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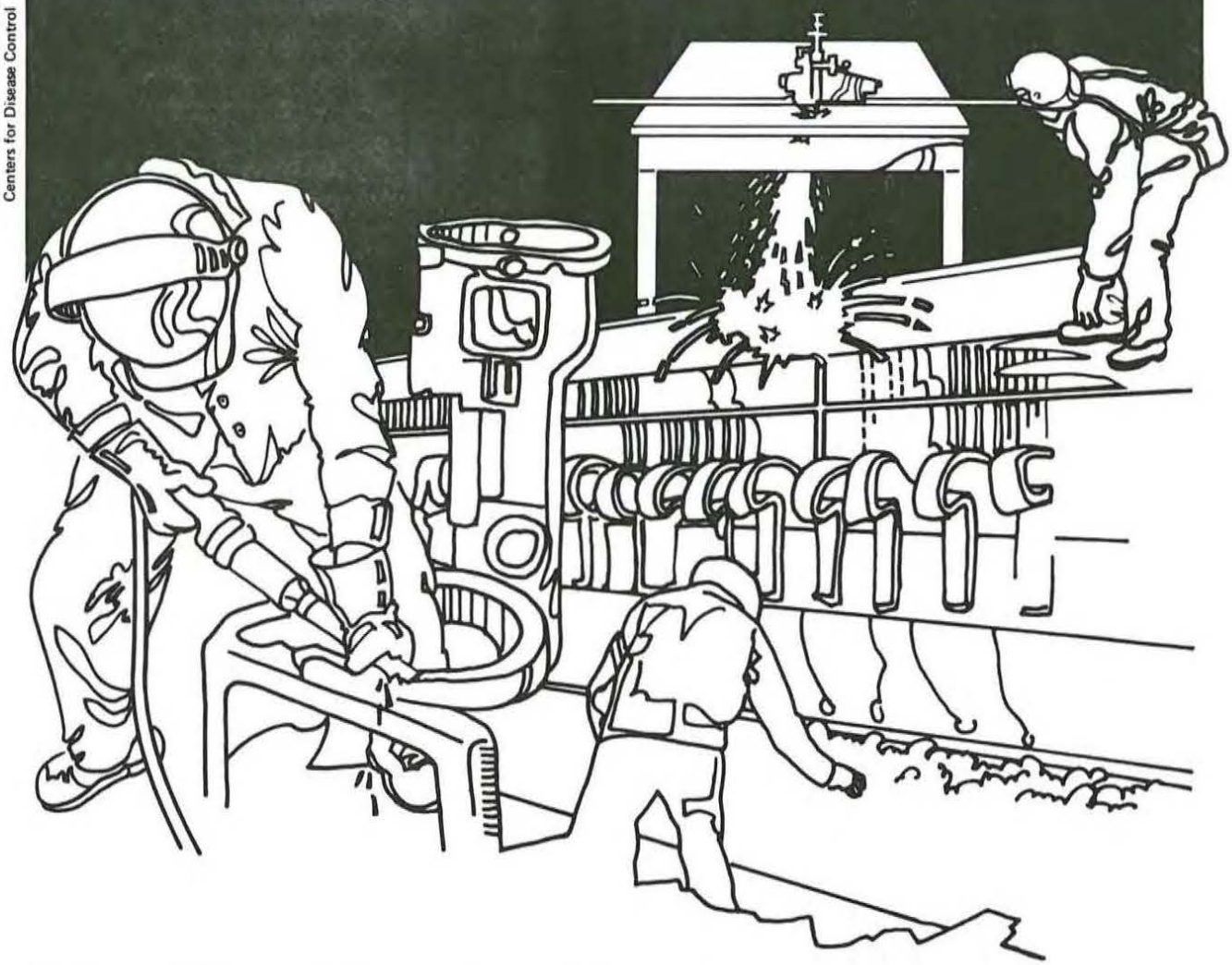

Health Hazard Evaluation Report

HETA 81-193-917
MONTANA STATE UNIVERSITY
BOZEMAN, MONTANA

II. INTRODUCTION

NIOSH received a request in February 1981 from an employee of Montana State University in Bozeman, Montana, to determine if there was a health hazard from exposure to various chemicals in the chemical storage rooms in the chemistry building. An environmental survey was conducted on March 13, 1981, to evaluate potential exposures to various chemicals in the building.

III. BACKGROUND

The facility is a typical college chemistry building with a basement and three floors and a chemical storeroom located on each floor. The basement storeroom was the only storage room with a chemical mixing hood.

Several workers in the building were under doctors' supervision for dermatitis, allergy-like symptoms, nausea, and headaches. Several of the employees in the chemistry building had to quit working in this building due to reoccurring symptoms each time they returned to work. Workers' symptoms improved when they were away from the work site for even a couple of days.

IV. ENVIRONMENTAL DESIGN AND METHODS

One general room air samples was taken on each floor of the building in the chemical storerooms for benzene, carbon tetrachloride, and toluene. These chemicals were monitored since they were being poured without the use of a hood. These samples were collected on organic vapor charcoal sampling tubes and analyzed according to NIOSH P&CAM Method No. 127.

In addition to air sampling, all employees completed NIOSH confidential employee interview forms.

V. EVALUATION CRITERIA

A. Environmental

The two sources of criteria used to assess the workroom concentrations of contaminants were the (1) NIOSH criteria for a recommended standard and the (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910), July 1980.

	Permissible Exposure Limit Time-Weighted Exposure Basis
Benzene	3.2 mg/M^3 (NIOSH) - 1 hr. Ceiling 32.0 mg/M^3 (OSHA) - 8 hr. TWA
Carbon Tetrachloride	12.6 mg/M^3 (NIOSH) - 1 hr. Ceiling 63.0 mg/M^3 (OSHA) - 8 hr. TWA
Toluene	375.0 mg/M^3 (NIOSH) - 8 hr. TWA 700 mg/M^3 (OSHA) - 8 hr. TWA

mg/M^3 = milligrams of substances per cubic meter of air.
TWA = time weighted average

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

B. Toxicological

Benzene[1] -- Benzene is highly toxic either by inhalation or skin absorption. Benzene is metabolized in the body to a phenolic compound which may alter the DNA molecule in bone marrow with injury to blood forming tissue. It produces liver necrosis and is also a central nervous system (CNS) depressant. Benzene is a carcinogen capable of producing leukemia. Benzene is also known to cause other blood disorders such as aplastic anemia, macrocytosis, leucopenia, thrombocytopenia, and hemolysis.

Carbon Tetrachloride[2] -- Carbon tetrachloride causes central nervous system depression and severe damage to the liver and kidneys. In animals it has produced liver tumors. The liver is the target organ in animals, but in humans the majority of fatalities have been the result of renal injury with secondary cardiac failure.

The acute effects from high exposures include: dizziness, vertigo, incoordination, mental confusion, abdominal pain, nausea, vomiting, and diarrhea. Cardiac arrhythmias and convulsions also occur.

The sweetish odor is not a satisfactory warning of excessive exposure.

There is a synergistic effect from excessive alcohol abuse and exposure to carbon tetrachloride. Alcohol has been a concomitant factor in many of the human cases of carbon tetrachloride poisoning, especially those cases with severe liver and kidney damage.

Preplacement and annual physical exams with emphasis on the liver, kidneys, and skin should be performed on all new and long term employees.

Toluene[3,4] -- Toluene is a clear, colorless, non-corrosive liquid with a sweet, pungent, benzene-like odor. Approximately 70 percent of all toluene that is produced is converted into benzene. Extreme caution when using toluene should be taken since it is often contaminated with benzene. It is dangerously absorbed both by inhalation and skin absorption. Toluene is an irritant, a central nervous system depressant, and may cause liver damage and bone marrow suppression. Some of the common symptoms include defatting dermatitis, bronchitis, pneumonitis, nausea, vomiting, headaches, dizziness, and irritability.

VI. RESULTS

A. Environmental Results

Four general room air samples were taken to measure benzene, carbon tetrachloride, and toluene concentrations. All values were below

evaluation criteria of 3.2 mg/M^3 for benzene, 375.0 mg/M^3 for toluene, and 12.6 mg/M^3 for carbon tetrachloride. Toluene and carbon tetrachloride were not detected and the highest value found for benzene was 0.4 mg/M^3. Due to the large variety of chemicals used in the chemistry department and since they are often mixed and poured without using a hood, it would be possible to become routinely overexposed. Refer to Table 1 for environmental results.

In January 1981 the Montana State Department of Health and Environmental Sciences conducted an environmental investigation of this laboratory. Discussion with their staff indicated that the results were very similar to those found by NIOSH.

B. Interview Results

All 26 employees present in the chemistry building on the day of the survey were asked to complete a NIOSH confidential employee interview form. All 26 completed the form. Review of these forms showed that 21 of the 26 workers had no complaints or illnesses related to their work in this building. Five of the 26 employees had complaints such as dermatitis, eye, nose, and throat irritation, headaches, dizziness, coughing, nosebleed, and other non-specific symptoms. All these complaints were directly contributed to their work and exposures in the chemistry building.

VII. DISCUSSION AND CONCLUSIONS

Based on the environmental sampling and completed confidential employee interview forms, a hazardous situation existed during this evaluation to all workers that were working in the chemistry building.

Even though environmental sampling did not indicate overexposures, the possibility of repeated exposures to trace quantities of any chemicals always exists since only one of the four chemical storerooms had an exhaust hood for mixing and dispensing chemicals. Other than the one exhaust hood, local exhaust ventilation systems in the entire chemical storage room areas are either non-existent or inadequate.

VIII. RECOMMENDATIONS

1. All chemical storage rooms in the chemistry building should be equipped with an adequate exhaust hood that can be used for mixing and pouring of chemicals.

2. All chemicals in all the storerooms should be carefully stored in suitable containers and stored in a compatible manner.

3. Eye wash fountains should be installed in all chemical storerooms.

4. Workers in the chemical storerooms should be advised on the toxicity of the various chemicals with which they are in daily contact.

5. Safety goggles and rubber gloves should be provided for the safe handling of corrosive and volatile chemicals.

IX. REFERENCES

1. Plunkett, E.R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, pp. 50-52.

2. Proctor, N.H., and Hughes, J.P. Chemical Hazards of the Workplace, J.B. Lippincott Company, Philadelphia, 1978, p. 153-154.

3. Criteria for a Recommended Standard...Occupational Exposure to Toluene, HEW Publication No. (NIOSH) 73-11023, Cincinnati, Ohio, 1973.

4. Plunkett, pp. 412-413.

X. AUTHORSHIP AND ACKNOWLEDGMENTS

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XI. 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 NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Montana State University.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Montana Department of Health and Environmental Sciences.
5. State Designated Agency.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1

Atmospheric General Room Air Concentrations
of Benzene, Toluene, and Carbon Tetrachloride
in Chemistry Building

Montana State University
Bozeman, Montana

March 13, 1981

Location	Sampling Time	mg/M^3 Benzene	Toluene	Carbon Tetrachloride
3rd Floor Storeroom	8:00 AM - 12:00 Noon	0.12	*	*
2nd Floor Storeroom	8:04 AM - 12:00 Noon	0.11	*	*
2nd Floor Storeroom	8:10 AM - 12:07 PM	0.40	*	*
Basement Storeroom	8:10 AM - 12:09 PM	*	*	*
EVALUATION CRITERIA		3.2	375.0	12.6
LABORATORY LIMIT OF DETECTION mg/sample		0.001	0.01	0.01

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