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THE CHLORINE INSTITUTE, INC.

Pamphlet 125

*Guidelines - Medical
Surveillance And Hygiene
Monitoring Practices For
Control Of Worker
Exposure To Mercury In
The Chlor-Alkali Industry*



A RESPONSIBLE CARE®
PARTNER ASSOCIATION

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1. INTRODUCTION

1.1 Scope

These guidelines highlight potential safety and industrial hygiene concerns and provide guidance for medical surveillance and industrial hygiene exposure assessment and control practices for worker exposure to mercury. As used in this pamphlet, mercury refers to elemental mercury or inorganic mercury compounds.

This pamphlet combines information contained in the prior edition of this pamphlet as well as information contained in the current edition of Pamphlet 156, *Guidelines to Physicians in Conducting Medical Surveillance Programs*, which is now being withdrawn. The combination of these two pamphlets allows for information to be provided to physicians or other qualified medical professionals, employers, and employees in a single document. The recommendations contained in this pamphlet should apply to all persons based on the potential for exposure to mercury regardless of whether they are employees of the company operating the facility or contractors at the site.

1.2 Background

This pamphlet is the fourth edition of Institute recommendations pertaining to medical surveillance and industrial hygiene practice for chlor-alkali employees exposed to mercury. The first edition was issued in 1972. In addition to a review of numerous articles dealing with mercury, the Institute has reviewed the recommendations by other organizations such as the American Conference of Governmental Industrial Hygiene (ACGIH) pertaining to mercury exposure.

1.3 Responsible Care

The Institute is an American Chemistry Council (ACC) Responsible Care⁷ Partnership Association. In this capacity, the Institute is committed to: Fostering the adoption by its members of the Codes of Management Practices; facilitating their implementation; and encouraging members to join the Responsible Care⁷ initiative directly.

Chlorine Institute members who are not ACC members are encouraged to follow the elements of similar responsible care programs through other associations such as the National Association of Chemical Distributors=(NACD) Responsible Distribution Program or the Canadian Chemical Manufacturers Association's Responsible Care⁷ Program.

1.4 Definitions

ACGIH American Conference of Governmental Industrial Hygienists - The ACGIH is a non government organization based in Cincinnati, Ohio that issues exposure guidelines or recommendations to assist in the control of workplace health hazards.

AIHA American Industrial Hygiene Association; A non profit organization focusing on industrial hygiene issues

Ceiling The concentration that should not be exceeded during any part of the working exposure

CNS	Central nervous system
EPA	Environmental Protection Agency (USA government regulatory body)
g	grams
Hg	Chemical symbol for mercury
IDLH	An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
Mercury	As used in this pamphlet, mercury refers to elemental mercury or inorganic mercury compounds.
NIOSH	National Institute for Occupational Safety and Health (U. S. Department of Health and Human Services)
OSHA	Occupational Safety and Health Administration (USA government regulatory body; part of the U. S. Department of Labor)
PEL	Permissible Exposure Limit (Regulations established by OSHA) - The maximum concentration that a worker can be exposed to for a prescribed period of time (TWA; STEL; Ceiling).
PPE	Personal Protective Equipment
STEL	Short Term Exposure Limit - The concentration to which a worker can be exposed continuously for a short period of time (typically 15 minutes).
TLV	Threshold Limit Value (guidelines developed by ACGIH) (TWA; STEL; Ceiling) - The exposure level to which it is believed that nearly all workers may be repeatedly exposed, day after day or short term, without adverse effect.
TWA	Time Weighted Average (based on 8 hour work day and a 40 hour work week)
U-Hg	Urinary mercury
g/g crt	Micrograms per gram of creatinine
g/L	Micrograms per liter
g/m ³	Micrograms per cubic meter

1.5 Disclaimer

The information in the pamphlet is drawn from sources believed to be reliable. The Institute and its members, jointly and severally, make no guarantee and assume no liability in connection with any of this information. Moreover, it should not be assumed that every acceptable procedure is included or that special circumstances may not warrant modified or additional procedures.

The user should be aware that changing technology or regulations may require a change in the recommendations herein. Appropriate steps should be taken to ensure that the information is current when used. These recommendations should not be confused with federal, state, provincial, municipal or insurance requirements, or with national safety codes.

1.6 Approval

The Institute's Mercury Issues Management Steering Committee approved Edition 4 of this pamphlet on October 27, 2003.

1.7 Revisions

Suggestions for revision should be directed to the Secretary of the Institute.

1.8 Reproduction

The contents of this pamphlet are not to be copied for publication, in whole or in part, without prior Institute permission.

2. EXPOSURE POTENTIAL FOR MERCURY

2.1 Occupational Exposure

In the mercury-type electrolytic cell, flowing mercury serves as one electrode and as a medium for the amalgamation of sodium or potassium formed (along with chlorine) from the electrolysis of brine. In a separate unit, the amalgam is reacted with water to form co-products sodium or potassium hydroxide and hydrogen. The mercury is subsequently recycled back to the electrolytic cell.

There is a potential for exposure to liquid mercury, mercury vapor, and chlorides of mercury through interaction with chlorine produced using mercury cells.

In the workplace, mercury on skin and/or clothing can vaporize, possibly resulting in potential exposure to employees. Contaminated clothing should be removed at the end of tasks involving significant contact with liquid mercury or at the end of the work shift and the skin and hair should be thoroughly washed.

2.2 Non Occupational Exposure

The following are among the non-obvious “off the job” sources of mercury:

- **Inadvertent Contamination within Home**

Inadvertent contamination of households (e.g., carpets, furniture), can result from contaminated street clothes or work clothes and shoes. Contamination of households can also result from the misuse of mercury taken home from the job.

- **Fish diet**

Fish is a dominant source of human exposure to organic mercury; this is a source of interference when testing mercury in blood unless inorganic and methyl mercury are analyzed separately since methyl mercury concentrates in red blood cells while inorganic mercury concentrates in plasma. Methyl mercury excretion in urine is very limited so its contribution to the overall body burden may be less apparent when considering only urinary excretion.

- **Dental fillings**

Silver amalgam contains approximately 40% mercury. Amalgam capsules are marketed to dentists in three different sizes (#1, #2, and #3). The mercury content in each is 368 mg., 550 mg., and 731 mg., respectively. Mercury is released from amalgam restorations in the mouth as vapor. Ingestion is increased by chewing and is correlated with the number of dental fillings. After insertion or removal of multiple fillings, urinary mercury may increase over the next several weeks.

- **Skin lightening creams and soaps**

Although they are no longer allowed in the United States, they may still be encountered. They have been applied overnight to give dark skin a lighter tone by pigment inhibition. Such soaps contain 3% mercuric iodide creams may contain 1-5% ammoniated mercury.

- **Therapeutic agents**

Some therapeutic agents (e.g., preservatives for nose drops and certain vaccines, diuretics (obsolete), antiseptics, soft contact lenses solutions (e.g., thimerosal)), may contain mercury. There are still some uses for antiseptic mercury ointment in selected dermatological conditions.

- **Other Categories**

Although some of these other uses may be restricted or prohibited within the United States or elsewhere, the use of mercury in these applications may still be encountered.

- * Medical instruments - e.g., thermometers, blood pressure sphygmomanometers
- * Paints - antifouling and mildew proofing additives
- * Pesticides - applied to seeds or bulbs to retard fungus growth
- * Hobbies - Photography, taxidermy
- * Gold searching
- * “Alternative medicine” (unregulated “remedies”)

3. ABSORPTION, DISTRIBUTION AND EXCRETION OF MERCURY

3.1 Routes of Entry

Elemental mercury and its salts can enter the body through inhalation, skin contact, and ingestion. Inhalation of mercury vapor and/or particles of mercury chloride are the major route of entry from industrial exposures. Approximately 80% of inhaled mercury is absorbed.

There can be significant absorption of mercury through the skin if mercury or mercury vapor is in continuous contact with the skin. Uptake via the skin of metallic mercury vapor, with whole body exposure, is only 2.2% (or 1.76% of contacted material) of uptake via inhalation. Vapor at 0.050 mg/M³ penetrates at a rate of about 7.2x10⁻⁸ mg/cm²/hr. (Reference 9.1). An EPA exposure assessment document has estimated that the mean surface area of skin for an adult male is 1.94 m² and is 1.69 m² for an adult female (Reference 9.2).

Mercury (elemental and inorganic salts of mercury) are poorly absorbed through the gastrointestinal tract (approximately 0.01% for elemental mercury and approximately 7% for inorganic salts of mercury) (Reference 9.1) thus making ingestion a relatively insignificant route of exposure for these forms of mercury. However, organic mercury is

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