Reduction of the welding workforce from nine to three full-time welders and elimination of the ventilation requirements of the six unused stations would increase the ventilation effectiveness of the three remaining stations. This would reduce the likelihood of overexposure to welding fumes.

VIII. RECOMMENDATIONS

1. Increase the effectiveness of the canopy hood local exhaust ventilation by enclosing the welding operation as much as possible. This could be accomplished with the addition of flexible canvass sides attached to the canopy hood.

2. An environmental monitoring program should be developed to accurately assess employee exposure to welding fumes, oil mist, and oil decomposition products. If heat treating production levels return to normal or near normal levels, initiation of a NIOSH Health Hazard Evaluation to assess exposure to toxicants would be in order.

IX. REFERENCES

1. General Industry Standards: Occupational Safety and Health Administration Safety and Health Standards (29 CFR 1910) revised January 1976.

2. Criteria for a Recommended Standard.. Occupational Exposure to Carbon Monoxide: NIOSH Publication No. 73-11000 (1973).

3. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment, American Conference of Government Industrial Hygienists, Cincinnati, Ohio (1979)

4. Criteria for a Recommended Standard.. Occupational Exposure to Vanadium Pentoxide: NIOSH Publication No. 77-222 (1977).

5. Industrial Ventilation, A Manual of Recommended Practice, 14th Edition, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio (1977).

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VIII. DISTRIBUTION AND AVAILABILITY

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (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 the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

a. United Steel Workers Local No. 15483.

b. United Steel Workers International.

c. U. S. Department of Labor, OSHA, Region V.

d. NIOSH Regional Offices/Divisions.

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

Table 1

Component of Electrodes

EAZ-LIFT Spring, Inc.
Elkhart, Indiana

Welding Electrode	Typical Weld Metal Analysis	
AWS A5.20 Class E-70T-1	Carbon	0.10%
	Manganese	1.1%
	Silicon	0.53%
	Phosphorus	0.024%
	Sulfur	0.014%
	Iron	Bulk

Table 2

EAZ-Lift, Inc.
Elkhart, Indiana

Substance	Recommended Environmental Limit*	Source	Primary Health Effects	OSHA Standard (Ref. 1)
Carbon Monoxide	200 ppm (ceiling)	NIOSH (Ref. 2)	Heart effects	50 ppm
Chromium	1 mg/M^3	OSHA (Ref. 1)	Lung and respiratory effects	1 mg/M^3
Copper fume	0.1 mg/M^3	OSHA (Ref. 1)	Metal fume fever	0.1 mg/M^3
Iron Oxide fume	5 mg/M^3	ACGIH (Ref.3)	Benign pneumoconiosis	10 mg/M^3
Manganese fume	1 mg/M^3	ACGIH (Ref. 3)	Metal fume fever	5 mg/m^3 (ceiling)
Vanadium pentoxide fume	0.05 mg/M^3 (ceiling)	NIOSH (Ref. 4)	Irritant, lung effects	0.1 mg/M^3
Total welding particulate	5 mg/M^3	ACGIH (Ref. 3)	Irritant, lung effects	15 mg/M^3

*All air concentrations are 8-10 hour time weighted average (TWA) exposures for a normal work day unless designated "ceiling". A "ceiling" limit is one which should not be exceeded.

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EAZ-Lift Spring, Inc.
Elkhart, Indiana

TABLE 3

RESULTS OF PERSONAL BREATHING ZONE SAMPLES OF ARC-WELDERS
MARCH 30, 1980

Job/Location	Time of Sample	Total particulate (mg/M3)	Iron oxide (mg/M3)	Manganese (mg/M3)	Copper (mg/M3)	Vanadium oxide (mg/M3)	Chromium (mg/M3)
Core Welder/ Booth 9	0708-1517	0.47	1.4	.009	ND	ND	ND
Core Welder/ Booth 2	0711-1514	3.2	1.9	.16	.008	ND	ND
Wire Welder/ Booth 1	0707-1518	4.1	2.6	.109			
Wire Welder/ Booth 5	0708-1517	4.9	0.81	.055			
NIOSH limit of detection (mg/sample):		0.2	.003	.002	.002	.015	.005
EVALUATION CRITERIA:		5	5	1	.1	.05	1

Abbreviations: mg/M^3= milligrams per cubic meters of air
ND= none detected