594-EHS-005A

Silver Recovery Test Procedure

Revision	Date	Approved By	QA Approval
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1.0 Scope

1.1 To provide instruction for the recovery of silver from fixer solution used in the developing process in radiographic operations and to verify that the silver content remaining in the fixer effluent does not exceed the limits established by the local POTW.

2.0 Referenced Documents

2.1 594-EHS-001 *Environmental, Health, Safety and Security Manual*

2.2 Resolution 2013-12 *Establishing Local Limits for Discharge to DELCORA Facilities Under the Industrial Pretreatment Program*

3.0 Silver Recovery

3.1 Silver recovery shall be accomplished using a combination of Electrolytic Silver recovery process and the metallic replacement process. The Electrolytic process is a silver recovery process where a direct current is passed through a silver rich solution (fixer) circulating between a positive electrode (the anode) and a negative electrode (the cathode). The silver, which is converted to its metallic state, adheres to the cathode, producing a nearly pure metallic silver. An IMG Photo Products model RU-21 or equivalent shall be used for this process.

3.2 Metallic replacement cartridges contain metallic iron. When photographic solutions (fixer) pass through the cartridge at a controlled flow rate the silver complexes in the solution react with the iron. The silver is reduced to its metallic form and stays in the cartridge while the iron is oxidized and passes into solution. A Pyromet model EMS 15R cartridge or equivalent shall be used for this process.

3.3 The silver recovery system shall consist of a holding tank that will feed fixer solution at a controlled rate to the Electrolytic silver recovery unit. After the fixer solution passes through the electrolytic process the solution shall go through a tailing system using one or multiple metallic replacement cartridges.

3.4 Each metallic replacement cartridge used in the tailing system will further reduce the silver content in the effluent solution. The number of metallic replacement canisters needed shall be determined by testing a sample taken at the canister outlet at an analytical lab for silver content. Add additional canisters until the silver content is below the levels allowed by the local POTW. Canisters are changed periodically by removing the canister at the end of the tailing system and installing a new canister at the beginning of the tailing system. Rotation frequency shall be determined by amount of fixer effluent processed.

4.0 Automatic Processor

4.1 In house automatic processors shall have a holding tank to collect used fixer effluent. The holding tank should be equipped with a sump pump designed to pump the used fixer solution directly to the silver recovery holding tank and processed as per section 3.0.

5.0 Manual/Automatic Processing in Mobile Darkrooms

5.1 For film manually processed in mobile darkrooms and for mobile darkrooms equipped with automatic processors, the used fixer solution shall be collected in containers designed, designated and marked for this purpose.

5.2 Once the used fixer solution is collected in the designated containers, the used fixer solution shall be manually added to the silver recovery units holding tank and processed as per section 3.0.

6.0 Compliance

6.1 The efficiency of the silver recovery process shall be checked periodically (quarterly) by testing a sample of the fixer effluent as described in section 3.4.

6.2 Records of the fixer effluent silver content test shall be maintained on file for 5 years.