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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. 76-69-323

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Lititz, Pennsylvania  
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I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute For Occupational Safety and Health (NIOSH) on June 9, 1976, at the Roy K. Yaeger Dental Office in Lititz, Pennsylvania. 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 microgram to 0.08 milligram per cubic meter. Some levels detected were in excess of the NIOSH recommended standard of 0.05 milligram per cubic meter and thus a potential health hazard to the employees from exposure to inorganic mercury is judged to exist.

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. Roy K. Yaeger, D.D.S.
- B. U.S. Department of Labor - Region III
- C. NIOSH - Region III

For the purpose of informing the four affected employees, copies of 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 an 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 Roy K. Yaeger, D.D.S., Lititz, Pennsylvania, to evaluate the potential hazards associated with exposures to mercury in his dental operatories.

IV. HEALTH HAZARD EVALUATION

A. Process Evaluated

This office has three dental operatories. In two of the operatories there is a potential for mercury exposure. A patient is prepared for dental work in one operatory while the dentist is performing a dental procedure in the other operatory. The basic procedure used when preparing a dental filling is dispensing into a capsule a powdered silver alloy 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 the 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 in both operatories. A dental assistant 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 Contaminant

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

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

<sup>1</sup>Reference: 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/M<sup>3</sup>. This is a ceiling concentration and should never be exceeded.

\*mg/M<sup>3</sup> = approximate milligrams of substance per cubic meter of air.

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.

Mercury is a general protoplasmic poison that can be absorbed by inhalation, ingestion, or absorption through the intact skin. 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 buccopharyngeal area. Cases of mercury poisoning with neurological symptoms have also been reported.<sup>1</sup>

#### E. Evaluation Results

Results of this investigation showed that the dentists as well as his assistants were exposed to mercury levels which approached the evaluation criteria used herein; thus a potential health hazard exists. The direct reading mercury vapor detector did indicate mercury contamination of work shoes. 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, preferable 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.<sup>2</sup>

V. REFERENCES

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

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

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TABLE I

## AIR CONCENTRATIONS OF MERCURY

DENTAL OPERATORY - RHE 76-69  
June 9, 1976

Locations	Job Classification	Time of Sample	Type of Sample	Air Concentrations MERCURY (mg/M <sup>3</sup> )
DENTAL OPERATORY 2	Dental Assistant	8:50 - 12:50	BZ	*
DENTAL OPERATORY 3	Dental Assistant	8:45 - 13:00	BZ	*
<u>OPERATORY 2</u>				
Table Top	General Air		DR	.01
Table (Floor Area)	General Air		DR	.08
Chair (Floor Area)	General Air		DR	.02
Chair (Patients Position)	General Air		DR	.03
<u>OPERATORY 3</u>				
Table Top	General Air		DR	.05
Table (Floor Area)	General Air		DR	.05
Chair (Floor Area)	General Air		DR	.04
Chair (Patients Position)	General Air		DR	.03
DENTAL ASSISTANT SHOES			DR	.08
			EVALUATION CRITERIA	0.05

mg/M<sup>3</sup> = approximate milligrams of substance per cubic meter of air.

\* = concentrations were below NIOSH detection limit of 0.25 micrograms per sample.

DR = direct reading instrument.

BZ = breathing zone.