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
HE 77-128-470

BISHOP TUBE DIVISION
CHRISTIANA METALS, INC.
FRAZER, PENNSYLVANIA

FEBRUARY 1978

I. TOXICITY DETERMINATION

The following determinations have been made based on environmental air samples collected November 10, 1977, evaluation of ventilation systems and work procedures, confidential employee interviews, and available toxicity information. Employee exposures to methyl chloroform (1,1,1-trichloroethane) did not constitute a health hazard during the degreasing/cutting operations observed. Personal and area air samples ranged in concentration from 3-73 parts per million (ppm), which are below the NIOSH evaluation criteria of 350 ppm. A TIG welding unit is being installed approximately 21 feet from the Building 8 degreasing tank. Area samples taken near the welding unit yielded methyl chloroform concentrations of 5 and 9 ppm. It is therefore recommended that the two operations be physically separated to safer locations or that an airtight barrier be erected between the work areas. The degreaser tank cover should always be in place during welding to reduce the potential of employee exposures to decomposition products - such as the highly toxic gas phosgene - of methyl chloroform when in contact with ultraviolet rays or hot surfaces of the welding process.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request 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 through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

a. Bishop Tube, Frazer, Pennsylvania
b. Authorized Representative of Employees - United Steel Workers of America - Local 7566, Frazer, Pennsylvania
c. United Steel Workers of America - Safety and Health Department, Pittsburgh, Pennsylvania
d. U.S. Department of Labor - Region III
e. NIOSH - Region III

For the purpose of informing the "affected employees" the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

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 an 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees of the United Steel Workers of America, Local 7566, regarding exposures to sodium bichromate and methylene chloride. While discussing the request with the union official on the telephone, it was learned that sodium bichromate was no longer used and methylene chloride had been replaced by another solvent - methyl chloroform. The requestor asked that NIOSH investigate exposures to the new solvent vapors. While not included in the request, employee exposures to nickel and chromium metal were also determined.

IV. HEALTH HAZARD EVALUATION

A. Conditions of Use

Bishop Tube produces small diameter (1 inch or less) redrawn and precision stainless steel tubing. For example, the tubing is used in heat exchangers, aircraft fire detection systems, and hydraulic lines. There are approximately 33 administrative and 180 production and maintenance personnel. Adjoining buildings contain the plant's activities. Building 8, built in 1958, includes annealing, welding, cold drawing, inspection, and finishing operations, and employs approximately 103 employees over three shifts. The building is approximately 165 feet wide by 580 feet long by 26-28 feet high. General ventilation is provided by 20-24 ceiling exhaust fans. The degreasing operation takes place in a tank which measures approximately 40 feet long by 10 feet high by four feet wide. The solvent level is maintained at about 1 1/2 - 2 feet and the temperature is kept at 115°F.

Two cutoff/degreasing operators first use band/circular saws to cut tubing to desired lengths. Then, using a ceiling hoist, they transfer a bundle of tubing into the tank. The bundle remains in the degreasing tank up to 15 minutes, at which time it is raised slowly from the tank to allow sufficient condensation of vapors onto the tank's cooling coils. One operator will degrease while the other is cutting or performing other duties. Approximately 10 loads/shifts are handled.

Building 5, built in 1928, and measuring approximately 100 feet by 340 feet by 12 feet high, includes some additional finishing of products. A degreasing tank measuring 5 feet on all sides maintains about a 2 foot solvent level. Approximately 2-4 times per shift, a basket of small parts may be immersed for a few minutes by different employees. This tank is also maintained at 115°F.

Both solvent tanks are fitted with cloth or canvas covers when not in use.

B. Evaluation Methods

1. Environmental

Personal and area samples were used to evaluate employee exposures. The personal samples were attached near the breathing zone of employees to collect a representative sample of air. The sampling data table includes information on the types of samples collected and their location.

Atmospheric samples for methyl chloroform were collected on activated charcoal tubes. Air was drawn through the tubes by a vacuum pump at a flow rate of approximately 50 or 200 milliliters per minute.

Atmospheric samples for total chromium and nickel metals were collected on 0.8 micron (μ) pore size mixed cellulose ester filters mounted in three piece closed face cassettes, while a sample for chromium VI metal was collected on a 5μ polyvinyl chloride filter. Air was drawn through the filters at a flow rate of 1.5 liters per minute (lpm) using a vacuum pump.

2. Medical

Five employees were interviewed using a non-directed questionnaire. These employees have worked as cutoff/degreasers for about 1-7 years. One employee claimed he had periodic chest pains which he thought could be related to the cutting/degreasing operations. The other four employees had no job-related health complaints.

C. Evaluation Criteria

1. Toxic Effects

Methyl chloroform (1,1,1-trichloroethane)

This substance is a colorless, nonflammable liquid. Upon contact with ultraviolet radiation or hot metal, it will decompose to form the irritant gases phosgene, dichloroacetylene, and hydrochloric acid. The vapor and liquid are irritating to the eyes on contact. Due to the solvent's defatting properties, a dry and fissured dermatitis may result following repeated contact. This substance acts as a narcotic and depresses the central nervous system. Acute symptoms may include dizziness, uncoordination, and drowsiness. Since methyl chloroform attacks natural rubber,

protective clothing of polyvinyl alcohol or neoprene is recommended.(1) The National Institute for Occupational Safety and Health has recommended a standard based on central nervous system, cardiovascular, and respiratory effects in acute and chronic conditions. (2) Carcinogenicity and mutagenicity testing of this solvent is now being conducted by the U.S. Environmental Protection Agency and the National Cancer Institute.

2. Environmental Criteria

Airborne exposure limits for the protection of the health of workers have been recommended or promulgated by several sources. These limits are established at levels designed to protect workers occupationally exposed to a substance on an 8-hour per day, 5-day per week basis over a normal working lifetime. For this investigation, the criteria used to assess the degree of health hazards to workers were selected from three sources:

1. NIOSH: Criteria for a Recommended Standard ... Occupational Exposure to Methyl Chloroform, 1976.

2. Threshold Limit Values (TLV): Guidelines for Chemical Substances and Physical Agents recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) for 1977.

3. OSHA Standard: The air contaminant standard for methyl chloroform enforced by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor and found in the Federal Register - CFR 1910.1000 (b)(Table Z-1).

Source	8-Hour Time Weighted Average Concentration (TWA)[1]	Acceptable Ceiling Concentration[2]
NIOSH Criteria Document - 1976		350 ppm
OSHA Standard	350 ppm[3]	

1 USDOL employee exposure standards are based on a computed time-weighted average exposure during any eight-hour work shift or a 40-hour work week. The standard represents conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effects.

2 This value should never be exceeded, even instantaneously, during a commonly used 15 minute sampling period.

3 ppm = parts of methyl chloroform per million parts of air.

D. Evaluation Results and Discussion

Eighteen air samples were collected for methyl chloroform. As illustrated in Table 1, breathing zone and area samples ranged from 3-73 parts of air per million parts of methyl chloroform (ppm). These results are all below the evaluation criteria of NIOSH - 350 ppm as a ceiling concentration - and that for OSHA - 350 ppm as an 8-hour time weighted average concentration (TWA). Several 15-20 minute samples were collected during degreasing cycles to determine peak methyl chloroform concentrations and to compare them to the acceptable NIOSH ceiling concentration, as well as 8-hour samples for comparison with the OSHA standard.

Personal and area air samples for chromium and nickel metals collected during cutting operations were also within acceptable levels. These metals occur in the stainless steel used during the survey.

It was observed that some employees were smoking near the degreasing tank in Building 8, and also that "no smoking" signs were not evident in this area nor near the degreasing tank in Building 5. A TIG (Tungsten - Inert Gas) welding unit was being installed approximately 21 feet from the degreasing tank in Building 8 during the survey. Area samples taken on the welding unit indicated concentrations of 5 and 9 ppm throughout the workday. The flammable (explosive) limits of methyl chloroform are 10-15% in air (100,000 - 150,000 ppm). Thus, there is no danger of vapors from the tank being ignited from the welding arc under the current conditions. However, there may be potential exposures to a highly toxic gas such as phosgene near the TIG welder should methyl chloroform vapors decompose upon contact with ultraviolet rays or hot metal associated with the welding process. Due to phosgene's poor warning properties, exposures to it must be avoided. For example, symptoms such as dizziness, chills, thirst, and sputum may occur frequently only after 5-6 hours following overexposure. Pulmonary edema may result. It was also noted that the emergency eyewash and shower were located at the opposite end of Building 8 from where the degreasing tank was.

V. RECOMMENDATIONS

To insure a safe and healthful workplace, the following recommendations are made:

1. It is recommended that the degreasing and welding operations conducted in Building 8 be physically separated to safer locations or that an airtight barrier be erected between the work areas.

2. Keep the Building 8 degreaser cover on whenever the TIG welder is operating to keep vapors from entering the welding area. The appropriate OSHA Standard for these recommendations would be found in CFR 1910.252 f(11)(ii). Possibly degreasing and welding times can be staggered. However, it must be remembered that solvent vapors may remain in the atmosphere for a time after the degreasing operation has been stopped.

3. There should be no smoking within at least 20 feet of any degreasing tank. Warning signs should be posted in conspicuous locations.

4. An emergency eyewash/shower is recommended for a location near the degreasing tanks in Building 8, in the event of a solvent spillage on employees.

5. A recommendation is made to provide local ventilation at metal cutting locations. A design such as that in Figure 1 may be modified in order to control metal dust emissions.

VI. REFERENCES

1. U.S. Department of Health, Education, and Welfare, PHS, NIOSH: Occupational Diseases - A guide to their recognition. U.S. Gov't Printing Office, June, 1977.

2. Criteria for a Recommended Standard ... Occupational Exposure to 1,1,1-trichloroethane. National Institute for Occupational Safety and Health, 1976.

VII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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TABLE 1

RESULTS OF SAMPLING FOR METHYL CHLOROFORM AND METALS (CHROMIUM AND NICKEL)

BISHOP TUBE DIVISION
FRAZER, PENNSYLVANIA

November 9, 1977

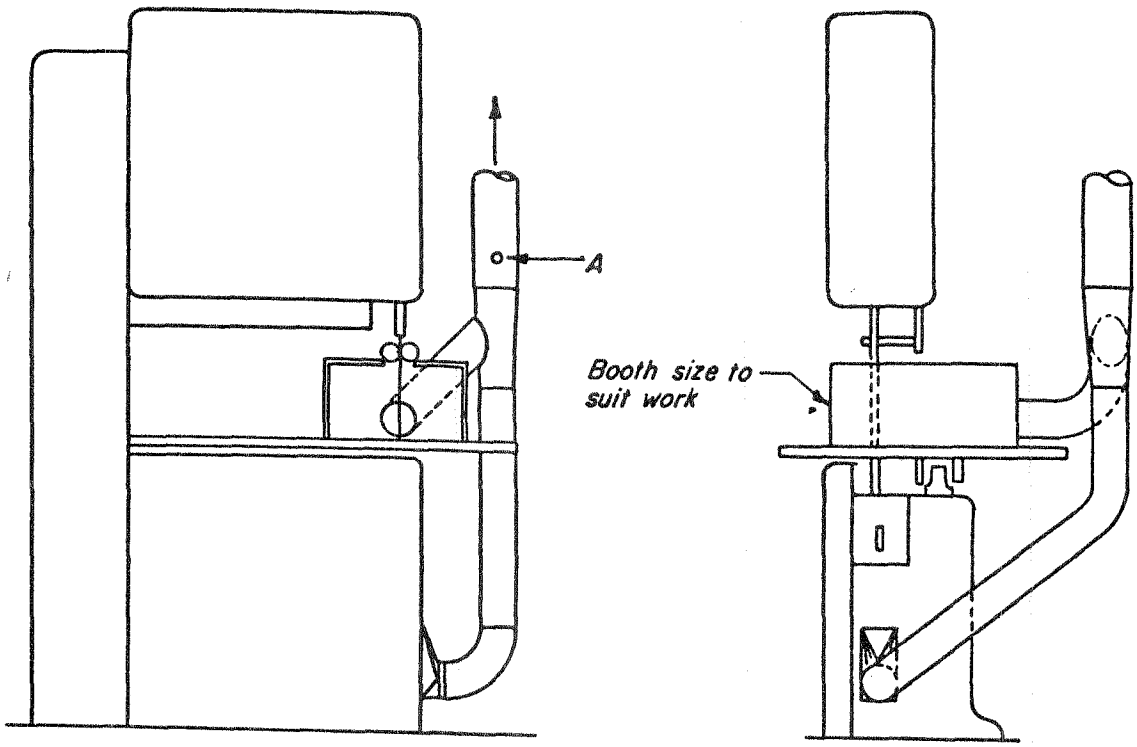
Location	Job Title or Location	Type[1] Sample	Sampling Period (hrs./min.)	CONCENTRATION			
				Methyl Chloroform	Nickel	Total Chromium	Chromium VI
Plant 5	Machine Operator	P	1010-1022	55 ppm[2]			
Plant 5	Near top edge of Degreaser-cover on	A	0740-1145	38 ppm			
Plant 5	On control Box Adjacent to Tank	A	1145-1445	4 ppm			
Plant 5	Near Surface Grinder	A	1230-1445	3 ppm			
Plant 8	Cutoff-Degreaser #1	P	0705-1120	12 ppm			
Plant 8	Cutoff-Degreaser #1	P	1230-1430	8 ppm			
Plant 8	Cutoff-Degreaser #1	P	1021-1041	37 ppm			
Plant 8	Cutoff-Degreaser #1	P	1252-1317	17 ppm			
Plant 8	Cutoff-Degreaser #1	P	0930-1120			3	
Plant 8	Cutoff-Degreaser #1	P	1332-1432		N.D.	0.02 mg/M^3	N.D.
Plant 8	Cutoff-Degreaser #2	P	0710-1151	12 ppm			
Plant 8	Cutoff-Degreaser #2	P	1236-1437	11 ppm			
Plant 8	Cutoff-Degreaser #2	P	0725-0741	21 ppm			
Plant 8	Cutoff-Degreaser #2	P	0903-0919	39 ppm			
Plant 8	Cutoff-Degreaser #2	P	1135-1151	17 ppm			
Plant 8	Cutoff-Degreaser #2	P	1330-1359	16 ppm			
Plant 8	Cutoff-Degreaser #2	P	1055-1151				
Plant 8	Cutoff-Degreaser #2	P	1235-1437		0.1 mg/M^3	0.2 mg/M^3	
Plant 8	Top Edge of Degreaser (in middle)	A	0715-1155	73 ppm			
Plant 8	Top Edge of Degreaser (in middle)	A	1200-1430	31 ppm			
Plant 8	On "TIG" Welding Unit	A	0720-1155	5 ppm			
Plant 8	On "TIG" Welding Unit	A	1200-1425	9 ppm			

1. P = Personal A = Area
2. ppm ≡ parts of methyl chloroform per million parts of air
3. mg/M^3 = milligrams of substance per cubic meter of air

EVALUATION CRITERIA

	NIOSH	OSHA	TLV
methyl chloroform	350 ppm (c)[4]	350 ppm	350 ppm
nickel metal	-	1 mg/M^3	1 mg/M^3
chromium metal	-	1 mg/M^3	0.5 mg/M^3

4. This represents a ceiling value which should never be exceeded.



Q, booth = 225 cfm/sq ft open area
Q, bottom = 350 cfm
Duct velocity = 4000 fpm
Entry loss = 1.75 VP in riser (point A)

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

METAL CUTTING BANDSAW

DATE 1-70 | VS-418

*Industrial Ventilation - A Manual of Recommended Practice, ACGIH 1974