

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. 76-6 -294

J. A. DEVINE, D.D.S.
CHEYENNE, WYOMING
MAY 1976

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I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on February 9, 1976, at the J. A. Devine Dental Clinic in Cheyenne, Wyoming. At the time of this evaluation, breathing zone and general room samples were taken for inorganic mercury. A direct reading instrument also was used. Concentrations of mercury during this evaluation ranged from less than 0.01 micrograms to 0.18 milligrams per cubic meter. This is in excess of the NIOSH recommended standard of .0.05 milligrams per cubic meter and is a potential health hazard to the employees.

II. DISTRIBUTION AND AVAILABILITY

Copies of this hazard evaluation determination report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

- (a) J.A. Devine, D.D.S.
- (b) U.S. Department of Labor - Region VIII
- (c) NIOSH - Region VIII

For the purpose of informing the four affected employees, copies of the report shall be provided to these employees or the report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

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 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.

NIOSH received such a request from J. A. Devine, D.D.S., Cheyenne, Wyoming, to evaluate the potential hazards associated with exposures to mercury in his dental operatories.

IV. HEALTH HAZARD EVALUATION

A. Process Evaluated

Dr. Devine has two dental operatories. A patient is prepared for dental work in one operatory while Dr. Devine is performing a dental procedure in the other operatory. The basic procedure used when preparing a dental filling is dispensing into a capsule a metal powder such as zinc or silver and then adding elemental mercury to this powder. The capsule is then placed in a shaker, where the mercury and metal are agitated for several seconds. Extreme caution should be taken throughout this procedure in order to prevent mercury exposure to the dentist and his employees. If the capsule containing the mercury and metal is not securely closed or has any leaks, mercury contamination and vaporization would be possible.

B. Evaluation Design

Breathing zone samples and direct reading measurements were taken on all dental assistants in both operatories. Dr. Devine was monitored with a direct reading instrument. These samples were taken using AA filters followed by an organic vapor charcoal sampling tube treated with iodine and designed specifically for mercury collection. The direct reading instrument was a Bacharach mercury detector.

C. Evaluation Methods

All breathing zone samples taken on AA filters and organic vapor sampling tubes were analyzed by atomic absorption spectroscopy. Results are presented in Table I.

D. Criteria for Assessing Workroom Concentrations of Air Contaminants

The three sources of criteria used to assess workroom concentrations of air contaminants in this evaluation are: (1) NIOSH recommended criteria for occupational exposures; (2) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1975); and (3) Occupational Safety and Health Standards (29 CFR 1910.1000), U.S. Department of Labor, as of January 1, 1976.

In the following tabulation of criteria, the most appropriate value is presented with its reference and other information footnoted.

<u>Substance</u>	<u>Permissible Exposures 8-Hour Time-Weighted Exposure Basis</u>
¹ Mercury	0.05 mg/M ³

mg/M³ = approximate milligrams of substance per cubic meter of air

¹Reference: NIOSH recommended criteria for occupational exposures and recommended and proposed TLV's and their supporting documentation as set forth by the ACGIH (1975).

The U.S. Department of Labor legally enforceable standard is 0.1 mg/M³. This is a ceiling concentration and should never be exceeded.

Mercury is a general protoplasmic poison that can be absorbed by inhalation or by ingestion. Mercury and its inorganic compounds may cause dermatitis, visual disturbances, chronic gingivitis, pharyngitis and renal insufficiency. Occupational poisoning due to mercury or its inorganic compounds is usually chronic in nature. Acute mercury poisoning may occur due to massive inhalation of mercury vapor. Acute conditions are limited to the bucco-pharyngeal area. Cases of mercury poisoning with neurological symptoms have also been reported.¹ Compliance with 0.05 mg/M³ of mercury for an 8-hour day, 40-hour work week over a working lifetime should protect workers.

Occupational health standards are established at levels designed to protect individuals occupationally exposed to individual toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

E. Evaluation Results

Results of this investigation showed that the dentist as well as his assistants were exposed to mercury levels in excess of the evaluation criteria used herein; thus a potential health hazard exists. Confidential employee interviews failed to show any health problems. The direct reading mercury vapor detector did not indicate mercury contamination of work clothing or workers' hands throughout the evaluation. Areas of mercury contamination documented by the direct reading mercury vapor detector included the mercury and amalgam shaker and floor areas in close proximity to the dental chairs.

F. Recommendations

1. Use tightly closed capsules (screw type capsules other than the push-together type) during amalgamation.
2. Remove carpeting from dental operatories.
3. Salvage all amalgam scraps and store in a closed container with a layer of water over the amalgam. Store mercury in an unbreakable, tightly sealed container.
4. All mercury spills should be cleaned up immediately, preferably by vacuuming. However, vacuum cleaners should be equipped with changeable charcoal filters so that mercury vapor will not escape into the air. Sweeping should be avoided because it creates dust and breaks the mercury into even smaller particles that can vaporize more quickly.

5. Eliminate hand squeezing of amalgam.
6. It is suggested that a comprehensive medical examination, including complete urinalysis, should be performed on all employees. This examination should place emphasis on signs and symptoms of mercury absorption such as loss of weight, sleeplessness, tremors, and personality change.²

V. REFERENCES

¹International Labour Office, Geneva: Occupational Health and Safety, Volume II, 1972, pp 860-863.

²NIOSH: Criteria for a Recommended Standard...Occupational Exposure to Inorganic Mercury, 1973.

VI. AUTHORSHIP

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TABLE I

AIR CONCENTRATIONS OF MERCURY

Office of J. A. Devine, D.D.S.
February 9, 1976

Sample Number	Location	Job Classification	Time of Sample	Type Sample	Air Concentrations MERCURY (mg/M ³)
1	Dental Operator 1	Dental Assistant	1:13 - 1:42 P.M.	BZ	*
2	Dental Operator 1	Dental Assistant	1:13 - 1:42 P.M.	BZ	*
3	Dental Operator 2	Office Assistant	1:13 - 1:42 P.M.	BZ	0.08
4	Dental Operator 2	Dental Assistant	1:13 - 1:42 P.M.	BZ	0.002
5	Dental Operator 1 (on shelf next to mercury and amalgam containers)	---	---	DR	0.18
6	Dental Operator 2 (on floor in close proximity to dental chair)	---	---	DR	0.10
7	Dental Operator 2 (next to mercury and amalgam mixer)	---	---	DR	0.08
EVALUATION CRITERIA					0.05

mg/M³ = approximate milligrams of substance per cubic meter of air

* = concentrations were below NIOSH detection limit of 0.2 micrograms per sample

DR = direct reading instrument

BZ = breathing zone