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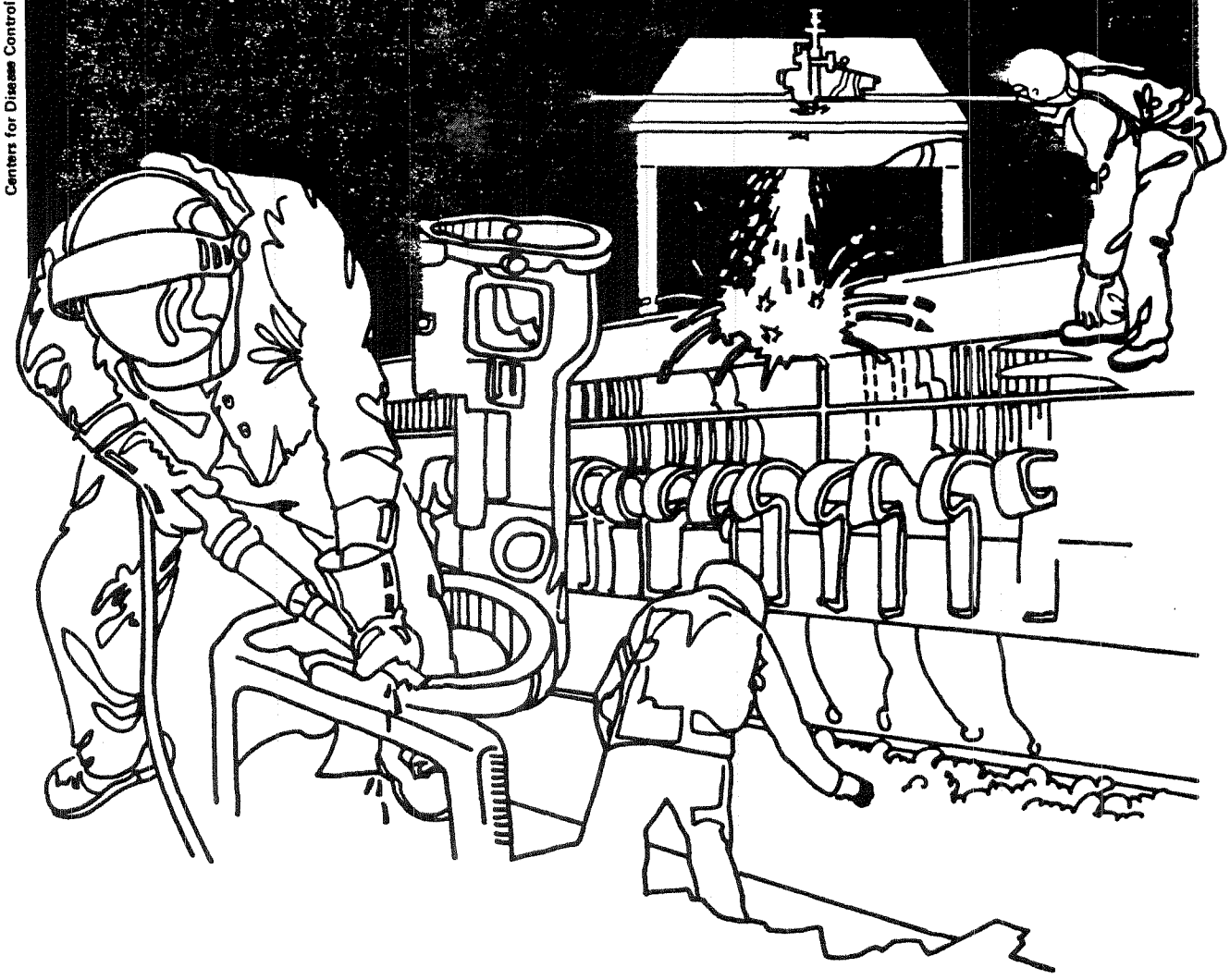

# Health Hazard Evaluation Report

HHE 80-046-914
CONSOLIDATED PRINTING INK COMPANY, INC.
WEST ST. PAUL, MINNESOTA

# 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.

HHE 80-046-914
August 1981
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota

NIOSH INVESTIGATORS:
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## I. SUMMARY

In January 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Oil, Chemical, and Atomic Workers Union, to evaluate exposures to various substances at the Consolidated Printing Ink Company (CPI), West St. Paul, Minnesota. Reported symptoms included skin and eye irritation, headaches, dyspnea, and nausea.

NIOSH surveys were performed on January 24-25, 1980, and May 7-8, 1980. Personal breathing zone and area air samples were collected for numerous solvents, as well as nuisance particulates and sodium hydroxide. The majority of the measured concentrations for these substances were quite low and well within NIOSH and ACGIH evaluation criteria and OSHA standards. Analysis of the environmental samples indicated the presence of the following substances, their respective concentrations, and the survey criteria or permissible exposure limits (PEL): ethyl acetate 2.8-183 mg/M$^3$ (PEL - 1400 mg/M$^3$); ethyl alcohol 12.8-266 mg/M$^3$ (PEL - 1900 mg/M$^3$); isopropyl alcohol 11.5-38.4 mg/M$^3$ (PEL - 984 mg/M$^3$); methyl alcohol 2.3-31 mg/M$^3$ (PEL - 262 mg/M$^3$); methyl ethyl ketone nondetectable (N.D.)-131 mg/M$^3$ (PEL - 590 mg/M$^3$); methyl isobutyl ketone N.D.-3.5 mg/M$^3$ (PEL - 200 mg/M$^3$); n-propyl acetate N.D.-104 mg/M$^3$ (PEL - 840 mg/M$^3$); toluene 1.8-37.6 mg/M$^3$ (PEL - 375 mg/M$^3$); xylene N.D.-318 mg/M$^3$ (PEL - 434 mg/M$^3$); nuisance particulate 0.1 and 4.1 mg/M$^3$ (PEL - 10 mg/M$^3$); and sodium hydroxide 0.02 mg/M$^3$ (PEL - 2 mg/M$^3$). No detectable concentrations were found on any samples collected for benzophenone, chromium, chromium VI, hydroquinone, lead, or trimethylol propane triacrylate.

A medical questionnaire was administered to 52 production employees. Results showed that 40% (21) of the employees reported headache, nausea, and eye irritation which varied greatly in severity and frequency. These symptoms reportedly occurred when the ultraviolet (UV) ink manufacturing process was in operation. Workers most affected stated that their UV ink exposures occurred infrequently. Fifty-eight percent (18 of 31) of those with no work-related health problems stated they routinely worked with UV inks.

Although no excessive exposures were documented at the Consolidated Printing Ink Company during the time of the NIOSH investigation, questionnaire data suggest that workers may be experiencing work-related symptoms. There are numerous substances used in the process which could cause or contribute to the workers' reported symptoms. In addition, a review of work practices and use of protective equipment and exhaust ventilation indicate a need to follow better procedures. To assure worker safety and health, recommendations to reduce potential exposures are included in Section VII of this report.

Keywords: SIC 2893 (Printing Inks), ethyl acetate, ethyl alcohol, methyl alcohol, methyl ethyl ketone, n-propyl acetate, toluene, xylene.

## II. INTRODUCTION

In January 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Oil, Chemical, and Atomic Workers Union to evaluate exposures to various substances at the Consolidated Printing Ink Company (CPI) West St. Paul, Minnesota. The request concerned exposure to bis [4 - (dimethyl-amino) phenyl] methanone (Michler's ketone), 2-nitropropane, 1,6-hexanediol diacrylate, polymers of methacrylic acid esters, ethyl acetate, ethyl alcohol, isopropyl alcohol, xylene, and various other chemicals used in the production of fluid inks such as flexographic and rotogravure inks, paste inks including letter press and offset, and ultraviolet (UV) cured inks. Reported symptoms included skin and eye irritation, headache, dyspnea, and nausea. Although the request expressed interest regarding the extent of exposure and possible health effects resulting from exposure to numerous chemicals used in the CPI facility, specific emphasis was placed on Michler's ketone and the UV ink manufacturing process.

On January 24-25, 1980, an opening conference and walk-through survey of the plant was conducted. The follow-up survey was performed on May 7-8, 1980.

## III. BACKGROUND

The CPI facility, is a 55,000-square foot single story building where 59 production employees work on three shifts. Most of the work is accomplished during the first shift: 6:45 - 15:50.

CPI manufactures custom inks; 75% of which are paste inks, and 0.6% ultraviolet. Several factors influence the constituents of the inks. These include the printing process to be employed, volume of ink to be produced, type and speed of press used, the surface and other characteristics of the materials to be printed, method of drying, and the end use of the final printed form. The ink may be applied to a variety of surfaces including paper, carbon stock, fiber and corrugated board, tin plate, plastics, glass, rubber, cotton, burlap, nylon, cellophane, and metal foil.

Depending on the type and desired qualities of ink made, a variety of ingredients may be added to the ink at specific process times. The fluid portion, commonly identified as the vehicle portion, functions as a carrier for the pigment and as a binder. The vehicle portion is composed of 1. resins (e.g., modified resins, alkyds, hydrocarbon resins, acrylic resins), 2. solvents (e.g., alcohols, esters, aliphatic and aromatic hydrocarbons, ketones, etc.), 3. oils (e.g., linseed oils, soybean oil, China wood oil, various mineral oils and others), 4. driers (soaps of cobalt, manganese, and zirconium), 5. antioxidants (e.g., eugenol, ketoximes, BHT, hydroquinone), 6. waxes (e.g., dispersions or dry polyethylene waxes, hydrocarbon waxes, and vegetable waxes), and 8. additives including chelating agents, surfactants, greases and cornstarch and other bodying agents. In addition UV curable inks are composed of 1. monomers and oligomers (e.g., polyfunctional acrylic monomers [trimethylol propane triacrylate, pentaerythretol triacrylate, 1,6-hexanediol diacrylate, and others]) and 2. photoinitiators (e.g., benzophenone, Michler's ketone, 2,2-dimethoxy-2-phenylacetophenone, and others).

Pigments (organic and inorganic) provide color in the inks and determine some specific properties such as transparency or resistance to heat and chemicals.

The majority of all CPI inks are made in a batch process in the volumes ranging from 1 to 750 gallons. The basic manufacturing process begins by weighing portions of the vehicle or varnish and pigment(s) and then placing these ingredients into mixing tubs of various sizes. The components are then blended or mixed (to disperse the pigment(s)) using butterfly, change can, dual blade, or vertical post mixers of various sizes and speeds. Some inks are further ground (to reduce particle size) on either 3-roll mills, Kady mills or shot mills.

The nature of the vehicle and the predispersion character of the coloring matter largely determine whether the printing ink can be produced by mixing or whether a milling or grinding operation will be required.

The ink is tested throughout the production process and just prior to shipment to check for viscosity, tack, grind, pH, proper drying, and color. If all specifications are met, the ink is placed in various size containers for shipping.

## IV. ENVIRONMENTAL DESIGN AND METHODS

During the follow up survey on May 7-8, 1980, personal breathing-zone and area environmental samples were collected (over sampling periods ranging from 1/2 to 7 hours) throughout the CPI plant. Environmental air samples were collected for benzophenone, chromium, chromium VI, ethyl acetate, ethyl alcohol, hydroquinone, isopropyl alcohol, lead, methyl alcohol, methyl isobutyl ketone, methyl ethyl ketone, n-propyl acetate, nuisance particulates, sodium hydroxide, toluene, trimethyl propane triacrylate, and xylene. The air sampling and analysis methodology including substance, collection device, flow rate, and analytical procedures are presented in Table I.

A medical questionnaire was administered by either the NIOSH physician or industrial hygienist to all production employees. The questionnaire was designed to obtain information regarding prevalence and severity of work-related health problems. In addition, respondents were asked questions regarding demographic characteristics and medical history.

## V. EVALUATION CRITERIA

The environmental evaluation criteria utilized in this study are presented in Table II. Listed for each substance are evaluation criteria, the current OSHA standard, and the primary health effects underlying each recommended limit.

## VI. RESULTS AND DISCUSSION

### A. Medical

A standard non-directed medical questionaire was administered to 52 production employees. Review of the questionnaires revealed that the ages and length of

employment of the employees interviewed ranged from 22-66 years (median 43) and 5 months - 33 years (median 7), respectively. Forty percent of the those interviewed (21), reported work-related health symptoms. The severity and frequency of the symptoms varied greatly. Headache, nausea, and eye irritation were the most common symptoms, which reportedly only occurred during the UV ink manufacturing process. Workers reporting the most severe symptoms stated that their UV ink exposures occurred infrequently. Sixty percent (31) of those interviewed had no work-related health problems, and 58% (18 of 31) routinely worked with UV inks.

B. Environmental

Results of the environmental air samples obtained are presented in Tables III-VIII. The majority of measured concentrations of substances sampled were all quite low and well within NIOSH, ACGIH, and OSHA recommended levels. No detectable (N.D.) concentrations were found on any samples for benzophenone, chromium, chromium VI, hydroquinone, lead, and trimethylol propane triacrylate. The remaining substances and their sample concentrations are listed below.

| Substance | # of Samples | Range ($mg/M^3$) | Mean ($mg/M^3$) | Evaluation Criteria ($mg/M^3$) |
|---|---|---|---|---|
| Ethyl Acetate | 15 | 2.8-183 | 66 | 1400 |
| Methyl Ethyl Ketone | 11 | N.D.-131 | 25 | 590 |
| Isopropyl Alcohol | 9 | 11.5-38.4 | 25 | 984 |
| Ethyl Alcohol | 15 | 12.8-266 | 115 | 1900 |
| Methyl Alcohol | 3 | 2.3-31.0 | 17 | 262 |
| Methyl Isobutyl Ketone | 11 | N.D.-3.5 | 2 | 200 |
| N-Propyl Acetate | 15 | N.D.-104 | 20 | 840 |
| Nuisance Particulates | 2 | 0.1 & 4.1 | 2 | 10 |
| Sodium Hydroxide | 1 | 0.02 | --- | 2.0 (15-min. ceiling) |
| Toluene | 15 | 1.8-37.6 | 9 | 375 |
| Xylene | 15 | N.D.-318 | 46 | 434 |

A few substances of concern in the initial request were no longer being used at the plant at the time of the follow-up survey. These included Michler's ketone, 2-nitropropane, 1,6-hexanediol diacrylate, pentaerythritol triacrylate, and polymers of methacrylic acid esters. As these substances have been removed from the ink manufacturing process, further contact with them should not be a problem for the affected employees unless there are delayed health effects. It should be recognized that the National Cancer Institute's Carcinogenesis Testing Program conducted a bioassay of Michler's ketone for possible carcinogenicity and found that, under the conditions of the bioassay, dietary administration of Michler's ketone was carcinogenic to certain species of rats and mice. This data may suggest that Michler's ketone poses a carcinogenic risk to humans. In addition, OSHA and NIOSH conclude that 2-nitropropane is a confirmed animal carcinogen and has the potential to

cause cancer in humans. Both groups urge that all recommendations included in the OSHA/NIOSH Health Hazard Alert Bulletin on 2-nitropropane (DHHS [NIOSH] Publication No. 80-142) be adhered to. If the above mentioned substances are reintroduced into plant processes, it is pertinent that operating procedures in CPI's "General Material Handling Guidelines" including "Dry Powders, Chemicals, Ultraviolet Materials, and Michler's Ketone," be followed.

During the surveys, deficiencies in the use of personal protective equipment and utilization of local exhaust ventilation systems were recognized. Specifically, the respiratory protection program was inadequate, as evidenced by bearded employees, and the lack of standard operating procedures including respirator maintenance, storage, and instruction. In addition, the portable Torit Dust Collectors used throughout the CPI facility were not operating efficiently as noted by their recirculation of particulates. Furthermore, the local exhaust ventilation system provided for the 3-roll mill operations was not always operable. Some dampers in the ventilation ductwork were found closed, which, in effect, eliminated all exhaust hood contaminant collection. Recommendations concerning these shortcomings and general work practices are included in Section VII of this report.

In conclusion, NIOSH believes that there are numerous substances used in the production of various inks at the CPI plant, which sufficient exposure may result in the symptoms reported by employees. However, information collected during the NIOSH surveys did not indicate excessive exposure to substances in the CPI facility at the time of the study. Although no excessive exposures were documented, the symptoms reported by 40% of the workers suggests that something in the work environment may be contributing to their occurrence. This may indicate that exposures at times are high, or, that there is a broad range of susceptibility to the component(s) of UV inks, and that some individuals develop symptoms at low exposures. This possibility is further supported by the use of an ineffective ventilation system, poor work practices, and improper use of personal protective equipment.

## VII. RECOMMENDATIONS

1. Plant management and the workforce should familiarize themselves with any manufacturers' recommendations regarding precautionary measures and specific directions before attempting to use any materials in the production of inks. Current Material Safety Data Sheets and all available information concerning products used (including health effects) should be obtained and made available to all personnel.

2. Post and enforce a no smoking rule in the oil laboratory area.

3. Guidelines covering general personal protective equipment should be implemented. Procedures regarding protective equipment maintenance, use, and limitations should be established and enforced.

4. If the portable Torit Dust Collectors continue to be used, they should be properly maintained. Periodic maintenance checks should be performed to ensure their proper working and collection efficiencies. If any new local exhaust systems are installed, they should be in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z.9.2. - 1960.

5. Establish and enforce a respiratory personal protective equipment program pursuant to those quidelines found in DHEW (NIOSH) Publication No. 76-189, "A Guide to Industrial Respiratory Protection," and to the General Industry Occupational Safety and Health Standards (29 CFR 1910.134).

6. Ascertain through periodic checks that the local exhaust ventilation system provided for the 3-roll mills is operating as designed when milling processes are performed. The manually adjustable dampers should be kept in a full open position when the ventilating system is in operation.

## VIII. REFERENCES

1. Kominsky, J.R., Hazard Evaluation and Technical Assistance Report HE 75-106, NIOSH, Cincinnati, Ohio, December 1975.

2. Printing Ink Handbook (3rd ed.). Compiled by Product and Technical Publications Committee, National Association of Printing Ink Manufacturers, Inc. 1976.

3. Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980, American Conference of Government Industrial Hygienists (ACGIH), Cincinnati, Ohio.

4. NIOSH/OSHA Pocket Guide to Chemical Hazards, DHEW (NIOSH) Publication No. 78-210, September 1978.

5. Bioassay of Michler's Ketone for Possible Carcinogencity, Carcinogenesis Testing Program, National Cancer Institute. U.S. Dept. (HEW), NIH Publication No. 79-1737.

6. OSHA/NIOSH Health Hazard Alert 2 - Nitropropane, DHHS (NIOSH) Publication No. 80-142.

## IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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## X. 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:

1. Consolidated Printing Ink Company, Inc., West St. Paul, Minnesota
2. International Representative, O.C.A.W.
3. Local 6-528 Representative, O.C.A.W.
4. NIOSH Region V
5. OSHA Region V

For the purposes 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 the exposed employees work.

TABLE I
Air Sampling and Analysis Methodology
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Substance | Collection Device | Flow Rate (liters per minute) | Analysis | References |
|---|---|---|---|---|
| Benzophenone | Glass Fiber Filter | 1.5 | High Pressure Liquid Chromatography (HPLC) | |
| Trimethylol Propane Triacrylate | Glass Fiber Filter | 1.5 | HPLC | |
| Chromium | Tared FWSB Filter | 1.5 | Atomic Absorption | NIOSH P&CAM 173 |
| Lead | Tared FWSB Filter | 1.5 | Atomic Absorption | NIOSH P&CAM 173 |
| Nuisance Particulates | Tared FWSB Filter | 1.5 & 2.0 | Gravimetric | |
| Chromium VI | Tared FWSB Filter | 2.0 | Colorimetric | NIOSH P&CAM 169 |
| Hydroquinone | AA Filter | 1.5 | HPLC | NIOSH S-57 |
| Sodium Hydroxide | Impinger & HCl | 1.0 | Atomic Absorption | NIOSH P&CAM 173 |
| Ethyl Acetate | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH S-49 |
| N-Propyl Acetate | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH S-48 |
| Toluene | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH P&CAM 127 |
| Xylene | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH P&CAM 127 |
| Ethyl Alcohol | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH S-56 |
| Methyl Ethyl Ketone | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH P&CAM 127 |
| Isopropyl Alcohol | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH S-65 |
| Methyl Isobutyl Ketone | Charcoal Tube | 0.05 & 0.1 | Gas Chromatography | NIOSH P&CAM 127 |
| Methyl Alcohol | Silica Gel Sorbent Tube | 0.05 | Gas Chromatography | NIOSH S-59 |

TABLE II
Environmental Evaluation Criteria
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Substance | Evaluation Criteria ($mg/M^3$) | Source | Primary Health Effects | OSHA Standard ($mg/M^3$) |
|---|---|---|---|---|
| Chromium | 0.5 | ACGIH | Respiratory system irritant | 1.0 |
| Chromium VI | 0.001 | NIOSH | Suspect carcinogen[1] Respiratory system | 0.1 |
| Ethyl Acetate | 1400 | OSHA | Eye, skin, and respiratory tract irritation | 1400 |
| Ethyl Alcohol | 1900 | OSHA | Eye, nose, skin irritation, narcosis | 1900 |
| 1,6-Hexanediol Diacrylate | ----- | ----- | Allergic skin sensitizer | ----- |
| Hydroquinone | 2 (15-min. ceiling) | NIOSH | Eye and skin irritant, CNS effects | 2 |
| Isopropyl Alcohol | 984 | NIOSH | Mild irritation of skin and eyes, narcosis | 984 |
| Lead | 0.05 | OSHA | CNS effects, kidneys, blood | 0.05 |
| Methyl Alcohol | 262 | NIOSH | Neuroptic, central and peripheral nervous system effects | 262 |
| Methyl Ethyl Ketone | 590 | NIOSH | Eye, skin, and mucous membrane irritation, narcosis | 590 |
| Methyl Isobutyl Ketone | 200 | NIOSH | Eye, skin, and mucous membrane irritation, narcosis | 410 |
| Michler's Ketone | ----- | ----- | See Footnote 2 | ----- |

TABLE II (Cont'd.)
Environmental Evaluation Criteria
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Substance | Evaluation Criteria ($mg/M^3$) | Source | Primary Health Effects | OSHA Standard ($mg/M^3$) |
|---|---|---|---|---|
| 2-Nitropropane | 90 | OSHA | Potential human carcinogen[3] | 90 |
| N-Propyl Acetate | 840 | OSHA | Irritation of eye, skin and respiratory system | 840 |
| Nuisance Particulates | 10 | ACGIH | Respiratory system impairment | 15 |
| Pentaerythritol Triacrylate | ----- | ----- | Allergic skin sensitizer | ----- |
| Sodium Hydroxide | 2 (15-min. ceiling) | NIOSH | Respiratory tract irritation eyes, skin, and alimentary tract | 2 |
| Toluene | 375 | NIOSH | Eye, skin, and respiratory tract irritation, CNS depressant | 753 |
| Trimethylol Propane Triacrylate | ----- | ----- | Eye and skin irritant, allergic skin sensitizer | ----- |
| Xylene | 434 | NIOSH | CNS depressant eye, nose, throat irritation | 434 |

1. NIOSH Criteria Document for Chromium VI, HEW (NIOSH) Publication No. 76-129. Value given is for carcinogenic Cr VI.
2. Under conditions of a NCI bioassay (1976), dietary administration of Michler's ketone was carcinogenic to certain species of rats and mice. NIH Publication No. 79-1737.
3. OSHA/NIOSH Health Hazard Alert 2-Nitropropane, DHHS (NIOSH) Publication No. 80-142.
4. All air contaminants are time-weighted average (TWA) exposures for a normal workday, 40-hour workweek unless otherwise designated.

TABLE III
Results of Environmental Air Samples
for Benzophenone and Trimethylol Propane Triacrylate
Processing Ultraviolet Inks
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Sample Location | Date/Time | Sample Volume (liters) | Benzophenone (mg/M3) | Trimethylol Propane Triacrylate (mg/M3) |
|---|---|---|---|---|
| Paste Ink Area Weigher | 5/7/80 16:50-21:50 | 450 | N.D. | N.D. |
| Mixing Room Mixer | 5/7/80 18:24-22:20 | 294 | N.D. | N.D. |
| 3-Roll Mill Area Millhand | 5/7/80 18:51-23:20 | 404 | N.D. | N.D. |
| 3-Roll Mill Area Millhand | 5/7/80 21:40-1:35 | 353 | N.D. | N.D. |
| Mixing Room Weigher/Mixer | 5/8/80 6:35-6:52 | 26 | N.D. | N.D. |
| Mixing Room Mixer | 5/8/80 6:55-14:52 | 671 | N.D. | N.D. |
| Oil Dept. Weigher | 5/8/80 8:37-10:06 | 134 | N.D. | N.D. |
| 3-Roll Mill Area Millhand | 5/8/80 13:15-14:35 | 120 | N.D. | N.D. |
| N.D. = nondetectable concentration | | | | |
| Laboratory analytical limits of detection (mg/sample) | | | 25 | 25 |

TABLE IV
Results of Environmental Air Samples for Chromium, Chromium VI, Lead, and Particulates
Processing Ultraviolet Inks

| Sample Location | Date/Time | Sample Volume (liters) | Chromium (mg/M3) | Chromium VI (mg/M3) | Lead (mg/M3) | Nuisance Particulates (mg/M3) |
|---|---|---|---|---|---|---|
| 3-Roll Mill Area Millhand | 5/7/80 6:51-11:20 | 404 | N.D. | --- | N.D. | 0.1 |
| Fluid Ink Area Weigher/Mixer | 5/7/80 12:52-13:25 | 66 | --- | N.D. | --- | 4.1 |
| Evaluation Criteria: | | | 1.0 | 0.001 | 0.1 | 10 |
| N.D. = nondetectable concentration. | | | | | | |
| Laboratory analytical limits of detection (mg/sample) | | | 2.0 | 0.5 | 1.0 | |

TABLE V
Results of Environmental Air Samples for Hydroquinone
Processing Ultraviolet Inks
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Sample Location | Date/Time | Sample Volume (liters) | Hydroquinone ($mg/M^3$) |
|---|---|---|---|
| Mixing, Dry Color, Weighout and Carbon Rooms Weigher | 5/7/80 16:50-21:50 | 450 | N.D. |
| Mixing Room Mixer | 5/7/80 18:24-22:20 | 294 | N.D. |
| 3-Roll Mill Area Millhand | 5/7/80 21:40-1:35 | 353 | N.D. |
| Mixing Room Mixer | 5/8/80 6:55-14:52 | 671 | N.D. |
| Weighout Area Weigher | 5/8/80 8:37-10:06 | 134 | N.D. |
| 3-Roll Mill Area Millhand | 5/8/80 13:15-14:35 | 120 | N.D. |
| Evaluation Criteria: | | | 2.0 (15-min. ceiling) |
| N.D. = nondetectable concentrations. Laboratory analytical limit of detection (mg/sample) | | | 18 |

TABLE VI
Results of Environmental Air Samples for Sodium Hydroxide

| Sample Location | Date/Time | Sample Volume (liters) | Sodium Hydroxide ($mg/M^3$) |
|---|---|---|---|
| Pan Wash Area Area Sample | 5/8/80 7:21-14:43 | 402 | 0.02 |
| Evaluation Criteria: | | | 2.0 (15-min. ceiling) |
| Laboratory analytical limit of detection (mg/sample) | | | 2.0 |

TABLE VII
Results of Environmental Air Samples for Solvents
Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Sample Location | Date/ Time | Sample Volume (liters) | Ethyl Acetate (mg/M ) | N-Propyl Acetate (mg/M ) | Toluene (mg/M ) | Xylene (mg/M ) | Ethyl Alcohol (mg/M ) | Methyl Ethyl Ketone (mg/M ) | Isopropyl Alcohol (mg/M ) | Methyl Isobutyl Ketone (mg/M ) |
|---|---|---|---|---|---|---|---|---|---|---|
| Fluid Ink Area Weigher | 5/7/80 6:51-11:10 | 13.9 | 97.6 | 2.5 | 8.6 | 4.1 | 96.0* | N.D. | 27.1 | 1.7 |
| Roto Area Mixer/Weigher | 5/7/80 6:49-11:12 | 27.9 | 183 | 27.0 | 37.6 | 2.7 | 12.8 | ---- | ---- | ---- |
| Roto Lab Area Lab Tech | 5/7/80 8:40-11:21 | 17.5 | 52.7 | 41.0 | 8.3 | 2.2 | 158* | N.D. | 34.6* | 2.0 |
| Fluid Ink Area Weigher/Mixer | 5/7/80 6:51-11:05 | 21.0 | 61.1 | 8.8 | 10.8 | 7.3 | 162* | N.D. | 38.4* | 3.5 |
| Roto Area Weigher | 5/7/80 6:53-11:05 | 26.3 | 75.5 | 12.7 | 11.8 | 2.9 | 44.2 | ---- | ---- | ---- |
| Roto Room Fluid Ink Area | 5/7/80 6:53-11:05 | 20.3 | 88.1 | 31.1 | 9.8 | 7.9 | 266* | N.D. | ---- | 2.5 |
| Roto Room Lab Tech | 5/7/80 11:23-16:10 | 17.4 | 131 | 104 | 7.9 | 3.9 | 181* | N.D. | 45.5* | 3.2 |
| Roto Room Weigher/Mixer | 5/7/80 11:06-15:03 | 8.6 | 57.0 | 5.4 | 6.1 | 3.8 | 103* | N.D. | 43.6* | N.D. |
| Roto Area Weigher | 5/7/80 11:07-15:03 | 23.6 | 46.5 | 14.5 | 12.1 | 3.0 | 43.0 | ---- | ---- | ---- |
| Roto Room Fluid Ink Operator | 5/7/80 11:04-15:03 | 11.7 | 84.1 | 49.2 | 6.6 | 2.4 | 249* | N.D. | ---- | 1.7 |
| Roto Room Weigher | 5/7/80 11:10-15:30 | 20.0 | 86.0 | 3.1 | 5.9 | 4.4 | 53.2* | N.D. | 18.1 | 1.1 |
| Roto Area Fluid Ink Operator | 5/7/80 11:12-15:03 | 23.6 | 46.5 | 14.5 | 12.1 | 3.0 | 43.0 | ---- | ---- | ---- |
| Roto Lab Area Color Matcher | 5/8/80 7:52-10:30 | 22.0 | 6.1 | N.D. | 2.6 | 318 | 100* | 131 | 34.0* | 0.6 |
| Roto Lab Area Color Matcher | 5/8/80 8:00-14:47 | 52.2 | 3.0 | N.D. | 3.5 | 134 | 54.0* | 58.0* | 11.5* | N.D. |
| Roto Lab Area Color Matcher | 5/8/80 7:55-14:53 | 33.9 | 2.8 | N.D. | 1.8 | 190 | 48.0* | 90.2* | 25.3* | N.D. |
| Evaluation Criteria: | | | 1400 | 840 | 750 | 434 | 1900 | 590 | 984 | 200 |

*Breakthrough may have occurred on this sample for this compound. Values should be considered as minimum concentrations.

N.D. = nondetectable concentrations.

TABLE VIII

Results of Environmental Air Samples for Methyl Alcohol

Consolidated Printing Ink Company, Inc.
West St. Paul, Minnesota
HE 80-46

| Sample Location | Date/Time | Sample Volume (liters) | Methyl Alcohol ($mg/M^3$) |
|---|---|---|---|
| Roto Room Weigher/Mixer | 5/7/80 11:06-15:03 | 8.9 | 2.3 |
| Roto Room Weigher | 5/7/80 11:07-15:03 | 4.2 | 31.0 |
| Roto Room Fluid Ink Operator | 5/7/80 11:05-15:03 | 7.9 | 16.5 |
| Evaluation Criteria: | | | 262 |
| Laboratory analytical limit of detection (mg/sample) | | | 0.01 |