

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

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 78-77-659

R.L. POLK COMPANY
CINCINNATI, OHIO

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I. SUMMARY

On April 28, 1978, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate complaints of burning of the eyes and mouth, skin irritation and headaches in workers employed in the Graphic Services Department of R.L. Polk Company, Cincinnati, Ohio. To evaluate the causes of those symptoms, NIOSH conducted an industrial hygiene and medical evaluation of eighteen exposed workers. Personal breathing zone air samples for determination of organics and amines were obtained. Bulk samples of two chemicals recently introduced into the work area were analyzed to identify the chemical components. Swipe samples were obtained and analyzed to determine residual levels of these components on work surfaces. The general state of health of employees was evaluated through administration of non-directed medical questionnaires. A dermatologist tested one employee to discover whether this employee had become sensitized to the components of an electrostatic premix toner.

Four organic solvents were determined to be potential sources of vapors in the work area: methylene chloride, 1,1,1-trichloroethane, perchloroethylene and isodecane. Exposure levels were all below the NIOSH recommended health standard for each of these substances considered singly and were less than the combined standard when additive affects were considered. Minor ingredients of an electrostatic premix toner-polymethacrylate and polyamine (specific names "Trade Secret") - were not detected through either personal breathing zone sampling or swipe testing.

One employee who experienced hive-like lesions on the lips and tongue and numerous episodes of nausea was determined by skin-testing to be hypersensitive to isodecane, the major solvent used in newly installed equipment. Reactions of this severity to isodecane are considered rare.

On the basis of data obtained in this investigation, NIOSH determined that a health hazard due to exposure to chemicals did not exist at the Graphic Services Department of R.L. Polk Company except for one employee who was determined to be hypersensitive to isodecane. This employee's medical problems relating to the isodecane were resolved by relocating to another work station remote from the Graphic Services Department and this agent. Recommendations on ventilation and work practices to reduce complaints from employees are incorporated in detail on page 6.

III. BACKGROUND

R.L. Polk Company has been operating for 35 years. The Graphic Services Department was established 25 years ago. There are approximately 600 employees 19 of whom work in this area (Graphic Services Department). There are two shifts. The primary activity of the Graphic Services Department is the conversion of computerized microfilm data to hard copy and subsequent reproduction for mass distribution. There are 3 major work areas within the Graphic Services Department: the developing and platemaking area, the mat preparation area and the multilith press area (Figure 1). Rolls of 35mm microfilm are received from the computer section. After developing in the Informational International Model 1120 film processor, the developed film is loaded into one of two Informational International Model 800 Platemakers where the information is transferred from the microfilm to printed mats. The mats are inspected, categorized and duplicated on one of 11 multilith presses. Increased numbers of complaints resulted from exposure to the platemaker chemicals. Primarily, the source of the problem was alleged to be handling of the fresh mats which still contained residual amounts of platemaker chemicals.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Liquid bulk samples of the premix toner and offset dispersant were analyzed to determine their chemical components. After determination of the specific components, a sampling strategy was developed to evaluate employee exposures to the platemaker chemicals, as well as to other organic solvents used in the cleaning of the multilith presses. Exposure to vapors of the various chemicals was evaluated using personal breathing zone sampling techniques as described in Appendix A. Swipe testing using a gauze pad was accomplished in the work area and on the hands of a few employees to determine residual amounts of chemicals.

B. Medical

Non-directed medical questionnaires were administered by the project officer to the 18 exposed workers to determine the occurrence of possible job-related illnesses. One employee was evaluated further for possible sensitization to components of the premix toner through a standard skin test procedure performed under contract with a dermatologist. Since the toner was a mixture of several compounds, the manufacturer provided individual components to facilitate the skin testing. The following substances were used:

Isopar "G", mixture of isodecans
polymethacrylate in Isopar "G"
polyamine in Isopar "G"
The specific dye used in Isopar "G"

Results of the personal breathing zone sampling for organics are shown in Appendix B. The results of testing for the four major organic solvents, expressed by work area, indicate that employee health problems would not normally be expected under the working conditions observed. The highest individual level found was the platemaker's exposure to isodecane at a concentration of 23.5 ppm or 31% of the estimated* health criteria (75 ppm). Other personal exposures to this compound were essentially the same in all work areas and averaged 11.0 ppm. Exposures to 1,1,1-trichloroethane were all less than 1 ppm. Perchloroethylene exposures were essentially the same and averaged 10 ppm in the mat preparation and multilith areas. The platemaker and film processor's exposure to this substance were each 3.3 ppm. The multilith operators and mat preparation personnel were exposed to an average of 18 ppm methylene chloride while the platemaker and film processor's exposure were 5.5 and 6.5 ppm respectively.

The isodecane results indicate that the vapors from this solvent were spreading to the mat preparation and multilith work areas through volatilization of residual isodecane on the mat material and possibly through the heating system, which is 100% recirculated. Cotton gloves were used by some of the mat preparation personnel to decrease skin irritation from handling the mats.

No detectable airborne levels of amines or methacrylates were found and only traces of isodecane were found on the swipe samples.

The health effects from each of the 4 solvents evaluated are similar, therefore, these effects are additive. Calculations of additive exposure, using the exposure data from Multilith Operator 3 (worst case), result in a number less than unity (0.7). Therefore, the combined health standard is not exceeded. This method is explained in more detail in Appendix C.

B. Medical

Seven of the 19 personnel interviewed complained of some irritation when the new platemaking equipment was put into operation. The most common symptoms were: burning of the eyes and mouth, headaches and slight feeling of dizziness. There were a few employees (mostly multilith operators) who complained of headaches and an occasional feeling of dizziness even before the new equipment was installed. Those symptoms associated more closely with the operation of the new equipment (eye and mouth irritation) decreased in intensity for most employees as time went on; however, one employee who also experienced episodes of nausea reacted more severely and eventually had to relocate away from exposure to the platemaking chemicals. This employee was subsequently determined to be hypersensitive to the isodecane solvents contained in both the premix toner and offset dispersant. This is a rare reaction. The manufacturer

*Isodecane does not have a health standard; however, since it is a saturated, aliphatic hydrocarbon, its toxicity would be expected to be similar to other such compounds i.e., octane which has a recommended health standard of 75 ppm.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. REFERENCES

1. Criteria for a Recommended Standard . . . Occupational Exposure to Methylene Chloride. DHEW (NIOSH Publication No. 76-138), March, 1976.
2. Criteria for a Recommended Standard . . . Occupational Exposure to 1,1,1-Trichloroethane. DHEW (NIOSH Publication No. 76-184), July, 1976.
3. Criteria for a Recommended Standard . . . Occupational Exposure to Perchloroethylene. DHEW (NIOSH Publication No. 76-185), July, 1976.
4. Current Intelligence Bulletin - Tetrachloroethylene (Perchloroethylene), DHEW, NIOSH, Bulletin No. 20, January 20, 1978.
5. Criteria for a Recommended Standard . . . Occupational Exposure to Alkanes. DHEW (NIOSH Publication No. 77-151), March, 1977.

APPENDIX A
SAMPLE METHODOLOGY

Methylene Chloride

Seven personal breathing zone samples were taken from employees in the Graphic Services Department of R.L. Polk Company. These samples were collected on charcoal tubes using battery-powered sampling pumps operating at 50 cc per minute. The samples were worn by the employees for approximately 7 hours and resulted in an average sample size of approximately 20 liters.

The charcoal tubes were subsequently desorbed by our Measurement Support Branch with 1 ml of CS₂ and analyzed initially by GC using a 20 feet, 55, 10%, SP 1000 column. GC/MS techniques were used to separate, and quantitate components.

1,1,1-Trichloroethane

same as above

Perchloroethylene

same as above

Isodecane

same as above

Swipe Samples

Approximately 1 sq. feet of various surfaces (10) within the work area under evaluation were swiped with a filter paper. The hands of 8 employees were also swiped. Dry filter papers were used in approximately 1/2 the samples taken while wet filter papers (alcohol saturated) were used for the rest. Each swipe sample was desorbed with 2 ml. CS₂, sonified, and then analyzed by GC using a 12 feet, 10%, SP 2100 column, temperature programmed up to 300°.

APPENDIX C

In general, health effects from exposure to each of the 4 solvents evaluated would be similar. Therefore, their effects should be considered to be additive⁶. Additive exposure is evaluated as follows:

If the sum of the following fractions

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_m}{T_m}$$

exceeds unity, then the threshold limit of the mixture should be considered as being exceeded. In these fractions, C_1, C_2, \dots, C_m are the measured airborne concentrations and T_1, T_2, \dots, T_m the corresponding threshold limits. The NIOSH recommended standard can be substituted for the ACGIH Threshold Limit Value. The worst case exposure in this investigation is multilith operator 3. For that worker, the values for the fractions above are:

Methylene Chloride:	$C_1 = 22.5$	$T_1 = 75$
1,1,1-Trichloroethane:	$C_2 = 0.9$	$T_2 = 350$
Perchloroethylene:	$C_3 = 11.4$	$T_3 = 50$
Isodecane:	$C_4 = 12.7$	$T_4 = 75$

therefore,

$$\frac{22.5}{75} \times \frac{0.9}{350} + \frac{11.4}{50} + \frac{12.7}{75} = 0.7$$

0.7 is less than unity. Therefore, the combined health standard is not exceeded.

TABLE I

R.L. POLK COMPANY
HE 78 - 77CURRENT HEALTH STANDARDS
(ppm)*

Substance	NIOSH	OSHA	ACGIH(TLV)	Possible Health Effects If Overexposed
Methylene Chloride	75 500 (ceiling)**	500 1000 (ceiling)	200 250 (STEL)***	Central nervous system depressant, skin and eye irritant, can cause chest pains and heart palpitations!
1,1,1-Trichloroethane	350 (ceiling)	350	350 450 (STEL)	Same as above
Perchloroethylene	50 100 (ceiling)	100 200 (ceiling)	100 150 (STEL)	Same as above. Repeated exposure to high levels may cause liver and kidney damage.
isodecane****	75 350 (ceiling)	None	None	Central nervous system depressant, skin and eye irritant.

*ppm - part per million (parts of contaminant per million parts of air)

**Ceiling value should not be exceeded.

***Short Term Exposure Level (15 min. exposure)

****No health standard but similar to alkanes; therefore, the standard should be approximately as indicated as a source of comparison.