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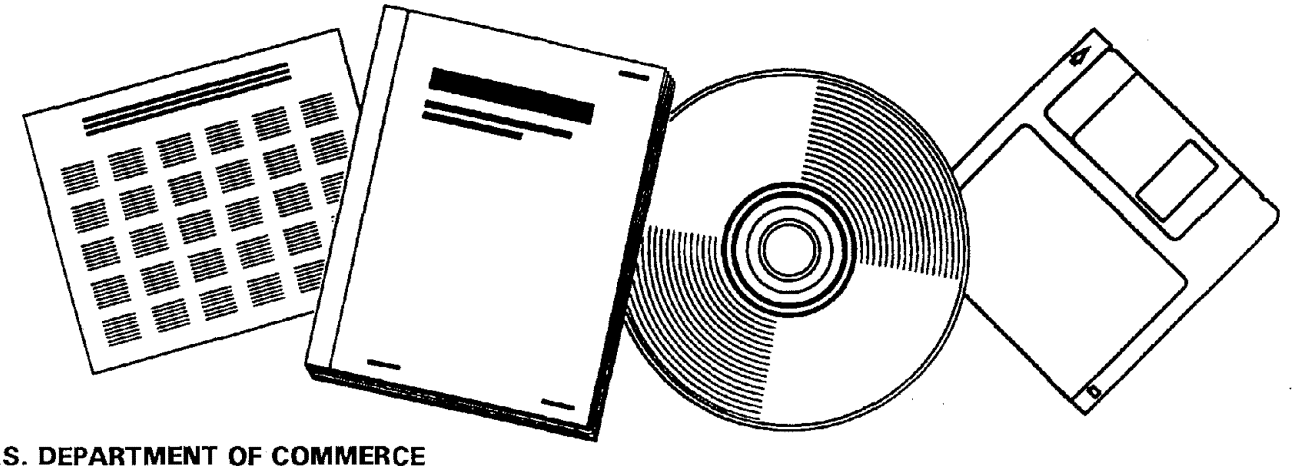
MINING HEALTH HAZARD EVALUATION HHE 79-101-105 WELD SHOP

NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY & HEALTH
CINCINNATI, OH

SEPT 1979



U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PURPOSE

The National Institute for Occupational Safety and Health performed a Health Hazard Evaluation on January 22 and 23, 1979, at Eastern Associated Coal Corporation Federal # 2, (MSHA I.D. #4601456).

The purpose of the visit was to evaluate the surface weld shop for possible excessive worker exposure to hazardous materials associated with the welding operation. The request was made by company officials. No employees had medical complaints at the time of the initial walk-through in November 1978.

DISCUSSION

Twenty-four workers are employed in the surface weld shop. Each of the three shifts has one full-time welder. The remainder of the workers are classified as mechanics and weld only on a demand basis.

The weld shop measures 127 feet by 100 feet with a ceiling height of 24 feet. Ventilation is provided by a 36" exhaust fan located in the ceiling and positioned near the center of the shop. Welding is performed mostly on mild steel utilizing welding rods with the American Welding Society (AWS) numbers E6010 and E7010. The approximate composition of these rods from AWS specifications is no more than 1.75% manganese, 0.5% nickel, 0.2% chromium, and the remainder is carbon steel. The workers wore goggles or welding helmets when welding.

At the time of the survey, work was in progress on the reconstruction of a continuous miner. Environmental sampling was conducted for fluorides, lead, total chromium, manganese, and nickel. Except for lead, all levels were below the evaluation criteria (see tables). Biological samples for fluoride in urine were taken on January 22, 1979. All urinary concentrations were within normal limits. Each of the participants received a personal letter informing them of their urine fluoride measurement results.

All environmental samples are tabulated in the enclosed tables. The lead exposure is assumed to be coming from the lead-containing paint (Rust Oleum lead base paint, information obtained from label) that was heated or welded upon in the reconstruction of the continuous miner.

The Occupational Safety and Health Administration has adopted a lead standard of 0.05 mg/m3. If this standard is adopted by MSHA, 4 of the 11 lead samples in the welding shop were at or exceeded this standard. It is also possible that in some future welding operations the current lead standard may be exceeded.

In the approximate center of the weld shop is located a degreasing tank measuring 4 feet by 2 feet by 4 feet deep. The free board in the tank was 2 feet. The solvent was a 50/50 mixture of methyl chloroform (1,1,1-trichloroethane) and naphtha. The tank had no cooling coils or other environmental controls. It was mentioned that the tank was used infrequently. However, the tank was not covered when not used. When using the degreasing tank, the worker would place the part to be cleaned on the edge of the tank; wash it with solvent; and, using a paint brush, clean the parts of grease and dirt. The part is air dried. Workers do not use any personal protective equipment during degreasing. Repeated skin contact with the solvent could produce a dermatitis. Other potential hazards of methyl chloroform are that upon contact with hot metal or exposure to ultraviolet light from welding, it may decompose to form the irritant gases hydrochloric acid, phosgene, and dichloroacetylene. The environmental sampling results for methyl chloroform shown in Table 2 are below the evaluation criteria.

CONCLUSION

Due to the potential exposure to lead when welding and cutting previously painted metal surfaces, proper protective measure should be taken to protect the workers.

Although no environmental measures exceeded the methyl chloroform evaluation criteria, the work procedures using the degreasing tank should be improved.

RECOMMENDATIONS

1. The use of lead base paint should be phased out of the operation and a suitable substitute found.

2. A pre-operation be performed in which the lead base paint is removed from the welding area. This could be done by either a sandblasting technique with a non-silica abrasive compound or a preburning operation. In either operation, the worker performing the task should be provided with proper personal protective equipment such as NIOSH-approved respirators for lead fume.

3. Local exhaust ventilation should be provided in the welding shop. Due to the diverse sizes and configurations of various parts being welded, the most appropriate type would probably be a flexible duct which can be moved within a few inches of the welding operation. (Figures 1 and 2 below show typical systems.) This duct should terminate in a tapered inlet or flanged hood to minimize entry losses as well as convenience. Minimum face velocity should be 1500 fpm, and minimum duct velocity should be 3000 fpm. The system should be designed and balanced by someone familiar with such work and also with the process being ventilated. The system should exhaust outside the plant and provisions for make-up air should be considered.

4. When welding in a confined area, ventilation is a must as well as the use of a NIOSH/MSHA approved airline respirator for fumes.

5. When using the degreasing tank, gloves and protective goggles should be worn. The gloves should be resistant to methyl chloroform.

6. The degreasing tank should be covered with a tight-fitting lid when not in use.

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TABLE I

Heavy Metal, Air Concentration
Surface Weld Shop HHE 79-102
January 22 and 23, 1979

Sample Number	Location	Sampling Volume (liters)	Concentrations mg per cubic meter of air+ Iron	Lead	Total Chromium (metal)	Manganese	Nickel
VA 1	area in center of shop near degreaser	540	0.48	0.01	ND*	0.04	ND
VA 2	area sample by welder performing cutting operation, near wall	650	0.23	0.05	ND	0.01	ND
VA 3	welder's personal sample, cutting on a continuous miner (metal plate)	770	1.30	0.05	ND	0.08	ND
VA 5	area sample by burning operation, chrome hard surfacing rod used	640	0.31	ND	ND	0.04	ND
VA 7	area sample by bench welding operation, center of shop while three welding operations in progress	370	0.76	0.02	ND	0.04	ND
VA 9	area by bench welding operation on top of welding machine near cutting and welding operations	782	1.28	0.02	ND	0.04	ND
VA 11	area sample near repair of gear box welding with E7018 rod	790	0.76	0.02	ND	0.11	ND
VA 12	behind welder's mask	190	0.84	ND	ND	0.11	ND
VA 13	personal sample of welder starting work on trip vehicle (outside mask)	963	1.04	0.09**	0.01	0.10	ND

TABLE I
(continued)

Sample Number	Location	Sampling Volume (liters)	Concentrations mg per cubic meter of air Iron	Lead	Total Chromium (metal)	Manganese	Nickel
VA 14	near cutting operation of trip vehicle	640		0.03	ND	0.05	ND
VA 16	personal sample of welder's helper in cutting operation of trip welder	780	1.79	0.11**	0.01	0.04	0.01
	Evaluation Criteria						
	American Conference of Governmental Industrial Hygienist 1978		5		0.05	5	
	NIOSH Recommended Standard		***	0.10	****	***	0.015

* nondetectable

** this sample is in excess of the proposed lead standard

*** no NIOSH Recommended Criteria Document

**** NIOSH Recommended Standard

Chromium (VI)

Carcinogenic Chromium VI 1 mg/cum
Noncarcinogenic Chromium VI 25 mg/cum

\+ Time-Weighted Average (TWA)

TABLE II

1,1,1-Trichloroethane Air Concentrations

Sample Number	Location	Sample Volume in liters)	Time-Weighted Average
6324	Worker exposure degreasing	59.0	4.7 ppm
7053	Area by degreaser 6 feet away breathing zone	63.3	3.2 ppm

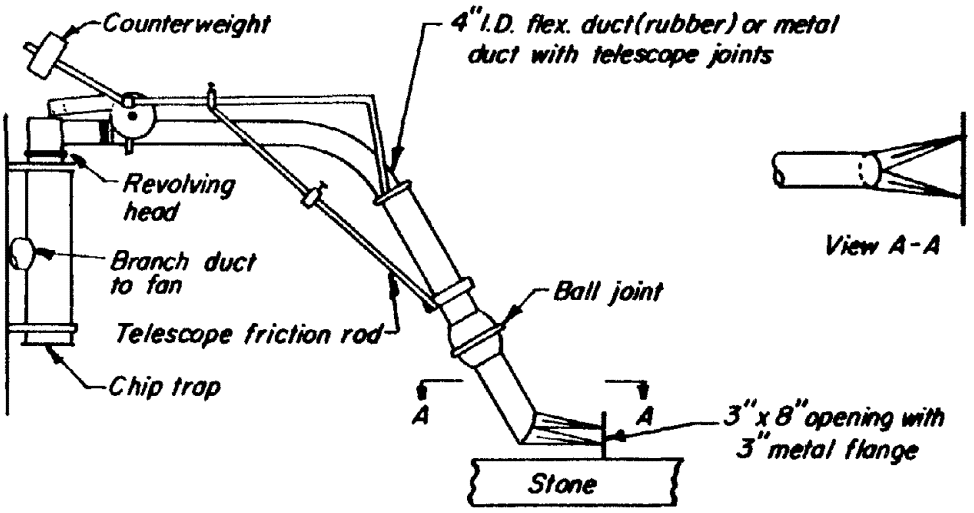
Evaluation Criteria

NIOSH Evaluation Criteria (ceiling)	350.0 ppm

TABLE III

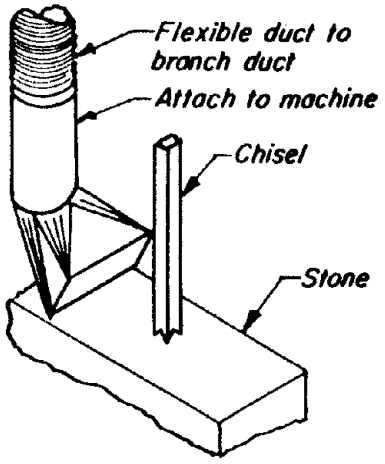
Gaseous and Particulate Fluoride

Location	Sample Volume (liters)	Particulate Fluoride (mg/m^3)	Gaseous Fluoride (mg/m^3)
by cutting operation, center of room	1037	0.054	0.005
area by acetylene tanks cutting and welding plate	1025	0.036	0.027
welder outside of mask	925	0.14	0.011
area sample by welding	947	0.137	0.003
welder's helper while welding outside of mask	958	ND	0.010
welder's helper while welding outside of mask	937	0.005	0.011
welder in front of mask	562	0.23	ND
personal sample of welder behind mask	937	0.005	0.011
NIOSH Evaluation Criteria (time-weighted average)		2.5	2.5



PNEUMATIC HAND TOOLS

Q = 400 cfm minimum, tool 10" max distance from hood
Minimum duct velocity = 3500-4000 fpm



Abrasive blasting to be done in a room or cabinet; 500 fpm at all openings. See "Abrasive Blasting," VS-101

SURFACING MACHINE HOODS

Hood	cfm	Branch diam
Baby surfacer	400	4"
Medium surfacer	600	5"

Entry loss = 1.0 VP

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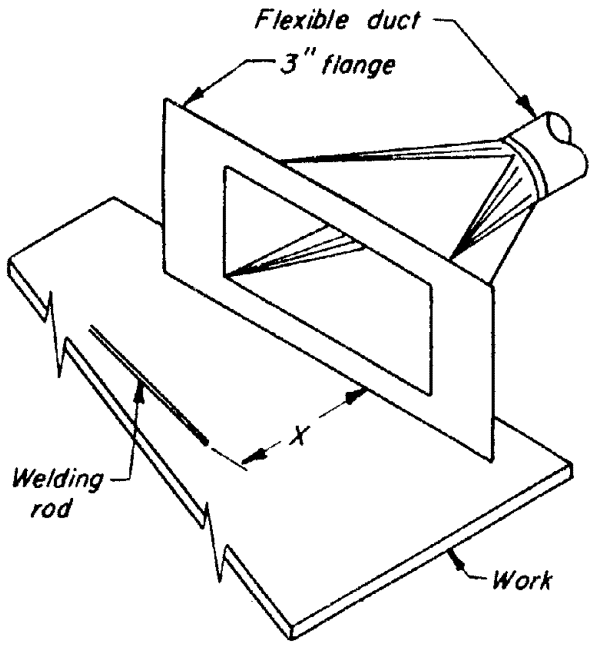
GRANITE CUTTING AND FINISHING

DATE 1-74 | VS-909



PORTABLE EXHAUST

X, inches	Plain duct cfm	Flange or cone cfm
up to 6	335	250
6 - 9	755	560
9 - 12	1335	1000

Face velocity = 1500 fpm
Duct velocity = 3000 fpm minimum
Plain duct entry loss = 0.93 duct VP
Flange or cone entry loss = 0.25 duct VP

GENERAL VENTILATION, where local exhaust cannot be used:

Rod, diam	cfm/welder
5/32	1000
3/16	1500
1/4	3500
3/8	4500

OR

A. For open areas, where welding fume can rise away from the breathing zone:
cfm required = 800x lb/hour rod used

B. For enclosed areas or positions where fume does not readily escape breathing zone:
cfm required = 1600x lb/hour rod used

For toxic materials higher airflows are necessary and operator may require respiratory protection equipment.

OTHER TYPES OF HOODS

Bench: See VS-416
Booth: For design See VS-415, VS-604
Q=100 cfm/sq ft of face opening

"Granite Cutting" VS-909

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WELDING BENCH

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