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. 78-89-550

THE BUDD COMPANY
RED LION PLANT
PHILADELPHIA, PENNSYLVANIA

DECEMBER, 1978

I. TOXICITY DETERMINATION

NIOSH conducted a health hazard evaluation at The Budd Company, Red Lion Plant, on August, 31, September 1, 1978. The purpose of the evaluation was to determine employee exposures to iron oxide, welding fumes, fluoride, hydrogen chloride and phosgene during the welding of auto frames. On Line 111 exposures to iron oxide fumes were less than the OSHA standard, however, they exceeded the American Conference of Governmental Industrial Hygienist criteria for iron oxide and welding fume (total particulate). Exposure to all other air contaminants, viz., fluoride, hydrogen chloride and phosgene were below their respective permissible levels.

Employees in the past, when a thirty-five (35) percent chlorinated paraffin oil was used, complained of skin, eye and throat irritation; however, the occurrence of these symptoms has diminished since the content of the chlorinated paraffin in the oil has been reduced to less than five (5) percent.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are available from NIOSH, Division of Technical Services, Information Resources 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 can be obtained from the NIOSH Publications Office at the Cincinnati address. Copies have been sent to:

a) The Budd Company, Red Lion Plant
b) United Auto Workers Local 92
c) U.S. Department of Labor - Region III
d) NIOSH - Region III

For the purpose of informing the approximately 375 "affected employees," the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

II. 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 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 concentration as used or found. The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees alleging skin, eye and throat irritation, as a result of exposure to airborne contaminants when welding on parts from which the cutting oil was not cleaned.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Condition of Use

The Budd Company at this plant manufactures automotive frames from purchased steel stock. The rolls of steel are coated with a cutting oil, fed into presses where the steel is formed and sheared into the individual parts of the frame. These parts then go to the subassembly area where the small parts are welded and from here to the assembly line where the frames are assembled and welded. Rod and CO_2 welding is done on a production basis, with incentive bonuses given if quotas are exceeded. The length of the frames range from 84 to 131 inches. During this evaluation, 109 inch frames were being manufactured. These operations are carried out in two large airplane hangar type buildings.

From 1974 until April, 1978, The Budd Company used a cutting oil that contained thirty-five (35) percent chlorinated paraffin. The composition of the cutting oil at the present time is less than five (5) percent chlorinated paraffin.

B. Evaluation Design and Methods

On June 15-16, 1978, an initial survey at the site was initiated by Walter Chrostek, NIOSH industrial hygienist. A walk-through survey was conducted and eighteen (18) employees, who consented, were interviewed using a non-directed medical questionnaire. During this visit four (4) bulk samples of cutting oil were collected and submitted to the laboratory to be analyzed for nitrate and nitrosamines utilizing the Greiss reaction which is sensitive to the level of 0.1 microgram per liter for nitrate and 1 microgram per liter for nitrosamines.

On August 30, 31, and September 1, 1978, employee exposures to iron oxide, welding fumes, fluoride and hydrogen chloride gas were evaluated.

Colorimetric detector tubes were used to determine if phosgene gas, which can be formed by the thermal decomposition of chlorinated hydrocarbons, was present in the work atmosphere.

Six (6) personal atmospheric samples were collected for hydrogen chloride analysis. These samples were collected in bubblers utilizing a 0.5 M sodium acetate collecting solution at a rate of 1.0 liters per minute. These samples were subsequently analyzed by NIOSH P&CAM #115[1] analytical method for chloride.

Three (3) personal atmospheric samples were collected for fluorides and total particulate at the rod welding operation in Department 111, Subassembly. These samples were collected on membrane filters which were located inside the welding helmet at a sampling rate of 1.6 to 1.7 liters per minute. These samples were analyzed by NIOSH P&CAM 212 analytical method for gaseous and particulate fluorides and gravimetrically for total particulate. Subsequently, information was received from the manufacturer stating no fluorides were present.

CO_2 gas welding operations were evaluated for iron oxide fume and total particulate on the No. 111 assembly; No. 111 subassembly and No. 112 lines. Fourteen (14) samples were collected on membrane filters which were located inside the welding helmet at a sampling rate of 1.6 to 1.7 liters per minute. These samples were analyzed by NIOSH P&CAM 212 analytical method.

C. Evaluation Criteria

1. Environmental

Certain contaminants which may have been in the work atmosphere were sampled for, and the evaluation criteria for them will be given. Airborne exposure limits for the protection of the health of workers have been recommended or promulgated by several sources. These limits are established at levels designed to protect workers occupationally exposed to a substance on an 8-hour day, 40-hour per week basis over a normal working lifetime. For this investigation, the criteria used to assess the degree of health hazards to workers were selected from three sources:

1) NIOSH: Criteria for a Recommended Standards....Occupational Exposure to Various Substances.

2) Threshold Limit Vales (TLV): Guidelines for Airborne Exposures Recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) for 1977.

3) OSHA Standard: The air contaminant standards enforced by the U.S. Department of Labor - Occupational Safety and Health Administration - as found in the Federal Register - 29 CFR 1910.1000 (Tables Z-1, Z-2).

Substance	Source/Concentration* NIOSH	TLV	OSHA
Iron Oxide Fume		5 mg/M^3*	10
Welding Fume (Total Particulate)		5	
Fluorides (as F)	2.5	2.5	2.5
C**Hydrogen Chloride		7	7
Phosgene	0.4	0.4	0.4
C***Phosgene	0.8		

* All concentrations are reported in units of milligrams of substance per cubic meter of air sampled, for up to a 10-hour work day, time weighted average, except where ceiling (C) concentrations are noted.

C**Denotes the concentration that should not be exceeded even instantaneously.

C***Ceiling concentration for any 15-minute period.

2. Toxic Effects of Substances Evaluated

Welding Fumes can be irritating to the eyes, nose and throat. The same is true of hydrogen chloride and fluorides in concentrations likely to be found in welding operations. In addition to irritation, the iron oxide fumes can lead to a cloudy chest x-ray which, although not disabling itself, makes it hard to see other changes in the x-ray which may be significant.

Phosgene which can be produced when chlorinated cutting oils are involved in welding, is an irritating gas which can react in the lungs to cause pulmonary edema and death.

Cutting Oils on skin contact can cause several kinds of dermatitis. The oil can plug the skin follicles and cause an oil acne. Some of the constituents of the oil can be irritating to the skin occasionally with an allergic sensitization. If there are chlorinated oils present, they may cause chloracne. Prevention is much more effective than treatment and requires as little direct contact with the oil as possible and good personal hygiene.

D. Evaluation Results

1. Environmental

Bulk Samples of Cutting Oil

Analysis of four bulk samples by the Greiss reaction showed that these cutting oils are water insoluble, viscous oils and are free of both nitrite and nitrosamine.

Phosgene(2)
Three (3) colorimetric tube determinations were made for phosgene gas which may occur during welding on steel which is coated with chlorinated paraffin. The lower limit of detection of the colorimetric tubes was 0.2 milligram of phosgene per million parts of air sampled. All determinations made were none detectable.

Hydrogen Chloride
Hydrogen Chloride may also be formed when chlorinated hydrocarbons are exposed to heat and ultra violet rays during welding. Six (6) samples were collected in the breathing zone of the employees by modifying the welding helmets. Exposure to hydrogen chloride ranged from none detected (N.D.) to 0.08 milligram per cubic meter of air. Results are shown in Table I.

Fluorides
Fluorides may be present as fluxes in welding rods. Three (3) samples were collected and analyzed for fluorides and total particulates. All exposure to fluorides were below the lower limit of detection of 5 micrograms per sample. The total particulate exposure ranged from .05 to 1.09 milligram per cubic meter of air. Results are shown in Table II.

Iron Oxide and Total Particulate
Employee exposures to the above contaminants were evaluated on Lines 111 and 112. Of the fourteen (14) exposures evaluated, all were below the OSHA permissible standards for iron oxide fumes (See Table III); however, one (1) sample exceeded the American Conference of Governmental Industrial Hygienist Threshold Limit Values (TLV) for iron oxide fume and two (2) exceed the TLV for welding fumes (total particulate). Results are shown in Table III.

2. Employee Interviews

Seven (7) employees complained about breathing problems, three (3) eye and eight (8) nose irritation and five (5) dermatitis problems. Most of the employees agreed that these problems are not as frequent or severe since the cutting oil was changed.

E. Discussion and Recommendation

Welding operations are equipped with either canopy hood exhaust (Line 111) or open duct exhaust (on both LIne 111 and 112). There are no blast gates or flanges on any of the ducts (See ACGIH vs 416.1, which is appended). Tempered air, open windows and doors supply the make-up air for both areas. The quantity of air exhausted or replenished was not available from the company.

The canopy hood exhaust area is approximately 120 x 30 feet in area and is about 8 feet from the floor. Ventilation is supplied by slot exhaust on both sides and in two center areas. Ventilation readings taken with an Alnor Junior velometer register 800 + feet per minute at the face of all local exhaust systems and 50-75 feet, face velocity, per minute at the work area. OSHA regulations states that ventilation rates should be 100 linear feet per minute in the zone of welding.

In some areas it was noted that the duct design was poor in that too many 90° elbows and flexible ducts were utilized.

The location of the make-up air fans is at the ceiling approximately 40-50 feet from the floor. Although no ventilation readings were taken at the face of the fan, Alnor Junior velometer readings at the work station registered 150-175 feet per minute. This interfered with the local exhaust system and was the cause for exposures to exceed the TLV.

The probable causative agent for the complaint prior to this health hazard evaluation was the high chlorinated paraffin content of the drawing oil. Certain chlorinated cutting oils react with the skin to product chloracne. Some of these oils can also break down with moisture from the skin to form mineral acids which also cause skin irritation.(4) This seemed to be the problem at The Budd Company when the chlorinated paraffin content was thirty-five percent.

In order to keep employee exposures to all air contaminants to a minimum, the following recommendations are made:

1) Redirect all make-up air units so that the air does not interfere with the exhaust ventilation systems.

2) When purchasing additional make-up air units, it would be advisable to purchase a few smaller units, than one large unit.

3) Install blast gates on the air ducts. These gates should be closed at operations where no work is being performed, to assure maximum ventilation in areas where the contaminants are generated.

4) Install flanges(5) on all open end ducts to assure maximum capture of air contaminants.

5) Establish a periodic maintenance program on all ventilation systems. This should include a cleanout, replacement of ruptured ducts, and replacement of cleanout doors.

6) When purchasing cutting oil, consider their human compatibility properties.

V. REFERENCES

1. NIOSH "Manual of Analytical Methods", Vol. Publication No. 77-157 A, 1977.

2. NIOSH "Safety and Health in Arc Welding, and Gas Welding, and Cutting", Publication No. 78-138, 1978.

3. Federal Register, Vol. 39, No. 125, Part II, June 21, 1974 (Revised January, 1976), Section 1910.252.

4. R. K. Springborn, "Cutting and Grinding Fluids, Selection and Application, American Society of Tool Manufacturing and Engineering (ASTME), 1967.

5. American Conference of Governmental Industrial Hygienists "Industrial Ventilation, A Manual of Recommended Practice", 14th Edition, 1976.

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Table I
Hydrogen Chloride
Breathing Zone Air Concentration Data
The Budd Company
Red Lion Plant
Philadelphia, Pennsylvania
HHE 78-89
August 30, 31, 1978

Date	Sample Number	Location	Job Description	Sampling Period	Concentrations mg/M^3(a) Hydrogen Chloride
8/30/78	4	Line 111, Sec 35 Rear	CO_2 Welding	9:18-10:30	0.28
	320	Line 111, Sec 15 Rear	CO_2 Welding	9:27-10:30	0.63
	220	Line 111, Sec 15 Rear	CO_2 Welding	13:33-14:03	N.D.(b)
	35	Line 111, Sec 35 Rear	CO_2 Welding	13:33-14:03	N.D.
	445	Line 111, Sec 30	CO_2 Welding	15:29-16:34	0.83
8/31/78	83	Line 111, Rear Rail Subassembly	CO_2 Welding	9:30-13:05	0.09

(a) mg/M^3 - milligram of substance per cubic meter of air sampled.
(b) N.D. - none detected, lower level of detection = 0.05 micrograms per cubic meter of air sampled.

Evaluation Criteria

(OSHA)	C	Hydrogen Chloride	7 mg/M^3
(TLV)	C	Hydrogen Chloride	7 mg/M^3

(c) "C" - denotes the concentration that should not be exceeded even instantaneously.

Table II
Fluoride and Total Particulate
Breathing Zone Air Concentration Data
The Budd Company
Red Lion Plant
Philadelphia, Pennsylvania
HHE 78-89
August 30, 31 and September 1, 1978

Date	Sample Number	Location	Job Description	Sampling Period	Concentrations mg/M^3(a)	
					Fluoride	Total Particulate
August 30	D8-1101	Subassembly Line 111	Spacer Welder	20:47-22:52	N.D.(b)	.05
August 31	D8-1010	Subassembly Line 111	Rail, bottom Seam Front	08:23-14:00	N.D.	1.09
August 31	D8-1161	Subassembly Line 111	Spacer Welder	09:15-14:00	N.D.	.68

(a) mg/M^3 - milligram of substance per cubic meter of air sampled.
(b) N.D. - non detected, lower level of detection = 0.05 micrograms per cubic meter of air sampled.

Evaluation Criteria

(OSHA) Fluoride (as F)	2.5 mg/M^3
(NIOSH) Fluoride (as F_2 combined ionic fluoride, atomic weight 19)	2.5 mg/M^3

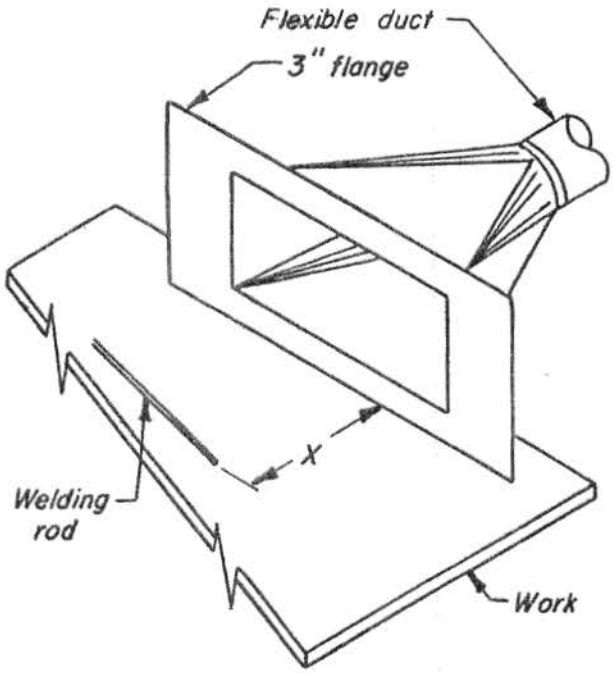
Table III
Total Particulate and Iron Oxide Fume Air Concentrations Data
The Budd Company
Philadephia, Pennsylvania
HHE 78-89
August 30, 31 and September 1, 1978

Date	Sample Number	Location	Job Description	Sampling Period	Concentrations, mg/M^3 (a) Iron Oxide Fume	Concentrations, mg/M^3 (a) Total Particulate
8/30/78	D8-1067	No. 111 Line, 40 Center	CO_2 Welder	9:21-14:03	0.45	0.94
	D8-1197	No. 111 Line, 35 Front End	CO_2 Welder	9:26-14:03	1.17	1.76
	D8-1081	No. 111 Line, 20 Middle	CO_2 Welder	9:30-14:03	0.45	0.90
	D8-974	No. 111 Line, 35	CO_2 Welder	15:07-19:40	2.35	3.16
	D8-1053	No. 111 Line, 25	CO_2 Welder	15:12-19:41	4.56	5.67
	D8-1094	No. 111 Line, 30	CO_2 Welder	15:13-19:42	6.94	8.16
	D8-1141	No. 111 Subassembly Rt. Hand Rail	CO_2 Welder	20:45-22:58	0.11	0.33
	D8-975	No. 111 Subassembly Pivot Box Welder	CO_2 Welder	20:50-22:55	0.44	0.61
8/31/78	D8-1104	No. 111 Subassembly Bottom Rail	CO_2 Welder	8:19-14:00	2.07	2.62
9/1/78	D8-1056	No. 112, Line 1, 613 Jig	CO_2 Welder	7:55-14:38	0.85	1.66
	D8-1102	No. 112, Line 2, 641 Jig	CO_2 Welder	8:20-14:40	1.03	1.15
	D8-1085	No. 112, Line 2, 613 Jig	CO_2 Welder	8:22-14:42	0.20	0.36
	D8-1106	No. 112, Line 2, 612 Jig	CO_2 Welder	8:25-13:05	0.07	0.06
	D8-1096	No. 112, Line 1, 641 Jig	CO_2 Welder	7:50-14:38	3.27	3.86

(a) mg/M^3 - milligrams of substance per cubic meter of air sampled.

Evaluation Criteria

(OSHA) Iron Oxide Fume	10 mg/M^3
(ACGIH) Iron Oxide Fume	5 mg/M^3
(ACGIH) Welding Fumes, Total Particulate	5 mg/M^3



PORTABLE EXHAUST

X, inches	Plain duct cfm	Flange or cone cfm
up to 6	335	250
6 - 9	755	560
9 -12	1335	1000

Face velocity = 1500 fpm
Duct velocity = 3000 fpm minimum
Entry loss = 0.25 duct VP
Also see "Granite Cutting" VS-909

GENERAL VENTILATION, where local exhaust cannot be used:

Rod, diam	cfm/welder
5/32	1000
3/16	1500
1/4	3500
3/8	4500

OR

A. For open areas, where welding fume can rise away from the breathing zone:
cfm required = 800x lb/hour rod used

B. For enclosed areas or positions where fume does not readily escape breathing zone:
cfm required = 1600x lb/hour rod used

For toxic materials higher airflows are necessary and operator may require respiratory protection equipment.

OTHER TYPES OF HOODS

Bench: See VS-416

Booth: For design See VS-415, VS-604
Q=100 cfm/sq ft of face opening

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

WELDING BENCH

DATE 1-76 | VS-416.1