Dental Amalgam: Public Health and the Environment Frequently Asked Questions

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Public Health

Dental amalgam contains mercury, which can be toxic. Doesn't the use of dental amalgam lead to toxic effects?

Dental amalgam is a durable alloy of silver, copper, tin, zinc, and mercury. Although mercury is a major component of dental amalgam, dental amalgam is not the equivalent of mercury and does not harm human health or the environment. Dental amalgam is a stable alloy that has been studied extensively and has an established record of safety and effectiveness.

If dental amalgam is hazardous before it is placed in the mouth and when it is removed from the mouth, how can it be safe when it is in the mouth?

"Hazardous," in this context, is a regulatory classification that dictates appropriate handling procedures. It does not correctly characterize amalgam's usefulness or safety as a medical device, or its actual environmental effects. Other devices, such as batteries, mercury-containing lamps, computer and television monitors, are considered hazardous once they are no longer useful devices. The "hazardous" label ensures such devices are properly disposed or recycled.

Does dental amalgam release mercury vapor in the body?

Amalgam fillings are known to emit minute quantities of mercury vapor during vigorous chewing or grinding. The amounts of mercury vapor emitted by amalgams fall well within levels considered safe, that is, they show no toxicity and cause no adverse health reactions.

I've heard the cause of some illnesses is traced to dental amalgam fillings—is this true?

No properly designed, peer-reviewed scientific study links dental amalgam to any neurological or systemic disease. The Working Group on Dental Amalgam of the USPHS Environmental Health Policy Committee issued a report concluding that the body of literature through 1997 does not support claims that individuals with dental amalgam restorations will experience adverse effects, except for rare allergic or hypersensitivity reactions. The FDA recently (May 9, 2003) published a notice requesting recommendations from the scientific and lay communities about peer-reviewed journal articles from 1996 to 2002 that address human health risks from dental amalgams. A literature review, although sponsored by governmental organizations, will be conducted by an independent group. The purpose of the review is to determine whether any studies published in the peer-reviewed scientific literature provide new evidence related to the health effects of dental amalgam in humans.

Significant research about dental amalgam continues, most notably two ongoing randomized, clinical trials, begun in 1997 on the biological effects of dental amalgam in children. These studies seek to determine whether dental amalgam has any demonstrable adverse health effects by measuring a whole array of neuropsychological functions, such as IQ, learning ability and behavior. Children participating in these studies also are being tested for kidney function and mercury levels in blood, urine and hair. Although those ongoing studies will not be completed until 2006, the government would have halted them immediately if at any point during the past six years the study subjects showed any sign that amalgam was harming them.

Other organizations concerned about public health, such as the Alzheimer's Association, the National Multiple Sclerosis Society and the American Academy of Pediatrics all have publicly stated that there is no scientific evidence linking dental amalgam with any disease or syndrome. The Autism Society of America states that there is no known cause for autism, but that it is generally accepted that it is caused by abnormalities in brain structure or function, and that children with autism are born with the disorder or born with the potential to develop it. The Institute of Medicine has concluded that there is no evidence linking mercury to any of the pathophysiological changes known to be associated with autism, such as genetic defects.

Why is the term "silver amalgam" used when mercury, not silver, is the major component?

The term "amalgam" is defined in Merriam-Webster's Dictionary as "an alloy of mercury with another metal that is solid or liquid at room temperature according to the proportion of mercury present and is used especially in making tooth cements." The chemical and metallurgical fields also are familiar with terms such as "gold amalgam" and "copper amalgam," where gold and copper, respectively, are alloyed with mercury. Another, more popular explanation, is that people tend to refer to many things by color—tooth fillings are silver, white (resin composites) or gold-colored.

Environment

Why has dental amalgam become a wastewater issue?

Dental amalgam contains mercury, and mercury is identified as one of 12 "persistent, bioaccumulative, and toxic" chemicals targeted by local, state, and federal environmental regulators. With the enactment of various environmental and occupational safety regulations, the use of mercury by U.S. industries began a steep decrease in the mid-1980s. As industries eliminate mercury from some products, such as paints and pesticides, or reduce its use in batteries, lamps, and electrical switches, environmental regulators have turned their attention to mercury's use in healthcare. Thermometers, blood pressure cuffs, medicines, and dental amalgam are among the healthcare products that

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regulators have identified as possible sources of mercury that can be released into the environment. It should be noted that dentistry's use of amalgam has decreased in recent years with a lower caries rate and with growing popularity of tooth-colored restorative materials.

Regulatory interest is highest in regions where fish are found with high concentrations of methylmercury. Some forms of mercury, under certain conditions, can be transformed by a biological process to become the more highly toxic methylmercury and bioaccumulate in fish. Mercury is a naturally-occurring element that cannot be destroyed, but can change forms. U.S. EPA and state and local environmental agencies measure and regulate for "total mercury." Other recent developments also drive regulators' interest in dental amalgam: (a) new tests that detect very low levels of mercury previously undetectable; (b) lower regulatory standards for mercury in water and mercury in fish; (c) exceedance of the new standards; and (d) international agreements to reduce mercury release and uses.

What is the fate of dental amalgam once it enters a dental office's plumbing lines and the community's sewer system?

During placement or removal of amalgam restorations, most amalgam debris is caught by the chairside filter and by a secondary filter at the vacuum. Amalgam particulate is heavy, and research indicates that most of the particulate in a wastewater stream will be entrained in amalgam-capturing devices or settle in pipes over time. If amalgam particulate makes it to a wastewater treatment plant, it is likely to be captured in one or more sediment, or grit, chambers at the plant. The resulting sludge (also called "biosolids") may be disposed at a landfill, used as a soil amendment, or incinerated. Sludge is regulated for mercury content.

How much mercury is released from dental amalgam into wastewater is unknown, and the process is likely dependent on a variety of factors. Research indicates that some line cleaners, primarily those with oxidizers, may release mercury from amalgam. Nevertheless, ADA-sponsored research conservatively estimates that the amount of mercury from dental offices that theoretically may be released into waterways and become available for conversion to methylmercury is less than one percent of all sources of mercury.

Why is wastewater regulation not the same across the state?

Water quality standards vary from community to community. The federal Clean Water Act allows states and communities to establish regulations specific to their own water quality criteria. For example, the elevated level of mercury in San Francisco Bay has led to greater regulation of all potential sources of mercury, including dental office wastewater. In contrast, mercury is not a significant concern in San Diego.

What is dentistry being asked to do?

Individual sanitation agencies (publicly-owned treatment works or "POTWs") have contacted dental offices, component dental societies, and CDA for a variety of reasons. Some POTWs are conducting surveys and/or educational outreach programs. A few POTWs have implemented regulatory programs.

If an individual dentist or component dental society has been contacted by a POTW, CDA should be notified as soon as possible. CDA can assist in determining the POTW's level of interest and in making recommendations for appropriate responses by the individual dentist or dental society. If a POTW seeks to implement a dental wastewater program, either educational or regulatory, CDA can provide information and guidance to the dental society. CDA recommends dental societies assign a volunteer leader to be the "point-person" on wastewater matters. The establishment of a wastewater task force is recommended when local POTW interest in dentistry is high.

CDA recommends all dental offices implement "best management practices" (BMPs) for dental office waste. Because wastewater regulations differ from community to community, CDA's approach is to address each situation on a case-by-case basis. CDA maintains open communication with local sanitation agencies and strongly encourages local dental societies to meet with local agencies when contacted.

Best Management Practices (BMPs)

- Do not rinse amalgam-containing traps, filters, or containers in the sink.*
- Do not place amalgam, elemental mercury, broken or unusable amalgam capsules, extracted teeth with amalgam, or amalgam-containing traps and filters with medical "red-bag" waste or regular solid waste.*
- Recycle, or manage as hazardous waste, amalgam, elemental mercury, broken or unusable amalgam capsules, extracted teeth with amalgam, amalgam-containing waste from traps and filters.*
- Empty dental amalgam capsules containing no visible materials may be disposed of as a non-hazardous waste, except as required by local regulations.*
- Collect and store dry dental amalgam waste in a designated, airtight container. Amalgam, which is designated for recycling, should be labeled "Scrap Dental Amalgam" with the name, address and phone number of your office and the date on which you first started collecting material in the container. In the past, dental amalgam scrap may have been kept under photographic fixer, water or other liquid. If you should encounter amalgam stored in this manner, do not under any circumstances decant the liquid down the drain and discontinue this practice in the future.

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- Keep a log of your generation and disposal of scrap amalgam; inspectors may ask to see this to verify that your office is managing it correctly. A generation and disposal log is a record of what you placed in the amalgam container, when it was placed in the container and when the container was picked up by or sent to a recycler or hazardous waste hauler.
- Check with your amalgam recycler for any additional requirements. Some recyclers do not accept contact amalgam (amalgam that has been in the patient's mouth); others may require disinfecting the amalgam waste. All recyclers have very specific packaging requirements.
- Separate excess contact dental amalgam from gauze that is retrieved during placement and place in an appropriate container.
- Use chair side traps to capture dental amalgam.
- Change or clean, chair side traps frequently. Flush the vacuum system before changing the chair side trap.
- Change vacuum pump filters and screens at least monthly or as directed by the manufacturer.
- Check the p-trap under your sink for the presence of any amalgam-containing waste.
- Eliminate all use of bulk elemental mercury and use only precapsulated dental amalgam for amalgam restorations.
- Limit the amount of amalgam triturated to the closest amount necessary for the restoration, i.e. do not mix two spills when one spill would suffice. Keep a variety of amalgam capsule sizes on hand to ensure almost all triturated amalgam is used.
- Train staff that handle or may handle mercury-containing material in its proper use and disposal.
- Install an amalgam separator compliant with ISO 11143.
- Do not use bleach to clean discharge systems as this may mobilize legacy mercury and amalgam in the system.

*Mandatory per California Code of Regulations Title 22

Regulatory Overview

Clean Water Act — US EPA

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Oversees a range of technical, regulatory, and grant programs established to implement the Clean Water Act

States — California State Water Resources Control Board and the nine regional water quality control boards

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- Develop and enforce water quality standards and implementation plans to protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology and hydrology
- Regulate waste dischargers by setting limits for specific pollutants and requiring other permit conditions

Business and POTWs that discharge waste directly to the nation's waterways and water bodies

POTWs — Municipalities and other agencies

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Have broad authority to regulate waste discharges to the sewer system in order to protect the integrity of the system and to meet conditions in their NPDES permits

Businesses

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Glossary

Best Management Practices: In dental offices, a combination or series of practices determined to be effective and practical means of preventing or reducing the amount of amalgam waste disposed into the environment. BMPs promoted by some environmental agencies also may target photochemicals and disinfectants.

Clean Water Act: Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. Commonly known as the Clean Water Act (CWA), it established the basic structure for regulating discharges of pollutants into the nation's waters. The statute employs a variety of regulatory and nonregulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Local Discharge limit: POTWs may regulate businesses discharging wastewater to their sewer systems. One method of regulation is to require businesses to meet local discharge limits for specific pollutants. Local discharge limits in California for mercury range from 0 to 0.1 ppm (or mg/l).

NPDES: National Pollutant Discharge Elimination System. This is the permit system established by the CWA to regulate direct wastewater discharges from wastewater treatment plants and industry. Wastewater dischargers may be required to comply with a specific mercury discharge limit (concentration and/or mass limit) or may only be required to monitor their discharges for mercury.

POTW: A Publicly Owned Treatment Works as defined by Section 212 of the CWA, which is owned by the state or municipality (as defined by Section 502(4) of the CWA). This definition includes any devices or systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes or other conveyances only if they convey wastewater to a POTW treatment plant. The term also means the municipality that has jurisdiction over indirect discharges to and the discharges from such a treatment works. POTWs may require businesses discharging wastewater to their systems to meet local discharge limits for specific pollutants and/or comply with other permit conditions, such as BMPs.

TMDL: The Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. TMDLs determine what level of pollutant load would be consistent with meeting water quality standards. The TMDL regulatory process also allocates acceptable loads among sources of the relevant pollutant.

Water Quality Criteria: Levels of individual pollutants or water quality characteristics, or descriptions of conditions of a waterbody that, if met, will generally protect the designated use of the water.

Water Quality Standards: Includes three major components: designated uses, water quality criteria, and antidegradation provisions.

Additional background information is available upon request. Please contact Teresa Pichay, Practice Analyst at the CDA office, 800.232.7645, ext. 5990.

June 2003, Updated January 2010