

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
CENTER FOR DISEASE CONTROL  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION  
REPORT NO. 75-129-275

REPUBLIC STEEL CORPORATION  
CLEVELAND, OHIO

APRIL 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) in the 45-inch slab mill area of Republic Steel's Cleveland plant on August 5 and 6, and on December 4, 1975. Breathing zone and general area air samples were taken to determine the exposure of crane operators to free silica, iron oxide, nuisance dust, and oil mist. Breathing zone dust concentrations of the two crane operators were within the standards established by the U.S. Department of Labor and the threshold limit values of the American Conference of Governmental Industrial Hygienists. Oil mist concentrations were found in the crane cab which exceeded the recommended threshold limit value. However, in view of the fact that the crane operators spend less than four hours per day in their cabs, the time weighted average exposure is below this concentration and is not viewed as harmful under present work practices.

It has been determined that the crane operators in the 45-inch mill area of this plant are not exposed to harmful concentrations of dust or oil mist in their job as it was performed on the days of this evaluation. It is felt, however, that since shielded dry bulb temperatures as high as 1090F. were observed in the crane cabs, that an evaluation should be made of the crane operators exposure to heat stress. Physical agents, such as heat, are currently outside the authority of NIOSH to investigate under Section 20(a)(6) of the Occupational Safety and Health Act. A request by the NIOSH industrial hygienists to perform such an evaluation was denied by Republic Steel.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

- a) Republic Steel Corporation
- b) Authorized Representative of Employees
- c) U. S. Department of Labor - Region V
- d) NIOSH - Region V

For the purpose of informing the approximately ten 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.

### 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 (NIOSH) received such a request from an authorized representative of employees to evaluate potential hazards to crane operators in the 45-inch slab mill at Republic Steel's Cleveland Plant.

### IV. HEALTH HAZARD EVALUATION

#### A. Process Description

The 45-inch slab mill at Republic Steel's Cleveland Plant is a two high reversing roller mill with vertical side rollers. It is used to roll low carbon steel ingots, in the range of twelve to twenty-seven tons, into slabs with a final thickness of four to ten inches. The ingots are brought by a conveyor system from soaking pits where they have been heated, and placed on the slab mill table. The passes of the ingot back and forth through the mill are controlled from an air conditioned pulpit, as is the scarfing operation.

During the time the mill is in operation, there are two cranes on duty, either in the crane cabs or nearby. One crane spends from one to two hours each shift removing scarfing waste and slag from a pit. The cranes are also used during the rolling operation if a breakdown occurs in any of several systems in the rolling mill, if an ingot/slab becomes jammed in the mill, or for various other tasks. Normal operation would call for the cranes to each be in use approximately three to four hours out of an eight hour rolling turn. When the cranes are not in operation, the operators are allowed to move to more comfortable areas.

#### B. Evaluation Design and Methods

Environmental samples were collected from the crane operators breathing zone by the use of battery powered personal sampling pumps worn by those operators. Similar pumps were also placed in the crane cabs to collect samples of air contaminants from those areas. Contaminants were collected on filters, some with the use of 10 mm nylon cyclones to remove the non-respirable fraction of the particulates prior to collection. The filters were subsequently analyzed for total dust load, iron oxide, free crystalline silica, and oil mist. Dust concentrations were determined by the method of differences using preweighed filters. Iron oxide concentration was determined by atomic absorption spectrophotometry. Crystalline silica polymorphs were measured by x-ray diffraction. Fluorescence and an ultrasonic benzene soluble method were used for oil mist. Temperature measurements, taken to correct

air volumes to standard conditions, were taken with a dry bulb thermometer shielded with reflective foil to eliminate the effects of infrared radiation. Settled dust samples were taken for analysis for crystalline silica.

In addition to environmental samples, crane operators and other employees in this area were informally questioned regarding possible adverse health and working conditions.

### C. Evaluation Criteria

The criteria for this evaluation include threshold limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH)<sup>1</sup> and the NIOSH criteria for a recommended standard on silica<sup>2</sup> and carbon monoxide<sup>4</sup>. Suggestions made as to potential heat stress problems are based on the NIOSH criteria for a recommended standard on hot environments.<sup>3</sup>

The following table indicates the maximum permissible exposure for the various substances:

<u>Substance</u>	<u>Permissible exposure 8-hour time weighted average</u>	<u>Source</u>
Iron oxide fume	5 mg/M <sup>3</sup>	ACGIH
Oil mist, particulate	5 mg/M <sup>3</sup>	ACGIH
Crystalline silica	10 mg/M <sup>3</sup>	ACGIH
	<u>% respirable quartz + 2</u>	
Crystalline silica (respirable)	0.05 mg/M <sup>3</sup>	NIOSH
Nuisance dust (total)	10 mg/M <sup>3</sup>	ACGIH
Nuisance dust (respirable)	5 mg/M <sup>3</sup>	ACGIH
Carbon monoxide	35 ppm*	NIOSH

\*35 parts carbon monoxide per million parts air.

Consideration was also given to symptomatology described by the employees during informal interviews.

### D. Evaluation Results and Conclusions

Results of sampling done on August 5 and 6, 1975, are given in Tables 1 and 2. Results of sampling on December 4, 1975, are in Table 3. The oil mist concentration was measured on the second visit at 5.9 mg/M<sup>3</sup> of oil per cubic meter of air in the cab of crane No. 92 and 7.4 mg/M<sup>3</sup> in No. 93. (Average exposure of the crane operators to oil mist, however, is considerably below these concentrations due to the fact that they spend much less than eight hours in their cabs). Carbon monoxide concentrations were measured by detector tubes and ecolozyer and found to be less than 5 and 10 ppm, respectively. Bulk samples of settled dust from each crane cab were analyzed for free crystalline silica and each of the three polymorphs was measured at less than 1%. Semi-quantitative analysis of oil mist samples taken during the August survey indicated concentrations on the order of 1 mg/M<sup>3</sup> in the crane cabs.

Informal questioning of crane operators and other employees in this area indicated no more severe problem from exposure to dust, fume and mist than occasional irritation. There was, however, some indication that exposure to heat was creating some physiological problems as well as preventing crane operators from wearing respiratory protection which would decrease irritation from the dust, fume, and mist.

V. RECOMMENDATIONS

Due to the possibly harmful concentrations of oil mist in the crane cabs, as well as the potential synergistic effect of other air contaminants and heat, crane operators and supervisory personnel should be informed of the importance of the crane operators having adequate time away from the crane cabs. An evaluation of potential heat stress problems should also be undertaken during the summer months. This should include instructing the crane operators, supervisory personnel, and clinical personnel in the symptomatology and prevention of heat stress as well as environmental measurements of heat.

VI. REFERENCES

1. Documentation of the Threshold Limit Values for Substances in Workroom Air, 1971, American Conference of Governmental Industrial Hygienists.
2. Criteria for a Recommended Standard, Occupational Exposure to Crystalline Silica, 1974, NIOSH
3. Criteria for a Recommended Standard, Occupational Exposure to Hot Environments, 1972, NIOSH
4. Criteria for a Recommended Standard, Occupational Exposure to Carbon Monoxide, 1972, NIOSH

VII. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE 1  
DUST AND FREE SILICA CONCENTRATIONS

REPUBLIC STEEL CORPORATION  
CLEVELAND, OHIO

August 5 & 6, 1975

<u>Time Period</u>		<u>Dust</u>		<u>Free Silica</u>		<u>Description</u>
<u>Start</u>	<u>Stop</u>	<u>mg/filter</u>	<u>mg/M<sup>3</sup></u>	<u>mg/filter</u>	<u>mg/M<sup>3</sup></u>	
14:16	18:20	0.45	1.1	<0.08	<0.2	Four hour respirable personal sample on crane operator
9:21	14:47	0.27	0.5	<0.08	<0.2	Five hour sample at B.Z. level in crane #92
14:21	18:15	0.16	0.4	<0.08	<0.2	Four hour respirable sample at B.Z. level in crane #93
9:31	14:59	0.44	0.8	<0.08	<0.1	Five hour sample at B.Z. level in crane #93
15:50	18:20	0.08	0.3	<0.08	<0.3	Two and one half hour respirable personal sample on crane operator

TABLE 2  
 IRON OXIDE CONCENTRATIONS  
 REPUBLIC STEEL CORPORATION  
 CLEVELAND, OHIO

August 5 & 6, 1975

<u>Time Period</u>		<u>mg Iron Oxide/M<sup>3</sup></u>	<u>Description</u>
<u>Start</u>	<u>Stop</u>		
14:21	18:15	0.58	Area sample in cab of crane #93
14:16	18:20	1.67	Area sample in cab of crane #92
9:31	14:59	0.19	Personal sample on operator of crane #93
9:21	14:46	0.13	Personal sample on operator of crane #92
9:31	14:59	0.11	Respirable area sample in cab of crane #93
9:21	14:47	0.05	Respirable area sample in cab of crane #92



TABLE 3  
 RESPIRABLE DUST CONCENTRATIONS  
 REPUBLIC STEEL CORPORATION  
 CLEVELAND, OHIO

December 4, 1975

<u>Time Period</u>		<u>Dust Concentration</u>	<u>Description</u>
<u>Start</u>	<u>Stop</u>		
12:27	19:37	0.78 mg/M <sup>3</sup>	Personal sample on operator of crane #92
12:27	19:38	0.77 mg/M <sup>3</sup>	Area sample in cab of crane #92
12:27	19:38	0.92 mg/M <sup>3</sup>	(same as #2)
12:35	19:28	0.86 mg/M <sup>3</sup>	Personal sample on operator of crane #93
12:35	19:34	1.61 mg/M <sup>3</sup>	Area sample in cab of crane #93
12:35	19:34	1.4 mg/M <sup>3</sup>	(same as #6)