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. 76-23-319

Western Gear Corporation
Jamestown, North Dakota

August 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on April 6, 7, and 8, 1976, at the Western Gear Corporation, Jamestown, North Dakota. At the time of this evaluation, personal breathing zone and general room samples were taken for oil mist, methanol, toluene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), butyl cellosolve, methylene chloride, xylene, normal butyl acetate, aluminum, lead, zinc, chromium, nitric acid, and hydrochloric acid. All airborne concentrations of chemicals were well within the most recent evaluation criteria, with the exception of oil mist. A potential health hazard was documented in the machine shop during this evaluation, since 54% of the workers were overexposed to airborne concentrations of oil mist.

II. DISTRIBUTION AND AVAILABILITY

Copies of this hazard evaluation determination report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

(a) Western Gear Corporation
(b) U.S. Department of Labor - Region VIII
(c) NIOSH - Region VIII

For the purpose of informing approximately 150 affected employees, copies of the report shall be posted in a prominent place accessible to the employees for a period of 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), 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 management of Western Gear Corporation, Jamestown, North Dakota, to evaluate the potential hazards associated with exposures to solvents and cutting and machining oils in the production of various aircraft accessories.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

The Western Gear Corporation manufactures various components for aircraft. These include the dumbwaiter for the Boeing 747 and rocket launchers for the Armed Services helicopters. During the production of such equipment, operations such as metal machining and cutting with generation of oil mist and spray painting with the possibility of solvent exposure may exist. All machinists were using a water-soluble cutting fluid; the trade name is Trim Sol®. Most of these machinists were monitored for exposures to oil mist.

There are three spray painters working in one large room. Each painter works in an individual filter-type paint booth. Ventilation measurements were taken in each paint booth. All booths were operating with an optimum exhaust ventilation velocity of 200 linear feet per minute or over. This is the most widely accepted figure for booths of this type.[1] Adjoining the paint booths were workers preparing parts to be painted. These workers, as well as all the painters, were monitored for exposures to all solvents present in the paint.

There was an anodizing shop employing three workers. Exposures in this shop were limited to hydrochloric and nitric acids. All three workers were monitored for possible exposures. The remainder of the workers in this plant were involved in touch-up painting and sanding operations. These workers were all monitored for metal dust and solvent exposures.

B. Evaluation Design

Personal breathing zone and general room samples were taken on April 6, 7, and 8, 1976, in the machine shop for oil mist; the paint booths for methanol, toluene, MEK, MIBK, butyl cellosolve, methylene chloride, xylene, and normal butyl acetate. Samples were taken on all workers in the anodizing shop for hydrochloric and nitric acids. Other areas in the plant were monitored both by personal breathing zone and general room samples for possible exposures to metal dust and solvent vapors generated from touch-up work on the finished products.

C. Evaluation Methods

All oil mist samples were taken on AA filters and analyzed by fluorescence spectroscopy. Methanol samples were collected on silica gel tubes and analyzed by gas chromatography. Toluene, MEK, MIBK, butyl cellosolve, methylene chloride, xylene, and normal butyl acetate were collected on organic vapor charcoal sampling tubes and analyzed by gas chromatography.

Aluminum, lead, zinc, and chromium were collected on AA filters and analyzed by atomic absorption spectroscopy. The nitric acid samples were collected in an aqueous solution using an MSA Model G pump at one liter per minute and analyzed spectrophotometrically. Hydrochloric acid samples were collected in an aqueous solution using an MSA Model G pump at one liter per minute and analyzed by nephelometry. The oil mist and metal samples were collected using MSA Model G pumps operating at 1.5 to 2 liters per minute. All solvent samples were collected using Sipin pumps operating at approximately 50 cubic centimeters per minute.

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) NIOSH recommended criteria for occupational exposures; (2) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1975); and (3) Occupational Safety and Health Standards (29 CFR 1910.1000), U.S. Department of Labor, as of January 1, 1976.

In the following tabulation of criteria, the most appropriate value is presented with its reference and other information footnoted.

Substance	Permissible Exposures 8-Hour Time-Weighted Exposure Basis
[1]Methanol	262 mg/M^3
[2]Hydrochloric Acid	7 mg/M^3
[3]Nitric Acid	5 mg/M^3
[1]Toluene	375 mg/M^3
[2]MEK	590 mg/M^3
[2]MIBK	410 mg/M^3
[4]Methylene Chloride	261 mg/M^3
[4]Xylene	435 mg/M^3
[2]Butyl Acetate	710 mg/M^3
[5]Butyl Cellosolve	370 mg/M^3
Aluminum	*
[5]Lead	0.15 mg/M^3
[5]Zinc	5 mg/M^3
[2]Chromium	0.5 mg/M^3
[2]Oil Mist	5 mg/M^3

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

* = no evaluation criteria available

[1]Reference: NIOSH criteria for recommended standards; recommended and proposed TLV's and their supporting documentation as set forth by the ACGIH (1975).

[2]Reference: Recommended and proposed TLV's and their supporting documentation as set forth by the ACGIH (1975); Occupational Safety and Health Standards (29 CFR 1910.1000) as of January 1, 1976.

[3]Reference: NIOSH criteria for recommended standards; recommended and proposed TLV's and their supporting documentation as set forth by the ACGIH (1975); Occupational Safety and Health Standards (29 CFR 1910.1000) as of January 1, 1976.

[4]Reference: NIOSH criteria for recommended standards.

[5]Reference: Recommended and proposed TLV's and their supporting documentation as set forth by the ACGIH (1975).

Occupational health 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. Evaluation Results

Since high exposures to oil mist were observed in 54% of the workers, it is conceivable that dermatitis may become a problem if this situation is not corrected. The most important element in a shop where oil mist is generated is cleanliness of shop personnel. Close personal attention to hygiene and cleanliness is the best means of avoiding and preventing dermatitis. Quick changing from street to shop clothes and wearing oil-impervious aprons are of some help. Splash guards are helpful on some cutting machines in the protection against both flying chips and oil sprays and mists.[2] The type of cutting oil (Trim Sol®) used in this shop is non-toxic and is not a hazard due to inhalation.

A potential health hazard did exist at the time of this evaluation to oil mist. Confidential employee interview forms were completed on 40 workers. These interviews failed to show any dermatitis from Trim Sol®. Headaches were the only complaints. However, since high levels of cutting oil mist were found, it is conceivable that dermatitis could become a problem if this is not corrected. All personal breathing zone and general room samples for the remaining 14 chemicals showed levels well within the most recent evaluation criteria. For a complete review of all sample results, refer to Tables I through VII.

RECOMMENDATIONS

1. Adequate ventilation is probably the only means of decreasing oil mist concentrations in the machine shop to an acceptable non-hazardous concentration.

2. The spray paint booths were in excellent condition and were adequately maintained. These efforts should be continued.

3. Personal hygiene in the machine shop area should be maintained in order to prevent the occurrence of oil mist dermatitis.

V. REFERENCES

[1]Patty, Frank (Editor). Industrial Hygiene and Toxicology, Interscience Publishers, Vol. I, p 300, 1958.

[2]Zenz, Carl (Editor). Occupational Medicine--Principles and Practical Applications, Year Book Medical Publishers, pp 220-221, 1975.

VI. AUTHORSHIP

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF
OIL MIST

Western Gear Company
April 6, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Oil Mist (mg/M^3)	Type of Sample
1	Machine Shop	Machinist	7:14 A.M.- 1:55 P.M.	5.4	BZ
2	Machine Shop	Machinist	3:34 P.M.- 8:30 P.M.	1.5	BZ
3	Machine Shop	Machinist	3:40 P.M.- 8:32 P.M.	1.7	BZ
5	Machine Shop	Machinist	3:31 P.M.- 8:30 P.M.	7.5	BZ
6	Machine Shop	Machinist	3:36 P.M.- 7:50 P.M.	5.3	BZ
7	Machine Shop	Machinist	7:19 A.M.- 1:50 P.M.	2.9	BZ
8	Machine Shop	Machinist	7:20 A.M.- 1:59 P.M.	6.0	BZ
60	Machine Shop	Machinist	7:16 A.M.- 2:01 P.M.	1.1	BZ
57	Machine Shop	Machinist	7:42 A.M.-11:21 A.M.	6.2	BZ
55	Machine Shop	Machinist	7:44 A.M.-11:20 A.M.	8.6	BZ
72	Machine Shop	Machinist	7:40 A.M.-11:20 A.M.	2.5	BZ
63	Machine Shop	Machinist	7:15 A.M.- 1:57 P.M.	1.5	BZ
61	Machine Shop	Machinist	7:11 A.M.- 1:58 P.M.	20.0	BZ
			EVALUATION CRITERIA	5.0	
			NIOSH LIMIT OF DETECTION	70 micrograms/sample	

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

BZ = breathing zone

TABLE II

ATMOSPHERIC CONCENTRATIONS OF
TOLUENE, MEK, MIBK, METHYLENE CHLORIDE, XYLENE,
BUTYL ACETATE, AND BUTYL CELLOSOLVE

Western Gear Company
April 7, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations mg/M^3 Toluene	MEK	MIBK	Methylene Chloride	Xylene	n-Butyl Acetate	Butyl Cellosolve	Type of Sample
1	Paint Shop	Painter	9:45 A.M.-11:32 A.M.	14.0	*	14.0	*	6.0	*	*	BZ
2922	Paint Shop	Painter	9:41 A.M.-11:33 A.M.	2.0	*	*	*	2.0	*	*	BZ
5	Paint Shop	Painter	7:18 A.M.- 9:44 A.M.	9.0	*	1.0	*	*	2.0	*	BZ
3	Paint Shop	Painter	7:21 A.M.- 9:44 A.M.	4.0	*	0.8	*	5.0	2.0	*	BZ
6	Paint Shop	Painter	9:44 A.M.-11:32 A.M.	3.0	*	1.0	*	*	*	*	BZ
2924	Subassembly	Assembler	8:10 A.M.-12:22 P.M.	1.0	*	1.0	*	*	*	*	BZ
2988	Subassembly	Assembler	8:09 A.M.-12:19 P.M.	5.0	14.0	4.0	2.0	3.0	1.0	*	BZ
2927	Subassembly	Assembler	8:05 A.M.-12:18 P.M.	0.5	*	*	*	*	*	*	BZ
2978	Paint Shop	Painter	12:51 P.M.- 3:13 P.M.	8.0	*	1.0	*	4.0	*	*	BZ
2920	Paint Shop	Painter	12:46 P.M.- 3:10 P.M.	10.0	*	1.0	25.0	3.0	*	*	BZ
2919	Paint Shop	Painter	7:20 A.M.- 9:45 A.M.	5.0	*	6.0	*	2.0	2.0	*	BZ
			EVALUATION CRITERIA	375	590	410	261	435	710	370	
			NIOSH LIMIT OF DETECTION	0.01	0.02	0.01	0.02	0.01	0.01	0.01	

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

BZ = breathing zone

* = below the NIOSH lower limit of detection

TABLE III

ATMOSPHERIC CONCENTRATIONS OF
TOLUENE, MEK, AND BUTYL CELLOSOLVE

Western Gear Company
April 8, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Toluene	MEK	Butyl Cellosolve	Type of Sample
				mg/M^3			
2925	Paint Shop	Painter	12:44 P.M.- 3:12 P.M.	*	*	*	BZ
2984	Paint Shop	Painter	12:55 P.M.- 3:12 P.M.	2.0	*	*	BZ
4	Paint Shop	Painter	7:24 A.M.-11:00 A.M.	0.7	*	*	BZ
2923	Paint Shop	Painter	12:48 P.M.- 3:10 P.M.	0.8	*	*	BZ
2983	Paint Shop	Painter	12:50 P.M.- 3:11 P.M.	2.0	*	*	BZ
2921	Paint Shop	Painter	12:57 P.M.- 3:12 P.M.	1.0	*	*	BZ
2926	Paint Shop	Painter	12:56 P.M.- 3:16 P.M.	0.8	*	*	BZ
			EVALUATION CRITERIA	375	590	370	
			NIOSH LIMIT OF DETECTION	0.01	0.02	0.01	

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

BZ = breathing zone

* = below the NIOSH lower limit of detection

TABLE IV

ATMOSPHERIC CONCENTRATIONS OF METHANOL

Western Gear Company
April 7, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Methanol (mg/M^3)	Type of Sample
1	Paint Shop	Painter	7:07 - 11:43 A.M.	*	BZ
2	Paint Shop	Painter	6:58 - 11:41 A.M.	*	BZ
3	Paint Shop	Paint Preparation	6:55 - 11:38 A.M.	*	BZ
4	Paint Shop	Paint Preparation	7:08 - 11:39 A.M.	*	BZ
5	Paint Shop	Painter	7:05 - 11:45 A.M.	*	BZ
			EVALUATION CRITERIA	262	
			NIOSH LIMIT OF DETECTION	0.01	

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

BZ = breathing zone

* = below the NIOSH lower limit of detection

TABLE V

ATMOSPHERIC CONCENTRATIONS OF NITRIC ACID

Western Gear Company
April 7, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Nitric Acid (mg/M^3)	Type of Sample
1	Anodizing Shop	Anodizer	11:15 A.M.-12:50 P.M.	0.01	BZ
2	Anodizing Shop	Anodizer	11:16 A.M.- 2:09 P.M.	0.04	BZ
3	Anodizing Shop	Anodizer	11:17 A.M.- 2:10 P.M.	0.03	BZ
			EVALUATION CRITERIA	5.0	
			NIOSH LIMIT OF DETECTION	5 micrograms/sample	

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

BZ = breathing zone

TABLE VI

ATMOSPHERIC CONCENTRATIONS OF HYDROCHLORIC ACID

Western Gear Company
April 7, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Hydrochloric Acid (mg/M^3)	Type of Sample
1	Anodizing Shop	Anodizer	7:45 - 11:11 A.M.	0.04	BZ
2	Anodizing Shop	Anodizer	7:58 - 11:15 A.M.	0.03	BZ
3	Anodizing Shop	Anodizer	7:48 - 11:16 A.M.	0.2	BZ
			EVALUATION CRITERIA	7.0	
			NIOSH LIMIT OF DETECTION	30 micrograms/liter	

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

BZ = breathing zone

TABLE VII

ATMOSPHERIC CONCENTRATIONS OF
ALUMINUM, LEAD, ZINC, AND CHROMIUM

Western Gear Company
April 8, 1976

Sample Number	Location	Job Classification	Time of Sample	Atmospheric Concentrations Aluminum	Lead	Zinc	Chromium	Type of Sample
				mg/M^3				
59	Sheet Metal Shop	Sheet Metal Worker	7:32 - 11:38 A.M.	0.87	*	0.004	*	BZ
70	Sheet Metal Shop	Sheet Metal Worker	7:26 - 11:39 A.M.	0.16	*	*	*	BZ
71	Sheet Metal Shop	Sheet Metal Worker	7:31 - 11:38 A.M.	1.7	*	0.01	*	BZ
53	Welding	Welder	7:12 - 11:19 A.M.	0.02	*	*	*	BZ
			EVALUATION CRITERIA	**	0.15	5.0	0.5	
			NIOSH LIMIT OF DETECTION	0.01	0.01	0.001	0.001	

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

BZ = breathing zone

* = below the NIOSH lower limit of detection

** = no evaluation criteria available