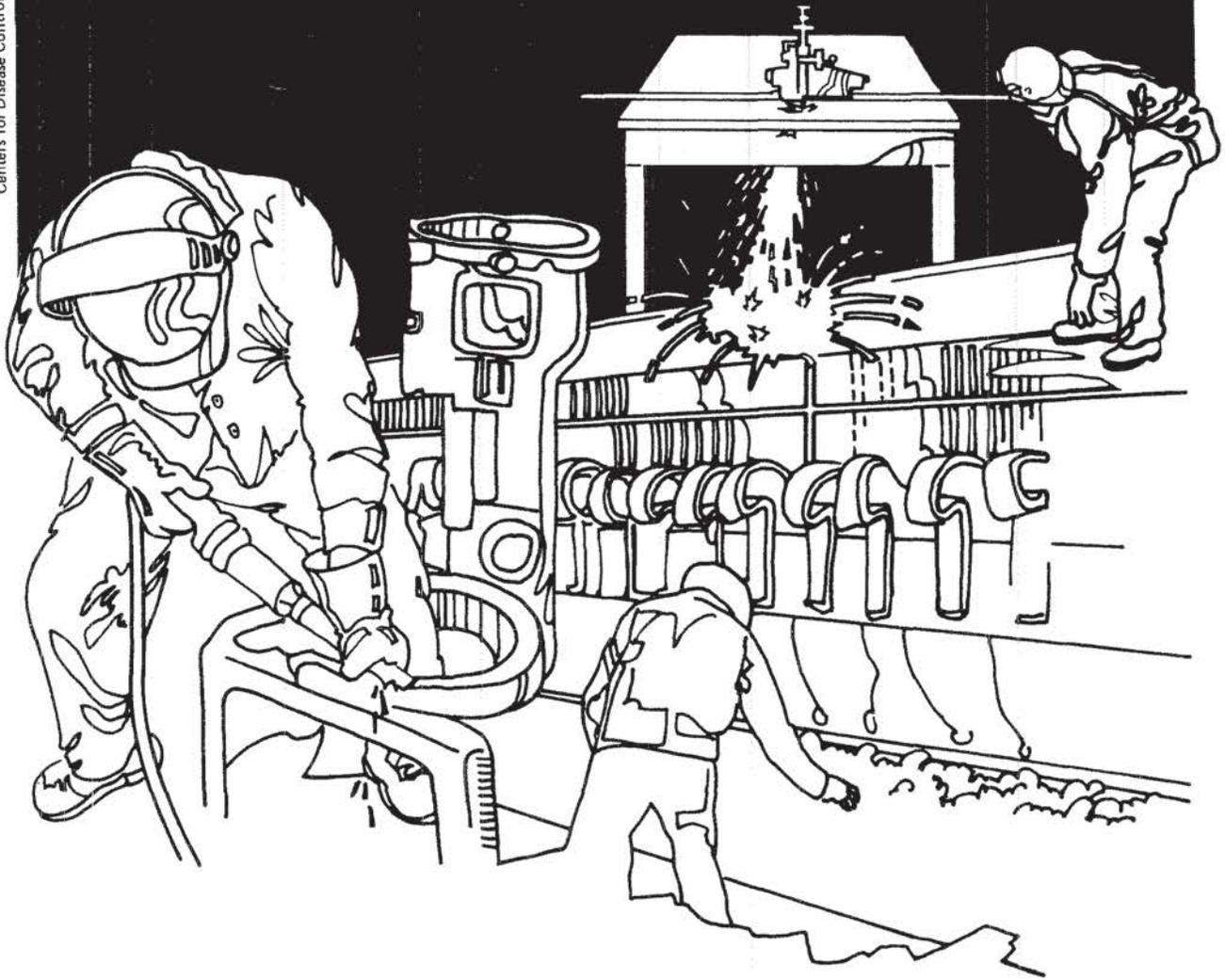


NIOSH



Health Hazard Evaluation Report

HETA 81-123-856
AMERICAN BRIDGE, SHIFFLER PLANT
PITTSBURGH, PENNSYLVANIA

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.

HETA 81-123-856
April 1981
American Bridge, Shiffler Plant
Pittsburgh, Pennsylvania

NIOSH INVESTIGATOR:
John R. Kominsky

I. SUMMARY

On January 12-14, 1981, the National Institute for Occupational Safety and Health (NIOSH), conducted a health hazard evaluation at American Bridge, Pittsburgh, Pennsylvania, a fabricator and galvanizer of transmission towers. The investigation evaluated exposures of No. 2 Galvanizing Unit employees to contaminants released from sulfuric acid pickling tanks heated by hot sticks and the contaminants released from zinc galvanizing kettles. Personal and area air samples were obtained to measure sulfuric acid mist and zinc chloride exposures. Interviewer-administered medical questionnaires were completed on exposed workers.

The maximum sulfuric acid mist concentration in 13 personal breathing zone samples obtained on unit operating personnel was 18% (range 0.05-0.18 mg/M³) of the OSHA Permissible Exposure Limit (PEL) and NIOSH recommended standard of 1 mg/M³, 8-10-hour time-weighted average. Sulfuric acid mist concentrations (range 1.05-5.66 mg/M³) in 5 of 5 (100%) area samples obtained on the maintenance platforms of the pickle crane exceeded both the OSHA (PEL) and NIOSH recommended standard. The area samples show that workers required to perform repairs on the pickle crane over the pickle area are at risk of exposure to toxic concentrations of sulfuric acid mist. Zinc chloride concentrations in 3 personal breathing zone samples obtained on the potman were 10% (range 0.05-0.10 mg/M³) of 1.0 mg/M³ OSHA PEL. Health questionnaires were completed on nine workers (approximately 50% of the directly exposed workers). The questionnaires showed that the workers complained of occasional symptoms of mild nose and eye irritation during normal operating conditions.

On the basis of air sampling and medical questionnaire results, NIOSH concluded that under normal operating conditions a health hazard to sulfuric acid mist and zinc chloride did not exist at the Shiffler Plant, American Bridge, Pittsburgh, Pennsylvania. However, workers required to perform repairs on the pickle crane over the pickling area are at significant risk of exposure to toxic concentrations of sulfuric acid mist. Recommendations to control this hazard are made in Section VII.

KEYWORDS: SIC 3440 (Fabricated Structural Metal Products), hot sticks, carbon combustion chambers, sulfuric acid mist, and zinc chloride.

II. INTRODUCTION

On December 15, 1980, NIOSH received a request for a health hazard evaluation from an authorized representative of Local Union 1579, United Steel Workers of America, to investigate potential exposures by No. 2 Galvanizing Unit employees to contaminants released from sulfuric acid pickling operations. The request did not specify any health effects, but it expressed concern about possible health risks associated with the recently installed hot sticks. The hot sticks were installed in November 1980 to heat the acid pickle, which was previously heated by jacketed steam pipes. Exposed workers were tank operating personnel and maintenance workers who were occasionally required to repair the remote controlled pickle crane positioned above the pickling tanks.

III. BACKGROUND

A. Description of Process

The Shiffler Plant's production is devoted principally to the fabrication, galvanizing and testing of transmission towers, substations, radio towers and similar structures. The plant employs 282 persons; 18 persons work in the No. 2 Galvanizing Unit. Each of three shifts includes a pickler, material handler, material helper, rack loader, galvanizing potman, and galvanizing helper.

The No. 2 Galvanizing Unit employs traditional stationary pickling and galvanizing techniques. In stationary pickling, the steel is immersed in the acid solution and generally remains stationary, while the solution is kept in motion. The pickling operation consists of two sulfuric acid (10-12% by weight) pickle tanks, two water rinse tanks, and one ammonium chloride pre-flux tank. The tank dimensions are approximately 5'X5'X35' and are constructed of mild carbon steel lined with acidproof brick. An operating temperature of approximately 180°F is maintained in each pickling tank by two hot sticks submerged in the acid bath. The hot sticks are carbon combustion cylinders (dimensions of approximately 1'X3') fueled by natural gas with a burner pressure of 6-10 PSIG. Each stick has a heating capacity of 380,000 BTU. Combustion inside the cylinder results in direct fire of the acid bath via 2 orifices located near the cylinder's base. The pickled steel is galvanized by immersion in molten zinc at a temperature of approximately 850°F and held for a period of several minutes. A zinc ammonium chloride flux is maintained on top of the molten zinc. The zinc kettle is approximately 5'X5'X32' and is constructed of 1-2 inch thick boiler plate steel lined with fire brick.

B. Exposure Controls

The pickle tanks and galvanizing kettles are not equipped with local exhaust ventilation. Air contaminants are removed to some degree from the general work environment by five roof fans, each with a design capacity of 46,500 cfm. In addition, an organic inhibitor is used to reduce the escape of acid mist from the pickling tanks, and a zinc ammonium chloride flux is used to reduce the escape of metal fume from the zinc kettle.

C. Potential Process Related Chemical Exposures

The workers are potentially exposed to sulfuric acid mist released from the pickling tanks and zinc chloride fume released from the galvanizing kettle. Sulfuric acid decomposes into sulfur trioxide and water at approximately 644°F, a temperature that is exceeded by the flame of the hot sticks. The likelihood of worker exposure, however, is small. The sulfuric trioxide almost immediately converts back to sulfuric acid before it escapes to the workplace atmosphere.

IV. STUDY DESIGN AND METHODS

An industrial hygiene survey was conducted in the No. 2 Galvanizing Unit by NIOSH industrial hygienists on January 12-14, 1980. Personal breathing zone samples were collected to evaluate sulfuric acid mist exposures of workers during routine pickling and galvanizing operations. Stationary samples were positioned on the pickle crane to estimate prospective exposure concentrations to maintenance personnel during repair of the crane over the pickle tanks. (This repair arrangement occurs if the crane cannot be moved to another location, which occurred once or twice during 1980). The measurements in the pickle crane would provide a basis for determining proper exposure controls. Personal breathing zone samples were collected to evaluate zinc chloride exposures. The sulfuric acid and zinc chloride air samples were collected using calibrated constant flow sampling pumps operating at 1.0 or 2.0 liters per minute and 0.8 μ m mixed cellulose ester filters in 3-piece closed faced cassettes. The sulfuric acid and zinc samples were analyzed according to NIOSH P and CA Methods 187 and 173, respectively.(1,2) The zinc chloride was calculated from the total zinc present in the sample. The results are reported as milligrams of sulfuric acid or zinc chloride fume per cubic meter of air sampled (mg/M^3).

Interviewer-administered medical questionnaires were completed on 9 of 18 No. 2 Galvanizing Unit and maintenance personnel. The interviewees were questioned on past and present occurrences of skin, eye, nose, and throat irritation, and other general symptoms of exposure.

V. EVALUATION CRITERIA

NIOSH recommends that no employee be exposed to airborne sulfuric acid mist at a level greater than $1 \text{ mg}/\text{M}^3$ of air determined as a time-weighted average (TWA) exposure for up to a 10-hour work day, 40-hour work week.(3) The OSHA standard or Permissible Exposure Limit (PEL) is $1 \text{ mg}/\text{M}^3$ for up to an 8-hour work day, 40-hour work week. NIOSH does not have a recommended standard for zinc chloride fume. The OSHA PEL is $1 \text{ mg}/\text{M}^3$ for up to an 8-hour work day, 40-hour work week.

Exposure to mists of sulfuric acid in humans can cause irritant effects on the mucous membranes, including those of the eyes, but principally those of the upper respiratory tract.(3) Zinc chloride fume is also an irritant of the eyes, mucous membranes, and skin.(4)

VI. RESULTS AND DISCUSSION

Table 1 presents the sulfuric acid mist exposure concentrations by job classification. The relative average acid mist concentrations by job classification are: pickler > 2nd helper > 1st helper > potman. The maximum exposure concentration of 0.18 mg/M³ shown for the pickler is less than 18% of the 1.0 mg/M³ NIOSH and OSHA standards.

Table 1 also shows the sulfuric acid mist concentrations measured on the carbon stick and pendent side maintenance platforms of the pickle crane. The air concentrations ranged from 3.80 to 5.66 mg/M³ (mean 4.73, \pm S.D. 1.32) on the carbon stick side and from 1.05 to 2.47 mg/M³ (mean 1.79, \pm S.D. 0.71) on the pendent side of the crane. By comparison, the OSHA and NIOSH standards are 1.0 mg/M³. The data show that persons conducting maintenance repairs on the crane, while positioned over the pickle tanks, are at risk of exposure to excessive levels of sulfuric acid mists.

Zinc chloride fume exposures by the potman were measured. The average concentration for three samples is 0.07 mg/M³ (range 0.05 to 0.10, \pm S.D. 0.03). None of these samples exceed the 1.0 mg/M³ OSHA PEL.

Health questionnaires were completed on nine workers or approximately 50% of the directly exposed workers. Included were one potman, one millwright, one motor inspector, two picklers, and four pickler helpers. The workers reported occasional symptoms of mild nose and eye irritation during normal operating conditions. The symptoms were most notable when the organic acid mist suppressant was not added to the pickling solution. No other work related health effects were reported.

VII. RECOMMENDATIONS

Sulfuric acid mist concentrations of approximately 5 times the OSHA PEL and NIOSH recommended standards were measured on the maintenance platform at the pendent side of the pickle crane. Employee(s) required to work on the platform with the crane positioned over the acid tanks should wear a NIOSH approved air purifying acid-mist respirator with cartridge and half-mask facepiece; if eye irritation is noted, a full mask should be worn. The NIOSH Criteria Document (3) and OSHA Standard 29 CFR Part 1910.134 should be consulted for further requirements for respirator usage.

Respiratory protection should be issued with caution. There might be individuals in the group for whom wearing a respirator carries certain specific dangers, i.e., highly increased resistance to airflow in a person with compromised pulmonary function may be associated with acute respiratory insufficiency. A physician should determine the ability of the worker to wear a respirator.

VIII. REFERENCES

1. P & CA Method No. 187, NIOSH Manual of Analytical Methods, HEW Publication No. (NIOSH) 75-121, 1974.
2. P & CA Method No. 173, NIOSH Manual of Analytical Methods, HEW Publication No. (NIOSH) 75-121, 1974.
3. Criteria Document: Recommendations for an Occupational Exposure Standard for Sulfuric Acid, HEW Publication No. (NIOSH) 74-128, National Institute for Occupational Safety and Health, 1974.
4. Proctor, N.H. and J.P. Hughes. Chemical Hazards of the Workplace. J.B. Lippincott Company, Philadelphia, Pa., 1978.

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X. DISTRIBUTION AND AVAILABILITY

Copies of this 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 the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Manager-Employee Relations, Shiffler Plant, American Bridge, 115 Fifty-First Street, Pittsburgh, Pennsylvania 15201.
2. President, Local 1579, United Steel Workers of America, Shiffler Plant, American Bridge, 115 Fifty-First Street, Pittsburgh, Pennsylvania 15201.
3. U.S. Department of Labor - OSHA, Region III.
4. NIOSH, Region III.

For the purpose of informing the approximately 18 "affected employees" the employer shall promptly "post" for a period of 30 calendar days, the Determination Report in a prominent place(s) near where the exposed employees work.

Table 1

Exposures to Sulfuric Acid Mist of No. 2
Galvanizing Unit Employees^AAmerican Bridge
Pittsburgh, Pennsylvania

January 12 - 14, 1981

Sample Date	Sample Description	Sample Volume Liters	Air Level mg/M ³	Mean	± S.D.
1-12	Pickler	882	0.08		
1-13	"	934	0.18		
1-14	"	932	0.13		
1-14	"	920	0.09	0.12	0.05
1-12	2nd Helper	830	0.08		
1-13	"	920	0.15		
1-14	"	938	0.10	0.11	0.04
1-12	1st Helper	886	0.07		
1-13	"	910	0.18		
1-14	"	932	0.11		
1-14	"	914	0.05	0.10	0.06
1-13	Potman	904	0.08		
1-14	"	910	0.07	0.08	0.01
1-13	Pickle crane-carbon stick side	835	3.80(S)		
1-14	"	848	5.66(S)	4.73	1.32
1-13	Pickle crane-pendent side	848	1.05(S)		
1-14	"	858	1.86(S)		
1-14	"	850	2.47(S)	1.79	0.71
Environmental Criteria				1.0 ^B	

^A Personal breathing zone samples excluding those preceded by a "S", which are stationary samples.

^B NIOSH Criteria Document (1974), 10-hr. time-weighted average (TWA). Current OSHA standard is 1 mg/M³ 8-hr TWA.