This Health Hazard Evaluation (HHE) report and any recommendations made herein are for the specific facility evaluated and may not be universally applicable. Any recommendations made are not to be considered as final statements of NIOSH policy or of any agency or individual involved. Additional HHE reports are available at http://www.cdc.gov/niosh/hhe/

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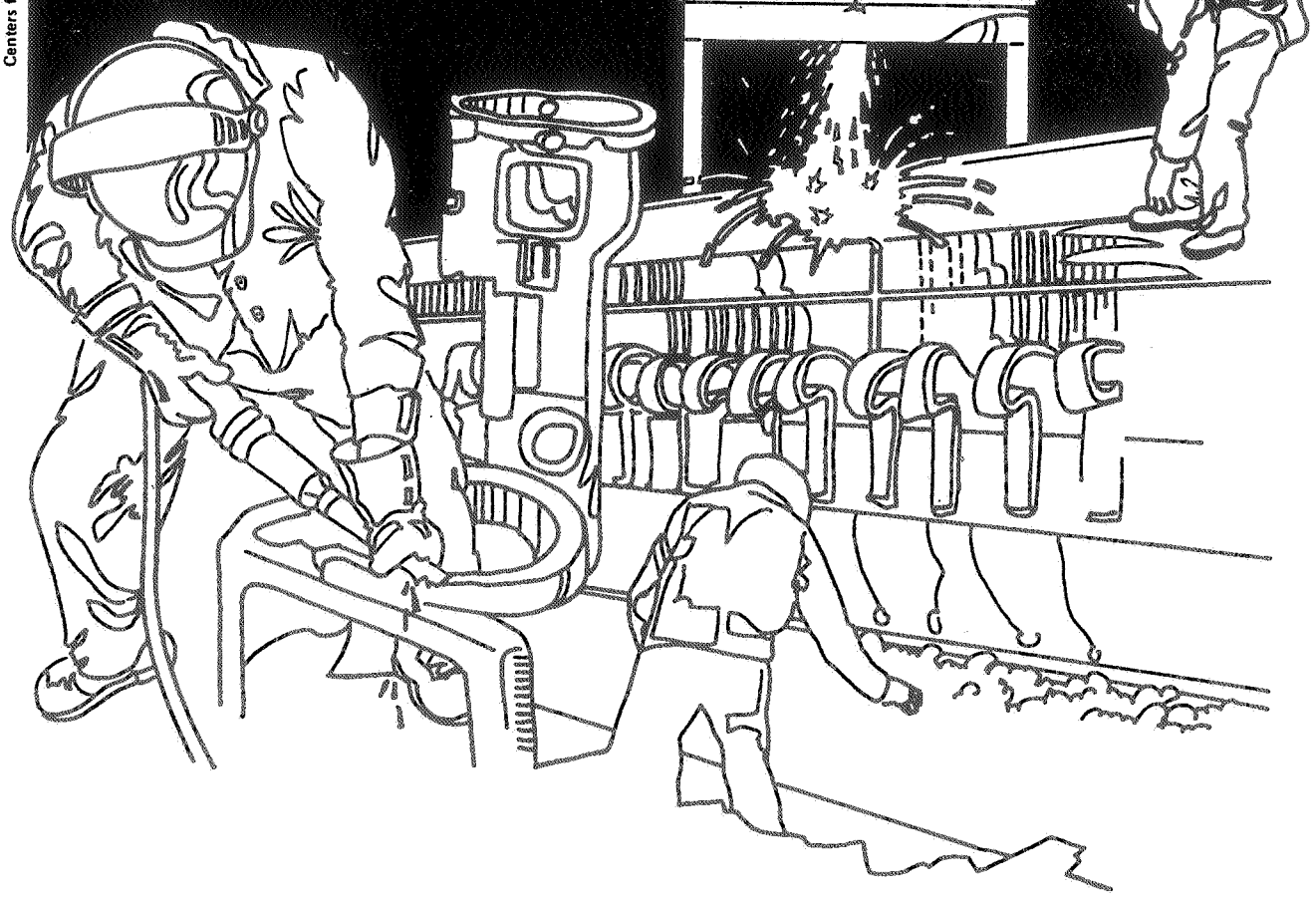

Health Hazard Evaluation Report

HETA 81-173-1051
DITTLER BROTHERS, INC.
ATLANTA, GEORGIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts 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 81-173-1051
February, 1982
Dittler Brothers, Inc.
Atlanta, Georgia

NIOSH Investigators:
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I. SUMMARY

On May 27, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Atlanta Typographical Union No. 48 to conduct a health hazard evaluation at Dittler Brothers, Inc., Atlanta, Georgia. Of concern were a variety of reported health problems including dermatitis, loss of energy and appetite, anemia and leukemia among employees engaged in various printing activities.

The field investigation was conducted on September 17, 1981. Workers at this plant are involved in various printing activities such as photography, film developing, cutting and splicing film and operating several presses. These operations, which employ approximately 100 workers over three shifts per day, take place in three separate locations within the building: composing rooms, preparation rooms, and press rooms.

The composing area is served by a separate air handling unit which cools and heats the air as needed and circulates 3,500 cfm to the 3,650 sq. ft. area (0.96 cfm/sq. ft.). No fresch makeup air is drawn into this unit from out-of-doors. Generally, air for this area is exhanged with adjacent areas of the building. The majority of dermatitis complaints came from the composing area. Air samples for 23 organic compounds were taken in all three areas. Analysis of field samples indicated vapor concentrations fairly evenly distributed throughout the work areas regardless of the location of chemical usage and storage. Isopropanol was detected in 21 of 23 field samples and concentrations ranged from 6 to 211 ppm. The 8-hour TWA Limit for isopropanol recommended by ACGIH is 400 ppm. Benzene exceeded 1 ppm in five air samples, with the highest concentration being 2.4 ppm. NIOSH recommends a ceiling limit for benzene of 1 ppm, 2-hour TWA. Acetic acid was analyzed in 13 air samples and was detected in 6 with vapor concentratons ranging from 1.6 to 6.1 ppm. The 8-hour TWA limit for acetic acid recommended by ACGIH is 10 ppm. Other chemicals yielded low or non-significant air concentrations.

One case of leukemia was identified. Of the five other current or former employees identified as having had illness possibly associated with conditions of work one reported having had a fine granular skin rash. On the basis of available information it cannot be determined whether or not this condition was work related. Of the remaining four cases, information obtained suggests that the reported illnesses were not caused by conditions of work.

Although exposures to solvent chemicals in work environments have been associated with leukemia, an isolated case, as reported, does not constitute reasonable evidence of a causal association; conversely, one cannot dismiss the possibility of such association. Some processes in the plant expose some employees to solvent vapors or particulate materials. Irritation of the skin or upper respiratory tract may be related to these exposures.

It is recommended that changes be made in ventilation of the composing room and that only solvents containing less than one percent by volume of benzene be used. Specific recommendations appear in Section VIII.

KEYWORDS: SIC 2750, printing, printers, isopropanol, acetic acid, benzene

II. INTRODUCTION

On May 7, 1981, the National Institute for Occupational Safety and Health (NIOSH) received from Atlanta Typographical Union #48 a request for a health hazard evaluation at Dittler Brothers, Inc. in Atlanta, Georgia. The request stated that a variety of health problems exists including dermatitis, loss of energy and appetite, anemia and leukemia among employees engaged in various printing activities.

III. BACKGROUND

The health hazard evaluation was begun at the plant on September 17, 1981, by the Occupational Health Studies Group, University of North Carolina, Chapel Hill, North Carolina, under a cooperative agreement with, and as a representative of, NIOSH. The team of investigators consisted of an engineer, a physician-epidemiologist, and an industrial hygienist.

Workers at this plant are involved in various printing activities such as photography, film developing, cutting and splicing film and operating several printing presses. These operations take place in three separate locations within the building: composing, preparation and press rooms. These operations employ approximately 100 workers over a period of 24 hours (three shifts).

IV. METHODS

A. Environmental

Environmental evaluation consisted of interviews with company personnel about environmental conditions, a walk-through industrial hygiene survey and collection of air samples for organic vapor analyses. The majority of the complaints came from the composing area, therefore more time was spent on its evaluation than on the preparation and press rooms. However, air samples were taken in all three areas. Air samples were collected using charcoal tubes and analyzed for organic vapors by means of gas chromatography following elution by carbon disulfide. Ventilation measurements were made in the composing room.

B. Medical

Medical evaluation consisted of interviews with employees, questioning physicians of employees with reported or potential work-related health problems, and examining those employee work history records considered to be pertinent to the evaluation.

C. General

A closing conference was held with management and union personnel to discuss the nature and scope of the evaluation, to review its findings, and to offer suggestions for improving conditions as observed during the one day of evaluation.

V. EVALUATION CRITERIA

A. Environmental

The criteria for evaluating the 23 organic vapors assayed are the current American Conference of Governmental Industrial Hygienists Threshold Limit Values (ACGIH-TLV), the U.S. Department of Labor Occupational Health Standards (OSHA), NIOSH Criteria Documents, and the NIOSH Registry of Toxic Effects of Chemical Substances. Limits appearing below reflect the lowest recommendations found among these sources.

Substance	Ceiling Limit or STEL (ppm)	8-hour Time Weighted Average (ppm)	Source	OSHA Limit (6)
Isopentane	610	120	NIOSH (1)	1,000
n-Pentane	610	120	NIOSH (1)	1,000
2,2-Dimethylbutane	510	100	NIOSH (1)	none
3-Methylpentane	510	100	NIOSH (1)	none
2-Methylpentane	510	100	NIOSH (1)	none
n-Hexane	125	100**	ACGIH (2)	500
Cyclopentane	900	600	ACGIH (2)	none
Methylcyclopentane	1,000*	500*	ACGIH (2)	none
n-Heptane	440	85	NIOSH (1)	500
Cyclohexane	375	300	ACGIH (2)	300
Methylcyclohexane	500	400	ACGIH (2)	500
n-Octane	385	75	NIOSH (1)	500
1,1,1-Trichloroethane	350	350	NIOSH (7)	350
Methyl ethyl ketone	300	200	ACGIH (2)	200
Isopropanol	500	400	ACGIH (2)	400
Benzene	1***	-	NIOSH (8)	10
Trichloroethylene	150	25	NIOSH (3)	100
Toluene	150	100	ACGIH (2)	200
Ethylene dichloride	15	5	NIOSH (7)	50
Xylenes; o,p,m	150	100	ACGIH (2)	100
Acetic Acid	15	10	ACGIH (2)	10

*Proposed TLV
**TLV of 50 ppm proposed by ACGIH
***2-hr. TWA Limit

The ventilation criteria used were the American Society of Heating, Refrigerating and Airconditioning Engineers (ASHRAE) recommendations for ventilation and for maintaining comfortable temperature and humidity (4,5).

B. Medical

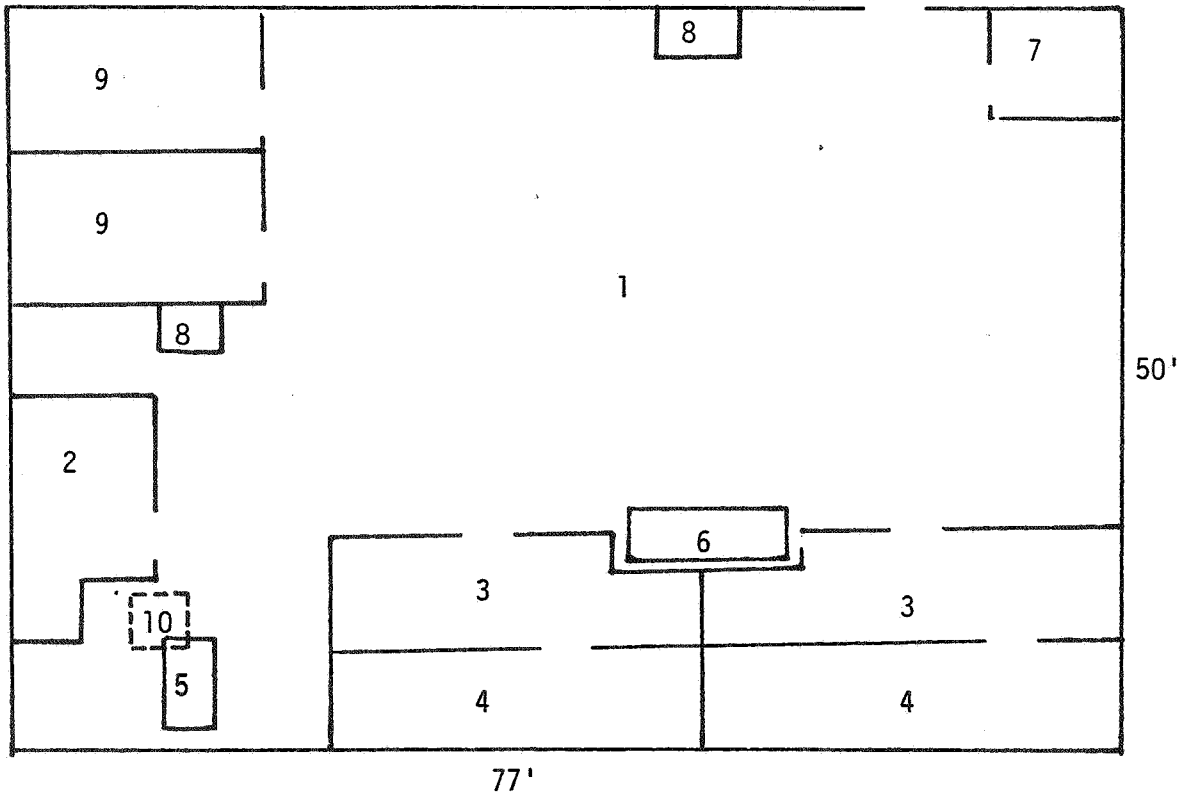
The purpose of this trip was to ascertain the nature of employee complaints related to worker exposures and to obtain documentation for the reported medical problems. Medical evaluation criteria used were the physician's judgment based on personal interviews, communication with the affected employees' physicians, and an attempt to estimate the population at risk by reviewing employment records contained in the personnel files.

VI. RESULTS

A. Environmental

The Company composing department occupies an area as shown in the sketch below. Descriptions of the numbered locations follow.

FIGURE 1 - COMPOSING AREA (not to scale)



1. Pasting area: This is an open area containing several tables on which items are composed. Chemicals used are a petroleum solvent used to clean film, an ammonia-based glass cleaning spray, and an anti-static spray.

2. Typesetting: In this room type is set with the use of video display terminals. No chemicals are used.

3. Photography: Photographs are taken of composed items. High-intensity lighting is used intermittently using pulsed xenon lamps (1500 W Ascorlux II) during photographing. An ozone odor was detected in these rooms.

4. Dark rooms: Negatives are developed and prints exposed. Shielded ultraviolet (UV) lights are used in these rooms.

5. Film processor: Sodium sulfite, boric acid, acetic acid, and aluminum sulfate are hand mixed in 5-gallon lots and placed in the processor.

6. Film processor: Aqueous hydroquinone (8%), sodium sulfite, and alkali are used as developer, and acetic acid and aluminum sulfate as fixer.

7. Film processor: This room contains a small processor using ammonia. There is a small exhaust vent in this room. Air flow could not be measured but is very low.

8. Waxer: These units (2) are open baths of melted pressure sensitive adhesive wax material used as a wax glue. Odor of this wax pervaded the air of the composing room.

9. Offices

10. Return air grille in ceiling

The composing area is served by a separate air handling unit which cools or heats the air as needed, and is located above the composing area ceiling. Air is distributed through ceiling outlets to the entire area except the typesetting room, which has a separate air conditioner. Air is returned through one 4 ft. X 4 ft. screened opening in the ceiling leading directly into the air circulating unit.

No fresh makeup air is drawn into this unit from the outside. The only makeup air the composing area receives is that which exchanges with the adjacent areas of the building (press room, preparation area) or infiltrates from outside. It was not known whether the

return air was filtered or humidified. Air flow measurements made at the return air grille indicated that 3,500 cubic feet per minute (cfm) of air is being recirculated. The composing area (less the typesetting room) has a floor area of approximately 3,650 square feet, with 8.5 ft. ceilings.

There are no specific air quantity requirements for ventilating printing plants; the amount of air needed depends on the airborne contaminants generated, heat load, the amount of local exhaust ventilation for particular processes, and other factors. However, ventilation guidelines for composing rooms are the same as for offices (4). Therefore, the conditions found in the composing area can be compared to requirements for general offices where generation of airborne contaminants and heat load would be minimal. Total air circulation in the composing room was calculated to be 0.96 cfm/sq. ft. of floor area, which is within the 0.75 to 2.0 cfm/sq. ft. range recommended by ASHRAE for office buildings. Fresh air supply was zero cfm/sq. ft. of floor area; the ASHRAE recommended range is 0.25 to 0.4 cfm/sq. ft. (4,5).

Twenty-three air samples (both personnel and area) were collected in the composing, preparation and press rooms (see Table 1). These were analyzed for the 23 vapors listed in Section V. Concentration in air of isopropanol was detected in 21 of the samples and ranged from 6 to 211 ppm. Benzene vapor concentrations exceeded 1 ppm in five samples with the highest concentration being 2.4 ppm. Acetic acid was analyzed for in 13 samples and was detected in six. Concentrations ranged from 1.6 to 6.1 ppm. Other chemicals analyzed for yielded concentrations very low relative to reference exposure limits.

B. MEDICAL

We identified three current and three former employees with health problems. They included three men and three women and ranged in age from 27 to 65 years. They had worked at the plant from 3 to 37 years. One person had leukemia diagnosed eight years after starting working at the plant. Another formerly had a recurrent rash, temporally related to working with the Opticopy machine. The others had, respectively, post-infectious acute polyneuritis (Guillain-Barre syndrome), eosinophilic granuloma (a non-malignant neoplastic disease affecting bones and other organs) which began at an early age, chronic low back pain, and an undiagnosed chronic problem.

VII. DISCUSSION AND CONCLUSIONS

We identified one case of leukemia; it occurred in an employee who worked as a stripper in the plate-making department. The diagnosis was made eight years after the employee began working at the plant. Although solvent chemicals in the work environment have been associated with leukemia, an isolated case such as this does not constitute reasonable evidence for an occupational health hazard. Generally, an interval of 10-25 years has been observed between exposure to environmental chemcials and manifestation of cancer. In this case, the interval was only eight years. No other cases of cancer have been reported from this occupational cohort. It cannot be dismissed that exposures to benzene may have taken place in the plant in the 1970's. In the current survey benzene vapor concentrations exceeded 1 ppm in five samples with the highest concentration being 2.4 ppm. NIOSH recommends a ceiling limit of 1 ppm, 2-hour TWA. In the Revised Recommendation for an Occupational Exposure Standard for Benzene, numerous epidemiologic studies are reported. NIOSH considers the accumulated evidence from clinical as well as from epidemiological data to be conclusive at this time that benzene is leukemogenic (8).

Since certain processes in the plant expose some employees to detectable vapors or paticulates, it is possible that irritation of the skin or upper respiratory tract may be related to these exposures. This does not appear to be a widespread complaint among the employees, but the symptoms of one employee could well be associated with the working environment.

Lack of adequate ventilation was noted in the composing area. The only local exhaust is for the film processor at location 7, Figure 1. Any other vapors or particulates generated depend on general ventilation for dilution to an acceptable level. There is little or no fresh makeup air provided. Dilution is an acceptable method for control of airborne materials of low toxicity. However, for this method to be effective, there must be adequate fresh air turnover and preferably with filtration or other treatment of recirculated air. The composing room apparently has neither. Other areas in the plant appeared to have ventilation problems similar to those of the composing room.

Sampling data indicated vapor concentrations fairly evenly distributed throughout the work areas regardless of the location of chemical usage and storage. This appears to be consistent with findings regarding the ventilation system which indicated that all areas mix air and have little or no makeup air entering the work areas. Benzene percentages in solvents used throughout the plant are reflected in the benzene concentrations noted in the solvent vapor samples. It has been reported on several occasions (5) that respiratory symptoms occur in work areas where ventilation is inadequate. Airborne chemicals generated at such rates that they are not ordinarily troublesome with typical ventilation may build up to irritating or toxic levels in the absence of adequate ventilation.

Even though specific causes of symptoms reported by employees were not determined, if the causes are airborne material it is likely that problems will be alleviated if adequate fresh makeup air is supplied in the range of 10 to 20 percent and if the return air is filtered. For the composing area, makeup air should be 350 to 700 cfm. One team member detected the odor of ozone in the photography areas, apparently coming from the pulsed xenon lamps. The manufacturer was contacted and indicated that there is no way for ozone to escape from a properly sealed lamp, but that 30 to 45 percent of the lamps the company makes are rejected and sent to local suppliers for sale. Reportedly, if the lamp is improperly seated, ozone may escape. Lamps passing company inspection are stamped "Ascor" on the cap. It should be noted that other NIOSH representatives later sampled for ozone with detection tubes in these areas and found none. There appears to be no excessive exposures of employees to ultraviolet light due to proper enclosures and shielding.

VIII. RECOMMENDATIONS

1) Adequate fresh makeup air should be supplied to the composing room. Outside air should be in the range of 10 to 20 percent (350 to 700 cfm) of total ventilation air, and both the fresh air and the return air should be passed through particulate filters for dust removal prior to being conveyed to the composing room.

2) Other areas such as the preparation room need to be further evaluated for adequate ventilation including fresh air makeup, circulation volume, and filtration of recirculated air.

3) The two adhesive wax baths in the composing room should have low volume exhaust vents to prevent the escape of wax odor, organic fumes and vapors into the room.

4) The benzene content of solvents used in printing operations should be limited. A purchasing specification limit as low as practicable and no more than 1 percent benzene (Volume/Volume) is recommended and certification of such content should be provided by the supplier for each shipment received.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

The cooperation of Mr. Wayne Harrell, Mr. Pat Barbar, Mr. Neal Lang, Mr. Bill Cross and other Management and Union officials in the environmental evaluation is hereby acknowledged. The cooperation and field survey assistance of Mr. Paul Roper, Regional Program Consultant, and other NIOSH officials are also acknowledged with appreciation.

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XI. DISTRIBUTION AND AVAILABILITY

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Copies of this report have been sent to:

(a) Dittler Brothers, Inc., Atlanta, GA

(b) Atlanta Typographical Union #48

(c) U.S. Department of Labor, OSHA, Region IV

(d) NIOSH Region IV

(e) Georgia Department of Human Resources

Table 1. Vapor concentrations for area and personal samples in the composing, preparation and press rooms at Dittler Brothers, Inc.

Charcoal Tube Sample Number and Sampling Time (minutes)	Location/comments	Vapor Concentrations (ppm)																					
		Isopentane	n-Pentane	2,2-Dimethyl-butane	3-Methyl-pentane	2-Methyl-pentane	n-Hexane	Cyclopentane	Methylcyclo-pentane	n-Heptane	Cyclohexane	Methylcyclo-hexane	n-Octane	1,1,1-Trichloro-ethane	Methyl ethyl ketone	Isopropanol	Benzene	Trichloro-ethylene	Toluene	Ethylene dichloride	Xylenes	Acetic acid
16 (126)	Area (same location as C.T. 15).	0.0*	0.0	0.0*	-	-	0.0	-	0.0*	0.0*	-	0.1	12	-	1.1	125	1.2	5.0	1.5	0.4	14	**
17 (87)	Personal, pressman on press number 42 adjusting ink flow.	0.1	0.0	0.0*	0.0	0.1	-	0.0	0.0*	0.0*	-	-	0.6	-	1.0	211	1.2	4.0	1.3	-	3.0	**
18 (131)	Personal (same worker as C.T. 17).	0.0*	0.0*	0.0*	0.1	0.0	0.1	0.0*	0.0	0.0	-	0.2	0.6	-	-	177	0.6	2.4	0.8	-	2.3	3.2
19 (88)	Personal, pressman on silk screen press using latex ink.	0.0*	0.0*	-	0.0*	0.0*	0.1	-	0.0*	0.0*	-	0.1	0.6	-	1.8	130	2.2	9.0	1.9	0.2	3.2	**
20 (119)	Personal (same worker as C.T. 19).	-	0.1	0.0	0.2	0.1	0.2	0.1	0.2	0.2	-	0.3	0.6	0.0	-	86	2.0	7.6	1.9	2.2	1.0	3.1
21 (91)	Area, press room on work table beside 01 silk screen press.	-	-	-	0.0*	0.0*	0.0*	-	0.0*	-	-	0.1	0.2	-	0.6	51	0.9	3.7	1.0	-	0.8	**
22 (92)	Area, press room beside press 22, near storage area.	-	-	-	0.0*	0.0*	0.0	-	0.0*	0.0*	-	-	0.2	-	-	118	0.2	0.7	0.8	-	0.7	**
23 (98)	Area, press room beside press 53 (not operating during sampling time).	0.0*	-	-	0.0*	0.0*	0.0	-	0.0*	0.0*	-	-	0.1	-	-	102	0.2	0.5	0.9	-	0.6	**

(-) = analyzed for but not detected
* = negative value after control subtracted
** = concentration not determined

Table 1. Vapor concentrations for area and personal samples in the composing, preparation and press rooms at Dittler Brothers, Inc.

Charcoal Tube Sample Number and Sampling Time (minutes)	Location/comments	Vapor Concentrations (ppm)																					
		Isopentane	n-Pentane	2,2-Dimethyl-butane	3-Methyl-pentane	2-Methyl-pentane	n-Hexane	Cyclopentane	Methylcyclo-pentane	n-Heptane	Cyclohexane	Methylcyclo-hexane	n-Octane	1,1,1-Trichloro-ethane	Methyl ethyl ketone	Isopropanol	Benzene	Trichloro-ethylene	Toluene	Ethylene dichloride	Xylenes	Acetic acid
1 (138)	Personal, Printer, Composing Room, 80% of time type setting. Also operates Developer and Fix Processor. (See location 2 and 5, Figure 1)	0.1	0.1	0.1	1.6	1.0	1.6	0.1	0.4	0.0	-	-	0.2	-	0.4	-	-	1.4	0.5	-	0.8	1.6
2 (116)	Personal (same worker as C. T. 1).	0.5	0.5	0.6	5.6	3.6	4.9	0.5	1.3	0.1	-	-	0.2	-	-	79	0.3	0.2	0.4	-	0.9	0.0
3 (136)	Area, center of composing room, 3½ ft. off floor. (See location 1, Figure 1)	0.2	0.2	0.3	2.7	1.8	2.6	0.3	0.8	0.1	-	-	0.3	-	-	98	0.5	1.7	0.6	-	0.9	2.3
4 (116)	Area (same location as C.T. 3).	0.0	0.1	0.1	1.3	0.8	1.3	0.0*	0.3	0.0*	4.9	0.3	0.3	-	-	91	-	1.3	0.4	-	1.5	0.0
5 (136)	Area, composing room on file cabinet, near wax machine. (See location 8, Figure 1)	0.1	0.1	0.1	1.4	0.9	1.4	0.1	0.4	0.1	-	-	0.2	-	-	78	0.2	1.2	0.5	-	0.7	0.0
6 (115)	Area (same location as C.T. 5).	0.1	0.1	0.1	1.0	0.6	1.1	0.2	0.4	0.1	-	0.1	0.4	-	-	103	0.4	1.7	0.6	-	1.2	6.1
7 (116)	Area, Opti copy #1 room, worker area. (See location 3, Figure 1)	0.0*	0.0	0.0	0.6	0.4	0.6	0.0*	0.1	0.0*	-	-	0.2	-	-	54	0.1	0.8	0.5	-	0.8	0.0

Table 1. Vapor concentrations for area and personal samples in the composing, preparation and press rooms at Dittler Brothers, Inc.

Charcoal Tube Sample Number and Sampling Time (minutes)	Location/comments	Vapor Concentrations (ppm)																					
		Isopentane	n-Pentane	2,2-Dimethyl-butane	3-Methyl-pentane	2-Methyl-pentane	n-Hexane	Cyclopentane	Methylcyclo-pentane	n-Heptane	Cyclohexane	Methylcyclo-hexane	n-Octane	1,1,1-Trichloro-ethane	Methyl ethyl ketone	Isopropanol	benzene	Trichloro-ethylene	Toluene	Ethylene dichloride	Xylenes	Acetic acid
8 (111)	Area, Opti copy #2 room, center of room. (See location 3', Figure 1)	0.2	1.6	0.8	1.2	-	0.0	-	-	-	-	-	0.1	-	0.4	113	0.0	0.6	0.8	-	1.1	0.0
9 (128)	Personal, plate maker, prep room.	0.0	0.0	0.0	0.2	0.1	0.2	0.0*	0.0	0.0	-	-	0.1	-	0.0	7	0.0	0.3	0.2	-	0.2	**
10 (116)	Personal (same worker as C.T. 9).	0.0	0.0	0.0	0.5	0.3	0.5	0.0*	0.1	0.0*	-	-	0.1	-	0.0	7	0.4	0.3	0.1	-	0.2	3.0
11 (128)	Area, center of prep room, table top.	0.0	0.0	0.0	0.2	0.1	0.2	0.0*	0.0*	0.0*	-	0.0	0.0	-	0.0	6	0.3	0.3	0.1	-	0.1	**
12 (116)	Area (same location as C.T. 11).	0.0	0.0*	0.1	0.4	0.2	0.4	0.1	0.2	0.1	-	-	0.1	-	0.2	6	0.5	0.3	0.2	0.0	0.3	0.0
13 (113)	Area, stripping near center of room, table top.	0.0	0.1	0.1	0.9	0.6	0.9	0.0	0.2	0.0*	-	0.1	0.1	-	0.0	8	0.0*	0.5	0.2	-	0.3	**
14 (115)	Area (same location as C.T. 13).	0.0*	0.1	0.1	0.9	0.5	0.9	0.1	0.2	-	0.6	-	0.0	-	-	-	0.0	0.2	0.1	-	0.5	0.0
15 (76)	Area, press room near number 08 press (full color.	0.0*	-	-	0.0*	0.0*	0.0	-	0.0*	0.1	-	0.7	2.8	-	2.2	113	2.4	9.6	2.7	-	8.9	**