RCRA INFOCUS

PHOTO PROCESSING

- Regulatory Review
- Reducing Risk From Photo Processing Solutions
- Resources For The Photo Processing Industry

EPA

United States Environmental Protection Agency

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FOR MORE INFORMATION CALL:

RCRA Hotline

U. S. Environmental Protection Agency
800 424-9346 or TDD 800 553-7672.
In the Washington, DC, area:
703 412-9810 or TDD 703 412-3323.

Foreword

If you are a photo processor, your business probably generates hazardous waste. That means you must follow regulations issued by the Environmental Protection Agency (EPA or the Agency) under a law called the Resource Conservation and Recovery Act (RCRA). Under RCRA, you are required to follow certain practices and procedures associated with the safe management of hazardous waste. *RCRA in Focus* provides an overview of the basic federal regulations covering wastes that are likely to be hazardous in your business. It also provides recycling and pollution prevention options to help businesses decrease the amount of hazardous waste they produce.

EPA acknowledges the photo processing industry for taking steps to practice and foster pollution prevention for silver-bearing wastes. This industry continually works to control silver discharges from photographic processing plants. Photo processors have developed a voluntary *Code of Management Practice for Silver Discharge*, which provides a cleaner, cheaper, and smarter means of promoting environmental performance by enhancing silver recovery by processors of photographic materials, in firms of all types and sizes. These management systems could decrease the amount of silver released to the environment and increase silver recycling and reuse. Employing these practices, however, does not relieve photo processors from their RCRA regulatory obligations.

EPA currently is assessing the risks associated with the management of silver-bearing wastes. The data from the study will provide the basis for determining whether silver needs to remain a RCRA-regulated hazardous waste. If the study determines that silver poses minimal risks to human health and the environment, EPA will initiate the process to change current regulations. While the Agency is assessing the RCRA regulatory status of silver-bearing wastes, wastes that meet the Toxicity Characteristic must be managed as hazardous waste.

Frequently Asked Questions About RCRA

What Is RCRA?

RCRA is a federal law that encourages environmentally sound methods for managing commercial and industrial waste as well as household and municipal waste. It regulates facilities that generate, transport, treat, store, or dispose of hazardous waste. The vast majority of photo processors are considered hazardous waste generators, rather than treatment, storage, and disposal facilities (TSDFs), which are subject to more rigorous regulations.

The term "RCRA" is often used interchangeably to refer to the law, the regulations, and EPA policy and guidance. The *law* describes the waste management program mandated by Congress that gave EPA authority to develop the RCRA program. EPA *regulations* carry out the Congressional intent by providing explicit, legally enforceable requirements for waste management. EPA *guidance documents* and *policy directives* clarify issues related to the implementation of the regulations.

All of the RCRA hazardous waste regulations can be found in the *Code of Federal Regulations* (CFR), Title 40, Parts 260 to 279. The CFR can be accessed at <www.access.gpo.gov/nara> or purchased through the U.S. Government Printing Office (GPO).

Who Is Regulated?

Any photo processor who generates waste is potentially subject to RCRA hazardous waste requirements. You must conduct tests required by the regulations or use your knowledge of and familiarity with the waste you generate to determine whether it is hazardous waste (as opposed to other types of waste). You might be subject to substantial civil and criminal penalties if you fail to properly or completely identify hazardous waste generated by your business.

What Is Hazardous Waste?

To be considered hazardous waste, a material first must be classified as a solid waste. EPA defines solid waste as garbage, refuse, sludge, or other discarded material (including solids, semisolids, liquids, and contained gaseous materials). If your waste is considered solid waste, you must then determine if it is hazardous waste. Wastes are defined as hazardous by EPA if they are specifically named on one of four lists of hazardous wastes (listed wastes) or if they exhibit one of four characteristics (characteristic wastes). Each type of RCRA hazardous waste is given a unique hazardous waste code using the letters D, F, K, P, or U and three digits (e.g., D001, F005, P039). See pages 8 to 10 for additional information on photo processing waste.

Listed Wastes. Wastes are listed as hazardous because they are known to be harmful to human health and the environment when not managed properly, regardless of their concentrations. Photo processing labs do not typically generate listed wastes. The lists include the following three types of waste:

- **Non-Specific Source Wastes.** These are material-specific wastes, such as solvents, generated by several different industries. Waste codes range from F001 to F039.
- **Specific Source Wastes.** These are wastes from specifically identified industries. Waste codes range from K001 to K161.
- **Discarded Commercial Chemical Products.** Off-specification products, container residuals, spill residue runoff, or active ingredients that have spilled or are unused and that have been, or are intended to be, discarded. Waste codes for acutely hazardous chemicals are P001 to P205. Waste codes for toxic chemicals are U001 to U411.

Characteristic Wastes. Even if your waste does not appear on one of the hazardous waste lists, it still might be regulated as hazardous waste if it exhibits one or more of the following characteristics.

STATE REQUIREMENTS

You may be regulated both by your state hazardous waste agency and EPA. RCRA allows states to receive legal permission, known as authorization, to implement the RCRA hazardous waste program. You must always contact your state authority to determine which state requirements apply to your business.

To operate a hazardous waste program, a state's regulations must be consistent with, and at least as stringent as, the federal program. Some states adopt more stringent requirements for facilities handling hazardous waste, which are considered part of the authorized program.

MORE QUESTIONS?

Call the RCRA Hotline at 800 424-9346 or TDD 800 553-7672 for additional information about RCRA rules and regulations. In the Washington, DC, area, call 703 412-9810 or TDD 703 412-3323.

Questions

Hazardous wastes generated during photo processing are typically hazardous wastes due to the toxicity characteristic. A typical photo processor's waste is hazardous because of silver only.

- **Ignitability**. Ignitable wastes create fires under certain conditions or are spontaneously combustible, and have a flash point less than 60 °C (140 °F). Examples in the photo processing industry include wastes oils and used solvents. The waste code for these materials is D001.
- **Corrosivity**. Corrosive wastes are acids or bases that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Examples include chromium compounds generated by Kodachrome color reversal films that use ferricyanide. The waste code for these materials is D002.
- **Reactivity**. Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when mixed with water. Examples include lithium-sulfur batteries and explosives. The waste code for these materials is D003.
- **Toxicity**. Toxic wastes are harmful or fatal when ingested or absorbed. When toxic wastes are disposed of on land, contaminated liquid may drain (leach) from the waste and pollute ground water. Toxicity is defined through a laboratory procedure called the Toxicity Characteristic Leaching Procedure (TLCP). The waste codes for these materials range from D004 to D039. Silver (D011) contained in films, papers, and silver-rich solutions is generated during film processing.

How Are Generators Regulated?

If your business generates hazardous waste, you must manage it according to the regulations for your specific generator type. Hazardous waste generators are divided into three categories, according to how much they generate in a calendar month:

- **Large Quantity Generators (LQGs).** LQGs generate greater than or equal to 1,000 kg (approximately 2,200 lbs) of hazardous waste per month, or greater than 1 kg (approximately 2.2 lbs) of acutely hazardous waste per month.
- **Small Quantity Generators (SQGs).** SQGs generate greater than 100 kg (approximately 220 lbs) but less than 1,000 kg of hazardous waste per month.
- **Conditionally Exempt Small Quantity Generators (CESQGs).** CESQGs generate less than or equal to 100 kg of hazardous waste per month, and less than or equal to 1 kg of acutely hazardous waste per month.

Some states do not recognize the CESQG class. Contact your state environmental agency to find out if the CESQG status is recognized. **To find your appropriate state contact, call the RCRA Hotline at 800 424-9346.**

Under the federal RCRA requirements, your generator status might change from one month to the next as the quantity of the waste you generate changes. You must comply with whichever standard is applicable for a given month. In many cases, small businesses that fall into different generator categories at different times choose to always satisfy the more stringent requirements (usually state requirements) to simplify compliance. Generators must "count" the amount of waste generated during a calendar month, which involves adding up the total weight of all quantities of characteristic and listed waste generated at a particular facility. Certain wastes, such as those that are reclaimed or recycled continuously on site, are not counted under the federal regulations.

AM I REGULATED BY RCRA OR SUPERFUND?

RCRA regulates the treatment, storage, and disposal of hazardous waste being generated now and in the future. Superfund was created to pay for the identification, inspection, investigation, ranking, and cleanup of abandoned or uncontrolled sites where hazardous substances were disposed of, and where the people responsible for contamination are unable or unwilling to clean up. Call the RCRA Hotline for more information.

Hazardous wastes generated by a photo processing facility, for instance, may be regulated differently depending upon how the wastes are managed. For example:

- If a spent characteristic photographic fixer waste is stored on site and then reclaimed, it must be managed as a hazardous waste and counted towards the facility's generator status. The reclamation process itself is exempt from regulation.
- If the spent characteristic photographic fixer waste is directly reclaimed without prior storage, the waste is not counted towards the facility's generator status. The reclamation process itself is exempt from regulation.
- If the waste is destined for precious metals recovery (i.e., recovery of economically significant amounts of precious metals) then reduced standards for the generators, transporters, and storers of these materials apply.

Also, the reclamation of photographic fixer of photo processing wastewater may generate a characteristic sludge that contains silver. If this sludge is sent for reclamation, it is not a solid waste and thus, is not regulated as a hazardous waste. If the sludge is sent for disposal, it is subject to hazardous waste requirements.

Do Exclusions Exist?

The RCRA regulations contain many exclusions for wastes and waste management practices that are not considered to be hazardous. Several exclusions and exemptions pertain to the photo processing industry.

Exclusions and Exemptions	Description
Characteristic Sludge Exclusion	A secondary material that meets the definition of sludge and exhibits a characteristic of hazardous waste is not considered a hazardous waste when it is reclaimed. (This includes silver recovery residuals such as silver-flake, spent metallic replacement cartridges, precipitation sludges, and spent ion exchange resins being sent off site for silver reclamation.)
"Closed Loop Recycling" Exclusion	Some secondary materials that are returned to the process or processes in which they were generated are excluded from the definition of solid waste.

Questions

Exclusions and Exemptions	Description
Domestic Sewage Exclusion	Mixtures of domestic sewage and other wastes that pass through a sewer system to a POTW for treatment are excluded from the definition of a solid waste. Generators are encouraged to contact their local POTW for prior approval and any pretreatment requirements.
Precious Metals Exemption	Recyclable materials from which precious metals are recovered are exempt from full hazardous waste regulation. These materials are subject to administrative requirements only, including obtaining an EPA identification number, complying with recordkeeping requirements, using a manifest when shipping materials off site, and complying with land disposal restrictions notification requirements.
Wastewater Treatment Unit Exemption	Any hazardous waste tank system that is used to store or treat the wastewater that is managed at an onsite wastewater treatment facility with a Clean Water Act permit, or that discharges to a POTW, is exempt from the RCRA regulations.

The Life Cycle of a Typical Photo Processing Waste

You've just processed a large job and are left with silver-bearing spent fixer and washwater (D011) hazardous waste that must be managed according to RCRA. You generate a small quantity of this type of waste each month. To comply with local pretreatment limits, you have decided to recover your silver on site. You evaluate the merits of each recovery unit, which include: the initial capital cost, operating and maintenance costs, and the ability of the unit to recover the highest percentage of silver based on the types of wastewater received.

This example details one typical waste life cycle at a photo processing business and illustrates the most common scenario of activities you would conduct as an environmental manager. Other life cycles could apply depending on the waste, whether on site treatment will occur, the type of waste management units used, and your generator status. See page 4 for information about exemptions.

Photo processing produces several silver-bearing waste streams, ranging from less than 5 milligrams per liter (mg/l) to 12,000 mg/l of silver. The silver concentration depends primarily upon two factors: (1) the stage from which the wastes originate and (2) the type of film being processed. The predominant sources of recoverable silver are from the photo processing solutions and spent rinse water. The silver in these two waste streams exists predominantly as soluble silver-thiosulfate complex with small amounts of silver sulfide.

1

IDENTIFY WASTE

By running tests or using your knowledge of the waste, identify whether the waste is hazardous. Based on these analyses, you determine that the waste is hazardous due to its toxicity characteristic (silver.) Keep all records of test results, waste analyses, and other determinations made in the hazardous waste identification process for 3 years.

2

COUNT WASTE

As a second step, determine the amount of waste generated in the calendar month. Count spent characteristic photographic fixer waste that is stored on site, even if it is destined for reclamation. Do not count waste placed directly into exempt recycling units. If the waste streams contaminated with silver are placed directly into a silver recovery unit, the initial waste stream is not regulated and not counted. The characteristic sludge removed from the recovery unit is excluded from the definition of solid waste, as long as the sludge will be reclaimed. Spent fixer that is sent off site for reclamation is not exempt from hazardous waste regulation. Only count sludge that is to be sent for treatment or disposal.

6

COMPLY WITH RECORD-KEEPING REQUIREMENTS

Since you are storing recyclable materials, keep records to document that you are not accumulating such materials speculatively. A material is not accumulated speculatively if you can show that the material is potentially recyclable and has a feasible means of being recycled and that 75 percent of accumulated materials is recycled annually.

7

IMPLEMENT SQG PREPAREDNESS AND PREVENTION REQUIREMENTS

You ensure that emergency preparedness and prevention requirements are met. These include adequate emergency response systems and notification to local emergency response authorities.

11

CONTRACT WITH HAZARDOUS WASTE TRANSPORTER

To send waste off site to a treatment, storage, or disposal facility, contract with a registered hazardous waste transporter. A common carrier can be used to send silver-bearing materials (sludges, precipitate, and ion-exchange resins) to a refiner that are not classified as a hazardous waste.

12

FOLLOW U.S. DEPARTMENT OF TRANSPORTATION (DOT) PACKAGING STANDARDS

Before shipping waste off site for treatment, storage, or disposal, package, label, and mark waste containers in accordance with all applicable DOT requirements.

13

PREPARE HAZARDOUS WASTE MANIFEST

Send a manifest along with all hazardous waste sent off site to a treatment, storage and disposal facility (TSDF). Keep copies of all manifests for 3 years. The manifest contains a certification statement that you have made a good faith effort to minimize waste generation and select the best waste management method available to an SQG that an SQG can afford.

3

DETERMINE GENERATOR STATUS

Based on waste counting, determine your generator status. In this case, you have produced between 100 and 1,000 kg/month, which means you are an SQG.

4

OBTAIN EPA IDENTIFICATION NUMBER

To identify your business as a hazardous waste generator, obtain an EPA identification number by submitting Form 8700-12 (Notification of Regulated Waste Activity), which can be obtained from your state hazardous waste agency. Remember, your state requirements might be different.

5

ACCUMULATE SILVER-CONTAINING WASTES PRIOR TO RECOVERY

Place counted hazardous waste, such as spent characteristic fixer that is stored on site and characteristic sludge that is destined for disposal, in RCRA accumulation units (tanks or containers compatible with the waste). You are not required to store materials that contain economically significant amounts of precious metals (in this case silver) in RCRA-regulated management units. EPA provided a partial exemption for wastes containing precious metals because the agency assumes that these materials will be managed carefully due to their economic value. Not all states may recognize the reduced regulatory requirements for precious metals waste.

8

PREPARE CONTINGENCY PROCEDURES

SQGs must assign a facility emergency coordinator, who is often the facility owner. The coordinator's responsibility is simply to be on site or on call at all times and be prepared with contingency procedures.

9

IMPLEMENT PERSONNEL TRAINING

Ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures relevant to their responsibilities.

10

RECOVER SILVER FROM DIFFERENT WASTE STREAMS

(See page 10)

14

PREPARE APPROPRIATE LAND DISPOSAL RESTRICTIONS NOTIFICATION AND CERTIFICATION FORMS

Ensure that all hazardous waste sent off site for treatment, storage, or disposal is accompanied by appropriate Land Disposal Restrictions (LDR) program notifications and certifications. (See page 9 for a description of LDRs).

15

SEND WASTE OFF SITE FOR TREATMENT, STORAGE, OR DISPOSAL

Using your registered hazardous waste transporter, send the waste to a hazardous waste TSDF accompanied by the appropriate manifest and LDR notifications and certifications. Generators can send hazardous waste to certain permitted or interim status TSDFs that can accept your type of waste.

Requirements for Regulated Photo Processors

The following table presents an overview of the federal RCRA regulatory requirements for photo processors that are either LQGs, SQGs, or CESQGs. As noted, your state might have different or more stringent requirements.

RCRA REGULATORY REQUIREMENTS

REGULATORY REQUIREMENT	LQGS	SQGS	CESQGS	IMPLEMENTATION EXPLANATION
EPA Identification Number	✓	✓		• Obtain an EPA identification number for each facility within your company. EPA and states use this 12-character identification number to track hazardous waste activities. • Obtain an EPA identification number by submitting form 8700-12 (Notification of Regulated Waste Activity), which is provided by your state hazardous waste agency. This is a one-time notification. Contact your state regarding the need for renotification if circumstances at your facility change.
Hazardous Waste Identification	✓	✓	✓	• Identify whether you generate hazardous waste to determine if you are subject to the RCRA hazardous waste regulations. Test procedures are described in "Test Methods for The Evaluation of Solid Waste, Physical/Chemical Methods, SW-846" or tests can be performed in a local laboratory.
Waste Counting	✓	✓	✓	• Determine how much hazardous waste you generate to determine your generator status.
Accumulation Area	✓	✓		• You can accumulate waste in a "satellite accumulation area" with minimal regulatory burden. This area must be at or near the point of generation and under the control of the operator of the process generating the waste. • There is no time limit on accumulation in the satellite accumulation area for waste under 55 gallons. • There is a 55-gallon accumulation limit in the satellite accumulation area. Excess waste beyond the 55-gallon limit must be moved from the satellite accumulation area within 3 days. • You must accumulate the waste in containers. • Waste containers must be marked with the words "Hazardous Waste" or other words that identify their contents. • This waste is exempt from other accumulation provisions while in the satellite accumulation area.
Other Accumulation Areas (Time and Quantity Limits)	✓	✓	✓	• If waste accumulation does not meet the requirements for satellite accumulation, it is subject to more stringent requirements. LQGs can accumulate waste on site for up to 90 days without a permit. SQGs can accumulate waste for 180 days, or 270 days if the SQG must transport the waste more than 200 miles to a designated facility. • Begin counting accumulation time when waste is first placed in the accumulation unit. • Waste must be put in an exempt unit, recycled, or sent off site within the proper time period stated above. • If an LQG accumulates wastes beyond the allotted time period, the facility is fully subject to the requirements of a hazardous waste storage facility unless granted an exemption. SQGs cannot accumulate more than 6,000 kg of hazardous waste at any time. • CESQGs cannot accumulate more than 1,000 kg of hazardous waste, more than 1 kg of acutely hazardous waste, or 100 kg of spill reside from acutely hazardous waste at any time.
Requirements for Recyclable Materials Used for Precious Metal Recovery	✓	✓		• Exempt from all RCRA standards except obtaining an EPA identification number, manifesting all waste off site, maintaining records, and complying with LDR notification requirements.
Accumulation Unit Requirements	✓	✓		• Accumulate waste only in units that are in good condition, remain closed except when adding or removing waste, are inspected at least weekly, are compatible with the types of waste, and meet special standards for ignitable waste and reactive waste. • LQGs can use accumulation tanks and containers that have been assessed for integrity, have a secondary containment system, and are inspected each operating day. SQGs can use certain accumulation tanks. • LQGs can use containment buildings. • For all units, the date that the accumulation period begins must be clearly marked and visible on each container. All containers and tanks must be clearly marked or labeled with the words "Hazardous Waste" and accumulation units must be shut down and closed permanently in accordance with standards at the end of the unit life. • LQGs and SQGs can treat their waste without a RCRA storage permit in accumulation units that meet standards.
Preparedness and Prevention	✓	✓		• LQGs and SQGs must comply with preparedness and prevention requirements, including the following: - An adequate internal alarm or communications system. - A device capable of summoning emergency personnel. - Portable fire control equipment. - Adequate water pressure to operate fire control systems. - Adequate testing and maintenance of all emergency systems. - Access to communication or alarm systems during waste handling activities. - Adequate aisle space for emergency response.

Preparedness and Prevention	✓	✓		LQGs and SQGs must comply with preparedness and prevention requirements, including the following: - An adequate internal alarm or communications system. - A device capable of summoning emergency personnel. - Portable fire control equipment. - Adequate water pressure to operate fire control systems. - Adequate testing and maintenance of all emergency systems. - Access to communication or alarm systems during waste handling activities. - Adequate aisle space for emergency response. - An arrangement with local emergency response authorities.
Contingency Plan	✓	✓		• LQG facilities must prepare a facility contingency plan in accordance with regulations. • The contingency plan must be designed to minimize hazards from fires, explosions, or any unplanned release of hazardous waste or constituents. • A copy of the contingency plan must be kept on site and an additional copy must be submitted to all local emergency services providers. • LQGs and SQGs must have an emergency coordinator on site or on call at all times to respond to emergencies. • Emergency response information must be posted next to the telephone. • In the event of a fire, explosion, or release that could threaten human health outside the facility or when a spill has reached surface water, the emergency coordinator must notify the National Response Center at 800 424-8802.
Personnel Training	✓	✓		• LQGs must have a personnel training program in accordance with regulatory standards. - Training must instruct facility personnel about hazardous waste management procedures and emergency response. - Training must be completed within 6 months from the applicability of requirements. - The facility must undertake an annual review of initial training. • SQGs must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures relevant to their responsibilities.
DOT Packaging	✓	✓	✓	• Before being transported, waste must be packaged, labeled, and marked in accordance with applicable DOT requirements. Call the DOT hazardous materials information line at 202 366-4488 for information.
Offsite Management of Waste	✓	✓	✓	• Hazardous waste sent off site for handling may only be sent to a hazardous waste TSDF or recycling facility unless otherwise exempt. • CESQGs: See onsite management of waste below.
Onsite Management of Waste			✓	• CESQGs may either treat waste on site, if the generator qualifies as one of the following types of facilities, or ensure delivery of waste to one of the following types of facilities: permitted RCRA TSDF; interim status TSDF; state authorized to handle hazardous waste; permitted, licensed, or registered by state to handle municipal solid waste according to standards; permitted, licensed, or registered by state to handle nonmunicipal waste; if managed after January 12, 1998, facility is permitted, licensed, or registered by state to handle nonhazardous waste in accordance with standards; facility beneficially uses or reuses, or legitimately recycles or reclaims its waste; facility treats its waste prior to beneficial use, reuse, or legitimate recycling or reclamation; or a universal waste handler in accordance with standards.
Manifest	✓	✓		• Hazardous waste sent off site must be accompanied by a manifest, a multipage form that documents the waste's progress through treatment, storage, and disposal. It can be obtained from your state agency. • The manifest must have enough copies to provide the generator, each transporter, and the destination facility with one copy for their records and a second copy to be returned to the generator after completion by the designated facility operator. • SQGs that have a contractual agreement with a waste reclaimer that specifies the types and frequencies of shipments do not need to manifest the wastes if they retain a copy of the agreement in their files.
Land Disposal Restrictions Notification	✓	✓		• Your waste must meet certain treatment standards under the LDR program. Waste must be treated to reduce the hazardous constituents to levels set by EPA or the waste must be treated using a specified technology. All waste sent off site for treatment, storage, and disposal must be accompanied by appropriate LDR program notifications and certifications. There are no required forms but these papers must indicate whether or not wastes meet treatment standards or whether the waste is excluded from the definition of hazardous or solid waste, or is otherwise exempt.
Hazardous Waste Minimization	✓	✓		• To encourage generators to produce less hazardous waste, LQGs are required to have a program in place to reduce the volume and toxicity of waste generated to the degree economically practicable, and must select a currently available treatment, storage, or disposal method that minimizes present and future threats. • LQGs and SQGs must sign a certification of hazardous waste minimization on the manifest. • SQGs must make a good faith effort to minimize waste generation and to select the best available waste management method that they can afford.
Biennial Report	✓			• LQGs must submit biennial reports of waste generation and management activity by March 1 of every even-numbered year. EPA, other agencies, and the public use this information to track trends in hazardous waste management.
Recordkeeping	✓	✓		• LQGs must maintain personnel training records until the facility closes. • LQGs must keep copies of each biennial report for 3 years. • LQGs and SQGs must keep LDR notifications for 3 years. • LQGs and SQGs must keep a copy of each manifest for 3 years. • LQGs and SQGs must keep records of test results, waste analyses, and other hazardous waste determinations for 3 years.

Silver Recovery Methods

Silver Recovery From Fixers

The most common methods of silver recovery from fixer and bleach fix processing solutions are metal replacement, electrolytic recovery, and chemical precipitation. For low-silver wash waters, ion exchange is used. Reverse osmosis, distillation, and evaporation are used to concentrate silver in dilute solutions. Some facilities use a primary silver recovery unit, which removes the bulk of silver, in combination with a tailing unit to treat the relatively low silver concentration wastewaters from a primary silver recovery system. Color developer wastewater does not flow through a silver recovery unit because the silver content is very low and the pH of the developer, if mixed with the other silver-bearing solutions, could reduce the efficiency of silver recovery and could result in ammonia generation.

Regardless of the technique used for silver recovery, the silver-bearing material must be sent to a refiner to complete the process. In addition, photographic films and papers may also be a source of silver from photo processing facilities. They also will require refining.

METALLIC REPLACEMENT

Metallic replacement occurs when an active solid metal, such as iron, contacts a solution containing dissolved ions of a less active metal, such as silver. The more active metal goes into solution as an ion, being replaced by an atom of the less active metal in the solid matrix. The dissolved silver, which is present in the form of a thiosulfate complex, reacts with the solid metal.

Silver ions will displace many of the common metals from their solid state. Because of its economy and convenience, iron, in the form of steel wool, is used most often.

ELECTROLYTIC RECOVERY

An electrolytic unit can be used for a primary or a tailing waste stream, and can be either batch or continuous. This silver recovery method applies a direct current across two electrodes in a silver-bearing solution. Metallic silver deposits on the cathode. Sulfite and thiosulfate become oxidized at the anode. An electrolytic system should recover about 90 percent of the recoverable silver.

BATCH ELECTROLYTIC RECOVERY

In batch recovery, overflow fixer from one or more process lines is collected in a tank. When sufficient volume is reached, the waste fixer is pumped to an electrolytic cell for silver recovery. The desilvered fixer can be discharged to a sewer, disposed of as a solid waste, or reused. If reused, it is transferred to a mix tank where sodium thiosulfate is added to replenish its strength.

Primary batch system cells are usually designed to desilver the fixing batch at initial silver concentrations of about 5,000 mg/L. The silver concentration in the effluent is typically 200 to 500 mg/L. Effluent of 20 to 50 mg/L is possible with additional treatment time and careful current density control. An electrolytic tailing unit typically achieves the lower range because the process can be optimized for low initial silver concentrations.

CHEMICAL PRECIPITATION

Chemical precipitation is the oldest and cheapest method for recovery of silver. It is widely used by manufacturers of photographic supplies but usually not by photo processors. Photo processors

no longer use precipitation technologies based on sulfide, borohydride, or amine borate due to the hazards associated with their use. Alternative precipitants currently in use do not generate hydrogen sulfide gas. Sludges resulting from the alternative precipitants do not have to be managed as hazardous waste. They are characteristic sludges for silver and, therefore, are not solid waste when reclaimed.

Silver Recovery From Rinsewater

Even with an efficient fixer solution silver recovery system and an effective squeegee on the fixer tank, up to 10 percent of the recoverable silver is lost by carry-over into the rinse tank. The silver concentration in the spent rinsewater is typically in the range of 1 to 50 mg/L, too low for economical recovery with electrolytic or metallic replacement methods. In addition, the iron byproduct from metallic replacement precludes reuse of the rinsewater, although some photo processors use metallic replacement to meet municipal sewer effluent limits. Precipitation is uneconomical for rinsewater. Two methods are currently being used for effective recovery of silver from rinsewater: resin ion exchange and reverse osmosis.

ION EXCHANGE

Ion exchange is the reversible exchange of ions between a solid resin and a liquid. A variety of weak and strong anionic resins are effective in silver recovery. Ion exchange has been shown to be very effective, recovering as much as 98 percent of the silver and achieving effluents with silver concentrations as low as 0.1 ppm. High capacity units can process as much as 500 gallons per hour.

REVERSE OSMOSIS

Photo processors may employ a concentration process such as reverse osmosis (RO), distillation, or evaporation prior to silver recovery. In reverse osmosis techniques, the wastewater stream flows under pressure over the surface of a selectively permeable membrane. Water molecules pass through the membrane and other constituents are left behind. The extent of separation is determined by membrane surface chemistry and pore size, fluid pressure, and wastewater characteristics. The RO unit has one inlet to receive the waste stream, and two discharge outlets. The process reportedly can recover 90 percent of the silver thiosulfate.

Shipping Silver-Bearing Materials

High purity flake silver from electrolyte silver recovery units is considered a product by EPA and is not regulated as a hazardous waste under RCRA when sent for refining. Silver-bearing sludge, precipitate, and ion-exchange resins that are destined for refining are considered characteristic sludges being reclaimed and are not regulated as a hazardous waste under RCRA. If these silver-bearing materials are not sent for refining, they must be classified as a hazardous waste if they contain leachable silver. The Toxicity Characteristic Leaching Procedure (TCLP) can be used to determine if the material is hazardous. If the material leaches more than 5 parts per million (ppm) of silver, it is classified as a hazardous waste for silver under RCRA.

Reduce or Minimize the Hazardous Wastes You Generate

The following examples show hazardous wastes typically generated by the photo processing industry and provide suggestions for how to recycle, treat, or dispose of them according to federal regulations.

Recycling and pollution prevention measures can significantly reduce your regulatory burden and may save your business considerable money. This section presents information on hazardous wastes typically generated by photo processing businesses and provides suggestions for how to recycle them or implement pollution prevention measures. This list might not cover all chemicals used or wastes produced by the photo processing industry. Consult the hazardous waste lists and characteristics to determine if you generate other hazardous wastes.

Only the federal hazardous waste codes are provided here. Your state might have different codes for some waste streams. You should check with your state hazardous waste authority for additional waste codes and requirements.

PROCESS	**Processing and Developing Negatives and Prints** (including bleach-fix, untreated fixers, bleach-fixers, reversal bleaches used in plumbingless minilabs, reversal bleaches, and system cleaners)
RCRA Waste Generated	Silver (D011)
Potential Recycling, Treatment, and Disposal Methods	■ Recover silver through metallic replacement, electrolytic recovery, or precipitation. ■ Send silver recovery residuals to a silver refiner via commercial recycler or common carrier (in states that allow it). ■ Ship silver waste, using a registered hazardous waste transporter, to a hazardous waste TSDF for treatment and disposal. ■ Discharge spent fixers (within allowable discharge limits) to a sewer system pursuant to a Clean Water Act permit.
Potential Pollution Prevention Methods	■ Follow manufacturers recommendations for pH levels and stop bath use. ■ Replenish the strength of the fixer by adding ammonium thiosulfate when necessary. ■ Keep fixer covered when not being used to prevent oxidation and minimize emissions. ■ Use floating covers on solution tanks. ■ Add ammonium thiosulfate to silver contaminated baths to extend the allowable buildup of silver.
PROCESS	**Washing**
RCRA Waste Generated	Silver (D011)
Potential Recycling, Treatment, and Disposal Methods	■ Recover silver through ion exchanges. ■ Send silver recovery residuals to a silver refiner via commercial recycler or common carrier (in states that allow it). ■ Ship silver waste, using a registered hazardous waste transporter, to a hazardous waste TSDF for treatment and disposal.

	■ Discharge post-fix wastewaters (within allowable discharge limits) to a sewer system pursuant a to Clean Water Act permit.
Potential Pollution Prevention Methods	■ Improve the efficiency of the wash bath by keeping the water at 80 °F, add ammonia to keep pH above 4.9, and add washing aids (salts). (Adding ammonia to adjust pH can result in local noncompliance for ammonia nitrogen pretreatment discharge limits.) ■ If an ion exchange system is used, recirculate the effluent from the unit. ■ Employ countercurrent (using water from previous rinsings in initial film washing stage) rather than parallel rinse techniques. ■ Collect wash water and reuse.
PROCESS	**Stabilizing**
RCRA Waste Generated	Silver (D011)
Potential Recycling, Treatment, and Disposal Methods	■ Recover silver through metallic replacement, electrolytic recovery, precipitation, or evaporation. ■ Send silver recovery residuals to a silver refiner via commercial recycler or common carrier (in states that allow it). ■ Ship silver waste, using a registered hazardous waste transporter, to a hazardous waste TSDF for treatment and disposal.
Potential Pollution Prevention Methods	■ Use floating covers on solution tanks. ■ Use squeegees to minimize chemical carryover.
PROCESS	**System Cleaning**
RCRA Waste Generated	Acid regenerants, system cleaners, and photographic activators (D002), dichromate based cleaners (D007)
Potential Recycling, Treatment, and Disposal Methods	■ Neutralize waste and discharge it to a sewer system pursuant to a Clean Water Act permit. ■ Send waste to a hazardous waste TSDF for neutralization and/or disposal.
Potential Pollution Prevention Methods	■ Collect cleaners and reuse them.
PROCESS	**Storing Products**
RCRA Waste Generated	Off-specification chemicals that are RCRA hazardous for corrosivity (D002) or ignitability (D001)
Potential Recycling, Treatment, and Disposal Methods	■ Dispose of hazardous off-specification chemicals by sending them to a hazardous waste TSDF. ■ Recycle unused commercial chemical products.
Potential Pollution Prevention Methods	■ Exercise inventory control to avoid disposal of off-specification film and chemicals. ■ Store unused chemicals and paper away from heat and light.

Other Environmental Laws Affecting the Photo Processing Industry

CFR Guide to Hazardous Waste Regulations

To review the RCRA regulations referred to in this document, consult the following citations in 40 CFR:

Part 260—Hazardous waste management system: general.

Part 261—Identification and listing of hazardous waste.

Part 262—Standards applicable to generators of hazardous waste.

Part 263—Standards applicable to transporters of hazardous waste.

Part 264—Standards for owners and operators of hazardous waste and specific types of hazardous waste management facilities.

Part 265—Interim status standards for owners and operators of hazardous waste TSDFs.

Part 266—Standards for the management of specific hazardous wastes and specific types of hazardous waste management facilities.

continued

The Clean Water Act

The Water Pollution Control Act, commonly known as the Clean Water Act (CWA), is the federal program designed to restore and maintain the integrity of the nation's surface waters. CWA controls direct discharges to surface waters (e.g., through a pipe) from industrial processes or stormwater systems associated with an industrial activity. It also regulates indirect discharges, or discharges to publicly owned treatment works (POTWs) through a public sewer system, by requiring industrial facilities to pretreat their waste before discharging to a public sewer. A serious concern with wastewater discharges from photo processing labs is the high level of silver contained in photographic fixer solutions and rinsewaters. These solutions will not meet wastewater treatment plant discharge limits unless the silver is removed.

CWA Resources:

- 40 CFR Parts 100 to 129 and 400 to 503
- EPA Office of Water home page: <www.epa.gov/OW>
- EPA Office of Water: 202 260-5700
- Your state water authority, regional EPA office, and local POTW

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, commonly known as Superfund, authorizes EPA to respond to releases, or threatened releases, of hazardous substances that might endanger public health, welfare, or the environment, that might come from any source. Superfund also grants EPA the authority to force parties responsible for environmental contamination to clean it up or to reimburse response costs incurred by EPA. The person in charge at your business must report to the National Response Center (phone: 800 424-8802) any release of a hazardous substance that exceeds a designated "reportable quantity" for that substance within a 24-hour period.

Superfund Resources:

- Internet access: <www.epa.gov/superfund>

The Emergency Planning and Community Right-to-Know Act

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created the Emergency Planning and Community Right-to-Know Act (EPCRA). This law was designed to improve community access to information about potential chemical hazards and to facilitate the development of chemical emergency response plans by state and local governments. The EPCRA regulations establish several types of reporting obligations for facilities that store or manage specified chemicals. Photo processors are likely to use some of the following extremely hazardous substances: ammonia, formaldehyde, hydroquinone, and nitric acid.

EPCRA Resources:

- 40 CFR Parts 350 to 372
- The State Emergency Response Commission (contact available from RCRA Hotline)
- Internet access: <www.epa.gov/opptintr/tri/index.htm> and <www.epa.gov/swercepp>

Laws Affecting Photo Processing

SAFE DRINKING WATER ACT

The Safe Drinking Water Act (SDWA) mandates that EPA establish regulations to protect human health from contaminants present in drinking water. Under the authority of SDWA, EPA has developed national drinking water standards and created a joint federal-state system to ensure compliance with these standards. EPA also regulates underground injection of liquid wastes under the SDWA to protect underground sources of drinking water.

SDWA Resources:

- 40 CFR Parts 141 to 148
- SDWA Hotline: 800 426-4791
- Internet access: <www.epa.gov/ogwdw>

TOXIC SUBSTANCES CONTROL ACT

The Toxic Substances Control Act (TSCA) allows EPA to collect data on chemicals to evaluate, assess, mitigate, and control risks that might be posed by their manufacture, processing, and use. Photo processing facilities may be affected by some TSCA requirements.

TSCA Resources:

- 40 CFR Parts 702 to 799
- TSCA Hotline: 202 554-1404
- Internet access: <www.epa.gov/internet/oppts>

CFR GUIDE *continued*

Part 268—Land disposal restrictions.

Part 270—EPA-administered permit programs: the Hazardous Waste Permit Program.

Part 271—Requirements for authorization of state hazardous waste programs.

Part 272—Approved state hazardous waste management programs.

Part 273—Standards for universal waste management.

Part 279—Standards for the management of used oil.

See the regulations at <www.access.gpo.gov/nara>.

FOR MORE INFORMATION

For additional information on any of these laws, contact the RCRA Hotline at 800 424-9346 or 703 412-9810 in the Washington, DC, area. TDD (hearing impaired): 800 553-7672 or 703 412-3323 in the Washington, DC, area.

CONTACTS AND RESOURCES

HOTLINES AND INFORMATION CENTERS

RCRA Hotline
U.S. Environmental Protection Agency
Phone: 800 424-9346
or TDD 800 553-7672
In the Washington, DC, area: 703 412-9810
or TDD 703 412-3323
Home page: <www.epa.gov/epaoswer/hotline>

Answers questions on matters related to RCRA solid waste, hazardous waste, and underground storage tanks, EPCRA, and CERCLA.

RCRA Information Center
U.S. Environmental Protection Agency
RCRA Information Center (5305W)
401 M Street, SW.
Washington, DC 20460
Phone: 703 603-9230
Fax: 703 603-9234
E-mail: rcra-docket@epamail.epa.gov

Holds and provides public access to all regulatory materials on RCRA and distributes technical and nontechnical information on RCRA issues.

Small Business Ombudsman Clearinghouse/Hotline
U.S. Environmental Protection Agency
Small Business Ombudsman (2131C)
401 M Street, SW.
Washington, DC 20460
Phone: 800 368-5888
Fax: 202 401-2302
Home page: <www.smallbiz-enviroweb.org>

Helps private citizens, small businesses, and smaller communities with questions on all program aspects within EPA.

EPA Headquarters Library
U.S. Environmental Protection Agency
Headquarters Library
401 M Street, SW., Room 2904
Washington, DC 20460
Phone: 202 260-5921 or 5922
Fax: 202 260-6257
E-mail: library-HQ@epamail.epa.gov
Home page: <www.epa.gov/natlibra/liblists.html>

Maintains environmental reference materials for EPA staff and the general public, including books, journals, abstracts, newsletters, and audiovisual materials generated by government agencies and the private sector. Also provides access to online computer service bulletin boards and CD-ROM systems.

U.S. Department of Transportation
Hazardous Materials Information Center
Phone: 800 467-4922

Provides information about DOT's hazardous materials regulations.

U.S. Government Printing Office
Superintendent of Documents
P.O. Box 371954
Pittsburgh, PA 15250-7954
Phone: 202 512-1800
Fax: 202 512-2250
Home page: <www.access.gpo.gov>

Prints and distributes the Code of Federal Regulations. Title 40, Parts 260 to 299, contains most of the RCRA requirements.

National Response Center (NRC)
Phone: 800 424-8802

In the event of a fire, explosion, or other release of hazardous waste that could threaten human health outside the facility, call the NRC to report the emergency. The NRC will evaluate the situation and help you make appropriate emergency decisions.

ADDITIONAL INTERNET ADDRESSES

EPA Home Page
<www.epa.gov>

EPA RCRA Hazardous Waste Resources
<www.epa.gov/osw/topics.htm>

Code of Federal Regulations
<www.epa.gov/docs/epacfr40>

Envirosense
<es.inel.gov>
(contains technical, policy, and general information on pollution prevention topics)

INDUSTRY CONTACTS

Photo Marketing Association International
3000 Picture Place
Jackson, MI 49201
Phone: 517 788-8100
Fax: 517 788-8371
Home page: <www.pmai.org>

Represents professionals in the imaging industry in over 100 countries. Publishes *Photo Marketing,* which contains some articles about pollution prevention.

The Silver Council
5454 Wisconsin Avenue
Chevy Chase, MD 20815
Phone: 301 664-5150
Fax: 301 664-5156
Home page: <www.silvercouncil.org>

Develops and promotes environmentally sound and cost-effective methods for recovering silver from photographic processing operations.

Eastman Kodak Company
Kodak Environmental Services
Phone: 716 477-3194
Fax:: 800 242-2424

Developed a series of publications on silver recovery from photographic processes.

ADDITIONAL RESOURCES

Code of Management Practice for Silver Dischargers provides information about cost-effective and sound environmental management systems, including pollution prevention and silver recovery. This document is published by the Association of Metropolitan Sewage Agencies and the Silver Council and can be obtained from the National Association of Photographic Manufacturers at:

550 Mamaronek Avenue, Suite 307
Harrison, NY 10528-1612
Phone: 914 698-7603
Home page: <www.silvercouncil.org>

Call the RCRA Hotline (800 424-9346) to order any of the following documents:

Understanding the Hazardous Waste Rules: A Handbook for Small Businesses, 1996 Update (EPA530- K-95-001) provides an overview to help small business owners and operators understand how best to comply with federal hazardous waste management regulations. This booklet defines the three categories of hazardous waste generators and assists small businesses in determining if federal regulations apply. This document also explains how to obtain an EPA identification number, manage waste on site and ship waste off site.

RCRA: Reducing Risk From Waste (EPA530-K-97-004) provides a brief overview of the national RCRA program and the role of the states. This booklet defines RCRA hazardous waste and how the RCRA regulations apply to generators, transporters, and TSDFs. It focuses on hazardous waste and also addresses municipal and industrial nonhazardous solid waste. It provides examples of waste and waste treatment and disposal methods, waste minimization tips, links to other environmental laws related to hazardous substances, a glossary of terms, and a guide to the RCRA sections of the *Code of Federal Regulations*.

United States
Environmental Protection Agency
401 M Street, SW. (5305W)
Washington, DC 20460

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