U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-96-390

Herald-Times, Inc.
1900 S. Walnut Street
Bloomington, Indiana 47401

April 1977

I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Herald-Times, Inc. on September 22-23, 1976. The following determinations are based upon the results of environmental sampling, confidential employee interviews, available toxicity information, evaluation of work procedures, and inspection of the plant premises.

1. Air contamination from the polymer plate system does not pose a chronic health hazard. However, there is an eye hazard because of potential contact with the process chemicals (especially the etch bath and its constituents).

2. Exposures to oil mist and Stoddard solvent in the press room do not constitute a health hazard.

3. With the personal protection program and limited exposure (1-2 hrs/day) the noise levels in the press room do not present a hearing loss hazard.

4. The sump box in the basement, presently a sealed unit, does not present a health hazard to nearby workers.

5. The "LPG" fork lift emitted hazardous concentrations of carbon monoxide (CO) and as was pointed out during the survey must be carefully maintained and used with discretion.

Several recommendations are presented in the text of this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Information 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 through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies have been sent to:

1. Herald-Times Inc., Bloomington, Indiana
2. U.S. Department of Labor, Region V
3. NIOSH, Region V

To inform the nine affected employees, the employer shall promptly post the Determination Report in a place prominent to these employees for a period of 30 days.

III. INTRODUCTION

Section 20 (a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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.

NIOSH received such a request from an authorized employer representative to evaluate the potential hazards associated with the photo-polymer system, the press room, and the rest of the Herald-Times complex. The request was prompted by the newspaper's interest in environmental affairs and wanting to "keep their own house in order". Also, about a year ago, several employees working in the vicinity of a basement sump, complained of headache.

IV. HEALTH HAZARD EVALUATION

A. Facility and Process Description

The Herald-Times is a newspaper which employs about 100 full-time and 50 part-time employees, has a circulation of about 26,000 daily and 40,000 Sunday papers, and has been located in the present building since 1961. About 300 pages of print are produced per week. With the exception of Saturday (2 shifts) the company works on a 1 shift per day, 7 days per week basis. Although a walk-through was made of the entire facility, the survey focused on the Plate and Press Departments. At the time of the survey, nine persons were employed in these two departments.

The plate-making process uses photo-initiated polymers to produce newspaper printing plates. In a tower (cabinet) the liquid polymer is dispensed automatically onto aluminum plate backings and leveled to a thickness of 0.020 inches with a motor-driven coating knife. The polymer is exposed, through a negative, to actinic light (360 nanometers) which solidifies the polymer in those areas where exposure occurs. During exposure, a door in the front of the coating/exposure tower is lowered to protect the operator

from the U-V light. After exposure, the remaining liquid polymer is emulsified by subjecting the plate to sonic energy in an etch bath. The plate is lifted from the etch bath and placed into a rinse bath where it is sprayed with fresh water to remove the etchant material. The washed plate is moved to a vertical dryer to remove all moisture. The dry plate is then inserted into a shielded cabinet and re-exposed to actinic light to complete the photo-hardening of the polymer. The plates are then trimmed and prepared for placement on the printing presses. It should be noted that the company has an older model tower and system (used for back-up) which generates the same product. The major disadvantage of the older unit is that several of the operations are manual and the operator has greater chance of physical contact with the process materials. The major health implications of this process are related to physical contact with the process materials, either the polymer solution or the etch bath constituents. Although it was not felt that emissions from this process would pose a health hazard, several air samples were collected for total phenols, sodium hydroxide (NaOH), and ozone in this work area. Methylene chloride is used for about 1 hour per month to clean dried polymer off the tower (it was not used during the survey).

The newspapers are printed in the press room on a 4-unit Walter Scott press which has a maximum capacity of 41,000 newspapers per hour. The number of units used in a production run is dependent primarily upon the pages of print desired. The black printing ink is piped from a 1200 gallon holding tank to the ink fountains and applied to the printing plates by rollers. The reel room is located on the floor level immediately below the presses. The worker exposures in the press and reel rooms include noise, oil mist (ink), and Stoddard solvent. There are two ink mist controllers in the press room, one at each end of the room. The effectiveness of these controllers was not evaluated.

An LPG fired fork lift truck is used on the lower level primarily for moving rolls of paper from the warehouse area (north store room) to the reel room.

B. Evaluation Methods and Results

1. Environmental

Air samples for total phenols were collected using midget impingers and personal sampling pumps operating at flow rates of 1.0 liters per minute (lpm). The absorbent was 10 milliliters (ml) of 0.1 N sodium hydroxide solution. The samples were analyzed by gas chromatograph (GC)[1] (Table 1).

Air samples for sodium hydroxide were collected by two methods, both using personal sampling pumps: 1) using fritted glass bubblers at flow rates of 1.0 lpm and containing 15 ml of 0.0075 M HCl absorbing solution; and 2) using 37 millimeter (mm) diameter membrane filters at flow rates of 1.0 lpm. All of these samples were analyzed by an electrometric titration method[2] (Table 2).

Drager colorimetric indicator tubes were used to check for ozone at the coating/exposure tower on September 22, 1976. These results were negative.

Air samples for oil mist were collected using 37 mm membrane filters and personal sampling pumps operating at air flow rates of 2.0 lpm. These samples were analyzed by a fluorescence method[3] (Table 3).

Air samples for Stoddard solvent were collected using organic vapor charcoal tubes and personal sampling pumps to provide an air flow of about 100 cubic centimeters (cc) of air per minute. The tubes were analyzed by gas chromatography[4] (Table 4).

Four bulk samples (2 newsprint paper and 2 settled dust) were collected and analyzed microscopically to determine the presence of asbestos fibers (none were detected).

Sound pressure level determinations were made at a number of locations using a General Radio Model 1565-B Sound Level Meter operating on the "A" weighting network and slow response (Table 5).

Drager colorimetric indicator tubes were used to measure for carbon monoxide (CO) in the vicinity of the LPG fork lift, while it was idling (Table 6).

2. Medical

During the survey, 9 employees working in the Plate and Press Departments were interviewed using a non-directed questionnaire. The purpose of the interviews was to elicit symptomatology which the employees might feel was related to their work environment. Three of the employees felt that the oil or ink mist made breathing "unpleasant" or "bothered" the breathing. One of these three employees also felt that the etching solution might cause a minor skin irritation. The other six employees did not cite symptomatology which might be work related. None of the employees cited chronic health problems which could be work-related.

C. Evaluation Criteria

1. Physiological Effects

a. Polymer

The liquid polymer system was developed and formulated to meet critical specifications necessary for newspaper printing plates. Little toxicological information exists on the components and there are no known applicable standards or criteria for standards. The manufacturer contracted with an independent firm to test the toxicological characteristics of the polymer mixture. These animal experiments indicated that the mixture was not acutely toxic by oral, respiratory, or dermal routes nor was it a primary eye irritant according to "191.1 (F)(3) of the Federal Substance Act". Repeated patch testing indicated that the material was not a primary skin irritant but that

skin sensitization is possible.[5] This skin sensitization may be due to a polymer incorporating a carbamate moity. Other carbamate monomers have been demonstrated to be moderate skin sensitizers.[6]

b. Sodium Hydroxide

Sodium hydroxide (NaOH) is a strong primary irritant by any route of contact with the body whether by inhalation or simple skin contact. Since NaOH is present in the etch bath at a high concentration, the bath must be considered hazardous.

The severity of damage, either skin irritation or chemical burns resulting from skin contact, depends on concentration and length of time of contact. There is a latent period following skin contact during which no sensation of irritation occurs.[7] Following contact, the exposed individual may not take immediate first aid measures because of the lack of pain sensation. Or splashed clothing may hold the caustic solution against the skin with the employee being reluctant to immediately change clothes since no irritation is felt.

There are many recorded instances where sodium hydroxide has caused eye burns and blindness in workers.[8] When NaOH is in contact with the eye, even for a few seconds, damage can result. Shapiro observed that eye contact with 4% NaOH solution for just two seconds, followed by extensive water irrigation, produced damage in the eyes of rabbits. Other experiments have shown a 2% solution of NaOH to cause blindness in 65-91% of rabbits whose eyes were exposed for just one minute, followed by irrigation with water.[10] Since the etch solution used at the Herald-Times is greater than two or even 4% NaOH, it must be concluded that a hazard, with potential for eye injury, does exist.

The inhalation of NaOH via a dry powder or in solution as a mist can result in irritation and injury to the upper respiratory tract and lungs. Chronic lung irritation, because of prolonged exposures, may lead to shortness of breath, chest pains, bronchopneumonia, and lung tissue destruction.[8]

c. Phenols

There is little available toxicological information on the proprietary phenolic compound which comprises a major proportion of the etch bath. An assessment of the toxicology of the proprietary phenol is therefore inferred by considering phenol and the phenolic chemical family. It was not possible to determine whether the proprietary phenol approached the degree of toxicity of phenol.

Phenol is both a strong primary irritant and a systemic poison with the ability to be rapidly absorbed through the skin and mucous tissue. Dermatitis consisting of reddening and inflamation of the skin may be the result of mild exposures and necrosis of the affected area may result from prolonged severe contact. With absorption, the initial effects will be numbness and blanching. Toxic effects to other areas of the body will then ensue, especially with acute exposures. Symptoms include vomiting, diarrhea, loss of appetite, headache, dizziness, metal confusion, and rapid irregular pulse and breathing. Death by respiratory arrest may occur in extreme cases of acute poisoning. The effects of chronic poisoning have been listed as damage to the heart, lungs, nervous system, liver and kidney. Chronic respiratory tract irritation due to phenol can lead to bronchitis and bronchopneumonia.[6,11-13]

d. Methylene Chloride

Methylene chloride is one of the least hazardous of the chlorinated hydrocarbons, the principal hazardous effect being a depressant action on the central nervous system. There is experimental animal evidence that methylene chloride can produce liver and kidney changes. Recent studies have shown that methylene chloride can be metabolized in the body to carbon monoxide, resulting in significant levels of carboxyhemoglobin.[14]

e. Ink Mist

The composition of the ink mist is predominately mineral oil with a lesser amount of carbon black. Inhalation of oil mists may cause mucous membrane irritation and a pulmonary pneumonitis. Prolonged contact with oil mist may cause skin irritation and dermatitis. Carbon black is generally considered to be relatively inert from a physiological viewpoint. Chronic animal studies have shown that other than an accumulation of dust in the pulmonary system, exposure to carbon black produced no significant effects. Although agents with carcinogenic potential have been extracted from carbon black their activity may be surpressed due to a protective action on the part of the carbon black.[15]

f. Stoddard Solvent

Stoddard solvent is generally considered to be a relatively high boiling mixture of aliphatic and aromatic hydrocarbons. Commercial brands are generally considered to have an aromatic content of about 15%. Acute exposure to Stoddard solvent may cause irritation of the eyes and respiratory tract and may produce narcotic effects.[15]

g. Carbon Monoxide

The predominate effect of carbon monoxide (CO) inhalation is its reaction with the blood hemoglobin to form carboxyhemoglobin. If the CO exposure is sufficient, the blood's ability to carry oxygen is impaired and general oxygen starvation (hypoxia) occurs in body tissue. Both the nervous system and the heart are susceptable to decreases in the blood oxygen. Symptoms of CO exposure may include headache, nausea, vomiting, dizziness, drowsiness, collapse, and unconsciousness. The physiological effects are typical of those resulting from tissue hypoxia. The more important of these effects are heart strain, which can induce myocardial damage, and injury to the nervous system and brain.

h. Noise

Environmental standards for noise exposure are designed to guard against hearing losses although noise exposure may also interfere with job performance and disrupt speech communications. For other physical and physiological disorders there is insufficient or inconclusive evidence upon which to base a standard.

2. Environmental Criteria

The primary sources of environmental evaluation criteria considered for this study were: 1) the NIOSH criteria documents,[8,13,16] 2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's),[17] and 3) the U.S. Department of Labor Federal Occupational Health Standards.[18] Only the criteria or standards considered most applicable are listed as follows:

Substance	Ceiling Value	8-Hour Time Weighted Average
Sodium Hydroxide[a]	2 mg/M^3	--
Phenol[a]	60 mg/M^3	20 mg/M^3
Oil Mist[b]	--	5 mg/M^3
Stoddard Solvent[b]	--	100 ppm
Carbon Monoxide[a]	--	35 ppm

[a]NIOSH Criteria for a Recommended Standard
[b]ACGIH Threshold Limit Value

The U.S. Department of Labor Federal Occupational Health Standard for noise is as follows:

Duration per Day (hours)	Sound Pressure Level (dbA)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
.5	110
.25 or less	115

These values apply to total time of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposures but does not apply to impact or impulse type of noises.

D. Discussion-Recommendations

1. Plate Department

A careful review and study of the Plate Department - work procedures, materials used, air sample results (Tables 1 & 2), employee interviews, etc. - indicated that at the time of the survey, air contamination did not pose a health hazard. However, several of the materials used in this department are irritants (e.g. the NaOH solution is highly caustic) and precautionary measures to ensure worker safety are necessary. It is recommended that:

a. The manufacturer's handling and hygiene procedures for the polymer system (provided to the Herald-Times) be frequently consulted and followed closely. It is particularly important that chemical safety goggles or face shields be used whenever there is any contact or potential contact with the process chemicals (especially the etch bath and its constituents).

b. The bare hands should not be used to move the plates into and out of the etch bath. If protective gloves slip on the plates, then perhaps tongs could be used. The manufacturer's production procedures state that "whenever contact with solvent or plate making material is likely, gloves must be worn for protection". Such gloves should be changed on a periodic basis.

c. Protective aprons might be considered for those persons working with the polymer process. Flannel-lined neoprene aprons would be suitable.

d. Since the sump box in the basement is a sealed unit, there cannot be emissions to affect the health of nearby workers. Even if it were an open unit - the air sample results from the Plate Department would indicate no problem. It is recommended that the sump box not be cleaned out immediately following a change of the etch bath in the Plate Department.

e. Lunches should not be stored or eaten in the vicinity of the polymer process or chemicals. During the survey, the coffee pot which was sitting adjacent to the etch tank, was moved at request of the NIOSH investigators.

2. Press and Reel Rooms

The principal health hazards in the Press Department which were studied relate to Stoddard solvent, ink mist (mineral oil and carbon black), and noise. The air sample results for solvent vapors and oil mist (ink) indicate concentrations which were only a fraction of appropriate environmental limits (Tables 3 & 4). On the basis of the air concentrations it is evident that additional control systems to reduce employee exposures to the solvent vapor and oil mist are not necessary. The employees who indicated that the press room environment imposed an "unpleasant" or "bothered" sensation on their breathing also stated that the use of respirators eliminated these non-normal sensations. It is therefore suggested that the company continue a respirator program for the comfort of the press room employees. U.S. Department of Labor Regulations[18] should be consulted for the elements of an acceptable respirator program. Paper dust, which is considered a "nuisance" dust for health standard considerations, was not a problem as judged by the press room atmosphere. The results of other studies support this conclusion. The analyses of the bulk samples (paper and dust) for asbestos did not show the presence of asbestos minerals.

Since the average daily production rate on a weekly basis is a bit less than 28,000 papers per day, the normal press time is expected to average about an hour per day. The sound pressure level determinations on Table 5 then indicate that the company is meeting current federal standards. It is noted that the company has a hearing conservation program which includes annual audiograms and provision of hearing protective devices for the press room employees. It is recommended that the company continue these programs.

3. Warehouse Area (Basement)

The air sample results for CO (Table 6) indicate that there is a potential for hazardous exposure because of the LPG-powered fork lift. It is recommended that the fork lift be carefully maintained on a periodic basis and that it be

13. Criteria for a Recommended Standard ... Occupational Exposure to Phenol, U.S. Department of Health, Education and Welfare, PHS, NIOSH, 1976, HEW Pub. No. (NIOSH) 76-196.

14. Carl Zenz, Editor. Occupational Medicine - Principles and Practical Applications (Chicago: Year Book Publishers, Inc.) 1975.

15. American Conference of Governmental Industrial Hygienists, Documentation of the Threshold Limit Values for Substances in Workroom Air. Ed. 3, Cincinnati, Ohio 1971.

16. Criteria for a Recommended Standard ... Occupational Exposure to Carbon Monoxide. U.S. Department of Health, Education, and Welfare, PHS, NIOSH, 1972. Pub. No. HSM 73-11000.

17. Threshold Limit Values for Chemical Substances in Workroom Air by ACGIH for 1976. American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio 45201.

18. U.S. Department of Labor, Occupational Safety and Health Administration. OSHA Safety and Health Standards (29 CFR 1910) OSHA 2206 (Revised January 1976) p. 99.

VI. AUTHORSHIP

Report Prepared By:

Kenneth J. Kronoveter
Sr. Sanitary Engineer
Industrial Hygiene Section
Hazard Evaluation & Technical Assistance Branch

Assisted By:

Jack Gill
Industrial Hygienist

VII. ACKNOWLEDGEMENTS

Analytical Services:

Measurements Support Branch
Cincinnati, Ohio

Utah Biomedical Test Laboratory
Salt Lake City, Utah

TABLE 1

RESULTS OF FIXED LOCATION AIR SAMPLES FOR TOTAL PHENOLS

Herald-Times, Inc.
Bloomington, Indiana

Date	Time	Location	Total Phenols (mg/M^3)*
9-22-76	9:16 - 12:25	6' from etch tank	None Detected**
9-22-76	9:16 - 12:25	1' above etch tank	None Detected
9-23-76	10:18 - 1:25	6' from etch tank	0.1
9-23-76	10:18 - 1:25	1' above etch tank	None Detected

There isn't a standard for total phenols but the NIOSH recommended standard for phenol is 20.0 mg/M^3 for an 8-hour time weighted average daily exposure.

* Milligrams of total phenols per cubic meter of air.

** None detected - less than 0.05 mg/M^3.

TABLE 2

RESULTS OF FIXED LOCATION AIR SAMPLES FOR SODIUM HYDROXIDE

Herald-Times, Inc.
Bloomington, Indiana

Date	Time	Sample Type	Location	NaOH Concentration (mg/M^3)*
9-22-76	8:18 - 3:30	(I)**	6' from etch tank	None Detected****
9-22-76	8:18 - 3:30	(I)	1' above etch tank	1.8
9-22-76	9:16 - 10:33	(F)***	6' from etch tank	None Detected
9-22-76	9:16 - 10:33	(F)	1' above etch tank	None Detected
9-23-76	9:13 - 2:25	(I)	6' from etch tank	.8
9-23-76	9:13 - 2:25	(I)	1' above etch tank	1.0
9-23-76	10:18 - 11:55	(F)	6' from etch tank	None Detected
9-23-76	10:18 - 11:56	(F)	1' above etch tank	None Detected

The NIOSH recommended standard for sodium hydroxide is 2 mg/M^3 as a "ceiling" or maximum exposure.

* Milligrams of NaOH per cubic meter of air

** Impinger sample

***Filter sample

****None Detected - less than 1.0 mg/M^3

TABLE 3

RESULTS OF AIR SAMPLES FOR OIL MIST (INK)

Herald-Times, Inc.
Bloomington, Indiana

Date	Time	Sample Type	Sample Description	Oil Mist Concentration (mg/M^3)*
9-22-76	12:50 - 3:30	Area	Work bench by Unit #1	0.7
9-22-76	12:51 - 3:35	Area	Basement by Unit #1	0.2
9-22-76	12:45 - 3:18	Personal	Folder	0.1
9-22-76	12:40 - 3:17	Personal	Setting Ink	0.5
9-22-76	12:43 - 3:15	Personal	Setting Ink	1.0
9-23-76	8:23 - 2:36	Area	Work bench by Unit #1	.3
9-23-76	12:13 - 2:34	Area	Basement by Unit #4	.4
9-23-76	12:03 - 2:35	Personal	Setting Ink	.7
9-23-76	12:04 - 2:25	Personal	Folder	.4

The 1976 ACGIH Threshold Limit Value for oil mist is 5 mg/M^3 for an 8-hour time weighted average daily exposure.

* Milligrams of oil mist per cubic meter of air.

TABLE 4

RESULTS OF AIR SAMPLES FOR STODDARD SOLVENT

Herald-Times, Inc.
Bloomington, Indiana

Date	Time	Sample Type & Location	Stoddard Solvent Concentration (mg/M^3)*
9-22-76	11:29 - 3:17	Personal - holding tension - basement	9
9-22-76	12:40 - 3:18	Personal - holding tension - basement	6
9-22-76	1:05 - 3:30	Area - work bench by press - main floor	6
9-23-76	8:15 - 9:51 12:31 - 2:34	Area - aisle by press #2 - basement	8
9-23-76	8:15 - 9:51 12:31 - 2:38	Personal - holding tension - basement	6
9-23-76	8:12 - 2:38	Area - work bench by press #1 - Main floor	7
3-76	12:27 - 12:54	Personal - holding tension - basement	5

The 1976 ACGIH Threshold Limit Value for Stoddard solvent is 575 mg/M^3 for an 8-hour time weighted average daily exposure.

* Milligrams of Stoddard solvent per cubic meter of air.

TABLE 5

RESULTS OF NOISE MEASUREMENTS

Herald-Times, Inc.
Bloomington, Indiana
1:55 pm - 2:55 pm, September 22, 1976

Location, comments	Sound Pressure Levels (dbA)*
Control room	71
Work bench - by Unit 1	97
Between Units 1 & 2	102
Between Units 2 & 3	102
Between Unit 3 & Folder	102
Between Unit 4 & Folder	101
Operator's position @ folder - 24,000 papers/hour	93
Operator's position @ folder - 34,000 papers/hour	99
Operator's position @ folder - 35,000 papers/hour	101
Operator's position @ folder - 40,000 papers/hour	102
Just inside plate room, door closed	82
Basement @ steps	91
Basement - between Unit 1 & wall	93
Basement - between Units 1 & 2	96
Basement - between Units 2 & 3	96
Basement - between Units 3 & 4	95
Basement - mailroom by conveyor	78

*All sound pressure measurements were taken with the sound level meter operating on the "A" weighting network (slow response).

TABLE 6

RESULTS OF AIR SAMPLING FOR CARBON MONOXIDE

Herald-Times, Inc.
Bloomington, Indiana
September 22, 1976

Time	Location - Comments	Carbon Monoxide Concentration (ppm)*
12:50	Fork lift started "cold"-left standing at idle rpm	-
12:53	Rear of fork lift	350
12:55	10' to side of fork lift	25
1:02	10' to side of fork lift	130
1:05	20' to rear of fork lift	450
1:07	10' to side of fork lift	250
1:09	Operator's position on fork lift	200
1:11	20' to rear of fork lift	500
1:12	Fork lift turned off	-
1:12	10' to side of fork lift	300
1:15	Operator's position on fork lift	100
1:18	10' to side of fork lift	40

Note: During these tests the fork lift was located in the north store room where the rolls of paper are stored.

The NIOSH recommended standard for carbon monoxide is 35 ppm for an 8-hour time weighted average exposure.

* Parts of carbon monoxide per million parts of air by volume.