SDDO

TB MED 6

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

OCCUPATIONAL HEALTH AND SAFETY IN DENTAL CLINICS

Department of the Army, Washington, D.C.
30 September 1976

1. Purpose and Scope. To familiarize Department of the Army dental personnel with occupational safety and health hazards in dental clinics and to provide guidance for the utilization of appropriate control measures. This bulletin contains guidance necessary for compliance with applicable Occupational Safety and Health Act (OSHA) and Department of the Army occupational health and safety regulations and standards.

2. Responsibilities. *a.* The MEDCEN/MEDDAC commander is responsible for ensuring that dental personnel are provided a "safe and healthful" environment as defined under OSHA (Public Law 91-596, Executive Order 11807).

b. The Director of Dental Services (DDS) is responsible for the conduct of the occupational safety and health program within the Dental Activity, as defined by AR 40-5. This includes ensuring that work practices and protective equipment are sufficient to provide a "safe and healthful" working environment, and that engineering controls are provided to adequately control dental occupational exposures.

c. Dental personnel are responsible for following proper work practices, using protective equipment and engineering control measures provided in accordance with instructions and training received, and reporting unsafe practices or conditions to the DDS.

d. The Chief, Health and Environment Activity, is responsible for providing technical support and assistance to the MEDCEN/MEDDAC commander and the DDS to ensure that dental personnel are provided a "safe and healthful" working environment.

3. Occupational Exposures and Control Measures. A wide variety of complex materials are used in the dental operatory, laboratory, and x-ray film processing area. Consequently, dental personnel are exposed to a variety of potential hazards. Appendix A provides a listing of occupational exposures and their sources commonly found in a dental clinic environment. Specific problem areas are discussed below.

a. Operatory. Primary exposures include mercury vapor, noise, projectiles, anesthetic gases, and infectious materials.

(1) *Mercury.* Mercury vapor sources in the operatory include mercury storage containers; mercury amalgam; amalgam and solid waste containers; hands, shoes, and clothing of dental personnel; contaminated towels, soap, and nailbrushes; and possibly air conditioner filters. Aerosols generated by dental handpieces may contain mercury vapor, mercury droplets, and mercury amalgam bits. Appendix B, Guide to Mercury Hygiene in Dental Facilities, provides a detailed discussion regarding the proper control measures for mercury handling.

(2) *Noise.* Properly maintained dental handpieces and accessory equipment in the operatory produce sound pressure levels in the range 70-85 decibels (db, using the A-weighting [db(A)] network on a noise measurement device. These levels are not considered to be noise hazardous as defined in chapter 4, AR 40-5, and TB MED 251. Excessively noisy equipment should be turned in for repair and maintenance. Personnel desiring hearing protection should be provided this protection as specified in TB MED 251.

(3) *Projectiles.* High speed dental handpieces may generate eye hazardous projectiles, possibly contaminated by oral pathogens. Operatory personnel should be provided and utilize protective eyewear. Authorization for procurement of protective equipment for the Army occupational vision program is contained in AR 385-32, Protective Clothing and Equipment.

(4) *Anesthetic gases.* Nitrous oxide (N_2O), an oxidizing gas, is nonflammable but readily supports combustion. National Fire Protection Association (NFPA) Codes 56A, Inhalation Anesthetics, and 56F, Nonflammable Medical Gas Systems, must be followed. In addition, recent studies have shown that chronic exposure to nitrous oxide may pose a significant health hazard to personnel. Proper anesthesia administration techniques and equipment maintenance should be used to minimize exposures. When suitable scavenging systems to collect and exhaust the waste anesthetic gases are developed, they will be used to further reduce exposure.

(5) *Infectious materials.* Items contaminated with blood, saliva, and sputum may contain potentially infectious microorganisms (e.g., hepatitis virus). Dental personnel will wear face masks and surgical gloves as protection against pathogens contained in aerosols generated during oral procedures. Solid waste (e.g., gauze, needles) contaminated with blood or other body fluids should be considered infectious waste and handled in accordance with paragraph 5-9, AR 40-5. Sterilization and disinfection procedures must be conducted in accordance with AR 40-19, Sterilizing Medical, Surgical, and Dental Materiel, and TB MED 266.

b. Laboratory (Excluding Regional Dental Laboratories). Exposures include dusts from buffing, grinding, and polishing operations; gases and fumes from casting, brazing, welding operations, and boil-out ovens; vapors from impression, denture, adhesive materials and solvents; contact with dermatitis-causing materials; noise; and eye hazards.

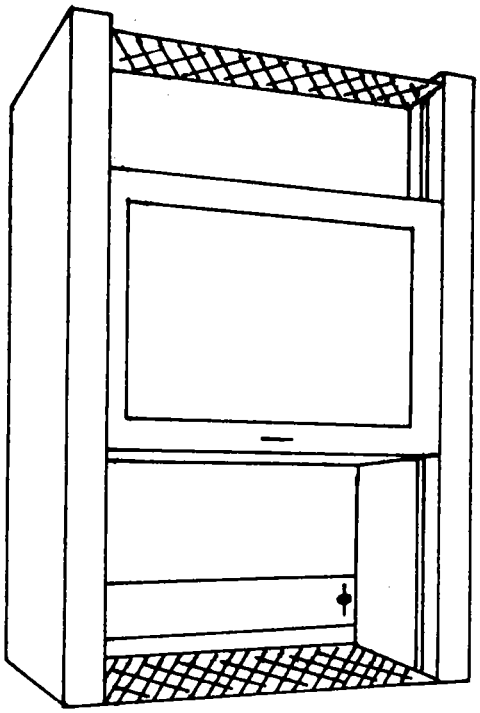
(1) Dusts, Gases, Vapors, Fumes and Mists.

(*a*) All dry operation grinding and polishing lathes should be equipped with standard hoods and dust collector units (NSN 6520-00-539-0750) or be part of a system having dust collectors.

(*b*) Laboratory operations using liquids or pastes (e.g., methyl methacrylate) known to liberate potentially harmful gases or vapors (app A), should be conducted in a laboratory hood providing exhaust ventilation of at least 100 cubic feet per minute (cfm) per square foot of hood face opening with the sash or door in the full open position, see figure. Although few of these gases and vapors are directly health hazardous even when used in a confined area, the long-term effects of multiple exposures to mixtures of these compounds are unknown.

(*c*) Boil-out ovens used to eliminate wax from molds by the investment thermal expansion technique should be exhaust-ventilated or vented to the outside because of carbon monoxide and carbon dioxide produced during the boil-out procedure.

(*d*) Where rubber impressions are electroplated using silver cyanide electroplating baths, the baths should be clearly labeled with caution signs



SPECIFICATIONS:
Hood Width 24-48"
Heat, solvent, and reagent resistant interior
Sliding front sash
Vapor proof light
Blower provided as necessary to provide at least 100 ft³/min per square foot of hood opening with the hood sash in the fully open position

EXAMPLE:
Standard 28 Fume Hood
Labconco Corporation
8811 Prospect Avenue
Kansas City, MO 64132

FIGURE:

Standard Fume Hood

IAW AR 385-30, placed in a well-ventilated area, and preferably vented to the outside. The bath should be covered when not in use to preclude acids or other materials from contacting the solution and producing highly toxic hydrocyanic acid vapor and mist. A gas mask approved for protection against hydrocyanic acid vapor and mist by the National Institute for Occupational Safety and Health (NIOSH) should be placed in a location away from the bath area.

(*e*) At metal casting, welding, brazing, and soldering areas, local exhaust ventilation of at least 100 feet per minute (fpm) should be provided at the point of operation [refer to 29 Code of Federal Regulations (CFR) 1910.252].

(2) *Noise.* Dental laboratory equipment and procedures can be noise hazardous, but most equipment produces sound pressure levels in the range 70-85 db(A). Sound level surveys should be con-

ducted by local health and environment personnel to locate equipment producing levels in excess of 85 db(A), and where found, a hearing conservation program should be instituted in accordance with TB MED 251.

(3) *Dermatitis-causing agents.* No-touch techniques, including the use of protective handwear, should be used whenever they are compatible with operational procedures to preclude exposure to dermatitis-causing agents (app A).

(4) *Projectiles.*

(*a*) The dental prosthetic laboratory is an eye-hazardous area. All entrances should be labeled in accordance with AR 385-30, and all personnel should be included in an Occupational Vision Program under the provisions of chapter 4, AR 40-5. Protective eyewear should be provided for all personnel, including visitors, entering the laboratory while the laboratory is in use. Protective eyewear may be requisitioned under the provisions of paragraph 6, AR 385-32.

(*b*) All dry grinding, buffing, and polishing lathes should be equipped with safety shields.

(*c*) During laboratory cleanup procedures, suction rather than a positive pressure air hose should be used to clean bench surfaces and equipment. If positive pressure air hoses are used for cleaning, air pressure must be reduced to less than 30 pounds per square inch, effective chip guarding utilized, and all personnel in the area must be wearing protective eyewear (refer to 29 CFR 1910.242).

c. X-Ray Film Processing Areas. The primary exposure is to acetic acid mist and vapor from processing solutions. Where exposures exceed occupational health standards, general ventilation of at least 10 air changes per hour, or local exhaust ventilation of at least 100 cfm per square foot of tank surface should be provided. Protective eyewear, aprons, and handwear should be used in the x-ray film processing laboratory whenever working with film processing chemicals, and a source of water should be readily available for emergency eye lavage and skin flushing [refer to 29 CFR 1910.132, 133, and 151 (c)].

d. Radiographic Areas. The US Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD, conducts periodic radiation protection surveys of US Army dental clinics. To preclude unnecessary exposures to ionizing radiation, deficiencies found during these surveys should be corrected as soon as possible.

e. General.

(1) *Illumination.* Hospitals (interpreted as medical and dental health care facilities) are exempt from most provisions of the Federal Energy Conservation Policy (para 5, app C, 34 CFR 232, Federal Energy Conservation). Department of Defense guidelines, however, require that illumination levels at a work task do not exceed those recommended in the IES Lighting Handbook, 5th edition, 1972, table 1 below, and are no greater than 10 footcandles in nonworking areas such as hallways and corridors. No supplementary lighting, with the exception of the operating light, appears necessary in dental operatories, radiographic, or x-ray film processing areas. In prosthetics laboratories, however, supplementary lighting should be provided at buffing, grinding, and polishing operations; at casting, brazing, soldering, and welding operations; and at prosthetic device finishing areas.

Table 1. On-Task Maximum Illuminating Levels for Dental Clinics

(Extracted from IES Lighting Handbook, 5th edition, 1972)*

Location	*Footcandles on task*
Operatory, General	70
Instruments Cabinet	150
Dental Entrance to Oral Cavity	1000
Prosthetic Laboratory Bench	100
Recovery Room General	5
Recovery Room, Local for Observation	70

(2) *General safety considerations.* Additional hazards and exposures exist that are not unique to dental clinics; they must be considered when implementing a fully comprehensive occupational safety and health program. A partial listing of items to consider would include electrical grounding and shielding; fire prevention and control; storage and use of compressed gases; and storage and use of flammable, caustic, and carcinogenic chemicals. Well-defined standards, regulations, and guidance are published by many organizations including the Department of the Army, OSHA, NIOSH, the Joint Commission on Accreditation of Hospitals (JCAH), NFPA, the American Hospital Association (AHA), and the National Safety Council (NSC).

4. Selected Bibliography.

a. Title 29 CFR 1910, Occupational Health Standards.

b. AR 40-5, Health and Environment.

c. AR 385-30, Safety Color Code Markings and Signs.

d. AR 385-32, Protective Clothing and Equipment.

e. TB MED 251, Noise and Conservation of Hearing.

f. TB MED 266, Disinfection and Sterilization of Dental Instruments and Materials.

g. Buchwald, H. 1972. Exposure of dental workers to mercury. American Industrial Hygiene Association Journal *33*: 492-502.

h. Frykholm, K. O. 1957. On mercury from dental

*Published by the Illuminating Engineering Society.

amalgams. Its toxic and allergic effects and some comments on occupational hygiene. Acta Odontologica Scandinavica *15* Supplement 22, 108 p.

i. Nixon, G. S. 1972. Occupational Hazards in dentistry. Community Health *3*: 221-225.

j. Recommendations on Mercury Hygiene. Council on Dental Materials and Devices, Journal of the American Dental Association *88*: 391-392. 1974.

k. Rupp, N. W. and G. C. Paffenbarger. 1971. Significance to health of mercury used in dental practice: A review. Council on Dental Materials and Devices. Council on Dental Research. Journal of the American Dental Association *82*: 1401-1407.

l. Skinner, E. W. and R. W. Phillips, 1967. "The Science of Dental Materials." 6th Edition, W. B. Saunders Company, Philadelphia. 670 p.

m. Stewart, F. H. and G. N. Stradling, 1971. Monitoring techniques for mercury and mercury vapor in dental surgeries, a preliminary report. British Dental Journal *131*: 299-308.

n. US Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, Development and Evaluation of Methods for the Elimination of Waste Anesthetic Gases and Vapors in Hospitals, HEW Publication No. (NIOSH) 75-137, 1975.

APPENDIX A

OCCUPATIONAL EXPOSURES IN DENTAL CLINICS

Exposure	*Source*
Noise	Handpieces, grinding and polishing equipment and procedures.
Projectiles	Handpieces, grinding and polishing equipment, rotary casting machines, dental soldering, investment heating and burnout.
X-radiation	Dental x-ray procedures
Inhalation exposures	
Mercury vapor	*Mercury, *mercury amalgams and *mercurial disinfectants.
Solvent vapors	*Acrylic resins, miscellaneous solvents
Gases of combustion	Muffle furnace, bunsen burner, soldering torch.
Nitrous Oxide	Anesthetic gas
Steam	Steam sterilizer
Miscellaneous aerosols	Dental handpieces
Siliceous and nuisance dusts	Laboratory procedures
Acid mists	X-ray film developing
Metal dust and fumes, flux fumes	Metal polishing and grinding, soldering
Contact exposures (skin and eyes)	
Hot objects, open flames	Steam sterilizer, muffle furnace, alcohol lamps, bunsen burners, soldering torch.
Steam	Steam sterilizer
Sharp objects	Dental instruments
Oral pathogens	Contaminated dental tools
**Dermatitis-causing agents	Impression materials
	Dental resins
	Metal prosthetic devices
	Mercury amalgam restorations and dies
	Dental waxes
	Investment materials
	Dental cements
	Grinding and polishing abrasives
	Sterilizing and disinfecting solutions
	Cleaning compounds, soaps and detergents
	Lubricants and cleaning solvents
	X-ray film processing chemicals
	Local anesthetic drugs
	Miscellaneous solvents and other materials

*mercury and some solvents may also be absorbed through the skin.

**may also be sensitizing agents in some cases.

APPENDIX B

GUIDE TO MERCURY HYGIENE IN DENTAL FACILITIES

1. Scope and Purpose. *a.* This appendix is intended to serve as a detailed guide to good practice in mercury hygiene for dental facilities. Recommendations are made for facility design, work practice procedures, environmental monitoring, and medical monitoring of personnel.

b. Guidance is based upon recommendations by various authors in the dental literature, the American Dental Association, and NIOSH.

2. General. Mercury vapor is tasteless, odorless, and invisible. Toxic effects may be caused by skin absorption of elemental mercury or by absorption of inhaled mercury vapor in the lungs. Mercury does not constitute a hazard to dental personnel unless negligent or careless handling of mercury results in gross contamination of dental facilities, or when, on rare occasions, individual sensitization to mercury occurs. Attention to mercury hygiene procedures reduces and can prevent or even reverse the clinical effects of mercury exposure to dental personnel, and may reduce the incidence of sensitization to mercury.

3. Facility Design. *a. Consolidation of Mercury Storage and Use Areas.* Mercury storage and dispensing, waste storage, and amalgam preparation areas should be consolidated, where practical, to reduce the number of contamination sources.

b. Heat Sources. Mercury storage and use areas should not be located near obvious heat sources, including room heating sources. Even a small elevation in temperature can considerably increase mercury evaporation rates.

c. Floors.

(1) Floor surfaces should be impervious and all cracks, crevices and seams, if present, should be sealed. A polymeric plastic coating or self-polishing floor wax (NSN 7930-00-926-1689) can be used for this purpose. New facilities will use seamless flooring material that extends two inches up each wall in mercury-use areas, such as all dental treatment rooms.

(2) Carpeting should not be installed in mercury-use areas. Existing carpeting should be removed as soon as practicable, and destroyed. Contaminated carpeting usually cannot be adequately cleaned and should not be reused.

d. Work Surfaces. Work surfaces should be smooth and impervious; a covered and sealed bench riser should be incorporated where possible to prevent the loss of mercury to inaccessible areas behind the work bench. Sufficient space should be provided to accommodate drip trays for each operation.

e. Vacuum Suction. Vacuum systems and pumps should be water-trapped to prevent aerosolization of mercury and mercury particulates.

f. Ventilation.

(1) *General ventilation.* Provided that adequate mercury hygiene procedures are used, additional general ventilation for mercury vapor control need not be installed.

(2) *Window units.* Window air conditioning and heating units should not be operated in the recirculation mode. Air filters should be replaced or washed, as appropriate, at least quarterly and more frequently if located near mercury aerosol generating equipment.

g. Amalgam Preparation.

(1) Mercury should be stored in unbreakable, tightly-closed containers.

(2) Mercury dispensing, proportioning, trituration, and squeezing should be conducted over drip trays. Preproportioned capsules may be used to limit the possibility of spillage.

(3) Triturator capsules should be clean and tight to prevent mercury loss during trituration. Single use capsules should not be reused.

(4) If squeezing is necessary, skin contact should be avoided by the use of disposable plastic bags or surgical gloves.

(5) Waste mercury and amalgam should be placed in nonmetallic closable containers. A one inch layer of glycerin for each inch of waste amalgam should be used to limit vaporization of free mercury.

(6) Waste amalgam should be collected into a single storage container (preferably not glass) as described in (5) above, at least weekly and turned in for reclamation as required by chapter 3, AR 40-61.

h. Spills.

(1) Spilled mercury should be cleaned up immediately. Unnecessary personnel should be removed from the immediate area to limit exposures. Hands should be protected with plastic bags or surgical gloves while wiping contaminated surfaces.

(2) Visible spilled mercury, not on drip trays, should be picked up using suction. Extension devices for the vacuum system may be fabricated using rubber tubing and a glass pipette. A small

plastic squeeze bottle may be adapted for use by cutting off part of the extender tube inside the bottle. Dry sweeping should not be used as this will further disperse the spilled mercury.

(3) The area of the spill should be coated with a mercury suppressant such as 1 percent calcium polysulfide solution, a paste of equal parts of calcium oxide (hydrated), flowers of sulfur and water; powdered sulfur; or activated alumina, then carefully swept, and wet mopped. Commercial products for this purpose are also available.

4. Work Practices. *a. General.*

(1) Mercury should be used or stored only in designated areas and on designated surfaces. Such areas should be kept clear of obstructions and equipment not in use.

(2) Mercury spills should be cleaned up immediately, as described in paragraph 3*h* above.

(3) Smoking, eating, and drinking should not be permitted in mercury-use areas.

(4) Waste paper and other materials contaminated with mercury should be consolidated with infectious waste materials, and disposed of as infectious waste.

(5) Personnel should wash their hands prior to departing mercury-use areas for any reason.

(6) Smocks or aprons should be used to prevent contamination of personal clothing. Commercial laundering of smocks and aprons and use of shoes restricted to the work environment are suggested to prevent contamination of the home environment. Protective clothing should be provided by the activity commander (para 1-3*a*(3), AR 40-5).

b. Training.

(1) All personnel should be instructed in the potential harm to health caused by mercury exposures, and in mercury hygiene procedures.

(2) Written procedures should be provided for reference.

c. Dental Procedures.

(1) Minimal mercury and no-touch dental techniques should be taught and used whenever possible.

(2) When drilling, grinding, or polishing amalgam, water spray cooling and suction should be used together to limit mercury vapor and aerosol dispersal.

(3) Ultrasonic condensation should not be used.

d. Cleaning Procedures.

(1) Mercury-use areas should be wet-mopped daily using equipment restricted to the mercury-use area to prevent dispersal of mercury to other areas. Mopheads should be changed and laundered daily (no special precautions are required to protect laundry personnel). Dry sweeping (except as noted below), dry mopping, and the use of dry vacuum cleaners not designed for use with mercury should be prohibited. Wet vacuum scrubbers are acceptable provided that waste water reservoirs are nonmetallic. Waxed floors should be rewaxed as necessary to maintain a seam-free surface. *Self-polishing waxes should be used to preclude the use of buffers.*

(2) Floors and bench surfaces should be cleaned at least quarterly using a mercury suppressant. Contaminated suppressant should be collected by careful dry sweeping, and the surface should be wet-mopped or wet-wiped.

(3) Drip trays, bench surfaces, and triturator wells and capsules, particularly those stored in drawers, should be cleaned daily. Dust should not be allowed to collect upon surfaces in mercury-use areas.

e. Environmental Monitoring.

(1) Daily visual contamination surveys should be conducted by supervisory personnel. Any area showing visible contamination should be decontaminated.

(2) Mercury-use area contamination surveys using appropriate mercury vapor measurement devices should be conducted at least annually by qualified personnel. Contaminated areas within the room should be marked for decontamination. Resurveys should be made after decontamination to ensure that cleaning procedures were effective.

(3) Short-term breathing zone mercury vapor determinations have not been found to be particularly useful in measuring mercury vapor exposures.

f. Personnel Monitoring.

(1) Routine urinary mercury monitoring is not recommended. Such monitoring may be instituted if it appears that adequate mercury hygiene procedures are not being followed, as evidenced by repeated findings of mercury contamination.

(2) Urine mercury level measurements are notorious for their variability among different individuals with apparently equal exposures, and for the same individual on successive days. Most laboratories consider mercury levels of 40 μg/1 to be the upper limit of normal. Measurements up to 150 μg/1 should not give cause for undue alarm with respect to the physical well-being of the individual involved, if found in an incidental case and not confirmed in a repeat determination. Urinary mercury levels consistently above 150 μg/1 should result in removal from further exposure, and a thorough medical examination for signs of intoxication. Return to work should be allowed if two consecutive determinations, 1 week apart, are below 150 μg/1, and mercury hygiene procedures have been instituted to reduce further mercury exposure to a practicable minimum.

By Order of the Secretary of the Army:

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GPO 902-335