U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 79-43-663

HARBISON-WALKER REFRACTORIES
CLEARFIELD, PENNSYLVANIA

REVISED - AUGUST 1980

I. SUMMARY

In December 1978, the National Institute for Occupational Safety and Health (NIOSH), received a request from the United Steel Workers of America to evaluate exposure of mixers and laborers to coal tar products at the Harbison-Walker Refractories No.1 Plant, Clearfield, Pennsylvania.

Environmental samples for coal tar products were collected on September 26-27, 1979. The samples were analyzed for total benzene solubles and for five identifiable polynuclear aromatic hydrocarbons (PNA's) - benzo (a)pyrene, chrysene, pyrene, benzo(a)anthracene, and fluoranthene. Concentrations of the benzene soluble fractions on the seven samples ranged from 0.03 to 1.42 milligrams per cubic meter (mg/M^3). NIOSH recommends that occupational exposure to coal tar products, including coal tar pitch and creosote, be controlled so that employees are not exposed to concentrations greater than 0.1 mg/M^3 of the cyclohexane-extractable fraction. (Cyclohexane solubles may vary slightly from benzene solubles but the results should be comparable.) Six of the seven samples collected exceeded the NIOSH permissible exposure level (PEL) for coal tar products (cyclohexane solubles) and four of the sample concentrations were at or exceeding the OSHA PEL of 0.2 mg/M^3 for coal tar pitch volatiles (benzene fraction). Sample results also indicated the presence of all five PNA's. No permissible exposure levels have been established for PNA's, but certain PNA's are carcinogenic and exposure to PNA's should be minimized.

Non-directed medical interviews were conducted with eight employees. Five workers reported no health problems. One employee reported being photosensitized and two others reported experiencing work-related health problems after being splashed with creosote.

The data collected during this investigation indicates that employees at Harbison-Walker Refractories are exposed to potentially hazardous levels of coal tar products (benzene solubles which contain PNA's). Recommendations for reducing exposures are presented on pages 4-5.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the workplace. NIOSH received a request from the United Steel Workers of America to evaluate workers' exposure to coal tar products at the Harbison-Walker Refractories. Employees were concerned with the adverse health effects associated with exposure as well as possible long term effects.

III. BACKGROUND

Harbison-Walker manufactures various refractory cements in Plant No.1. Of interest during this health hazard evaluation was the compounding of a tap hole mix containing coal tar creosote.

The system is a semi-automated type. Clays in bins are pre-weighed, and dumped into mullers. To this is added coal tar pitch and coal tar creosote. Following the mixing cycle, the material is dropped from the muller onto a 20 foot conveyor belt which transports it to the extruder. Two pieces, 6 inches x 12 inches, are extruded simultaneously. These pieces are then wrapped in polyethylene, hot wire sealed, and manually inserted into boxes. Manual handling takes place in the transfer of the pieces from the extruder to the plastic sealing machine. All materials are handled at room temperature. Approximately 12-16 batches are produced per 8-hour shift. The operation is reportedly conducted for five days every three to six months.

IX. EVALUATION DESIGN AND METHODS

A walk-through survey of the plant was conducted on May 25, 1979. Due to the intermittent nature of the production operation using coal tar products, a follow-up survey for collection of environmental samples was delayed until June 27, 1979. Due to error in the sampling and analytical techniques, these results were of no value and it was necessary to conduct additional environmental monitoring on September 26-27, 1979.

On September 26-27, 1979, seven employees who came directly in contact with coal tar products were evaluated by collecting breathing zone samples. Samples were collected on silver membrane filters preceded by glass fiber filters and followed by porous polymer back-up tubes. Benzene solubles were analyzed according to NIOSH Method P&CAM 217 and PNA's were determined as outlined in NIOSH Method P&CAM 184.

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*Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health and Human Services, following a written request by an 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.

During the June 27, 1979 survey, eight employees were questioned concerning work-related health complaints.

An interim report was sent to the union and management on September 20, 1979.

V. EVALUATION CRITERIA

The term coal tar products include coal tar, coal tar pitch, and creosote. In addition to other substances, coal tar products contain various PNA's. Benzo(a)pyrene, phenanthrene, benzanthracene, and chrysene are carcinogenic. Anthracene, pyrene, and fluoranthene may be carcinogenic. NIOSH considers coal tar products to be carcinogenic and that exposure increases the risk of lung and skin cancer. In addition to the increased risk of cancer, exposure to coal tar products by skin contact, inhalation, or ingestion can result in the following harmful effects:

Local - The liquid and vapors are strong irritants producing local erythema, burning, itching, pigmentation (grayish yellow to bronze), vesiculation, ulceration, and gangrene. Eye injuries include keratitis, conjunctivitis, and permanent corneal scars. Contact dermatitis is reported in industry. Photosensitization has been reported.

Systemic - Symptoms of systemic illness include salivation, vomiting, vertigo, headache, loss of pupillary reflexes, hyporthermia, cyanosis, convulsions, thready pulse, respiratory difficulties, and death.

For this evaluation the criteria used to assess the degree of health hazards to workers were selected from three sources:

NIOSH - Criteria for a Recommended Standard...Occupational Exposure to Coal Tar Products.

Threshold Limit Values (TLV) - Guidelines for airborne exposures recommmended by the American Conference of Governmental Industrial Hygienists (ACGIH) for 1979.

OSHA Standard - The air contaminant standards enforced by the U.S. Department of Labor - Occupational Safety and Health Administration - as found in the Federal Register - 29 CFR 1910.1029.

NIOSH - Coal Tar Products (Cyclohexane fraction) 0.1 mg/M^3

TLV - Coal Tar Pitch Volatiles (Benzene fraction) 0.2 mg/M^3

OSHA - Coal Tar Pitch Volatiles (Benzene fraction) 0.2 mg/M^3

VI. RESULTS AND DISCUSSION

The results of the environmental samples collected on September 26-27, 1979, are presented in Table 1. The benzene soluble fractions for coal tar products ranged from 0.03 mg/M^3 to 1.42 mg/M^3. Six of the seven sample concentrations exceeded the NIOSH PEL of 0.1 mg/M^3 for coal tar products (cyclohexane soluble fraction). Although the laboratory analyses for benzene solubles was used, the results should be comparable with cyclohexane solubles. Four of the seven sample concentrations were at or exceeded the OSHA standard and the TLV for coal tar pitch volatiles of 0.2 mg/M^3. The OSHA standard and TLV are based on the benzene soluble fraction.

In addition to determining the benzene soluble fraction, each sample was analyzed for five PNA's. Benzo(a)pyrene levels ranged from 0.3 to 4.98 ug/M^3, chrysene from 0.31 to 3.26 ug/M^3, pyrene from non-detected to 0.87 ug/M^3, benzo(a)anthrancene from 0.22 to 2.41 ug/M^3, and fluoranthene from 0.11 to 1.00 ug/M^3. Benzo(a)pyrene, chrysene, benzo(a)anthrancene, and fluoranthene were present on all seven samples. Pyrene was found on three of the seven samples. Because of the carcinogenic potential of PNA's exposure should be minimized.

Medical interviews were conducted with eight employees on June 27, 1979. Five of the workers reported no health complaints. One worker indicated that he was photosensitized. Another worker indicated the necessity for medical treatment when creosote splashed into his eye. A third employee reported being taken to a hospital for treatment when he was splashed with creosote when a flange burst. He reported that later he went into convulsions and was hospitalized for three days. Medical records on the three reported cases were not reviewed.

VII. RECOMMMENDATIONS

Based on the data collected at the time of this evaluation, the following recommendations are made for reducing employees' exposure to coal tar products:

1. Local exhaust ventilation and engineering controls should be installed at the points of contaminant generation to reduce exposure to coal tar products.

2. The conveyor belt and packaging machine were designed to process one plug at a time rather than the two plugs presently being processed. Consideration should be given to processing only one plug at a time which would reduce the required manual handling and thus reduce exposures.

3. At times batches of the material are too dry or too wet. When the batches are too dry, creosote, which has been dispensed into a 5 gallon open pail, is dumped into the muller. Filling the pail and dumping the creosote exposed the employee to splashing. If this practice is to continue, a safety can or dispensing of the material directly from the tank into the muller would be preferable.

4. During the survey it was noted that valves and piping on the muller were dripping. A periodic maintenance program should be established for all equipment involved with the handling of coal tar products. All spills of coal tar products should be cleaned up immediately.

5. A program should be established to inform all employees of the hazards of working with coal tar products. Training should include proper work practices, clean-up procedures and what to do in case of an accident.

6. The employer should provide and require the use of protective clothing and equipment impervious to coal tar products. Protective equipment should include safety goggles and shoes or boots impervious to coal tar products. Employees should also be encouraged to shower and change clothing at the end of their work shift.

7. Until changes are instituted to reduce exposures below the PEL, respiratory protection should be provided for workers according to the OSHA regulations (29 CFR 1910.134).

8. Periodic monitoring should be conducted to insure that exposure to coal tar products is reduced to an acceptable level and maintained.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. REFERENCES

1. NIOSH Manual of Analytical Methods, 2nd Edition, Volume I, DHEW (NIOSH) Publication 77-157A, April 1977.

2. NIOSH "Criteria for a Recommended Standard, Occupational Exposure to Coal Tar Products," Publication No. 78-107, September 1977.

3. American Conference of Governmental Industrial Hygienist, "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment," 1979.

4. U.S. Department of Labor, Occupational Safety and Health Administration, Federal Register, Vol. 39, No. 125, Part II, June 12, 1974, Subpart Z, Section 1910.1000, Table Z-1.

5. NIOSH "Special Occupational Hazard Rview and Control Recommendations, Chrysene," Publication No. 78-163, May 1978.

6. Marshal Sitting, "Hazard and Toxic Effects of Industrial Chemicals," Noyes Data Corporation, Part Ridge, New Jersey, 1979.

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are available 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 Natioal Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability can be obtained from the NIOSH Publication Office at the Cincinnati address. Copies have been sent to:

a. Harbison-Walker Refractories, Clearfield Plant, Clearfield, Pennsylvania

b. Harbison-Walker Refractories, Pittsburgh, Pennsylvania

c. United Steel Workers of America, Local 76

d. U.S. Department of Labor, OSHA, Region III

e. NIOSH, Region III

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

Table 1
Harbison-Walker Refractories
Clearfield, Pennsylvania
HHE 79-43

September 26-27, 1979

Results of Personal Air Samples for Coal Tar Products (Benzene Solubles) and Polynuclear Aromatic Hydrocarbons (PNA's) in Building 1

Operation	Sample Number	Time	Benzene Solubles (mg/m^3)***	B(a)P*	Chrysene	PNA's $\mu g/m^3$ Pyrene	B(a)A**	Fluoranthene****
September 26, 1979								
Bagging	1	15:02-22:25	1.42	0.65	0.71	0.28	0.44	0.26
Fork Lift	2	15:00-22:25	0.03	0.44	0.32	<0.13	0.22	0.12
Boxing	3	15:05-22:25	0.16	0.30	0.31	<0.13	0.23	0.10
Panel Board	4	15:12-22:25	0.20	2.13	1.86	0.73	1.25	0.63
September 27, 1979								
Panel Board	6	07:10-14:35	0.33	4.98	3.26	0.87	2.41	1.00
Boxing	7	07:20-14:35	0.11	0.42	0.32	<0.13	0.25	0.11
Bagging	8	07:23-14:35	0.20	0.73	0.41	<0.13	0.37	0.16

* B(a)P = Benzo(a)Pyrene
** B(a)A = Benzo(a)Anthrancene
*** mg/m^3 = milligrams of substance per cubic meter of air sampled.
**** $\mu g/m^3$ = micrograms of substance per cubic meter of air sampled.

Substance	Lower Limit of Detection
Benzene Solubles	0.2 milligram/sample
Benzo(a)Pyrene	0.05 microgram/sample
Chrysene	0.15 microgram/sample
Pyrene	0.25 microgram/sample
Benzo(a)Anthracene	0.05 microgram/sample
Fluoranthene	0.05 microgram/sample

Evaluation Criteria

0.2 mg/m^3 (ACGIH) (Benzene solubles)
0.10 mg/m^3 (NIOSH) (Cyclohexane solubles)
0.20 mg/m^3 (OSHA) (Benzene solubles)

NIOSH - to be controlled as a potential occupational carcinogen - lowest reliable analytical detection limit