5 Processing Options with KODAK EKTACOLOR Chemicals

Process RA-4 is versatile, especially when supported by KODAK EKTACOLOR Chemicals and Kodak expertise. You may be able to obtain additional environmental advantages by using the options described in this section:

- Developer regeneration
- Bleach-fix regeneration

REGENERATION AND REUSE OF *KODAK EKTACOLOR* RA DEVELOPER REPLENISHER 12

KODAK EKTACOLOR RA Developer Replenisher 12 is designed specifically for high-volume processors (i.e., at least one developer-tank turnover per week). To determine tank turnovers, see Section 2, *Using KODAK EKTACOLOR Chemicals in Continuous Processors*. You can regenerate EKTACOLOR RA Developer Replenisher 12 overflow with KODAK EKTACOLOR RA Developer Regenerator 12/55. With this regenerator, you do not need to treat the overflow with ion-exchange equipment.

Equipment and Chemicals

Developer regeneration with EKTACOLOR RA Developer Regenerator 12/55 requires very little capital expenditure for equipment. To regenerate developer, you will need the following equipment and chemicals:

- Collection tank for developer overflow
- pH meter that is reliable and accurate
- Buffers and reagents for pH meter adjustment and electrode storage
- KODAK EKTACOLOR RA Developer Regenerator 12/55
- A supply of KODAK EKTACOLOR RA Developer Replenisher 12, for times when there is not enough developer overflow to regenerate.
- Sulfuric acid (20-percent solution) for pH adjustment
- Potassium hydroxide (45-percent solution) for pH adjustment

Regeneration

The regeneration procedure is simple. You collect the overflow, and then add regenerator and water. An important final step is to check the pH of the regenerated replenisher, and adjust if necessary.

KODAK EKTACOLOR RA Developer Regenerator 12/55 is designed so that pH adjustment of the mixed replenisher does not need to be done routinely. However, in the event that pH adjustment is necessary, it typically requires a minimum amount of acid or base for pH adjustment. Sometimes this is necessary to compensate for minor differences between labs. It is likely that the amount of adjustment required in a particular lab will be consistent with each regenerated mix.

Be sure that your pH meter is well maintained and calibrated. Without reliable and accurate pH measurements, you will not be able to regenerate the solution properly and maintain developer activity. For information on using, maintaining, and calibrating a pH meter, see KODAK Publication CIS-121, *Measuring the pH of Photographic Processing Solutions*. Follow this method carefully to avoid errors in pH adjustment.

If the carryover of developer consistently exceeds 58 mL/m^2 (5.4 mL/ft^2), you will need to add EKTACOLOR RA Developer Replenisher 12 periodically to restore the developer-system volume. To do this, keep in inventory a supply of KODAK EKTACOLOR RA Developer Replenisher 12. It is also recommended to keep enough KODAK EKTACOLOR RA Developer Replenisher 12 in inventory for emergency replacement of the developer tank solution.

To reduce the effects of oxidation and evaporation, use a floating lid on the storage tank and do not store more developer overflow than you can use within the recommended keeping time.

Use the following procedure to prepare replenisher with EKTACOLOR RA Developer 12 overflow, water, and EKTACOLOR RA Developer Regenerator 12/55:

1. Collect 312 litres (82.5 gallons) of EKTACOLOR RA Developer 12 tank overflow.
2. Add 66.2 litres (17.5 gallons) of water at 21 to 32°C (70 to 90°F).
3. Add the entire contents of Developer Regenerator 12/55 Part A, and stir for 2 minutes.
4. Add the entire contents of Part B, and stir for 2 minutes.
5. Add the entire contents of Part C.

6. Add water at 21 to 32°C (70 to 90°F) to bring the total volume to 568 litres (150 gallons), and stir until the solution is completely mixed.
7. Pass the regenerated replenisher through a filter (similar to that used in the developer recirculation system) when pumping it to the replenisher holding tank to remove any particulates.
8. Check the pH; if it is not within the range of 10.75 to 10.85 at 25°C (77°F), adjust it. Use a 45-percent potassium hydroxide solution to raise the pH; or a 20-percent sulfuric acid solution to lower the pH. Table 1 gives starting amounts of these solutions for pH adjustment. You may need to make more than one addition to adjust the replenisher to the correct pH range.

   CAUTION: Potassium hydroxide and sulfuric acid require careful handling; they are strongly corrosive and can cause serious harm to the skin and eyes; they will damage clothing. For your safety, follow the directions in Appendix 2 and observe all caution statements.
9. Record the original pH, the amount of acid or base added, and the final pH. Use this record to monitor additions and to avoid errors. If you get a non-typical pH reading, check the calibration of your pH meter, and retest the pH.

Starting Amounts of Potassium Hydroxide and Sulfuric Acid for pH Adjustment

If the pH is *below* 10.75, add 45-percent potassium hydroxide (KOH) in the amounts shown in Table 5-1. If the pH is *above* 10.85, add 20-percent sulfuric acid in the amounts shown in Table 5-1.

Table 5-1 pH Adjustment

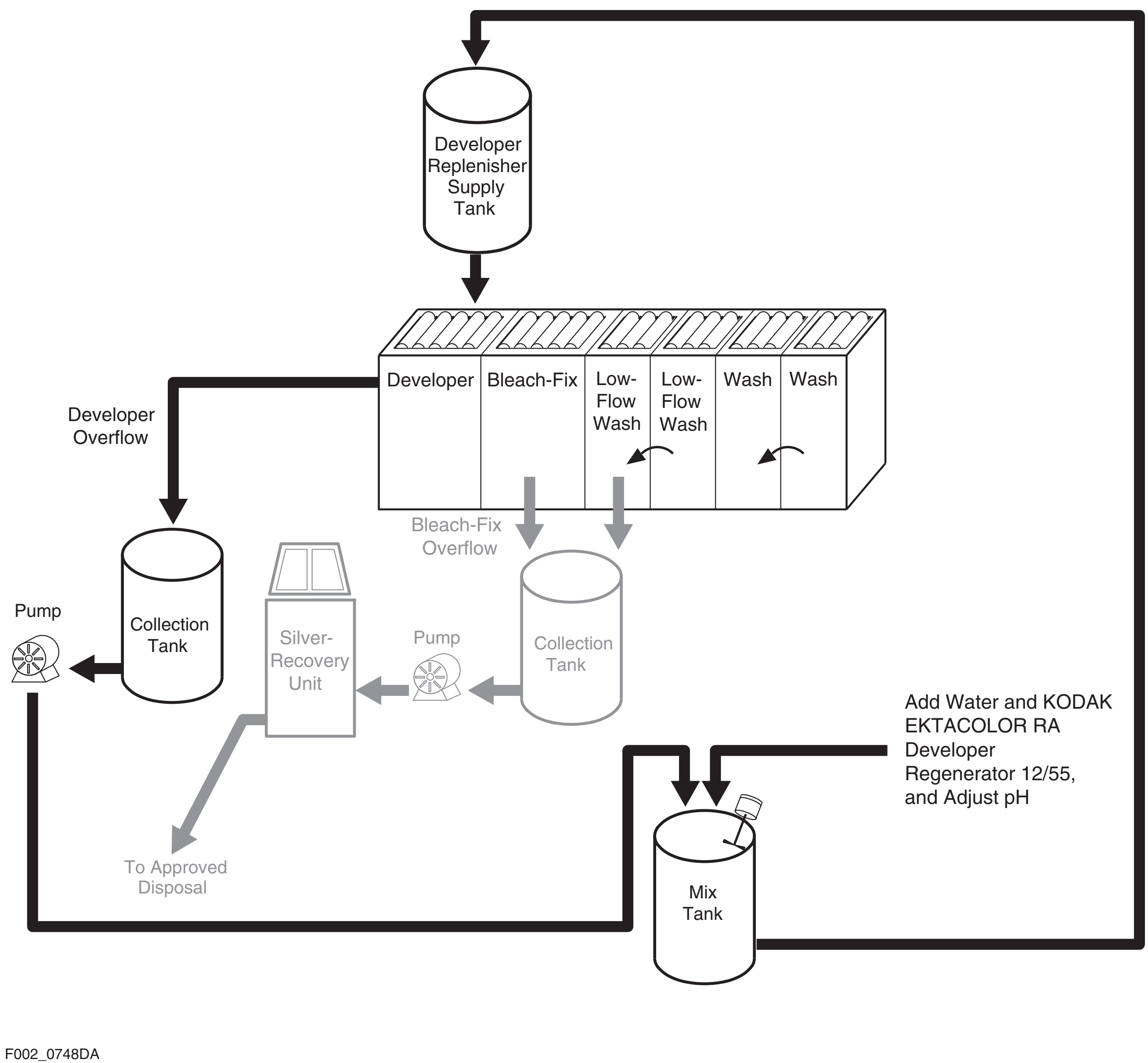
Starting pH	mL 45-Percent Potassium Hydroxide Addition (per 150 gallons)	Starting pH	mL 20-Percent Sulfuric Acid Addition (per 150 gallons)
10.74	174	10.86	264
10.73	200	10.87	306
10.72	230	10.88	350
10.71	260	10.89	394
10.70	288	10.90	438
10.69	316	10.91	482
10.68	345	10.92	526
10.67	373	10.93	570
10.66	402	10.94	614
10.65	432	10.95	658
10.64	460	10.96	702
10.63	489	10.97	746
10.62	518	10.98	790
10.61	546	10.99	834
10.60	576	11.00	876
10.59	604		
10.58	632		
10.57	662		
10.56	690		
10.55	718		
10.54	747		
10.53	776		
10.52	806		
10.51	834		
10.50	862		

Note: See Appendix 2 for directions to prepare solutions used to adjust pH.

Processing Conditions

Use the steps and conditions given for Process RA-4 (see Section 2, *Using KODAK EKTACOLOR Chemicals in Continuous Processors*. The replenishment rate for replenisher prepared from regenerated overflow is the same as for EKTACOLOR RA Developer Replenisher 12 , (see Table 2-2, Section 2, *Using KODAK EKTACOLOR Chemicals in Continuous Processors*.)

Figure 5-1



REGENERATING *KODAK EKTACOLOR* RA BLEACH-FIX

By regenerating bleach-fix for Process RA-4, you can reduce the bleach-fix contribution to BOD, COD, and iron in the processing effluent by approximately 40 percent. To regenerate the bleach-fix, collect the overflow, adjust the pH if required, desilver the solution with standard electrolytic recovery methods, and add KODAK EKTACOLOR RA Bleach-Fix Regenerator II.

An important step in regeneration is checking the pH of the bleach-fix overflow and regenerated replenisher, and adjusting if necessary, For information on using, maintaining, and calibrating a pH meter, see KODAK Publication CIS-121, Measuring the pH of Photographic Processing Solutions. Follow this method carefully to avoid errors in pH adjustment.

EQUIPMENT AND CHEMICALS

To regenerate your bleach-fix, you will need the following:

- Collection and storage tanks for the bleach-fix and low-flow-wash overflows
- Transfer pumps
- Plumbing to provide separate collection and desilvering of the low-flow wash
- Electrolytic silver-recovery cell capable of desilvering bleach fixes (see Appendix 1)
- KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Parts A and B.
- Means of accurately measuring pH

MODIFYING YOUR PROCESSOR

Use the standard processing steps and conditions for Process RA-4. Note that in Figure 5-2, the processor is shown with a single bleach-fix tank. While you can regenerate by using one tank of bleach-fix, optimum performance is obtained by using two countercurrent flow bleach-fix tanks in you processor. If your processor has more than one bleach-fix tank, plumb the tanks so that the overflow cascades into the preceding tank (countercurrent flow) and the replenisher feeds into the last tank. You'll need to configure the heating and pumping circulation lines to ensure that each tank is treated independently. Tanks cannot be cross-plumbed, which is the case with many processors.

Note: Countercurrent flow is different from the plumbing recommended for processors using KODAK EKTACOLOR RA Bleach-Fix NR. Do **not** use countercurrent flow with a non-regenerated system that uses Bleach-Fix NR; it can cause precipitate to form.

If necessary, install a separate recirculation, filter, and pump system for each bleach-fix tank. Install squeegees between tanks. When the bleach-fix tanks are set up with countercurrent flow, less silver will be lost to the wash.

If you cannot reconfigure the bleach-fix tanks on the processor as described above, it is possible to use KODAK EKTACOLOR RA Bleach-Fix Regenerator II with a single tank. However, the first bleach-fix tank will be at a lower pH than in a two-tank system, typically requiring a pH adjustment to the collected overflow prior to silver recovery.

If there is a low flow wash on the processor, you **must** provide for separate collection and desilvering of the low-flow wash. You can desilver the separate low-flow wash electrolytically or with chemical recovery cartridges. Hauling for off-site recovery may also be an option.

If you eliminate the low-flow wash, you will lose considerable silver to the final wash. However, you can recover silver from the final wash by using an ion-exchange method. For more information on the low-flow-wash setup and requirements, see KODAK Publication Nos. J-212, *The Technology of Silver Recovery for Photographic Processing Facilities*, or J-215, *Recovering Silver from Photographic Processing Solutions*.

STARTING UP A REGENERATED BLEACH FIX SYSTEM

To Prepare a Fresh Working Tank Solution

There are two methods to prepare a fresh working tank solution. The first method uses the EKTACOLOR RA Bleach-Fix Regenerator II concentrates. Mix according to the ratios in Table 5-2. Note the cautions for handling acids and bases described in Appendix 2.

Table 5-2 Preparing Fresh Tank Solution with KODAK EKTACOLOR RA Bleach-Fix Regenerator II

To Prepare 1 Litre of Fresh Tank Solution	
Start with water	737 mL
KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part A CAT 105 3131 or 895 5072	175.0 mL
KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part B CAT 105 0236 or 881 5680	76.0 mL
Adjust the pH to 7.0 ± 0.25*	

* Use 28* ammonium hydroxide or 45% potassium hydroxide to iincrease pH.

Another method to prepare a fresh bleach-fix tank solution is by diluting KODAK EKTACOLOR RA Bleach-Fix Replenisher NR 1:1 with water. Adjust the pH close to 6.2 ±0.25 with 28% ammonium hydroxide or 45% potassium hydroxide.

To Prepare a Fresh Replenisher Solution

There may be times when it will be necessary to prepare a fresh replenisher solution without regenerating existing tank solution. Mix according to the ratios in Table 5-3 that describes the mixing procedure.

Table 5-3 Preparing Fresh Replenisher Solution with KODAK EKTACOLOR RA Bleach-Fix Regenerator II

To Prepare 1 Litre of Fresh Replenisher Solution	
Start with water	698 mL
KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part A CAT 105 3131 or 895 5072	210 mL
KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part B CAT 105 0236 or 881 5680	92 mL
Adjust the pH to 7.0 ± 0.25*	

* Use 28* ammonium hydroxide or 45% potassium hydroxide to iincrease pH.

Bleach-Fix Regeneration

Step 1: Collect the Bleach-Fix Overflow

Install plumbing to collect the overflow from the bleach-fix tank in your processor. If you have more than one processor using Process RA-4, you can collect the overflows in a common holding tank. Be sure that the holding tank is large enough to accommodate overflow during peak production periods and during downtime for maintenance and equipment repairs. Equip the collection tank with an overflow port to your lab's secondary silver-recovery system so that you can desilver excess solution before you discard it. Protect the solution from dirt and contamination by using a floating lid and a dust cover on the tank.

Step 2: Desilver the Bleach-Fix Overflow

Depending on processor configuration and the capacity of your silver-recovery cell, you may need to adjust the pH of the bleach-fix overflow to within the range of 7.5 to 8.0 before desilvering.

If the processor has two or more counter-current flow bleach-fix tanks, it is possible to run the system pH so that the overflow will be close to pH 7.5. At this pH and with a large-capacity silver-recovery cell, no pH adjustment is needed. If you operate a small-capacity silver-recovery system or have a single bleach-fix tank, the tank pH will be lower, around 7.0 to 7.25 and you will need to adjust the overflow to a pH of 7.5 - 8.0 for silver recovery.

If a pH adjustment is necessary for your system, you can pump the bleach-fix overflow to a mixing tank and adjust the pH there. Or you can pump the overflow to the recovery cell and add the alkali while the solution is recirculating.

Increase pH by adding 28-percent ammonium hydroxide or 45 % potassium hydroxide. **Do not** use sodium hydroxide to adjust the pH of bleach-fix as it will cause formation of reddish-brown crystals in the solution.

When the overflow is within the range of pH 7.5 to 8, desilver the solution to a concentration of 1g/L. If you desilver to lower concentrations, poor plate quality will result. The desilvering time and current density will depend on laboratory conditions. See Appendix 1 to calculate starting-point conditions. You can adjust these conditions slightly if necessary.

It is important to maintain the pH of the system during desilvering. A pH below 7.5 will reduce the efficiency of the desilvering cell; it will take longer to reduce the silver concentration to 1.0 g/L. If the pH is too high, ammonia vapors will be released.

Step 3: Store the Desilvered Bleach-Fix Overflow

After you have desilvered the bleach-fix overflow, pump it to a storage tank for regeneration as soon as possible. Use a tank suitable for both peak production times and partial downtime. Equip the tank with a floating lid and dust cover.

The regenerator contains chemicals that protect the bleach-fix against oxidation. If you do not regenerate the bleach-fix within three days after it is desilvered, add 10 mL of 45 percent potassium sulfite or KODAK EKTACOLOR RA Bleach-Fix Additive (CAT No 803 6832) per litre of solution as a preservative.

A regenerated bleach-fix system eventually produces an excess volume of bleach-fix. Therefore, you will need to discard solution at some point. When you need to dispose of surplus volume, you can discharge the desilvered, unregenerated bleach-fix to a terminal silver-recovery system and/or haul it away for disposal.

Step 4: Regenerate the Desilvered Bleach-Fix Overflow

Use Table 5-4 for preparing regenerated replenisher.

For CAT Nos. 105 3131 and 105 0236

These catalog numbers come in flexible containers and make 100 gallons of regenerated replenisher. Add the full contents of KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Parts A and B, to the volume of overflow specified on the product label (91 gallons [344.5 L]). Stir until the solution is completely mixed.

For CAT Nos. 895 5072 and 8815680

These catalog numbers come in drums (55 gal) and are typically used with automatic mixing systems. For splitting directions for mixing replenisher, use the directions for preparing 1 litre of bleach-fix replenisher and multiply for the amount needed.

Table 5-4 Preparing Bleach-Fix Replenisher from Desilvered Overflow with KODAK EKTACOLOR RA Bleach-Fix Regenerator II

To Prepare 100 Gallons (378.5 Litres) (CATs 105 3131 and 105 0236)	To Prepare 1 Litre by Automixer (CATs 895 5072 and 881 5680)
Start with 91 gallons (344.5 litres) of desilvered bleach-fix overflow.	Start with 910 millilitres of desilvered bleach-fix overflow.
Add 5.12 gallons (1 container) KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part A.	Add 51.2 millilitres KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part A.
Add 3.2 gallons (1 container) KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part B.	Add 32.0 millilitres KODAK EKTACOLOR RA Bleach-Fix Regenerator II, Part B.
Add 0.68 gallon of fresh water to make 100 gallons.*	Add 6.8 millilitres of fresh water to make 1 litre.
Adjust the pH to 7.0 ± 0.25.	Adjust the pH to 7.0 ± 0.25.

* To lower the pH, add 78% acetic acid, or use EKTACOLOR RA Bleach-Fix and Replenisher NR, Part C. You can also use 20% sulfuric acid, but do not use concentrated sulfuric acid as it will immediately degrade the solution. For Automixers, if you find you need to make consistent adjustments to maintain the pH of the mixed replenisher, it is possible to add the amount of acid required into the water portion in the above table.

When mixing is completed and you have adjusted the pH, transfer the regenerated bleach-fix to the replenisher storage tank.

CONVERTING FROM ANOTHER BLEACH-FIX OR BLEACH-FIX REGENERATOR

To start using EKTACOLOR RA Beach-Fix Regenerator II without dumping existing tank solutions, follow the appropriate procedure below:

To Convert EKTACOLOR RA Bleach-Fix NR to a Regenerated System with EKTACOLOR RA Bleach-Fix Regenerator II

To convert without dumping the seasoned tank solution, prepare a fresh replenisher by diluting KODAK EKTACOLOR RA Bleach-Fix and Replenisher NR 1:1 with water. Adjust the pH to 7.0 with 28% ammonium hydroxide or 45% potassium hydroxide (See Appendix 2 for the preparation of hydroxide and acid solutions for pH adjustment.) Use this solution to replenish your present tank solution.

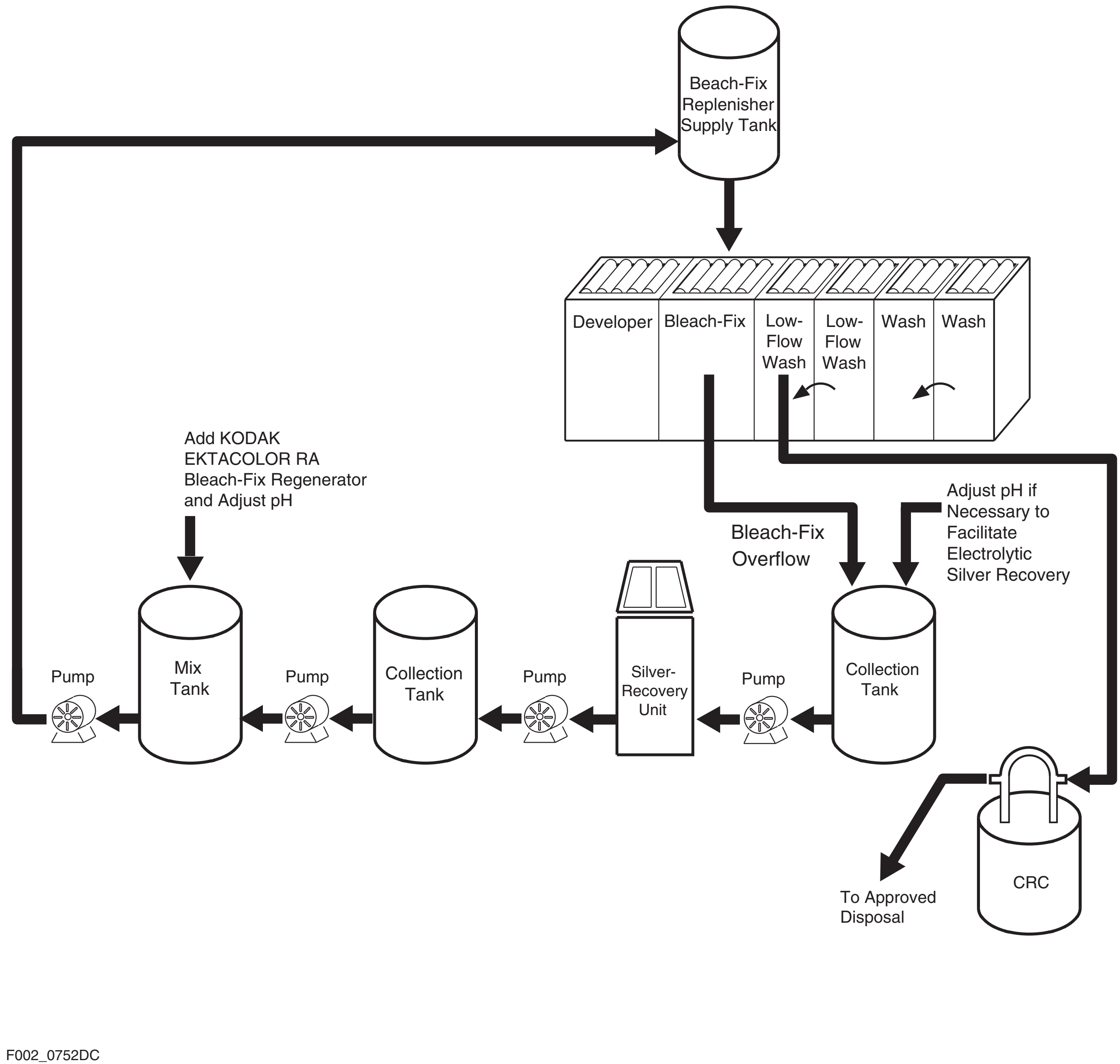
Desilver and clear the system of any combined bleach-fix and low-flow-wash overflows. Collect the bleach-fix and low-flow-wash overflows separately.

Desilver and regenerate the bleach-fix overflow as described under Starting Up a Regenerated Bleach-Fix System. Then replenish with the regenerated solution. **During the conversion, adjust the replenishment rate to 247 mL/m2 (23 mL/ft2).** This will provide a safety factor against retained silver. After a week or two of operation, adjust the rate to 215 mL/m2 (20 mL/ft2).

Configuration for Regenerated Bleach-Fix System

Use the steps and conditions given for Process RA-4; see KODAK Publication No. Z-130, Section 2, Using KODAK EKTACOLOR Chemicals in Continuous Processors. The bleach-fix replenishment rate for regenerated overflow is 215 mL/m2 (20 mL/ft2).

Figure 5-2 Regenerated Bleach-Fix System



This diagram shows a single bleach-fix tank. If you use two countercurrent tanks, the replenisher is added to the last tank (closest to the wash) and the overflow is collected from the first tank closest to the developer tank.

Monitoring the Bleach-Fix Regeneration

Bleach-fix regeneration is more complex than most operations in a finishing lab. Any error left uncorrected is compounded over time in a regenerated system. However, if you mix all solutions correctly, desilver the overflow properly, replenish correctly, maintain the squeegees well, and carefully monitor and adjust the pH, the system should operate without problems.

Monitor the pH—

EKTACOLOR RA Bleach-Fix Regenerator II concentrates are designed to maintain the correct pH in a system that has efficient squeegees and is correctly replenished. It also has flexibility to allow adjustments of system pH to accommodate different processor configurations. The pH of the solutions has a great effect on bleaching performance and silver recovery efficiency. If squeegee efficiency varies, you will need to control the pH by direct pH adjustment or by changing the bleach-fix replenishment rate to maintain the pH. See Table 5-5 below for pH specifications.

Table 5-5

Solution		pH
Single Bleach-Fix Tank		7.0 to 7.3
2 Countercurrent Flow Tanks	Tank1	7.4 to 7.7
	Tank 2	7.0 ± .01
Regenerated Bleach-Fix Replenisher		7.0 ± .01

If the pH of the overflow does not lie within the specified ranges, check for several possible causes:

- Be sure that the pH meter is operating correctly. It may require recalibration, electrode replacement, or some other repair.
- Check the processor squeegees. Are they worn or out of adjustment?
- Check the bleach-fix replenishment rate. If the pH is low, you may need to reduce the replenishment rate. If the pH is high, you may need to increase the rate.

To monitor your bleach-fix system, keep a record of the pH of the bleach-fix during each stage of regeneration—the collected overflow, the desilvered overflow, the regenerated solution, and the pH-adjusted solution.

DIAGNOSING PROBLEMS

Retained Silver—High Black Patch density values and the visual appearance of the yellow Patch on the control strip are indications of a retained-silver problem. Compare the visual appearance of the Yellow Patch against the reference strip. If the Yellow patch on the processed control strip appears more brown, or "muddy," then retained silver is likely the cause. Also, prints that look desaturated in yellow and red colors are indicative of retained silver. Also, you can view the BP patch on the control strip with an infrared scope to check for retained silver. Retained silver is usually caused by too high a pH or dilution of the bleach-fix tank solution.

Underreplenishment, inefficient squeegees, or high replenisher pH may increase the pH of the bleach-fix tank solution. If the replenisher pH is correct, the most probable causes are excessive developer carried over into the bleach-fix tank or a bleach-fix replenishment rate that is too low. Check the condition of the squeegees before adjusting the replenishment rate.

Precipitates—Precipitates in the bleach-fix have three possible causes: incorrect pH adjustment (if needed) before desilvering, sodium compounds in the bleach-fix system, and overconcentration of a developer compound in the bleach-fix.

A *reddish-brown sludge* may indicate improper mixing of potassium or ammonium hydroxide with the bleach-fix overflow. These chemicals may be used to raise pH before desilvering. An incorrect mix ratio causes iron oxide to form.

Reddish-brown crystals are most often caused by using sodium compounds for pH adjustment (sodium hydroxide) or as a preservative (sodium sulfite). Correct the problem by switching to ammonium or potassium compounds.

A *white-yellow to gray precipitate* can form due to breakdown of the bleach-fix, This is primarily elemental sulphur, often accompanied by a noticeable odor of sulfur. The bleach-fix can breakdown due these causes:

- Low replenishment rate. Check to make sure replenishment rate is correct, and not set too low.
- Amperage too high during electrolytic cycle. Use Appendix 1 to calculate amperage and time for desilvering cycle. Also, check to make sure electrolytic unit is functioning properly.

A *purple precipitate* forming in the electrolytic cell tank above the solution level can be caused by one or a combination of these problems:

- Too much of developer is carried over into the bleach-fix. If this occurs, check and adjust the squeegee between the developer and the bleach-fix to reduce developer carryover into the bleach-fix.
- Too much solution foaming in the electrolytic cell tank. If foaming is excessive it can cause the purple precipitate to form in the foam, then adhere to the side of the tank. Check for loose fittings or pinhole leaks on the feed or recirculation lines of the electrolytic cell which could be introducing air into the solution. Or, make sure the feed and recirculation lines are plumbed so that bleach-fix is not "dropping" into the tank introducing air into solution to cause foaming.

Also, change the recirculation filters in the processor and the silver-recovery cell more often than normal until the problem is corrected

Long Desilvering Times

See Appendix 1, page 5-21 for calculating the average desilvering batch time. The calculations used in Appendix 1 are a guide only, and actual desilvering times can vary due to process variables. However, if your desilvering batch time is much longer than calculated, it could be caused by:

- **The bleach-fix overflow could be low in pH:** A pH of below 7.5 will cause the desilvering time to be longer. Adjust the overflow to be desilvered to a pH of 7.5 to 8.0.
- **The regenerated bleach-fix system may be too concentrated:** Bleach-fix solutions contain iron, which can compete with silver for the cell amperage. Therefore, the higher the concentration of the regenerated bleach-fix system, the longer the desilvering batch time. Over concentration can occur due to evaporation or poor water top-off procedures. In some cases, it can even occur due to extremely efficient squeegees limiting overflow into the bleach-fix. The concentration of the bleach-fix can be monitored by taking specific gravity reading with a hydrometer of the correct range.

Specific Gravity at 25°C (77°F)	
Tank 1	1.130 to 1.160
Replenisher*	1.130 to 1.150

* Tank 2 in countercurrent tank system same as replenisher

APPENDIX 1: DETERMINING OPTIMUM OPERATING CONDITIONS FOR BLEACH-FIX REGENERATION

To determine the optimum operating conditions for your laboratory, you'll need to gather data on lab capacity and needs. It is important to ensure that the capacity of the silver-recovery and regeneration system is significantly larger than the capacity of the processing equipment to generate bleach-fix overflow. This permits future expansion of business and allows for downtime due to equipment failure or scheduled maintenance.

You'll need the following data:

- Desilvering batch size. The physical size of the silver-recovery unit will usually determine batch size.
- Silver concentration in the overflow.
- Silver concentration after desilvering. The aim is approximately 1.0 g/L.
- Cathode surface area. The cathode is the removable electrode from the cell on which the silver plates. Measure the surface area of one side in square metres or square feet.
- Amount of paper processed per day in square metres.
- Theoretical current efficiency of the cell. This data is provided by the equipment supplier.

Bleach-Fix Volume/Batch Size

The volume of bleach-fix generated during a day will be-

Paper processed daily x Replenishment rate in L/m2
—or—
m2 paper per day x 0.215 = Litres of bleach-fix overflow

Most of the overflow is likely to be generated during an 8-hour period of the day, so collection tanks must be adequate to hold at least this volume.

Desilvering will be on a batch basis, and batch size will depend on the capacity of the cell. The desilvering of more than one batch during a 24-hour period may be possible. However, to match the desilvering and regeneration process to the processor capacity, we suggest using a cell that can handle the daily volume of bleach-fix overflow in 15 hours. This will provide flexibili-ty for future expansion and for equipment downtime.

Plating Current

Electrolytically desilver the overflow to approximately 1.0 g/L silver. To obtain good plating, do not exceed a current density of 40 amps per square foot (431 amps per square metre) of the cathode area.

For example, if the cathode area is 3 square feet (0.279 square metre), the maximum plating current should not Exceed-

40 amps per ft2 x 3 ft² = 120 amps
—or—
431 amps/m²2 x 0.279 m² = 120 amps

If the plating quality is poor (i.e., if it is very dark or soft, or contains silver sulfide precipitates), decreasing the current may improve plating. If you need more recovery capacity, you may be able to increase plating current by increasing the cathode area. For example, you may be able to install a larger cathode or modify a rotary cathode so that the silver will plate on both sides. See your equipment supplier about possible modifications.

Optional: When silver from the cathode(s) is removed, and the cathode(s) cleaned, try desilvering the next batch of bleach-fix overflow at a lower amperage (30 amps per ft^2) for the first batch of overflow to insure silver is well adhered to cathode. Then for subsequent batches of bleach-fix overflow desilvered use the normal amperage of 40 amps per ft^2.

Desilvering Time

Use the following equation to estimate the electrolysis time required to recover silver from a particular batch size. Silver-recovery efficiencies of electrolytic units can vary considerably; use this calculation only as a guide.

$$T = \frac{(S - E) \times V}{A \times 4 \times N}$$

Where:
T = Hours required to desilver a batch of bleach-fix overflow
S = Starting silver concentration in g/L
E = Ending silver concentration in g/L
V = Batch size in litres
A = Amperage per hours through cell (Plating Current)
N = Theoretical current efficiency of cell expressed as a decimal (This value is supplied by the manufacturer. If it is not availa-ble, a value of 0.2 to 0.25 would be typical.)

Example:

To desilver a 380-litre batch of bleach-fix that has a starting concentration of 4.5 g/L to a final concentration of 1.0 g/L at 120 amps with a current efficiency of 20 percent, the time would be-

$$\frac{(4.5 - 1.0) \times 380}{120 \times 4 \times 0.2} = \text{Time (14 hours)}$$

Use KODAK Silver Estimating Test Papers to check the silver concentration. Do not try to reduce the silver concentration below 1.0 g/L; it will reduce silver-recovery efficiency and may cause poor plating. No silver is lost by maintaining the silver at 1.0 g/L, because it will be recycled into the bleach-fix replenisher.

APPENDIX 2: PREPARING SOLUTIONS FOR PH ADJUSTMENT

Note:

- Where possible, use commercially available 45% potassium hydroxide (KOH) from a vendor, so that mixing is not necessary and handling risks are minimized in the lab. Potassium hydroxide is often commercially available as a nominal 45- to 50-percent solution
- Where possible, use commercially available 20% sulfuric acid from a vendor, so that mixing is not necessary and handling risks are minimized in the lab.
- If ammonium hydroxide is for adjusting pH during bleach-fix regeneration, it is typically available as a nominal 28% solution.
- If acetic Acid is used for adjusting pH during bleach-fix regeneration, use commercially available 78% acetic acid from a vendor, or use EKTACOLOR RA Bleach-Fix and Replenisher NR, Part C.

To Prepare 45-Percent Potassium Hydroxide Solution

If you cannot obtain 45% potassium hydroxide solution from a vendor, mix as follows: Use commercial or reagent grade potassium hydroxide. To prepare 1 litre of 45% potassium hydroxide solution, carefully and slowly add 652 grams of Potassium Hydroxide to about 700 mls of water. Use cool water, and do not use a plastic vessel, use glas or stainless steal to dissolve the chemical as solution will get hot (exothermic reaction) and considerable heat may be released. Stir until mixed, then add additional water to bring total volume up to 1 liter, stir until completely mixed.

CAUTION: AMMONIUM HYDROXIDE AND POTASSIUM HYDROXIDE ARE STRONGLY CORROSIVE.

Ammonium hydroxide and potassium hydroxide require careful handling; they are strongly corrosive and can cause serious harm to skin and to eyes; they will damage clothing. Do not weigh these chemicals in an aluminum container. For your safety, follow these directions for preparing these chemicals for use in pH adjustment. Wear eye protection and avoid contact of the solid material or the solution with skin. See the Material Safety Data Sheet for handling and precautionary information. Observe all CAUTION statements. In the case of contact, follow the emergency procedure found in the MSDS.

To Prepare 20-Percent Sulfuric Acid

To prepare a 20-percent (7.2 N) solution of sulfuric acid, start with 4 parts of cold water. Stir the water, and slowly add 1 part concentrated (36 N) sulfuric acid. However do not use fuming sulfuric acid (40 N), because it is super-concentrated, very hazardous to handle, and more expensive. Always add the acid to the water; NEVER add the water to the acid.

CAUTION: SULFURIC ACID IS CORROSIVE.

Sulfuric acid requires careful handling; it is strongly corrosive and can cause serious harm to the skin and eyes; it will damage clothing. For your safety, follow these directions for preparing these chemicals for use in pH adjustment. See the Material Safety Data Sheet for handling and precautionary information. Observe all CAUTION statements. Avoid contact with skin or clothing by solution. Always use appropriate protective equipment including: gloves, goggles, and aprons to protect your eyes and skin.

For more information, see KODAK Publication J-98A, Safe Handling of Photographic Chemicals.