

C. Evaluation Methods

1. Zinc oxide fume, Manganese, Iron oxide fume, Copper fume

Work area samples were collected by using MSA battery-operated vacuum pumps with AAWP cellulose membrane filters at a sampling rate of 1.7 liters per minute. Samples were of a "general area" type, but were collected as close to the workers' breathing-zone as possible.

Sample filters were dissolved in nitric acid and hydrochloric acid, and the analysis was performed by atomic absorption spectroscopy.

2. Carbon Monoxide

Carbon monoxide samples were taken by use of DRAGER detector tubes (Cat. No. 28900). All samples were collected as close to the workers' breathing-zone as possible.

3. Nitrous Fumes (NO + NO₂)

Nitrous fume samples were taken by use of DRAGER detector tubes (Cat. No. 29401). All samples were collected as close to the workers' breathing-zone as possible.

4. Ozone

Ozone general area evaluations were made for the entire workshift by use of "rubber strips" which were later compared with laboratory standards for degree of deterioration.

D. Evaluation Criteria

1. Environmental Standards

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

Substance	8-hour time weighted concentration	
	(p.p.m.)*	(mg/M ³)**
Zinc oxide fume	x	5
"c" Manganese	x	5
Iron oxide fume	x	10
Copper fume	x	0.1
*** Carbon Monoxide	50	x
Nitrous fumes (NO ₂)	5	x
Ozone	0.1	x

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

** mg/M³ - milligrams of substance per cubic meter of air sampled

"c" - Acceptable ceiling concentration

*** Occupational health standards are established at levels designed to protect individuals exposed to substances on an 8-hour, 40-hour per week basis over a normal working lifetime. NIOSH has forwarded to the Department of Labor a recommended criteria for exposure to carbon monoxide of 35 p.p.m. for an 8-hour work day, 40-hour work week, with a "ceiling" level of 200 p.p.m.

- (b) Permissible noise exposures - The Occupational Health Standards, as promulgated by the U. S. Department of Labor (Title 29, Chapter XVII, Part 1910, Subpart 1910.95, Table G-16), applicable to this survey are as follows:

Duration per day, hours	Sound level dBA slow response
8 -----	90 (***)
6 -----	92
4 -----	95
3 -----	97
2 -----	100
1½ -----	102
1 -----	105
1/2 -----	110
1/4 or less -----	115

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 + \dots + C_n/T_n$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at that level.

Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

(***) - NIOSH has recommended 8-hour exposure level of 85dBA

E. Evaluation Results and Discussion

1. Environmental

The results of the 179 evaluations (23-Zinc oxide; 23-Manganese; 23-Iron oxide; 23-Copper fume; 39-Carbon monoxide; 28-Nitrous fumes; 20-Ozone) conducted during the May 8, 1974, environmental survey are shown in Tables 1 through 3. It is pointed out that environmental sampling was not conducted concurrent with the medical evaluation which was performed on October 25, 1973. As can be seen from the tables, all results were found to be well below the applicable standard(s).

Existing local exhaust ventilation was found to be somewhat less than that required to capture fumes being emitted by the various welding operations in the heat-exchanger area. Average velocities, approximately 4-6 inches from the point of weld were found to be 100 feet per minute. (rooftop line); 110 feet per minute. (horizontal line); and 110 feet per minute. (oil furnace line).

Two (2) brazing operations previously located in the heat exchanger welding area have now been relocated in the coil assembly area and, based on personal employee interviews and evaluation of existing ventilation, are felt to present no hazards to the employees performing duties in that area.

Table 4 shows that sound levels, as measured in the various welding booths, were, in some cases, borderline when compared to permissible noise exposure standards as promulgated by the U. S. Department of Labor, and above the NIOSH recommended standard of 85dBA if exposed on an 8 hours/day basis.

2. Medical

Each of the thirty (30) men working in the various welding operations were interviewed during, or at the end of, the work shift. 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; difficulty in breathing; decrease in hearing ability; and dermatitis.

All questions failed to elicit significant symptomatology. Although the majority of the welders felt that the ventilation was of such poor quality to cause them varying degrees of respiratory distress, none had ever consulted the plant physician or missed work because of said conditions.

Three (3) individuals stated that they had received skin burns as a result of welding sparks. Two (2) employees working with pyrolite (used in the combustion chambers of the heaters) gave histories consistent with fiber glass dermatitis which occurred at the time of their initial contact with the material; one (1) of these two individuals was symptomatic during the evaluation.

Based on (a) results of environmental sampling, and (b) the sparsity of medical symptomatology found among individuals employed in the welding area, it is judged that a toxic environment does not exist to welding gases and fumes evaluated.

F. Recommendations

1. Capture velocities 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 the American Conference of Governmental Industrial Hygienists Ventilation Manual, pp. 4-5 and 5-52).

2. Insure that all welding operations are conducted inside appropriate booths to facilitate collection of emitted fumes/gases.

3. Insure that the welder places the movable hoods as near as practicable to the work being welded. Collection efficiency will thus be improved.

4. Repair ventilation ducts at furthestmost North brazing station (Post C-17). Existing ductwork was observed to contain holes and was in a general state of bad repair.

5. Improve current policy/procedure for glove maintenance/replacement. Numerous "stiff fingers" and holes were observed in those currently being used, thus decreasing resistance potential.

6. Where engineering/administrative controls are not possible, improved hearing protection should be made available to employees in the alleged hazard area. Foam rubber type protectors currently being used were observed to be relatively "dirty", thus increasing the possibility of ear infection in certain cases. The need for a hearing conservation program also exists, including procedures to insure sound analyses, periodic audiometric testing, and proper fitting of ear protectors.

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VI. TABLES

Table 1

Concentrations of Zinc Oxide, Copper, Manganese and Iron Oxide

Rheem Manufacturing Company
Fort Smith, Arkansas
May 8, 1974

Location*	Sample Volume (liters)	Type of Sample	Concentrations (mg/M ³)***			
			Zinc Oxide	Copper	Manganese	Iron Oxide
A-1	229	GA	0.02	0.02	0.12	1.2
A-1	306	GA	0.02	0.02	0.08	0.9
A-2	229	GA	0.04	0.04	0.14	2.1
A-2	306	GA	0.05	0.03	0.12	1.6
A-3	228	GA	0.08	0.02	0.06	1.0
A-3	306	GA	0.08	0.01	0.08	1.0
A-4	228	GA	0.11	0.02	0.11	1.7
A-4	306	GA	0.10	0.04	0.18	2.3
A-5	228	GA	0.38	0.03	0.12	1.4
A-5	306	GA	0.48	0.02	0.08	2.0
A-6	228	GA	0.23	0.07	0.27	2.4
A-6	306	GA	0.05	0.08	0.29	2.1
B-1	196	GA	0.02	0.01	0.03	0.3
B-1	306	GA	0.01	0.01	0.01	0.1
B-2	196	GA	0.03	0.08	0.29	3.1
B-2	306	GA	0.01	0.01	0.01	0.1
B-4	196	GA	0.17	0.01	0.04	0.3
B-4	306	GA	0.01	0.01	0.01	0.1
B-5	196	GA	0.02	0.02	0.06	0.9
B-5	306	GA	0.01	0.01	0.01	0.1
C-1	306	GA	0.01	0.01	0.01	0.1
C-3	306	GA	0.01	0.01	0.06	1.6
C-4	306	GA	0.81	0.02	0.10	1.4
U. S. Department of Labor Standard			5.0	0.1	"c" 5.0	10.0

*A - Rooftop line
B - Horizontal line
C - Oil Furnace line

i.e., A-1 = Rooftop line, booth #1

**GA - General Area

***mg/M³ - milligrams of substance per cubic meter of air sampled

"c" - acceptable ceiling concentration

Table 2

Concentrations of Carbon Monoxide and Nitrous Fumes (NO + NO₂)

Rheem Manufacturing Company
 Fort Smith, Arkansas
 May 8, 1974

Location*	Carbon Monoxide (p.p.m.)**		Nitrous Fumes, NO + NO ₂ (p.p.m.)**	
	A.M.	P.M.	A.M.	P.M.
A-1	< 1.0 < 1.0	1.0	0.5	0.3
A-2	< 1.0	< 1.0	0.5	0.4
A-3	1.0	1.0	0.3	0.4
A-4	1.0	< 1.0 < 1.0	0.3	0.3
A-5	< 1.0 < 1.0	2.0	-	-
A-6	1.0	1.0	0.5	0.3
B-1	< 1.0 < 1.0	< 1.0 (x)	0.3	0.1 (x)
B-2	1.0	-	0.3	0.1 (x)
B-3	1.0	< 1.0 (x)	0.2	0.1 (x)
B-4	< 1.0 < 1.0	< 1.0 (x)	0.3	0.1 (x)
B-5	< 1.0	-	-	-
B-6	< 1.0	-	0.5	0.1 (x)
C-1	1.0	< 1.0 < 1.0	0.3	0.4
C-2	< 1.0 1.0	1.0	0.3	0.3
C-3	-	-	-	-
C-4	-	-	-	-
C-5	< 1.0 < 1.0	< 1.0 < 1.0	0.3	0.4
C-6	-	-	-	-
C-7	-	-	-	-
C-8	-	-	-	-
D-1	1.0 2.0	1.0	< 0.3	< 0.3
U.S. Department of Labor Standard 50			5	

*A-Rooftop line
 B-Horizontal line
 C-Oil furnace line
 D-Oil furnace line (small parts)
 i.e., A-1 = Rooftop line, booth #1

- No evaluation performed

(x) As result of reported production "scheduling problems", a minimum of welding activity was conducted during the period this sample was collected.

**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 3

Concentrations of Ozone

Rheem Manufacturing Company
Fort Smith, Arkansas
May 8, 1974

Location*	Sampling Period (minutes)	Type** of Sample	Concentration Ozone (p.p.m.) ***
A-1	345	GA	< 0.003
A-2	345	GA	< 0.003
A-3	345	GA	0.014
A-4	345	GA	0.021
A-5	345	GA	< 0.003
A-6	345	GA	0.015
B-1	330	GA	0.009
B-2	330	GA	0.009
B-3	330	GA	< 0.003
B-4	330	GA	0.006
B-5	330	GA	< 0.003
B-6	330	GA	< 0.003
C-1	320	GA	< 0.003
C-1	320	GA	< 0.003
C-2	320	GA	< 0.003
C-3	320	GA	< 0.003
C-4	320	GA	< 0.003
C-5	320	GA	< 0.003
C-9	320	GA	< 0.003
D-1	320	GA	0.003
U. S. Department of Labor Standard			0.1

*A - Rooftop line
B - Horizontal line
C - Oil furnace line
D - Oil furnace line (small parts)

**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 4

Sound Level Measurements

Rheem Manufacturing Company
Fort Smith, Arkansas

May 8, 1974

<u>* Location</u>	<u>**Sound Level (dBA)</u>
A-1	83
A-2	83
A-3	84
A-4	85
A-5	85
A-6	85
B-1	85
B-2	92
B-3	90
B-4	90
B-5	95
B-6	92
C-1	91
C-2	91
C-3	90
C-4	90
C-5	90
C-6	90
C-7	93
C-8	90
D-1	85

*A - Rooftop line
 B - Horizontal line
 C - Oil furnace line
 D - Oil furnace line (small parts)
 i.e. A-1 = Rooftop line, Booth #1

**dBA = measured sound level in decibels - slow
 response (MSA Permissible Sound Level Meter,
 Model 1565-B).