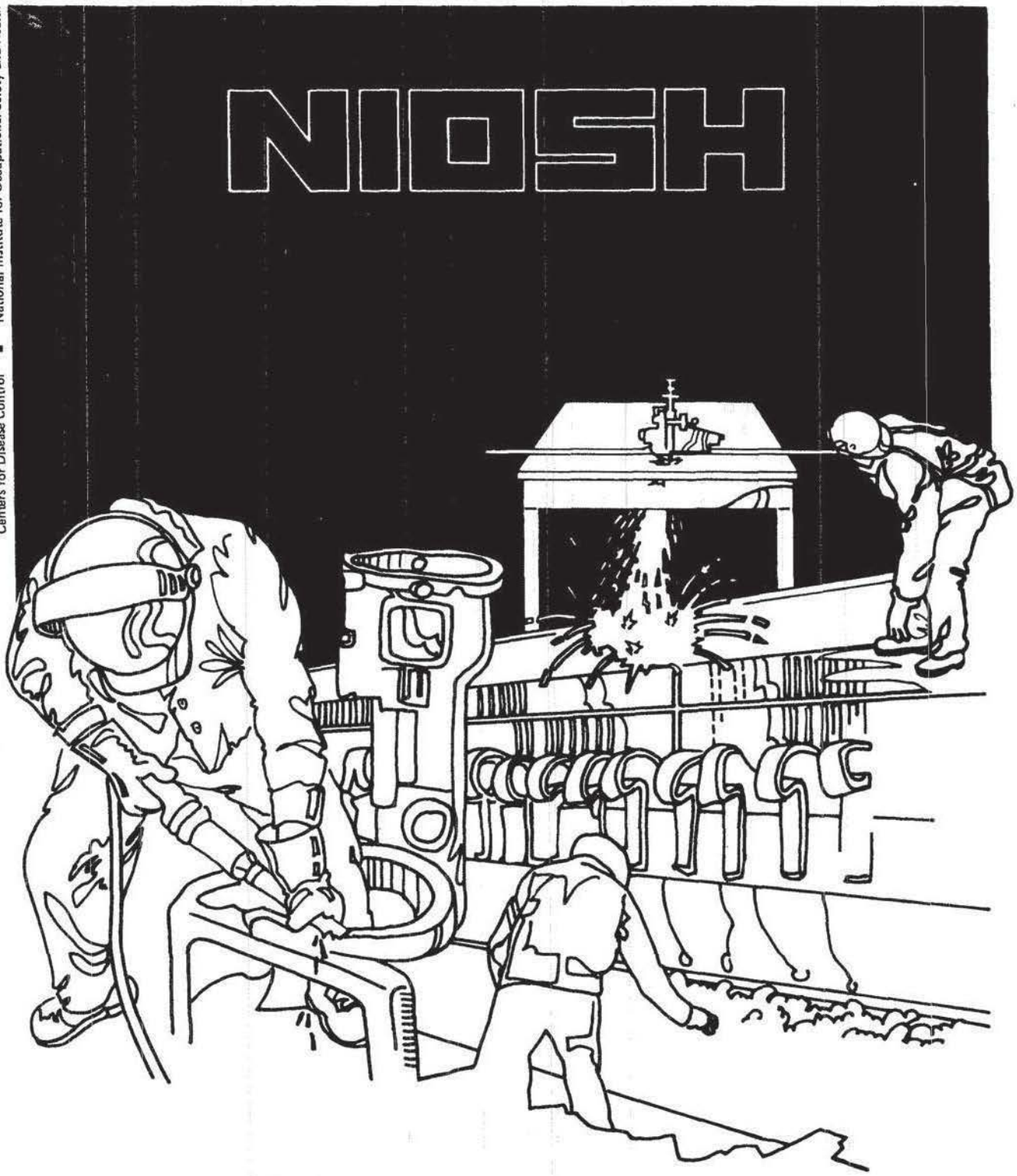
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HHE 79-020-839
GRAPHIC COLOR PLATE, INC.
STAMFORD, CONNECTICUT

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.

HE 79-020-839
MARCH 1981
GRAPHIC COLOR PLATE, INC.
STAMFORD, CONNECTICUT

NIOSH INVESTIGATORS:
Frank A. Lewis, IH
Theodore W. Thoburn, M.D.

I. SUMMARY

In November 1978, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate employee exposures to organic vapors and ozone gas at the Graphic Color Plate printing and photographic operations, Stamford, Connecticut. The workers' exposures were reportedly resulting in an increased incidence of cancer, kidney disorders, dermatitis, stomach disorders, hypertension, heart disease, hyperglycemia, and hypoglycemia.

Environmental samples for xylene, benzene, toluene, methyl ethyl ketone, butyl cellosolve, methylene chloride, mineral spirits (naphtha), phenol, and ozone were collected on November 30, December 1 and 6, 1978, and January 10, 11, and March 29, 1979. All atmospheric samples were well within environmental criteria used in this report.

Ozone concentrations were found to range from 0.002 to 0.005 ppm. Xylene vapor concentrations ranged 1.6 to 46 ppm. Benzene vapors ranged from $\leq$0.01 to 0.9 ppm; toluene vapors from 1 to 4.2 ppm; methyl ethyl ketone vapors from 3.6 to 14 ppm; butyl cellosolve vapors from $<$ 0.04 to 0.49 ppm; methylene chloride vapors from 7 to 163 ppm; mineral spirits from 58 to 159 mg/M^3 and phenol $<$0.001 ppm.

The medical interviews revealed several individuals with heart disease and kidney stones. However, considering the high proportion of smokers or ex-smokers, the age of the workers, their long history of previous work in the industry, the relating small size of the workforce, and the low environmental findings, it is difficult to pinpoint any specific occupational cause for these health problems. The larger NIOSH industry-wide study of mortality in the printing industry will better address the health hazards in the industry. This study should be completed by September, 1981.

Based on the data obtained in this study, NIOSH determined that a health hazard did not exist at the time of our environmental sampling. While several individual cases of heart disease, renal stones, and cancer were identified, several factors made it difficult to discern any relationship to occupational exposures. Recommendations to help improve the workplace environment are included at the end of this report.

KEYWORDS: SIC 7333 (Graphic Arts), phenol, ozone, xylene, benzene, toluene, methyl ethyl ketone, butyl cellosolve, methylene chloride, and mineral spirits.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970, NIOSH investigates the toxic effects of substances found in the workplace.

On November 7, 1978, NIOSH received a request from local 90-P, Stamford, Connecticut, Graphic Arts International Union, for a Health Hazard Evaluation of all departments in the plant located at 1083 East Main Street. The request alleged employee exposure to organic solvents, plate-making chemicals, ink and oil mists and dry-ink proofing, possibly resulting in cancer, kidney disorders, dermatitis, stomach disorders, hypertension, heart disease, hyperglycemia and hypoglycemia.

III. BACKGROUND

A. Plant Process

The facility is involved in the production of graphics for advertisements and cover pictures for national magazines. It consists of an offset print area, gravure print area, and letter press print area; associated photographic operations; etching and plate-making areas; and retouch, lay-out and finishing areas. A central stockroom supplies chemicals to all of the above areas.

1. Offset Printing

The method used to produce any type of original material for offset printing is divided into two stages. The image is printed down to register on a flexible metal plate which has a thin film of light sensitive coating on its surface. The light (may be visible and/or U.V.) passes through the transparent areas of the negative (or positive - if used) and hardens the coating on the plate, while the opaque part of the film remains unaffected. The plate then requires processing with various chemicals or lacquers to make it ready for the press. Ink is transferred to a rubber blanket (rather than directly to paper) where it is offset onto the paper. Three cylinders are used: (a) a plate cylinder picks up ink and transfers it to the (b) rubber blanket cylinder where it is offset to (c) the paper which is on an impression cylinder. Various inks and solvents are used in this area.

The offset printing complex consists of a darkroom, photography gallery, dot-etching area, stripping area, chromalin room, retouch area and plate-making area and pressroom.

Various solvents, "photographic" chemicals, inks, etches and ozone from the ultraviolet and xenon lamps are present in varying amounts.

2. Gravure Printing

Gravure printing is a photographic process in which the design itself is composed of cells of uniform size and area etched into the surface of a copper-coated flexible plate to various depths. Special thin ink is flooded

onto the plate and the surface wiped clean by a "doctor" blade, leaving the etched depressions filled with ink. The ink is then lifted out of these depressions when the paper comes into contact with the plate. Gradations of tone in the illustrations are obtained by etching the cells to different depths so that more or less ink is held in the depressions, even though the dots themselves are the same size. A volatile solvent-based fluid ink is used for fast production speeds and because of the minute cells in the cylinder. The plate is processed by exposing first a screen and then a positive onto light-sensitive material fixed onto the cylinder/plate and developing and applying, in stress, an etching solution to the surface.

The gravure printing department consists of a photographic section (dark-room, stripping/layout area, positive and negative retouch areas, etching department, and chromalin area); plate-making section; and printing area. Various solvents, inks etches, photographic chemicals, blueprint machines (ammonia gas), and ultraviolet and xenon lamps (ozone gas) are used throughout the gravure department.

3. Letter Press

A process of producing a printed image from a relief surface which receives ink and then transfers it under pressure to the paper is carried out here. A photograph is reproduced in the required size on metal by photo-engraving --a photographic negative is placed on a copper sheet (with a light-sensitive coating) and a "print" is obtained by exposure with light or U.V. This design is then protected (using a lacquer) while non-printing areas are etched away with acid--leaving the printing surface in relief.

The letter press printing department consists of photographic section (dark room, gallery, stripping/layout area, proofing/flat-etch, and color-finishing area); plate-making section (deep-etch area, plate-washing area); and printing area.

Various "photographic" chemicals, inks, etchants, solvents, wood resin, acids, and mercury vapor lamps are used in the letter press department.

IV. EVALUATION DESIGN AND METHODS

A. Environment

Two area air samples were taken to determine an eight-hour time-weighted average (8-hr. TWA) employee exposure to ozone from the offset press ultraviolet (U.V.) drying lamps (offset press area) and from the U.V. blueprint machine (gallery area). These are two areas where ozone odors were particularly noticeable.

The area air samples for ozone were taken using 10 ml of alkaline potassium iodide in a midget impinger. Air was drawn through the impinger. Air was drawn through the impinger solution at a flow rate of 1.0 liter per minute (LPM) with a MSA Model G personal sampling pump for the entire 8-hour work shift. These samples were analyzed according to NIOSH Method No. P&CAM 154 using a spectrophotometer.

Two 8-hr. TWA personal air samples were taken on pressmen operators (offset press area) to determine exposures to xylene, butyl cellosolve, methyl ethyl ketone (MEK), toluene and benzene vapors.

Two 8-hr. TWA personal air samples were taken of the pressmen in the Gravure Press area for xylene and benzene vapors.

One 8-hr. TWA personal air sample was taken of the color-finisher in the letter press area for toluene and methyl ethyl ketone exposure.

One 8-hr. TWA personal air sample was taken of the dot-etcher in the offset press area for benzene, toluene and methyl ethyl ketone.

Two 8-hr. TWA personal and area air samples were taken of the platemakers and strippers in the letter press area for phenol, methylene chloride, xylene, and mineral spirits.

One 8-hr. TWA personal air sample of the plate cleaner in the letter press was taken for methylene chloride, xylene and mineral spirits.

One 8-hr. TWA personal air sample of the deep-etcher in letter press was taken for xylene and mineral spirits.

And one 8-hr. TWA air sample was taken of the pressman in letter press for xylene, butyl cellosolve, methyl ethyl ketone, toluene and mineral spirits.

Personal air samples for benzene, toluene, xylene, methyl ethyl ketone, butyl cellosolve, methylene chloride, Salvosol and mineral spirits were collected on Lot #107 activated charcoal tubes. Air was drawn through the charcoal tubes at a flow rate of 50 cc/minute with Sipin Model SP-1 personal air sampling pumps. All samples and bulks were analyzed by gas chromatography according to NIOSH Method P&CAM #127 (modified) and in some of the analyses with a GC-Mass Spec combination.

Personal and area air samples for phenol were collected using a 0.1 N sodium hydroxide solution in a midget impinger. Air was drawn through this impinger solution at a flow rate of 1.0 LPM with a MSA Model G personal sampling pump. These samples were analyzed using a gas chromatograph with a flame ionization detector.

During the walk-through and sampling periods ventilation measurements were taken using smoke tubes and an Alnor Sr. Velometer.

B. Medical

Twenty-one workers were interviewed by the NIOSH Industrial Hygienist utilizing a non-directed medical questionnaire. The sample was picked to get a representation of the various jobs in the offset, gravure, and letter press departments and also included the worker from the stockroom. Table 1 further characterizes the workers who were interviewed.

V. EVALUATION CRITERIA 1-8

The environmental evaluation criteria used for this study, and the current OSHA standards, are presented in Table 2.

Toxicology

Ozone - is a gas which is irritating to the eyes and mucous membranes. In order of increasing concentrations, the following are the symptoms of ozone exposure: dryness of upper respiratory system; nose and throat irritation; choking, coughing and severe fatigue, bronchial irritation, substernal soreness and cough; delayed pulmonary edema. Chronic exposures to laboratory animals have shown that ozone may cause chronic bronchitis, bronchiolitis, emphysematous and fibrotic changes, aging effects and increased susceptibility towards lung cancer.

Xylene - can cause eye, nose and throat irritation; skin contact will cause drying and defatting leading to dermatitis. Acute exposures can cause a depression of the central nervous system and liver and kidney damage. At high concentrations, xylene may cause dizziness, drowsiness, and unconsciousness; very high concentrations may cause pulmonary edema, anorexia, nausea, vomiting and abdominal pain.

Benzene - contact with vapor or liquid may cause irritation to skin, eyes, and upper respiratory system; drying and defatting of skin may lead to dermatitis. Acute exposures to benzene may cause central nervous system depression, headache, dizziness, nausea, convulsions, coma and death. Chronic benzene exposures affect the blood-producing tissues and may lead to aplastic anemia and leukemia. Chromosomal aberrations have also been observed in recent studies.

Toluene - may cause skin, eye and respiratory irritation. Prolonged contact may cause dermatitis through drying and defatting of the skin. Acute exposures to the vapor may cause central nervous system depression, headache, dizziness, fatigue, muscle weakness, drowsiness, and coma. Damage may also be done to the liver and kidneys through very high exposures.

Methyl Ethyl Ketone - repeated contact with the skin may lead to dermatitis problems through drying and defatting. High vapor concentrations can cause irritation of the eyes and mucous membranes in the nose and throat; also narcosis may result with symptoms of headache, nausea, light headedness, vomiting, dizziness, uncoordination and unconsciousness.

Butyl Cellosolve - is mildly irritating to the skin; vapors may cause conjunctivitis and upper respiratory irritation; eye irritation may result in temporary corneal clouding. Acute exposures may result in narcosis, pulmonary edema, and kidney and liver damage; symptoms from repeated overexposures are fatigue, headache, nausea, anorexia and tremors. Animal studies have shown blood changes although they have not been observed in humans.

Methylene Chloride - contact with skin will cause drying and defatting and lead to dermatitis (dry, scaly, fissured). Both liquid and vapors may cause eye and upper respiratory irritation; methylene chloride is classified as mildly narcotic in action. Effects include headache, giddiness, stupor, irritability, numbness and tingling of the limbs. At higher dosages, eye and upper respiratory irritation may occur. In very high concentrations, hallucinations, pulmonary edema, coma and death may occur. Methylene chloride can cause elevated carboxyhemoglobin levels which should be given consideration when dealing with smokers or workers with anemia or heart disease or exposed to carbon monoxide.

Phenol - its corrosive properties will bring severe damage in contact with human tissue. Exposure to phenol may cause paleness, weakness, sweating, headache, tinnitus, shock, cyanosis, excitement, frothing from mouth and nose, dark-colored urine, kidney damage and death. Chronic exposures may cause vomiting, difficulty in swallowing, diarrhea, lack of appetite, headache, fainting, dizziness, dark urine, mental disturbances, skin rash, discoloration of the skin, and liver and kidney damage.

Mineral Spirits - can cause nose and throat irritation, nausea, vomiting, fatigue, pallor.

VI. RESULTS AND DISCUSSION

A. Environmental

1. Ozone
   Two long-term area samples were collected for ozone in the offset press (U.V. drying lamps) and offset gallery (blueprint machine). Exposures ranged from 0.002 to 0.005 ppm (TWA), as compared to 0.1 ppm (TWA) (ACGIH/OSHA) and 0.3 ppm (STEL), ACGIH minimum permissible exposure limits.

2. Xylene
   Ten personal air samples were collected for xylene in the offset (pressmen and dot-etcher), gravure (pressman), and letter-press (pressman, deep-etcher, plate-maker, stripper, plate-cleaner) press areas. Exposures ranged from 1.5 to 46 ppm (TWA) as compared to 100 ppm (TWA), NIOSH/ACGIH/OSHA; 200 ppm (10 min. ceiling), NIOSH minimum permissible exposure limits.

3. Benzene
   Eight personal air samples were collected for benzene in the offset (pressmen), gravure (pressman), letter-press (color-finisher) press areas. Exposures ranged from $<$0.01 to 0.9 ppm (TWA), as compared to 1 ppm (60 min. ceiling), NIOSH minimum permissible exposure limit.

4. Toluene
Five personal air samples were collected for toluene in the offset (pressmen, dot-etcher) and letterpress (color-finisher, pressman) press areas. Exposures ranged from 1.0 to 4.2 ppm (TWA), as compared to 100 ppm (TWA), NIOSH/ACGIH; 200 ppm (10 min. ceiling), minimum permissible exposure limit.

5. Methyl Ethyl Ketone (MEK)

Four personal air samples were collected for MEK in the offset (pressmen, dot-etcher) and letterpress (pressman) areas. Exposures ranged from 3.6 to 14.0 ppm (TWA), as compared to 200 ppm (TWA), NIOSH/ACGIH/OSHA permissible exposure limits.

6. Butyl Cellosolve
Three personal air samples were collected for butyl cellosolve in the offset press (pressmen) and letterpress (pressman) areas. Exposures ranged from < 0.04 ppm to 0.49 ppm (TWA), as compared to 25 ppm (TWA) and 75 ppm (STEL), ACGIH minimum permissible exposure limits.

7. Methylene Chloride
Three personal air samples were collected for methylene chloride in the letterpress (plate-maker, stripper and plate-cleaner) area. Exposures ranged from 7 to 63 ppm (TWA), as compared to 75 ppm (TWA) and 500 ppm (ceiling), NIOSH minimum permissible exposure limits.

8. Mineral Spirits
Five personal air samples were collected for mineral spirits in the letterpress (plate-maker, stripper, plate-cleaner, deep-etcher, and pressman) area. Exposures ranged from 58 to 159 mg/m^3 (TWA), as compared to 350 mg/m^3 (TWA--10 hr.), NIOSH minimum permissible exposure limit.

9. Phenol
One personal and one area sample were collected for phenol in the letterpress area (plate-maker). Exposures were less than 0.001 ppm of phenol vapor as compared to 5.0 ppm (TWA) and 10 ppm (STEL), ACGIH minimum permissible exposure limits.

The results of these air samples were well within the environmental criteria for each of the air contaminants tested. A listing of the individual substances and the sampling results are presented in Table 3. The mixture TLV calculations were not even considered since all of the concentration results were well below the permissible exposure limits.

In the offset department, general ventilation (air-conditioned air brought in and exhausted through the doors) is used and air movement ranges from <10 feet per minute up to 50 feet per minute in the press, darkroom, gallery, dot-etching, stripping, chromalin, retouch, and plate-making areas. A local exhaust "downdraft" unit is used on an inking table in the Chromalin Room. Air velocity measurements were 150 feet per minute at the point of ink application.

The Gravure printing department also has general ventilation and air movement ranges from 10 to 75 feet per minute in the press, finishing, stripping/lay-out, retouch, etching, chromalin and photography areas.

The Letter-Press department has general ventilation and this air movement ranges from <10 to 25 feet per minute in the press, stripping, proofing/flat etch, deep-etch, color finishing, plate-working and gallery areas. A local exhaust hood is used in the deep-etch room for handling "Dragon's Blood"; velometer measurements show 100 to 150 feet per minute at the face of the hood. A local exhaust unit in the plate-washing area over the plate washing tanks shows 400 feet per minute at the face of the slot exhaust and 25 feet per minute at the point of vapor emission from the tank. (This is below the acceptable criteria of 90-100 feet per minute.)

B. Medical

None of the 21 workers interviewed identified acute health problems associated with any specific job exposures, but five mentioned that the job was high pressure and/or stressful. Three workers (ages 46-52) had had heart attacks (all were smokers, none worked with methylene chloride); three (ages 33-55) had had kidney stones, and one (age 56) had kidney failure. One worker had had dermatitis for five years, treated with creams and oral medication, but no specific cause was identified. There were also one worker with emphysema (a smoker), two asthmatics (an ex-smoker and a smoker), one worker with high blood pressure and diabetes, one with an ulcer and one with rheumatoid arthritis.

Although none of the interviewed workers had had cancer, five individuals were identified as having had cancer--two cancers of the pancreas (one a worker in another company), one cancer of liver or pancreas, one cancer with site unknown, and one lung cancer (12 years ago). In addition to the three workers interviewed, seven other individuals were mentioned by name as having had heart problems and/or heart attacks. Ages were in 40's and 50's when mentioned and occurrence was up to ten years in the past. Two were said to have died. Three heart surgeries were mentioned, not by name, indicating at least one additional case. One of the named workers with heart problems was said to be a diabetic. Other than mention of diabetes, no reference was made to hyper or hypoglycemia.

In all, of the 21 workers interviewed, eleven were current cigarette smokers, one was a pipe smoker, five were ex-smokers, and four had never smoked.

Considering the low environmental findings, a job situation perceived by the workers as stressful, the large proportion of smokers and ex-smokers, and the fact that the work force is mostly in the age when an increasing incidence of heart attacks is seen, it is not possible to pinpoint any specific occupational cause for the occurrence of heart attacks.

Considering that most workers have been in the trade twice as long as they have been working for this particular company, the NIOSH industry-wide study of mortality in the printing trade will better address the general health hazards of this industry than can further study of this particular company. The industry-wide study is well along, with plans for its completion before the end of Fiscal Year 1981 (September 1981).

VII. RECOMMENDATIONS

1. General ventilation should be increased (minimum of ten air changes per hour) in all areas and/or local exhaust ventilation utilized (particularly over the Gravure presses) following good, recognized industrial hygiene practice.

2. Chemical splash goggles and impervious gloves (e.g. neoprene) should be used by those employees handling corrosive chemicals and solvents. Particular attention should be paid to the handling of dichromate solutions where sensitization may be a problem.

3. Deluge-type eye-washes are recommended for those areas storing and/or using corrosive chemicals, they should be located in areas that have easy access and are immediately available.

4. Ingestion of toxic materials (particularly toxic metals and dyes in inks) from hand, clothing or hair to mouth contact can be prevented by wearing protective gloves or barrier creams, long-sleeve shirts, and proper sanitary practices. Vacuuming clothing and washing of hands, face and neck before breaks, lunch and going home is desirable. Showers before leaving work and a daily change of work clothing with separate lockers for street and work clothing is recommended for those workers in direct contact with the inks and dyes.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Submitted By:

Frank A. Lewis
Principal Environmental Investigator
NIOSH, Region III

Theodore W. Thoburn, M.D.
Medical Consultant
Medical Section
NIOSH, Region VIII

Originating Office:

Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies
Cincinnati, Ohio

Report Typed By:

Elaine M. Turner, Secretary
NIOSH, Region III
Philadelphia, Pennsylvania

IX. REFERENCES

1. Summary of NIOSH Recommendations for Occupational Health Standards - October 1978, U.S. HEW, PHS,CDC, NIOSH, Cincinnati, Ohio.

2. NIOSH Manual of Sampling Data Sheets, 1977 Edition, U.S. HEW, PHS, CDC, NIOSH, March 1977.

3. NIOSH Revised Recommendation for an Occupational Exposure Standard for Benzene, U.S. HEW, PHS, CDC, NIOSH, August 1976.

4. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

5. General Industry, OSHA Safety and Health Standards, 29 CFR 1910, OSHA 2206, revised January 1976.

6. Emergency Temporary Standard for Occupational Exposure to Benzene; Notice of Hearing, 29 CFR 1910, Occupational Safety and Health Standards, Federal Register, Vol. 42, No. 85, May 1977, DOL, OSHA.

7. NIOSH Criteria For a Recommended Standard...Occupational Exposure to Refined Petroleum Solvents, No. 77-192, U.S. HEW, PHS, CDC, NIOSH.

8. Occupational Diseases - A Guide to Their Recognition, Revised Edition, June 1977, U.S. HEW, PHS, CDC, NIOSH.

9. Health and Safety in Printmaking - A Manual For Printmakers, Alberta Labour, Occupational Health and Safety Division, Occupational Hygiene Branch, Edmonton, Alberta.

10. NIOSH - Employee Health and Safety in The Lithographic Printing Industry, No. 77-223, U.S. HEW, PHS, CDC, NIOSH.

11. Environmental Aspects of Chemical Use in Printing Operations, Ben H. Carpenter and Garland K. Hilliard, Jr., Research Triangle Park, North Carolina 27709.

12. Occupational Health and Safety, Volume II/L-Z, International Labour Office Geneva, McGraw-Hill, New York, 1972.

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are available from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Graphic Color Plate, Inc. Stamford, Connecticut
2. Authorized representative of employees, Local 90-P of Graphic Arts International Union
3. NIOSH, Region III
4. OSHA, Region III

For the purpose of informing the affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees, for a period of 30 calendar days.

TABLE 1

Characterization of Workers Interviewed from the
Off-Set, Gravure, and Letter-Press Departments

Graphic Color Plate, Inc.
HE 79-20

	Average	Median	Range
Off-Set Department. 11 interviewed out of 65			
Age (years)	49.0	49	34-64
Years with Company	15.5	15	10-29
Years in Trade	27.3	31	10-45
Gravure Department. 4 interviewed out of 23			
Age (years)	52.0	52	49-55
Years with Company	11.8	12	10-13
Years in Trade	29.0	30	24-32
Letter-Press Department. 5 interviewed out of 31			
Age (years)	44.4	46	33-60
Years with Company	15.4	14	13-22
Years in Trade	23.0	26	12.33
Total Off-Set, Gravure, and Letter-Press.			
Age (years)	48.4	49	33-64
Years with Company	14.7	13.5	10-29
Years in Trade	26.6	30	10-45
By Job			
Gallery/Photography	5 workers interviewed of 25		
Etching	4 out of 25		
Plating/Routing	0 out of 7		
Retouch	2 out of 6		
Stripping/Layout	5 out of 30		
Finishing	1 out of 4		
Proofing	0 out of 22		
Pressmen	3 out of 12		

TABLE 2

Evaluation Criteria

Graphic Color Plate, Inc.
HE 79-20

Substance	NIOSH	ACCIH	OSHA
Ozone	--	0.1 ppm (TWA) 0.3 ppm (STEL)	0.1 ppm (TWA)
Xylene	100 ppm (TWA) 200 ppm (10 min. ceiling)	100 ppm (TWA) 150 ppm (STEL)	100 ppm (TWA)
Benzene	1 ppm (60 min. ceiling)	10 ppm (TWA)	10 ppm (TWA) 25 ppm (Ceiling) 1 ppm (TWA)* 5 ppm (Ceiling)*
Toluene	100 ppm (TWA) 200 ppm (10 min. ceiling)	100 ppm (TWA) 150 ppm (STEL)	200 ppm (TWA) 300 ppm (Acc. Ceiling) 500 ppm (Max. Ceiling 10 mins.)
MEK	200 ppm (TWA)	200 ppm (TWA)	200 ppm (TWA)
Butyl Cellosolve	--	25 ppm (TWA) 75 ppm (STEL)	50 ppm (TWA)
Methylene Chloride	75 ppm (TWA) 500 ppm (Ceiling) (C O present < TWA/C)	200 ppm (TWA) 250 ppm STEL)	500 ppm (TWA) 1000 ppm (Acc. Ceiling) 2000 ppm (Max. 5 mins. in 2 hrs.)
Mineral Spirits (Naptha) (on Stoddards Solvent)	-- 350 mg/m^3(TWA-10 hr.)	575 mg/m^3 (TWA) 720 me/m^3 (STEL)	2000 mg/m^3 (TWA)
Phenol	5.2 ppm (TWA) 15.6 ppm (Ceiling)	5 ppm (TWA) 10 ppm (STEL) Skin	5 ppm (TWA) Skin

TWA = Time-Weighted Average
STEL = Short-Term Exposure Limit

*Proposed OSHA Standard

Table 3

Graphic Color Plate, Inc.
Stamford, Connecticut
HHE 79-20

January 11 and March 29, 1979

Substance	Sample No.	Location/Operation	Sampling Time (Minutes)	Concentration
(1/11/79)				
Ozone (area)	GCP-1	Offset Press/U.V. Drying Lamps	428	0.005 ppm
	GCP-2	Offset Gallery/Blueprint Machine	420	0.002 ppm
Xylene (personal)	GCP-4 & 5	Offset Press/Pressman	425	3.8 ppm
	GCP-6 & 7	Offset Press/Pressman	419	2.9 ppm
	GCP-8 & 9	Gravure Press/Pressman	425	10.8 ppm
	GCP-10 & 11	Gravure Press/Pressman	351	45.6 ppm
	GCP-12 & 13	Letterpress/Platemaker	419	8.8 ppm
	GCP-14 & 15	Letterpress/Stripper	413	7.8 ppm
	GCP-16 & 17	Letterpress/Plate Cleaner	440	13.6 ppm
	GCP-20 & 21	Letterpress/Pressman	436	3.6 ppm
	GCP-22 & 23	Letterpress/Deep Etcher	428	3.3 ppm
	GCP-24 & 25	Offset/Dot Etcher	366	1.6 ppm
Benzene (personal)	GCP-4 & 5	Offset Press/Pressman	425	0.9 ppm
	GCP-6 & 7	Offset Press/Pressman	419	0.2 ppm
	GCP-8 & 9	Gravure Press/Pressman	425	<0.01 ppm
	GCP-10 & 11	Gravure Press/Pressman	351	<0.01 ppm
	GCP-18 & 19	Letterpress/Color Finisher	366	0.3 ppm
Toluene (personal)	GCP-4 & 5	Offset Press/Pressman	425	1.6 ppm
	GCP-6 & 7	Offset Press/Pressman	419	1.0 ppm
	GCP-18 & 19	Letterpress/Color Finisher	366	4.2 ppm
	GCP-20 & 21	Letterpress/Pressman	436	0.3 ppm
	GCP-24 & 25	Offset Press/Dot-Etcher	366	2.8 ppm
Methyl Ethyl Ketone (Personal)	GCP 4 & 5	Offset Press/Pressman	425	4.5 ppm
	GCP 6 & 7	Offset Press/Pressman	419	3.6 ppm
	GCP 20 & 21	Letterpress/Pressman	436	14.4 ppm
	GCP 24 & 25	Offset Press/Dot-Etcher	366	5.4 ppm
Butyl Cellosolve (personal)	GCP 4 & 5	Offset Press/Pressman	425	0.5 ppm
	GCP 6 & 7	Offset Press/Pressman	419	<0.04 ppm
	GCP 20 & 21	Letterpress/Pressman	436	<0.04 ppm
Methylene Chloride	GCP 12 & 13	Letterpress/Plate-Maker	419	8.8 ppm
	GCP 14 & 15	Letterpress/Stripper	413	7.0 ppm
	GCP 16 & 17	Letterpress/Plate-Cleaner	440	63.4 ppm

Table 3 continued, HHE 79-20

Substance	Sample No.	Location/Operation	Sampling Time (Minutes)	Concentration
Mineral Spirits	GCP 12 & 13	Letterpress/Plate-Maker	419	11.4 mg/m^3
	GCP 14 & 15	Letterpress/Stripper	413	58.0 mg/m^3
	GCP 16 & 17	Letterpress/Plate Cleaner	440	159.0 mg/m^3
	GCP 20 & 21	Letterpress/Pressman	436	136.0 mg/m^3
	GCP 22 & 23	Letterpress/Deep Etcher	428	110.0 mg/m^3
(3/29/79)				
Phenol (personal)	2GCP 10,2	Letterpress/Plate-Maker	428	<0.001 ppm
(area)	2GCP 3	Letterpress/Oven	430	<0.001 ppm

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

Third Class Mail

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396