

1 KODAK FLEXICOLOR CHEMICALS

KODAK FLEXICOLOR Chemicals are designed for processing all Kodak color negative films. This section describes these chemicals, lists the available sizes, and tells you how to mix and store them. It also gives simple methods of checking chemicals and mixes, and tells how to dispose of them properly and safely.

WHY USE KODAK CHEMICALS?

The primary considerations when you choose photographic chemicals are—

- quality of the results the chemicals produce
- availability, reliability, and expertise of the service you receive
- availability of the chemicals
- environmental impact of the chemicals
- chemical cost per roll

In all of these factors, KODAK Chemicals are superior or competitive.

KODAK Chemicals are readily available. When you purchase KODAK Chemicals, you are supported by a reliable network of expertise: Kodak field representatives, Kodak Service and Support, Kodak Information Center, Kodak Environmental Services, and many helpful publications and other services.

KODAK FLEXICOLOR Chemicals offer you the following features and benefits.

FEATURES	BENEFITS
<ul style="list-style-type: none"> • All-liquid concentrates 	<ul style="list-style-type: none"> • Easy mixing
<ul style="list-style-type: none"> • Available in a wide variety of sizes 	<ul style="list-style-type: none"> • Sizes convenient for all users—minilabs, large processing labs, professional labs, advanced amateurs, etc.
<ul style="list-style-type: none"> • Formulated to provide excellent performance when mixed with a variety of water supplies 	<ul style="list-style-type: none"> • Quality of local water supply not critical
<ul style="list-style-type: none"> • Low developer replenishment rates with FLEXICOLOR Developer Replenisher LORR 	<ul style="list-style-type: none"> • Less mixing • One-half the replenishment rate of FLEXICOLOR Developer Replenisher • Less effluent discharged—more favorable environmental impact • Chemical savings
<ul style="list-style-type: none"> • Efficient bleaching with FLEXICOLOR Bleach III Replenisher 	<ul style="list-style-type: none"> • Robust bleaching performance • Reduced environmental impact
<ul style="list-style-type: none"> • Packaged bleach regenerator available 	<ul style="list-style-type: none"> • One-part concentrate for easy mixing • Reduced chemical costs • HV Regenerator specifically formulated for high-volume photofinishers • Less COD, iron, chelates, and ammonia discharged to treatment plant
<ul style="list-style-type: none"> • Odorless solution with FLEXICOLOR RA Bleach Replenisher NR 	<ul style="list-style-type: none"> • Better workplace environment
<ul style="list-style-type: none"> • ELECTROSILVER Fixer and Replenisher LORR available for in-line silver recovery 	<ul style="list-style-type: none"> • Chemical cost savings • Very low replenishment rate • Less effluent discharged • More efficient silver recovery
<ul style="list-style-type: none"> • Excellent physical performance, and elimination of formaldehyde from workplace with FLEXICOLOR Final Rinse and Replenisher 	<ul style="list-style-type: none"> • Fewer drying marks • Less makeovers and retouching • No need for formaldehyde training or associated record keeping required by OSHA
<ul style="list-style-type: none"> • Rapid-access cycle time for some minilabs with FLEXICOLOR RA Chemicals 	<ul style="list-style-type: none"> • Faster turnaround time for customer orders

WHAT KODAK CHEMICALS ARE AVAILABLE?

KODAK FLEXICOLOR Chemicals are available in a variety of sizes to meet the needs of all types of processing operations. Select the best chemical and the right sizes that best meet your business needs.

The chemicals and sizes given apply to the U.S. region. Other regions may supply these chemicals in different sizes.

KODAK FLEXICOLOR Chemicals for Continuous, Roller-Transport, and Rack-and-Tank Processors

KODAK FLEXICOLOR Developer Replenisher LORR

This developer offers you the same performance as KODAK FLEXICOLOR Developer Replenisher except with lower replenishment rates. This has many benefits for your lab—developer effluent discharge reduction of approximately 50 percent, less chemical mixing, and lower cost per square foot of film processed. Processor utilization is not a factor; you can use FLEXICOLOR Developer Replenisher LORR at any utilization level. Primarily recommended for use in continuous processors.

- *For Large-Volume Automatic Processors:* Available in sizes to make 50 and 100 U.S. gallons.
- *For Small- to Medium-Volume Automatic Processors:* Available in sizes to make 5 and 10 litres and 25 U.S. gallons (two 12.5-gallon sizes).

KODAK FLEXICOLOR Developer Starter LORR

Use this starter to prepare a fresh tank solution from KODAK FLEXICOLOR Developer Replenisher LORR.

- *For All Processors:* Available as a 1-quart concentrate to make 8.3 U.S. gallons of developer tank solution.

KODAK FLEXICOLOR Developer Replenisher

This developer is a long-time standard for processing Kodak color negative films in Process C-41. To make a fresh tank solution from this replenisher, use *only* KODAK FLEXICOLOR Developer Starter. Primarily recommended for use in roller-transport and rack-and-tank processors.

- *For Large-Volume Automatic Processors:* Available in a size to make 75 U.S. gallons.
- *For Small- to Medium-Volume Processors:* Available in sizes to make 5 and 25 U.S. gallons (two 12.5-gallon sizes).

KODAK FLEXICOLOR Developer Starter

Use this starter *only* with KODAK FLEXICOLOR Developer Replenisher.

- *For All Processors:* Available as a 1-quart concentrate to make 17.8 U.S. gallons of developer tank solution.

KODAK FLEXICOLOR Bleach III Replenisher

FLEXICOLOR Bleach III offers excellent performance with less iron and chelates. Use this bleach as a replenisher or mix it with starter to prepare a tank solution. You can also regenerate bleach overflow to reduce chemical costs and chemical discharge.

- *For Large-Volume Automatic Processors:* Available in two parts in a size to make 75 U.S. gallons. (Both parts are required to prepare replenisher solution.)
- *For Small- to Medium-Volume Processors:* Available in sizes to make 5 and 12.5 U.S. gallons.

KODAK FLEXICOLOR Bleach Starter

Use this starter to prepare bleach tank solution with FLEXICOLOR Bleach III Replenisher. This product is odorless, non-corrosive, and non-foaming for easy use.

- *For All Processors:* Available as a 1-gallon concentrate to make 20 U.S. gallons of Bleach III tank solution.

KODAK FLEXICOLOR Bleach III Regenerator

By regenerating FLEXICOLOR Bleach III tank overflow with this regenerator, you can reduce bleach chemical costs and the amount of ammonia, iron, and COD in bleach effluent. Available as a one-part concentrate for easy mixing.

- *For Large-Volume Automatic Processors:* Available in sizes to prepare 25 U.S. gallons (two 12.5-gallon sizes) and 75 U.S. gallons of replenisher from overflow.
- *For Small- to Medium-Volume Automatic Processors:* Available in a size to make 5 U.S. gallons.

KODAK FLEXICOLOR Bleach III HV Regenerator

Specifically formulated for high-volume photofinishers, this regenerator uses the same replenishment rate as Bleach III, but uses half as much concentrate to regenerate a given amount of overflow. Larger mix sizes can be made while keeping less inventory of product in stock.

- *For Large-Volume Automatic Processors:* Available in sizes to make 150 U.S. gallons replenisher from overflow and in 55 U.S. gallon drums.

KODAK FLEXICOLOR Fixer and Replenisher

Dilute this concentrate for use as replenisher or tank solution.

- *For Large-Volume Automatic Processors:* Available in sizes to make 25 and 75 U.S. gallons.
- *For Small- to Medium-Volume Automatic Processors:* Available in sizes to make 5 litres and 1, 5, and 25 U.S. gallons.

KODAK ELECTROSILVER Fixer and Replenisher LORR

This solution was designed for labs that desilver fixer electrolytically in a “closed loop” system. With this fixer, routine analysis of pH and sulfite are not required. This product reduces replenishment rates and effluent volume for loading of effluent components, such as ammonia.

- *For Large-Volume Automatic Processors:* Available in sizes to make 75 and 150 U.S. gallons.

KODAK FLEXICOLOR Final Rinse and Replenisher

This final rinse is designed with state-of-the-art surfactants to reduce deposits and drying marks on processed color negative films. As a result, both the processed film and the seasoned working tank solution will be cleaner. This means less maintenance and less frequent dumping of working tanks. Because the new final rinse contains no stabilizing agent, labs will not need to provide formaldehyde training or do the associated record-keeping required by OSHA guidelines.

- *For Large-Volume Automatic Processors:* Available in a size to make 75 U.S. gallons.
- *For Small- to Medium-Volume Automatic Processors:* Available in sizes to make 5 and 10 litres and 12.5 U.S. gallons.

KODAK FLEXICOLOR Stabilizer III and Replenisher

Stabilizer III provides excellent performance for reducing drying marks, and robust image stability for films requiring stabilization.

- *For Large-Volume Automatic Processors:* Available in a size to make 75 U.S. gallons.
- *For Small- to Medium-Volume Automatic Processors:* Available in sizes to make 5 and 12.5 U.S. gallons.

KODAK FLEXICOLOR Chemicals for Processors with In-Line Replenishment

KODAK FLEXICOLOR AR Developer Replenisher

Use this developer in processors that use automatic in-line replenishment systems. Three parts are required for a developer replenisher mix, and are available separately. To make a tank solution from this replenisher, use *only* FLEXICOLOR Developer Starter.

- *Part A available in a 5-gallon flexible container.*
- *Part B available in a 1-gallon flexible container.*
- *Part C available in a 1-gallon flexible container.*

KODAK FLEXICOLOR Developer Starter

Use this starter *only* with KODAK FLEXICOLOR AR Developer Replenisher or FLEXICOLOR Developer Replenisher.

- *For All Processors:* Available as a 1-quart concentrate to make 17.8 U.S. gallons of developer tank solution.

KODAK FLEXICOLOR Bleach III Replenisher

This chemical is supplied in a flexible plastic container.

- *Available in a size to make 12.5-gallons.*

KODAK FLEXICOLOR Bleach Starter

Use this starter to prepare bleach tank solution with FLEXICOLOR Bleach III Replenisher. This product is odorless, non-corrosive, and non-foaming for easy use.

- *For All Processors:* Available as a 1-gallon concentrate to make 20 U.S. gallons of Bleach III tank solution.

KODAK FLEXICOLOR Fixer and Replenisher

This chemical is supplied in a flexible plastic container.

- *Available in a size to make 12.5-gallons.*

KODAK FLEXICOLOR AR Stabilizer III and Replenisher

Use this stabilizer in roller-transport and rack-and-tank processors. It provides robust image stability for films requiring stabilization and excellent performance for reducing drying marks.

- *Available in a 5-gallon flexible container.*

KODAK FLEXICOLOR Chemicals for Minilabs

KODAK FLEXICOLOR Developer Replenisher LORR

This developer has low replenishment rates that help reduce developer effluent discharge by as much as 50 percent. Lower replenishment rates mean less chemical mixing and lower cost per roll of film processed. Use *only* FLEXICOLOR Developer Starter LORR to prepare a fresh tank solution with FLEXICOLOR Developer Replenisher LORR.

- Available in sizes to make 5 and 10 litres and 25 U.S. gallons (two 12.5-gallon sizes).

KODAK FLEXICOLOR Developer Starter LORR

Use this starter to prepare a fresh tank solution from FLEXICOLOR Developer Replenisher LORR.

- Available in a size to prepare 8.3 U.S. gallons of developer tank solution from developer replenisher.

KODAK FLEXICOLOR Bleach III NR Replenisher

For minilabs using Process C-41B, this bleach offers reduced cost per roll of film and reduced replenishment rates and volume of effluent discharged. It requires no mixing; it is packaged ready to use.

- Available in a 5-litre size.

KODAK FLEXICOLOR RA Bleach Replenisher NR

This bleach was designed for use *only* with minilabs that use Process C-41RA. It requires no mixing; it is packaged ready to use. This bleach is also odorless.

- Available in a 5-litre size.

KODAK FLEXICOLOR Bleach Starter

Use this starter to prepare a bleach tank solution with FLEXICOLOR Bleach III NR Replenisher or FLEXICOLOR RA Bleach Replenisher NR. This product is odorless, non-corrosive, and non-foaming for easy use.

- Available as a 1-gallon concentrate to make 20 U.S. gallons of Bleach III NR tank solution or 8.3 U.S. gallons of RA Bleach NR tank solution.

KODAK FLEXICOLOR Fixer and Replenisher

Use this fixer for Process C-41 or C-41B.

- Available in sizes to make 5 litres and 5 and 25 U.S. gallons.

KODAK FLEXICOLOR RA Fixer and Replenisher

This fixer was designed for use *only* with minilabs that use Process C-41RA.

- Available in sizes to make 5 and 10 litres.

KODAK FLEXICOLOR Final Rinse and Replenisher

This final rinse is designed with state-of-the-art surfactants to reduce deposits and drying marks on processed color negative films. It also reduces the potential for biological growth in the mixed solution. As a result, both the processed film and the seasoned working tank solution will be cleaner. This means less maintenance and less frequent dumping of working tanks. Because the new final rinse contains no stabilizing agent, labs will not need to provide formaldehyde training or do the associated record-keeping required by OSHA guidelines.

- Available in sizes to make 5 and 10 litres and 12.5 and 75 U.S. gallons.

KODAK FLEXICOLOR Chemicals for Rotary-Tube Processors, Small Tanks, and Unreplenished Sink Lines

These chemicals are designed for use in unreplenished batch systems—e.g., small tanks, rotary tubes, and small-volume sink lines. They are ready to use as mixed without adding starter.

Note: For higher-volume replenished sink-line systems, it is more practical to use larger chemical sizes. You can prepare tank solutions of developer and bleach by adding the appropriate starters to the replenisher solutions.

KODAK FLEXICOLOR Developer

Use this developer in unreplenished systems. No starter is needed.

- *Available in a size to make 1 U.S. gallon.*

KODAK FLEXICOLOR Bleach III

Use this bleach full-strength in small tanks and tube-type processors without replenishment.

- *Available in a size to make 1 U.S. gallon.*

KODAK FLEXICOLOR Fixer and Replenisher

Mix according to the directions for use as a working solution.

- *Available in sizes to make 1 and 5 U.S. gallons.*

KODAK FLEXICOLOR Stabilizer III

Mix according to the directions for use as a working solution.

- *Available in a size to make 1 U.S. gallon.*

CHEMICAL TERMS

To help you understand the terms we've used to describe the chemicals in this manual, here are some definitions:

Chemical Concentrates—Chemicals that are used to make replenisher solutions and fresh tank solutions.

Replenisher—Solution used to restore the chemical components of a tank solution to maintain photographic performance over time.

Regenerator—Concentrate added to tank solution overflow to convert it for reuse as replenisher solution.

Seasoned Solution—A tank solution that has been used and replenished for a period of time. The chemical components and seasoning by-products of a seasoned solution are at an optimum level for processing.

Starter—Solution added to diluted chemical concentrates to prepare a fresh tank solution so that it yields results similar to those provided by a seasoned tank solution.

Tank Solution—The solution used in the processor tank; often referred to as “working solution.”

SAFE HANDLING OF PHOTOGRAPHIC CHEMICALS

Every substance we come into contact with is composed of chemicals—the food we eat, the air we breathe, the clothing we wear, the medicine we take. Although most of these chemicals are not hazardous, you may need to take precautions to limit the exposure to some chemicals that could be harmful. For example, direct skin or eye contact with or inhalation of vapors or mists from some household cleaning products can be irritating.

When handled properly, photographic processing chemicals are safe to use. Follow the guidelines below to minimize the potential hazardous effects of these chemicals.

Be Informed

Safe handling of chemicals requires that you recognize and avoid the potential hazards. Learning more about photographic processing chemicals reduces the possibility of illness or injury.

Occupational Health and Safety Regulations

The Occupational Safety and Health Administration (OSHA) Hazard Communication Standard requires chemical manufacturers to label their products properly and to provide Material Safety Data Sheets (MSDSs) for hazardous chemicals. OSHA also requires employers to make MSDSs available in the workplace for the purpose of proper chemical container labeling, and to train employees on the safe use of chemicals.

Product Labels

Kodak provides warning and precautionary statements on product labels, instruction sheets, and packaged products. Kodak also provides labels for processor and replenisher tanks. Kodak evaluates photographic processing chemicals for potential health and physical hazards. When a photographic processing chemical has little, if any, potential hazard, the statement “LOW HAZARD FOR RECOMMENDED HANDLING” is included on the label.

Photographic processing chemicals that are potentially hazardous have appropriate precautionary statements, such as:

Signal Word—For example, “CAUTION,” “WARNING,” or “DANGER!”

Statement of Hazard—For example, “CAUSES SKIN AND EYE BURNS,” “HARMFUL IF ABSORBED THROUGH THE SKIN,” or “FLAMMABLE.”

Precautionary Wording—For example, “Do not get in eyes, on skin, or on clothing” or “Keep away from heat, sparks, and flame.”

First-Aid Statements—Included on labels and signs to describe immediate measures you must take in case of contact with or overexposure to a photographic processing chemical.

Material Safety Data Sheets

Photographic processing facilities are required by OSHA to have MSDSs for all hazardous chemicals. MSDSs provide detailed information about each product. Information included in MSDSs is outlined in the following categories: chemical and manufacturer identification; composition/ingredients; hazard identification; first-aid measures; fire-fighting measures; accidental release measures; handling and storage; exposure controls and personal protection; physical and chemical properties; stability and reactivity; toxicological information; ecological issues; disposal issues; transport issues; regulatory issues; and other information.

Kodak provides customers with MSDSs for all photographic processing chemicals. If you need replacement(s) or extra MSDSs for any Kodak chemical, visit the Kodak website at www.kodak.com/go/MSDS or call 1-800-242-2424, extension 10. You will need to supply the catalog (CAT) number of the products for which you need MSDSs.

Training

OSHA requires that all employees be trained on the safe handling of photographic processing chemicals and general lab safety prior to their initial assignment and whenever new hazards are introduced into the workplace. Employees should be familiar with the OSHA Hazard Communication Standard, operations where hazardous chemicals are present, the location and content of Material Safety Data Sheets, physical and health hazards of chemicals in their work area, and additional topics. For more information on OSHA’s Hazard Communication Standard, see KODAK Publication No. J-311, *Hazard Communication for Photographic Processing Facilities*. You may also want to review KODAK Publication No. J-98R, *Health, Safety, and Environmental Program*.

Handle Chemicals Properly

Once you know the hazards, learn how to handle chemicals safely. Safe handling practices include wearing personal protective equipment, following procedures that minimize chemical contact, and following the instructions on chemical labels. If contact occurs, know how to treat or obtain medical/first-aid assistance.

Protective Equipment and Clothing

OSHA requires that personal protective equipment (PPE) be used in the workplace whenever the possibility of chemical contact exists. OSHA also requires that you perform a hazard assessment in your facility to determine what type of personal protective equipment is required to protect against the hazards present. In general, the personal protective equipment required for handling photographic processing chemicals includes:

- Neoprene or nitrile gloves
- Safety goggles
- Vinyl or rubber apron or lab coat

Check personal protective equipment often to make sure it is in good working condition, is clean, and works and fits properly. Training must be provided on the use, limitations, and maintenance of personal protective equipment. For more information, see KODAK Publication No. J-312, *Personal Protective Equipment Requirements for Photographic Processing Facilities*.

Corrosive Materials

Certain photographic processing chemicals contain materials that can burn or irritate the skin and eyes, sometimes with only brief contact. To reduce the possibility of injury, always wear personal protective equipment when handling photographic processing chemicals. Also make sure an emergency eyewash station is readily available.

Contact Dermatitis

Dermatitis is the medical term used to describe a skin inflammation. Contact with some materials, such as acids and bases, can cause *irritative contact dermatitis*, while other chemicals, such as photographic developers, may cause *allergic contact dermatitis*.

Early symptoms of **irritative contact dermatitis** may include dry, red, cracked or scaly skin at the site of contact. Symptoms may worsen with continued chemical exposure. In most cases of **allergic contact dermatitis**, the symptoms are itchy blisters similar to those seen from exposure to poison ivy or poison oak. Although the rash is usually confined to the site of contact, most often fingers, hands, and forearms, it may spread to other areas.

Sometimes people can work with a chemical for years without any noticeable effect, only to develop contact dermatitis at a later date. The time between contact and when a response develops varies widely among individuals. People with a history of skin allergies, eczema, or other skin disorders may be more susceptible to the effects of contact with chemicals.

If you think you have developed contact dermatitis, contact your manager. A medical examination may be required to determine the cause of the problem. **Do not** attempt to self-medicate with lotions or creams; they may make the problem worse.

To **prevent contact dermatitis** when handling photographic processing chemicals, follow these guidelines:

- **Read the labels** on chemical containers so you know what precautions to take when handling the contents.
- **Avoid contact with chemicals whenever possible.** Handle chemical solutions carefully to avoid splashing. Keep all personal protective equipment (gloves, goggles, apron, etc.) free of chemical residues.
- **Wear the proper gloves.** Do not use gloves sold for household use; they may not be durable enough for handling photographic processing chemicals. Neoprene or nitrile gloves protect you from photographic processing chemicals. To minimize the possibility of chemicals coming in contact with your bare hands, rinse gloves thoroughly with water before taking them off. On a regular basis or if chemicals get inside the gloves, wash them inside and out, and hang them by the fingertips to dry.
 - Check gloves regularly for pinholes, leaks, or tears.
 - Dispose of gloves when they are damaged or begin to degrade.
 - Barrier creams ARE NOT an acceptable substitute for gloves.
- **In case of contact with chemicals, wash your hands or other affected skin areas immediately** with plenty of water. Wash with a mild soap or pH-balanced cleanser (like Phisoderm, Sulfo Hand Cleaner, or pH6). Avoid using harsh or abrasive soaps or hand cleaners.

- **Protect skin abrasions or cuts.** The risk of contact dermatitis is increased if chemicals penetrate the skin. Skin damaged by cuts or abrasions is especially susceptible to irritants.
- **Change and launder clothing worn while handling chemicals.** If photographic processing chemicals are splashed or spilled on your clothes, immediately rinse the clothes to remove the chemical residue. Wash contaminated clothing before wearing it again.
- **Clean up chemical spills or splashes immediately.** Always wear personal protective equipment when cleaning up spilled photographic processing chemicals. Follow the directions under “Accidental Release Measures” in the MSDS. To prevent a potentially dangerous chemical reaction, never use soaps, bleaches, or other cleaners directly on a spill.
- **Immediately report any unusual skin condition** that you think might be related to photographic processing chemicals to your manager and to your physician. Conditions such as contact dermatitis can be caused by materials other than photographic processing chemicals; dermatitis usually will not improve until the cause is found and the condition is properly treated.

Absorption of Chemicals Through the Skin

Some chemicals are able to enter the body by absorption through the skin. A variety of factors determines the effects of these chemicals, including the toxicity of the chemical, its concentration, and the duration of skin contact. Chemicals can have a toxic effect even without skin irritation. If tests indicate that a photographic processing chemical may be absorbed through the skin in amounts that could cause an adverse effect, the product label will include a precautionary statement, such as “HARMFUL IF ABSORBED THROUGH THE SKIN.” Always wear personal protective equipment when handling these chemicals.

Ventilation

Proper ventilation is important to ensure a safe and comfortable indoor air environment for photographic processing areas. Several common potential indoor air contaminants can be associated with photographic processing. These include acetic acid, sulfur dioxide, and ammonia. These chemicals may be eye and respiratory tract irritants depending on their airborne concentrations. OSHA and other agencies have established exposure guidelines and standards that represent concentrations under which it is believed that nearly all employees may be repeatedly exposed to these chemicals without adverse health effects. If significant eye or respiratory tract irritation occurs during normal photographic processing or maintenance operations, this may indicate elevated levels of these materials and the need for better control.

For more information, see KODAK Publication No. J-314, *Indoor Air Quality and Ventilation in Photographic Processing Facilities*.

Photographic Chemicals in a Home Darkroom

Photographic chemicals used in home darkrooms are essentially the same as those used in commercial photoprocessing labs, but they are used in smaller volumes and less frequently. The safety precautions are the same as those required for commercial labs. However, it is important to take extra precautions for storage and use to protect young children and pets.

Know First Aid in Case of an Emergency

Appropriate first-aid treatment is included in the MSDS and on the product and processor labels. First aid should be used for immediate treatment in the event of an emergency and is not intended to replace medical attention. **Do not** administer first aid to others unless you have been specifically trained to do so.

Chemical Splashes

If a chemical gets into a person’s eye(s), use an eyewash station to thoroughly flush the eye(s). Get medical attention, if necessary.

If you get chemicals on your clothing, thoroughly rinse the affected clothes to remove all of the chemical residue. Use water to rinse the skin area where the chemical contact took place. If the chemical is a developer, wash with a pH-balanced cleanser. Wash contaminated clothing before wearing it again. Thoroughly clean contaminated shoes; if they cannot be cleaned, discard them.

Swallowed Chemicals

Immediately identify which chemical was swallowed and follow the first-aid recommendations on the container/processor label and in the MSDS. Call a physician or poison-control center as quickly as possible; make sure you have the MSDS with you when you call.

Inhaled Vapors and Gases

Immediately get fresh air. If symptoms persists, get medical attention.

Store Chemicals Safely

Keep containers easily accessible—Always store photographic processing chemical containers in a designated area, away from heavy traffic, where they can be identified and inventoried. Position containers in an area where you can easily reach without having to stretch.

Do not remove chemical labels—Container labels include the chemical name, appropriate hazard warnings, and precautionary measures where applicable.

Processor tanks and other storage tanks also need to be properly labeled. Kodak provides hazard warning labels for this purpose.

Use the proper containers—Store photographic processing concentrates in the containers in which they were originally delivered. **Do not** transfer chemicals into any other containers.

Keep corrosive materials separated—Store corrosive materials away from any materials with which they may react, and away from other incompatible materials. See the stability and reactivity section on the MSDS for more information.

Dispose of Photographic Chemicals Properly

Always follow the procedures designated for your photographic processing facility when disposing of photographic processing chemicals. These disposal procedures are based on local, state, and federal requirements that regulate the disposal of photographic processing chemicals.

If your facility discharges waste solutions, make sure you have reviewed the local sewer discharge requirements for your area. Use silver-recovery methods for silver-bearing effluents (e.g., used fixers, bleach-fixes, and stabilizers). Also, know what other materials may be discharged to a common drain. **Never** pour any photographic processing chemicals into a drain where cleaning agents containing chlorine are present *unless* the drain has been *thoroughly* rinsed. Run plenty of water down the drain prior to disposing of photographic processing chemical effluents. Then thoroughly rinse the drain again after disposal of effluents.

For more information on silver recovery, see KODAK Publication No. J-212, *The Technology of Silver Recovery for Photographic Processing Facilities*.

If off-site treatment (hauling) is used for the disposal of waste photographic processing solutions, make sure the only solutions poured into the waste drum(s) are photographic processing solutions.

Regardless of the type of recovery or disposal procedure you use in your facility, maintain the system so that overflows and spills do not occur.

Summary

Safe handling of photographic chemicals is easy when you use common sense and follow these guidelines:

- Know the chemicals you are handling.
- Read the MSDSs and container labels.
- Protect your eyes and skin by wearing personal protective equipment.
- Use caution when mixing and pouring photographic processing chemical solutions into processor tanks.
- Use care when moving containers from one location to another.
- Store photographic processing chemicals safely.
- Do not eat, drink, or smoke in chemical-handling areas.

More Information

If you have environmental or safety questions about Kodak products or services, contact Kodak Environmental Services at 716-477-3194, between 8 a.m. and 5 p.m. (Eastern time).

Kodak also maintains a 24-hour health hotline to answer questions about the safe handling of photographic chemicals. If you need health-related information about Kodak products, call 716-722-5151.

For questions concerning the safe transportation of Kodak products, call Kodak Transportation Services at 716-722-2400.

The products and services described in this publication may not be available in all countries. In countries outside the U.S., contact your local Kodak representative, or your usual supplier of Kodak products.

For more information, visit the Kodak website at www.kodak.com/go/photochemicals.

MIXING CHEMICALS

For the most current mixing instructions, follow those packaged with the chemicals or on the label of the container. Be sure to follow all safety precautions and the handling recommendations described earlier. Table 1-1 summarizes the mixing instructions for FLEXICOLOR Chemicals.

Table 1-1 Mixing KODAK FLEXICOLOR Chemicals

Chemical	Comments
Developer Developer Replenisher Developer Replenisher LORR	Mix the developer solution at 21 to 38°C (70 to 100°F). The mixing order is important with developers and developer replenishers because Parts A and B contain the preservatives. Therefore, add Part C only after you have mixed Parts A and B. It is not necessary to mix each part for a long time. You can add the parts in fairly rapid succession without causing a problem. Agitate enough to mix the developer completely in less than 5 minutes without introducing a lot of air into the developer solution. The solution will be clear and colorless after you add Parts A and B; it will be amber after you add Part C.
Bleach III Bleach III Replenisher Bleach III Regenerator Bleach III HV Regenerator	Mix at 21 to 38°C (70 to 100°F). The chemicals mix easily. Lengthy agitation does not harm bleaches; it provides beneficial aeration. Fresh bleach and replenisher should be colorless and clear (no solids) after Part A is added. After both Parts A and B have been mixed, the bleach should be greenish yellow, and should not contain any solids. Visual appearance will change after the bleach overflow is regenerated; the solution will be darker.
Bleach III NR Replenisher RA Bleach Replenisher NR	These bleaches do not require mixing; they are ready to use as supplied. The color of the Bleach III NR should be a greenish yellow. The color of the RA Bleach NR should normally be dark green-yellow.
Fixer Fixer and Replenisher ELECTROSILVER Fixer and Replenisher LORR RA Fixer and Replenisher	Mix at 21 to 38°C (70 to 100°F). Provide moderate agitation so that mixing is complete in approximately 5 minutes. Although fixers are not as oxygen-sensitive as developers, avoid aeration. In extreme cases, too much agitation can cause sulfurization. Mixed fixer solution is clear and colorless to light yellow.
Final Rinse and Replenisher Stabilizer III and Replenisher	Mix at 21 to 38°C (70 to 100°F). FLEXICOLOR Stabilizer III and Final Rinse and Replenishers contain a wetting agent that can produce a lot of foam if agitation is too vigorous. Mixed final rinse and stabilizer are clear and colorless.

Contamination Can Ruin a Process

To minimize the possibility of contamination, keep processing and mixing equipment and storage containers clean. Dirt and contamination can affect the life and photographic quality of the processing solutions. Avoid conditions where solutions can come in contact with other chemicals. Contamination is most often caused by—

- solution splashed or dripped into another solution
- using mixing equipment that has not been thoroughly cleaned
- dry chemicals that become airborne during mixing
- pipes and tanks made of material that reacts with the photographic chemicals

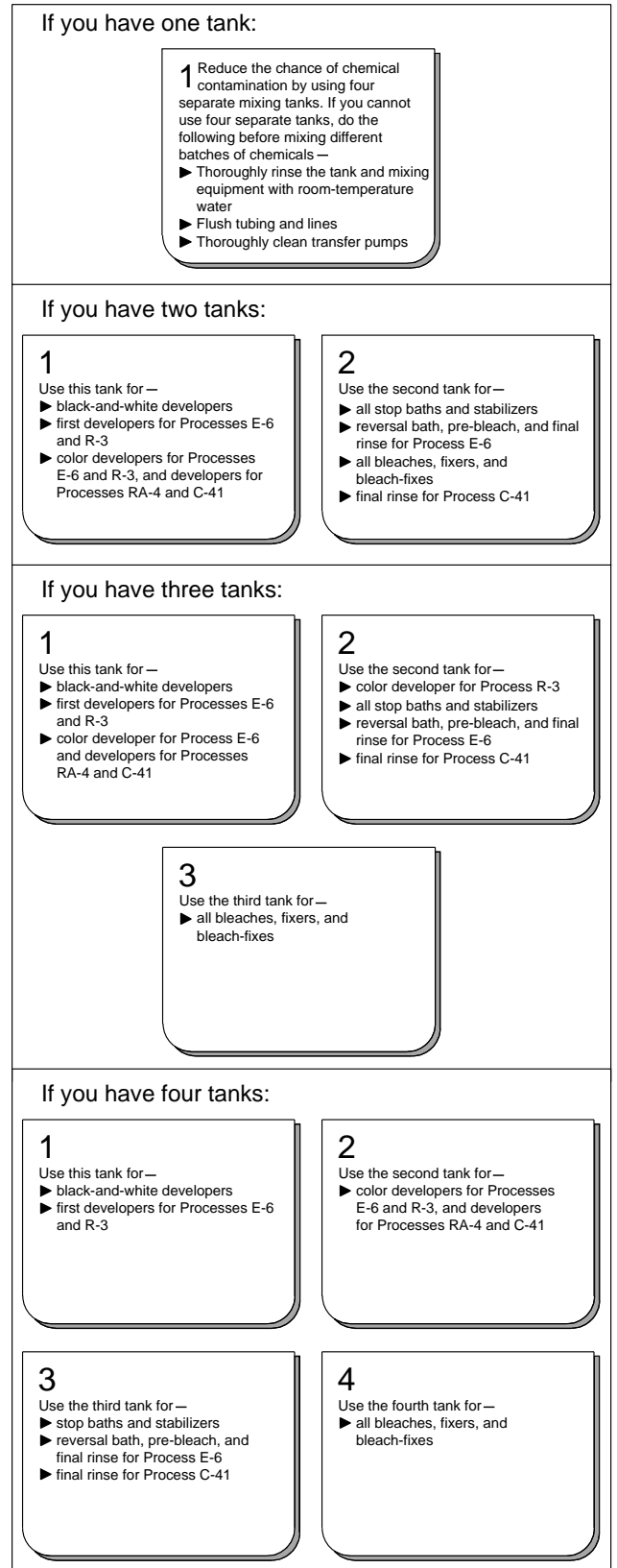
To reduce the possibility of contamination, take care to avoid dripping solution into other tanks when you remove racks for cleaning, avoid splashing by not agitating too vigorously, and check that processing and mixing equipment and plumbing are made of suitable material. If possible, use a separate set of mixing equipment to mix each type of solution, and wash all equipment *thoroughly* before you reuse it.

Using separate mixing tanks may not always be practical or possible. Figure 1-1 gives mixing arrangements for one to four mixing tanks. Use it as a guide for using your mixing tanks in the best manner to reduce the possibility of contamination.

- If you mix only chemicals for **NEGATIVE** processes, use two mix tanks: one for developer and one for all other solutions.
- If you mix only chemicals for **REVERSAL** processes, use two mix tanks: one for the first and color developers and one for all other solutions. Three mix tanks are preferable: one for the developers, one for the bleach and fixer, and one for all other solutions.
- If you mix chemicals for **NEGATIVE** and **REVERSAL** processes, use four mix tanks: one for the negative developer and the reversal first developer; one for color developer; one for bleach and bleach-fix; and one for all other solutions.

Remember also that good housekeeping (e.g., keeping the mixing area clean, neat, and well ventilated; proper storage of chemicals, etc.) will reduce the possibility of contamination and provide safer working conditions.

Figure 1-1 Configurations for Chemical Mixing Tanks



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Water Quality

Water can have a significant effect on photographic quality. Generally, most municipal or public water supplies are sufficiently pure for photographic use. Note that the quality of water supplies can vary seasonally, and it is a good idea to have your water supply tested periodically.

Water for photographic processing should be free of color, suspended material, and heavy metals, and should not be excessively hard. For mixing processing solutions, the water should have less than 250 ppm of total dissolved solids (less than 1000 ppm for wash water). The pH of water should be 6.5 to 8.5 and should not be highly buffered. Practical limits for common water impurities for photographic processing are listed in Table 1-2. If you use well water, be sure to have the water tested for the impurities listed in Table 1-2.

Also, poor plumbing materials (e.g., old, rusty pipes or pipes made of the wrong material) can be a source of dirt and contamination. Check your plumbing and replace it if necessary.

Table 1-2 Practical Limits of Impurities for Water Used in Photographic Processing

Impurity	Acceptable Limit or Range (ppm)
Color, suspended material	None
Dissolved solids	1000 (for washes) 250 (for preparing solutions)
pH	6.5 to 8.5
Hardness, as CaCO ₃	40 (preferable) to 150
Copper, iron, manganese	0.10 each
Chlorine, as free hypochlorous acid	2
Chloride	100
Bicarbonate	150
Sulfate	200
Sulfide	0.10
Silica	20

Note: If analysis of water shows a marked deviation from the amounts in Table 1-2, consult a water-conditioning company to determine the most suitable method of treatment or filtration of the water.

Construction Materials for Processing Equipment

It is important to use the proper construction materials for processing equipment.

Developers—Use Type 316 stainless-steel tanks for developers. Some plastic materials, such as polyethylene, are also acceptable.

Other Solutions—Bleach and fixer solutions rapidly corrode brass, copper, and lower grades of stainless steel. Avoid contact of these metals with bleach and fixer. For FLEXICOLOR Bleach III, FLEXICOLOR Fixer, and wash tanks, the best material is Type 316 stainless steel. For FLEXICOLOR RA Bleach and FLEXICOLOR RA Fixer, the preferred construction material is titanium. Several plastic materials, such as polyethylene, are also acceptable as construction materials for processing equipment.

Clean Your Processor Tanks and Racks Regularly

Always wear splash-proof goggles and protective gloves and apron when you clean racks and tanks.

Routine Cleaning—Follow the recommendations described below. **Be sure to follow your equipment manufacturer's recommendations for regular maintenance procedures.**

1. Remove crossovers, squeegee rollers, or squeegees at shutdown, and rinse them with hot water.
2. Once a week, remove each rack from the processor, clean it with hot water and a soft, non-abrasive brush, and rinse thoroughly. Inspect the racks for non-moving rollers, deformities in rollers, worn or broken springs, loose screws, deteriorated retaining clips, etc., to ensure smooth transport of film.
3. On a periodic basis (every 6 to 12 months), clean racks and tanks with a non-abrasive brush, and remove stains from racks and tank walls with a cleaner such as KODAK Developer System Cleaner and Neutralizer (follow the instructions provided with this product). Rinse racks and tanks thoroughly before you refill the tanks.

Removing Biological Growth—Biological growth can occur in final rinse and wash tanks. This is a potential source of dirt. To remove biological growth:

1. Empty the processing solution tank. Dispose of waste solutions according to local disposal regulations.
2. Rinse the tanks and racks with hot water; drain the rinse water and repeat.

DANGER! The addition of cleaning agents that contain strong acids or oxidizing agents (e.g., chlorine-containing bleaches) to thiocyanate-containing photoprocessing solutions (i.e., some fixer solutions) may release poisonous and flammable hydrogen cyanide gas, as well as other irritating and toxic gases, such as cyanogen chloride and sulfur dioxide. **Do not** add cleaning agents to processing tanks unless the tanks, racks, and recirculation system have been completely drained and thoroughly flushed and rinsed with water. Read the Material Safety Data Sheet for information on the potential hazards of the working tank solution.

3. Fill the tank with sodium hypochlorite (NaOCl) solution, such as 2 mL Clorox (5.25 percent NaOCl) or 1 mL Sunny Sol (12.5 percent NaOCl) per litre of water. (Note the caution above.)
4. Allow the hypochlorite solution to remain in the tanks for up to 30 minutes. Longer dwell times can damage plastic or rubber materials. After treatment, dispose of the hypochlorite solution according to local or state disposal regulations.
5. Brush foreign matter from the tanks and racks.
6. Before refilling the tanks, flush them *thoroughly* with water. Small amounts of remaining hypochlorite can have an adverse effect on processing solution activity. *Be sure to recirculate rinse water through the recirculation system to remove traces of hypochlorite.*

Note: For more information on the recommended methods for cleaning processing tanks, in the U.S., contact the Kodak Information Center at 800-242-2424, extension 60. In Canada, call 800-465-6325. In other regions, contact Kodak in your country. For information on controlling biological growth, request a copy of KODAK Publication CIS-3, *Biocides for Photographic Solution Tanks and Wash Water*.

STORING CHEMICAL CONCENTRATES AND SOLUTIONS

How well you store chemical concentrates and solutions may affect the activity of processing solutions. For the most up-to-date source of information on mixing and storing chemicals, see the instructions packaged with the chemicals.

Storage Temperature—Store *unmixed chemical concentrates* in a dry location at a temperature of 5 to 30°C (40 to 86°F). Lower temperatures may cause components to come out of solution or crystallize. Higher temperatures can accelerate chemical reactions and cause deterioration.

Store *mixed solutions* in polyethylene storage tanks at approximately 21°C (70°F). If a replenisher is stored at a temperature that is too low, it can affect the temperature of the tank solution. Too high a storage temperature accelerates oxidation and evaporation.

Storage Tanks and Containers—Equip storage tanks with floating lids and dust covers to minimize evaporation and protect solutions from dust and dirt.

Once you open the original container, the chemicals are exposed to oxygen that will react with the chemicals and gradually cause them to deteriorate. This is especially true of developers. Oxidation occurs to some extent even if you immediately reseal the container. To reduce the effects of oxidation, store solutions in amounts that you can use at one time. For example, if you open a 10-gallon-size container, mix the entire amount, and then store the solution in closed one-gallon containers. Each time you need more chemicals, open a bottle and use the entire amount. The remaining mix stored in separate containers is not exposed to air.

When you store solutions in plastic bottles, fill the bottle close to the top and then squeeze the bottle gently before you cap it to raise the chemical level to the top of the neck.

Flexible plastic containers minimize oxidation because air is excluded when the plastic container collapses as chemicals are removed. Store drums upright to expose as little surface area to the air as possible.

Length of Storage Time—For best results, do not use solutions stored longer than the times given in Table 1-3.

Table 1-3 Storage Times for KODAK FLEXICOLOR Chemicals

Mixed Solution (Fresh)	Full Stopped Glass Bottles	Tanks with Floating Covers
Developer or Developer Replenisher	6 weeks	4 weeks
Bleach III Replenisher	8 weeks	8 weeks*
Bleach Tank Overflow awaiting regeneration	8 weeks	8 weeks*
Other Solutions	8 weeks	8 weeks

* Because aeration is beneficial to Bleach III Replenisher, do not use floating lids.

CHECKING CHEMICALS AND CHEMICAL MIXES

Fresh FLEXICOLOR Chemical concentrates and solutions have a characteristic appearance and odor. By checking the appearance and odor, you may be able to determine if a concentrate was stored properly or if a solution was mixed correctly. Table 1-4 summarizes the characteristics of FLEXICOLOR Chemicals and solutions. You can also check your mixes for possible mixing errors by using specific-gravity measurements.

Table 1-4 Characteristics of KODAK FLEXICOLOR Chemicals

Chemical	Part	Normal Appearance	Comments
Developer Developer Replenisher Developer Replenisher LORR	A B C	Clear, colorless to very pale yellow; odorless Clear, colorless; odorless Clear; color varies from light yellow to yellow	A crystalline precipitate may appear in parts that are kept too long (more than 2 years) and/or exposed to cold temperatures. If color and odor are normal, Part A is usable if the crystalline material dissolves upon mixing. Extended mixing and heat may be needed before adding Parts B and C. However, be sure mixture is no warmer than 38°C (100°F) when Part C is added. The color range is due to different levels of sulfite. Absence of sulfur dioxide odor means the preservative is exhausted. If the solution turns color or becomes opaque, or if there is a precipitate, do not use it.
Developer Starter Developer Starter LORR		Clear, colorless to very pale yellow; faint odor	
Bleach III (1-gallon size) Bleach III Replenisher	A B	Clear, colorless to very pale yellow; odor of acetic acid (vinegar) Greenish-yellow; slight ammonia odor	Occasionally you may see a very small amount of light yellow-brown sediment in the mix. This material should not affect processing. When exposed to cold (below 4° C/40° F), the solution may form a green-brown precipitate. This material will not redissolve, do not use.
Bleach III Regenerator Bleach III HV Regenerator		Greenish-yellow; slight ammonia odor	When exposed to cold (below 4° C/ 40° F), the solution may stratify. Requires agitation to redissolve after reaching room temperature.
Bleach III NR		Greenish-yellow; slight ammonia odor	When exposed to cold (below 4° C/ 40° F), the solution may form a green-brown precipitate. This material will not redissolve, do not use.
RA Bleach NR		Dark yellowish-green; no odor	When exposed to cold (below 4° C/40° F), the solution may form a green-brown precipitate. This material will not redissolve, do not use.
Bleach Starter		Clear, colorless; odorless	
Fixer ELECTROSILVER Fixer LORR RA Fixer		Clear, colorless to very pale yellow; odor of ammonia	Age and/or exposure to high temperature can cause sulfurization. When a white to light yellow sediment forms, the solution becomes more yellow, and a musty odor (sulfur) is noticeable along with the acetic acid odor. A severely degraded fixer may have a large amount of precipitate and an odor of hydrogen sulfide (i.e., rotten-egg odor) and may appear dark; do not use it.
Final Rinse and Replenisher		Very light to light cyan	
Stabilizer III and Replenisher		Clear, colorless; slight odor of formaldehyde	

Check Your Mixes with Specific-Gravity Measurements

Specific gravity provides a convenient way to measure the total dissolved material in a solution. Its primary use with FLEXICOLOR Chemicals is to check for mixing errors. Specific gravity is the ratio of the mass of a liquid to the mass of an equal volume of water. The amount and type of materials in a solution determine the specific gravity.

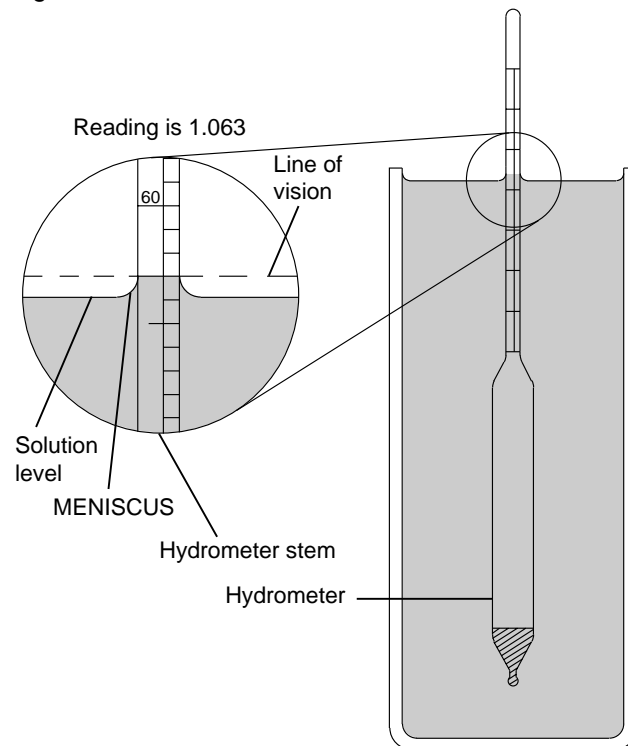
How to Measure Specific Gravity—You can make specific-gravity measurements of your solutions with any hydrometer that meets the standard ASTM E100-95 (2001). The hydrometer should be marked in increments of at least 0.001 for an accuracy of ± 0.0005 . Although most hydrometers are calibrated at 15.5°C (60°F), they are useful at other temperatures. To measure the specific gravity of FLEXICOLOR Chemicals, follow the procedure described below. Typical specific-gravity ranges for fresh mixes are given in Table 1-5.

1. Fill a clean, dry 250 mL graduated cylinder to within 2.5 cm (1 in.) of the top with the solution you are measuring.
2. Adjust the solution to a temperature of $25 \pm 1^\circ\text{C}$ ($77 \pm 2^\circ\text{F}$). *Proper solution temperature is very important.*
3. Place the cylinder in a sink or tray to catch overflow.
4. Choose the correct hydrometer to match the approximate specific gravity of the solution.
5. Be sure that the hydrometer is clean and dry. Carefully lower the hydrometer into the solution. Let it bob up and down slightly. When it stops, read the number at the top of the meniscus (see Figure 1-2).
6. After making the measurement, discard the sample. To avoid contaminating solutions, **do not** return the sample to the tank.

7. Rinse the hydrometer and graduated cylinder thoroughly with water.

Note: Never take specific-gravity readings of solutions in the processor tanks. Inaccurate readings can result if the hydrometer bobs on the surface of the tank solution, or if the line of vision is not level with the hydrometer. Also, if you use the wrong hydrometer, it can sink to the bottom of the tank and break. Label hydrometer boxes to avoid confusion. **Do not** use tape labels on hydrometers.

Figure 1-2



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Table 1-5 Specific-Gravity Values for KODAK FLEXICOLOR Chemicals

KODAK FLEXICOLOR Chemical	Specific Gravity at 25°C (77°F)		
	Fresh Tank	Seasoned Tank	Replenisher
Developer	1.034 to 1.040	1.036 to 1.044	1.034 to 1.040
Developer LORR	1.034 to 1.040	1.036 to 1.044	1.036 to 1.042
Developer LORR (5 and 10 litres)	1.034 to 1.040	1.036 to 1.044	1.034 to 1.040
Bleach III	1.030 to 1.040	1.030 to 1.060*	1.030 to 1.040
Bleach III HV	—	1.040 to 1.070*	—
Bleach III NR	1.035 to 1.045	1.040 to 1.070	1.045 to 1.055
RA Bleach NR	1.130 to 1.160	1.130 to 1.160	1.155 to 1.165
Fixer	1.055 to 1.100	1.055 to 1.100	1.080 to 1.090
RA Fixer	1.075 to 1.095	1.085 to 1.115	1.080 to 1.090
ELECTROSILVER			
Fixer LORR	1.075 to 1.115	—	1.130 to 1.140
Tank 1	—	1.085 to 1.125	—
Tank 2	—	1.095 to 1.135	—
Final Rinse	0.990 to 1.010	0.990 to 1.010	0.990 to 1.010
Stabilizer III	0.990 to 1.010	0.990 to 1.010	0.990 to 1.010

* The specific gravity of regenerated bleach replenisher should fall within this range.

EFFLUENT DISPOSAL

Effluent from KODAK FLEXICOLOR Chemicals consists of normal amounts of spent developer, bleach, desilvered fixer, wash water, and stabilizer. Desilver the fixer before you dispose of it. This effluent is compatible with and effectively treated by a municipal secondary waste-water treatment plant.

Because regulations define photographic effluent as an industrial waste discharge, most municipalities require a permit to discharge it to a waste-water treatment facility.

After efficient silver recovery, typical effluent from processes using KODAK FLEXICOLOR Chemicals has the characteristics listed in Table 1-6.

Table 1-6

pH	6.5 to 9
Temperature	Less than 30°C (90°F)
Silver	Less than 5 mg/L
Suspended solids	Less than 50 mg/L
Oils, greases, or detergents	None
Flammable, explosive, or toxic materials	None

Concentration of other materials (e.g., ammonia, iron, sulfates, developing agents, and chemicals that have an oxygen demand [BOD, COD]) depends on factors such as replenishment and wash rates, type of processor, efficiency of squeegees, use of regeneration and pretreatment methods, dilution by effluent from other processes and non-processing waste water, etc. To characterize waste from your processing operation, we recommend that you have your effluent sampled by an analytical laboratory according to the method required by local discharge codes.

You can minimize photographic effluent by using squeegees where they are recommended, and by using the correct replenishment rates. Avoid making large batch discharges, such as tank dumps. If your permit allows, discharge large amounts of working-strength solutions by adjusting the pH and then releasing them slowly to the sewer along with your normal processing effluent.

Silver is regulated by many municipal sewer codes. Therefore, you should include silver recovery as a part of your normal processing. The primary recommendation for Process C-41 is to desilver the fixer effluent with an electrolytic recovery cell and then run the treated solution through a chemical-recovery cartridge to further reduce the silver concentration. For more information about choosing a silver-recovery method, see KODAK Publication No. J-212,

The Technology of Silver Recovery for Photographic Processing Facilities.

If you have other questions about discharging FLEXICOLOR Chemicals or other environmental concerns, in the U.S., call the Kodak Information Center at 800-242-2424, extension 25. In Canada, call 800-465-6325. In other regions, contact Kodak in your country.

Other Effluent Disposal Methods—Although most labs discharge their effluent to a municipal waste-treatment plant, restrictions or lack of access to a treatment plant may require some labs to use an off-site disposal service.

You can have your processing effluent removed by a licensed disposal company. The KODAK RELAY Program is a disposal service for customers who use Kodak photographic chemicals. It is offered in conjunction with the Safety-Kleen Corporation. Participation in the RELAY Program can help you comply with waste-management regulations, especially when you cannot discharge processing effluent to a sewer.

To participate in the RELAY Program, contact your Kodak sales representative or call Kodak Environmental Services at 716-477-3194.

SOLID-WASTE RECYCLING

In the U.S., Kodak has established a series of recycling programs designed to help minilabs minimize the amount of solid waste that they send to landfills. These programs, administered by Kodak as part of the KODAK ENVIROWATCH System, include—

- KODAK Film Container Recycling Program
- KODAK FUN SAVER 35 Camera Recycling Program

The terms and conditions of each program are different. For more information about these programs, contact your Kodak sales representative, or call the Kodak Information Center at 800-242-2424 in the U.S.; in Canada, call 800-465-6325. In other regions, contact Kodak in your country.

For additional information on waste prevention and Kodak recycling programs, refer to KODAK Publication No. J-412, *Waste Prevention and Recycling for Photographic Processing Facilities*, or visit the Kodak website at www.kodak.com/go/kes.

SIMPLIFIED METRIC CONVERSION CHARTS

Volume, Length, and Weight

Because most laboratory measuring devices are calibrated in metric units, you can use the following table for converting U.S. units of volume, length, and weight to metric units. **Do not** use Table 1-7 to convert from metric to U.S. values. Accuracy of the table is within one percent. This degree of accuracy is adequate for most measurements in a photoprocessing laboratory (e.g., replenishment rates, safelight distances, equipment location, etc.). To use Table 1-7, find the number you are converting at the top of the table for numbers from 1 to 9. For numbers greater than nine, find the number you are converting by using a combination of the number at the left side of the table and the number at the top.

Table 1-7

U.S. Gallons to Litres										
gal	0	1	2	3	4	5	6	7	8	9
0	—	3.8	7.6	11.4	15.1	18.9	22.7	26.5	30.3	34.1
10	37.8	41.6	45.4	49.2	53	56.8	60.6	64.4	68.1	71.9
20	75.7	79.5	83.3	87.1	90.8	94.6	98.4	102.2	106	107.8
30	113.6	117.3	121.1	124.9	128.7	132.5	136.3	140.1	143.8	147.6
40	151.4	155.2	159	162.8	166.6	170.3	174.1	177.9	181.7	185.5
U.S. Fluid ounces to Millilitres										
fl oz	0	1	2	3	4	5	6	7	8	9
0	—	29.5	59	89	118	148	177	207	237	265
10	295	325	355	385	415	445	475	500	530	560
20	590	620	650	680	710	740	770	800	830	860
30	890	920	950	980	1006	1035	1065	1094	1124	1153
Inches to Centimetres										
in.	0	1	2	3	4	5	6	7	8	9
0	—	2.5	5.1	7.6	10.2	12.7	15.2	17.8	20.3	22.9
10	25.5	28.0	30.5	33.0	35.5	38.0	40.5	43.0	45.5	48.5
20	51	53	56	58	61	64	66	69	71	74
30	76	79	81	84	86	89	91	94	97	99
Ounces to Grams										
oz	0	1	2	3	4	5	6	7	8	9
0	—	28.5	57	85	113	142	170	198	227	255
10	285	310	340	370	395	425	455	480	510	540
20	570	600	620	650	680	710	740	770	790	820
30	850	880	910	940	960	990	1021	1049	1077	1106

You can use Table 1-8 to convert from metric to U.S. values, or from U.S. to metric values. To do this, multiply the metric or U.S. units in column 1 by the number in column 2 (e.g., to convert 450 millilitres to fluid ounces, multiply 450 by .03382 = 15.22 fluid ounces).

Table 1-8

To Convert	Multiply By
Millilitres to Fluid ounces	0.03382
Fluid ounces to Millilitres	29.573
Pints to Litres	0.4732
Litres to Pints	2.113
Quarts to Litres	0.9463
Litres to Quarts	1.057
Gallons to Litres	3.785
Litres to Gallons	0.2642

Temperature

To convert a temperature from one unit of measure to another, use the following table. Find the temperature you are converting in the “°F or °C” column; if you are converting to degrees Celsius, read the number from the “to °C” column. If you are converting to degrees Fahrenheit, read the number from the “to °F” column.

Table 1-9

to °C	°F or °C	to °F
37.78	100	212.0
37.22	99	210.2
36.67	98	208.4
36.11	97	206.6
35.56	96	204.8
35.00	95	203.0
34.44	94	201.2
33.89	93	199.4
33.33	92	197.6
32.78	91	195.8
32.22	90	194.0
31.67	89	192.2
31.11	88	190.4
30.56	87	188.6
30.00	86	186.8
29.44	85	185.0
28.89	84	183.2
28.33	83	181.4
27.78	82	179.6
27.72	81	177.8
26.67	80	176.0
26.11	79	174.2
25.56	78	172.4
25.00	77	170.6
24.44	76	168.8
23.89	75	167.0
23.33	74	165.2
22.78	73	163.4

to °C	°F or °C	to °F
22.22	72	161.6
21.67	71	159.8
21.11	70	158.0
20.56	69	156.2
20.00	68	154.4
19.44	67	152.6
18.89	66	150.8
18.33	65	149.0
17.78	64	147.2
17.22	63	145.4
16.67	62	143.6
16.11	61	141.8
15.56	60	140.0
15.00	59	138.2
14.44	58	136.4
13.89	57	134.6
13.33	56	132.8
12.78	55	131.0
12.22	54	129.2
11.67	53	127.4
11.11	52	125.6
10.56	51	123.8
10.00	50	122.0
9.44	49	120.2
8.89	48	118.4
8.33	47	116.6
7.78	46	114.8

to °C	°F or °C	to °F
7.22	45	113.0
6.67	44	111.2
6.11	43	109.4
5.56	42	107.6
5.00	41	105.8
4.44	40	104.0
3.89	39	102.2
3.33	38	100.4
2.78	37	98.6
2.22	36	96.8
1.67	35	95.0
1.11	34	93.2
0.56	33	91.4
0.00	32	89.6
-0.56	31	87.8
-1.11	30	86.0
-1.67	29	84.2
-2.22	28	82.4
-2.78	27	80.6
-3.33	26	78.8
-3.89	25	77.0
-4.44	24	75.2
-5.00	23	73.4
-5.56	22	71.6
-6.11	21	69.8
-6.67	20	68.0
-7.22	19	66.2

to °C	°F or °C	to °F
-7.78	18	64.4
-8.33	17	62.6
-8.89	16	60.8
-9.44	15	59.0
-10.00	14	57.2
-10.56	13	55.4
-11.11	12	53.6
-11.67	11	51.8
-12.22	10	50.0
-12.78	9	48.2
-13.33	8	46.4
-13.89	7	44.6
-14.44	6	42.8
-15.00	5	41.0
-15.56	4	39.2
-16.11	3	37.4
-16.67	2	35.6
-17.22	1	33.8
-17.78	0	32.0
-18.33	-1	30.2
-18.99	-2	28.4
-19.44	-3	26.6
-20.00	-4	24.8
-20.56	-5	23.0
-21.11	-6	21.2
-21.67	-7	19.4
-22.22	-8	17.6
-22.78	-9	15.8