

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 NO. 76-86-389

ALLIED CHEMICAL CORPORATION  
MARCUS HOOK, PENNSYLVANIA

APRIL 1977

I. TOXICITY DETERMINATION

An environmental study was conducted in the chromium (III) nitrate production area of the Baker and Adamson Works of The Allied Chemical Corporation, Marcus Hook, Pennsylvania, on November 21, 1976. An environmental assessment was made by obtaining measurements of employee exposure to chromium (VI). A non-directed questionnaire was conducted with one employee, who had no health complaints.

The following determination has been made based on environmental samples collected during the survey and available toxicity data: the employee exposure to chromium (VI), as measured during the survey, did constitute a potential health hazard. The two samples that were taken exceeded the current OSHA ceiling standard of 100 micrograms of chromium (VI) per cubic meter of air ( $\mu\text{g}/\text{M}^3$ ) for chromic acid and chromates, as well as the NIOSH recommended ceiling standard of 50  $\mu\text{g}/\text{M}^3$  for non-carcinogenic chromium (VI). Neither sample exceeded the NIOSH recommended standard of 25  $\mu\text{g}/\text{M}^3$  of breathing zone air determined as a time weighted average (TWA) exposure for up to a 10-hour workday; this assumes no further exposure to non-carcinogenic chromium (VI) occurred during the remainder of the workday.

To eliminate the potential health hazard, suitable engineering controls should be instituted. Capture velocities ranging from 100-200 feet per minute (fpm) may be necessary to control the dust release. A lateral local exhaust system could be installed around the rim of the material addition porthole. While this is being accomplished, the company should continue to provide and maintain a respiratory protection program. A type of program such as that listed in the Federal Register (CFR 1910.134) should be a minimum requirement.

A medical surveillance program should be instituted with special emphasis on routine health surveillance as well as a program that will allow monitoring of chronic diseases, especially cancer.

## II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information 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) Allied Chemical Corporation, Marcus Hook, Pennsylvania
- b) Authorized Representative of Employees - United Steelworkers of America (USWA), Local 13866, Chester, Pennsylvania
- c) Safety and Health Department, USWA, Pittsburgh, Pennsylvania
- d) U.S. Department of Labor - Region III
- e) NIOSH - Region III

For the purpose of informing the "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 regarding worker exposure to chromate pigments. The request originated after preliminary results from a Dry Color Manufacturer's Association-sponsored study showed a higher than expected incidence of lung cancer mortality among chromate pigment producers. This plant employed United Steelworkers of America members and was not included in the epidemiologic study.

## IV. HEALTH HAZARD EVALUATION

### A. Description of Process

It must be pointed out that this plant does not produce chromium-containing pigments like the other two facilities for which Health Hazard Evaluations were requested (RHE's 76-87, 88). Hexavalent chromic acid anhydride ( $\text{CrO}_3$ ) is a starting material and the final product is a trivalent chromium compound - chromium (III) nitrate - in solution. Initially, one employee dumps a 100 pound drum of solid chromic acid into a port-hole of a large capacity vessel, contained under negative pressure to

control the spread of dust. A quantity of drums was dumped during the survey in a 25 minute period. The employee, equipped with respiratory protection, then rinses out the drums, adding the washings to the vessel. These processes conclude the employee's exposure to chromium (VI), as then other reactants are added. The "batch" process requires about a three to four day period for completion.

At one time this facility did produce hexavalent chromates, but no longer does. Approximately six-seven years ago, production of lead chromates ended. By early 1975, production of calcium chromate, calcium dichromate, magnesium chromate, and chromic acid ceased. All of these compounds, with the exception of chromic acid, are considered to be evident or inferred carcinogens by NIOSH.

## B. Evaluation Methods

Environmental sampling was conducted for hexavalent chromium (Cr (VI)) during employee addition of chromic acid flakes to the reaction vessel. Air was drawn through a 5 micron (u) polyvinyl chloride filter at a flow rate of 1.5 liters per minute (lpm) using a Mine Safety Appliance\* (MSA) Model G pump. The filter, encased in a three piece plastic cassette, was worn by the employee near his breathing zone.

Two personal samples were collected on the employee adding the solid chromic acid, one a 15-minute sample and one for the duration of the addition of the chromic acid.

The samples were analyzed in the NIOSH laboratory in Cincinnati. Chromium (VI) was determined using the specific diphenylcarbazide method. The limit of detection was approximately 2.5 micrograms/filter.

## C. Evaluation Criteria

### 1. Toxic Effects

Based on current evidence, NIOSH has defined "non-carcinogenic chromium (VI)" to be the chromium (VI) in monochromates and dichromates (bichromates) of hydrogen, lithium, sodium, potassium, rubidium, cesium, ammonium, and chromium (VI) oxide (chromic acid anhydride).

"Carcinogenic chromium (VI)" comprises any chromium (VI) material not included in the group above, such as lead, zinc, and calcium chromates.

Chromic acid anhydride (chromium (VI) oxide) is the chromium (VI) material handled at the Allied Chemical facility. The chromium ion is in the hexavalent state or commonly termed "Chromium (VI)".

\*Mention of commercial names does not constitute endorsement by the National Institute for Occupational Safety and Health

Chromium (VI) compounds are known to cause ulceration and perforation of the nasal septum and inflammation of the mucous membranes through inhalation. "Chrome holes", which are penetrating sores of the skin, result after contact of chromium (VI) compounds with the cutaneous layer of skin. Common sites include the backs of hands, forearms, skin folds over the knuckles, and the nail root areas. The NIOSH criteria for a recommended standard for chromium (VI) reports that exposure to chromium (VI) may cause kidney or liver damage, tooth erosion and discoloration, and perforated eardrums.<sup>1</sup>

## 2. Environmental Standards

Airborne exposure limits for the protection of the health of workers have been recommended or promulgated by several sources. These limits are established at levels designed to protect workers occupationally exposed to a substance on an 8-hour per day, 40-hour per week basis over a normal working lifetime. For this investigation the criteria used to assess the degree of health hazards to workers were selected from three sources:

- a. NIOSH: Criteria for a Recommended Standard...Occupational Exposure to Chromium (VI), 1975.
- b. Threshold Limit Values (TLV): Guidelines for airborne exposures recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) for 1976.
- c. OSHA Standard: The air contaminant standard for chromic acid and chromates enforced by the Occupational Safety and Health Administration of the U.S. Department of Labor and found in the Federal Register - CFR 1910.1000(b)(Table Z-2).

<u>Source</u>	<u>Substance</u>	<u>8-Hour Time Weighted Average Concentration (TWA)</u>	<u>Acceptable Ceiling Concentration**</u>
NIOSH Criteria Document	Non-carcinogenic Chromium (VI)	25 ug/M <sup>3</sup> *	50 ug/M <sup>3</sup>
OSHA Standard	Chromic Acid and Chromates (Chromium(VI))	---	100 ug/M <sup>3</sup>
1976 TLV	Chromates	100	---

\* ug/M<sup>3</sup> = micrograms of chromium (VI) per cubic meter of air  
(1 ug = 0.001 milligrams)

\*\* This value should never be exceeded in an 8-hour work day; it is commonly measured in a 15-minute period.

## D. Results and Discussion

## 1. Environmental

The results of atmospheric sampling for chromium (VI) are presented in the table below. Concentrations are given in micrograms of chromium (VI) per cubic meter of air.

<u>Sample</u>	<u>Employee</u>	<u>Sample Location</u>	<u>Sampling Period (min.)</u>	<u>Concentration ug/M<sup>3</sup> (Cr(VI))</u>
1090	2nd class operator	Building 21 Bay 32	23	279
1060	2nd class operator	Building 31 Bay 32	15	258

The two samples that were taken exceeded the current OSHA ceiling standard of 100 ug (chromium (VI))/M<sup>3</sup> for chromic acid and chromates, as well as the NIOSH recommended ceiling standard of 50 ug/M<sup>3</sup> for non-carcinogenic chromium (VI). Neither samples exceeded the NIOSH recommended standard of 25 ug/M<sup>3</sup> of breathing zone air as determined as a time weighted average (TWA) exposure for up to a 10-hour workday. This assumes no further exposure to non-carcinogenic chromium (VI) occurred during the remainder of the workday.

The recommended ceiling standard exists to augment protection provided by the recommended time weighted average standard. The additional protection should prevent adverse effects resulting from short time period exposures to chromium (VI). Adverse effects from chromic acid dust or mist include mucous membrane irritation and ulceration and perforation of the nasal septum. Lesions - "chrome holes" - may form on exposed skin surfaces after sufficient contact.

## 2. Medical

On November 21, 1976, one employee was interviewed using a non-directed questionnaire. The employee had no health complaints.

V. RECOMMENDATIONS

## A. Environmental

To eliminate the potential health hazard to employees, suitable engineering controls should be instituted. Capture velocities ranging from 100-200 fpm may be necessary to control the dust release. A lateral local exhaust system could be installed around the rim of the material addition porthole. While this is being accomplished, the company should continue to provide and maintain a respiratory protection program. A type of program such as that listed in the Federal Register (CRF 1910.134) should be a minimum requirement.

B. Medical

Although the following surveillance methods may already exist, the following recommendations are given as minimum requirements:

1. Workers exposed to chromium (VI) oxide should have periodic examinations to detect ulcerations in the nostrils and other parts of the body. Workers should also be examined for the presence of respiratory disease periodically.

2. Other examinations and useful information should include:

- a) Medical history including conditions, such as dermalogic or respiratory, which may be aggravated by exposure to chromium (VI) materials.
- b) Occupational work history.
- c) Smoking history.
- d) Urinalysis.
- e) Chest x-ray.
- f) An evaluation of a worker's ability to use respiratory protection.

VI. REFERENCES

1. Criteria for a Recommended Standard...Occupational Exposure to Chromium (VI), USDHEW, PHS, CDC, NIOSH, 1975.

VII. AUTHORSHIP AND ACKNOWLEDGMENTS

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