

criteria for a recommended standard

OCCUPATIONAL EXPOSURE TO

INORGANIC MERCURY

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

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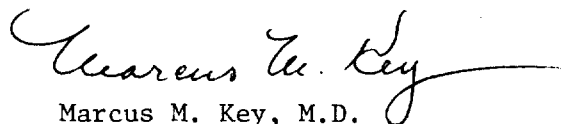
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PREFACE

The Occupational Safety and Health Act of 1970 emphasizes the need for standards to protect the health and safety 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 (NIOSH) 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 analytical 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 inorganic mercury by members of my staff, the valuable constructive comments by the Review Consultants on inorganic mercury, the ad hoc committee of the Society of Toxicology, and the ad hoc committee of the Industrial Medical Association, by Robert B. O'Connor, M.D., NIOSH consultant in occupational medicine, and Edwin C. Hyatt on respiratory protection. The NIOSH recommendations for standards are not necessarily a consensus of all the consultants and professional societies that reviewed this criteria document. 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 the recommended standard for inorganic mercury. Frank W. Mackison served as criteria manager and had NIOSH program responsibility for development of the document. Tabershaw-Cooper Associates, Inc., developed the basic information for consideration by NIOSH staff and consultants under contract HSM-099-71-46.

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CRITERIA DOCUMENT: RECOMMENDATIONS FOR AN
OCCUPATIONAL EXPOSURE STANDARD FOR INORGANIC MERCURY

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I. RECOMMENDATIONS FOR AN INORGANIC MERCURY STANDARD

The National Institute for Occupational Safety and Health recommends that employee exposure to inorganic mercury in the workplace be controlled by adherence to 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 inorganic mercury on the health and safety of workers. The standard is measurable by techniques that are valid, reproducible, and available to industry and governmental agencies and is attainable with existing technology. The criteria and the standard recommended in this document will be reviewed and revised as necessary.

"Inorganic mercury" in this document includes elemental mercury, and all inorganic mercury compounds and organic mercury compounds other than ethyl and methyl mercury compounds.

"Exposure to inorganic mercury" is defined as exposure to a concentration of inorganic mercury greater than 40% of the recommended level in the workplace. Exposure at lower environmental concentrations will not require adherence to the following sections, except Section 7a.

Section 1 - Environmental (Workplace air)

(a) Concentration

Occupational exposure to mercury shall be controlled so that workers are not exposed to inorganic mercury at a concentration

greater than 0.05 mg Hg/cu m determined as a time-weighted average (TWA) exposure for an 8-hour workday.

(b) Sampling and Analysis

Procedures for collection of environmental samples shall be as provided in Appendix I, or by a method shown to be equivalent. Analysis of samples shall be as provided in Appendix II, or by any method shown to be equivalent in sensitivity, accuracy, and precision.

Section 2 - Medical

Comprehensive medical examinations (which should include complete urinalysis) shall be made available to all workers subject to "exposure to inorganic mercury" prior to employee placement and annually thereafter. These examinations should place emphasis on any symptoms or signs of unacceptable mercury absorption such as loss of weight, sleeplessness, tremors, personality change, or other evidence of central nervous system involvement.

Medical records shall be available to the medical representatives of the employer, of the Secretary of Labor, of the Secretary of Health, Education, and Welfare, and of the employee at his request. These records shall be kept for at least five years after the employee's last occupational exposure to inorganic mercury.

Section 3 - Labeling (Posting)

The following warning shall be posted to be readily visible at or near entrances or accessways to work areas where there is potential exposure to inorganic mercury.

WARNING!

MERCURY WORK AREA

Unauthorized Persons Not Permitted

The following warning shall be posted in readily visible locations in any work area where there is potential exposure to inorganic mercury.

WARNING!

MERCURY

High Concentrations

Are Hazardous to Health

Maintain Adequate Ventilation.

If environmental levels are at or greater than the recommended standard, add information to the warning describing the location of the respirators.

These warnings shall be printed in English and in the predominant primary language of non-English-speaking workers, if any.

Section 4 - Personal Protective Equipment and Work Clothing

Subsections (a) and (b) 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. When the limits of exposure to inorganic mercury prescribed in paragraph (a) of Section 1 cannot be met by limiting the concentration of mercury in the work environment,

an employer must utilize a program of respiratory protection to effect the required protection of every worker exposed.

(a) Respiratory Protection

Engineering controls shall be used wherever feasible to maintain inorganic mercury concentrations in the workplace air at or below the prescribed limits. Appropriate respirators, as prescribed in Table I-1, shall be provided and used when a variance has been granted to allow respirators as a means of control of routine operations and while the application is pending. Administrative controls can also be used to reduce exposure. Respirators shall also be provided and used for nonroutine operations (occasional brief exposures above the environmental standard and for emergencies); however, for these instances, a variance is not required but the requirements set forth below continue to apply. Respirators 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 inorganic mercury 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 mercury concentration. The employer shall ensure that no worker is exposed to inorganic mercury in excess of the standard because of improper respirator selection or fit.

Table I-1
Requirements for Respirator Usage
At Concentrations Above the Standard

Mg Hg/cu m	Respirator Type*
Less than 5.0	I, II, III
Greater than 5.0	II, III

- *TYPE I - Full facepiece gas mask equipped with a high efficiency filter plus canister containing iodine-impregnated charcoal.
- TYPE II - Type C (positive pressure) supplied air respirator.
- TYPE III - (Positive pressure) self-contained breathing apparatus.

(2) Employees experiencing breathing difficulty while using respirators shall be evaluated by a physician to determine the ability of the worker to wear a respirator.

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

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

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

(A) Gas masks - - - 30 CFR 13 (Bureau of Mines Schedule 14 E)

(B) Self-contained breathing apparatus - - - 30 CFR 11 (Bureau of Mines Schedule 13 E)

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

(6) Usage of a respirator specified for use in higher concentrations of inorganic mercury is permitted in atmospheres of lower concentrations.

(b) Work Clothing

(1) Each employee subject to exposure to inorganic mercury shall be provided coveralls or similar full body work clothing, shoes

or shoe covers, and hat, which shall be worn during the working hours in areas where there is exposure to inorganic mercury. A daily change of clean work clothing shall be supplied by the employer.

(2) Adequate shower facilities provided with hot and cold or tempered water shall be available for use and used by workers.

(3) Work and street clothing shall not be stored in the same locker.

(4) Work clothing should be vacuumed before removal. Clothes shall not be cleaned by blowing or shaking.

Section 5 - Appraisal of Employees of Hazards

from Inorganic Mercury

(a) Each employee exposed to inorganic mercury shall be apprised at the beginning of his employment or assignment to an inorganic mercury work area of hazards, relevant symptoms, appropriate emergency procedures, and proper conditions and precautions for safe use or exposure. He shall be instructed as to availability of such information including that prescribed in (b) below. Such information shall be kept on file and shall be accessible to the worker at each place of employment where inorganic mercury is used.

(b) Information as specified in Appendix III shall be recorded on U.S. Department of Labor Form OSHA-20, "Material Safety Data Sheet" (see Appendix III) or on a similar form approved by the Occupational Safety and Health Administration, U.S. Department of Labor.

Section 6 - Work Practices

(a) Emergency Procedures

(1) Procedures, including fire fighting procedures, shall be established and implemented to meet foreseeable emergency events.

(2) Respirators shall be available for wearing during emergencies. Self-contained respirators shall be available for employee use in the event of fire or other emergencies where equipment or operations cannot be abandoned because of an emergency.

(b) Exhaust Systems

Where a local exhaust ventilation system is used, it shall be designed and maintained to prevent the accumulation or recirculation of mercury vapor, dust, and fumes into the workroom.

(c) General Housekeeping

(1) Floors, work surfaces, and equipment shall be so constructed and maintained as not to have cracks, crevices, or other areas which may retain mercury.

(2) Spills and leaks of mercury shall be promptly cleaned up either mechanically or chemically, or by other appropriate means. No blowing or dry sweeping shall be permitted. When vacuum cleaners are used, they shall be equipped with mercury vapor absorbing filters to prevent dispersal of mercury vapors into the workplace air and shall be maintained so they will not disperse mercury-laden dust into the workplace.

(3) Waste mercury or materials contaminated with mercury shall be kept in vaporproof containers, under water, or in chemically treated solutions, pending removal for disposal or processing for reuse.

(d) General Procedures

(1) Containers of mercury shall be kept covered when it is not necessary to have them open for process operations.

(2) Open containers of mercury, to the greatest extent possible, shall have the surface of the mercury covered with an aqueous layer maintained at a temperature below its boiling point to prevent vaporization of the mercury.

Section 7 - Sanitation Practices

(a) Food preparation, dispensing (including vending machines), and eating shall be prohibited in mercury work areas.

(b) Smoking materials shall not be permitted in mercury work areas.

(c) Handwashing facilities, including hot and cold running water, soap, and towels, shall be made available adjacent to mercury work areas. Employees shall be instructed in the importance of thoroughly washing their hands before eating or smoking.

(d) Soiled clothing shall be stored in vaporproof containers pending removal for laundering.

(e) Laundering of work clothing shall be provided by the employer. Persons responsible for laundering mercury contaminated clothing shall be informed of the hazards involved.

Section 8 - Monitoring and Recordkeeping Requirements

Workroom areas where it has been determined, on the basis of an industrial hygiene survey or the judgment of a compliance officer, that environmental levels do not exceed 40% of the environmental standard shall not be considered to involve worker exposure to inorganic mercury. An additional survey shall be made if there is a change in process or engineering controls. Records of these surveys, including the basis for concluding that air levels are below 40% of the environmental standard, shall be kept.

Requirements set forth below apply to inorganic mercury exposures.

(a) Employers shall monitor environmental levels of inorganic mercury at least every 6 months. Breathing zone samples shall be collected to permit calculation of a time-weighted average exposure for every operation.

(b) When any time-weighted average exposure is at or above the environmental standard, immediate steps shall be taken to reduce environmental levels. Samples shall be taken every 30 days until the environmental level has been reduced below the standard.

(c) Records shall be maintained for all sampling schedules to include the sampling and analytical methods, type of respiratory

protection in use (if applicable), and the air concentrations of mercury in each work area. Records shall be maintained so that 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 inorganic mercury. The 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, after a review of data and consultations with others, formalized a system for the development of criteria upon which standards can be established to protect the health of employees from exposure to hazardous chemical and physical agents. It should be pointed out that any recommended criteria for a standard should enable management and labor to develop better engineering controls resulting in more healthful work practices and should not be accepted as a final goal.

These criteria for a standard for inorganic mercury are part of a continuing series of criteria developed by NIOSH. The proposed standard applies only to the processing, manufacture, and use of

mercury as applicable under the Occupational Safety and Health Act of 1970.

The occupational safety and health aspects of mining and milling mercury ores are covered by provisions of the Federal Metal and Nonmetallic Mine Safety Act (30 U.S.C. 725 et seq.) under which the Bureau of Mines has responsibility.

The recommended standard is based on currently available information relating exposure to effect. The environmental limit is based on the prevention of effects on the central nervous system such as tremor, behavioral and personality changes, and nervousness, attributable to occupational exposure to mercury.

These criteria were developed to assure that the standard based thereon would 1) protect workers against the acute or chronic toxic effect of mercury; 2) is measurable by techniques that are valid, reproducible, and available to industry and governmental agencies; and 3) is attainable by existing technology.