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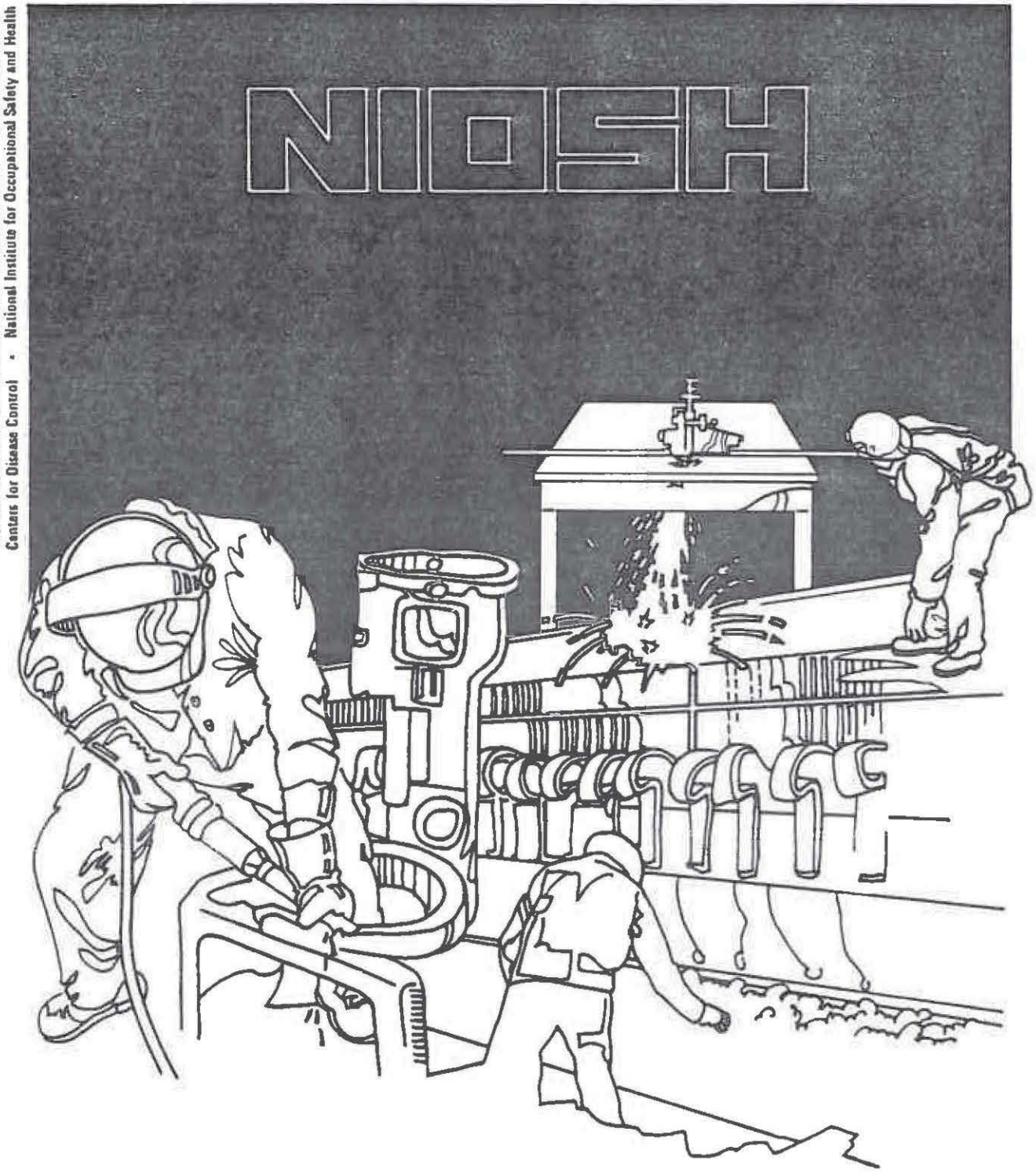

Health Hazard Evaluation Report

80-126-777

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. 699(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.

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NOVEMBER 1980
ST. REGIS PAPER COMPANY
BUCKSPORT, MAINE

NIOSH INVESTIGATOR:
Kevin P. McManus, IH

I. SUMMARY

On April 4, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from an authorized representative of employees at the St. Regis Paper Company, Bucksport, Maine. The request stated that eye and skin irritation had occurred in workers in the Coating Preparation Department. An environmental evaluation was conducted by NIOSH on June 18, 1980 to determine whether formaldehyde, styrene or methylamine was causing the irritation.

A review of Company, OSHA and NIOSH generated data (Table 1) revealed that formaldehyde levels at the sampling ports of the mixing vats do reach concentrations of 3 ppm instantaneously, which is capable of causing the reported irritation. Styrene and methylamine were not detected. Employee interviews indicated that the source of eye irritation was the sampling ports of the mixing vats. The data obtained in this investigation revealed concentrations of formaldehyde in excess of the ACGIH criteria.

NIOSH determined that an irritation hazard to employees existed in the final mix area of the Coating Preparation Department due to excessive instantaneous formaldehyde levels. The Company has completed plans for the installation of a ventilation system designed to create a negative pressure inside the mix tanks. This system will greatly reduce the possibility of formaldehyde escaping through the sampling ports, and consequently should eliminate employee exposure to formaldehyde.

KEYWORDS: SIC 2611 (Paper Mills), formaldehyde, styrene, methylamine, eye irritation.

II. INTRODUCTION

On April 4, 1980, an authorized representative of employees Local #1188, United Paperworkers International Union, submitted a request for a Health Hazard Evaluation in the Coating Preparation Department of the St. Regis Paper Company of Bucksport, Maine. The request stated that employees were experiencing eye and skin irritation. Substances identified by the requestor were Metasol D3TA and DuStrypp (trade names). Federal OSHA and corporate health staff had previously investigated the problem and the operation was found to be in compliance with OSHA standards for formaldehyde and sodium hydroxide.

NIOSH conducted a field investigation on June 18, 1980.

III. BACKGROUND

St. Regis Paper Company's Bucksport, Maine operation manufactures printing paper utilizing a thermo-mechanical pulping process. The "Coating Prep." Department employs twenty persons (4 crews, 5 per crew) and produces approximately 112,000 gallons of coating per day. The total plant produces an average of 1,110 tons of printing paper per day. The final mix area, where the complaints arise, is where the latex, Metasol D3TA and DuStrypp are added via a closed system to the mixing vats containing a clay dispersion. This coating is then fed to the coating machines and applied to the paper rolls.

The final mix area contains five mixing vats approximately 8 ft. in diameter and 10 - 15 ft. deep. Each vat is equipped with a 1 ft. square hinged access port for collection of hourly quality control (Q.C.) samples. Vats operate at 140 degrees Fahrenheit. Each "Coating Prep." Dept. crew consists of five employees working on a 7 day rotating shift basis, allowing three shift coverage and one crew off each day. Of the five employees, two work in the vat room while the other three work in an air conditioned computer room, or outside the building in the pre-mix area.

IV. EVALUATION DESIGN AND METHODS

A. ENVIRONMENTAL

The symptoms presented by the employees suggested exposure to an irritant chemical. A review of the process and of the chemicals used indicated the possibility of three irritant chemicals being present: formaldehyde, styrene and methylamine.

Formaldehyde exposure levels were documented previously on two separate occasions by the Company and OSHA. NIOSH did not attempt to duplicate this data using the same methods. This data is included in the evaluation of formaldehyde exposure. The company data was collected on March 4, 1980 by bubbling air through two impingers in series containing sodium bisulfite collection medium. Analysis was performed colorimetrically using chromatrophic acid (P & CAM 125).[1]

OSHA formaldehyde data was collected on March 25, 1980 using colorimetric detector tubes. On June 18, 1980 NIOSH collected 30 min. air

samples indicative of ceiling concentrations, using specially treated charcoal media. Analysis was performed by gas chromatography. (NIOSH Draft Method)*

Bulk air samples were also collected on silica gel media and analyzed for the presence of methylamine (P & CAM 221 Modified) and charcoal tubes media (P & CAM 530) for styrene.

B. MEDICAL

No formal medical evaluations were deemed necessary. However, private employee interviews were conducted with affected employees at their work stations.

C. EVALUATION CRITERIA

In this study three sources of criteria were used to evaluate workers' exposure to toxic chemicals. These exposure limits are derived from existing human and animal data, and industrial experience, and represent values to which it is believed that nearly all workers may be exposed for an 8 to 10 hour day, 40 hour work week, over a lifetime with no adverse effects. However, due to variations in individual susceptibility, a small percentage of workers may experience effects at or below the recommended exposure limit, a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by development of an occupational illness.

* W.S. Kim, C.L. Geraci, R.E. Kupel, "Sampling and Analysis of Formaldehyde in the Industrial Atmosphere," Dept. of HEW, NIOSH Division of Physical Sciences and Engineering, Cincinnati, Ohio 45226 (Oct., 1978)

The three sources of criteria for this study are: 1) Criteria for a Recommended Standard...Occupational Exposure to Formaldehyde[2] by the National Institute for Occupational Safety and Health; 2) Occupational Safety and Health Standards for General Industry[3] by the Department of Labor's Occupational Safety and Health Administration; and 3) Threshold Limit Values (TLVs) and their supporting documentation[4] by the American Conference of Governmental Industrial Hygienists.

Formaldehyde

Formaldehyde is an intense irritant of the upper respiratory passages. For this reason, systemic poisoning is unlikely since workers would be compelled to leave the exposure area before levels sufficient to cause systemic poisoning were reached. Formaldehyde also irritates the eyes, causing a burning, stinging sensation with consequent tearing.

There are several studies reported in the literature concerning occupational exposure to formaldehyde, with some being analogous to this situation. Bourne and Seferian[6] reported that customers and employees were affected by 0.13-0.45 ppm formaldehyde, reporting stinging eyes, headaches, and throat irritation. Shipkovitz[7] studied eight textile plants and found that an average formaldehyde concentration of 0.68 ppm was causing irritation of mucous membranes, heavy tearing, wheezing, excessive thirst and disturbed sleep in employees. The California Department of Public Health[8] also studied a textile factory which manufactured "permanent press" clothing and found eye and upper respiratory tract irritation from exposures ranging from 0.9 to 2.7 ppm. Additionally,

many studies, Shipkovitz[7], California Department of Public Health[8], Sim and Pattie[9], Kerfoot and Mooney[10], have uncovered evidence that the irritant effects of low level formaldehyde exposure may cease due to "olfactory adaptation" or "acclimatization." However, this adaptation is transient since irritation returns following periods of nonexposure. Elkins[12,13] reported that workers may develop a tolerance to formaldehyde irritation; on the other hand, Henderson and Haggard[11] reported that people may become more susceptible on repeated exposure.

Various studies have reported the odor threshold for formaldehyde. Patty[14] indicates an odor threshold below 1 ppm, which is consistent with Bourne, et al[6], Shipkovitz[7], Reinhalt, Melekhina, and Leonardos et al.

NIOSH has recommended that employee exposure be limited to 1 ppm formaldehyde as measured by a 30 minute sampling period; i.e., any 30 minute exposure during the working day should not exceed 1 ppm. The ACGIH recommends a 2 ppm limit or ceiling value not to be exceeded, even instantaneously. The OSHA Standard is an 8-hour time weighted average of 3 ppm, with a 30 minute ceiling of 5 ppm.

NIOSH has recently reviewed two studies[16] in which laboratory rats exposed to formaldehyde developed nasal cancer. Although humans and animals may differ in their susceptibility to specific chemical compounds, any substance that produces cancer in experimental animals should be considered a cancer risk to man.

Styrene

Styrene vapor in concentrations of 200-400 ppm has a transient irritating effect on the eyes and mucous membranes of the nose.[14] OSHA and ACGIH recommend an 8 hr. Time Weighted Average of 100 ppm.

Methylamine

Methylamine produces transient eye, nose and throat irritation upon brief exposures to 20-100 ppm. No symptoms of irritation are produced from longer exposures at less than 10 ppm.[14] OSHA and ACGIH recommend 10 ppm, 8 hr. TWA.

V. RESULTS AND DISCUSSION

A. ENVIRONMENTAL

A review of the "Coating Prep." Department's raw materials list indicated the possible presence of three contaminants known to elicit the reported symptoms: formaldehyde, styrene and methylamine. Styrene could be present in the latex while formaldehyde and methylamine are reported by the manufacturer as decomposition products of Metasol D3TA. No odor of formaldehyde or styrene was detected by the NIOSH investigator.

Employee exposure levels to suspected concentrations of these three chemicals were evaluated by review of company data, OSHA survey data, and NIOSH environmental survey data (Table 1).

Work practice observations and employee interviews indicated that the source of exposure was the sampling ports of each of the mix tanks. These sampling ports are normally kept closed during "cook", but are required to be opened periodically (one to three times per hour) to collect Q.C. samples. The length of time it took to collect these

samples averaged 30 seconds. (Employees indicated that these ports have been left open in the past and symptoms were worse.)

OSHA sampling data indicates that there was no employee exposure to formaldehyde in the general work area where employees spend the majority of their time. However, all three data sources recorded levels of exposure at the sampling ports that are high enough to cause irritative symptoms in workers (see cited literature). NIOSH environmental sampling did not detect the presence of styrene or methylamine. The limit of detection for these was 0.01 mg per sample.

B. MEDICAL

Informal interviews with the union steward and several employees in the "Coating Prep." Department and review of the first aid records revealed the following information:

1. Eye irritation is common to workers in the final mix area who are required to collect samples from the mix tanks (screeners). Employees indicated that the irritation is worse in the winter months when the windows are closed. The irritation is characterized by mild pain and tearing in the eyes. The irritation subsides rapidly upon removal from exposure.

2. Other employees of the "Coating Prep." Department, who have no direct exposure but must pass through the area, have experienced eye irritation. These employees are the operators and assistant operators whose work station is in the air conditioned computer room and the slurry men who work in the back room. The irritation subsides as soon as they enter the computer room or leave the final mix area.

3. Between the months of August, 1979 through March, 1980 only two employees reported to the plant infirmary, one complaining of eye and skin irritation, the other had symptoms of gastritis.

From the above it is concluded that the irritative symptoms are compatible with the known effects of formaldehyde exposure.

VI. RECOMMENDATIONS

At the time of this writing, plans were being completed for the installation of a ventilation system designed to create a negative pressure inside the mix tanks. This system will greatly reduce the possibility of formaldehyde escaping through the sampling ports, and consequently, should eliminate employee exposures to formaldehyde.

VII. REFERENCES

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VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. 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, this report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report to:

1) St. Regis Paper Company, Bucksport, Maine
2) U.S. Department of Labor, OSHA, Region I
3) NIOSH, Region I
4) Authorized employee representative
5) U.S. Department of Labor, OSHA National Office
6) Maine Department of Human Services, Division of Health Engineering

TABLE 1

SUMMARY OF ENVIRONMENTAL SAMPLING
AT ST. REGIS PAPER COMPANY
COATING PREP. DEPT.
BUCKSPORT, MAINE

FORMALDEHYDE - Criteria 1 ppm* (30 minutes) NIOSH

SOURCE	LOCATION	SAMPLE TIME	RESULT
Company	#1 Mix tank	200 min.	0.1 mg/M^3 (0.8 ppm)
Company	#1 Mix tank	200 min.	0.5 mg/M^3 (.41 ppm)
OSHA	#4 Mix tank	instantaneous	3 ppm
OSHA	#5 Hot storage	"	N.D.**
OSHA	#1 Mix tank	"	2 ppm
OSHA	#5 Mix tank	"	2 ppm
OSHA	#2 Mix tank	"	N.D.
OSHA	#2 Hot storage	"	N.D.
OSHA	Operators table	"	N.D.
NIOSH	#1 Mix tank	30 min.	0.51 mg/M^3 (0.42 ppm)
NIOSH	#5 Hot storage	30 min.	0.49 mg/M^3 (0.40 ppm)

* ppm = parts of contaminant per million parts of air by volume
** = none detected
*** = Time Weighted Average

STYRENE - Criteria 100 ppm (8 hr. TWA)*** OSHA/ACGIH

Company	Final mix area	60 min.	N.D.
Company	Final mix area	60 min.	N.D.

METHYLAMINE - Criteria 20 ppm OSHA/ACGIH

NIOSH	#1 Mix tank	30 min.	N.D.
NIOSH	#5 Hot storage	30 min.	N.D.