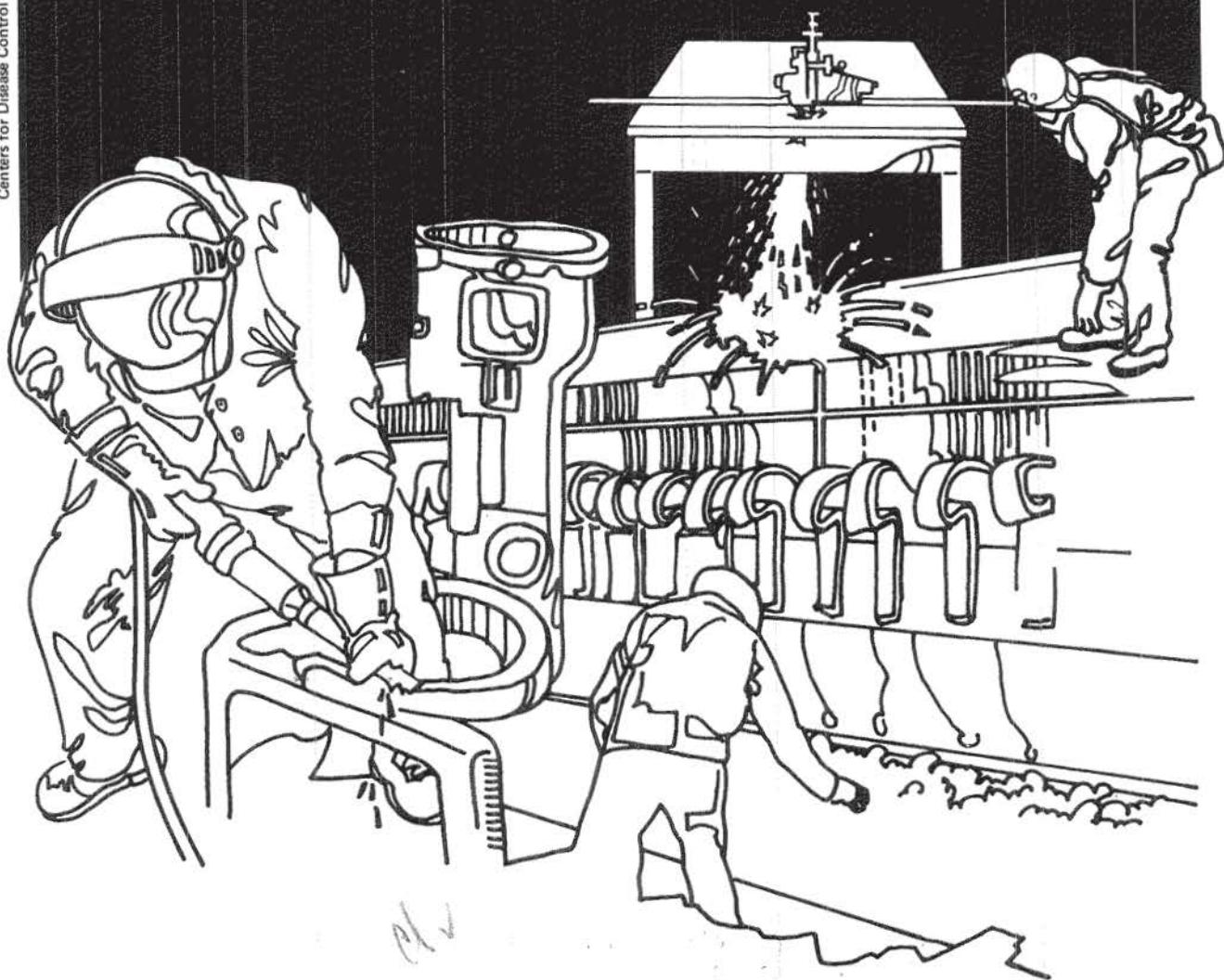


NIOSH



Health Hazard Evaluation Report

HHE 80-064-857
MARTIN MARIETTA ALUMINUM
LEWISPORT, KENTUCKY

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

John R. Dickey, M.D.

Director, NIOSH

John D. Rappaport

HHE 80-064-857
April 1981
Martin Marietta Aluminum
Lewisport, Kentucky

NIOSH INVESTIGATORS:
Steven A. Lee, IH
Joann Schloemer, RN, M.Ed.

I. SUMMARY

In February 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Martin Marietta Aluminum, Lewisport, Kentucky. The request was prompted by concerns about "increasing dust levels, and reports of burning and sores in the nose, sore throat, and bad taste in the mouth" among workers in the Cast and Remelt Department. The department employed about 100 workers whose predominant occupational health concerns involved dross dust and periodic chlorine leaks.

On April 7-8, 1980, to evaluate workers exposure, we obtained personal and area samples for determination of airborne particulate levels. We also evaluated the prevalence and severity of symptoms by administration of a combined non-directed and directed questionnaire to all 23 day shift employees in the Cast and Remelt Department.

The dross dust was found to consist almost entirely of aluminum oxide, which is primarily considered a nuisance particulate. Total airborne particulate concentrations ranged from 0.8 to 4.5 milligrams per cubic meter of air (mg/M^3) with a mean of $1.9 mg/M^3$. Respirable dust concentrations ranged from 0.2 to $0.4 mg/M^3$. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit value of $10 mg/M^3$ for total nuisance dust, and $5 mg/M^3$ for respirable dust. No chlorine leaks were reported by employees during the NIOSH survey and none were detected during a series of colorimetric indicator tube measurements.

Twenty-two of the 23 workers interviewed reported intermittent exposures to dross dust and/or chlorine followed by acute mucous membrane irritation symptoms compatible with these exposures (burning nose, bad taste in mouth, sore throat).

On the basis of the environmental data obtained in this investigation, we determined that, during the NIOSH survey, there were no hazardous exposures to chlorine or dross dust in the Cast and Remelt Department. However, on the basis of the medical interviews, it seems that intermittent exposures to chlorine gas and excessive dross dust occur at levels sufficient to cause mucous membrane irritation.

Recommendations on medical surveillance and work practices are presented in Section VIII of this report.

KEYWORDS: SIC 3341 (Non-Ferrous Foundries), nuisance particulates, aluminum oxide, chlorine, respiratory irritation.

II. INTRODUCTION

In February 1980, the National Institute for Occupational Safety and Health, received a request for a health hazard evaluation at Martin Marietta Corporation in Lewisport, Kentucky. The request was prompted by the workers' concerns about "the increasing dust level in the Cast and Remelt Department," reports of "burning nose, sore throat, sores inside the nose and bad taste in the mouth and general concerns about how these might be affecting their health." In May 1980, a preliminary report was sent to the employer and employees describing the sampling and interviewing results.

III. BACKGROUND

The process begins with scrap aluminum that arrives at the plant by rail car from a wide variety of sources. A quantity of the scrap, plus additives such as chromium, magnesium, iron, copper, and manganese, are weighed and charged into eight melting furnaces. The molten metal is transferred to seven holding furnaces, where it is fluxed with chlorine, or sometimes with a mixture of chlorine and nitrogen. Ingots of aluminum ranging from 15,000 to 20,000 pounds are formed by a process known as direct cooling, where fine streams of cold water actually form the side of the ingots.

Impurities which rise to the top of the molten aluminum in the smelting process are periodically skimmed off as "dross" from the melting and holding furnaces. This dross is transferred to a floor area known as the dross pad where it is raked out to cool. After cooling, the dross is mixed with salts (predominately sodium chloride) and charged into a rotary melting furnace where additional aluminum is recovered.

Most of the dust in the cast and remelt department appears to be generated during the skimming, raking, and cooling of dross. Cracked and worn tubing used for transferring chlorine to the holding furnaces appear to be the major source of chlorine leaks.

At the time of the study there were 24 employees per shift for four shifts in the Cast and Remelt Department.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Six bulk samples of dust were collected from various areas of the plant and from different points in the cast and remelt process. The samples were analyzed for metal content by inductively coupled plasma-atomic emission spectroscopy.

Personal breathing zone samples for airborne particulates were collected on pre-weighed polyvinyl chloride membrane filters using battery powered sampling pumps operated at 1.5 liters per minute for about 7 hours. The samples were analyzed for total particulate weight and for arsenic, chromium, lead, magnesium, selenium and tellurium. The particulate weights were determined by weighing the samples plus the filters on a Perkin-Elmer Model AD-2 electrobalance and subtracting the previously determined tare weights of the filters. After weighing, the filters were wet ashed with nitric and perchloric acid to insure complete oxidation. The ashed samples were aspirated into the atomic absorption spectrophotometer as described in NIOSH Method No. P&CAM 173 and analyzed for inorganic lead, magnesium, chromium, and tellurium. Arsenic and Selenium were analyzed by hydride generation following the method of Pierce, et. al., Applied Spectroscopy, Vol. 30, pp. 38-42, 1976.

Colorimetric indicator tube measurements were taken several times throughout the day for chlorine and carbon monoxide.

B. Medical

By means of a non-directed and directed questionnaire we assessed the prevalence and severity of worker reported exposures and possible work-related health problems.

Work-related health problems are defined here as symptoms temporally associated by the worker with an acute exposure. Exposures are defined as specific dusts, chemicals, gases, fumes reported by workers when asked "Are you exposed to any dust, chemical, gas, fume in your present job as insert job title?"

Approximately 100 workers, 25 each shift (four shifts), are employed in the Cast and Remelt Department. All 23 workers present on the day shift of April 8, 1980, in the cast and remelt department were interviewed.

The workers are divided by job title into six groups: 1) DC Operator, 2) Dross Handler, 3) Furnace Tender, 4) Charge Maker, 5) Material Handler, 6) Other, which includes Salt Furnace Operator, Overhead Crane Operator and Maintenance Mechanic.

Classification of health status is into one of two groups: 1) those reporting no probable work-related health problems on either the non-directed or directed portion of the questionnaire, and 2) those reporting possible work-related health problems on either the non-directed or directed portion of the questionnaire. The presence or absence of a work-related health problem on the non-directed portion of the questionnaire was defined by the response to the question "Do you have any health problems which you feel might be related to your work?" With a "yes" response further questions were asked concerning the health problem(s), duration, persistence and possible etiology. The presence or absence of a work-related health problem on the directed portion of the questionnaire was defined by the response to the specific symptom questions "Do you have any of the following symptoms while you are at work: burning nose, sore nose, sore throat, bad taste in the mouth?"

Of the 23 workers 11 (48%) reported work-related health problems on the non-directed portion of the questionnaire, and 19 (83%) reported work-related symptoms on the directed portion of the questionnaire.

On the non-directed portion of the questionnaire the 11 workers reported mucous membrane irritation (running nose - 5, burning of the nose, eyes and/or throat - 5, and respiratory system health problems (shortness of breath - 4, chest pains - 3, choking and cough - 3), which they associated with chlorine exposure. On the directed portion of the questionnaire 19 workers reported one or more of the following symptoms of mucous membrane irritation identified in the health hazard evaluation request. These symptoms in descending order of frequency are:

<u>Symptoms</u>	<u>Number</u>	<u>Percent</u>
burning in nose	13	57
bad taste in mouth	11	48
sore throat	10	44
sores in nose	4	17

Forty-eight percent reported two to four of the above symptoms. Twenty (87%) of the 23 workers reported work-related health problems on either the non-directed or directed portion of the questionnaire. Three (13%) of 23 workers reported no work-related health problems on either portion of the questionnaire. Twenty of the 23 workers temporally related their mucous membrane irritation and respiratory symptoms to the chlorine and/or dross dust.

VII. CONCLUSIONS

All contaminants measured by NIOSH were well below all OSHA standards and NIOSH Recommended Standards. However, employees reported that dust levels were intermittent and varied considerably depending on weather conditions. During warm weather most doors and windows were left open and dust levels were lower, especially on windy days.

No pattern of health symptoms by job title could be established. Workers from all job categories in the cast and remelt department reported similar exposures, specifically to dross dust and chlorine. Intermittent excessive exposures probably existed and were dependent upon the factors listed above. Acute health effects were reported to be temporally related to these intermittent exposures.

VIII. RECOMMENDATIONS

1. An enclosed dross cooling system should be installed to minimize dust exposure. The management of Martin Marietta has informed NIOSH that the Dross Cooler and integral air pollution equipment has been purchased and delivered. Once the Bay House installation permit request has been reviewed by the State Air Pollution Division, installation can be expected to begin around February, 1981. After installation, an industrial hygiene evaluation of the new system should be conducted.

2. A medical surveillance program is recommended to monitor possible health effects of chlorine and the various components of dross dust. NIOSH Recommended Standards for chlorine include both pre-placement and periodic examinations of the cardiovascular, respiratory and olfactory systems. Special emphasis should be given to possible chlorine effects also on the skin, eyes, mucous membranes, as well as cardiovascular, respiratory and olfactory systems.
3. More thorough preventive maintenance of the chlorine flux lines is needed to prevent chlorine leaks and the consequent skin, eye and mucous membrane irritation.
4. NIOSH approved personal protective methods should include respiratory protection when excessive chlorine gas levels exist, such as during chlorine leaks or when chlorine is coming off the dross. A full-faced gas mask with proper canister or supplied air respirator is needed.
5. It is a good work practice that employees change work clothes daily and shower following each shift.

IX. REFERENCES

1. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment. American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 1980.
2. Occupational Diseases: A Guide to Their Recognition. DHEW (NIOSH) Publication No. 77-181, 1977.
3. NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Chlorine, 1976, DHEW (NIOSH) Publication No. 76-170.
4. Proctor, Nick H., PhD., Hughes, James P.: Chemical Hazards of the Workplace. Philadelphia: J.B. Lippincott Co., 1978.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted
and Report Prepared by:

Steven A. Lee
Industrial Hygienist
Industrial Hygiene Section

Joann Schloemer, RN, M.Ed.
Medical Investigator
Medical Section

Assisted by:

G. Edward Burroughs
Industrial Hygienist
Industrial Hygiene Section

Originating Office:

Hazard Evaluations and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies

Report Typed by:

Jackie Woodruff
Clerk/Typist

TABLE II
RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR
TOTAL PARTICULATE AND MAGNESIUM CONCENTRATIONS

MARTIN MARIETTA ALUMINUM CORPORATION
LEWISPORT, KENTUCKY
HE 80-64

April 8, 1980

Job	Sampling Time	Concentration mg/M ³ *	
		Total Particulate	Magnesium
Dross Handler	8:24 AM - 11:35 AM	2.1	-
Dross Handler	8:17 AM - 11:35 AM	4.5**	-
Dross Handler	9:11 AM - 3:06 PM	3.5	0.14
Melt Furnace Tender	8:35 AM - 3:10 PM	1.1	-
Melt Furnace Tender	8:30 AM - 3:08 PM	1.1	-
Melt Furnace Tender	8:27 AM - 3:08 PM	1.4	0.03
Ingot Pourer	8:43 AM - 3:05 PM	1.5	0.03
Ingot Pourer	8:48 AM - 3:05 PM	1.7	-
Salt Furnace Tender	8:15 AM - 3:05 PM	1.7	-
Charge Maker	8:38 AM - 3:10 PM	0.8	0.2

* Permissible Exposure Level (OSHA) 15.0 15.0
Threshold Limit Value (ACGIH) 10.0 10.0

** Sample contained loose particulate material which could not be quantitatively transferred for weighing. Therefore, its reported weight may be low.

- Sample was not analyzed for Magnesium

TABLE III
RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR
RESPIRABLE PARTICULATE

MARTIN MARIETTA ALUMINUM CORPORATION
LEWISPORT, KENTUCKY
HE 80-64

April 8, 1980

<u>Job</u>	<u>Time</u>	<u>Concentration mg/M³*</u>
Dross Handler	8:20 AM - 3:03 PM	0.4
Dross Handler	8:55 AM - 3:15 PM	0.2
Ingot Pourer	8:45 AM - 3:02 PM	0.4
* Threshold Limit Value (ACGIH)		5.0

DEPARTMENT OF HEALTH AND HUMAN SERVICES

PUBLIC HEALTH SERVICE

CENTERS FOR DISEASE CONTROL

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

ROBERT A. TAFT LABORATORIES

4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226



OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE: \$300

Third Class Mail

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396