U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION REPORT 73-102-198
DEARBORN STOVE COMPANY
GARLAND, TEXAS
MAY 1975

I. TOXICITY DETERMINATION

Based on results of environmental sampling/medical interviews, as conducted by the National Institute for Occupational Safety and Health (NIOSH) on August 20, 1973, September 25, 1973, and August 27, 1974, it was determined that exposures to iron oxide, fluoride, oxides of nitrogen and ozone were not toxic, in the amounts used or found, to employees in the arc welding area of the Dearborn Stove Company.

Workroom air concentrations of substances listed above were found to be below existing standards. Interviews conducted with nine (9) employees performing duties in the arc welding area indicated symptoms of upper respiratory tract irritation which were considered sporadic in nature. None were considered to be serious in nature. The type of complaints voiced by applicable employees are most common in the welding industry, and are related more to the dry particulate matter given off as smoke, rather than to any identifiable toxic substance.

Various recommendations were made to management for possible improvement of existing conditions in the work environment of the arc welding area.

II. DISTRIBUTION AND AVAILABILITY

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U. S. Post Office Building, Room 508 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Dearborn Stove Company, Garland, Texas

b) Authorized Representative of Employees

c) U. S. Department of Labor - Region VI

d) NIOSH - Region VI

For the purpose of informing the "affected employees," the employer will promptly "post" the Determination Report in a prominent place(s) near where the approximately 9-12 affected employees work, for a period of thirty (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) authorized the Secretary of Health, Education and Welfare, following receipt of 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of employees to evaluate the potential health hazard associated with employee exposure to smoke and fumes in the arc welding shop.

IV. HEALTH HAZARD EVALUATION

A. Description of Process

This industrial facility has been in operation since 1962, and is involved in the complete fabrication of heating and air conditioning space units. At the time of the initial survey, approximately 335 persons were employed in the plant, with 230 of those being classified as production employees. Considering that the production schedule in the arc welding shop varies, from 6 - 9 employees were observed in the area at the time the survey(s) were performed (August 20, 1973, September 25, 1973, and August 27, 1974).

B. Study Progress and Design

On August 20, 1973, an initial walk-through survey of the facility was conducted by NIOSH representative, Mr. Harry L. Markel, Jr., who was accompanied by a representative of management. Only two (2) welding booths were being utilized on that day -- a situation which both management and numerous plant employees agreed was most certainly not considered to be "representative." Based on this fact, it was decided that no environmental samples would be collected until such time as the work schedule(s) necessitated the utilization of additional welders. The two (2) employees working in the arc welding shop on that day and six (6) employees who normally work there, but who were, on that day, performing duties in other areas of the plant, were interviewed in a non-directed manner. Results of those interviews are shown in a later portion of this report.

Environmental sampling was conducted by Mr. Markel on September 25, 1973, to determine employee exposures to fluoride and iron oxide in the arc welding shop. "Area" samples, as opposed to those of the "personal" variety, were collected at that time because of reluctance on the part of several employees to wear required sampling equipment. Although negative environmental findings resulted, the symptomatology of some employees resulted in a NIOSH decision to conduct additional sampling at a later date.

Such evaluations were conducted on August 27, 1974, at which time employee exposure to iron oxide fume and fluorides was again considered as well as applicable exposures to ozone and oxides of nitrogen.

C. Evaluation Methods

1. Iron oxide

Breathing-zone and general area samples were collected (September 25, 1973; August 27, 1974) by using MSA battery-operated vacuum pumps with mixed cellulose ester 0.8 μ filters at a sampling rate of 1.7 liters per minute. The samples were ashed with nitric acid and analyzed by atomic absorption spectrophotometry.

2. Fluoride

Breathing-zone and general area samples were collected (September 25, 1973; August 27, 1974) by using MSA battery-operated vacuum pumps with mixed cellulose ester 0.8 μ filters at a sampling rate of 1.7 liters per minute. Laboratory analyses were performed by the ion specific electrode method.

3. Oxides of nitrogen ($NO + NO_2$)

Environmental evaluations (August 27, 1974) were performed by use of the DRAGER multi-gas detector and appropriate detector tubes (Cat. No. 29401). All samples were collected as close to the workers' breathing-zone as possible.

4. Ozone

Ozone general area evaluations (August 27, 1974) were made for an entire work shift by use of "rubber strips," which were later compared with laboratory standards for degree of deterioration.

D. Evaluation Criteria

1. Environmental Criteria

Air Contaminants - The Occupational Safety and Health Standards, as promulgated by the U. S. Department of Labor (Title 29, Chapter XVII, Part 1910, Subpart 1910.93, Table G-1 and other relevant criteria, applicable to this survey, are as follows:

Substance	8-hour time-weighted average concentration	
	(p.p.m.)*	(mg/M^3)**
Iron Oxide fume***	x	10.0
Fluoride (as F)	x	2.5
Nitrogen Dioxide (NO_2)***	5.0 (ceiling)	9.0 (ceiling)
Ozone	0.1	0.2

*p.p.m. - parts of vapor of gas per million parts of contaminated air by volume @25°c and 760 millmeters of mercury pressure

**mg/M^3 - milligrams of subtance per cubic meter of air sampled.

*** ACGIH TLV 1974 recommends 5 mg/M^3 for "Total Welding Fumes" and ceiling value of 5.0.

E. Evaluation Results and Discussion

1. Environmental

The results of the eighty-five evaluations (22-Iron oxide; 38-Fluoride; 15-$NO + NO_2$; 10-Ozone) performed during the September 25, 1973; and August 27, 1974, environmental survey(s) are shown in Tables 1 through 5. As can be seen from the tables, all concentrations of iron oxide, fluoride, oxides of nitrogen and ozone, as measured in the arc welding shop, were well below applicable standards.

Existing local exhaust ventilation was, however, found to be somewhat less than the required to capture fumes being emitted by welding operations in the arc welding shop.

2. Medical

Each of the nine (9) men working in the arc welding shop were interviewed on August 20, 1973, September 25, 1973, and/or August 27, 1974, and the Health Hazard Evaluation Initial Survey Employee Interview form was administered to each of those persons. All interviews were begun in a non-directed manner to elicit health complaints and general information regarding working conditions. Afterward, each employee in the work area was specifically questioned regarding the following symptoms; eye burns and decrease in vision; burns; nose and throat irritation; and difficulty in breathing. The majority of those interviewed commented that at one time or another, they had witnessed nasal discharges and/or the presence of phlegm in their throats. Personal attitudes of those interviewed revealed their feeling that the ventilation was of such poor quality so as to cause them varying degrees of discomfort as a result of the welding operation(s) being conducted in the area in question. Two (2) employees had, at one time or another, consulted their personal physicians about their conditions, which were never definitely established as being work-related. In all cases, the conditions indicated by the employees were symptoms of upper respiratory tract irritation and considered to be sporadic in nature. None were felt to be serious in nature. No employees were symptomatic during the evaluation.

3. Conclusions

Based on (a) results of environmental sampling, and (b) the absence of significant symptomatology of a serious nature among individuals employed in the welding area, it is judged that a toxic environment does not exist. However, there is some evidence (employee interviews, etc.) that at times symptoms of minor irritation are present.

V. RECOMMENDATIONS

1. Capture velocities of the local exhaust ventilation system, as measured during the survey, were found to be marginal. A thorough inspection/evaluation of the existing local exhaust ventilation system should be conducted to insure that conditions such as obstructions, belt slippages, leaking joints, etc., are not preventing the attainment of maximum efficiency and that adequate make-up air is being provided. (Note: Appropriate desired performance data can be found in (a) Department of Labor Standard 1910.252(f), and (b) The American Conference of Governmental Industrial Hygienists Ventilation Manual, pp. 4-5 and 5-51).

2. It is recommended that consideration be given to the installation and use of a flexible/movable hood which can be placed as near as practicable to the work being welded. Collection efficiency will thus be improved.

3. Insure that welding operations are, at all time, conducted inside appropriate booths to facilitate collection of emitted fumes/gases.

4. When all booths are not being utilized for welding operations, consideration should be given to the closing of dampers in those booths attaining a "vacant" status -- Thereby affording greater collection efficiency in booths where welding is being conducted.

5. Observations made during the survey revealed that the small overhead oscillating fans, mounted to the rear of the welding booths, were actually blowing airborne fumes beneath the hoods being worn by the welders. It is recommended that consideration be given to the discontinuance of this practice.

VI. AUTHORSHIP AND ACKNOWLEDGEMENT

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VI TABLES

Table 1
Iron Oxide Concentrations
Dearborn Stove Company
Garland, Texas

Location/Job	Employee Number	Sample Date	Laboratory Number	Sampling Period (Minutes)	Type of Sample	** Concentration (mg/M^3)
Arc Welder (Booth #10)	1	9-25-73	14296	98	P	1.3
Arc Welder (Booth #9)	2	9-25-73	14297	96	P	0.4
Arc Welder (Booth #8)	3	9-25-73	14298	95	P	1.1
Arc Welder (Booth #7)	4	9-25-73	14299	93	P	1.7
Arc Welder (Booth #6)	5	9-25-73	14300	92	P	0.5
Arc Welder (Booth #5)	6	9-25-73	14301	90	P	0.8
Arc Welder (Booth #4)	7	9-25-73	14302	89	P	0.8
Arc Welder (Booth #1	8	9-25-73	14303	73	P	1.8
South of Booth #1	x	9-25-73	14304	88	GA	0.8
South of & between Booths #7-8	x	9-25-73	14305	88	GA	< 0.1
South of & between Booths #4-5	x	9-25-73	14306	86	GA	< 0.5
South of & between Booths #9-10	x	9-25-73	14307	66	GA	< 0.1
South of & between Booths #6-7	x	9-25-73	14308	64	GA	0.2
Arc Welder (Booth #9)	2	8-27-74	16907	129	P	0.7
Arc Welder (Booth #8)	4	8-27-74	16908	131	P	1.9
Arc Welder (Booth #7)	6	8-27-74	16909	121	P	2.8
Arc Welder (Booth #6)	3	8-27-74	16910	143	P	2.3
Arc Welder (Booth #5)	8	8-27-74	16911	138	P	0.5
Arc Welder (Booth #2-3)	9	8-27-74	16912	134	P	4.0
Between & behind Booths #10 -11	x	8-27-74	16913	173	GA	0.2
Behind Booth #7	x	8-27-74	16914	173	GA	0.4
Behind & between Booths #4-5	x	8-27-74	16915	141	GA	0.3
Applicable Criteria: TLV Committee 1974						5.0

*P - Personal
GA - General Area

**mg/M^3 - milligrams of substance per cubic meter of air sampled

Table 2
Fluoride Concentrations
Dearborn Stove Company
Arc Welding Department
Garland, Texas

Location/Job	Employee Number	Sample Date	Sampling Period (Minutes)	* Type of Sample	** Concentration (mg/M^3)
Arc Welder (Booth #10)	1	9-25-73	88	P	0.05
"	1	9-25-73	52	P	0.09
Arc Welder (Booth #9)	2	9-25-73	87	P	0.04
" (Booth #9)	2	9-25-73	50	P	0.07
Arc Welder (Booth #8)	3	9-25-73	87	P	0.06
"	3	9-25-73	49	P	0.10
Arc Welder (Booth #7)	4	9-25-73	86	P	0.05
"	4	9-25-73	34	P	0.16
Arc Welder (Booth #6)	5	9-25-73	86	P	0.06
"	5	9-25-73	48	P	0.10
Arc Welder (Booth #5)	6	9-25-73	85	P	0.07
"	6	9-25-73	33	P	0.13
Arc Welder (Booth #4)	7	9-25-73	84	P	0.04
"	7	9-25-73	47	P	0.09
Arc Welder (Booth #1)	8	9-25-73	84	P	0.07
"	8	9-25-73	57	P	0.08
South of Booth #1	x	9-25-73	83	GA	0.04
"	x	9-25-73	56	GA	0.05
South of & between booths #7-8	x	9-25-73	82	GA	0.06
"	x	9-25-73	57	GA	0.06
South of & between booths #4-5	x	9-25-73	83	GA	0.06
"	x	9-25-73	48	GA	0.12
South of & between booths #9-10	x	9-25-73	81	GA	0.05
"	x	9-25-73	58	GA	0.13
South of & between booths #6-7	x	9-25-73	82	GA	0.06
"	x	9-25-73	58	GA	0.15
Arc Welder (Booth #9)	2	8-27-74	80	P	<0.125
"	2	8-27-74	74	P	<0.125
Arc Welder (Booth #8)	4	8-27-74	82	P	<0.125
"	4	8-27-74	95	P	<0.125
Arc Welder (Booth #7)	6	8-27-74	78	P	<0.125
"	6	8-27-74	86	P	<0.125
Arc Welder (Booth #6)	3	8-27-74	75	P	<0.125
"	3	8-27-74	81	P	<0.125
Arc Welder (Booth #5)	8	8-27-74	71	P	<0.125
"	8	8-27-74	83	P	<0.125
Arc Welder (Booths #2-3)	9	8-27-74	69	P	<0.125
"	9	8-27-74	83	P	<0.125

Department of Labor Standard (8-hour time-weighted average---------- 2.5

*Personal
GA-General Area

**mg/M^3 - milligrams of substance per cubic meter of air sampled

Table 3

Oxides of Nitrogen
Dearborn Stove Company
Arc Welding Department
Garland, Texas

Location/Job	Sample Date	Time of Sample	*Type of Sample	**Concentration (p.p.m.)
Booth 10	8-27-74	A.M.	P	0.2
"	8-27-74	P.M.	P	0.4
Booth 9	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.5
Booth 8	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.5
Booth 7	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.4
Booth 6	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.5
Booth 5	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.5
Booth 4	8-27-74	A.M.	P	0.3
"	8-27-74	P.M.	P	0.4
Booth 1	8-27-74	P.M.	P	0.5

Applicable Criteria: 1974 ACGIH TLV 5.0 (ceiling)

*P - Personal Breathing-Zone

**p.p.m. - parts of vapor or gas per million parts of contaminated air by volume @25°c and 760 millimeters of mercury pressure

NOTE: Evaluations were conducted by using DRAGER multi-gas detector with detector tubes (Cat. No. 29401) at the immediate breathing-zone of the workers.

Table 4
Ozone Concentrations
Dearborn Stove Company
Arc Welding Department
Garland, Texas

Location/Job	Sample Date	Sampling Period (minutes)	*Type of Sample	**Concentration (p.p.m.)
Booth #10	8-27-74	255	GA	0.0
Booth #9	8-27-74	255	GA	< 0.01
Booth #8	8-27-74	255	GA	< 0.01
Booth #7	8-27-74	255	GA	< 0.01
Booth #6	8-27-74	255	GA	0.0
Booth #5	8-27-74	255	GA	0.0
Between booths #2-3	8-27-74	255	GA	0.0
Between & behind booths #4-5	8-27-74	255	GA	0.0
Behind Booth #7	8-27-74	255	GA	0.0
Between & behind booths #10-11	8-27-74	255	GA	< 0.01

Department of Labor Standard (8-hour time-weighted average)----------0.1

*GA - General Area

**p.p.m. - parts of vapor or gas per million parts of contaminated air by volume @25°c and 760 millimeters of mercury pressure.

Table 5
Summary of Air Sampling Activities
Dearborn Stove Company
Garland, Texas

Date	Compound	No. Of Samples	Type Sample	Applicable Criteria***	Concentration Minimum	Concentration Maximum	Concentration Average
9-25-73	Iron Oxide	13	GA	5.0mg/M^3	0.10	1.8	0.8
9-25-73	Fluoride	26	GA	2.5mg/M^3	0.04	0.15	0.8
8-27-74	Iron Oxide	6	P	5.0mg/M^3	0.49	3.96	2.0
		3	GA	5.0mg/M^3	0.15	0.38	0.27
8-27-74	Fluoride	12	P	2.5mg/M^3	0.125	0.125	0.125
8-27-74	Ozone	10	GA*	0.1 p.p.m.	0	0.01	0.01
8-27-74	Oxides of Nitrogen ($NO + NO_2$)	15	P**	5.0 p.p.m.	0	0.5	0.4

*Rubber Strips

**Drager detector tubes

***8-hour time weighted average