

Hazardous (and Universal) Waste Management



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CE Credits: 2 hours

Intended Audience: Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assistant Students

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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Note to Iowa dental professionals: This course complies with the Iowa Dental Board for recertification in the area of infection control standards, as established by the Centers for Disease Control and Prevention (CDC).

Conflict of Interest Disclosure Statement

- Ronald L Occhionero reports no conflicts of interest associated with this course. He has no relevant financial relationships to disclose.
- Shelly Feiwell reports no conflicts of interest associated with this course. She has no relevant financial relationships to disclose.
- Ms. Denise Kissell reports no conflicts of interest associated with this course. She has no relevant financial relationships to disclose.

Short Description

This continuing education course focuses on those parts of federal EPA regulations (40 CFR Parts 260-273) that are relevant to developing and implementing an effective hazardous waste management program in oral healthcare settings. It is advisory in nature and informational in content.

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Overview

Participants in this course will be introduced to the EPA's Hazardous Waste Standard, 40 Code of Federal Regulations (CFR), Parts 260-273. The course is advisory in nature and informational in content. It focuses on those parts of the regulations that apply to oral healthcare facilities and is intended to assist in developing and implementing an effective hazardous waste management program.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Understand the purpose and general requirements of EPA's Hazardous Waste Standard.
- Understand key terms associated with hazardous waste.
- Understand the process of hazardous waste determination.
- Discuss the principles related to listed hazardous waste.

- Discuss the principles related to characteristic hazardous waste.
- Discuss key elements of hazardous (and universal) waste management.
- Identify hazardous waste generated in the oral healthcare setting.
- Implement best management practices related to hazardous waste generated in oral healthcare settings.

Introduction

The Resource Conservation and Recovery Act (RCRA) of 1976, an amendment to the Solid Waste Disposal Act provides general guidelines for the management of non-hazardous (Subtitle B) and hazardous solid wastes (Subtitle C).¹ The RCRA also set national goals to protect human health and the environment, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

While the RCRA provides a framework for the waste management program envisioned by Congress, it gives the federal Environmental Protection Agency (EPA) the authority to develop explicit, legally enforceable requirements for waste management (Title 40, Code of Federal Regulations (CFR), Parts 239-282).² The EPA also promulgates guidance documents and policy directives to clarify issues related to the implementation of the RCRA.^{1,3}

The federal EPA defines any garbage, refuse, sludge, and other discarded material resulting from industrial, commercial, mining, agricultural, healthcare, and community activities as **solid waste**.^{1,5} The definition does not imply that the waste is physically solid. A solid waste may be semi-solid, liquid, or contained gaseous material. **Discarded material** is any solid waste that is **inherently waste-like, recycled or abandoned** (Box A).^{1,4}

Most solid waste generated in oral healthcare settings is **non-hazardous solid waste**, a subset of **municipal solid waste**.⁶ Standard methods of collecting, storing, transporting, and disposing such wastes are regulated by state or local jurisdictions. It is of import to note that municipal solid waste regulations

Box A. EPA definitions of “discarded material” as they apply to solid wastes.^{1,4}

Inherently waste-like	Some materials pose such a treat to human health and the environment that they are always considered solid waste, i.e., they are “inherently waste-like.”
Recycled	A material is considered “recycled” if it is used or reused (e.g., as an ingredient in a process), reclaimed, or used in a manner constituting disposal (e.g., burned for energy).
Abandoned	The term “abandoned” means thrown away. A material is considered abandoned if it is disposed of, burned, or incinerated.

often include mandatory requirements for recycling certain materials (e.g., newspapers, cardboards, plastics, glass containers, aluminum cans, etc.).

A small percentage of solid waste generated in oral healthcare settings is **hazardous solid waste** derived from **hazardous material**. These may be biological, chemical, radiological, or physical agents used or generated in the workplace, which because of their quantity; concentration; or physical, chemical, or infectious nature pose a hazard to human health (increase the incidence of serious illness or mortality) or to the environment when improperly handled.¹

Subsets of hazardous solid waste include **regulated medical waste** and **hazardous waste**. The federal OSHA and its counterpart state agencies are responsible for developing and enforcing rules for regulated medical waste. These rules are based on anticipated risks of exposure to blood and other potentially infectious material and relate to workers’ health and safety. A review of **regulated medical waste management** in oral healthcare settings is presented elsewhere.⁶

The federal OSHA and its counterpart state agencies are also responsible for developing and enforcing rules for **hazardous chemicals** as they relate to workers’ health and safety. These rules are predicated on anticipated risks of exposure to chemicals in the workplace and the need to communicate this information to workers based on the principle of “right to know.” A review of **hazard communication compliance** in oral healthcare settings is presented elsewhere.⁷

Federal EPA regulations (40 CFR, Parts 239-259) identify state and local governments as the primary planning and regulating entities for non-hazardous solid waste management such as household garbage and industrial solid waste.² Title 40 CFR, Parts 260-273 establishes a federal program for hazardous solid wastes management from cradle to grave to ensure that hazardous solid wastes are handled in a manner that protects human health and the environment.²

This continuing education course focuses on those parts of federal EPA regulations (40 CFR Parts 260-273) that are relevant to developing and implementing an effective **hazardous waste management program** in oral healthcare settings. It is advisory in nature and informational in content. Since state regulatory requirements may be more stringent, the State-by-State Hazardous Waste Resource Locator provides information for specific jurisdictions (Figure 1).⁴

Hazardous Waste Determination

Hazardous waste management begins with a determination whether the material to be discarded is a solid waste (Figure 2). Subsection 40 CFR Part 264(a) specifically excludes several materials from the definition of solid waste. Similarly, subsection 40 CFR Part 264(b) specifically excludes certain solid wastes from the definition of hazardous waste. Wastes that are excluded from the definition of solid waste and/or hazardous waste are not subject to EPA regulations.⁴

If a waste is determined to be a solid waste that is not excluded from the definition of solid and/or hazardous waste, the next step is to determine whether the waste is listed or

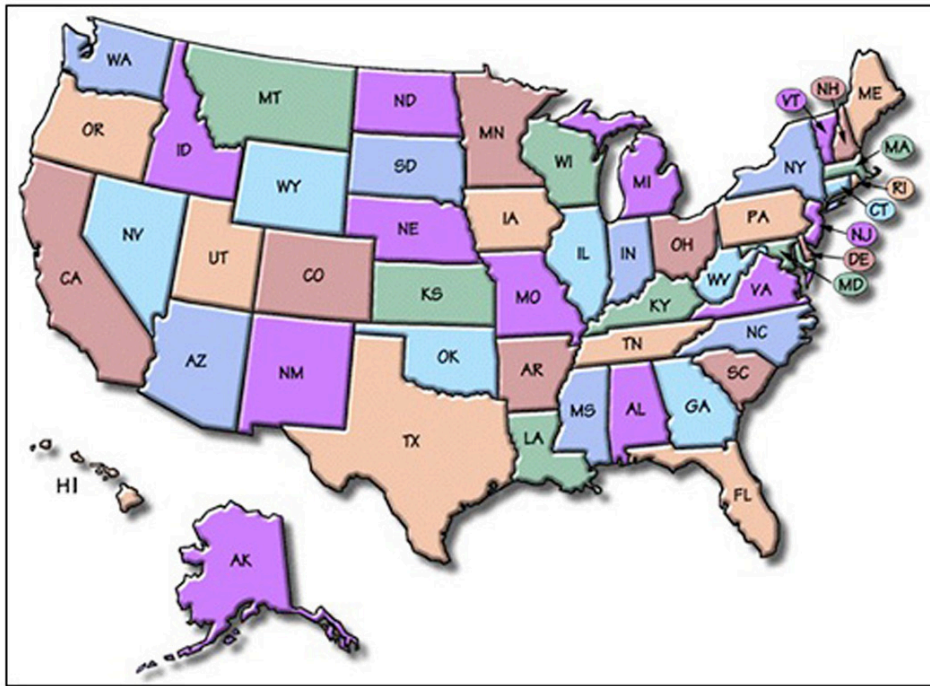


Figure 1. State-by-State Hazardous Waste Resource Locator.⁸

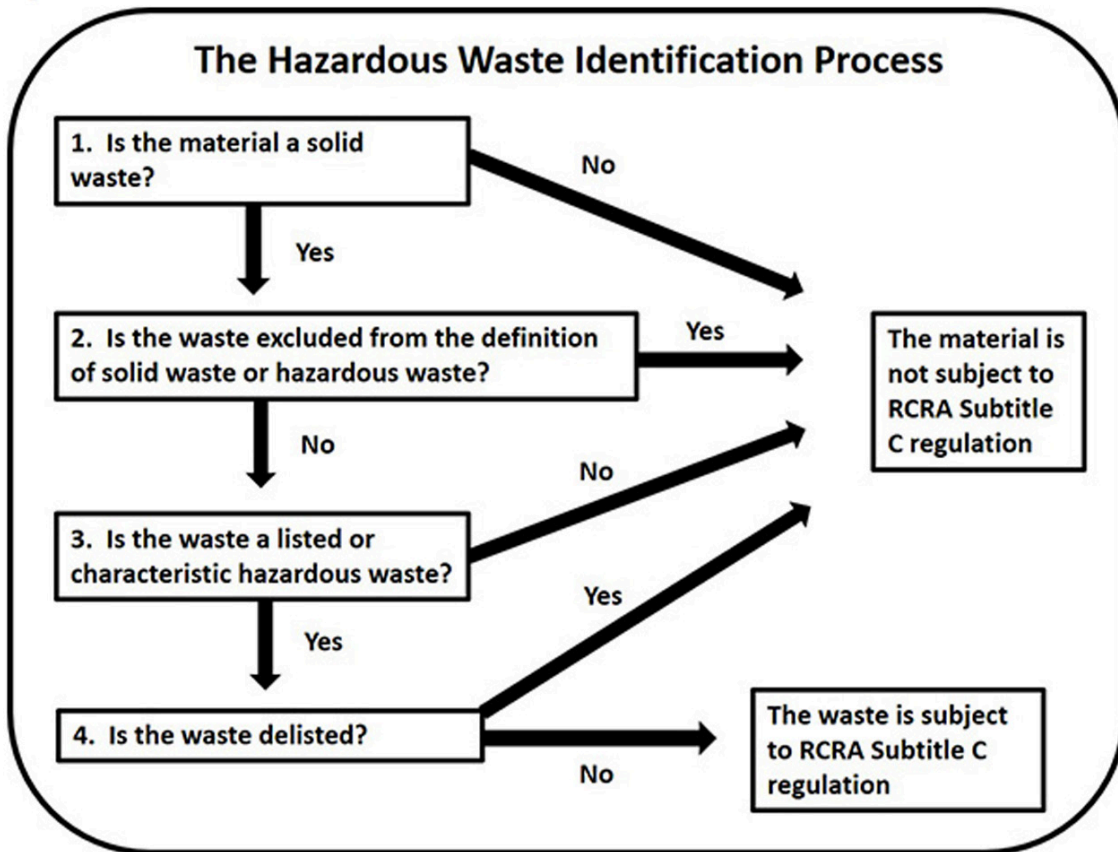


Figure 2. Hazardous Waste Identification Process.⁴

characteristic. **Listed hazardous waste** means that the material appears on EPA lists F, K, P, or U.^{1,2,9} Listed hazardous wastes are specific types of wastes from various industrial processes, wastes from specific sectors of industry, or wastes in the form of specific chemical formulations.

To indicate the reason for listing a waste, the EPA also assigns a hazard code to each waste listed on the F, K, P, and U lists.^{1,2,9} Hazard codes I (ignitable), C (corrosive), R (reactive) and E (toxicity characteristic waste) reflect typical hazardous properties of specific listed wastes. Codes T (toxic waste) and H (acutely hazardous waste) apply to listed wastes whose constituents pose additional threats to human health and the environment.¹

Characteristic hazardous wastes are not listed on the F, K, P, or U lists, but they do exhibit one or more of the following four measurable “characteristic” properties of hazardous wastes: ignitability, corrosivity, reactivity, or toxicity.^{1,2,9} Characteristically ignitable, corrosive, and reactive hazardous wastes carry EPA waste codes D001, D002, and D003, respectively. Characteristically toxic hazardous wastes carry EPA waste codes D004 through D043.

Listed Hazardous Wastes

The **F-list** (40 CFR Part 261.31) identifies seven major categories of wastes from common manufacturing and industrial processes as hazardous.^{1,2,9} Because the processes generating these wastes occur in different sectors of industry, F-listed wastes are considered non-source specific wastes. With the possible exception of non-halogenated solvents such as acetone or xylene (EPA code F003 [I and T]), F-listed wastes are not likely to be found in oral healthcare facilities.^{1,2,9}

The **K-list** identifies hazardous wastes from specific sectors of industry and manufacturing and, therefore, K-listed wastes are considered source-specific wastes.^{1,2,9} To qualify as a K-listed hazardous waste, the waste must fit into one of the 13 major categories on the list and the waste must match one of the detailed K-list waste descriptions (40 CFR Part 261.32).^{1,2,9} K-listed wastes are not likely to be found in oral healthcare facilities.

The **P-** and **U-lists** designate as hazardous waste pure and commercial grade formulations of certain chemicals.^{1,2,9} For a waste to be considered a P- or U-listed waste it must meet the following three criteria: (1) it must contain one of the chemicals listed on the P or U list; (2) the chemical in the waste must be unused; and (3) the chemical in the waste must be 100 percent pure, commercial grade, or the sole active ingredient in a formulation.¹

The P-list (40 CFR Part 261.33) identifies 239 acutely toxic hazardous wastes from discarded commercial chemical products. Examples of P-listed chemicals found in oral healthcare facilities include epinephrine (P042[H]) and nitroglycerin (P081[H and R]).^{1,2,9} The U-list (40 CFR Part 261.33) identifies 472 hazardous wastes. Examples of U-listed chemicals that may be found in oral healthcare facilities include formaldehyde (U122[T]) and phenol (U188[T]).^{1,2,9}

Characteristic Hazardous Wastes

Ignitable wastes (40 CFR Part 261.21) readily catch fire; are spontaneously combustible; or have a flash point below 140°F (60°C), i.e., the vapor above a pool of liquid will catch fire under a standard set of conditions.^{1,2,9} Other ignitable wastes include non-liquids that burn under specific conditions (e.g., friction or water absorption), and certain compressed gases and strong oxidizers. Ignitable wastes (D001) in oral healthcare facilities include alcohol and silver nitrate.

Corrosive wastes (40 CFR Part 261.22) are acids and bases (pH equal to or less than 2 or a pH equal to or greater than 12.5), which can readily dissolve flesh or corrode metal and other materials such as storage tanks, drums, and barrels.^{1,2,9} Sulfuric acid from automotive batteries is among the most common hazardous corrosive wastes. Examples of corrosive wastes (D002) that may be found in oral healthcare facilities include acetic acid and sodium hydroxide.

Reactive wastes (40 CFR Part 261.23) readily explode (e.g., discarded munitions) or may undergo violent reactions under normal handling conditions.^{1,2,9} Other reactive wastes explode or violently react when exposed to heat or water; or generate toxic fumes, gases,

or vapors or explosive mixtures when exposed to water.^{1,2,9} Lithium-sulfur batteries that may be found in oral healthcare facilities are considered reactive wastes (D003).

Toxic wastes (40 CFR Part 261.24) leaching into groundwater drinking supplies from wastes disposed of in landfills is one of the most common ways the general population can be exposed to hazardous chemicals found in industrial waste.^{1,2,7,9} Some toxic wastes generated in oral healthcare facilities may contain lead (D008), mercury (D009), and silver (D011), which are regulated at levels of 5.0 mg/L, 0.2 mg/L and 5.0 mg/L, respectively.

Hazardous Waste Management

Under the RCRA, hazardous waste generators (40 CFR Part 261 and 262) are the first link in the cradle-to-grave hazardous waste management system.¹⁻³ Because various types of facilities generate different quantities of wastes resulting in varying degrees of risk to human health and the environment, the degree of regulation to which each generator is subjected to depends on how much waste each generator produces every calendar month (Box B).

Universal Waste Management

Universal waste management programs promote the collection and recycling of a certain widely generated subset of hazardous wastes, known as **universal waste**.¹⁰ Currently, there are four types of wastes covered under universal waste regulations: hazardous waste batteries, pesticides, mercury-containing equipment, and fluorescent lamps (40 CFR Part 273). The State-by-State Universal Waste Resource Locator provides information for specific jurisdictions (Figure 3).¹¹

Hazardous Waste Management in Oral Healthcare Settings

Under federal regulations nearly all oral healthcare facilities fall under the CESQG category. However, some states do not recognize the EPA's CESQG category and in those states dental offices are regulated as SQGs.¹² Other states have a CESQG category, but require that CESQGs follow SQG requirements related to the tracking of and accountability for the waste. The State-by-State

Hazardous Waste Resource Locator provides information for specific jurisdictions.⁸

To be in compliance with RCRA hazardous waste rules under federal EPA regulations, CESQG oral healthcare facilities are not required to obtain an EPA ID number, comply with hazardous waste accumulation and storage requirements, follow the manifest system, or meet recordkeeping and reporting requirements, and there is no time limit on how long they may accumulate hazardous waste (as long as the 1,000 kg maximum quantity limit is not exceeded).

However, it is prudent practice (not specifically required by the EPA) to label hazardous waste containers with the words "Hazardous Waste" and the identity of their contents (Figure 4). It is also prudent (not specifically required by EPA) that oral healthcare facilities maintain records (e.g., manifests, billing records, certificates of disposal, or other documents from hazardous waste disposal contractors) demonstrating that they have properly disposed of their waste.

Mercury-containing Waste: Scrap Amalgam

Dental amalgam is a mixture of two nearly equal parts of liquid mercury (D009) and a powder containing silver (D011), tin, copper, zinc and other metals.¹³ When amalgam restorations are placed in or removed from teeth, or during chewing, a small amount of mercury vapor is released. Although the vapor may be absorbed by inhalation or ingestion, the FDA considers amalgam restorations safe for adults and children over the age of six.

However, amalgam waste not captured or removed at the dental office is discharged into a sanitary sewer system. From the sewers the amalgam waste is transferred to publically-owned treatment works (POTWs), i.e., sewage treatment plants. POTWs remove about 95 percent of the amalgam waste, which then becomes part of the POTWs sewage sludge. The sludge may then be disposed of in landfills, incinerated, or applied to agricultural land as fertilizer.

If the sludge is sent to a landfill, the mercury component may be released into ground

Box B. Categories of hazardous waste generators.¹⁻³

Categories of hazardous waste generators	Definitions of hazardous waste generator categories	Regulatory requirement
Large quantity generators (LQG)	Facilities that generate: <ul style="list-style-type: none"> ✓ 1,000 kg or more of hazardous waste per calendar month (approximately 2,200 lbs.) or ✓ 1 kg or more of acutely hazardous waste per calendar month (approximately 2.2 lbs.) 	LQGs and SQGs must: <ul style="list-style-type: none"> ✓ Identify whether their solid waste is a hazardous waste, and if so, determine the quantity of hazardous waste generated in a calendar month to establish its generator category ✓ Obtain an EPA ID number ✓ Comply with accumulation and storage requirements (including requirements for training and emergency arrangements)
Small quantity generators (SQG)	Facilities that generate: <ul style="list-style-type: none"> ✓ Greater than 100 kg (approximately 220 lbs.) but less than 1,000 kg of hazardous waste per calendar month and ✓ Accumulate on-site 6,000 kg or less (approximately 13,200 lbs.) of hazardous waste at any time 	<ul style="list-style-type: none"> ✓ Prepare the hazardous waste for transportation ✓ Track the shipment and receipt of such waste ✓ Meet recordkeeping and reporting requirements
		VSQGs must: <ul style="list-style-type: none"> ✓ Identify whether their solid waste is a hazardous waste, and if so, determine the quantity of hazardous waste generated in a calendar month to establish its generator category ✓ Comply with waste accumulation quantity limit requirement <ul style="list-style-type: none"> • May not accumulate or store more than 1,000 kg of hazardous waste
Very small quantity generators (VSQG)	Facilities that generate: <ul style="list-style-type: none"> ✓ 100 kg or less of hazardous waste per calendar month or ✓ 1 kg or less of acutely hazardous waste per calendar month. 	<ul style="list-style-type: none"> ✓ Accumulate hazardous wastes in containers in a manner that prevents its release into the environment ✓ Deliver their own hazardous waste in their own vehicle or have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility: <ul style="list-style-type: none"> • Permitted or interim status hazardous waste treatment, storage, and disposal facility (TSDF) • State hazardous waste facility • Municipal solid waste landfill (MSWLF) • Recycling facility • Universal waste facility (see Universal Waste Management section)

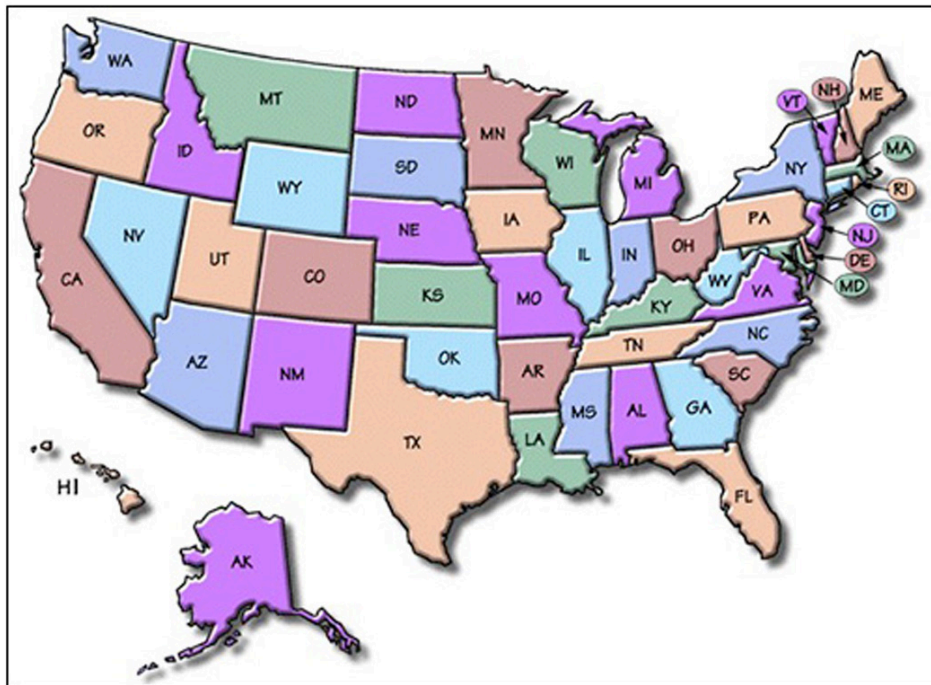


Figure 3. State-by-State Universal Waste Resource Locator.¹¹



Figure 4. "Hazardous Waste" Label.

water or the air; if it is incinerated, mercury may be emitted into the air; and if the sludge is used as fertilizer, evaporating mercury may become airborne. Airborne mercury is eventually deposited onto surface water, land and vegetation. Mercury is a persistent and bio-accumulative pollutant in the environment with well-documented neurotoxic effects on humans.

On June 14, 2017, the EPA finalized specific regulatory guidance to require dental practices to comply with requirements for controlling the discharge of mercury and other metals in dental amalgam into POTWs based on the

best available technology.¹⁴ Most dental offices already use some type of basic filtration system (chairside traps, vacuum pump filters); in addition, the EPA regulatory guidance enacted in 2017 required non-exempt dental offices to install amalgam separators by 2020.⁹ Amalgam separators are devices designed to remove amalgam particles from dental office wastewater through sedimentation, filtration, centrifugation, chemical removal by ion exchange or a combination of these technologies. Amalgam separators that meet the International Organization for Standardization (ISO) standard (ISO 11143) can capture over 95 percent of the amalgam waste discharged by dental offices into sanitary sewer systems.¹⁵⁻¹⁶

The ADA encourages dentists to implement **best management practices** (BMPs) to help reduce the environmental effects of amalgam waste (Box C).¹⁵ BMP is a method or technique available to oral healthcare facilities that has been generally accepted as the best because it produces results that are superior to those achieved by other means or because it has become the standard way of doing things, i.e., the standard way of complying with legal or ethical requirements.

Box C. Best management practices for the disposal of mercury-containing scrap amalgam.¹⁵⁻¹⁶

1. Stock pre-capsulated amalgam alloys in a variety of sizes to minimize the amount of hazardous mercury-containing amalgam waste generated.
 - A. DO NOT USE BULK ELEMENTAL MERCURY.
2. Collect and store used (both partially filled and empty) disposable amalgam capsules in a wide-mouthed, airtight container labeled "Hazardous Waste - Amalgam Capsules."
 - A. Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
 - i. DO NOT PLACE AMALGAM CAPSULES IN NON-HAZARDOUS OFFICE WASTE OR REGULATED MEDICAL WASTE CONTAINERS.
3. Use chairside disposable or reusable traps, vacuum pump filters, and an ISO 11143-compliant amalgam separator to capture amalgam particles generated when removing old or carving new amalgam restorations.
 - A. Disposable chairside trap – when the trap is full, remove trap according to manufacturer's recommendations and place it in a wide-mouthed, airtight container labeled "Hazardous Waste – Scrap Amalgam."
 - i. Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
 - a. DO NOT RINSE DISPOSABLE CHAIRSIDE TRAPS THAT CONTAIN AMALGAM PARTICLES IN THE SINK.
 - b. DO NOT TROW DISPOSABLE CHAIRSIDE TRAPS THAT CONTAIN AMALGAM PARTICLES IN NON-HAZARDOUS OFFICE WASTE OR REGULATED MEDICAL WASTE CONTAINERS.
 - B. Reusable chairside trap – when the trap is full, remove and clean trap according to manufacturer's recommendations and place content in a wide-mouthed, airtight container labeled "Hazardous Waste – Scrap Amalgam."
 - i. Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
 - a. DO NOT RINSE REUSABLE CHAIRSIDE TRAPS THAT CONTAIN AMALGAM PARTICLES IN THE SINK.
 - C. Vacuum pump filter – change filter according to manufacturer's recommendations, put the lid on the filter and place it in the box in which it was originally shipped.
 - i. Once the box is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
 - a. DO NOT RINSE VACUUM PUMP FILTERS THAT CONTAIN AMALGAM PARTICLES IN THE SINK.
 - b. DO NOT THROW DISPOSABLE VACUUM PUMP FILTERS THAT CONTAIN AMALGAM IN NON-HAZARDOUS OFFICE WASTE OR REGULATED MEDICAL WASTE CONTAINERS.
 - D. Amalgam separators.
 - i. Follow manufacturer's recommendations for maintenance and recycling procedures.

Box D. Best management practices for the disposal of spent x-ray developer solution¹⁷

1. Discharge spent developer solution into the sanitary sewer system if the pH is within approved limits. A. DO NOT DISCHARGE SPENT DEVELOPER SOLUTION INTO A SEPTIC SYSTEM. B. DO NOT MIX SPENT DEVELOPER SOLUTION WITH FIXER SOLUTION.
2. If the pH is not within regulatory limits or the oral healthcare facility is on a septic system, collect and store spent developer solution in a container labeled "Hazardous Waste - Used Developer." A. Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.

Silver-containing Waste: Spent X-ray Developer Solution

Used developer solutions are typically considered non-hazardous waste because their silver content is usually below the regulatory level of 5 mg/L.¹⁷ In most jurisdictions, the solution may be disposed of in the municipal sewer system if the pH is within 6 to 10. The State-by-State Hazardous Waste Resource Locator provides information for specific jurisdictions.⁸ Used developer solution should never be disposed of in a septic system, it will destabilize the system.

Some x-ray processing systems mix the spent developer and fixer and render the solution hazardous waste. Consider changing the equipment. It is also of note that unused developer solutions typically contain 1 to 5 percent hydroquinone. While this chemical is not considered hazardous waste by the EPA, it is neither listed nor characteristic, many state and local jurisdictions restrict its disposal. Consult the State-by-State Hazardous Waste Resource Locator.⁸

Silver-containing Waste: Spent X-ray Fixer Solution

The x-ray fixer is typically a weak acid solution. During the fixing process, light-sensitive silver-halide crystals present on radiographic films are released as silver-thiosulfate. The concentration of silver in spent fixer solutions is in the range of 3,000 to 8,000 mg/L, while the regulatory level of silver is 5 mg/L.¹⁷ In the environment, free-ionic silver acts as an enzyme inhibitor by interfering with metabolic processes within organisms.

On-site treatment of spent fixer solutions minimizes the risk of toxicity. The best option for an average practice is the use of a Chemical Recovery Cartridge (CRC). CRCs are canisters filled with another metal, usually steel wool. The iron dissolves in the fixer solution and interacts with the silver, i.e., the silver plates-out on the iron. To minimize the amount of silver from spent fixer from entering sanitary sewer or septic systems follow best management practices (Box E).

Box E. Best management practices for the disposal of spent x-ray fixer solution¹⁷

1. Use a CRC to capture silver from the spent fixer solution and collect the silver-iron residue in a container. A. Label the hazardous waste container "Hazardous Waste – Silver Residue."
 - i. Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility. a. DO NOT DISCARD SPENT FIXER INTO SANITARY SEWER OR SEPTIC SYSTEMS. b. DO NOT PLACE CRC INTO MUNICIPAL GARBAGE.
2. The de-silvered fixer solution can be diluted with water and disposed of in sanitary sewer or septic systems. A. The x-ray developer is an aqueous solution with a slightly basic pH due to the presence of potassium hydroxide. Environmental risks are minimal unless exposure is to concentrated solution. i. The spent developer may be mixed with the de-silvered fixer, diluted with water, and discharged into sanitary sewer or septic systems.

N.B.

1. Many cleaner solutions for x-ray developer systems contain chromium (D007), a toxic substance. A. DO NOT DISCHARGE CHROMIUM-CONTAINING CLEANERS INTO SANITARY SEWER OR SEPTIC SYSTEMS. i. Ask the supplier for a cleaner that is chromium-free.

Silver-containing Waste: Undeveloped Radiographic Film

Undeveloped films contain high levels of silver and must be treated as hazardous waste. Collect and store unused film in a wide-mouthed, airtight container labeled “Hazardous Waste – Unused X-ray Film.” Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.¹⁸ Developed radiographic films have little residual silver and may be disposed of as non-hazardous office waste for recycling or disposal.

Lead Containing Waste: Lead Foil in Radiographic Film Packets

Elemental lead from lead foil in radiographic packets is a leachable toxin that can contaminate the soil and groundwater in landfill sites. Lead foil must be treated as hazardous waste. Collect and store lead foils in a wide-mouthed, airtight container labeled “Hazardous Waste – Lead Foil.” Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility for recycling or disposal.¹⁸

Lead Containing Waste: Leaded Aprons and Collars

Elemental lead from lead foil in radiographic packets is a leachable toxin that can

contaminate the soil and groundwater in landfill sites. Lead foil must be treated as hazardous waste. Collect and store lead foils in a wide-mouthed, airtight container labeled “Hazardous Waste – Lead Foil.” Once the container is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility for recycling or disposal.¹⁸

Chemical Waste: Disinfectants and Sterilants

EPA-registered intermediate-level hospital disinfectants include chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, and iodophors.¹⁹ FDA-registered sterilants/high-level disinfectants include glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, and hydrogen peroxide with peracetic acid.¹⁹ Chemiclaves may use formaldehyde. Some of these chemicals are P- or U-listed while others may be characteristic hazardous wastes. Information to determine if a chemical (including disinfectant and sterilant) is hazardous can be obtained from the Safety Data Sheet (SDS) provided by the supplier of the product.⁷ In some jurisdictions disposal into a sanitary sewer system is permitted if a product is first treated, for example Cidex OPA, an aldehyde, treated with glycine. To minimize the environmental effects of disinfectants and sterilants, follow best management practices (Box F).

Box F. Best management practices for the use of and disposal of chemical disinfectants and sterilants.^{7,19}

1. Ensure office personnel have read the SDS for all chemicals (including the SDS for chemical disinfectants and sterilants) used in the oral healthcare facility and are trained to handle hazardous chemicals.
2. Avoid the use of chemical disinfectants and sterilants, especially halogenated products (i.e., those containing chlorine or iodine), and glutaraldehydes) when other alternatives are available. A. Follow manufacturers’ recommendations on treatment and disposal of waste disinfectants and sterilants. i. DO NOT POUR CHEMICAL DISINFECTANT AND STERILANTS INTO A SEPTIC SYSTEM. B. Paper or cloth products impregnated with disinfectants and sterilants may be disposed of as non-hazardous office waste. C. Rinse empty disinfectant and sterilant containers with water, remove or deface labels to indicate the container no longer contains hazardous chemicals, and discard as non-hazardous office waste.
3. Use steam and dry heat to sterilize heat-tolerant instruments and devices. A. Replace chemiclaves with autoclaves to avoid the use of formaldehyde.

Pharmaceutical Wastes

In general, the disposal of expired and other drugs is regulated by the federal EPA and/or its counterpart state agencies if the sole active ingredient in the pharmaceutical in question is a hazardous waste (e.g., epinephrine [P042]), the pharmaceutical contains some other ingredient that results in the pharmaceutical to exhibit a characteristic of hazardous waste (e.g., contains enough alcohol [D001] to be flammable), or the material is otherwise regulated by your state environmental agency.²⁰ Disposal of controlled substances is regulated by the U.S. Drug Enforcement Administration (DEA).²¹

Hazardous pharmaceutical wastes are most commonly treated by incineration and the resulting ash is disposed of in a permitted hazardous waste landfill. The federal EPA recommends that non-hazardous and non-controlled drugs should be incinerated in accordance with state and local environmental regulations.^{22,23} No drugs should be disposed of into the sanitary sewer, septic systems or in the municipal trash to avoid impacts to the environment and health of the public.²⁴

The disposal of controlled or scheduled drugs under the Controlled Substance Act must be managed according to the regulations issued by the DEA.²¹ Oral healthcare practitioners registered with the DEA may destroy unused controlled substances in accordance with state guidelines, which require appropriate documentation. BMP for the disposal of pharmaceutical waste – a ten-step blueprint for healthcare facilities is presented elsewhere.²⁴

Summary

Non-hazardous and hazardous solid wastes are regulated under the federal RCRA. The RCRA gives the federal EPA and its counterpart state agencies the responsible for developing and enforcing rules for solid waste management. These rules require all businesses, including oral healthcare facilities, to determine if they generate hazardous waste. Dental offices that generated hazardous wastes must comply with regulations related to managing and disposing such wastes.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/ce-courses/ce499/test

1. Which statement is inaccurate related to the management of non-hazardous and hazardous solid wastes?

- A. The Resource Conservation and Recovery Act (RCRA) of 1976, an amendment to the Solid Waste Disposal Act provides general guidelines for the management of non-hazardous and hazardous solid wastes.
- B. The RCRA gives the federal Environmental Protection Agency (EPA) the authority to develop explicit, legally enforceable requirements for waste management.
- C. The EPA promulgates guidance documents and policy directives to clarify issues related to the implementation of the RCRA.
- D. The RCRA gives the federal Occupational Health and Safety Administration (OSHA) the authority to develop explicit, legally enforceable requirements for waste management.

2. Which does not match the definition of solid waste by the EPA?

- A. Garbage, refuse, sludge, and other discarded material resulting from industrial, commercial, mining, agricultural, healthcare, and community activities.
- B. Solid waste excludes discarded recycled waste.
- C. Semi-solid, liquid, or contained gaseous material.
- D. Discarded material that is inherently waste-like or abandoned.

3. Which is uncharacteristic of the solid waste generated in oral healthcare settings?

- A. Most is non-hazardous solid waste, a subset of municipal solid waste.
- B. Most is hazardous solid waste, a subset of municipal solid waste.
- C. A small percentage is hazardous solid waste derived from hazardous material.
- D. A large percentage of chemical hazardous material is generated.

4. Which statement incorrectly defines the federal and state agencies responsible for developing and enforcing rules for medical waste management, hazard communication, and hazardous waste management?

- A. The federal OSHA and its counterpart state agencies are responsible for regulated medical waste management.
- B. The federal OSHA and its counterpart state agencies are responsible for hazardous communication compliance.
- C. The federal EPA and its counterpart state agencies are responsible for hazardous communication compliance.
- D. The federal EPA and its counterpart state agencies are responsible for hazardous wastes management.

5. Which statement about classifying hazardous waste is inaccurate?

- A. Hazardous waste management begins with a determination whether the material to be discarded is a solid waste.
- B. A solid waste is subject to EPA regulations if it is a listed or a characteristic waste.
- C. Hazard codes I, C, R, and E reflect typical hazardous properties of specific listed solid wastes.
- D. Characteristic hazardous wastes with properties such as ignitability, corrosivity, reactivity, or toxicity are listed on the EPA's F, K, P, or U lists.

6. Which incorrectly identifies the listed wastes that would be found in oral healthcare facilities?

- A. With the possible exception of non-halogenated solvents such as acetone or xylene, F-listed wastes are not likely to be found.
- B. K-listed wastes are considered source-specific wastes and are the most common listed wastes likely to be found.
- C. P-listed chemicals found in oral healthcare facilities include epinephrine (P042 [H]) and nitroglycerin (P081 [H and R]).
- D. U-listed chemicals that may be found include formaldehyde (U122 [T]) and phenol (U188 [T]).

7. Which is uncharacteristic of wastes found in oral healthcare facilities?

- A. Examples of ignitable wastes (D001) include alcohol and silver nitrate.
- B. Examples of corrosive wastes (D002) include acetic acid and sodium hydroxide.
- C. Reactive wastes (D003) leaching into groundwater from landfills is a common way to be exposed to hazardous chemicals.
- D. Some toxic wastes generated in oral healthcare facilities may contain lead (D008), mercury (D009), and silver (D011).

8. Which statement accurately describes the waste produced under a VSQG classification?

- A. VSQGs generate >10 kg of acutely hazardous waste per calendar month.
- B. VSQGs generate 100-1000kg of hazardous waste per calendar month.
- C. VSQGs generate ≤100 kg of hazardous waste per calendar month.
- D. VSQGs may accumulate and store up to 6,000 kg of hazardous waste.

9. Which product is not covered under universal waste regulations?

- A. Waste batteries
- B. Pesticides
- C. Scrap amalgam
- D. Fluorescent lamps

10. Which statement inaccurately describes the VSQG category for hazardous wastes management in oral healthcare facilities?

- A. Under federal regulations nearly all oral healthcare facilities fall under the VSQG category.
- B. Some states do not recognize the EPA's VSQG category and in those states dental offices are regulated as SQGs.
- C. Some states require that VSQGs follow SQG requirements related to the tracking of and accountability for the waste.
- D. Oral healthcare facilities that fall under the VSQG category are required to obtain an EPA ID number.

11. Which is not included among the best management practices for the disposal of mercury-containing scrap amalgam?

- A. Stocking pre-capsulated amalgam alloys in a variety of sizes.
- B. Collecting and storing used disposable amalgam capsules in a container labeled "Hazardous Waste - Amalgam Capsules."
- C. Using chairside disposable or reusable traps, vacuum pump filters, or an amalgam separator to capture amalgam particles.
- D. The rinsing of reusable chairside mercury traps in the sink.

12. Which statements incorrectly depicts best management practices for the disposal of spent x-ray developer solution?

- A. Never discharge spent developer solution into the sanitary system.
- B. If the oral healthcare facility is on a septic system, collect and store spent developer solution in a labeled container.
- C. Full containers of spent developer can be transported to an approved hazardous waste management facility.
- D. Discharge spent developer solution into the sanitary sewer system if the pH is within approved limits.

13. Which statement inaccurately reflects best management practices for the disposal of spent x-ray fixer solution?

- A. Use a CRC to capture silver and collect the silver-iron residue in a labeled container.
- B. Avoid mixing fixer and developer together during disposal.
- C. Dilute the de-silvered fixer solution with water and discharge it into a sanitary sewer or septic system.
- D. The CRC may be disposed of as municipal waste.

14. Which statement inaccurately represents best management practices for the disposal of radiographic film?

- A. Collect and store undeveloped film in a wide-mouthed, airtight container.
- B. Have an approved transporter deliver unused film to an approved hazardous waste management facility.
- C. Developed radiographic films may be disposed of as non-hazardous office waste for recycling or disposal.
- D. Developed radiographic film have high levels of residual silver.

15. Which approach is not included in the best management practices for the disposal of lead foil in radiographic film packets?

- A. Lead foil is best disposed of as municipal waste.
- B. Lead foil must be treated as hazardous waste.
- C. Collect and store lead foils in a wide-mouthed, airtight container
- D. Have an approved transporter deliver it to an approved hazardous waste management facility.

16. Unwanted leaded aprons and collars must be treated as hazardous waste - have an approved hazardous waste transporter deliver them to an approved facility for recycling or disposal.

- A. True
- B. False

17. Which statement is inaccurate regarding the use of EPA and FDA-registered disinfectants?

- A. EPA-registered intermediate-level hospital disinfectants include chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, and iodophors.
- B. FDA-registered sterilants/high-level disinfectants include glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, and hydrogen peroxide with peracetic acid.
- C. Information to determine if a chemical is hazardous can be obtained from the Safety Data Sheet (SDS) provided by the supplier of the product.
- D. Disinfectant wipes impregnated with an EPA registered intermediate-level hospital disinfectant must be disposed of as regulated hazardous waste.

- 18. Which statement does not represent best management practices for the disposal of chemical disinfectants and sterilants?**
- A. Ensure office personnel are trained to handle all hazardous chemicals used in the oral healthcare facility.
 - B. Rinse empty containers with water, remove or deface labels, and discard as non-hazardous office waste.
 - C. Replace chemiclaves with autoclaves to avoid the use of formaldehyde.
 - D. Rinse empty containers with water, leave labeling, and discard as regulated hazardous waste.
- 19. Which is not considered a best management practice for the disposal of pharmaceutical agents?**
- A. Federal EPA and/or its counterpart state agencies regulate drug disposal if the sole active ingredient is a listed hazardous waste.
 - B. If a drug contains some ingredient in sufficient quantity to be considered a hazardous waste, EPA regulates the disposal.
 - C. Non-hazardous and non-controlled drugs may be disposed of into sanitary sewer or septic systems.
 - D. Disposal of controlled substances is regulated by the U.S. Drug Enforcement Administration (DEA).
- 20. Oral healthcare practitioners registered with the DEA may destroy unused controlled substances in accordance with state guidelines, which require appropriate documentation.**
- A. True
 - B. False

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Additional Resources

- No Additional Resources Available

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