

# Hazardous (and Universal) Waste Management



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**Conflict of Interest Disclosure Statement**

- The authors report no conflicts of interest associated with this course.

**Introduction**

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).<sup>1</sup> 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).<sup>2</sup> The EPA also promulgates guidance documents and policy directives to clarify issues related to the implementation of the RCRA.<sup>1,3</sup>

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**.<sup>1,4</sup> The definition does not imply that the waste is physically solid. A solid waste may be semi-solid (or semi-liquid), liquid, or contained gaseous material. **Discarded material** is any solid waste that is **inherently waste-like, recycled or abandoned** (Box A).<sup>1,4</sup>

Most solid waste generated in oral healthcare settings is **non-hazardous solid waste**, a subset of **municipal solid waste**.<sup>5</sup> 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 often include mandatory requirements for recycling certain

**Box A. EPA definitions of “discarded material” as they apply to solid wastes.<sup>1,4</sup>**

<b>Inherently waste-like</b>	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.”
<b>Recycled</b>	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).
<b>Abandoned</b>	The term “abandoned” means thrown away. A material is considered abandoned if it is disposed of, burned, or incinerated.

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.<sup>1</sup>

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.<sup>6</sup>

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.<sup>7</sup>

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.<sup>2</sup> 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.<sup>2</sup>

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).<sup>8</sup>

### **Hazardous Waste Determination**

Hazardous waste management begins with a determination whether the material to be

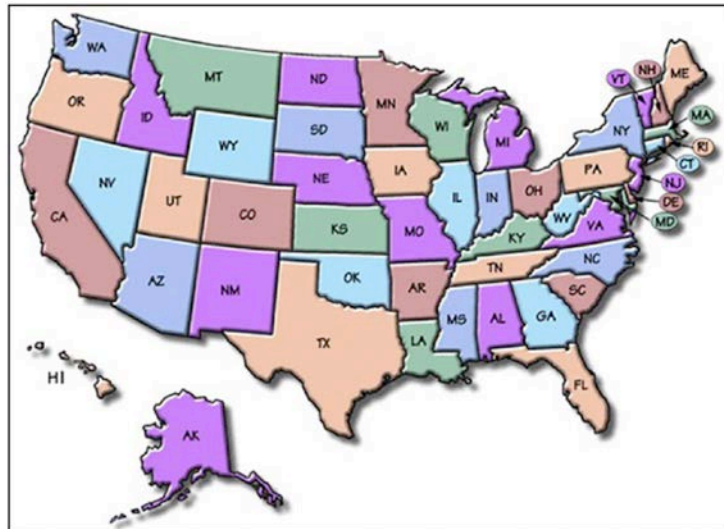


Figure 1. State-by-State Hazardous Waste Resource Locator.<sup>8</sup>

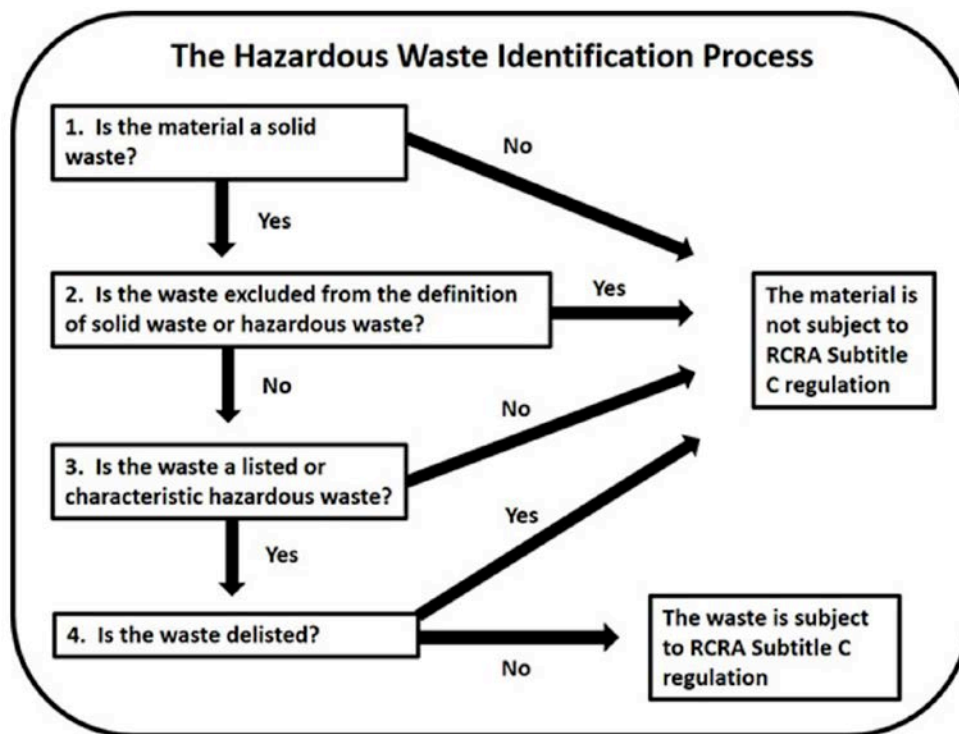


Figure 2. Hazardous Waste Identification Process.<sup>4</sup>

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.<sup>4</sup>

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

characteristic. **Listed hazardous waste** means that the material appears on EPA lists F, K, P, or U.<sup>1,2,9</sup> 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.<sup>1,2,9</sup> 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.

**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.<sup>1,2,9</sup> 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.<sup>1,2,9</sup> 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.<sup>1,2,9</sup>

The **K-list** identifies hazardous wastes from specific sectors of industry and manufacturing and, therefore, K-listed wastes are considered source-specific wastes.<sup>1,2,9</sup> 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).<sup>1,2,9</sup> 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.<sup>1,2,9</sup> 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.

The P-list (40 CFR Part 261.33) identifies over 235 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]).<sup>1,2,9</sup> The U-list (40 CFR Part 261.33) identifies over 470 hazardous wastes. Examples of U-listed chemicals that may be found in oral healthcare facilities include formaldehyde (U122[T]) and phenol (U188[T]).<sup>1,2,9</sup>

### 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.<sup>1,2,9</sup> 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.<sup>1,2,9</sup> 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.<sup>1,2,9</sup> 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.<sup>1,2,9</sup>



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.<sup>1,2,6,9</sup> 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.<sup>1-3</sup> 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

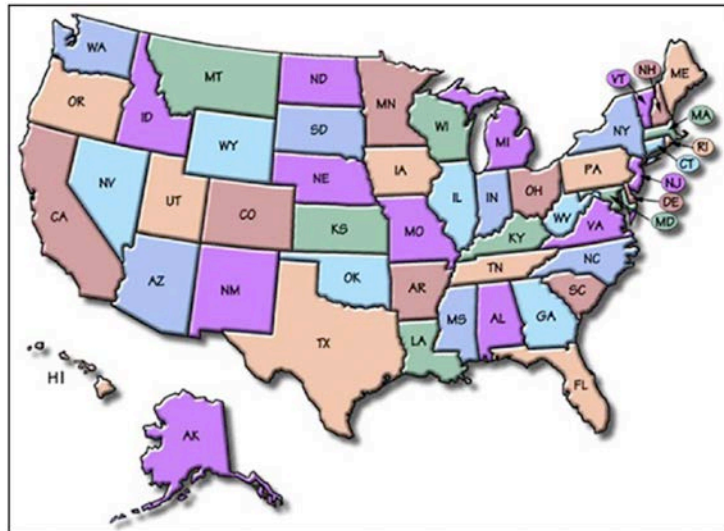
Universal waste management programs promote the collection and recycling of a certain widely generated subset of hazardous wastes, known as **universal waste**.<sup>10</sup> Currently, there are five types of wastes covered under universal waste regulations: hazardous waste batteries, pesticides, mercury-containing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

**Box B. Categories of hazardous waste generators.**<sup>1-3</sup>

Categories of hazardous waste generators	Definitions of hazardous waste generator categories	Regulatory requirement
<b>Large quantity generators (LQG)</b>	Facilities that generate: <ul style="list-style-type: none"> <li>1,000 kg or more of hazardous waste per calendar month (approximately 2,200 lbs.)</li> <li><b>or</b></li> <li>1 kg or more of acutely hazardous waste per calendar month (approximately 2.2 lbs.)</li> </ul>	LQGs and SQGs must: <ul style="list-style-type: none"> <li>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</li> <li>Obtain an EPA ID number</li> <li>Comply with accumulation and storage requirements (including requirements for training and emergency arrangements)</li> <li>Prepare the hazardous waste for transportation</li> <li>Track the shipment and receipt of such waste</li> <li>Meet recordkeeping and reporting requirements</li> </ul>
<b>Small quantity generators (SQG)</b>	Facilities that generate: <ul style="list-style-type: none"> <li>Greater than 100 kg (approximately 220 lbs.) but less than 1,000 kg of hazardous waste per calendar month</li> <li><b>and</b></li> <li>Accumulate on-site 6,000 kg or less (approximately 13,200 lbs.) of hazardous waste at any time</li> </ul>	

**Box B. Continued.**

Categories of hazardous waste generators	Definitions of hazardous waste generator categories	Regulatory requirement
Very small quantity generators (VSQG)	<p>Facilities that generate:</p> <ul style="list-style-type: none"> <li>• 100 kg or less of hazardous waste per calendar month</li> </ul> <p><b>or</b></p> <ul style="list-style-type: none"> <li>• 1 kg or less of acutely hazardous waste per calendar month.</li> </ul>	<p>VSQGs must:</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• Comply with waste accumulation quantity limit requirement <ul style="list-style-type: none"> <li>◦ May not accumulate or store more than 1,000 kg of hazardous waste</li> </ul> </li> <li>• Accumulate hazardous wastes in containers in a manner that prevents its release into the environment</li> <li>• 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"> <li>◦ Permitted or interim status hazardous waste treatment, storage, and disposal facility (TSDF)</li> <li>◦ State hazardous waste facility</li> <li>◦ Municipal solid waste landfill (MSWLF)</li> <li>◦ Recycling facility</li> <li>◦ Universal waste facility (see Universal Waste Management section)</li> </ul> </li> </ul>



**Figure 3.** State-by-State Universal Waste Resource Locator.<sup>11</sup>

### Hazardous Waste Management in Oral Healthcare Settings

Under federal regulations nearly all oral healthcare facilities fall under the VSQG category. However, some states do not recognize the EPA's VSQG category and in those states dental offices are regulated as SQGs.<sup>12</sup> Other states have a VSQG category, but require that VSQGs 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.<sup>8</sup>

To be in compliance with RCRA hazardous waste rules under federal EPA regulations, VSQG 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



**Figure 4.** "Hazardous Waste" Label.

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.<sup>13</sup> 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 publicly-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 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.<sup>14</sup> Most dental offices already use some type of basic filtration system (chairside traps, vacuum pump filters); in addition, some states and local governments have enacted regulations requiring dental offices to install amalgam separators.<sup>8</sup>

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.<sup>15,16</sup>

The ADA encourages dentists to implement **best management practices** (BMPs) to help reduce the environmental effects of amalgam waste (Box C).<sup>15</sup> 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.

### **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.<sup>17</sup> 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.<sup>8</sup> 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.<sup>8</sup>

### **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.<sup>17</sup> 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 C. Best management practices for the disposal of mercury-containing scrap amalgam.**<sup>15,16</sup>

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, or 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 TROW 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 solution.<sup>17</sup>**

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.

**Box E. Best management practices for the disposal of spent x-ray fixer solution.<sup>17</sup>**

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.<sup>18</sup> 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.<sup>18</sup>

#### **Lead Containing Waste: Leaded Aprons and Collars**

Elemental lead from leaded aprons and other protective devices (e.g., leaded thyroid shields) is a leachable toxin that can contaminate soil and groundwater in landfill sites if these items are disposed of as non-hazardous office waste. Unwanted leaded aprons and collars must be treated as hazardous waste. Have an approved hazardous waste transporter deliver unwanted leaded safety devices to an approved hazardous waste management facility for recycling or disposal.<sup>18</sup>

#### **Chemical Waste: Disinfectants and Sterilants**

EPA-registered intermediate-level hospital disinfectants include chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, and iodophors.<sup>19</sup> FDA-registered sterilants/high-level disinfectants include glutaraldehyde, glutaraldehyde with phenol, hydrogen peroxide, and hydrogen peroxide with peracetic acid.<sup>19</sup> 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.<sup>7</sup> 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).

#### **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.<sup>20</sup> Disposal of controlled substances is regulated by the U.S. Drug Enforcement Administration (DEA).<sup>21</sup>

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 disposed of in a solid waste landfill or incinerated in accordance with state and local environmental regulations.<sup>22,23</sup> Non-hazardous pharmaceuticals should not be disposed of into sanitary sewer or septic systems.

The disposal of controlled or scheduled drugs under the Controlled Substance Act must be managed according to the regulations issued by the DEA.<sup>21</sup> 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.<sup>24</sup>

#### **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

**Box F. Best management practices for the use of and disposal of chemical disinfectants and sterilants.<sup>7,19</sup>**

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.

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/professional-education/ce-courses/ce499/test](http://www.dentalcare.com/en-us/professional-education/ce-courses/ce499/test)

- 1. All of the following statements related to the management of non-hazardous and hazardous solid wastes are correct, EXCEPT for one. Which one is the exception?**
  - 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. All of the following statements related to waste are correct, EXCEPT for one. Which one is the exception?**
  - A. The EPA defines any garbage, refuse, sludge, and other discarded material resulting from industrial, commercial, mining, agricultural, healthcare, and community activities as solid waste.
  - B. Discarded recycled waste does not qualify as solid waste.
  - C. The definition of solid waste does not imply that the waste is physically solid, it may be a semi-solid (or semi-liquid), liquid, or contained gaseous material.
  - D. By definition, discarded material is any solid waste that is inherently waste-like, recycled, or abandoned.
  
- 3. All of the following statements related to solid waste are correct, EXCEPT for one. Which one is the exception?**
  - A. Most solid waste generated in oral healthcare settings is non-hazardous solid waste, a subset of municipal solid waste.
  - B. Most solid waste generated in oral healthcare settings is hazardous solid waste, a subset of municipal solid waste.
  - C. A small percentage of solid waste generated in oral healthcare settings is hazardous solid waste derived from hazardous material.
  - D. Hazardous material may be biological, chemical, radiological, or physical agents used or generated in the workplace.
  
- 4. All of the following statements identify correctly the agency responsible for developing and enforcing rules for medical waste management, hazard communication, and hazardous waste management, EXCEPT for one. Which one is the exception?**
  - A. The federal OSHA and its counterpart state agencies are responsible for developing and enforcing rules for regulated medical waste management.
  - B. The federal OSHA and its counterpart state agencies are responsible for developing and enforcing rules for hazardous communication compliance.
  - C. The federal EPA and its counterpart state agencies are responsible for developing and enforcing rules for hazardous communication compliance.
  - D. The federal EPA and its counterpart state agencies are responsible for developing and enforcing rules for hazardous wastes management.

5. **All of the following statements are correct with respect to solid wastes EXCEPT which one?**
- 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 (ignitable), C (corrosive), R (reactive), and E (toxicity characteristic waste) reflect typical hazardous properties of specific listed solid wastes.
  - D. Characteristic hazardous wastes with measurable “characteristic” properties such as ignitability, corrosivity, reactivity, or toxicity are listed on the EPA’s F, K, P, or U lists.
6. **All of the following statements about listed wastes are correct EXCEPT which one?**
- A. With the possible exception of non-halogenated solvents such as acetone or xylene, F-listed wastes are not likely to be found in oral healthcare facilities.
  - B. K-listed wastes are considered source-specific wastes and are the most common listed wastes likely to be found in oral healthcare facilities.
  - C. Examples of P-listed chemicals found in oral healthcare facilities include epinephrine (P042 [H]) and nitroglycerin (P081 [H and R]).
  - D. Examples of U-listed chemicals that may be found in oral healthcare facilities include formaldehyde (U122 [T]) and phenol (U188 [T]).
7. **All of the following statements about characteristic wastes are correct EXCEPT which one?**
- A. Examples of ignitable wastes (D001) that may be found in oral healthcare facilities include alcohol and silver nitrate.
  - B. Examples of corrosive wastes (D002) that may be found in oral healthcare facilities include acetic acid and sodium hydroxide.
  - C. Reactive wastes (D003) 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.
  - D. Some toxic wastes generated in oral healthcare facilities may contain lead (D008), mercury (D009), and silver (D011).
8. **All of the following statements about hazardous waste management are correct EXCEPT which one?**
- A. Under the RCRA, hazardous waste generators are the first link in the cradle-to-grave hazardous waste management system.
  - B. Although various types of facilities generate different quantities of hazardous waste, the regulatory requirements for all hazardous waste generators are the same.
  - C. VSQGs generate  $\leq 100$  kg of hazardous waste per calendar month or  $\leq 1$  kg of acutely hazardous waste per calendar month.
  - D. VSQGs may not accumulate and store more than 1,000 kg of hazardous waste.
9. **All of the following types of wastes are covered under universal waste regulations EXCEPT which one?**
- A. Waste batteries
  - B. Pesticides
  - C. Mercury-containing scrap amalgam
  - D. Fluorescent lamps

- 10. All of the following statements related to hazardous wastes management in oral healthcare settings are correct, EXCEPT for one. Which one is the exception?**
- 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 have a VSQG category, but require that VSQGs follow SQG requirements related to the tracking of and accountability for the waste.
  - D. Under federal regulations oral healthcare facilities that fall under the VSQG category are required to obtain an EPA ID number.
- 11. Best management practices for the disposal of mercury-containing scrap amalgam include all of the following, EXCEPT for one. Which one is the exception?**
- A. Stocking pre-capsulated amalgam alloys in a variety of sizes to minimize the amount of hazardous mercury-containing amalgam waste generated.
  - B. Collecting and storing used disposable amalgam capsules in a wide-mouthed, airtight container labeled "Hazardous Waste - Amalgam Capsules."
  - C. Using chairside disposable or reusable traps, vacuum pump filters, or an ISO 11143-compliant amalgam separator to capture amalgam particles generated when removing old or carving new amalgam restorations.
  - D. The rinsing of reusable chairside mercury traps in the sink.
- 12. All of the following statements reflect best management practices for the disposal of spent x-ray developer solution, EXCEPT for one. Which one is the exception?**
- A. Never discharge spent developer solution into the sanitary system.
  - B. 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."
  - C. Once the container labeled "Hazardous Waste - Used Developer" is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
  - D. Discharge spent developer solution into the sanitary sewer system if the pH is within approved limits of state and local jurisdictions.
- 13. All of the following statements reflect best management practices for the disposal of spent x-ray fixer solution, EXCEPT for one. Which one is the exception?**
- A. Use a CRC to capture silver from the spent fixer solution and collect the silver-iron residue in a container labeled "Hazardous Waste - Silver Residue."
  - B. Have an approved hazardous waste transporter deliver the full "Hazardous Waste - Silver Residue" container to an approved hazardous waste management facility.
  - 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. All of the following statements represent best management practices for the disposal of radiographic film, EXCEPT for one. Which one is the exception?**
- A. Collect and store unused (undeveloped) film in a wide-mouthed, airtight container labeled "Hazardous Waste - Unused X-ray Film."
  - B. Once the container labeled "Hazardous Waste - Unused X-ray Film" is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility.
  - C. Developed radiographic films have little residual silver and may be disposed of as non-hazardous office waste for recycling or disposal.
  - D. Developed radiographic film must be disposed of as hazardous waste.

- 15. All of the following statements represent best management practices for the disposal of lead foil in radiographic film packets, EXCEPT one. Which one is the exception?**
- 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 labeled "Hazardous Waste – Lead Foil."
  - D. Once the container labeled "Hazardous Waste – Lead Foil" is full, have an approved hazardous waste transporter deliver it to an approved hazardous waste management facility for recycling or disposal.
- 16. Unwanted leaded aprons and collars must be treated as hazardous waste - have an approved hazardous waste transporter deliver unwanted leaded safety devices to an approved hazardous waste management facility for recycling or disposal.**
- A. True
  - B. False
- 17. All of the following statements with respect to EPA-registered intermediate-level hospital disinfectants and FDA-registered sterilants/high-level disinfectants are correct, EXCEPT for one. Which one is the exception?**
- 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 (including disinfectant and sterilant) 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. All of the following statements represent best management practices for the disposal of chemical disinfectants and sterilants, EXCEPT for one. Which one is the exception?**
- A. 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.
  - B. 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.
  - C. Replace chemiclaves with autoclaves to avoid the use of formaldehyde.
  - D. Rinse empty disinfectant and sterilant containers with water, leave labeling, and discard as regulated hazardous waste.
- 19. All of the following statements represent best management practices for the disposal of pharmaceutical agents, EXCEPT for one. Which one is the exception?**
- A. 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 formulation is a listed hazardous waste.
  - B. In general, the disposal of expired and other drugs is regulated by the federal EPA and/or its counterpart state agencies if the formulation contains some ingredient in sufficient quantity to be considered a hazardous waste.
  - 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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