

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 80-45-688

U.S. PRECISION LENS INC.
CINCINNATI, OHIO

May 1980

I. SUMMARY

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at U.S. Precision Lens, Incorporated, Cincinnati, Ohio, on January 17-18, 1980 at the invitation of the Company. The purpose of this investigation was to determine whether exposures to polymethyl methacrylate, methyl methacrylate vapor, 1,1,1-trichloroethane, toluene, magnesium fluoride, isopropyl alcohol, iron oxide and oil mist were posing a health hazard to massive optics (M.O.) and tool grinding room employees.

Personal breathing zone and/or area air samples were taken for each of the above listed contaminants. A bulk sample was analyzed for silica content. In addition, most of the employees present during this investigation who worked in the M.O. and tool grinding room were interviewed. Ventilation measurements and work practices were also evaluated.

Environmental sample results for each of the aforementioned contaminants ranged up to about 20% of their respective criteria. Polymethyl methacrylate particulate analysis in the M.O. work area ranged up to 0.45 mg/M³ for respirable particulate (recommended permissible exposure limit, PEL - 10 mg/M³). The bulk samples did not contain silica. Monomeric methyl methacrylate and toluene vapor concentrations ranged up to 2.0 ppm (recommended PEL - 100 ppm). Isopropyl alcohol and 1,1,1-trichloroethane vapor concentrations were below 8 ppm (recommended PEL - 400 and 350 ppm, respectively). Magnesium fluoride dust levels ranged up to 0.02 mg/M³ (recommended PEL - 10 mg/M³, as Mg). Iron oxide dust and oil mist concentrations in the tool room ranged between 0.07 and 1.07 mg/M³ (recommended PEL - 5 mg/M³).

Based on the environmental sample results, employee interviews, ventilation measurements and a review of pertinent literature, NIOSH determined that exposures to chemical substances sampled during this investigation were not hazardous to the massive optics and tool grinding room employees at the time of this investigation. The recommendations included in this report are presented to assist in insuring the safety and health of the employees (pages 3 and 4).

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the work place. The management at U.S. Precision Lens, Incorporated requested such an evaluation from NIOSH to evaluate potential employee exposure to polymethyl methacrylate in the M.O. work area. Following the initial walkthrough on January 11, 1980, the employer representative requested that NIOSH also investigate the tool grinding work room for potential health hazards.

On February 8, a letter was sent to the employer with some of the results of the particulate analysis and personal medical interviews.

III. BACKGROUND

U.S. Precision Lens Incorporated employs approximately 250 workers in the production of plastic lenses for use in large screen televisions as well as in other optical applications. Specific areas of concern were (1) in the massive optics department and (2) in the tool grinding room where particulates and/or solvent vapors were generated. A description of the lens manufacturing process will not be provided because it entails proprietary information.

IV. EVALUATION DESIGN AND METHODS

Personal breathing zone (BZ) and general area (GA) air samples for polymethyl methacrylate, magnesium fluoride, iron oxide and oil mist were collected on membrane filters at a flowrate of 1.7 lpm. Polymethyl methacrylate was analyzed gravimetrically. Iron oxide and magnesium fluoride dust samples were analyzed by atomic absorption spectrophotometry. Oil mist samples were analyzed via fluorescence spectrophotometry.

Personal and/or area air samples for methyl methacrylate, 1,1,1-trichloroethane, isopropyl alcohol and toluene vapors were collected on charcoal tubes at 100 cc/min and analyzed by gas chromatography with a Flame Ionization Detector. Ventilation and work practices were evaluated. Also, employees present during the investigation were interviewed using non-directed medical questionnaires to determine work related health problems.

*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 concentrations as used or found.

V. ENVIRONMENTAL LIMITS, CRITERIA, AND HEALTH EFFECTS

The environmental evaluation criteria used to assess the potential toxicity of the contaminant exposures under investigation are presented in Table 1. Listed in Table 1, for each substance, are the recommended environmental limit, the source of the recommended limit and the current OSHA standard. Compliance with all of the pertinent exposure limits should prevent adverse affects on the health and safety of workers.

VI. RESULTS & DISCUSSION

All environmental samples collected at U.S. Precision Lens Inc. have been analyzed and a summary of the results along with the criteria which affords the best health protection are presented in Table 2. Individual sample results appear in Appendices 1-3. The concentrations of all chemical substance samples were well below the appropriate environmental criteria. The bulk sample was analyzed and no silica was detected. These results obviously reflect the quality of the work environment under the conditions that existed during the time of this evaluation.

A review of the non-directed medical questionnaires indicated that thirteen (13) employees were asymptomatic from a total of twenty-two interviewed employees. Of the remaining nine (9) employees specific complaints were as follows: eye irritation (4), skin dryness (3), skin sores (3), scalp irritation (2), headaches (1) and sore throats (1). All of the skin problems were associated with the M.O. employees and, in particular, those who worked with water.

Ventilation measurements at the spray paint booth indicated a face velocity averaging about 120 cfm/sq ft of open face area (range 100-150 cfm/sq ft). This value is below the 150 cfm/sq ft value recommended by the ACGIH⁷. System performance was probably affected by partially loaded filters.

VII. CONCLUSIONS

Based on the results of the environmental sampling, ventilation measurements, and employee interviews, in addition to observation of work practices/exposure, controls and a review of the pertinent literature, it is concluded that no health hazards existed in the massive optical manufacturing areas and tool grinding room during the time of this investigation.

VIII. RECOMMENDATIONS

The local exhaust system in the massive optics work area could be improved by installing a booth-type enclosure at each machine as per the #1 prototype that is currently in use. An enclosure of this type will provide better localization and capture of the acrylic.

Local exhaust ventilation in the tool grinding room should also be expanded to incorporate all of the grinding machines. The flexible plastic ductings used on some of the machines are too short and cannot be used. These ducts should be lengthened to more effectively serve their purpose.

For those affected employees two barrier creams should be used to avoid dry, chapped skin.

The spray paint manometer should be repaired as it indicates system performance and also "informs" the worker of necessary filter changes.

The spray paint gun should be disassembled and cleaned in the spray paint booth. During cleaning, gloves must be worn to prevent skin absorption of cleaning solvents.

IX. REFERENCES

1. TLV's[®] Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1979, Published by the American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio 45201.
2. Criteria for a Recommended Standard: Occupational Exposure to Trichloroethane (Methyl Chloroform), HEW Publication No. (NIOSH) 76-184, July 1976.
3. Criteria for a Recommended Standard: Occupational Exposure to Toluene, HEW Publication No. (NIOSH) 73-110, July 1973.
4. Criteria for a Recommended Standard: Occupational Exposure to Inorganic Fluorides, HEW Publication No. (NIOSH) 76-103, June 1975.
5. Criteria for a Recommended Standard: Occupational Exposure to Isopropyl Alcohol HEW Publication No. (NIOSH) 76-142, March 1976.
6. U.S. Department of Labor, Occupational Safety and Health Administration OSHA Safety and Health Standards (29 CFR 1910) OSHA 2206 (Revised November 7, 1978).
7. Industrial Ventilation - A Manual of Recommended Practice by the American Conference of Governmental Industrial Hygienists, Committee on Industrial Ventilation, 15th ed., ACGIH, Lansing, Michigan 1978.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

- a. U.S. Precision Lens Incorporated, Cincinnati, Ohio
- b. U.S. Department of Labor, Region V
- c. NIOSH, Region V

For the purpose of informing the "affected employees" the employer shall promptly "post" the determination report for a period of 30 days in a prominent place near where exposed employees work.

Table I

Environmental Evaluation Criteria

U.S. Precision Lens, Inc.
Cincinnati, Ohio

January 17 & 18, 1980

HE 80-45

<u>Substance</u>	<u>Recommended Environmental Limit</u>	<u>Source</u>	<u>Primary Health Effects</u>	<u>OSHA Standard(Ref. 6)</u>
Polymethyl Methacrylate				
Respirable particulate	10 mg/M ³	ACGIH(Ref.1)	Irritating to the upper respiratory tract and skin	15 mg/M ³
total particulate	5 mg/M ³ 1% silica	ACGIH(Ref.1)		5 mg/M ³
Monomeric Methylmethacrylate	100 ppm	ACGIH(Ref.1)	Mucous membrane irritation	100 ppm
1,1,1-trichloroethane	350 ppm	NIOSH(Ref.2)	Irritating to eyes, upper respiratory tract and skin	350 ppm
Toluene	100 ppm	NIOSH(Ref.3)	Irritating to eyes, upper respiratory tract and skin	200 ppm
Magnesium Fluoride	10 mg/M ³ (as Mg)	ACGIH(Ref.1)	Mucous membrane and skin irritation, chronic bone changes may develop	15 mg/M ³
	2.5 mg/M ³ (as F)	NIOSH(Ref.4)		2.5 mg/M ³
Isopropyl Alcohol	400 ppm	NIOSH(Ref.5)	Mucous membrane irritation	400 ppm
Iron Oxide	5 mg/M ³	ACGIH(Ref.1)	Benign pneumoconiosis(siderosis)	10 mg/M ³
Oil Mist	5 mg/M ³	ACGIH(Ref.1)	Irritation to upper respiratory tract and skin	5 mg/M ³

*All air concentrations are time weighted average (TWA) exposures for a normal work day.

Table II

Summary of Environmental Data and Evaluation Criteria

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HE 80-45

<u>Substance</u>	<u>Number of Samples</u>	<u>Mean Concentration</u>	<u>Range Concentration</u>	<u>Recommended Exposure Limit</u>
Polymethyl methacrylate respirable particulate	23	0.13 mg/M ³	N.D.* → 0.45 mg/M ³	10 mg/M ³ 1% silica
total particulate	5	0.23 mg/M ³	N.D.* → 0.58 mg/M ³	5 mg/M ³
Monomeric Methylmethacrylate	4	1.5 ppm	0.9 → 2.0 ppm	100 ppm
1,1,1-trichloroethane	1	6.3 ppm	-	350 ppm
Toluene	2	< 1 ppm	-	100 ppm
Magnesium Fluoride	2	0.01 mg/M ³	N.D.* → 0.02 mg/M ³	10 mg/M ³ (as Mg) 2.5 mg/M ³ (as F)**
Isopropyl Alcohol	1	7.1 ppm	-	400 ppm
Iron Oxide	4	0.17 mg/M ³	0.07 → 0.27 mg/M ³	5 mg/M ³
Oil Mist	4	0.83 mg/M ³	0.66 → 1.07 mg/M ³	5 mg/M ³

*N.D. - None Detected

**Based on the magnesium concentrations, theoretical fluoride concentrations would also be well below its environmental criteria of 2.5 mg/M³.

Appendix 1

Gravimetric Total and Respirable Particulate Analysis

U.S. Precision Lens Inc.
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HE 80-45

<u>Date</u>	<u>Sample Type</u>	<u>Type of Sample Collected</u>	<u>Sample Time(hrs)</u>	<u>Sample Location</u>	<u>Air Concentration Mg/M</u>
1/17/80	BZ*	Respirable	7.03	#4 operator	0.10
1/17/80	BZ	Respirable	6.92	#5 operator	0.06
1/17/80	BZ	Respirable	6.92	#1 operator	0.11
1/17/80	BZ	Respirable	6.95	#2 operator	0.16
1/17/80	BZ	Respirable	6.75	#3 operator	0.09
1/17/80	BZ	Respirable	6.80	#4 operator	0.12
1/17/80	BZ	Respirable	6.62	setup	0.10
1/17/80	BZ	Respirable	6.53	setup	0.14
1/17/80	BZ	Respirable	6.67	trepanner	0.06
1/17/80	BZ	Total	6.63	trepanner	0.18
1/17/80	BZ	Respirable	6.88	M.O. midroom	0.11
1/17/80	BZ	Total	6.47	M.O. midroom	0.20
1/17/80	BZ	Respirable	6.33	M.O. midroom	0.33
1/17/80	GA*	Total	6.37	bagroom	N.D.**
1/17/80	GA	Respirable	6.30	bagroom	0.03
1/18/80	BZ	Respirable	7.18	#1 operator	0.14
1/18/80	BZ	Respirable	7.17	#2 operator	0.07
1/18/80	BZ	Respirable	7.12	#3 operator	0.06
1/18/80	BZ	Respirable	7.33	#4 operator	0.04
1/18/80	BZ	Respirable	6.97	setup	0.10
1/18/80	BZ	Respirable	6.92	setup	0.45
1/18/80	BZ	Respirable	6.53	trepanner	0.15
1/18/80	BZ	Total	5.70	trepanner	0.19
1/18/80	BZ	Respirable	6.68	M.O. midroom	0.16
1/18/80	BZ	Respirable	6.68	M.O. midroom	0.26
1/18/80	BZ	Respirable	6.63	M.O. midroom	0.21
1/18/80	GA	Total	5.90	bagroom	0.58
1/18/80	GA	Respirable	6.78	bagroom	N.D.

Bulk sample contained no silica

*General Area (GA), Breathing Zone (BZ)

**N.D. - None detected

Appendix 2

Charcoal Tube Analyses

U.S. Precision Lens Inc.
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<u>Date</u>	<u>Substance</u>	<u>Type</u>	<u>Sample Time (hrs)</u>	<u>Location</u>	<u>Air Concentration (ppm)</u>
1/17/80	Monomeric Methyl Methacrylate	GA*	5.42	between #5 & #1	1.8
1/17/80	Monomeric Methyl Methacrylate	GA	5.23	trepanner	0.9
1/18/80	Monomeric Methyl Methacrylate	GA	5.75	#2	2.0
1/18/80	Monomeric Methyl Methacrylate	GA	5.18	trepanner	1.5
1/17/80	Toluene	BZ*	5.72	spray painter	< 1
1/18/80	Toluene	BZ	5.58	spray painter	< 1
1/18/80	1,1,1-trichloroethane	GA	5.33	M.O. near warehouse	6.3
1/18/80	Isopropyl	GA	5.22	M.O. coating room	7.1

*General Area (GA), Breathing Area (BZ)

Appendix 3

Magnesium Fluoride, Iron Oxide and Oil Mist
Environmental Sampling Results

U.S. Precision Lens Inc.
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<u>Date</u>	<u>Substance</u>	<u>Type</u>	<u>Sampling Time (hrs.)</u>	<u>Location</u>	<u>Air Concentration (hrs.)</u>
1/17/80	Magnesium Fluoride(as Mg)	BZ	5.67	coating room	0.02
1/18/80	Magnesium Fluoride(as Mg)	BZ	5.13	coating room	N.D.*
1/17/80	Iron Oxide (as Fe)	GA*	6.13	tool room(west)	0.14
1/17/80	Iron Oxide (as Fe)	GA	6.10	tool room(east)	0.27
1/18/80	Iron Oxide (as Fe)	GA	7.08	tool room(west)	7.08
1/18/80	Iron Oxide (as Fe)	GA	7.00	tool room(east)	0.07
1/17/80	Oil Mist	GA	6.22	tool room(west)	0.72
1/17/80	Oil Mist	GA	6.22	tool room(east)	0.87
1/18/80	Oil Mist	GA	7.08	tool room(west)	1.07
1/18/80	Oil Mist	GA	7.05	tool room(east)	0.66

General Area (GA), Breathing Zone (BZ)
*None Detected (ND)