

How to Prevent Pollution From Your Dental Practice

A GUIDE FOR DENTISTS



IDEM

Indiana Department of Environmental Management

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Source Reduction

The Indiana Department of Environmental Management (IDEM) has developed this guide to assist you in the selection and management of materials which will reduce or eliminate pollution from your dental practice. In accordance with the Indiana General Assembly, IDEM's goal is to reduce the use of toxic substances at the source. Besides, pollution prevention is often the most cost-effective manner of reducing the toxicity of a discharge.

International Joint Commission Agreement

In 1980, the International Joint Commission developed a binational agreement between Canada and the United States that calls for the virtual elimination of toxic substances from point sources. In 1991, IDEM's Remedial Action Plan (RAP) for the Grand Calumet River (see inset) identified mercury as one of these toxic substances because of its human consequences, its harmful effects on the beneficial uses of the river and Lake Michigan and its ability to accumulate in the tissues of the aquatic life of the Lake, and persist in the ecosystem. While dental amalgam is not a toxic substance, mercury, which may be released from old or new amalgam and discharged to the sewer system, is of vital concern within the Grand Calumet River basin and the Nearshore Lake Michigan area.

What is the Remedial Action Plan?

The International Joint Commission was established by the United States and Canada to protect the Great Lakes. This organization designated the Grand Calumet River and its watershed as one of the 43 polluted "areas of concern" around the lakes. Each state and province surrounding the Great Lakes has agreed to submit a 3-stage Remedial Action Plan (RAP) for these polluted areas. Stage 1 (published in January 1991) identifies the problem, Stage 2 (in progress) identifies remedial measures, and Stage 3 will schedule cleanup.

Survey Results

In the early summer of 1994, IDEM's Office of Pollution Prevention and Technical Assistance surveyed the 210 dentists in Lake County, Indiana. Over 40 percent of this dental community responded to this survey, telling us of their current efforts to protect the environment. Two-thirds of the dentists recycle excess amalgam prepared for their patients. However, the results of this survey also indicate that more than half of old amalgam removed from patients' teeth and nearly 90 percent of the amalgam shavings produced from restorative operations is currently going down the drain. It is estimated that approximately 100 pounds of dental amalgam, carrying 50 pounds of mercury, are going to the sewer from the dental community in Lake County, Indiana, annually.

More Than 120 Pounds of Mercury

It cannot be said with certainty that all of the mercury in the dental amalgam is going to the wastewater treatment plants or getting into the waterways. Records indicate that more than 120 pounds of mercury gets deposited in the Calumet treatment plants every year. Since amalgam is a relatively heavy, water-insoluble substance, some of the dental amalgam is likely getting trapped in the urban sewer systems, and not making it to the treatment plant. But this, in itself, is a potentially dangerous resting place.

Methyl Mercury

It is known that corrosive and reactive combinations of chemicals can release mercury from the bonds of many of its compounds. Common sense indicates that the alkaline “soup” in many sewers can do the same. And once released, this elemental or ionic mercury can be transformed, either by common bacteria in the sewers or by common chemicals, into organic mercury. This organic form of mercury, typically methyl mercury, when released to the river and Lake Michigan, is taken up by small aquatic plants and quickly finds its way into the food supply of the waterway’s fish and bird life. Methyl mercury is a major part of the reason there are warnings about human consumption of some types of fish from the lake.

Voluntary Removal and Recycle

Because of the complexity of the chemical, plant, and animal interactions within this water cycle, it cannot be said exactly how much of what form of mercury is present at any specific stage. Yet, mercury is in the wastewater and the responses to the dental survey indicates Lake County’s dental community is releasing about 100 pounds of mercury-bearing amalgam into the sewers each year. Whether it can be definitively proven that the mercury in the treatment plants comes totally or partially from dental sources, it is appropriate to voluntarily remove and recycle those materials that don’t belong in the environment.

In addition to recommendations for preventing mercury pollution, suggestions are also given here for preventing or reducing other wastes that may be generated in your practice.

Amalgam--a Source of Mercury

One of the chief goals of the Remedial Action Plan for the Grand Calumet River, as well as the International Joint Commission, is to reduce the amount of all sources of toxic and bioaccumulative metals, including mercury and silver, entering the sewage system, trash, or waste incinerator. Amalgam particles are a source of both mercury and silver in the environment. Amalgam particles are created when old fillings are removed and new fillings are mixed and used.

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Dental Pollution Prevention Options

The goal of pollution prevention is to reduce or eliminate the use of toxic substances at the source. In the practice of dentistry, pollution prevention means the development and use of materials other than mercury and silver-bearing amalgams. Unfortunately, although some substitutes are available and are used by many dentists in certain clinical situations, amalgam remains the best and least expensive substance for most dental restorations. A list of substitute materials and their benefits and shortcomings is given on page four.

New Amalgam Substitutes

Dental researchers are actively pursuing improved substitutes for dental amalgam, and hint that the first of these products will be ready for use within several years. Dental professionals are encouraged to follow the developments of new dental materials that do not contain mercury. It is only through the collective action that environmental protection will be achieved.

Patient's Choice

While the selection and use of particular therapeutic agents must remain between the patient and the doctor, full and complete information on the benefits and shortcomings of the various dental restorative materials should be given to the patient. To optimize informed choice this information should include the environmental aspects of that choice. Information about the persistence and accumulation of mercury in our environment should be given, as well as, the quantity of mercury and other heavy metals that are potentially in this waste stream.

In any case, steps should be taken to minimize the amount of material discharged to the environment.

Minimize Amalgam Discharge

Stock amalgam materials in a range of capsule sizes. This procedure will minimize waste. If mixed virgin amalgam remains after a restoration, save this material for recycling. To minimize the amount of mercury vapor emitted to the office environment from waste amalgam, the American Dental Association recommends that it be stored in a closed, airtight container under a small amount of photographic fixer.

Amalgam shavings and bits of amalgam from the drilling or restoration-shaping operations should be intercepted by the drain traps or screens. While no change in your vacuum suction system should be attempted without engineering consultation, more of the amalgam can be intercepted if the standard 40-mesh screen is replaced with a finer 100-mesh form. Screens and standard drain traps should be cleaned out daily to retain good water flow and to collect amalgam waste for recycling. When selecting new equipment, keep in mind that better filters and systems that can remove small shavings of amalgam are being developed.

Mercury Should Not Be Incinerated

Because medical waste is usually incinerated, the standard practice of disposing drain trap sludge and amalgam shavings in the medical waste bag is not recommended. When amalgam is burned mercury is released to the atmosphere where it ends up deposited on the ground or in the water. Shifting the waste from water to the

Restoration Material Options

Selected Characteristics of Posterior Restorative Materials

CRITICAL PARAMETERS	AMALGAM	COMPOSITE	GLASS IONOMER	GOLD FOIL	GOLD ALLOY (CAST)	METAL-CERAMIC CROWNS
Median Longevity Estimate ¹	8 to 12 Years	6 to 8 years when used in conservative non-stress bearing situations.	No Data: ¹ 5 years predicted	No data; 10 to 15 years estimated	12 to 18 years	12 to 18 years
Relative Surface Wear	Wears slightly faster than enamel	Excessive wear in stress-bearing situations	Excessive wear in stress-bearing situations	Excessive wear in stress-bearing situations	Wears similar to enamel	Porcelain surface may wear opposing tooth
Resistance to Fracture	Fair to excellent	Poor to Excellent	Poor	Fair to Good	Excellent	Excellent
Marginal Integrity (Leakage)	Fair to excellent; Self-sealing through corrosion products.	Poor to Excellent; Polymerization shrinkage can cause poor margins	Poor to Excellent	Poor to Excellent	Fair to Good Depends upon fit and type of luting agent used	Poor to Excellent -- Depends upon fit and type of luting agent used
Conservation of Tooth Structure	Good	Excellent	Excellent, if initial restoration – not, if replacement	Good	Poor	Poor
Esthetics	Poor	Excellent	Good	Poor	Poor	Excellent
Indications: Age Range	All Ages	All Ages	All Ages	Adult	Adult	Adult
Indications: Occlusional Stress	Moderate Stress	Low-stress-bearing	Adult – Class V and low-stress primary teeth	Class III and V and crown repair	High-stress areas	High-stress areas
Indications: Extent of Caries	Incipient to moderate-size cavity	Incipient to moderate-size cavity	Class I and II child incipient to moderate-size cavity	Incipient to moderate-size cavity	Severe tooth destruction	Severe tooth destruction or aesthetic considerations
Cost to Patient ²	1X	1.5X	1.4X	4X	8X + gold	8X

¹ Longevity estimates reflect medians from published studies; however, under different clinical situations, many restorations will last longer. For materials which have emerged in the last decade and gold foil, estimates are speculative.

² Relative cost to patient, in relation to amalgam (1X). There may also be considerable geographic variation.

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air and then to the ground where pollution can migrate to water through rainwater runoff or other routes, does not prevent its bad effects.

Follow Infectious Waste Disposal Guidelines

Since amalgam shavings that have been in contact with a patient's saliva, blood, and mucous membranes usually meet the definition of infectious waste by the Indiana State Department of Health (ISDH), waste materials from screens and traps should be chemically sterilized before recycling. (Heat sterilization in an autoclave is not recommended due to the low volatilization temperature of mercury.) A log of the waste materials and their disposition must be kept according to ISDH regulations.

For a complete copy of the infectious waste regulations, contact:

Universal Precautions Coordinator
Indiana State Department of Health
1330 West Michigan Street, Room 226
Indianapolis, IN 46206

(317) 383-6825

Used empty amalgam capsules have been determined to not be a RCRA (Resource Conservation and Recovery Act) hazardous waste, based on toxicity test results. Empty amalgam capsules may be placed in the trash.

Small amounts of elemental mercury can be made into amalgam by reacting it with alloy. The resulting amalgam scrap can be added to the scrap jar and recycled. However, larger amounts of *contaminated* elemental mercury from spills, and absorbent from cleaning up spills of mercury, are accepted by some recyclers of amalgam. This material must be managed and transported as a *hazardous waste*, using proper labeling, storage,

manifest form (EPA 8700-22 and continuation form 22-A), and shipping techniques.

Steps to Minimize and Dispose Amalgam Waste.

- 1. Stock amalgam in various capsule sizes to minimize waste.**
- 2. Recycle any remaining mixed virgin amalgam.**
- 3. Clean and remove amalgam from drain traps or screens. Sterilize or follow infectious waste guidelines before recycling.**
- 4. Used empty amalgam capsules are non-toxic and may be placed in the trash.**
- 5. Refer to enclosed recycling guidelines list.**

Recycling Amalgam

For your reference, a list of recyclers follows these guidelines. These companies will take clean used amalgam and old amalgam that may be mixed with contaminants caught in traps or on screens. Since most amalgam recyclers want dry material separate the fixer and air dry the amalgam. Do not subject the material to heat, as mercury volatilizes at relatively low temperatures.

Many recyclers pay for clean scrap amalgam, but may not pay for amalgam that is mixed with other wastes from traps and screens. The recyclers request that clean and mixed amalgam be kept separated to aid in the recycling process.

Waste amalgam may be sent to the recycler via common carrier (UPS, Federal Express, etc.) in a strong, suitable container.

Separator Systems Available

Separator systems are available to treat water contaminated with amalgam that is too fine to be caught in traps or on screens. These systems are currently used and mandated in several European countries and are being evaluated by several U.S. environmental agencies. The Indiana Department of Environmental Management anticipates that enough dental amalgam materials can be voluntarily captured and recycled to make further regulation unnecessary.

X-ray Fixer

Since the development and stabilization of x-ray materials depends on specifically formulated chemicals, optional or substitute materials may not be available for dental operations. Pollution prevention must rely on the photographic industry. Used x-ray fixer is a hazardous *waste* because of its high silver content. However, because of the high silver content, used fixer is readily recyclable. Recycling is the recommended management method;

Suitable Used Fixer Recycling Methods

There are two suitable methods of recycling used fixer. Purchasing your own silver recovery unit is economically feasible for small and large volume users due to the availability of different systems and technologies. On the other hand, you may give, sell or pay someone that already operates a silver recovery unit to take your used

fixer. For your reference, a list of silver recyclers and manufacturers of recovery units is included in this guide.

If you have your own silver recovery unit, liquid that has gone through the process can be washed down the drain. If used fixer will be taken off site, store it in a closed plastic container labeled: Hazardous Waste - Used Fixer. Request a receipt from the person who accepts your fixer for recycling in order to document that you are managing your waste properly.

X-ray Developer

Do not mix developer and fixer solutions. Waste developer may be flushed down the drain; silver-laden fixer cannot. Some older processing units mix the spent fixer and developer. The entire resulting solution becomes hazardous waste and many recyclers will not accept it. If your office has one of these units buy an adapter kit to keep the two solutions separate.

Lead Foil/Lead Shields

Lead foil that shields X-ray film or protective lead shields should not be put in the trash. This material may be a hazardous *waste unless* it is recycled for its scrap metal content. The Lake County dental survey indicates that a high percentage of the dentists already recycle lead foil. Eastman Kodak, along with companies that recycle amalgam or fixer and many scrap metal dealers also accept lead waste. Lead foil reclaimers have been included with the list of amalgam and silver recycling companies following these guidelines.

Cleaners for X-ray Developer Systems

Many cleaners for X-ray developer systems contain chromium. Chromium is also a toxic substance identified by the Remedial Action Plan and the International Joint Commission. However, according to photo industry representatives environmentally safe cleaners not containing chromium are as effective as those that contain this ingredient. Check the package label or the Material Safety Data Sheet (MSDS) to see if the cleaner you use contains chromium. If it does, ask your dealer to get a non-chromium cleaner. If your cleaner does contain this metal, the wastes must be managed as a hazardous waste and counted in the 220 pound conditionally exempt small quantity generation limit. It is easier and more economical to use a system cleaner that does not contain chromium.

Disinfectants

Most used disinfectants may be discharged directly to the sewage system. Verify and follow label directions. Residue left in containers may be rinsed down the drain. The container may be disposed of in the trash *or* recycled through your local program. Flush the drain well when disposing of any disinfectant.

Straight alcohols and ethers are considered ignitable and must not be sent down the drain because they could explode. These materials are considered *hazardous waste*.

Chemiclave Waste

In most cases, used chemical sterilizer waste may be discharged to the sewer system; flush the drain well when disposing of this waste. Any chemical waste is a hazardous waste if it has a flashpoint (temperature at which it will ignite, if exposed to a

spark) below 140 degrees Fahrenheit. The pollution prevention option is to steer clear of these low-flash-point preparations or any preparations containing formaldehyde. Also, buying only the amount of chemical sterilizer needed eliminates the need to dispose of excess material.

Other Wastes

Blood Flowable quantities of blood may be discharged to the sewer system. Swabs or dressings that meet Indiana's definition of *infectious waste* must be treated as infectious medical waste and handled according to the infectious waste rules.

Sharps: Needles, scalpels, reamers, broaches, and other sharp objects that could cause a puncture wound should not be placed directly into the trash, even if they are sterilized. This type of waste should be placed in a puncture-proof container. Dispose according to Indiana's infectious waste rule.

Office Waste: Although office waste is usually not hazardous, aluminum, glass, newspaper, corrugated cardboard, and office paper may easily be recycled through your trash hauler or local recycling program. Please call your local solid waste management district office or IDEM's Office of Pollution Prevention at 800-451-6027 for more information.

Compliance with State and Federal Hazardous Waste Rules

Here's where it pays for you to closely monitor your clinic's wastes. If a dental office or clinic generates less than 220 pounds in any calendar month of hazardous waste, it is considered a conditionally exempt small quantity generator and *is not* subject to hazardous waste regulations. Since these regulations can be time-consuming and must be closely followed to protect people and the

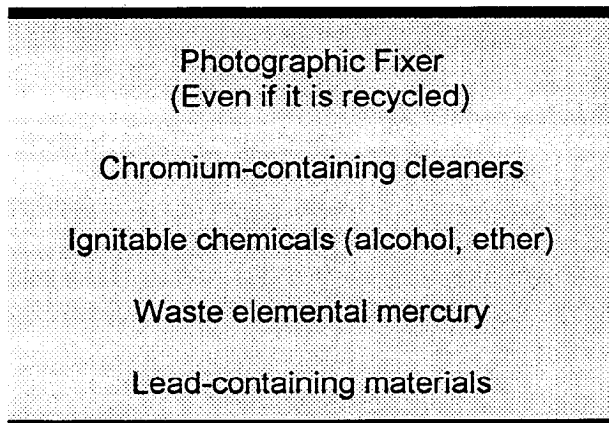
environment from the harmful effects of dangerous wastes, they may increase the time and the expense of operating your business.

An assumption exists that most dentists and clinics generate less than 220 pounds of hazardous waste from all sources in a month. To minimize your efforts and expense, and yet comply with the safety regulations, monitor your waste and ensure that you do not exceed the 220 pound-per-month limit. If you exceed it, even one month, you will not be exempt from the regulations for the waste generated in that month.

As a conditionally exempt small quantity generator of hazardous waste in Indiana, your only requirement is to monitor your wastes to make sure that you stay below the 220-pound limit. In addition, IDEM asks that you carefully store and dispose of those wastes according to the manufacturer's instructions.

Dispose or Recycle Waste

If you generate any of the following wastes, their amounts must be figured into the 220-pound-per-month allowable amount, and the materials must be disposed of or recycled properly.



If you generate more than 220 pounds of hazardous waste per month, you must comply with additional regulations. For more information, contact:

Office of Solid and Hazardous
Waste Management
Indiana Department of
Environmental Management
100 North Senate Avenue, P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-4518
(800) 451-6027 ext. 2-4518

For further information about how to prevent pollution from your dental practice, please call:

David F. Lawrence
Indiana Department of Environmental
Management
504 North Broadway, Suite 418
Gary, IN 46402
(219) 881-6712

or contact the Office of Pollution Prevention and Technical Assistance 800 451-6027 ext. 2-8172.

Note: This guide was prepared with the assistance of a grant from the United States Environmental Protection Agency.

Dental Waste Disposal Checklist

Waste Type	Source	Recommended Management Method
Amalgam Particles	Excess Mix	1. Send to a recycler.
Amalgam Particles	Traps, Screens, Filters, Separators	1. Clean out daily. 2. Treat as <i>infectious waste</i> . 3. Recycle, or dispose of as <i>infectious waste</i> .
Waste Mercury	Spills, Spill Cleanup	1. Count as <i>hazardous waste</i> toward 220 lb. limit . 2. Send to a recycler.
Empty Amalgam Capsules		1. Dispose of in the trash.
Fixer	X-ray Processing	1. Sell, give away, or pay to have silver reclaimed. 2. Buy silver recovery system. 3. Count as <i>hazardous waste</i> toward 220 lb. limit.
Developer	X-ray Processing	1. Discharge to sewer.
Combined Fixer and Developer	X-ray Processing	1. Purchase kit to separate liquids in processor, and use methods listed for fixer and developer.
Chromium-Containing X-ray System Cleaners	X-ray System Cleaning	1. Switch to non-chrome cleaners. 2. Count as <i>hazardous waste</i> toward 220 lb. limit.
Disinfectants	Used	1. Stop using ignitable and formaldehyde preparations. 2. Discharge remainder to sewer.
Chemiclave Chemicals	Used	1. Discontinue use of ignitable and formaldehyde preparations. 2. Discharge remainder to sewer.
Chemiclave Chemicals	New	1. Call dealer to check on status as <i>hazardous waste</i> ; manage material as directed by dealer.
Lead Foils and Shields	X-ray Processing Protective Shields	1. Send to Eastman Kodak or a local metal reclaimer.
Blood(liquid, flowable)	Drains, traps, screens, etc.	1. Discharge to sewer.
Bloody Materials	Swabs or cotton dressings	1. Dispose of as <i>infectious waste</i> .
Sharps		1. Treat as <i>infectious waste</i> .
Office Waste		1. Reduce. 2. Reuse 3. Recycle as much as possible. 4. Contact local solid waste management district or 1-800-451-6027, ext. 2-8172 for more information.

Dental Practice Recycling Resources

Amalgam Recyclers

EnviroChem
21821 Industrial Boulevard
Rogers, MN 55374
(612) 428-4002

Mercury Refining Company
709 Watervliet-Shaker Road
Latham, NY 12110
(800) 833-3505

Premier Dental
478 South Robert Street
St. Paul, MN 55107
(612) 222-0741

Strickland Refining Company
1290 81st Avenue Northeast
Minneapolis, MN 55107
(612) 786-2858

Silver Recyclers

James Alexander
5534 Maple Grove Road
Hermantown, MN 55811
(218) 729-8928

EnviroChem
21821 Industrial Boulevard
Rogers, MN 55374
(612) 428-4002

W.E. Mowery & Company
1435 University Avenue
St. Paul, MN 55104
(612) 646-1895

Strickland Refining Company
1290 81st Avenue Northeast
Minneapolis, MN 55107
(612) 786-2858
(Note: Will take Fixer that is
contaminated with developer.)

Silver Recovery Systems

American Precious Metals
151 A Highway 35 North
River Falls, WI 54022
(715) 425-9005

Silver Recovery Systems

Eastman Kodak Company
343 State Street
Rochester, NY 14650-0547
(800) 933-8031

Northern Recovery Systems
5260 Samuelson Road
Duluth, MN 55811
(218) 729-5697

Sloan Metal Company, Inc.
2416 South Archer Avenue
Chicago, IL
(312) 326-0101

Lead Foil Reclaimers

Eastman Kodak Company
343 State Street
Rochester, NY 14650-0547
(800) 933-8031

Lake Iron & Metal
741 Hoffman Street
Hammond, IN 46327
(219) 931-5065

Northwest Metals Co.
4606 Tod Avenue
East Chicago, IL 46312
(219) 398-5510

Medical Waste Transporters/Disposers

WMI Medical Waste Services of Illinois
5245 West 38th Street
Cicero, IL 60650
(800) MED-WAST
(708) 652-4600

This list may not be all inclusive. Any omission is unintentional. IDEM does not endorse any of the companies on this list.