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. 77-58-428

STEIGER TRACTOR, INC.
FARGO, NORTH DAKOTA

SEPTEMBER 1977

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on May 9-13, 1977, at Steiger Tractor, Inc., Fargo, North Dakota. At the time of this evaluation, breathing zone and general room samples were taken for xylene, toluene, isopropanol, 1,1,1-trichloroethane, petroleum naphtha, iron oxide, manganese, aluminum, and lead. A health hazard existed from exposures to isopropanol, petroleum naphtha, xylene, iron oxide, and lead. Confidential employee interviews documented this health hazard, since worker complaints were compatible with overexposure to welding fumes and the above solvents. Recommendations for improving work conditions and decreasing occupational exposures are given in this report.

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:

a) Steiger Tractor, Inc.
b) National headquarters of the International Association of Machinists and Aerospace Workers
c) International Association of Machinists and Aerospace Workers, Fargo
d) U.S. Department of Labor - Region VIII
e) NIOSH - Region VIII

For the purpose of informing the 100 affected employees, copies of the report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

I. 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 International Association of Machinists and Aerospace Workers, Fargo, North Dakota, to evaluate potential exposures to welding fumes and solvent exposures to painters.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

A previous hazard evaluation (No. 75-30-266) was conducted at this plant in 1975. This is a reconnaissance request by labor. This plant manufactures approximately 20 large farm tractors per day. Many parts of the tractor are purchased from other vendors such as engines, transmissions, and differentials. The tractors are assembled at this plant. The assembly line process requires extensive welding, cutting, and painting of iron. The areas of concern during this evaluation included welding and cutting operations as well as paint stations and paint booths.

B. Evaluation Design

There are approximately 100 workers in the specific areas of this request. All workers were monitored for either welding fumes or paint fumes. Both general room and breathing zone samples were taken. Each worker was interviewed, and questions were directed at work history and specific medical complaints.

C. Evaluation Methods

All metal samples were collected on AA filters using pumps operated at 1.5 liters per minute. The metal samples were analyzed by atomic absorption spectroscopy. Solvent samples in painting areas were taken on organic vapor charcoal sampling tubes using pumps operated at approximately 50 cubic centimeters per minute. These samples were analyzed by gas chromatography. Ventilation measurements were made with Alnor Junior and Senior velometers.

D. Criteria for Assessing Workroom Concentrations of Air Contaminants

The three sources of criteria used to assess workroom concentrations of air contaminants in this evaluation are: (1) recommended threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1976); (2) NIOSH recommended criteria for occupational exposures; and (3) Occupational Safety and Health Standards (29 CFR 1910.1000), U.S. Department of Labor, as of January 1, 1976.

Substances	1976 TLV's	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M^3) NIOSH Criteria	OSHA Standards
Xylene	435.0	435.0	435.0
Toluene	375.0	375.0	750.0
Isopropanol	980.0	980.0	980.0
1,1,1-trichloroethane	1910.0	"C" 1910.0	1910.0
Petroleum Naphtha	---	---	2000.0
Iron Oxide	5.0	---	10.0
Manganese	"C" 5.0	---	"C" 5.0
Aluminum 1/	---	---	---
Lead	0.15	0.1	0.2

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

"C" = ceiling concentration which should never be exceeded

1/ = no available standard

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

E. Toxicology

Xylene

Xylene vapor is an irritant of the eyes, mucous membranes, and skin. Gastrointestinal disturbances such as anorexia, nausea, vomiting, and abdominal pain can also occur. Narcosis may occur at high concentrations.

Toluene

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.[1]

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.

1,1,1-trichloroethane

This is a narcotic in high concentrations. It is slightly irritating to the eyes and other mucous membranes. Its most toxic route of entry is by inhalation.

Petroleum Naphtha

Inhalation of high concentrations of petroleum naphtha causes intoxication resembling that of alcohol. It produces headaches and nausea. Hemorrhages to various vital organs have been reported from ingestion. There have been very few cases of industrial poisoning from petroleum naphtha.

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.

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.

Aluminum

Aluminum rarely causes an occupational health hazard. The process of aluminum smelting and aluminum refining does pose a health hazard. Aluminum itself is relatively non-toxic. Inhalation of finely divided aluminum powder may cause a form of pulmonary fibrosis.[2]

Lead

Prolonged exposure 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 wrist and ankles. Encephalopathy can result with the most severe lead exposure.

F. Environmental Results and Discussion

Results of the environmental sampling showed that workers were overexposed to iron oxide, lead, xylene, and isopropanol when exposure levels are compared to the environmental criteria utilized in this report. A low percentage of workers were overexposed. For a detailed description of all environmental samples, please refer to Tables I and II.

Ventilation measurements were made on all paint booths. Most of the booths would have had adequate ventilation if the filters had been cleaned. When filters were removed, ventilation measurements went up to 500 linear feet per minute; when the dirty filters were put back in the booths, measurements dropped significantly. The waterfall paint booth was working adequately and was exhausting approximately 500 linear feet per minute. All paint booth ventilation throughout this plant, both filter and waterfall, is more than adequate. The only problem is that they should be serviced more frequently. Two hundred linear feet per minute face velocity is adequate for paint booths. These paint booths are capable of 500 linear feet per minute.

Sixty-six workers were interviewed. Analysis of the data obtained from these interviews showed that 32% of the workers had complaints that were compatible with those usually associated with overexposures to welding fumes and solvents. Complaints consisted of chest pain, coughing, production of black phlegm, dizziness, nausea, vomiting, tiredness, and muscle weakness.

G. Conclusions

Results of environmental data and confidential employee interviews illustrate that some workers were exposed to excessive levels of xylene, isopropanol, iron oxide, and lead. Combined exposures to these compounds did not pose an additional health hazard.

V. RECOMMENDATIONS

1. An improved ventilation system should be installed in the rim building, since the exhausting system is inadequate.

2. The welding ventilation system in the main building should receive better maintenance, since many of the flexible exhaust lines leading to the welding head were not attached or contained holes and tears.

3. If respirators are to be provided, a respirator program must be initiated following all the rules and regulations of the OSHA standards (Subpart I, 1910.134).

4. Filters in the paint booths and sanding booths should be changed frequently, since many of them were clogged during this survey. Inadequate ventilation was found in all paint booths. Ventilation measurements ranged from 25-75 linear feet per minute.

VI. REFERENCES

1. Sax, N. Irving. Dangerous Properties of Industrial Materials, Fourth Edition, Van Nostrand Reinhold Company, 1975, p 1174.

2. Ibid, p 372.

VII. AUTHORSHIP

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF
IRON, MANGANESE, ALUMINUM, AND LEAD

Steiger Tractor Company
May 10-12, 1977

Sample Number	Location	Job Classification	Time of Sample	Iron Oxide (Fe_2O_3)	Manganese	Aluminum	Lead	Type of Sample
				(mg/M^3)				
157	Rim Shop	Grinder	7:22 AM- 2:36 PM	15.0	0.61	0.28	0.13	BZ
185	Rim Shop	Arc Welder	7:23 AM- 2:38 PM	0.12	0.01	*	*	BZ
184	Rim Shop	Rim Farmer	7:24 AM- 2:43 PM	0.08	*	*	*	BZ
1408	Rim Shop	Grinder	7:26 AM- 2:43 PM	0.31	*	*	*	BZ
1404	Rim Shop	Lead Man	7:28 AM- 2:38 PM	0.08	*	*	*	BZ
1435	Rim Shop	Welder	7:05 AM- 2:47 PM	2.1	0.20	*	0.01	BZ
1412	Rim Shop	Welder	7:06 AM- 2:33 PM	0.83	0.10	*	0.01	BZ
193	Rim Shop	Welder	7:08 AM-12:00 PM	0.23	0.03	*	*	BZ
1420	Rim Shop	Welder	7:08 AM- 2:33 PM	3.0	0.30	*	*	BZ
1407	Rim Shop	Welder	7:12 AM- 2:35 PM	3.4	0.31	*	0.01	BZ
1410	Rim Shop	Automatic Rim Welder	7:14 AM- 2:35 PM	1.3	0.03	*	0.01	BZ
157	Rim Shop	Grinder	7:15 AM- 2:35 PM	7.3	0.07	*	*	BZ
1387	Rim Shop	Automatic Rim Welder	7:16 AM- 2:36 PM	1.0	0.06	*	*	BZ
196	Rim Shop	"	7:18 AM- 2:40 PM	0.6	0.04	*	*	BZ
181	Rim Shop	Arc Welder	7:20 AM- 2:45 PM	0.1	*	*	*	BZ
159	Fabricating	Hot Saw Operator	6:56 AM- 2:50 PM	0.13	0.03	*	0.005	BZ
311	"	Flame Cutter Opr.	7:00 AM- 2:52 PM	5.0	0.04	*	*	BZ
174	"	"	7:05 AM- 2:52 PM	5.0	0.06	*	0.005	
499	Cab Welding	Finish Welder	7:09 AM- 2:55 PM	4.0	0.30	*	0.01	BZ
493	"	Finish Welder	7:13 AM- 2:54 PM	2.0	0.05	*	0.006	BZ
469	"	Finish Welder	7:16 AM- 2:54 PM	4.0	0.20	*	0.01	BZ
310	"	Finish Welder	7:20 AM- 2:59 PM	1.7	0.15	*	0.006	BZ
498	"	Finish Welder	7:24 AM- 2:57 PM	3.0	0.3	*	0.006	BZ

TABLE I (continued)

Steiger Tractor Company
May 10-12, 1977

Sample Number	Location	Job Classification	Time of Sample	Iron Oxide (Fe_2O_3)	Manganese	Aluminum	Lead	Type of Sample
				(mg/M^3)				
190	Fender Welding	Welder	7:27 AM- 2:59 PM	2.0	0.3	*	*	BZ
325	Frame Welding	Welder	7:32 AM- 3:09 PM	5.0	0.16	*	0.01	BZ
384	"	Welder	7:35 AM- 3:11 PM	2.2	0.30	*	0.01	BZ
173	"	Welder	12:50 PM- 2:57 PM	0.2	0.8	*	*	BZ
156	"	Welder	7:37 AM-12:50 PM	3.6	1.1	*	0.01	BZ
452	"	Welder	7:40 AM- 3:08 PM	0.09	0.01	*	0.01	BZ
180	Support Welding	Welder	7:44 AM- 2:55 PM	2.5	0.15	*	0.01	BZ
495	"	Welder	7:49 AM- 2:30 PM	4.5	0.38	*	0.01	BZ
491	"	Welder	7:52 AM- 3:02 PM	2.1	0.5	*	0.01	BZ
312	"	Welder	7:56 AM- 3:07 PM	3.0	0.6	*	*	BZ
467	Frame Welding	Welder	7:58 AM- 3:14 PM	5.0	1.0	*	0.02	BZ
472	"	Welder	12:48 PM- 3:05 PM	0.14	0.23	*	*	BZ
197	"	Welder	8:02 AM- 3:04 PM	1.8	0.35	*	0.01	BZ
492	Small Parts	Hoods	7:32 AM-12:40 PM	2.7	0.26	*	0.01	BZ
457	Small Parts	Steps	7:33 AM- 2:55 PM	3.5	0.26	*	0.01	BZ
450	Cab Welding	Finish Welder	7:35 AM- 3:04 PM	7.3	0.50	*	0.01	BZ
474	Small Parts	Cab Welder	7:36 AM- 1:30 PM	2.8	0.24	*	0.03	BZ
326	Cab Welding	Finish Welder	7:38 AM- 2:55 PM	0.01	0.46	*	0.01	BZ
454	Small Parts	Brake Welder	7:40 AM- 2:52 PM	2.3	0.19	*	0.01	BZ
464	Small Parts	Welder	7:42 AM- 2:51 PM	10.3	0.76	*	0.01	BZ
1424	Small Parts	Brake Welder	7:44 AM- 2:58 PM	1.5	0.16	*	0.01	BZ
476	Small Parts	Box Covers	7:46 AM- 2:50 PM	1.6	0.11	*	*	BZ
1405	Small Parts	Welder	7:02 AM- 2:50 PM	3.0	2.8	*	0.01	BZ

TABLE I (continued)

Steiger Tractor Company
May 10-12, 1977

Sample Number	Location	Job Classification	Time of Sample	Iron Oxide (Fe_2O_3)	Manganese	Aluminum	Lead	Type of Sample
				(mg/M^3)				
463	Small Parts	Welder	7:04 AM- 2:53 PM	6.1	1.06	*	0.11	BZ
496	Small Parts	Material Handler	7:06 AM- 2:53 PM	0.1	0.1	*	0.05	BZ
1382	Small Parts	Welder	7:08 AM- 2:50 PM	3.0	1.23	*	0.01	BZ
1422	Small Parts	Welder	7:11 AM- 2:52 PM	3.0	1.07	*	0.01	BZ
473	Small Parts	Welder	7:14 AM- 3:04 PM	2.1	0.50	*	0.01	BZ
494	Small Parts	Welder	7:16 AM- 2:55 PM	2.0	0.47	*	0.01	BZ
479	Frame Welding	Welder	7:19 AM-12:35 PM	4.0	0.29	*	0.01	BZ
1403	Frame Welding	Welder	7:22 AM- 3:00 PM	2.6	0.49	*	0.01	BZ
475	Small Parts	Grinder	7:25 AM- 3:00 PM	3.0	0.15	*	0.01	BZ
386	Small Parts	Grinder	7:26 AM- 3:00 PM	5.9	0.15	*	0.01	BZ
477	Small Parts	Welder	7:29 AM- 2:53 PM	3.5	0.33	*	0.01	BZ
		EVALUATION CRITERIA		5.0	"C" 5.0	1/	0.1	
		NIOSH LIMIT OF DETECTION		.003 mg/s	.003 mg/s	.003 mg/s	.003 mg/s	

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

* = below laboratory detection limit

BZ = breathing zone

1/ = no available standard

mg/s = milligrams per sample

"C" = ceiling concentration which should never be exceeded

TABLE II

ATMOSPHERIC CONCENTRATIONS OF
XYLENE, TOLUENE, ISOPROPANOL, 1,1,1-TRICHLOROETHANE, AND PETROLEUM NAPHTHA

Steiger Tractor Company
May 10-11, 1977

Sample Number	Location	Job Classification	Time of Sample	Xylene	Toluene	Iso-propanol	1,1,1-Trichloro-ethane	Petroleum Naphtha	Type o Sample
				(mg/M^3)					
1	Spray Paint Booth	Spray Painter	8:20 AM-10:58 AM	48	40	90	11	19	BZ
2	"	Spray Painter	8:22 AM-11:01 AM	126	151	117	34	66	BZ
3	Small Parts Paint Booth	Spray Painter	8:25 AM-11:10 AM	7	*	138	*	*	BZ
4	Vinyl Upholstery	Vinyl Installer	8:15 AM-11:05 AM	*	*	156	217	19	BZ
5	Rework Paint Booth	Spray Painter	8:12 AM-10:52 AM	30	73	99	17	27	BZ
6	Vinyl Upholstery	Vinyl Installer	8:15 AM-11:08 AM	*	*	117	182	19	BZ
7	Small Parts Paint Booth	Spray Painter	8:28 AM-11:10 AM	8	6	161	*	15	BZ
8	"	Spray Painter	11:00 AM- 1:35 PM	28	39	182	10	36	BZ
9	Spray Paint Booth	Spray Painter	11:00 AM- 1:35 PM	52	79	256	*	65	BZ
10	Small Parts Paint Booth	Spray Painter	11:10 AM- 1:37 PM	6	*	245	8	29	BZ
11	Vinyl Upholstery	Vinyl Installer	11:07 AM- 1:37 PM	*	*	688	*	63	BZ
12	Rework Paint Booth	Spray Painter	10:55 AM- 1:39 PM	*	*	186	*	36	BZ
13	Vinyl Upholstery	Vinyl Installer	11:09 AM- 1:39 PM	1006	*	1241	*	244	BZ

TABLE II (continued)

Steiger Tractor Company
May 10-11, 1977

Sample Number	Location	Job Classification	Time of Sample	Xylene	Toluene	Isopropanol	1,1,1-Trichloroethane	Petroleum Naphtha	Type of Sample
						(mg/M^3)			
14	Small Parts Paint Booth	Spray Painter	11:13 AM- 1:40 PM	19	19	552	20	17	BZ
15	"	Spray Painter	8:00 AM-10:25 AM	35	6	131	20	15	BZ
16	Rework Paint Booth	Spray Painter	8:02 AM-10:33 AM	106	163	1333	35	63	BZ
17	Tractor Cab Paint Booth	Spray Painter	8:06 AM-10:32 AM	95	142	1652	*	203	BZ
18	Small Parts Paint Booth	Spray Painter	7:57 AM-10:20 AM	*	*	2400	*	178	BZ
19	Tractor Cab Paint Booth	Spray Painter	8:04 AM-10:37 AM	919	*	2946	*	572	BZ
20	Small Parts Paint Booth	Spray Painter	7:55 AM-10:18 AM	*	*	733	*	128	BZ
21	"	Spray Painter	7:59 AM-10:28 AM	19	*	1410	*	138	BZ
22	"	Spray Painter	10:27 AM- 1:16 PM	38	5	49	11	8	BZ
23	Tractor Cab Paint Booth	Spray Painter	10:35 AM- 1:20 PM	62	97	40	23	37	BZ
24	"	Spray Painter	10:33 AM- 1:18 PM	32	54	46	14	19	BZ
25	Small Parts Paint Booth	Spray Painter	10:24 AM- 1:19 PM	41	45	162	15	14	BZ
26	Tractor Cab Paint Booth	Spray Painter	10:38 AM- 1:21 PM	147	10	229	*	65	BZ
27	Small Parts Paint Booth	Spray Painter	10:24 AM- 1:14 PM	*	*	333	*	*	BZ

TABLE II (continued)

Steiger Tractor Company
May 10-11, 1977

Sample Number	Location	Job Classification	Time of Sample	Xylene	Toluene	Iso-propanol	1,1,1-Trichloro-ethane	Petroleum Naphtha	Type of Sample
				(mg/M^3)					
28	Small Parts Paint Booth	Spray Painter	10:29 AM- 1:17 PM	9	3	216	9	*	BZ
29	"	Spray Painter	12:05 PM- 2:36 PM	2	6	1048	*	241	BZ
30	"	Spray Painter	8:54 AM-10:02 AM	19	32	*	19	*	BZ
32	Small Parts Paint Booth	Spray Painter	7:32 AM-10:02 AM	4	4	*	*	*	BZ
			EVALUATION CRITERIA	435	375	980	1910	2000	
			NIOSH LIMIT OF DETECTION	0.01 mg/s	0.01 mg/s	0.01 mg/s	0.01 mg/s	0.01 mg/s	

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

* = below laboratory detection limit

BZ = breathing zone

mg/s = milligrams per sample