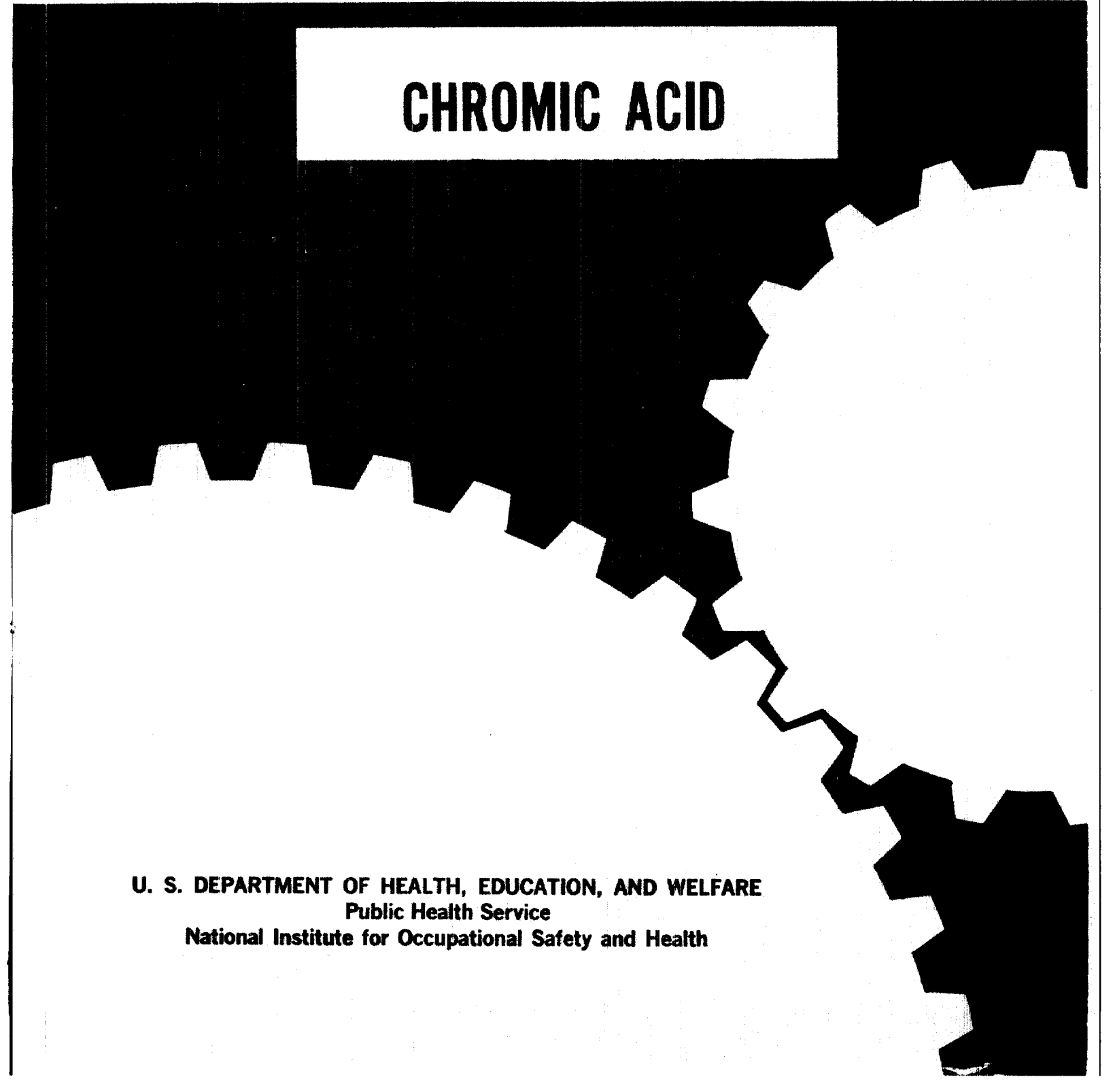


**criteria for a recommended standard . . . .**

# **OCCUPATIONAL EXPOSURE TO**

**CHROMIC ACID**



**U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service  
National Institute for Occupational Safety and Health**

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## PREFACE

The Occupational Safety and Health Act of 1970 emphasizes the need for standards to protect the health of workers exposed to an ever-increasing number of potential hazards at their workplace. To provide relevant data from which valid criteria and effective standards can be deduced, the National Institute for Occupational Safety and Health has projected a formal system of research, with priorities determined on the basis of specified indices.

It is intended to present successive reports as research and epidemiologic studies are completed and sampling and analytic methods are developed. Criteria and standards will be reviewed periodically to ensure continuing protection of the worker.

I am pleased to acknowledge the contributions to this report on chronic acid by members of my staff, by Robert B. O'Connor, M.D., NIOSH consultant in occupational medicine, and by Edwin C. Hyatt, NIOSH consultant on respiratory protection. Valuable and constructive comments were presented by the Review Consultants on Chronic Acid and by the ad hoc committees of the Industrial Medical Association and of the American Academy of Industrial Hygiene. The NIOSH recommendations for standards are not necessarily a consensus of all the consultants and professional societies that reviewed this criteria document on chronic acid. Lists of the NIOSH Review Committee members and of the Review Consultants appear on the following pages.



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The Office of Research and Standards Development, National Institute for Occupational Safety and Health, had primary responsibility for development of the criteria and recommended standard for chronic acid. George D. Clayton and Associates developed the basic information for consideration by NIOSH staff and consultants under contract No HSM-99-72-34. Bryan D. Hardin had NIOSH program responsibility and served as criteria manager.

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**CRITERIA DOCUMENT: RECOMMENDATIONS FOR AN  
OCCUPATIONAL EXPOSURE STANDARD FOR CHROMIC ACID**

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## I. RECOMMENDATIONS FOR A CHROMIC ACID STANDARD

The National Institute for Occupational Safety and Health recommends that worker exposure to chromic acid (chromium trioxide) in the workplace be controlled by compliance with the following sections. The standard is designed to protect the health and safety of workers for an 8-hour day, 40-hour week over a working lifetime. Compliance with the standard should prevent adverse effects of occupational exposure to chromic acid. The standard is measurable by techniques that are valid, reproducible, and available. Sufficient technology exists to permit compliance with the recommended standard. The standard will be subject to review and revision as necessary.

"Chromic acid" is defined to mean chromium trioxide (chromium (VI) oxide, or chromic acid anhydride) and aqueous solutions thereof. "Occupational exposure to chromic acid" is defined as exposure above half the recommended workroom environmental standard.

### Section 1 - Environmental (Workplace air)

(a) Concentration: Occupational exposure to chromic acid shall be controlled so that no worker is exposed either to:

(1) A concentration of chromic acid greater than 0.05 milligram as chromium trioxide per cubic meter of air determined as a time-weighted average exposure for an 8-hour workday, 40-hour work week; or

(2) A ceiling concentration in excess of 0.1 milligram as chromium trioxide per cubic meter as determined by a sampling time of fifteen (15) minutes.

(b) Sampling and Analysis: Procedures for sampling and analysis of air samples shall be as provided in Appendices I and II, or by any method shown to be equivalent in precision, accuracy, and sensitivity to the methods specified.

Section 2 - Medical

Medical surveillance shall be made available as outlined below for all workers occupationally exposed to chromic acid. Maintenance personnel periodically exposed during routine maintenance or emergency repair operations shall also be offered medical surveillance.

(a) Preplacement and annual medical examinations shall include:

(1) A work history to elicit information on all past exposures to chromic acid and other hexavalent chromium compounds.

(2) A medical history to elicit information on conditions indicating the inadvisability of further exposure to chromic acid, eg, skin or pulmonary sensitization, or a skin or mucous membrane condition that may promote response to chromic acid.

(3) Thorough examination of the skin for evidence of dermatitis or chromic ulcers and of the membranes of the upper respiratory tract for irritation, bleeding, ulcerations or perforations.

(4) An evaluation of the advisability of the worker's using negative- or positive-pressure respirators.

(b) Preplacement examinations shall include 14" x 17" chest X-rays. Thereafter, X-ray examinations shall be offered at 5-year intervals and annually after age 40.

(c) All workers with symptoms of skin or upper respiratory tract irritation shall be offered medical examinations at the time the symptoms first occur.

(d) Proper medical management shall be provided for workers adversely affected by exposure to chromic acid.

(e) Initial annual examinations shall be offered within 6 months of the promulgation of a standard incorporating these recommendations.

(f) The medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, and of the employer shall have access to all medical records. Physicians designated and authorized by any employee or former employee shall have access to his medical records.

(g) Medical records shall be maintained for persons employed one or more years with exposure to chromic acid. X-rays for the five years preceding termination of employment and all medical records with pertinent supporting documents shall be maintained at least 20 years after the individual's employment is terminated.

### Section 3 - Labeling(Posting)

(a) All storage containers of chromic acid shall bear the following label in addition to or in combination with labels required by other statutes, regulations or ordinances.

CHROMIUM TRIOXIDE

(CHROMIC ACID)

DANGER! STRONG OXIDANT

CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE

MAY CAUSE DELAYED BURNS OR EXTERNAL ULCERS

Keep container closed.

Do not get in eyes, on skin, on clothing.

Do not breathe dust or mist from solutions.

In case of contact, immediately flush skin or eyes  
with plenty of water for at least 15 minutes.

For eyes, get medical attention immediately.

Wash clothing before reuse.

Use fresh clothing daily. Take hot showers  
after work, using plenty of soap.

(b) The following warning sign shall be affixed in a readily visible location at or near entrances to areas in which there is occupational exposure to chromic acid.

WARNING!

Chromic Acid Area

Unauthorized Persons

KEEP OUT

#### **Section 4 - Personal Protective Equipment and Clothing**

Subsection (a) shall apply whenever a variance from the standard recommended in Section 1 is granted under provisions of the Occupational Safety and Health Act, or in the interim period during the application for a variance. Until the limits of exposure to chromic acid prescribed in paragraph (a) of Section 1 are met, an employer must utilize, as provided in subsection (a) of this Section, a program of respiratory protection for every worker exposed.

(a) **Respiratory Protection:** Engineering controls shall be used to maintain chromic acid concentrations below the prescribed limits. Appropriate respirators shall be provided and used when a variance has been granted to allow respirators as a means of control of exposure in routine operations and while the application for variance is pending. Administrative controls may also be used to reduce exposure. Respirators shall also be provided and used for nonroutine operations (occasional brief concentrations above the time weighted average or ceiling and for emergencies); however, for these instances a variance is not required but the requirements set forth below continue to apply. Appropriate respirators as described in Table I-1 shall only be used pursuant to the following requirements:

(1) For the purpose of determining the class of respirator to be used, the employer shall measure the atmospheric concentration of chromic acid in the workplace when the initial application for variance is made and thereafter whenever process, worksite, climate, or control changes occur which are likely to affect

the chromic acid concentration. The employer shall ensure that no worker is being exposed to chromic acid in excess of the standard because of improper respirator selection or fit.

(2) A respiratory protective program meeting the general requirements outlined in section 3.5 of American National Standard Practices for Respiratory Protection Z88.2-1969 shall be established and enforced by the employer.

Table I-1

**Multiples of TWA Limit**

**for 8 hour day**

**Respirator Type**

less than 10x	Half-mask respirator with replaceable high efficiency or dust, fume, and mist filter.
less than 100x	Full facepiece respirator with replaceable high efficiency filter.
greater than 100x	Type C (positive pressure) supplied-air respirator.

(3) The employer shall provide respirators in accordance with Table I-1 and shall ensure that the employee uses the respirator provided.

(4) Respiratory protective devices described in Table I-1 shall be those approved either under the following regulations or under 30 CFR 11, published in the Federal Register March 25, 1972.

(A) Filter-type dust, fume, and mist respirator--30 CFR 14 (Bureau of Mines Schedule 21B)

(B) Supplied-air respirator--30 CFR 12 (Bureau of Mines Schedule 19B)

(5) A respirator specified for use in higher concentrations of chromic acid may be used in atmospheres of lower concentrations.

(6) Employees shall be given instruction on the use of respirators assigned to them, on cleaning respirators, and on testing for leakage.

(b) Protective Clothing:

(1) Coveralls or other full body protective clothing shall be worn in areas where there is occupational exposure to chromic acid. Protective clothing shall be changed at the end of each workday.

(2) Protective gloves, aprons, and footwear which are impervious to chromic acid shall be worn at operations where chromic acid spills and splashes may contact the skin.

(3) Unless eye protection is afforded by a respirator hood or facepiece, protective goggles or face shields impervious to chromic acid shall be worn at operations where chromic acid splashes may contact the eyes.

(4) All protective equipment shall be maintained in a clean and satisfactory working condition.

#### Section 5 - Informing Employees of Hazards from Chromic Acid

At the beginning of employment in a chromic acid area, employees exposed to chromic acid shall be advised of the hazards of exposure and the relevant symptoms. Proper conditions for safe use and precautions to minimize exposure shall be provided and explained to the employee. Instruction shall include, as a minimum, all information in Appendix III which is applicable to the material to which there is exposure. This information shall be posted in the work area and kept on file and readily accessible to the worker at all places of employment where chromic acid is manufactured or used in unit processes and operations.

A continuing educational program shall be instituted to ensure that all workers have current knowledge of job hazards, proper maintenance procedures and cleanup methods, and that they know how to correctly use respiratory protective devices and protective clothing.

Information as required shall be recorded on U.S. Department of Labor Form OSHA-20 "Material Safety Data Sheet" or a similar form approved by the Occupational Safety and Health Administration, U.S. Department of Labor.



**Section 6 - Work Practices**

(a) **Control of Airborne Chromic Acid:** Chromic acid shall be controlled at sources of dispersion by means of effective and properly maintained methods such as fully enclosed operations, local exhaust ventilation, and/or the use of surface active or other agents which reduce mist formation. Other methods may be used if they are shown to effectively control atmospheric levels of chromic acid within the limits of the recommended standard.

(b) **General Housekeeping:**

(1) Spills shall be cleaned up promptly. Equipment shall be kept in good repair and free of leaks.

(2) No dry sweeping shall be performed. Wet methods or dry vacuuming shall be used as appropriate.

(3) Work clothes contaminated with chromic acid shall be changed immediately. Outer garments shall be changed daily.

(4) Protective gloves, aprons, footwear, and goggles contaminated with chromic acid shall be cleaned with water. When the inside of such protective equipment is contaminated, the equipment shall be removed immediately and discarded, or decontaminated before being reused.

(5) Skin contaminated with chromic acid shall be washed immediately and thoroughly with water. Eyes contaminated with chromic acid shall be washed immediately with copious amounts of water, after which the worker shall be referred immediately to a physician and, if necessary, an eye specialist.

(c) Chromic Acid Anhydride Work Practices: Those persons working directly with chromic acid anhydride, with unsealed containers of the anhydride, or with the anhydride in other than fully enclosed operations shall adhere to the following work practices.

(1) All protective devices and clothing specified below are required.

(A) Dust respirator meeting at least the minimum requirements of Section 4(a).

(B) Protection for the head, neck, and face against airborne particles of chromic acid anhydride, eg, a broad-brimmed hat, such as a full-brimmed hard hat, or respirator hood.

(C) Face shield or goggles, if eye and face protection is not provided by the respirator hood or facepiece.

(D) Coveralls or other full body protective clothing.

(E) Impermeable gauntlets, shoes, and apron.

(2) Protective devices and clothing shall be removed and the arms, hands, and face thoroughly washed:

(A) After working with the anhydride; and

(B) At 30-minute intervals when working with the anhydride for extended periods of time.

#### Section 7 - Sanitation Facilities

(a) Emergency shower facilities shall be available in the workplace for the removal of chromic acid.

(b) Hand washing and emergency eye washing facilities shall be provided in the work area. Instructions shall be posted for proper use of the eye washing facilities and for obtaining medical assistance.

(c) Food storage, preparation, and eating should be prohibited in areas where there is exposure to chromic acid.

#### Section 8 - Monitoring and Recordkeeping Requirements

Workroom areas shall not be considered to have chromic acid exposure if environmental levels, as determined on the basis of an industrial hygiene survey or by the judgment of a compliance officer, do not exceed half of the environmental standard. Records of these surveys, including the basis for concluding that air levels are below half of the environmental standard, shall be maintained. Requirements set forth below apply to areas in which there is chromic acid exposure.

Employers shall maintain records of environmental exposures to chromic acid based upon the following sampling and recording schedules:

(a) The first environmental sampling shall be completed within 6 months of the promulgation of a standard incorporating these recommendations.

(b) Environmental samples shall be taken within 30 days after installation of a new process or process changes.

(c) Samples shall be collected at least quarterly in accordance with Appendix I for the evaluation of the work environment with respect to the recommended standard.

(d) Samples shall be collected and evaluated in accordance with Appendix I for determination of time-weighted values and ceiling values.

(e) For work areas in which either the time-weighted average or the ceiling concentration of chromic acid exceeds the standard, monitoring and recordkeeping shall be repeated on a weekly basis until three consecutive sampling periods have demonstrated that environmental levels meet the standard.

(f) Records of all sampling (and of medical examinations) shall be maintained for at least 20 years. Records shall indicate the type of personal protective devices, if any, in use at the time of sampling. Records shall be maintained so that they can be classified by employees. Each employee shall be able to obtain information on his own environmental exposure.

## II. INTRODUCTION

This report presents the criteria and the recommended standard based thereon which were prepared to meet the need for preventing occupational disease arising from exposure to chromic acid. The criteria document fulfills the responsibility of the Secretary of Health, Education, and Welfare, under Section 20(a)(3) of the Occupational Safety and Health Act of 1970 to "...develop criteria dealing with toxic materials and harmful physical agents and substances which will describe....exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The National Institute for Occupational Safety and Health (NIOSH), after a review of data and consultation with others, formalized a system for the development of criteria upon which standards can be established to protect the health of workers from exposure to hazardous chemical and physical agents.

These criteria for a standard for chromic acid are in a continuing series of criteria developed by NIOSH. The proposed standard applies only to the processing, manufacture, and use of chromic acid in products as applicable under the Occupational Safety and Health Act of 1970.

The standard was not designed for the population-at-large, and any extrapolation beyond general occupational exposures is not warranted. It is intended to (1) protect against injury from chromic acid, (2) be measurable by techniques that are valid, reproducible,

and available to industry and official agencies, and (3) be attainable with existing technology.