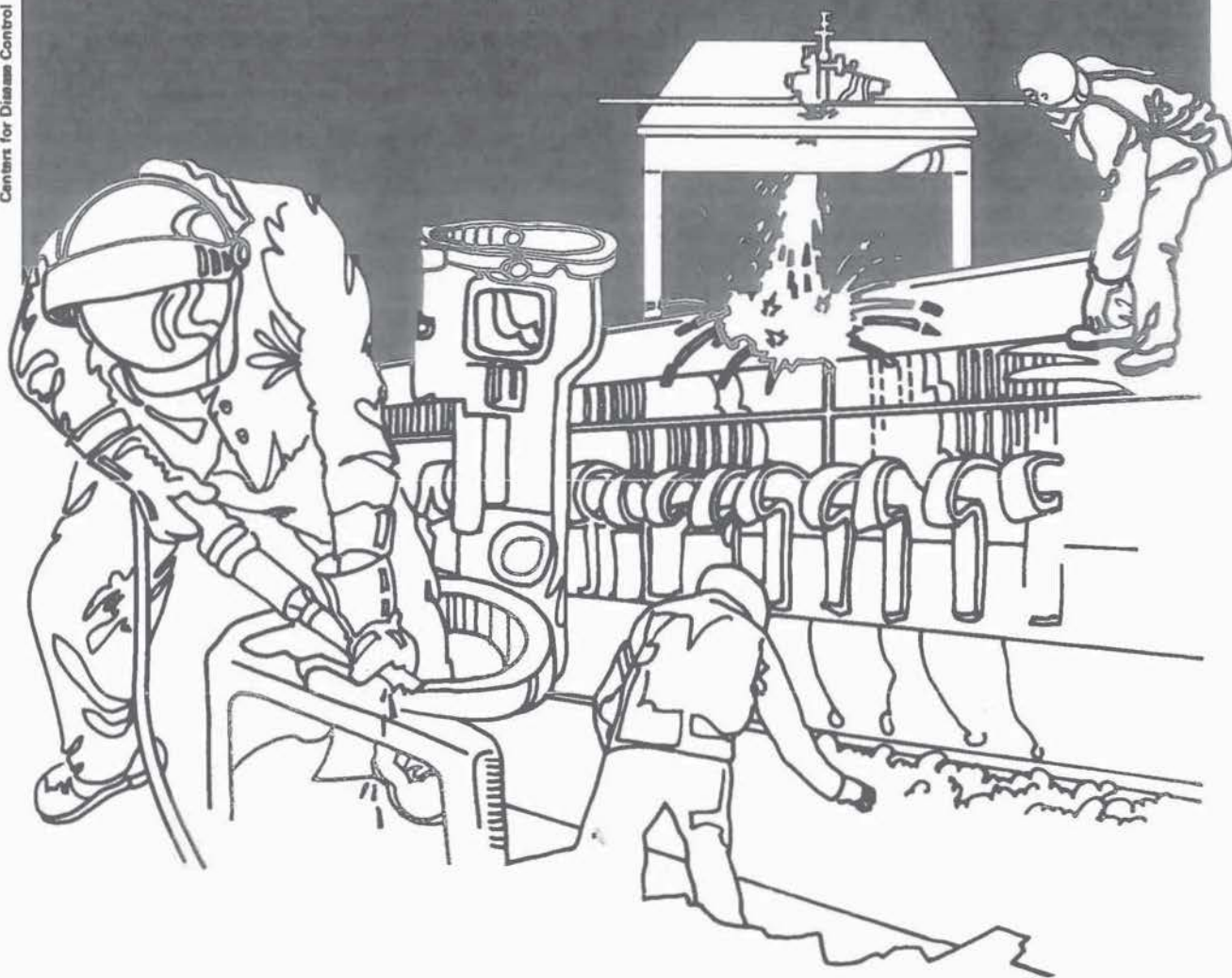


NIOSH



Health Hazard Evaluation Report

HETA 83-096-1415
MARK BRODIE, D.D.S.
ENGLEWOOD, COLORADO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 83-096-1415
February 1984
MARK BRODIE, D.D.S.
ENGLEWOOD, COLORADO

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I. SUMMARY

In January 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from Mark Brodie, D.D.S., Englewood, Colorado, to evaluate the possible health hazards from exposure to mercury in the dental office.

On July 30 and October 13, 1983 NIOSH investigators conducted an environmental survey at the office. The survey consisted of collecting breathing zone and general room air samples for measurement of exposure to mercury. Mercury levels were measured by film badges and by direct reading instruments. Work practices and techniques were observed and employees were informally interviewed.

Concentrations of airborne mercury in personal samples ranged from 0.008 to 0.012 mg/M³ for the dentist and their assistants. These levels all were below the evaluation criterion of 0.05 milligrams per cubic meter (mg/M³). All areas sampled, except those taken in the Sterilization Room, had concentrations below the evaluation criteria. Mercury levels in the Sterilization Room ranged from 0.02 to 1.0 mg/M³.

On the basis of the data obtained in this investigation, NIOSH has determined that the personnel in this dental office were not over-exposed to mercury. Recommendations to reduce or eliminate the mercury exposures found in the Sterilization Room and other areas with high mercury levels were given at the time of each survey and these are presented in Section VIII of this report.

KEYWORDS: SIC 8021 (Offices of Dentists), dental operatories, and mercury.

II. INTRODUCTION

In January 1983, NIOSH received a request from Mark Brodie D.D.S., Englewood, Colorado to evaluate the potential health hazards to mercury in the dental operatories at the Englewood location. On July 30 and October 13, 1983, NIOSH conducted an environmental investigation. Results of the sampling by direct reading methods and verbal recommendations for lowering exposure levels were given at the time of each survey.

III. BACKGROUND

Doctor Brodie has shared the dental practices with Doctor Gene Bloom D.D.S., for the last few years at the Englewood office. Other staff included two dental assistants, one full time and two part time dental hygienists, and one full time and two part time receptionists. There are four main operatories and one dental hygienist operatory in the office. There is also a main waiting room, a receptionist area, one laboratory, and a sterilization room. Other rooms in the office include the doctors private offices and an employee break area.

During the NIOSH investigation, similar amalgams (mercury) were prepared by both dentists. The amalgams were prepared in closed capsule arrangement with pre-measured mercury in one end and the remaining alloy mixture in the other. This closed system allows the person preparing the amalgam to do so without any personal contact with the mercury prior to agitation.

Throughout the application of amalgams to the patient the only opportunity for mercury exposures to the dentists or his assistant would occur during the removal of old amalgams or while placing the material in the patient's mouth. Other potential mercury exposures are primarily limited to the dental assistants. These occur during cleaning of the amalgamator and the surrounding area, filling the amalgamators or disposing of waste material. The only other potential mercury exposures occur while cleaning up spills or from residue left after cleanup.

IV. ENVIRONMENTAL DESIGN AND METHODS

Personal and area samples for mercury measurements of airborne concentrations were taken using two different methods. One method utilized a Bacharach Model MV2 Mercury Sniffer, which is a portable direct reading instrument that works on the principle of ultra-violet absorption. The second method was a film badge type sampling technique which is utilized for characterizing personal exposures. This method was used only during the second investigation.

During the first investigation the mercury sniffer was used for screening. Based on this information a second investigation was scheduled to characterize personal exposures and to re-evaluate areas where high mercury exposures were thought to exist. Work practices and techniques were observed and employees were informally interviewed.

V. EVALUATION CRITERIA

A. Environmental

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is important to note, however, that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Criteria Documents and recommendations; (2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's); and (3) the U.S. Department of Labor (OSHA) Occupational Health Standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH recommended standards, by contrast, are based solely on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8 to 10 hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Permissible Exposure Limits
8-Hour Time-Weighted
Exposure Basis

Mercury.....	0.05 mg/M ³ (NIOSH) 8-hour TWA
	0.1 mg/M ³ (OSHA) Ceiling

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

B. Toxicological

Mercury -- Mercury can enter the body through the lungs by inhalation, through the skin, by direct contact, or through the digestive system.

Acute or short-term exposure to high concentrations of mercury causes tightness and pain in the chest, difficulty in breathing, coughing, inflammation of the mouth and gums, headaches, and fever. Acute mercury poisoning is, however, relatively rare in industry today.

Chronic or long-term exposure to lower concentrations of mercury is more common. Chronic mercury poisoning is known to cause kidney damage (nephrosis), tremors and shaking (usually of the hands), inflammation of the mouth and gums, metallic taste, increase in saliva, weakness, fatigue, insomnia, allergic skin rash, loss of appetite and weight, and impaired memory. These symptoms generally occur gradually and may be associated with personality changes such as irritability, temper outbursts, excitability, shyness, and indecision.

VI. ENVIRONMENTAL RESULTS

Excessive mercury exposures were not found in the breathing zone of the dentists or their assistants at the time of this survey. Personal breathing zone samples for mercury ranged from 0.008 to 0.012 mg/M³ which is below the current NIOSH criterion of 0.05 mg/M³.

The direct reading results for mercury ranged from Non-Detectable (ND) to 1.0 mg/M³. In operatory number 1 the results ranged from ND to 0.08 mg/M³ with the amalgamator area showing the higher levels. All other operatories at this office had levels ranging from ND to 0.03mg/M³. The only other area where mercury levels were detected was in the Sterilization Room. Mercury levels in this area ranged from ND to 1.00 mg/M³. The higher levels were found in and around the trash bin which is located in the south west corner of the room.

Direct reading measurements taken on the second investigation were below those found during the first study (i.e., mercury levels ranged from ND to 0.03 mg/M³). Based on these results it appeared that the implementation of those recommendations made by NIOSH during the first evaluation (i.e., cleaning and maintenance procedures for mercury) reduced the exposures.

VII. DISCUSSION AND CONCLUSIONS

Based on the data obtained during the latest investigation it was determined that a health hazard did not exist to the employees at this office. However, direct reading results did indicate the need for improved cleaning or maintenance procedures in certain areas. These areas included the amalgamator in operatory number one and in and around the trash container in the sterilization room.

VIII. RECOMMENDATIONS

The following recommendations are offered to assist in reducing and/or eliminating the mercury exposures found.

1. All surfaces on and around the amalgamators should be thoroughly cleaned with soap and water and dry wiped at least once per week. This should also be performed on the surfaces of the amalgamators.
2. The area in and around the trash bin in the sterilization room should be cleaned each week and the liner in the trash container should be replaced each day.
3. Housekeeping personnel should be made aware of the hazards associated with mercury as well as the proper procedures for cleanup.
4. Mop heads should be washed separately and discarded every six months to prevent accumulation of mercury.
5. A procedure for waste mercury disposal and mercury spill decontamination should be established and followed by all persons working in areas where mercury is used.
6. When mercury is spilled, it should be cleaned up immediately by vacuum.
7. Mercury should be used in non-carpeted areas and carpets should be replaced with non-porous floors when appropriate.
8. Areas should be re-surveyed following a mercury spill to confirm complete cleanup of all contaminants.
9. The recommendations for mercury hygiene as set forth by the American Dental Association should be consulted, as they provide further methods of reducing employee exposures to mercury vapor.
10. Other Concerns: Because of the current concern for Nitrous Oxide, (7-14), it is highly recommended that an evaluation for this hazard be performed to determine if a potential overexposure exists in this office.

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X. AUTHORSHIP AND ACKNOWLEDGMENTS

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XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Mark Brodie, D.D.S.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado Department of Health.
5. State Designated Agency.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1
Breathing Zone and Area Air Concentrations for Mercury

Mark Brodie, D.D.S.
Englewood, Colorado

March 30, 1982

Job Description	Sampling Time (Hours)	mg/M ³ Mercury
<u>Personal Samples</u>		
Dentist Breathing Zone	5.0	0.008
Assistant's Breathing Zone	6.5	0.011
Dentist Breathing Zone	5.5	0.009
Assistant's Breathing Zone	6.5	0.012
<u>Area Samples (Mercury Sniffer)</u>		<u>Range</u>
<u>Operator 1</u>		
-Dental chair area	NA	ND-0.03
-Amalgamator area	NA	0.02-0.08
<u>Operator 2</u>		
-Dental chair area	NA	ND-0.02
-Amalgamator area	NA	ND-0.02
<u>Operator 3</u>		
-Dental chair area	NA	ND-0.02
-Amalgamator area	NA	ND-0.02
<u>Operator 4</u>		
-Dental chair area	NA	ND-0.02
-Amalgamator area	NA	ND-0.02
<u>Sterilization Room</u>		
-Counter area	NA	0.02-0.03
-Trash bin and floor area	NA	0.04-1.0
<u>EVALUATION CRITERIA</u>		0.05

mg/M³ = milligrams of substance per cubic meter of air
 NA = Non-applicable
 ND = Non-detectable