DEFENSE LOGISTICS AGENCY
DEFENSE REUTILIZATION AND MARKETING SERVICE
FEDERAL CENTER
74 N. WASHINGTON
BATTLE CREEK, MI 49017-3092

WSRC-TR--91-567

DE92 013243

IN REPLY REFER TO DRMS-OCP (Mr. Duncan/(616)961-7058/(FAX)(616)961-5907/sv)
DDN E-MAIL: drms-o@drms.dla.mil

26 AUG

SUBJECT: Silver Recovery System Data

Mr. B. Boulineau
Quality Control Photographer
Westinghouse Savannha River Co.
Aiken, SC 29808

Dear Mr. Boulineau:

In regard to your telephone conversation on 22 Aug 91, with Mr. Gerald Duncan of my staff, subject as above, the silver recovery system you are operating sounds like something we would be interested in. Your effluent test results indicate the equipment operates within allowable limits. Request you provide a copy of your effluent test results and other information regarding the equipment set-up and operations. As discussed, this information will be provided at no cost to us. This will be most helpful.

Any questions may be directed to Mr. Duncan, DRMS-OCP, (616) 961-7058.

Sincerely,

JOHN C. COOPER
Acting Director
Directorate of Operations

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To B. Boulineau	From G. Duncan
Co. Westinghouse Savannha	Co. DRMS-OCP
Dept. River Co.	Phone # (616) 961-7058
Fax # (803) 725-1292	Fax # (616) 961-5907

GAO

DRAFT

Dear Mr. Duncan,

Enclosed please find the information that you requested regarding the silver recovery equipment that is used by the Savannah River Site Photography Group. I have included a description of the equipment, a copy of the procedure that we use, the results of our tests that show that the system works well for us, and an invention disclosure for a device that aids in opening the cartridges.

This equipment may also be purchased from:

American Photographic Services
3715 Northcrest Rd
Suite 6
Atlanta, Ga. 30340
(800) 221-2745

Southeastern Smelting & Refining
P.O. Box 4786
Jacksonville, Florida 32201-4786
Phone: 800-329-2245

The equipment manufacturer should be able to give you a list of vendors that are closer to home.

I hope that this information will be helpful to you. I'm sure you will be doing your own tests on the equipment to be sure that it will be suited to your particular application. Please feel free to call me with any questions.

Sincerely,

Bruce Boulineau
Quality Control Photographer
WSRC

DRAFT

Abstract

In August of 1990 the ~~SRS~~ Savannah River Site Photography Group began testing on a different type of silver recovery system. This paper will describe the baseline study and the different phases of installation and testing of the system.

Introduction

The original silver recovery system that was used by SRS Photography was installed when a move was made to a new building in August of 1985. This system made use of electrolytic recovery units and iron based chemical recovery cartridges. (Previously the group sent out spent fixer to a central location on site for silver recovery.)

The new building was required to make use of a Trade Waste Equalization tank to minimize the impact on the site sanitary sewer system. Analysis of the total effluent from the waste tank was performed in September of 1985. It showed that the silver content of the wastewater was well below the federal guideline for hazardous waste.

The silver recovery system is maintained by the designated Quality Control Photographer. It is his responsibility to maintain the system and account for the silver that is recovered. While working with the system, the Quality Control Photographer began to suspect that it was not the best possible system for the SRS photo lab.

Electrolytic silver recovery was not very efficient. The lowest silver concentration SRS photo was able to achieve was approximately 80 ppm. (still hazardous waste) It was necessary to "tail" the units (allow the chemicals to flow through a steel wool chemical recovery cartridge) to bring the concentration of silver down to safe levels.

Another problem with the electrolytic silver recovery units was the formation of silver sulfide. Silver sulfide is formed when the electric current in the fixer is too high in relation to the available silver. This causes the current to begin removing the sulfides from the fixers. This "burning" of the silver caused it to form a soft dark sludge that fell to the bottom of the desilvering chamber. Cleaning the silver recovery chamber became a very messy job when silver sulfide was present.

The biggest concern with the electrolytic system was the hazardous waste that it produced. The silver flake contained dissolved silver in amounts greater than 5ppm. In seven out of the nine chemical recovery

cartridge tailing units on hand dissolved silver was also greater than 5ppm. Due to packaging requirements the SRS Photo Lab generated at least three 55 gal. drums of hazardous waste per year.

The best possible silver recovery system would be self contained and simple to operate. It should take very little time to monitor and maintain. It should also recover silver in a form that is not considered hazardous waste. With these features in mind the Quality Control Photographer began to search the photographic market for the "perfect" solution to his problem.

Discussion

The system that was determined to be the best for SRS Photography is manufactured by Silver Solutions ® in Yazoo City, Mississippi. This system uses the same proven technology that iron based chemical recovery cartridges do. When silver laden photographic fixers come in contact with iron an ion exchange takes place. The silver is removed from the fixer and replaced with dissolved iron.

The beauty of the Silver Sure® Cartridge is it's design. The cartridge is made of large PVC plastic pipe with caps on each end. It holds a replaceable core made by spraying iron powder into a sheet of fiberglass and then rolling it up. Photographic fixer flows through the cartridge from the bottom to the top and overflows to a drain. As the ion exchange takes place the silver is embedded in the fiberglass core as the dissolved iron goes out the drain.

To help determine the effectiveness of the recovery system that was in place before the change to the Silver Sure ® system the fixers involved in the study were analyzed for silver content. The results of the analysis showed concentrations from 1,916 ppm to 4,484 ppm silver.

To determine the effectiveness of the electrolytic silver recovery system samples were collected at the discharge point of each recovery unit. The silver concentration of these samples ranged from less than 3ppm to 590 ppm.

The most efficient electrolytic set ups were the ones that were "tailed" by steel wool chemical recovery cartridges. The steel wool cartridges obviously were catching the silver that the electrolytic units missed. The least efficient setups were the electrolytic units that were not compatible with steel wool cartridge "tailing". "Tailing" was not used because those electrolytic units used pumps to discharge the chemicals to the drain. The high rate of discharge would not allow enough time in the steel wool cartridges for silver to be removed from the solution.

With the baseline information about the fixers and the electrolytic silver recovery system completed it was time to test the proposed system manufactured by Silver Solutions®.

To test the Silver Sure ® system the electrolytic system was taken out of service. A single cartridge was placed in service at each processor that is used by SRS Photography. When the cartridges were put in place they were initially filled with water per manufacturers instructions. The cartridges were allowed to remain in place for several days before the first samples were taken to allow the fixer to completely displace the water in each cartridge.

Samples were taken from the discharge port of each cartridge and analyzed for silver content. The results of the first tests ranged from less than 0.11 ppm to 1.92 ppm silver. Approximately one month later another sample was taken from each cartridge. Those samples were analyzed with results ranging from 0.29 ppm to 9.97 ppm.

As expected, the samples showed that the cartridges became less efficient as the process of ion exchange depleted the iron in the cartridges. To have a complete silver recovery system each processor would need to have two cartridges attached to it in a series. The second cartridge would catch the silver that the first one missed as it became depleted.

The second cartridge was placed in series at each processor and another series of samples were taken. A sample port was placed at the discharge of the first cartridge so each cartridge could be sampled individually. The samples taken from the first cartridge in each series ranged from less than 0.1 ppm to 8.42 ppm. The samples from the second cartridge in each series ranged from less than 0.1 ppm to 0.4 ppm.

Now that the Silver Sure® System was complete it was necessary to have a complete procedure to handle the equipment properly. The procedure gives detailed instructions regarding the setup and operation of the Silver Sure system. It covers the configuration, monitoring, core replacement, and drying the cores for shipment.

Monitoring the cartridge for depletion is very simple. A small sample of effluent is taken from the sample port that was installed on the discharge of the first cartridge. Silver estimating test paper is then dipped into the sample to test for the presence of silver. The test papers require a high level of silver to change color (approximately 500 to 1000ppm but the drain is protected by the second cartridge in the series. When silver is detected on the effluent from the first cartridge it is removed from service

and it's core is replaced. The second cartridge is then rotated into the first position and a fresh cartridge is placed in the second position. This procedure ensures that the drain is always protected by the most efficient of the two cartridges.

When the procedure is followed properly the spent cartridge cores are rinsed and the effluent from each cartridge is sampled. The sample results determine if the dissolved silver has been removed from the core. When the core has been rinsed and dried properly it should contain only metallic silver, fiberglass, and iron. The dry core can be considered non hazardous solid waste for the purposes of normal handling and shipping to a refiner.

Conclusion

Sample analysis for silver content has shown that in some cases the electrolytic silver recovery system was not efficient enough to meet federal guidelines for hazardous waste. It should be noted, however, that due to sanitary treatment of the photographic waste effluent that SRS was not in violation of any hazardous waste laws regarding photographic silver from the SRS Photography Group.

The sample data that was collected also shows the Silver Sure ® silver recovery system as much more efficient than electrolytic recovery for SRS Photography. Silver concentrations in the effluent from the Silver Sure cartridges have proven to be ten times less than the federal guideline for hazardous silver concentration in liquid effluents.

Summary

The Silver Sure® silver recovery system has been in use for just over one year in the SRS Photography Lab. During that year the procedure for monitoring and handling the cartridges has been refined. Time spent on maintenance of the system has been reduced to an average of two hours or less per week. The system requires no electrical power supply to operate. Chemistry flows through it by gravity feed. Monitoring frequency has been reduced to once every two weeks because of the long life of the cartridges. (three months to over one year).

The best feature of the system is that when procedure is followed carefully exhausted cores can be handled as non-hazardous solid waste. The Silver Sure ® silver recovery system has successfully met all of the needs of the SRS Photographic Lab in a reliable and economical manner.

SILVER RECOVERY PROCEDURE

1.0 PURPOSE

To explain the operation of the system used to recover silver from spent photographic fixer solutions from photographic processors used by the Photography/Reproduction Group.

2.0 SCOPE

This procedure applies to activities associated with precious metal recovery (i.e. silver) from spent photographic fixers and bleach fixers that are used by the Photography/Reproduction Group.

3.0 DEFINITIONS

Ion Exchange Cartridge (IEC) - For application in this procedure an Ion Exchange Cartridge (IEC) is a cartridge that contains iron powder or steel wool. This cartridge removes silver when photographic solution passes through it by exchanging ions of silver with ions of iron. It will be referred to as an IEC in this procedure.

Rinse Station - The Rinse station is a ten gallon container attached to two IECs in series. It discharges to the sanitary sewer. When it is used to rinse an exhausted IEC the exhausted IEC is placed in series between the ten gallon tank and the two IECs that are part of the rinse station.

4.0 RESPONSIBILITIES

Photography Group personnel that are trained in the use of this procedure are responsible for the implementation of this procedure.

5.0 PROCEDURE

5.1 Configuration

5.1.1 Two IECs are installed in series on each processor that the Photography/Reproduction Group recovers silver from. There is an effluent sampling port attached to the tubing between the IECs.

5.1.2 The first IEC is the cartridge that the processing effluent travels through first.

5.3.5 Connect the exhausted IEC to the rinsing station and slowly (<500 mL/min) run 20 to 30 gal of fresh cold water through it to displace the chemistry in it through another IEC connected to the rinse station.

5.3.6 When it is in use the rinse station should be monitored for efficiency by using step 5.2.3 of this procedure.

5.3.7 Collect a sample (approximately 4 oz.) of the final rinsing effluent from the exhausted IEC.

5.3.8 Verify that silver concentration in the sample is less than 5ppm by using Silver Pollution Control Test Strips.

5.3.9 If sample shows 5ppm or more, repeat steps 5.3.5 through 5.3.8.

5.3.10 If the sample shows less than 5ppm, send it to an analytical laboratory to double check results.

5.3.11 Drain the IEC and remove the cartridge core. Assign a number to the exhausted core for accounting and package it in two plastic bags with the core number identified on the bags. Evacuate as much air as possible from the bags and place the packaged IEC core in the Photography/Reproduction precious metals repository.

IMPORTANT: Always remove the cartridge core immediately upon draining the cartridge. Do not drain and allow the cartridge to stand for more than 30 minutes. Due to rapid oxidation a cartridge core will generate heat.

5.3.12 If lab analysis of the sample shows 5ppm or more, return core to an empty IEC and repeat steps 5.3.5 through 5.3.11.

5.3.13 If the lab analysis results show the effluent from the IEC to contain less than 5 ppm silver, record the lab results on the IEC Core Log. The exhausted IEC core may then be dried and handled as non-hazardous solid waste that is subject to precious metals accounting.

5.3.14 Complete and file a Precious Metals Transfer Advice (OSR 22-7) with the estimated silver content of the core with the SRS Property Accounting Group.

5.4 IEC Core Drying

5.4.1 Handle the damp IEC core carefully when drying as it will generate heat when it is exposed to air.

SAVANNAH RIVER LABORATORY
ANALYTICAL CHEMISTRY DIVISION

REPORT OF ANALYSIS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY

Submitter Boulineau, Samples _____ Element Ag Atomic Weight _____ Curve _____ Date 2-4-91

(Negative sample numbers indicate nominal concentrations of calibration standards)

Sample No.	Dil'n. Fact.	Abs'n.	Conc'n (mg/l)	Molar Concentration	Vol. Soln. (ml)	Wt. Samp. (mg)	Wt. % Element
cal std	0.0	0.670	5.0000	0.00004634			
54920	6.0	0.188	8.4179	0.00007802			
54921	0.0	0.054	0.4030	0.00000373			
54922	0.0	0.016	0.1194	0.00000111			
54923	0.0	<0.014	<0.1045	<0.00000097			
54924	0.0	<0.014	<0.1045	<0.00000097			
54925	0.0	0.018	0.1343	0.00000124			
54926	0.0	0.202	1.5075	0.00001397			
54927	0.0	0.041	0.3060	0.00000284			
ck std	0.0	0.678	5.0597	0.00004689			
54928	0.0	0.186	1.3861	0.00001286			
54929	0.0	0.024	0.1791	0.00000166			
ck std	0.0	0.683	5.0970	0.00004724			

5-2965

OSR 24-E33 (Rev. 5-90)

Analysis Request
Savannah River Laboratory
Analytical Division

Labels: RED = Radioactive
YELLOW = Thorium or Uranium
WHITE = Nonradioactive

Data Group 900 238	Study	Requestor B.J. Boulineau	Phone No. 5-8996 / Date 1-24-91
Radioactive Material ☐ Yes ☑ No		Criticality Material ☐ Yes ☑ No	
____ ALPHA ____ BETA/GAMMA ____ MAJOR NUCLIDE		____ MAJOR ISOTOPE ____ WEIGHT	
Hazardous Material ☐ Yes ☐ No PHOTO FIXER		Sample Delivered to	
____ CARCINOGEN ____ TOXIC ✓ EXPLOSIVE ____ OTHER Ag		ADD REC. ____ HLC REC. ____ CHEMIST NAME ____	
Return Sample ☑ Yes ☐ No	Print This Request ☐ Yes ☐ No	Analysis Reviewed With	Comment

Add Sample Number	Sample ID	Sample Type	Label Color	Analysis	PPM
2-54920	PAKO-A	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	8.42
2-54921	PAKO-B	Solid ____ g; Liquid ____ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	.40
2-54922	E-6-A	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	1.2
2-54923	E-6-B	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	<.1
2-54924	C-41-A	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	<.1
2-54925	C-41-B	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	.13
2-54926	EP2-A	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	1.51
2-54927	EP2-B	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	.31
2-54928	B+W-A	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	1.39
2-54929	B+W-B	Solid ____ g; Liquid ✓ o/a; Volume 100 ml; Gas ____ yes/no	RED YELLOW (WHITE)	EST Ag VALUE	.18
		Solid ____ g; Liquid ____ o/a; Volume ____ ml; Gas ____ yes/no	RED YELLOW WHITE	EST VALUE	
		Solid ____ g; Liquid ____ o/a; Volume ____ ml; Gas ____ yes/no	RED YELLOW WHITE	EST VALUE	

> > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996
Address : Unknown

UserId: EP2-A BOULINEAU 1/24/91
ADS SampId: 200054926
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

Results Section

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD)
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE

Analyst: INGRAM_RS

Component	Value	Units	R V 1 1
OTHER ELEMENTS	AG= 1.51 PPM	RESULT-TEXT	

Cartridge 1 effluent of a two Cartridge series.

Blueprint two Black Fig

PAGE: 8 > > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < < Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: EP2-B BOULINEAU 1/24/91 CustomDG : CSWE/PLANT MISC SubmissionId: 100011714
ADS SampId: 200054927 SampleType: IRM-FIXR-AA SubmitDate : 01/24/91
Study : INFO RESOUCRE/PHOTO FIXR LoggedBy : DEWEESE_BM LoggerPhone : 52352

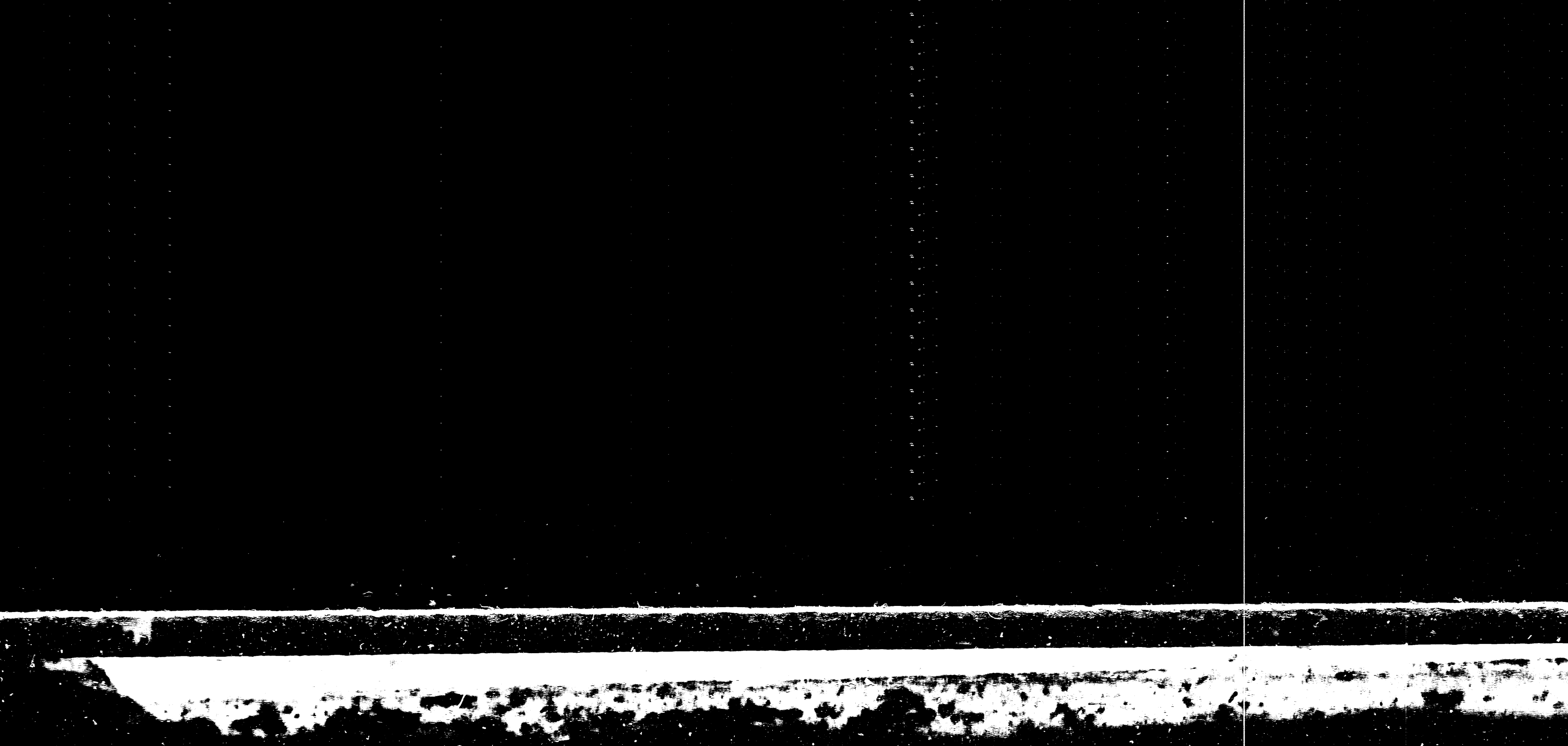
---------- Results Section ----------

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= .31 PPM	RESULT-TEXT	1	1

Cartridge two effluent from a two cartridge Series.

Ektaprint Two Bleach Fix



)))) Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: E-6-A BOULINEAU 1/24/91
ADS SampId: 200054922
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

---------- Results Section ----------

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= .12 PPM	RESULT-TEXT	1	1

Cartridge one effluent from a two cartridge Serie.

E-6 fixer

> > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

/serId: E-6-B BOULINEAU 1/24/91
ADS SampId: 200054923
Study : INFO RESOUCRE/PHOTO FIXR
CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM
SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

Results Section

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= <.10 PPM	RESULT-TEXT	1	1

Cartridge two effluent from a two cartridge Serie

E-6 fixer

PAGE: 1 > > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < < Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: B&W-A BOULINEAU 1/24/91 CustomDG : CSWE/PLANT MISC SubmissionId: 100011714
ADS SampId: 200054928 SampleType: IRM-FIXR-AA SubmitDate : 01/24/91
Study : INFO RESOURCE/PHOTO FIXR LoggedBy : DEWEESE_BM LoggerPhone : 52352

---------- Results Section ----------

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= 1.39 PPM	RESULT-TEXT	1	1

Cartridge one of a two cartridge Serie.

Black + White Print-Kodak Destomatic Stop fixer

> > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: B&W-B BOULINEAU 1/24/91
ADS SampId: 200054929
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

Results Section

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= .18 PPM	RESULT-TEXT	1	1

Cartridge two of a two cartridge series

Black and White Print - Kodak Dektomatic Stop Fixer

 > > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < < Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: C-41 A BOULINEAU 1/24/91
ADS SampId: 200054924
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

---------- Results Section ----------

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE

Component	Value	Units	R	V
OTHER ELEMENTS	AG= <.10 PPM	RESULT-TEXT	1	1

Cartridge one of a two cartridge serie

Process C-41 fixer used for Overhead Slide production

> > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996

Address : Unknown

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

UserId: C-41 B BOULINEAU 1/24/91
ADS SampId: 200054925
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: M-FIXR-AA
LoggedBy : DEWEESE_BM

Results Section

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD)
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE

Analyst: INGRAM_RS

Component	Value	Units	R	V
OTHER ELEMENTS	AG= .13 PPM	RESULT-TEXT	1	1

Cartridge two of a two cartridge series.

C-41 fixer used for Overhead Slide Production

> > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < <

Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996
Address : Unknown

UserId: PAKD A BOULINEAU 1/24/91
ADS SampId: 200054920
Study : INFO RESOUCRE/PHOTO FIXR

CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM

SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

---------- Results Section ----------

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD)
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE

Analyst: INGRAM_RS

R V
1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= 8.42 PPM	RESULT-TEXT	1	1

Cartridge one of a two cartridge series.
Black & White
Graphic arts film processor for Process Camera Negatives

 > > > > Analytical Services: Customer Sample RESULTS Report V1.15.9 < < < < Tuesday Feb 5, 1991 6:1 am

Group by Submitter Ordered by Sample Type, User Id, Method, Sequence

Submitter : BOULINEAU_BT 53261 5-8996 Address : Unknown

UserId: PAKO B BOULINEAU 1/24/91
ADS SampId: 200054921
Study : INFO RESOURCE/PHOTO FIXR
CustomDG : CSWE/PLANT MISC
SampleType: IRM-FIXR-AA
LoggedBy : DEWEESE_BM
SubmissionId: 100011714
SubmitDate : 01/24/91
LoggerPhone : 52352

Results Section

AA Method Results.
Operation 1 : FLAME ATOMIC ABSORPTION (NONRAD) Analyst: INGRAM_RS R V
ADP FILE/NOTEBOOK REF: ATOMIC ABSORPTION AA FILE 1 1

Component	Value	Units	R	V
OTHER ELEMENTS	AG= .40 PPM	RESULT-TEXT	1	1

Cartridge two qa two cartridge Serie.

Black and White Graphic Arts film Processor for Process Camera Negatives

MEET ENVIRONMENTAL DISCHARGE REQUIREMENTS FOR SILVER WITH A SILVER SURE®

PA 5½ - 6.5

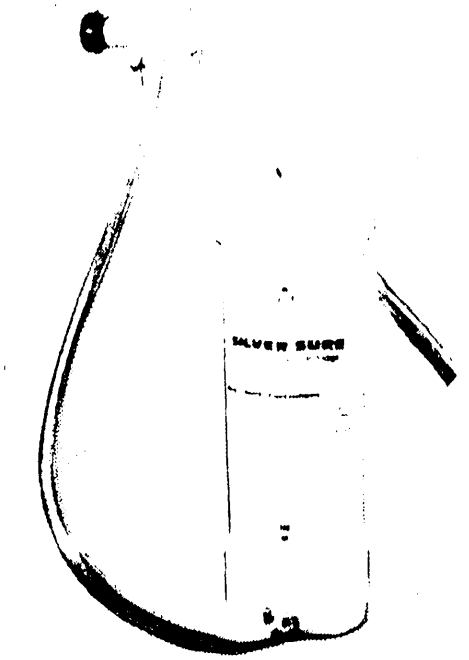
ION EXCHANGE CARTRIDGE

Controls silver pollution in photographic discharge to 5 parts per million and below when used according to manufacturers' recommendations

SILVER SURE® CARTRIDGES ARE THE CHOICE FOR PRIMARY OR SECONDARY SILVER RECOVERY FROM ALL TYPES OF FIXERS, BLEACH FIXERS, AND WASH WATERS

MEET ENVIRONMENTAL DISCHARGE REQUIREMENTS FOR SILVER WITH A SILVER SURE® METERING TANK SYSTEM

Controls silver pollution in photographic discharge to 5 parts per million and below when used according to manufacturers' recommendations



- **Compatible with all types of fixers, bleach fixers, stabilizers, and wash waters.**
- **A tailing system for batch type electroplating systems.**
- **Ideal as a primary system for for hand tank, tray, and other manual processing operations.**
- **Simple set-up.**
- **Available in 5 and 10 gallon sizes (larger tanks available).**

We believe your pockets, not your drains, should have a silver lining!

END

DATE
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6/22/92