

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. 76-45 -313

G. A. RIDDELL, D.D.S.
CODY, WYOMING
JULY 1976

FILE COPY

FILE COPY

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on May 24 and 25, 1976, at the G. A. Riddell Dental Clinic in Cody, Wyoming. At the time of this evaluation, breathing zone and general room samples were taken for inorganic mercury. A direct reading instrument was also used. Concentrations of mercury during this evaluation were well below the NIOSH recommended standard of 0.05 milligrams per cubic meter. The highest concentration found in the breathing zone was 0.018 milligrams per cubic meter. Therefore, a health hazard was judged not to exist at the time of this evaluation.

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) G. A. Riddell, D.D.S.
- (b) U.S. Department of Labor - Region VIII
- (c) NIOSH - Region VIII

For the purpose of informing the three 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 G. A. Riddell, D.D.S., Cody, Wyoming, to evaluate the potential hazards associated with exposures to mercury in his dental operatories.

HEALTH HAZARD EVALUATIONA. Process Evaluated

Dr. Riddell has three dental operatories. One of the operatories is used mainly for dental hygiene work. Dr. Riddell performs dental procedures in the other two operatories. 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 workers. These samples were taken using AA filters followed by an organic vapor charcoal sampling tube treated with iodine and designed specifically for mercury collection. Direct reading measurements were taken using a Bacharach mercury vapor 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 Tables I and II.

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 Exposure 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

Traces of mercury were found in 2 out of 10 environmental samples collected on charcoal tubes. Direct reading measurements showed mercury contamination in several areas of the operatories, notably the carpeting directly below the amalgam shaker and on the hands of workers handling the wet amalgam. Concentrations using the direct reading instrument ranged from 0.01 to 0.5 mg/M³. Only one worker had a medical complaint, which was described as chronic fatigue, possibly related to an occupational exposure. From the results of the personal samples obtained during this evaluation, a health hazard did not exist from mercury exposures at that time.

F. Recommendations

1. Use tightly closed capsules (screw type capsules other than the push-together type) during amalgamation.
2. 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.
3. 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.

4. Dental operatories should not be carpeted, since this offers a collecting and storage system for spilled mercury.
5. Hand squeezing of wet amalgam should be discontinued.

V. REFERENCES

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

VI. AUTHORSHIP

Report Prepared By: Bobby J. Gunter, Ph.D.
Regional Industrial Hygienist
NIOSH - Region VIII
Denver, Colorado

Originating Office: Jerme P. Flesch, Acting Chief
Hazard Evaluation and Technical
Assistance Branch
NIOSH - Cincinnati, Ohio

TABLE I

AIR CONCENTRATIONS OF MERCURY

Office of G. A. Riddell, D.D.S.
May 24 and 25, 1976

Sample Number	Sampling Medium	Location	Job Classification	Time of Sample	Type Sample	Air Concentrations MERCURY (mg/M ³)
2	AA Filter	Dental Operatory 1	Dentist	8:30 - 10:50 A.M.	BZ	0.018
10	AA Filter	Dental Operatory 1	Dental Hygienist	8:40 - 9:05 A.M.	BZ	*
2059	AA Filter	Dental Operatory 2	Dental Assistant	8:50 - 9:24 A.M.	BZ	*
1	AA Filter	Dental Operatory 2	Dental Assistant	9:00 - 11:00 A.M.	BZ	*
EVALUATION CRITERIA						0.05

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

* = concentrations were below NIOSH detection limit of 0.05 micrograms per sample

BZ = breathing zone

TABLE II

AIR CONCENTRATIONS OF MERCURY

Office of G. A. Riddell, D.D.S.
May 24 and 25, 1976

Sample Number	Sampling Medium	Location	Job Classification	Time of Sample	Type Sample	Air Concentrations MERCURY (mg/M ³)
4	Charcoal Tube	Dental Operator 1	Dentist	8:30 - 10:50 A.M.	BZ	0.01
8	Charcoal Tube	Dental Operator 1	Dental Hygienist	8:40 - 9:05 A.M.	BZ	*
3	Charcoal Tube	Dental Operator 2	Dental Assistant	8:50 - 9:24 A.M.	BZ	*
7	Charcoal Tube	Dental Operator 2	Dental Assistant	9:00 - 11:00 A.M.	BZ	*
5	Charcoal Tube	Dental Operator 2	Dental Hygienist	8:30 - 10:50 A.M.	BZ	*
11	Charcoal Tube	Dental Operator 3	Dentist	9:00 - 9:30 A.M.	BZ	*
12		Dental Operator 1			DR	0.18
13		Dental Operator 2			DR	**
14		Dental Operator 3			DR	**
15		Dental Assistant's fingers			DR	0.5
EVALUATION CRITERIA						0.05

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

* = concentrations were below NIOSH detection limit of 0.05 micrograms per sample

** = concentrations were below the detection limit of 0.01 mg/M³ for the direct reading instrument

BZ = breathing zone

DR = direct reading instrument