U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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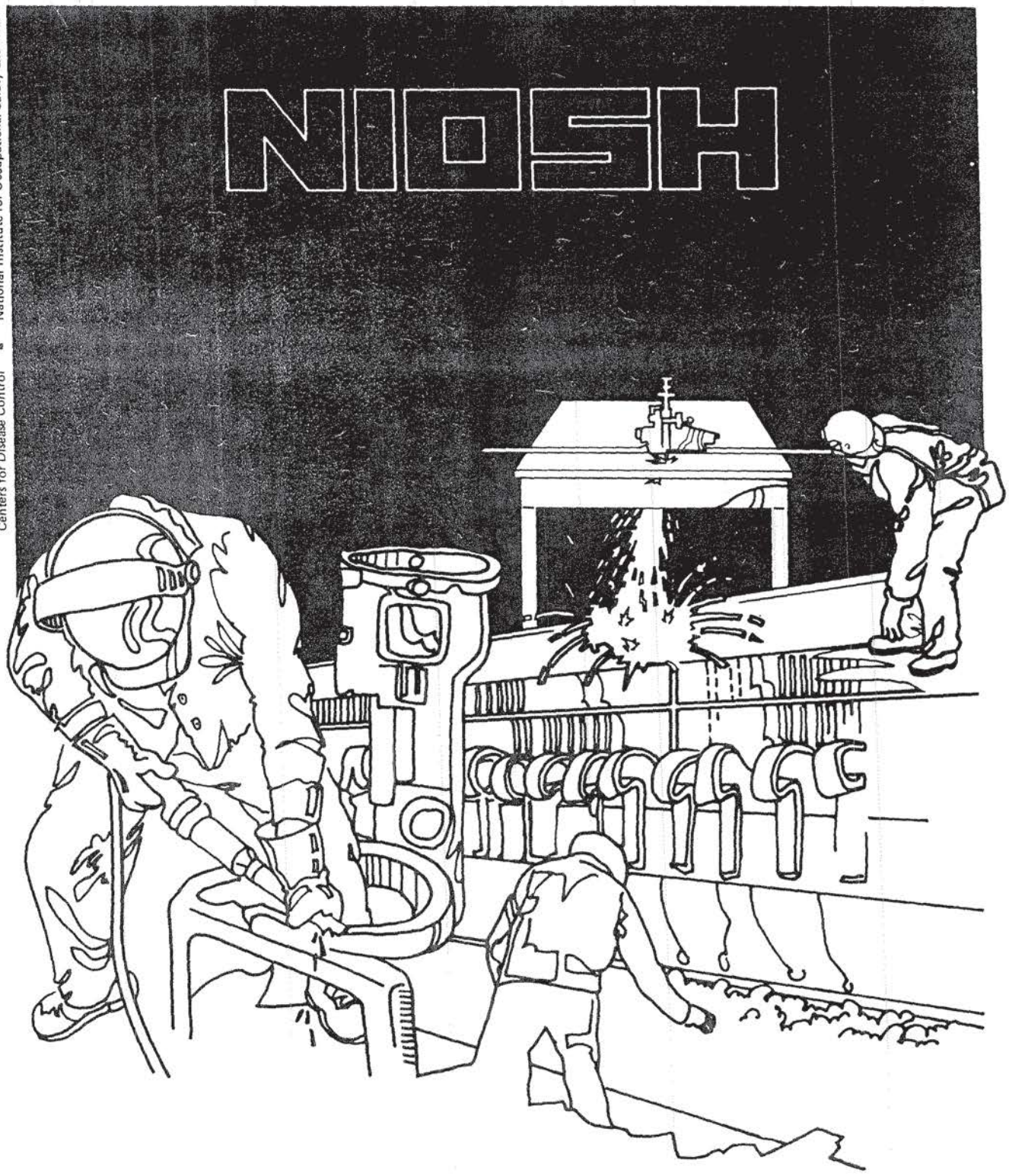

Health Hazard Evaluation Report

HETA 81-127-901
FANSTEEL ELECTROMETALS INC.
NORTH CHICAGO, ILLINOIS

HETA 81-127-901
June 1981
Fansteel Electrometals Inc.
North Chicago, Illinois

NIOSH Investigator:
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I. SUMMARY

On December 23, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Fansteel Electrometals, North Chicago, Illinois. The request was submitted by Local #1777 of the International Association of Machinists and Aerospace Workers. The requestor was concerned about the potential health hazards of a newly introduced manufacturing process using chromium powder.

Only one employee is directly involved in the process. Approximately 10 employees work in nearby areas.

On April 7, 1981, NIOSH conducted a health hazard evaluation of the actual production process. Environmental air samples were collected by both general area and personal sampling techniques. The local exhaust ventilation, which had been installed by Fansteel Inc. as a dust control measure, was also evaluated.

Results of the air sampling indicated that there was one personal exposure of 0.006 milligrams per cubic meter of air (mg/M^3) of total chromium. The OSHA standard for metallic chromium is 1 mg/M^3. Eight other area and personal samples were below the limit of detection for total chromium (1 microgram per sample). The local exhaust ventilation system was judged to be of the proper type, and operating in an efficient manner.

On the basis of data obtained during the survey, NIOSH determined that the exposures to total chromium were within acceptable limits. The recently installed local exhaust ventilation system was found to be operating properly and efficiently.

KEYWORDS: SIC 3471 (Electroplating, plating, polishing, anodizing and coloring), chromium, chromium VI.

IV. EVALUATION DESIGN AND METHODS[1]

Discussions with management involved the collection of information concerning process description, engineering controls, personal protective equipment and clothing, work practices, training programs and monitoring for the areas in question. Interviews with employees focused on the job description, work practices, training programs and housekeeping procedures.

The area samples and personal air samples for total chromium were collected on cellulose ester membrane filters using portable pumps at a flowrate of 1.5 liters per minute. These samples were analyzed by atomic absorption according to NIOSH Method P & CAM 173.

The personal sampling was designed to determine the workers' exposure to chromium in his breathing-zone. Area samples were taken to determine whether any procedure in the process created an excessive dust hazard.

Samples were obtained both in the immediate vicinity of the process and in nearby areas where employees were working.

Smoke tubes were employed to observe the efficiency of the local exhaust ventilation.

V. EVALUATION CRITERIA[2-8]

Chromium (Refer to Table I for Environmental Standards)

Chromium may exist in one of three valence states in compounds, +2, +3, and +6. The +3 (trivalent) and +6 (hexavalent) states are the most biologically significant. Routes of entry to the body include skin absorption, inhalation and ingestion.

Local Effects: In some workers, chromium compounds act as allergens which cause dermatitis to exposed skin. They may also produce pulmonary sensitization, leading to attacks of respiratory distress even at low exposure levels.

Systemic Effects: Chromium compounds in the +6 state are irritants and corrosive. Acute exposures to dust or mist may cause coughing and wheezing, headache, dyspnea, pain on deep inspiration, fever and loss of weight. Tracheobronchial irritation and edema persist after other symptoms subside. Hexavalent chromium causes ulceration of the nasal septum with subsequent perforation. Certain forms of hexavalent chromium have been found to cause increased rate of lung cancer among exposed workers.

VI. RESULTS AND DISCUSSION

Results of the personal and area air samples were well within the environmental criteria/standards for total chromium. The sample obtained from the breathing-zone of the ball mill operator indicated a concentration of

0.006 mg/M^3 of total chromium. Levels of chromium were below the limits of detection on the other samples.

The ball mill operator wore protective clothing which included a respirator, gloves, apron and coveralls. He has 2 separate foot lockers, one for personal clothing, and one for work clothing.

Paper was spread on the chromium weighing table. This enabled an easy and efficient cleanup of the area. A special waste barrel was provided for the paper and disposable protective clothing. Wet sweeping methods are used to clean up the area.

The slot hood local exhaust ventilation at the weighing table was of the proper type, and operating efficiently. A vibrating separator was equipped with an enclosed flexible duct and local exhaust ventilation. Smoke tubes indicated that the ventilation was sufficient to capture dust generated on the weighing table and near the separator. Environmental air measurements demonstrated the efficiency of the ventilation. During the pilot process (at which time there was no local exhaust ventilation) total chromium concentrations ranged from 0.04 mg/M^3 to 0.20 mg/M^3. During actual production (with ventilation installed and operating) chromium was detected on only 1 sample at 0.006 mg/M^3. The electrostatic precipitator, which has been installed as part of the ventilation system, is the proper type of collector for fine dust particles.

During the survey, standing water was observed in some areas near the ball mills. This represents a potential safety hazard to workers who might slip and become ensnared in nearby moving machinery. Standing water is also a potential electrical hazard. Maintenance efforts should be increased to prevent the accumulation of water and mud on the working floor areas.

To summarize the results: air concentrations of total chromium have been substantially reduced by the installation of local exhaust ventilation; the use of protective gloves, aprons and coveralls should be continued to prevent skin contact with the chromium powder; the continued use of respirators should be unnecessary given the low concentrations of chromium which are present.

VII. RECOMMENDATIONS

The following recommendations are intended to minimize contact with chromium powder:

1. Protective gloves and coveralls should be used during weighing, pouring, separating and cleanup operations.

2. Head, arms, neck and face should be washed before breaks and lunch, and a thorough wash up or shower should be taken before leaving work.

3. Work clothes should be kept in a separate locker from street clothes; work clothes should not be brought home.

4. No smoking, eating or drinking should be allowed in the area where chromium is used.

5. The weighing table should be covered with paper to aid in cleanup operations. Spills, leaks and dust accumulations should be cleaned up immediately by either dry/wet vacuuming or wet-mopping.

6. All weighing and separating activities should be performed only when the local exhaust ventilation is properly functioning.

7. All ventilation units should be monitored and maintained on a regular basis.

8. Medical surveillance should be implemented to monitor for potential sensitization to the chromium powder by employees.

9. A comprehensive health and safety program should be initiated to alert employees to the potential health effects of chromium. Special emphasis should be placed on work practices which will reduce the possibility of contaminating the work area with chromium powder.

10. A preventive maintenance program should be implemented to prevent the accumulation of standing water and dust in the ball milling area.

VIII. REFERENCES

1. NIOSH Manual of Sampling Data Sheets. DHEW (NIOSH), March 1977.

2. Occupational Diseases: A Guide to Their Recognition. DHEW (NIOSH), June 1977.

3. Toxicology: The Basic Science of Poisons. Casarett and Doull MacMillan Publishing Company, Inc., New York, 1975.

4. Occupational Medicine: Principles and Practical Applications. Carl Zenz, ed., Year Book Medical Publishers, Inc., Chicago, Illinois, 1975.

5. Criteria for a Recommended Standard---Occupational Exposure to Chromium VI. DHEW (NIOSH) Publication No. 76-129.

6. NIOSH/OSHA Pocket Guide to Chemical Hazards. DHEW (NIOSH) Publication No. 78-210.

7. General Industry, OSHA Safety and Health Standards. 29 CFR OSHA 2206, Revised November 1978.

8. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1979. American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati, Ohio, 1979.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Publications Dissemination, 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. Fansteel Electrometals, Incorporated
2. I.A.M. and A.W.
3. NIOSH, Region V
4. OSHA, Region V

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

TABLE I

Environmental Criteria[1]

Fansteel Electrometals, Inc.
North Chicago, Illinois
HE 81-127

Substance	OSHA Standard	ACGIH	NIOSH
Chromium, Soluble Chromic, Chromous Salts as Cr.	0.5	0.5	-----
Chromium Metal and Insoluble Salts	1.0	-----	-----
Chromium (II) Compounds (as Cr).	-----	0.5	-----
Chromium (III) Compounds (as Cr)	-----	0.5*	-----
Cr VI Compounds, as Cr water soluble Cr VI Compounds	-----	0.05*	-----
Carcinogenic Chromium VI	-----	-----	0.001
Non-Carcinogenic Chromium VI	-----	-----	0.025

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1 All concentrations are for an 8-hour time-weighted average (TWA) exposure, units are in mg/M^3, milligrams of substance per cubic meter of air.

* Adopted for 1981.

TABLE II

Results of Air Sampling for Total Chromium

Fansteel Electrometals, Inc.
North Chicago, Illinois
HE 81-127

April 8, 1981

Substance	Job Operation or Location	Type of Sample	Sampling Time (min.)	Concentration (mg/M^3)
Total Chromium	Ball Mill Operator	Personal	345	0.006
	Above Separator	Area	351	ND*
	Above Ball Mill	Area	333	ND
	Aisleway, West of Measuring Station	Area	334	ND
	Sizing Disc Operator	Personal	328	ND
	Above Weighing Station	Area	317	ND
	Parts Table Near Weighing Station	Area	318	ND
	Machine Operator in Cutoff Area	Personal	321	ND
	General Area, 5 ft. high on a post directly east of the Weighing Station	Area	310	ND

*ND = The substance was below the limit of detection which is 1 microgram per sample.