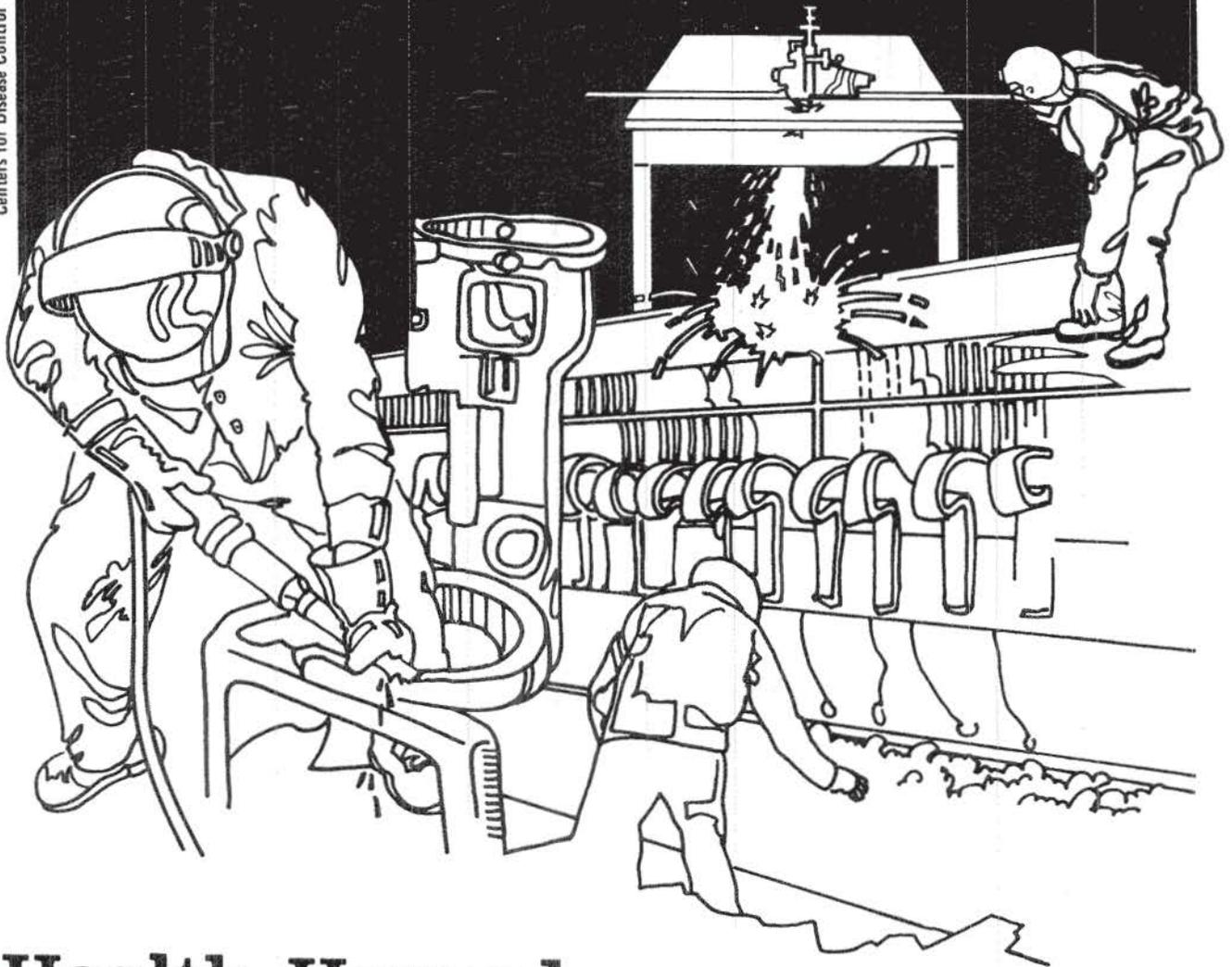


NIOSH



Health Hazard Evaluation Report

HHE 80-98-790
SAN FRANCISCO GENERAL HOSPITAL
SAN FRANCISCO, CALIFORNIA

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HE 80-98-790
JANUARY 1981
SAN FRANCISCO GENERAL HOSPITAL
SAN FRANCISCO, CALIFORNIA

NIOSH INVESTIGATORS:
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I. SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) received a request to conduct a health hazard evaluation (HHE) at San Francisco General Hospital, San Francisco, California. The requestor was concerned that hospital staff working in an intensive care unit (ICU) are intermittently exposed to a drug -- dimethyl sulfoxide (DMSO) -- currently being used intravenously in an experimental protocol for the control of cerebral edema. These workers were exposed by inhalation of the exhaled respiratory gases of patients who have been treated with DMSO. Nearby workers complained of nausea and headache when exposed to the drug.

An environmental/medical survey was conducted by NIOSH regional staff (medical officer and industrial hygienist) on April 30, 1980. Subsequent to an opening conference, the NIOSH investigators conducted a walk-through survey of the 4E intensive care unit and interviewed several nurses who worked during both of the two previous occasions when DMSO was administered to the patients. The director of the DMSO project was consulted at a later date.

The walk-through survey and interviews with workers who had been affected by exposure to DMSO on the first occasion of its use indicated that adequate controls had been instituted before the second occasion. There were no complaints of worker effects on this occasion, and no industrial hygiene monitoring was undertaken.

Based upon the walk-through survey and interviews with hospital staff, it appears that the use of DMSO has been successfully controlled during the second case of its usage. Due to the dermatologic and central nervous system effects of DMSO, as well as its potential reproductive system effects, controls are necessary to limit dermal and respiratory exposure.

KEYWORDS: SIC 8060, dimethyl sulfoxide (DMSO), hospital workers.

II. INTRODUCTION

On March 31, 1980, the National Institute for Occupational Safety and Health received a request* for a health hazard evaluation from an authorized employee representative of the Service Employees International Union (Local 400) to evaluate workers' intermittent exposure to dimethyl sulfoxide (DMSO), an experimental drug, which had allegedly caused headaches and nausea in previously exposed workers in the trauma intensive care unit at San Francisco General Hospital.

III. BACKGROUND

Dimethyl sulfoxide is an experimental drug which has been used twice in an experimental protocol at San Francisco General Hospital since February 1980. DMSO is administered intravenously to decrease intracranial pressure in neurosurgical patients, when alternative therapies have not been successful.

There are approximately 30 nurses and 6 respiratory therapists on all shifts who may be potentially exposed to DMSO. At the time of this investigation, none of the nurses or respiratory therapists reported suffering any ill effects from their previous DMSO exposure.

Control of DMSO exposure consists of placing the patient in an outer room with window ventilation. The patient is intubated and ventilated, and the ventilation system is connected to a wall suction unit.

IV. TOXICOLOGY

Dimethyl sulfoxide is widely used as a solvent in industry. It is a potent solvent with a strong smell which is sometimes described as garlicky or sickly sweet. It is commonly used as a vehicle for biological experiments. Its use as a medical therapeutic has been confined largely to topical application for relief of arthritis and other musculoskeletal pain. More recently, at both the University Hospital in Portland, Oregon and San Francisco General Hospital in San Francisco, California, DMSO has been used experimentally as an intravenous infusion for the control of severe cerebral edema. This use is extremely limited, and the primary risk of exposure to workers involved in handling DMSO appears to be inhalation of the exhaled respiratory gases of patients who have been treated with DMSO.

DMSO may produce headache, dizziness, sleepiness and nausea. It is known to penetrate the skin very rapidly and also increase skin permeability to other chemicals. It is exhaled through the lungs and excreted in the urine as a metabolic product (dimethyl sulfone).

There are a large number of animal studies of the effects of topical application and intravenous infusion of DMSO. An association with reproductive abnormalities in rodents has been reported,¹ as well as a transient decrease in blood pressure and hemolysis associated with DMSO exposure to rodents in another series.² A very complete study of the short term effects of dermally applied DMSO on humans was conducted in the late 1960's.³ The major changes found were: 1) an increase in eosinophil count, believed to be related to the cutaneous histamine-releasing effect of DMSO; 2) conjunctival irritation; 3) dermatitis including wheal, erythema, drying and scaling, and 4) systemic complaints of sedation, nausea, headache and dizziness.

The known effects of DMSO on humans are: 1) dermatitis; 2) mild and apparently reversible changes in the hematopoietic system, and 3) central nervous system symptoms of solvent exposure. The long term effects of low level exposure to DMSO are unknown. The animal evidence of reproductive effects suggest the need for extreme caution in handling DMSO or in allowing worker exposure to this substance on a regular basis.

V. RESULTS AND CONCLUSION

The workers' complaints involved periods during which DMSO was being administered to patients. In the first instance of the use of DMSO, the patient was in an indoor room without window ventilation, and the wall suction was not functioning properly. The patient was intubated and ventilated, and the ventilation system was connected to a scavenging wall unit. Two of the nurses who monitored the patient at that time complained of the strong DMSO odor in the patients' room, and of headache and dizziness. Other ICU nurses as well as orderlies, janitors and some house staff complained of headache and mild nausea.

As a result of this first experience with DMSO, the second use of DMSO took place under somewhat changed circumstances. The patient was placed in an outer room with window ventilation. The wall suction unit was checked and found to be working properly. As a result, the smell of DMSO was not detected in the patient's room nor in the entire surgical unit. The nurses had no complaints of headaches, nausea, or other symptoms. The DMSO project director and the nursing staff believe that DMSO exposure is now adequately controlled.

Industrial hygiene monitoring of DMSO use was not undertaken because DMSO is infrequently administered to patients. Also, new procedures were implemented by hospital staff prior to the second occasion, to prevent DMSO exposure to ICU staff. These procedures appear to have abated the problem.

It is concluded that the use of DMSO is adequately controlled at present in this workplace, and it is suggested that these new procedures be maintained.

VI. RECOMMENDATIONS

1. Current precautions should be maintained whenever DMSO is administered to patients in the ICU.
2. The mechanical ventilator connected to wall suction should be checked for proper operation and tight connection of hoses.
3. The wall suction should be periodically checked to ascertain there is adequate suction.
4. Staff personnel (nurses and respiratory therapists) working in the ICU should contact the DMSO Protocol Administrator if they detect DMSO odors.
5. Hospital staff, who either administer DMSO or care for patients who receive DMSO treatment, should receive training regarding the potential health hazards associated with DMSO exposure.
6. Any person who intends to reproduce during their period of employment in the trauma intensive care unit should be given the opportunity to work in another area when DMSO is used.

VII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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VIII. REFERENCES

1. Wilson, J. 1972. In: N. Assali, Ed. Pathophysiology of Gestation, Vol. II. New York.
2. Distefani, V., and J. J. Klahn. Observations on the Pharmacology and Hemolytic Activity of Dimethyl Sulfoxide. In: Toxicology and Applied Pharmacology, Vol. 7, pg. 660-666.
3. "Human Toxicology of DMSO," Study Report by Charles Lebo, M.D. Conducted at Vacaville State Prison, California, November 1967.

IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of the 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:

1. San Francisco General Hospital.
2. Service Employees International Union (Local 400).
3. U. S. Department of Labor - Region IX
4. CAL/OSHA

For the purpose of informing the approximately 36 "affected employees," the employer shall promptly "post" for a period of 30 calendar days, this Determination Report in a prominent place(s) near where exposed employees work.

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