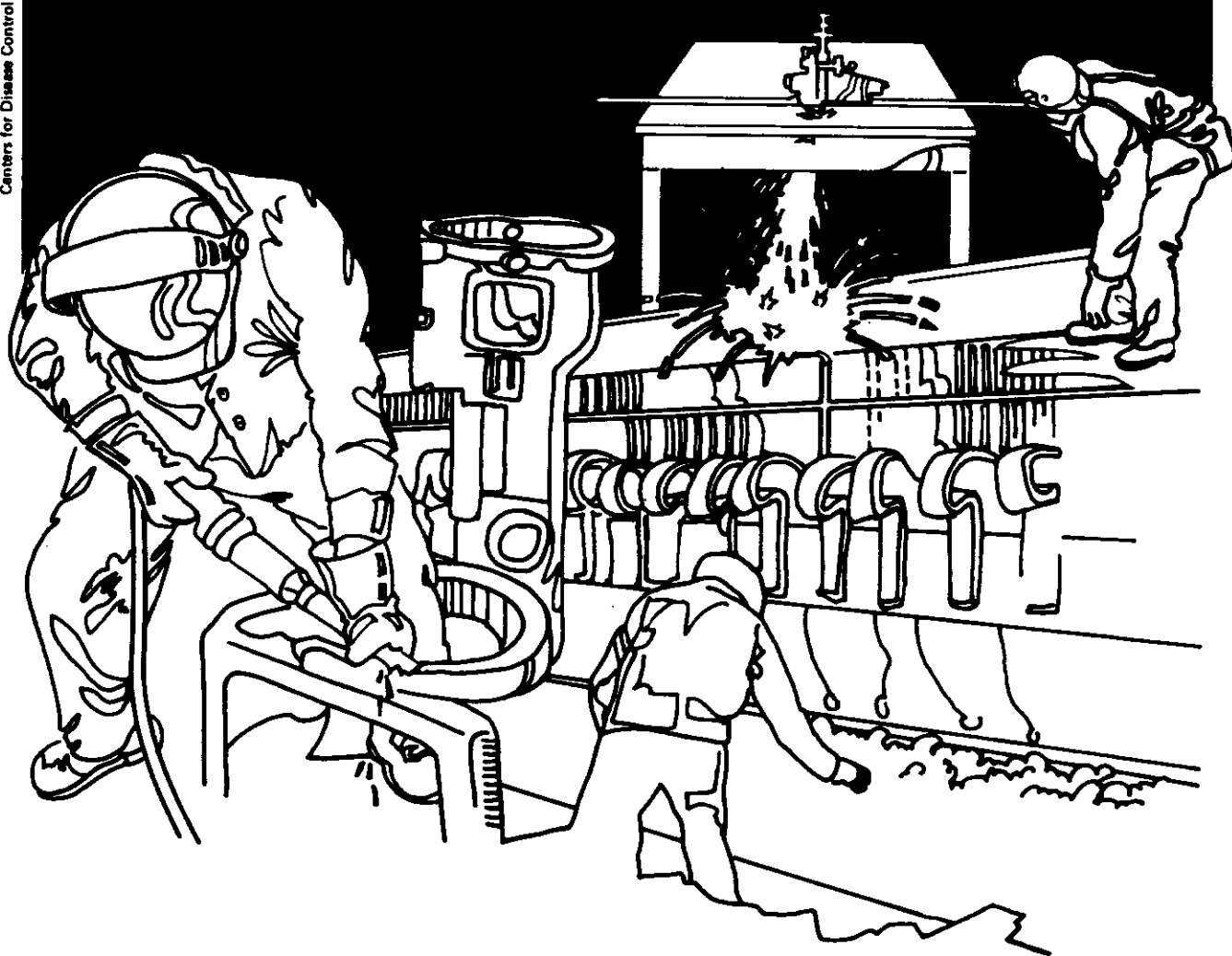


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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

MHETA 89-362-2027
HELEN MINING COMPANY
HOMER CITY, 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.

MHETA 89-362-2027
MARCH 1990
HELEN MINING COMPANY
HOMER CITY, PENNSYLVANIA

NIOSH INVESTIGATOR:
Rick P. Ferguson

I. SUMMARY

On September 15, 1989, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Mine Workers of America (UMWA) in Washington, D.C. to evaluate potential exposures to tipple operators from a mixture of perchloroethylene and dibromomethane. The two solvents were being used in a float-sink testing operation at the Helen Mining Company in Homer City, Pennsylvania. The tipple operators that run the float-sink test on the coal had complaints of headache, dizziness, and skin rashes. The workers were also concerned about missing labels on the chemical solvent containers used in the test procedure. A walk-through survey was conducted on September 26, 1989. During this walk-through, it was learned that dibromomethane use had been discontinued on September 7, 1989. On October 17, 1989, the float-sink operation was evaluated for perchloroethylene (PCE). NIOSH considers PCE to be a potential carcinogen and exposures should be reduced to the lowest level feasible.

Based on the information obtained during this evaluation, a hazardous exposure to perchloroethylene did not exist in the employee's work area at the time of the evaluation. Recommendations found in Section VII of this report provide additional guidance to improve existing work practices and exposure control methods.

KEYWORDS: SIC 1221 (coal preparation plant), perchloroethylene.

II. INTRODUCTION AND BACKGROUND

On September 15, 1989, the Division of Respiratory Disease Studies (DRDS) of the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Mine Workers of America in Washington, D.C. to conduct a health hazard evaluation at the Helen Mining Company in Homer City, Pennsylvania. One of the tipple operators at the coal preparation plant had complained of headaches, dizziness and skin rashes from working with a mixture of solvents used in the float-sink test operation. The solvents were perchloroethylene (tetrachloroethylene) and dibromomethane (methylene bromide).

Approximately six months prior to the request, dibromomethane was being added to perchloroethylene (the most commonly used solvent in float-sink operations) in order to get a specific gravity of 1.9 for the required coal test procedure. Float-sink testing generally involves separating coal into various specific gravity fractions (relative densities) by immersion in heavy organic solvents. The coal fractions (after separation) are evaluated according to percent weight, ash and BTU value which are used to determine a coal's amenability to cleaning.

At the Helen Mining Company, there is one tipple operator on each of three shifts. Each operator on his shift is responsible for conducting the float-sink tests. The operator that works the midnight shift has reported having a skin rash since working with the mixture of perchloroethylene and dibromomethane. The other two operators did not report having problems.

On September 7, 1989, the use of dibromomethane was discontinued because: (1) a tipple operator was reporting skin problems which he did not have previously, (2) the manufacturer had shipped four unlabelled (55 gallon) drums of this solvent and (3) the Mine Safety and Health Administration (MSHA) did not have a threshold limit value (TLV) for the solvent.

Currently, the only solvent being used during coal testing at this facility is perchloroethylene. None of the tipple operators have complained from the use of this solvent. As a result of the complaints received from one worker at the float-sink operation, Helen Mining Company installed a 9 square foot (36" x 36") exhaust fan along one wall at the table (48" x 28") where the operator performs the float-sink test and installed a local exhaust over the dryer oven. The oven dries the separated coal before final weighing. The work table where the test actually takes place now has a mesh top and permits the passage of air. On the September 26 visit, the work table had a solid top. At any one time, there are normally two containers on top of this test table; one (10 gallon) container usually half-full of perchloroethylene (PCE) and the other container for collecting strained waste. Both containers were observed covered before and after testing.

An approved MSA respirator and safety glasses were worn by the operator when conducting each 5-7 minute test. Rubber gloves and apron are provided and available, however, they are worn at the discretion of the operator. During the survey, it was noted that the operator preferred to wear a rubber/cloth glove. This type of glove would permit, over time, absorption of the solvent through the glove and eventually, the skin.

III. METHODS

Seven consecutive, partial-period, personal breathing zone air samples were collected on the day shift tippie operator using a Dupont low flow pump calibrated at a flow rate of 200 cubic centimeters per minute (cc/min) in-line with solid sorbent charcoal tubes. Since there were no other organic solvents being used during this evaluation, perchloroethylene was the only solvent sampled. Two (area) air bulk samples were collected during the shift at various locations to determine background levels. Two liquid bulk samples of perchloroethylene were collected; one from the original shipping container and the other from the testing container. The liquid bulk samples were collected to determine the actual concentration of the perchloroethylene used and to verify that perchloroethylene was being used.

The personal breathing zone samples were collected hourly and the area samples were collected three and one-half hours each.

IV. EVALUATION CRITERIA AND TOXICOLOGY

- A. Evaluation criteria are used as guidelines to assess the potential health effects of occupational exposures to substances and conditions found in the work environment. These criteria are generally established at levels that can be tolerated by most healthy workers occupationally exposed day after day for a working lifetime without adverse effects. Because of variations in individual susceptibility, a small percentage of workers may experience health problems or discomfort at exposure levels below these criteria. Consequently, it is important to understand that these evaluation criteria are not absolute limits between safe and dangerous levels of exposure.

The primary sources of environmental evaluation criteria used in this report are: (1) NIOSH Recommended Exposure Limits (RELs), and (2) the 1972 American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs). In evaluating the exposure levels and any recommendations for reducing the levels found in this report, it should be noted that the coal mine surface work areas are mandated by Mine Safety Health Administration (MSHA) to meet the criteria established by the 1972 ACGIH TLVs.⁽¹⁾

Often, the NIOSH RELs are lower than the corresponding ACGIH TLVs. NIOSH recommended exposure limits are usually based on the most recent information available and primarily on the concerns related to the prevention of occupational disease.

A time-weighted average (TWA) exposure in this report refers to the average airborne concentration of a substance during a normal eight to ten hour workday. Some substances have recommended short-term exposure criteria or ceiling (C) values which are intended to supplement the TWA where there are recognized toxic effects from brief high exposures. These exposure criteria and standards are commonly reported as parts per million (ppm), or milligrams per cubic meter of air (mg/m^3). Occupational exposure limits used for the contaminant evaluated in this survey is 100 ppm per the 1972 ACGIH TLVs and the lowest feasible limit per NIOSH.

B. Toxicology

Clinical evidence accumulated over the years clearly demonstrates that perchloroethylene (PCE) is toxic to the liver and kidneys in humans. The vapor is narcotic, irritating to the eyes and upper respiratory tract, and may cause frontal sinus congestion and headache. Contact with the skin can cause erythema due to a "degreasing" effect (removal of oil from the skin). Over time, this can cause dermatitis and associated skin infections. PCE exposure can also result in altered physiological and behavioral responses related to depression of the central nervous system. These symptoms include vertigo, impaired memory, confusion, fatigue, drowsiness, irritability, loss of appetite, nausea and vomiting.⁽²⁾ The carcinogenic potential of PCE is believed to be due to its structural similarity to vinyl chloride and other chlorinated olefins (chloroethylene) which are known to be carcinogenic.⁽³⁾

Animal studies conducted by the National Cancer Institute have shown perchloroethylene to be carcinogenic in mice. Since January 1978, NIOSH has recommended that perchloroethylene be handled as if it were a human carcinogen. Consequently, NIOSH feels that a prudent public health policy is to reduce exposures to the lowest feasible limit.⁽⁴⁾

V. RESULTS AND DISCUSSION

Since the use of dibromomethane was discontinued on September 7, 1989, for reasons mentioned earlier in this report, the only solvent evaluated was perchloroethylene. From discussions with both the union and management on the September 26 walk-through, the work performed by the day shift tipple operator is also representative of the other two work shifts. Consequently, only the day shift was monitored.

Seven partial period consecutive samples were collected as personal breathing zone samples on the day shift tipple operator. Only one of the samples detected any perchloroethylene; the level detected was at the limit of detection (0.12 ppm) of the sampling and analytical method.

Two liquid bulk samples were collected and analyzed; one from the 55 gallon container stored outdoors and one from the 10 gallon container used to run the float-sink test. Both were found to contain 1600 ppm of PCE. The potential for exposure is present. However, based on the sampling, work practice observations, engineering controls and the personal protective equipment used (rubber gloves/apron, safety glasses), there should be no over exposure unless the product is spilled in the work area.

Two area bulk air samples collected 18" above the float-sink test container for 3 1/2 hours each did not detect any perchloroethylene in the workplace. The reasons why the samples did not detect any perchloroethylene is likely a result of: (1) newly installed engineering controls, (2) air movement through the new mesh top work table and (3) rearrangement of the test area (see Figure I). As a result of worker complaints from dibromomethane, Helen Mining Company added a local exhaust ventilation hood over the oven (used to dry the fractionated coal) and a wall exhaust fan (36" x 36") at the work table where the float-sink test is performed. The capture velocity of the wall exhaust fan two feet away and at the float-sink test container measured 250 feet per minute (fpm); at three feet it measured 100 fpm and at four feet measured 20 fpm. The work table, which abuts the wall fan, has a diamond shaped mesh top which allows air to pass through. The table measures 48" long and 28" wide. Perchloroethylene vapors that are released during the 5-7 minute test procedure (conducted each hour) are being exhausted away from the operator. This was indicated by smoke tubes. There was some turbulence with air flow noted at the right corner of the work table near the dryer oven (see Figure I). However, the exhaust from the wall fan is not affected by the oven local exhaust hood. Since only one sample out of nine total samples detected perchloroethylene, it is assumed that the engineering controls are effectively removing the solvent vapors from the worker's workplace.

On the initial walk-through, a piece of equipment called a sample splitter was situated on the work table along with the float-sink test container. It was determined from smoke tubes that the sample splitter (between the test container and wall exhaust fan) was blocking the air flow from the float-sink test container. The air flow measured 20 fpm 28" away. It was suggested that the sample splitter be relocated so the wall exhaust could be more effective. On the October 17 survey, the sample splitter had been relocated from the work table to a table near the office (see Figure I). This rearrangement of equipment, the new mesh table top and engineering controls have reduced worker exposures to the lowest feasible level. In addition to the above changes, the worker also wears an approved NIOSH/MSHA organic vapor respirator when performing the test procedure.

Because NIOSH considers perchloroethylene to be a human carcinogen,⁽³⁾ respiratory protection should not be used in lieu of engineering controls. Respirators can be used to supplement engineering controls. If respiratory protection is the sole source of worker protection, then the employer must: (1) have a respiratory protection program and (2) provide either a self-contained full face pressure-demand respirator or a Type-C supplied air full face pressure-demand respirator.

VI. CONCLUSIONS

On the day of the survey, environmental sampling indicated that present engineering controls and rearrangement of equipment had reduced perchloroethylene to the lowest feasible limit.

VII. RECOMMENDATIONS

A. Replace the combination rubber/cloth type glove presently being used with a Teflon/ or Viton/ glove. These gloves, per NIOSH tests, provide better protection and greater resistance to permeation from perchloroethylene. The rubber/cloth glove will permit absorption of solvents which can lead to the solvent eventually being absorbed by the skin.

1. The Teflon/ glove vendor* whose product was evaluated and met "degradation" test standards conducted by NIOSH is:

Clean Room Products, Inc.
1800 Ocean Avenue
Ronkonkoma, NY 11779

2. The Viton/ glove vendor* whose product was evaluated and met NIOSH "degradation" test standards is:

North Hand Protection
4090 Azalea Drive
P.O. Box 70729
Charleston, SC 29405

B. While the wall exhaust fan appears to be controlling solvent generation, its present design is subject to various air turbulences. For greater efficiency in preventing any effects from turbulent air currents, it is suggested that the work table be enclosed as shown in Figure II of this report.

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

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are temporarily available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Deputy Administrator
United Mine Workers of America
900 Fifteenth Street, N.W.
Washington, D.C. 20005
2. Helen Mining Company
c/o Len Harding, Safety Director
Rd #2, Box 2110
Homer City, Pennsylvania 15748
3. UMWA Safety Representative
290 Church Avenue
Indiana, Pennsylvania 15701
4. District 2 Manager
Mine Safety and Health Administration
4800 Forbes Avenue
Pittsburgh, Pennsylvania 15213

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

X. REFERENCES

1. Title 30, Code of Federal Regulations, Part 71, Washington, D.C., July 1988.
2. Occupational Health Guidelines for Chemical Hazards, NIOSH/OSHA, DHHS Publication 81-123, 1981.
3. National Institute for Occupational Safety and Health, Current Intelligence Bulletin #20, Tetrachloroethylene, No. 78-112, January 1978.
4. National Institute for Occupational Safety and Health, Pocket Guide to Chemical Hazards, DHHS Publication 85-114, September 1985.

TABLE I

HELEN MINING COMPANY
 HOMER CITY, PENNSYLVANIA
 MHETA 89-362

<u>Compound</u>	<u>Type Sample</u>	<u>Sample Results</u> ⁽¹⁾
Perchloroethylene	Personal	0.12
Perchloroethylene	Personal	None Detected
Perchloroethylene	Personal	None Detected
Perchloroethylene	Personal	None Detected
Perchloroethylene	Personal	None Detected
Perchloroethylene	Personal	None Detected
Perchloroethylene	Personal	None Detected
Perchloroethylene	Air Bulk	None Detected
Perchloroethylene	Air Bulk	None Detected
Perchloroethylene	Liquid (55 gal. drum)	1600 ⁽²⁾
Perchloroethylene	Liquid (10 gal. drum)	1600

(1) - Results reported in parts per million (ppm)

(2) - Results reported in ppm by weight

LOD - Limit of detection of analyzing instrument (0.12 ppm) for this procedure

NIOSH REL lowest feasible level
 ACGIH TLV (1972) 100 ppm