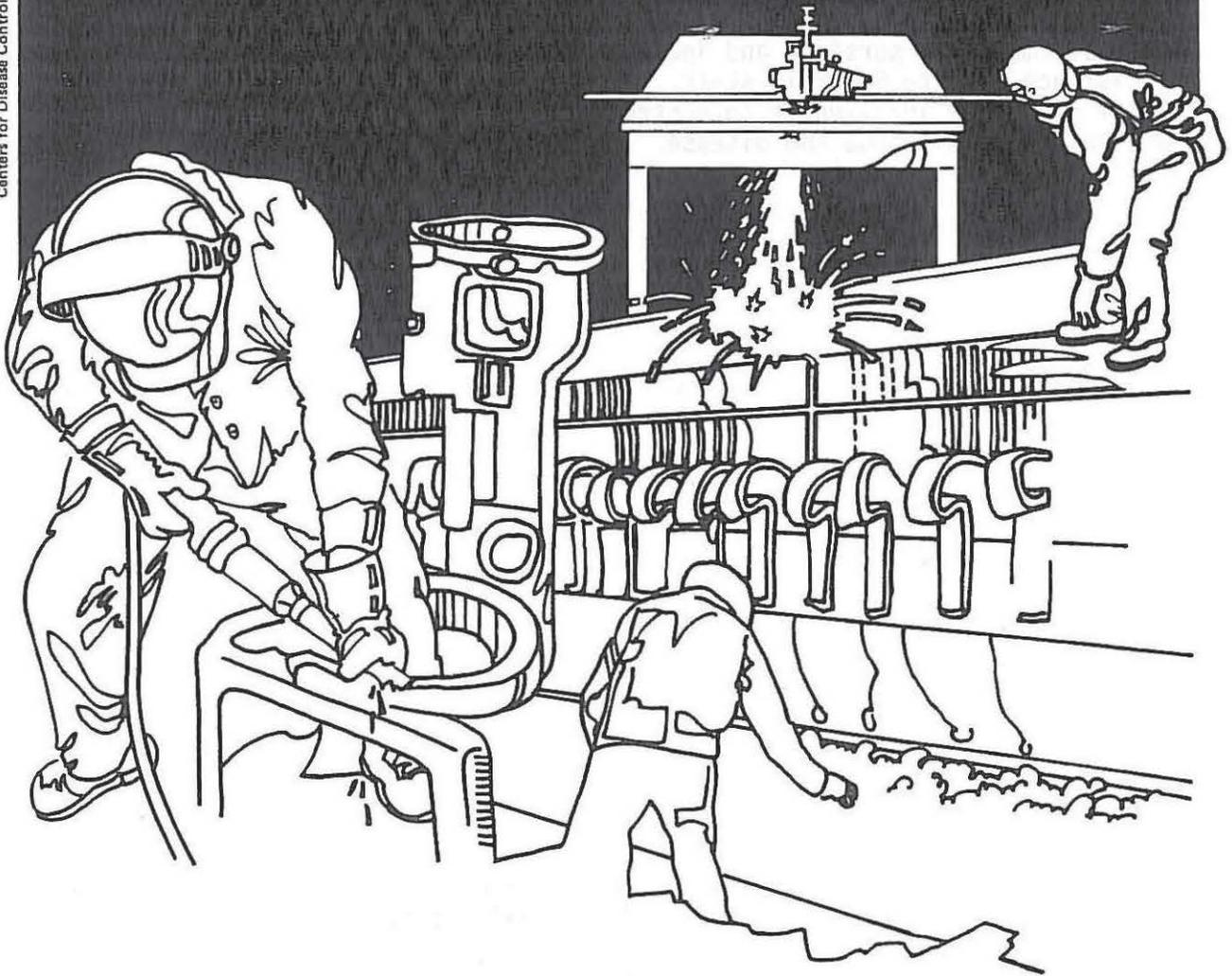


NIOSH



Health Hazard Evaluation Report

HETA 81-105-831
LABELS WEST, INC.
REDMOND, WASHINGTON

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 81-105-831
MARCH 1981
LABELS WEST, INC.
REDMOND, WASHINGTON

INVESTIGATOR:
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I SUMMARY

In December, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the owner of Labels West, Inc. to determine whether a potential health hazard existed from exposures to perchloroethylene, chlorine, and hydrogen chloride used and/or found in the plate making process and to the organic solvents used in the label printing process.

NIOSH conducted an environmental survey on December 16 and 17, 1980. Personal breathing zone air samples were collected for butyl cellosolve, ethyl alcohol, isopropyl alcohol, methyl ethyl ketone, perchloroethylene, chlorine, hydrogen chloride, and phosgene. A short pre-and post-shift questionnaire regarding irritative and systemic symptoms was administered with the 7 exposed day-shift workers.

Analysis of the environmental data indicated that the employee conducting layout and plate making was overexposed to a combination of chlorine, hydrogen chloride, and organic solvents. The worker was exposed from 3 to 6 times a day for about 7 minutes each time to chlorine concentrations of 3 ppm (NIOSH recommended standard-0.5 ppm ceiling) and hydrogen chloride concentrations of 25 ppm (OSHA and WISHA standards - 5 ppm ceiling). After the 1st day of sampling we recommended modifying the ventilation system. This modification reduced the chlorine levels to 0.3 ppm and the hydrogen chloride levels to 5 ppm. During these 2 days the plate maker was also exposed to 8-hour time weighted average, solvent vapor concentrations that were 58-62% of the WISHA standards and 68% of the NIOSH-recommended standards. During this period he reported having a post-shift headache, irritation of the eyes, dry and constricted throat, tightness of the chest and productive cough. The pressmen were not overexposed to butyl cellosolve, ethyl alcohol, isopropyl alcohol, methyl ethyl ketone and perchloroethylene. The combined exposure to these substances was from 58 to 78% of the OSHA and WISHA standards and from 64 to 85% of the NIOSH-recommended standards. Of the pressmen, one reported having a slight headache and slight irritation of the eyes at the end of the shift.

On the basis of this investigation, NIOSH determined that a hazardous exposure to chlorine and hydrogen chloride existed during the making of plates. Changes made in the ventilation system at the end of the first day of sampling significantly reduced these exposures. NIOSH also determined that the plate maker's exposure to the ethyl alcohol, isopropyl alcohol, methyl ethyl ketone, perchloroethylene and butyl cellosolve vapors in combination with the chlorine and hydrogen chloride produced symptoms that were not experienced by the pressmen who were exposed to only the solvent vapors, but at levels slightly below (64-85%), the NIOSH-recommended standards. Ventilation and work practice recommendations have been included in this report to further reduce the airborne concentrations of chlorine, hydrogen chloride, and solvent vapors.

Keywords: SIC 2752 (commercial printing-labels) chlorine, hydrogen chloride, butyl cellosolve, ethyl alcohol, isopropyl alcohol, methyl ethyl ketone, perchloroethylene.

II INTRODUCTION

In December, 1980, NIOSH received a request from the owner of Labels West, Inc. to determine if a potential health hazard existed to perchloroethylene, chlorine, hydrogen chloride in the plate making process and to organic solvents used in the label printing process. An initial survey was conducted on December 11, and an environmental survey on December 16 and 17, 1980. A written report including extensive ventilation recommendations and the environmental results available at the time was submitted to the company on January 7, 1981.

III BACKGROUND

Labels West prints pressure sensitive roll labels. The printing plates are made from a flexible polymer called Cyrel^R. A photographic negative is laid over the plate material and exposed to ultraviolet light. This process hardens the exposed portion of the plates. The plates are then placed in a bath of perchloroethylene, which dissolves the unhardened plate material leaving a raised image. The plates are dried with infrared heat, and are finished by rinsing in a chlorine solution made by mixing a household bleach and hydrochloric acid. The finished plates are transferred to a sink and rinsed with water. The Cyrel^R processor, infrared drier and the finishing hood are equipped with local exhaust ventilation. There is also an exhaust ventilation grill at floor level under the sink.

The printing is an offset process. A roll of blank labels is fed continuously through the press and then rerolled. The pressmen are exposed to solvents present in the inks and the roller washes. The solvents most commonly used are butyl cellosolve, ethyl alcohol, isopropyl alcohol, and methyl ethyl ketone. Ethyl alcohol is used in the largest quantities as a roller wash. The only ventilation in the printing area is through the adjacent plate making room. There are 6 pressmen and 1 layout-plate maker for each of the 2 shifts.

IV EVALUATION DESIGN AND METHOD

A. Environmental - Breathing zone air samples were collected for chlorine, hydrogen chloride and phosgene on detector tubes. Butyl cellosolve, ethyl alcohol, isopropyl alcohol, methyl ethyl ketone, and perchloroethylene vapors were collected on charcoal tubes at a flow rate of 25 to 50 cc/min. These samples were analyzed by gas chromatography using NIOSH method P&Cam 127 (modified). The limits of detection were 0.08 ug/sample for ethyl alcohol and 0.01 ug/sample for the other solvents.

B. Medical - Medical evaluation consisted of a short pre and post-shift questionnaire regarding headache, nausea, lightheadedness, irritation of the eyes, nose and throat, dizziness, coughing, and tightness of the chest.

V. EVALUATION CRITERIA

A. ENVIRONMENTAL

SUBSTANCE	NIOSH	CURRENT
	Recommended Standard 10 HR. TWA*	OSHA & WISHA Standard 8 Hr. TWA
Butyl Cellosolve	—	50 ppm
Chlorine	0.5 ppm (ceiling)	1 ppm
Ethyl Alcohol	—	1000 ppm
Hydrogen Chloride	—	5 ppm (ceiling)
Isopropyl Alcohol	400 ppm	400 ppm
Methyl Ethyl Ketone	200 ppm	200 ppm
Perchloroethylene	50 ppm	100 ppm

*TWA - Time weighted average.

B. Toxicology

Chlorine - Chlorine is irritating to the eyes, nose and throat. Because of its solubility in water it will readily irritate the throat and produce a cough. Chlorine may also reach the lungs causing pulmonary congestion, tightness in the chest and edema.

Hydrogen Chloride - Hydrogen chloride is highly irritating to the eyes, nose, throat and skin. Pulmonary edema is possible but usually the cough and choking sensation from irritation of the upper respiratory tract compel workers to leave the area.

Ethyl Alcohol, Isopropyl Alcohol, Methyl Ethyl Ketone, Perchloroethylene and Butyl Cellosolve. All of these organic solvents have similar effects. The vapors are irritating to the eyes, nose and throat. They produce narcosis, with symptoms of headache, dizziness, nausea, and incoordination. Contact with the liquids may cause a drying of the skin and dermatitis.

VI RESULTS AND DISCUSSION

Ventilation - In the plate making room there are 3 local exhaust and 1 general ventilation systems. The Cyrel^R processor and the finishing hood have built in exhaust fans. These 2 systems each have about 4-5 ft. of flexible duct connected to the fan outlets. These are joined together and share a common duct to the roof. This arrangement creates a positive pressure in the ductwork. Smoke tube tests showed that there were extensive leaks in the system. All the joints leaked and the junction of the 2 flexible ducts had a large opening. Because of the positive pressure in the ducts a large portion of the exhausted air reentered the work area. The velocity of the air entering the finishing hood was too low to measure. There was an exhaust unit mounted on the roof that exhausted air from below the sink. The infrared drying unit had an exhaust fan built into it so this duct system was also under positive pressure. It was also found to be leaking air at the joints.

Platemaking - The sampling was conducted on the first day with the exhaust systems operating as they had been. During the finishing, the plates are washed in a chlorine solution made by mixing household bleach and hydrochloric acid. This is done in the hood. The plates are removed from the hood and rinsed with tap water in the sink. These operations are done 3-6 times a day and take 6-8 minutes to complete. During these times, the operator would periodically bend over with his head close to the floor to get "fresh air". The chlorine concentrations during these periods were 3 ppm and the hydrogen chloride concentrations were 25 ppm. Phosgene was not detectable.

Before the next day, all the joints in the ducts were taped and the opening of the finishing hood was reduced 50%. With these modifications, the chlorine levels the next day were 0.3 ppm and the hydrogen chloride concentrations were 5 ppm. This was a large reduction from the previous day. Additional changes are needed in the ventilation system and are included in Recommendation Section VIII, of this report.

The plate maker was also exposed to a time weighted average perchloroethylene concentration of 10 ppm. In addition the organic solvent vapor from solvents and inks in the press area fill the entire room including the layout and plate making room. This combined solvent exposure was 58% of the WISHA and OSHA standards and 68% of the NIOSH recommended standard. (Table 1)

At the end of the 1st day, the plate maker had tightness in the chest, a headache, stuffy nose, irritation of the eyes, nose, and throat, and was coughing. He was coughing phlegm and had slight chest tightness before the shift on the second day, and at the end of the shift had a slight headache, some nasal irritation, dry throat, and tightness in the chest. These symptoms are probably a result of his combined exposure to the chlorine, hydrogen chloride and solvent vapor exposure during the work shift.

Pressroom - The pressmen (6 per each on 2 shifts) are exposed to the solvents in the inks, and the roller washes. These substances include butyl cellosolve, ethyl alcohol, isopropyl alcohol, methyl ethyl ketone and perchloroethylene. Since all have similar health effects, they were considered as additive and a combined exposure level was calculated for each sample. The average combined solvent vapor exposure for the pressmen on the first day was 75% of the WISHA and OSHA standards and 81% of the NIOSH recommended standards. On the second day they were 59% of the WISHA and OSHA standards and 66% of the NIOSH recommended standard. (Table 1) One pressman had a slight post-shift headache and slight eye irritation only on the second day. None of the other five pressmen had any of the following post-shift health effects on either day: headache, nausea, dizziness, lightheadedness, irritation of the eyes, nose, or throat.

Summary - On the basis of this investigation, NIOSH determined that the layout-platemaker was exposed to hazardous concentrations of chlorine and hydrogen chloride and that the additional exposure to solvent vapors may have provided additional symptoms (headaches) and increased other symptoms such as irritation of the eyes, nose, and throat. The pressmen's exposures were slightly below the limit (range 64-85%) recommended by NIOSH for combined exposure to solvent vapors.

VII RECOMMENDATIONS

1. An opening should be cut just above the sink in the exhaust duct that passes directly behind it and the opening below the sink blocked off. An enclosure should be constructed over the sink area. This will capture the chlorine and hydrogen chloride generated when the plates are rinsed off.
2. The finishing hood and the plate processor should have separate exhaust systems. The fans should be mounted on the roof so the entire systems are under negative pressure.
3. The exhaust rate for the finishing hood should be at least 300 cfm.
4. An exhaust hood should be constructed over the plate processor with an exhaust rate of at least 300 cfm.
5. Until new ventilation systems are installed, the fans on both the finishing hood and the processor must be on at the same time. When one is on and the other is off, the exhausted air backs up through the other system and reenters the room.
6. The tape on the duct joints should be checked several times a month. Perchloroethylene vapors may loosen the adhesive on the tape and leaks will result.
7. Whenever air is exhausted from the room, the air has to be replaced. When the door to the plate room is closed, the ventilation system does not work properly. A grill should be installed in the door or in the wall next to the door. The opening should be about 9 square feet or larger.
8. Air inlets should be installed in the back of the pressroom. This would permit air being exhausted from the plate room to first sweep through the pressroom. This should reduce the solvent vapor concentration in the pressroom.
9. All solvent soaked cleaning rags should be placed in self-closing containers immediately after use.
10. All cans of solvent should be labeled.
11. Storage cabinets for flammable liquids must meet the requirements listed in the WISHA and OSHA regulations.
12. The employees should be educated regarding the health effects, proper handling and storage of the organic solvents used.

VIII REFERENCES

1. National Institute for Occupational Safety and Health Criteria for Recommended Standards. Occupation Exposure to Chlorine. NIOSH Pub. No. 76-170

2. National Institute for Occupational Safety and Health Criteria for Recommended Standards. Occupational Exposure to Isopropyl Alcohol NIOSH Pub. No. 76-142.
3. National Institute for Occupational Safety and Health Criteria for Recommended Standards. Occupational Exposure to Ketones. NIOSH Pub. No. 78-173.
4. National Institute for Occupational Safety and Health Criteria for Recommended Standards. Occupational Exposure to Tetrachloroethylene (Perchloroethylene) NIOSH Pub. No., 76-185.
5. Occupational Diseases. A guide to their Recognition. NIOSH Pub. No. 77-181.
6. Industrial Hygiene and Toxicology Vol. 11 2nd Revised Edition. Frank A. Patty. Interscience Publishers. New York, N.Y..

IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this complete Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio, 45226. After ninety (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:

1. Labels West, Inc.
2. U.S. Department of Labor, Occupational Safety and Health Administration, Region X, Seattle, Washington.
3. Washington Industrial Safety and Health Agency, Washington Department of Labor, Olympia, Washington.

For the purpose of informing the 14 affected employees, the employer shall promptly post this Determination Report in a prominent place(s) near the work area of the affected employees for a period of thirty (30) calendar days.

X. ACKNOWLEDGMENTS

Report prepared and survey conducted by:

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Originating Office:

Hazard Evaluation and Technical
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DSHCFS/NIOSH

TABLE 1

LABELS WEST, INC.
 REDMOND, WASHINGTON
 HE 81-105
 SOLVENT VAPOR AIR CONCENTRATIONS

JOB	DATE	SAMPLE NUMBER	SAMPLE TIME MIN.	BUTYL	ETHYL	ISOPROPYL	METHYL	PERCHLOR-	COMBINED SOLVENT	
				CELLOSOLVE TWA* ppm	ALCOHOL TWA ppm	ALCOHOL TWA ppm	ETHYL KETONE TWA ppm	ETHYLENE TWA ppm	WISHA & OSHA STDS	% of NIOSH RECOMMENDED STDS.
Layout & Plate Maker	12-17-81	1 & 7	454	1	273	32	21	10	58	68
Pressman	12-17-81	2 & 8	398	2	312	39	53	7	78	85
Pressman	12-17-81	3 & 9	390	2	306	42	42	7	73	80
Pressman	12-17-81	4 & 10	393	2	282	40	51	6	74	80
Layout & Plate Maker	12-18-81	13 & 19	427	(1)	(82)	(10)	(8)	(6)	(23)	(29)
Pressman	12-18-81	14 & 20	408	2	294	38	25	7	62	69
Pressman	12-18-81	15 & 21	404	2	291	37	18	7	58	65
Pressman	12-18-81	17 & 23	406	2	260	32	27	6	58	64

* Time weighted average in parts per million.

** When 2 substances are present that have similar health effects, they are considered additive and a combined permissible exposure level is calculated for each sample.

() The sampling pump malfunctioned during the sampling period.

