U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT HE 78-25-488

WHEELING PITTSBURGH STEEL CORPORATION
YORKVILLE, OHIO

May 1978

I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) in the HNX area of Wheeling Pittsburgh Steel Corporation's Yorkville, Ohio plant. On February 6 and 7, 1978, environmental samples were taken for monoethanolamine and carbon monoxide.

Findings on the days of this evaluation indicate that personal and area samples to assess exposure to these contaminants were below recommended 8-hour time weighted average environmental limits although carbon monoxide was detected at levels from 10 to 80 ppm. Exposures to MEA might contribute to frequent sore throats claimed by employees. Recommendations are limited primarily to improved housekeeping.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this 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:

a. Wheeling Pittsburgh Steel Corporation
b. United Steelworkers of America, Local 1223
c. United Steelworkers of America, Pittsburgh, Pennsylvania
d. U.S. Department of Labor, Region V
e. NIOSH, Region V

For the purpose of informing the approximately five "affected employees," the employer shall promptly post for a period of 30 calendar days the determination report in a prominent place near where exposed employees work.

III. INTRODUCTION

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, Education and Welfare, 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.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees at Wheeling Pittsburgh Steel Corporation's Yorkville plant.

The request stated a concern primarily with exposure to monoethanolamine used in the HNX building, alleging complaints of sore throats from operators in that area.

IV. HEALTH HEALTH EVALUATION

A. Process Description

The Yorkville plant is involved primarily in treating and finishing steel produced by other Wheeling Pittsburgh facilities. The HNX operation produces a reducing gas used in other parts of the plant. This gas, a mixture of hydrogen and nitrogen, is produced by burning natural gas in a combustion chamber under controlled conditions and subsequently removing unwanted components which would adversely affect the finish of the steel.

Natural gas is piped into the building and premixed with air prior to being injected into the combustion chamber. The products of combustion include water, carbon dioxide, carbon monoxide and hydrogen. These gases and nitrogen, which comes through the process unreacted, are passed through a converter to oxidize the carbon monoxide to carbon dioxide. The carbon dioxide is subsequently removed in a scrubbing tower with an aqueous solution of monoethanolamine (MEA). The gas mixture, now composed of H_2, N_2, and H_2O, is cooled to condense out most of the water, and final traces are removed by desiccation. The desired gas mixture, approximately 7% H_2 and 93% N_2, is then piped to other areas of the plant for use.

The work force in the HNX operation consists of one operator per shift plus an operator/repairman on the day shift.

The entire operation takes place in a closed system and thereby limits exposure to only those substances which escape through leaks in the system. There appear to be some leaks in pipes carrying water or a water-MEA solution, which could create an exposure to MEA. Most of the pipes and equipment in the building are covered with a coating of an oily-looking substance which is soluble in water and which several employees believe to be MEA. Carbon monoxide could also be present in the work environment, as could any of the other gases in the mixture, or natural gas if there was a leak upstream from the combustion chamber. Another potential exposure in this area is Freon which is used as a refrigerant in the gas drying process. In the past there was a potential exposure to hydrochloric acid in this area when a commercial solution called "Calci-Solve" was used to clean water deposits from heat exchange units. This cleaning now is done outside the building.

B. Evaluation Design and Methods

On February 6 and 7, 1978, an environmental survey was conducted at this plant. In the afternoon of February 6, a walk-through survey was conducted with representatives of both management and labor. That evening environmental samples were taken for MEA and CO. The following day additional samples were taken for MEA.

Samples for MEA were taken with battery powered sampling pumps used to draw air through silica gel which adsorbed the contaminant.[1] Sample duration was approximately 4 hours, and air flow was 200 cc/min through the adsorption media. Some samplers were hung on the belts of employees with plastic tubing running to the sorbent clipped to his collar in order to obtain a breathing zone sample. Other samplers were placed in various locations throughout the work area. Immediately after the sample was collected, the silica gel was treated with hydrochloric acid to stabilize the amine. Analysis was by gas chromatography after treatment with methanol, sodium hydroxide, and benzaldehyde to form the benzylidene-aminoethanol derivative.

Carbon monoxide samples were obtained using certified length-of-stain detector tubes.

Employees were informally interviewed regarding work histories and health problems.

C. Evaluation Criteria

The Threshold Limit Value (TLV) for monoethanolamine established by the American Conference of Governmental Industrial Hygienists (ACGIH) is 3 ppm for an eight-hour time weighted average exposure.[2] The primary basis for this value is systemic effects observed in animals; MEA is also stated to be a central nervous system stimulant at low doses and a central nervous system depressant at lethal doses. MEA has an irritant and necrotic effect on the skin. In animal experiments MEA was found to be highly irritating to the skin, eyes and respiratory tract, although it produced only redness of the skin in human experiments.[5] The odor detection limit is around 3 to 4 ppm for most people,[3] and it has a faint ammonia odor. The OSHA standard is 3 ppm.[4]

The Threshold Limit Value and OSHA Standard for carbon monoxide have been established at 50 ppm. NIOSH recommends 35 ppm for a time weighted average standard, with a 200 ppm ceiling. The effects of carbon monoxide on the heart were the primary concern of NIOSH in establishing the lower suggested standard.

D. Evaluation Results

Results of the eighteen atmospheric samples for MEA are shown in Table 1. Sixteen of these samples are below the limit of detection of 0.1 mg for currently available analytical techniques. This corresponds to an airborne concentration of approximately 1 ppm in most samples. The remaining two samples, taken in the breathing zone of the HNX operator/repairman and in the area near the absorbing tower of Unit #5 above a puddle of liquid from a leaky pipe, measured 2.1 ppm and 1.0 ppm respectively.

In addition to atmospheric samples, three substances were tested qualitatively for the presence of MEA. These substances were: (1) a tar-like substance scraped from a pipe near the operators desk; (2) a sample of liquid from a puddle on the floor near Unit #5; and (3) an oily coating wiped from a pipe of Unit #3. MEA was detected in all three samples, the quantity being high in (2) and (3).

Detector tube measurements for carbon monoxide indicated concentrations of 10-30 ppm near the operator's desk; 30-50 ppm walking between Units 1, 2 and 3; and 70-80 ppm in areas among the machinery believed to be the source of CO. Time weighted average exposures to CO would be below the NIOSH recommended 35 ppm level unless an employee spent the majority of an eight hour shift working among machinery near a leak that was allowing CO to escape into the workarea.

All three employees questioned stated that they had frequent sore throats. Two of the three stated that they had a sore throat on the day of the survey, and the third stated that he had occasional symptoms of nasal irritation thought to be caused by occupational exposure.

V. CONCLUSIONS AND RECOMMENDATIONS

Employee exposures to both MEA and carbon monoxide appear to be below recommended levels. Due to deficiencies in analytical techniques, it was not possible to accurately determine how low the MEA concentrations were in most cases. It is possible that exposure to MEA contributes to the frequent sore throats experienced by employees.

It is recommended that, since there is MEA present in standing liquid and on pipes and machinery, an increased effort be made to dry-up these puddles, to clean pipes and machinery, and to reduce leakage in the system. Even though MEA has a low vapor pressure, it is believed that a significant portion of the atmospheric concentration comes from evaporation from these sources, and that evaporation is likely to increase in warm weather. Improved housekeeping would also decrease potential skin problems from contact with MEA, although precautions should be taken during clean-up to protect the skin.

Occasional monitoring should be conducted for carbon monoxide to assure that levels remain below recommended standards. Carbon monoxide levels will probably be seen to drop as leaks in the system are eliminated.

VI. REFERENCES

1. NIOSH Analytical Method for Aminoethanol Compounds, P & CAM 270, unpublished.

2. Documentation of Threshold Limit Values, American Conference of Governmental Industrial Hygienists, 1971.

3. Patty, F.A. (ed), Industrial Hygiene and Toxicology, Vol. II, Interscience Publ, New York, New York, 1963

4. OSHA Safety and Health Standards, 25 CRF 1910.

5. Occupational Diseases, A Guide to Their Recognition, NIOSH, 1977.

AUTHORSHIP AND ACKNOWLEDGEMENT

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TABLE 1

Monoethanolamine Concentrations

Wheeling Pittsburgh Steel Corporation
February 6 & 7, 1978

Location	Type*	Date	Time	Concentration
In Breathing Zone of HNX Operator	P	2-6	2:45 - 6:30 p.m.	<0.9 ppm
" " " " " "	P	2-6	6:30 - 10:05 p.m.	<1.6
On Operators Desk	A	2-6	2:50 - 6:00 p.m.	<0.8
" " "	A	2-6	6:00 - 10:05 p.m.	<0.9
Hanging at Breathing Zone Level Between Units #2 and #3	A	2-6	2:55 - 6:00 p.m.	<0.9
Hanging at Breathing Zone Level Between Units #2 and #3	A	2-6	6:00 - 10:05 p.m.	<1.2
In Breathing Zone of HNX Operator/ Repairman	P	2-7	7:00 - 10:45 a.m.	2.1
In Breathing Zone of HNX Operator/ Repairman	P	2-7	10:45 a.m. - 2:20 p.m.	<1.2
In Breathing Zone of HNX Operator	P	2-7	7:00 - 10:45 a.m.	<1.0
" " " " "	P	2-7	10:45 a.m. - 1:15 p.m.	<2.2
Near Absorbing Tower of Unit #5, Above Puddle of Liquid from Leaky Pipe	A	2-7	7:05 - 10:55 a.m.	<0.8
Near Absorbing Tower of Unit #5, Above Puddle of Liquid from Leaky Pipe	A	2-7	10:55 a.m. - 2:00 p.m.	1.0
In Bearing Repair Shop, Near Desk	A	2-7	7:10 - 10:50 a.m.	<0.9
" " " " " "	A	2-7	10:50 a.m. - 2:10 p.m.	<1.0
On Operators Desk	A	2-7	7:20 - 10:50 a.m.	<2.9
" " "	A	2-7	10:50 a.m. - 2:00 p.m.	<3.4
Hanging at Breathing Zone Level Between Units #2 and #3	A	2-7	8:45 - 10:55 a.m.	<0.5
Hanging at Breathing Zone Level Between Units #2 and #3	A	2-7	10:55 a.m. - 2:10 p.m.	<3.8

Recommended Environmental Limit 3 ppm

*"P" indicates a personal sample, employee carrying sampler with him
"A" indicates an area sample, placed in a fixed location