

Best Management Practices



Photo Processors



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Introduction

Photo processors across the state regularly generate wastes that are of concern to the environment. Silver found in used fixer, bleach-fixers, washless stabilizer and C-41 RA bleach poses hazardous waste and water quality concerns.

Silver has a very high aquatic toxicity and accumulates in the tissue of aquatic organisms. Used photo processing solutions containing more than 5.0 mg/L silver are a state and federal hazardous waste. With thousands of businesses in Washington State generating used fixer, it's important that each one do their part to manage these wastes correctly and keep them out of the soils and waters of the state.

You play an important role. Used fixer and other hazardous wastes don't belong on the ground, untreated down the drain, or in the dumpster. Good waste management practices are important for the following reasons:

- You'll ensure that you're in compliance with federal, state, and local waste management regulations and avoid costly penalties.
- You'll provide a safer, healthier workplace for you and your employees.

Water Quality Requirements

Local Sewer Discharge Limits

The LOTT Clean Water Alliance operates a "delegated" Pretreatment Program. This means that the Department of Ecology has granted LOTT regulatory authority to draft local ordinances, develop discharge permits, and regulate local businesses. LOTT has developed a local limit for silver for discharges less than 1,000 gallons a day of no more than 0.002 pounds per day. The following chart shows the maximum concentration (mg/L) that discharges less than 1,000 gallons per day can have and not exceed the 0.002 pounds per day silver limit.

Gallons Per Day	Local Limit (mg/L)	Pounds Per Day	Gallons Per Day	Local Limit (mg/L)	Pounds Per Day	Gallons Per Day	Local Limit (mg/L)	Pounds Per Day
up to 48	< 5.0	0.002	95	2.5	0.002	550	0.4	0.002
50	4.8	0.002	100	2.4	0.002	600	0.4	0.002
55	4.4	0.002	150	1.6	0.002	650	0.4	0.002
60	4.0	0.002	200	1.2	0.002	700	0.3	0.002
65	3.7	0.002	250	1.0	0.002	750	0.3	0.002
70	3.4	0.002	300	0.8	0.002	800	0.3	0.002
75	3.2	0.002	350	0.7	0.002	850	0.3	0.002
80	3.0	0.002	400	0.6	0.002	900	0.3	0.002
85	2.8	0.002	450	0.5	0.002	950	0.3	0.002
90	2.7	0.002	500	0.5	0.002	≥ 1,000	0.2	N/A

Any waste stream exceeding these limits is an illegal discharge and violators will be subject to a costly fine. The LOTT Clean Water Alliance Pretreatment Program hopes that through education and Best Management Practices about proper waste management, businesses will minimize the amount of wastes sent to the sanitary sewer. Utilizing waste minimization methods and centralized treatment and recovery of silver-bearing wastes are a few ways to accomplish this.

Waste Minimization Methods

Waste minimization options can be classified as source reduction and recycling, or resource recovery. In addition to the specific recommendations provided below, rapidly advancing technology makes it important that companies continually educate themselves about improvements that are waste reducing and pollution preventing. Information sources to help inform companies about such technology include trade associations and journals, chemical and equipment suppliers, equipment expositions, conferences, and industry newsletters. By keeping abreast of changes and implementing applicable technology improvements, companies can often take advantage of the dual benefits of reduced waste generation and a more cost efficient operation.

Waste Stream	Waste Minimization Methods
Aqueous Waste	Use squeegees to minimize chemical carry over Recover silver from effluent Reuse fixer Regenerate developer Regenerate bleach Use counter-current rinsing Use plumbing-less minilabs
Expired or Off-Spec Chemicals	Control inventory carefully Store away from heat and light
Other Solid Waste	Store paper at a cool temperature Recover silver from off-spec paper and from excess film Recycle cartridges, cassettes and spools to film manufacturer
Air Emissions	Use floating covers on solution tanks

Hazardous Waste Generated

Photo processors concern the LOTT Clean Water Alliance Pretreatment staff because fixers, bleach-fixers, and washless stabilizers accumulate silver during use and become hazardous wastes. Some developers, if they contain more than one percent hydroquinone as an ingredient and are discarded before used, may also be a hazardous waste. Minilab system cleaners may contain hazardous levels of chromium or fail pH limits. Black-and-white reversal film processing requires an intermediate bleach step, which may contain sodium dichromate. Spent sodium dichromate bleach is a hazardous waste because of its chrome content. Knowing how to handle and dispose of these products will help you manage your wastes, prevent hazardous spills, make safer working conditions, and help your business achieve regulatory compliance.

Bleach Solution

The bleach bath converts metallic silver on film back to a silver halide through an oxidation reaction. An iron solution is commonly used to accomplish this. Used C-41 RA bleach may contain up to 3.0 mg/L silver.

- If you use chemical recovery cartridges (CRCs) for on-site silver recovery, consider mixing used C-41 RA bleach and washless stabilizer with the used fixer prior to recovery.
- Consider regenerating your used bleach solutions. Ask your chemical supplier for details.
- Make sure your employees know that used C-41 RA is a sewer discharge concern.
- Never put bleach, treated or not, into a septic system, storm drain, dry well, or onto the ground.

Developer

Most developers for black and white film contain a small percentage of hydroquinone. These developers, if disposed as an unused product, will be hazardous due to hydroquinone levels. However, hydroquinone is consumed during use and does not show up in used developer in concentrations that would be considered hazardous waste.

- If possible, purchase developer solutions that contain less than one percent hydroquinone; check with your supplier or look on your Material Safety Data Sheet.
- Never put used or unused developer into a septic system, storm drain, dry well, or onto the ground.
- Never dispose of unused or past shelf life developer to the sanitary sewer.
- Never put developer into silver-bearing wastes when using CRCs. Developer can plug the cartridges causing a dangerous pressure buildup.

Fixer and Bleach-Fixer Solution

Fixer allows silver to dissolve out of the film and paper into the solution. As a result, used fixer and bleach-fixers contain high concentrations of silver, usually between 3,000 and 8,000 mg/L. Because of these high silver levels, used fixer is a hazardous waste.

- Never put used fixer into the sanitary sewer unless it meets hazardous the LOTT Clean Water Alliance local sewer discharge limits.
- LOTT has a local silver discharge limit based on the concentration, pounds, and gallons of wastewater discharged from your business each day. Refer to the chart on page 3 to determine your business's silver limit. A discharge higher than what your waste-stream allows will be subject to a costly fine.
- Attach labels to your used fixer containers, identifying them as hazardous waste.
- Count the amount of used fixer and bleach-fixers generated during the month toward your hazardous waste total if accumulated or stored prior to discharge.
- Never put used fixer into a septic system, storm drain, the ground, surface water or any other drain.

Stabilizer

Washless stabilizer solutions are used in the last step of the photo finishing process. Stabilizers enhance image stability and stop the reaction started by the developing solution. Washless stabilizers typically contain silver in the range of 100 to 300 mg/L, making them a hazardous waste and exceeding local sewer discharge limits.

- If you recover silver on-site, mix used washless stabilizer with your used fixer and bleach-fixers prior to recovery.
- If you send silver-bearing chemicals off-site for recovery, ask your service if they will accept washless stabilizer for pick up.
- Never put stabilizer into a septic system, storm drain, dry well, or onto the ground.
- Never put untreated washless stabilizer into the sanitary sewer. You will be in violation of sewer discharge limits.

System Cleaners

Some color and specialty photo processing shops may use system cleaners and bleaches that result in hazardous wastes due to chromium, cyanide, other heavy metals, or pH.

- If you are currently using a system cleaner that contains a dichromate compound, investigate switching to a system cleaner that does not contain dichromate.

- Make sure that the system cleaners and other chemicals you are using do not cause you to exceed your local sewer discharge limits for pH, chromium, cyanide, and other heavy metals.
- Never put system cleaners or cyanide-containing wastes, treated or untreated, into a septic system, storm drain drywell, or onto the ground.

Wash Waters

Wash waters used in the film developing process may contain small amounts of film developing chemicals, including used fixer that may exceed the local discharge limit. Therefore, even wash waters can present a concern.

- Maintain your photo processing equipment and regularly check to ensure bleach, developer, and fixer are not being lost by being carried over into the wash water.
- Routinely test the silver levels in your wash water to ensure compliance with local discharge limits.
- Never dispose of wash water that contains silver down the drain or into the sanitary sewer as this may be an illegal discharge.

Managing Used Fixer and Silver Bearing Waste

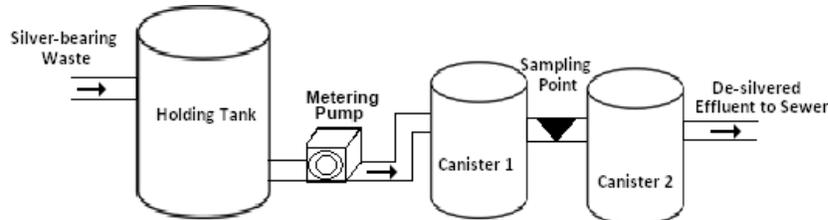
Photo processors generate developer, used fixer, bleach-fixers, washless stabilizers and C-41 RA bleach wastes as a normal part of doing business. Used fixer and bleach-fixers solutions from photo processors contain up to 8,000 mg/L silver. This number greatly exceeds the LOTT Clean Water Alliance's local limit for silver. Used washless stabilizer contains 100-300 mg/L silver and used C-41 RA bleach may contain up to 3 mg/L silver. None of these silver-bearing wastes should be discharged to the sanitary sewer without proper silver recovery, either at your place of business or through off-site management. And they should never be put into storm drains, septic systems, or dry wells.

On-Site or Off-Site Management?

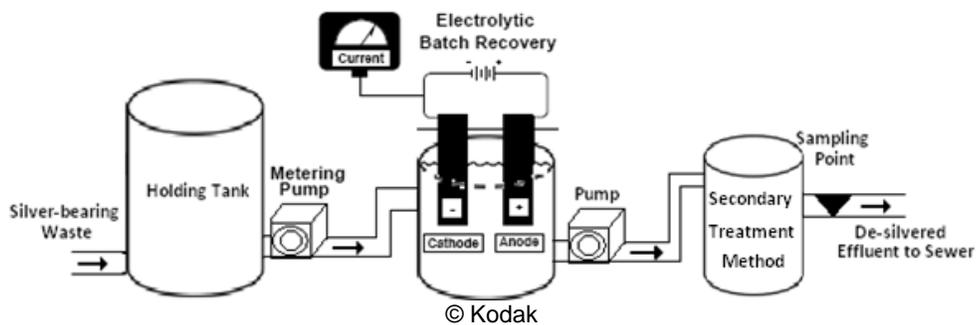
Silver-bearing wastes can have monetary value, and some photo processors are using on-site technologies to reclaim their spent silver. These businesses should consider this option carefully as they will be fully responsible for proper management and results of the system they choose. Businesses can choose whether to use on-site treatment, off-site treatment, or a combination of both. While a business generating large volumes of used fixer may recover the costs of their on-site recovery system in a matter of months, smaller volume producers like grocery store minilabs may not see a similar payoff. It is important to remember that whichever strategy you choose, your business must meet hazardous waste and local sewer discharge limits for silver-bearing wastes.

Historically, on-site silver recovery has focused on economics rather than meeting hazardous waste and sewer discharge limits. On-site silver recovery designed to meet such limits is not as simple as plugging in a machine and walking away. It takes a lot of time, effort, and trial and error to do it right. There are currently several on-site recovery units on the market.

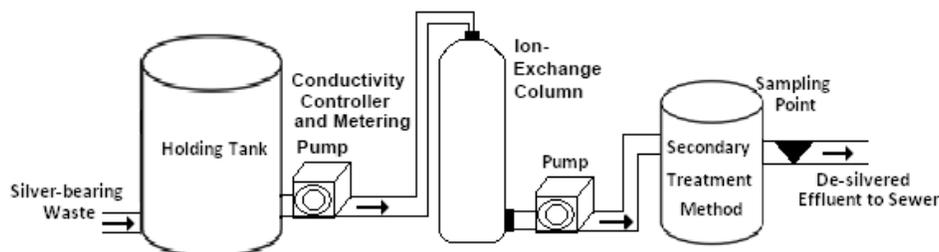
Chemical Recovery Cartridges (CRCs) are hollow canisters that contain steel fibers or fiberglass impregnated with iron filings. Fixer, bleach-fixers, C-41 RA bleach and washless stabilizer are filtered through the cartridge. When the solution containing dissolved silver contacts the iron, the iron is dissolved and is discharged with the effluent while the silver stays in the steel fibers to be reclaimed. To meet local discharge limits, CRCs need to be used in a series of two canisters.



Electrolytic Recovery units work by attracting positively-charged silver ions to a negatively-charged cathode that is immersed in used silver-bearing waste. A disadvantage is that it can only reduce silver concentrations down to a range of 100 to 300 mg/L. Without further reclamation, your effluent will not meet hazardous waste or sewer discharge limits. Electrolytic units should be used in combination with another system, such as CRC or Ion Exchange, to meet local silver discharge limits.



Ion Exchange uses a resin that attracts negatively charged silver thiosulfate complex to positively charged sites on the ion exchange resin. When all the positively charged sites are filled, breakthrough occurs and the resin is regenerated and the silver recovered. Cost, space required, and technical requirements typically make ion exchange suitable only for larger photographic facilities. This system is generally considered suitable only for dilute solutions and should be used in combination with another system, such as CRC or Electrolytic Recovery, to meet local silver discharge limits.



Evaporation and Distillation units are used to reduce the volume of liquid waste that has been produced. If ammonia is present in the waste stream, as in the case of fixers and bleach-fixers, the ammonia must be removed prior to evaporation/distillation. This can be done using activated carbon. The sludges or solids that remain are typically hazardous because of the silver they contain, and must be disposed of accordingly. Your local air authority should be consulted if you use an evaporator that discharges into the air.

Method	Advantages	Disadvantages	Effluent Concentration
CRC/Metallic Replacement	<ul style="list-style-type: none"> • Low investment • Low operating cost • Simplest operation 	<ul style="list-style-type: none"> • High iron content of effluent • Silver recovered as sludge • High silver concentration in effluent unless two units are in series. 	0.2 to 15 mg/L
Electrolytic Recovery	<ul style="list-style-type: none"> • Recovers silver as a pure metal • High silver recovery 	<ul style="list-style-type: none"> • Potential for sulfide formation • High silver concentration in effluent unless used in combination with another system 	50 to 250 mg/L
Ion Exchange	<ul style="list-style-type: none"> • Attains very low silver limits 	<ul style="list-style-type: none"> • High investment • Complex Operation • Only for dilute influent (wash water) 	0.1 to 2.0 mg/L
Evaporation	<ul style="list-style-type: none"> • Minimum to no aqueous effluent • Water Conservation 	<ul style="list-style-type: none"> • High energy requirement • Organic contaminant buildup • Silver recovered as a sludge • Potential air emissions 	No effluent

Businesses opting to use on-site silver recovery using Chemical Recovery Cartridges (CRCs) in a series of two canisters will be deemed as meeting LOTT's local limit. CRCs maintenance and operations will be discussed later. Businesses who do not install a silver recovery unit may need to prove compliance by testing their wastewater or may have no choice but to explore off-site options.

Off-site management of used fixer has certain advantages over on-site recovery. Capital, operation, and maintenance costs for equipment are non-existent. Administrative costs, such as analytical monitoring, are not incurred. If a business has space limitations, the off-site option may help ease crowding. Most importantly, having used fixer managed off-site will ensure that hazardous waste and local silver discharge limits for silver will not be violated at your facility.

The downside to off-site management may be in putting your hazardous waste into the hands of a third party. In addition, off-site hauling may create more air pollution due to increased trucking and transporting of wastes. If you choose an off-site option, carefully choose the company; you still have the ultimate responsibility for the proper management of your wastes.

Maintaining and Operating CRCs

Businesses using CRCs for on-site reclamation need to use two CRCs in series, at a minimum, to meet local discharge limits (unless they can document through routine testing that they consistently meet hazardous waste and local water quality discharge limits with only one CRC). Using just one canister, even if it is high quality, will show diminishing effectiveness after being used a few times and will eventually stop working. An electrolytic recovery unit alone will not meet hazardous waste or sewer discharge limits. If you use an electrolytic recovery unit, you still need to use a secondary system such as a CRC to meet local discharge limits.

A sample valve needs to be installed between the canisters. Use this valve to take samples of the effluent from the first CRC canister. Using silver test paper, check the sample to see when the first canister is spent. Silver test paper can detect silver at levels between 200 and 500 mg/L. When your first canister reaches this level, it is time to rotate it out, putting your second canister first in line and adding a new, second canister. In addition, if your tubing between canisters is clear plastic, you can visually inspect the solution flowing through — if it is brown or has debris in it, it's a good sign that the working ability of the first canister is spent.

Monitor the flow of used solutions into the canisters. If the flow is too fast, the proper reaction won't happen inside the canister and you won't meet silver discharge limits. If it is too slow, it may deteriorate the canister too soon. Use a metered pump system or a restricted gravity feed system and keep flow rates at manufacturer's recommendation, usually between one and three gallons per hour.

Take periodic samples of recovered out-flow from the final canister and have the waste analyzed for silver to see if it meets LOTT's local sewer discharge limits. Keep a file with all test data in it and you'll have a starting point from which to make refinements to your on-site process.

Combine your silver-bearing wastes before treatment. Add washless stabilizers and C-41 RA bleach into spent fixer and run them through CRCs as a single batch. Used washless stabilizers have enough silver in them to make them a hazardous waste, and used C-41 RA bleach may have enough silver to exceed some water quality discharge levels.

Keep a maintenance/changeover log. Perform regular maintenance as recommended in the manufacturer's instruction manual. Work closely with your supplier for help in developing a changeover schedule based on your volumes of silver-bearing solutions. Ask your supplier if they provide a full service waste management option.

If you're using electrolytic recovery before CRCs, monitor/adjust the pH of the silver-bearing waste before it enters the CRCs. Using simple pH testing papers as an indicator, keep the pH of silver-bearing wastes entering CRCs between 5.5 and 6.5, which is the optimum range for pulling out the most silver and lengthening the life of the canisters. Look for units that have a sample valve in the tubing entering the canisters where a small sample can be periodically taken. Record pH monitoring levels and occurrences in your maintenance/changeover log.

Hazardous Waste Requirements for Photo Processors

Identify Your Waste and Generator Status

If your total monthly amount of hazardous waste totals over 220 pounds (about 26 gallons), which includes more than just used fixer, you are a regulated generator. Regulated generators need to "count" their different waste chemicals toward a monthly hazardous waste total. As a regulated generator, you are required to notify Ecology of your hazardous waste activities, and obtain a site-specific RCRA ID number. Call (360) 407-6170 or your nearest regional Ecology office for more information on obtaining the RCRA ID number and the compliance regulations you must follow. If you always generate less than 220 pounds (26 gallons) of hazardous waste per month and dispose of this waste without storing and accumulating more the 220 pounds, then you are a small quantity generator. Small quantity generators are required to comply with local and federal regulations and should follow these steps:

Step 1: Perform Preventive Maintenance

Hazardous wastes must be handled in a manner that prevents leaks, spills, fires and explosions. Develop and follow a written inspection schedule for all hazardous waste storage areas, containers, and tanks. By sealing, or capping, floor drains you can help prevent accidental hazardous spills from entering the sewer. Always keep necessary emergency equipment, such as fire extinguishers and telephones, on hand and accessible to employees. You must regularly test and maintain all your emergency equipment in addition to keeping a log of inspection dates and comments.

Step 2: Properly Accumulate Hazardous Waste

Photo processors typically generate less than 220 pounds. per month. If so, they can accumulate their hazardous waste on site for up to 180 days from the date it is first generated before they must manage it on-site or send it to an appropriate facility. If you generate more than 220 pounds per month you can only accumulate the waste up to 90 days. While accumulating wastes, you must follow certain requirements:

- Establish and clearly mark an accumulation area. It must have a secondary containment system able to hold spills and leaks.
- Place the waste in an appropriate container and mark it with the words “Hazardous Waste,” the waste’s major risk (such as “Ignitable”), and the date you first put the waste in the container.

Step 3: Plan for Emergencies

There must be an emergency coordinator on the premises or on call at all times who is familiar with the operations and activities at the site and has the authority to commit the resources necessary to deal with a hazardous waste emergency. In a small shop, this will probably be the owner or manager. Make sure you train your employees to know how to react to different types of emergencies in your shop.

Step 4: Use Proper Containers

Many hazardous waste incidents and work related injuries are linked to improper or unsafe container management. To avoid such accidents:

- Accumulate your wastes in containers that are sturdy, leak-proof, properly labeled, and kept securely closed unless wastes are being added or removed.
- Use your empty product containers as convenient waste accumulation containers.
- Store reactive and ignitable wastes according to the uniform fire code.
- Maintain a minimum aisle space of 30 inches between container rows.
- Inspect containers at least once a week, keeping a log of inspections.
- Store waste filled containers in a secondary containment that will hold spills or leaks.

Step 5: Ensure Proper Transportation and Disposal

Small quantity generators can transport their own wastes to a legitimate recycler such as Hazo House or the LOTT Clean Water Alliance, or they can arrange to have them picked up by a hazardous waste hauler.

Step 6: Keep Records

There are a number of records that must be kept on the premises. These might include annual reports, manifest forms, notification reports, inspection records, results from waste analyses or tests, on-site recycling records, MSDSs, and hazardous waste management activities.

Businesses discharging reclaimed used fixer are responsible for knowing if they meet hazardous waste and sewer discharge limits. Sending a sample of a waste to a accredited laboratory for analysis is the most accurate way to determine if the waste is hazardous or meets sewer discharge limits; and it’s relatively inexpensive.

Closing

For additional information and assistance on regulatory concerns, contact the LOTT Clean Water Alliance at (360) 528-5708 or (360) 528-5725.

For additional information on Ecology's Pollution Prevention Program and Waste Reduction, visit the following website: <https://ecology.wa.gov/Waste-Toxics/Business-waste/Reduce-waste-pollution>

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