CITY OF PHOENIX
USE OF BEST MANAGEMENT PRACTICE
FOR
SILVER RECOVERY

By

Raymond A. Eynard
Technical Director
Veritas, Inc.
Scottsdale, AZ

INTRODUCTION

The Phoenix metropolitan area has a population of about 2 million. To meet their sanitary needs, the City of Phoenix operates two Wastewater treatment plants (WWTP). The 91st Avenue Plant, 150 million gal/day, services Gilbert, Glendale, Guadalupe, Mesa, Paradise Valley, Peoria, Phoenix, Scottsdale, Tempe, and Youngtown, Arizona. The 23rd Avenue Plant, 37 million gal/day, services communities in metropolitan Phoenix. Both plants discharge into the Salt River above its confluence with the Gila River.

Local discharge limitations for industrial users were approved for these plants by EPA in 1983 as part of their Industrial Pretreatment Program. The Phoenix City Code and other local ordinances include numeric limitations for 14 metals. Silver, since 1965, has had a discharge limit of 0.5 mg/L. In addition the ordinance includes numeric limitations for other inorganic compounds, oil, grease, pH, and temperature. It also contains prohibitions against inflow of fire, or explosion hazards, solid and viscous pollutants, certain oils, and human health hazards such as toxic and radioactive materials.

Proposed revisions to the local discharge limitations submitted in 1987 were not approved. In January of 1991, a Multi-City Subregional Operating Group (SROG) representing the cities of Glendale, Mesa, Phoenix, Scottsdale, Tempe, and Youngstown, AZ, initiated an update of the local limits process to develop revised limitations.

In December of 1991, the City of Phoenix received new federal discharge permits for the City's two wastewater treatment plants which significantly decreased the amounts and types of pollutants the City could legally discharge from its treatment plants to the Salt River.

Then in February, 1992, the State of Arizona revised their Surface Water Quality Standards which again dramatically affected the City's ability legally discharge treated wastewater to the Salt River.
COMPREHENSIVE LIMIT STUDY

Both of these factors motivated the City of Phoenix to conduct a comprehensive review of the existing local limits and to lay groundwork for future efforts directed at maintaining a technical basis for all local limits imposed upon industry. The Cities hired a national consulting engineering firm, Malcolm Pirnie, to actually conduct the study.

A primary determination was made for pollutants of concern (POC). This list contained 46 toxic pollutants of which silver was one. A secondary determination was made which also included conventional and non-conventional pollutants such as BOD$_5$, TSS, pH, Temperature, Oil and Grease, and Nitrogen. The next step was to monitor the system to determine if the POC’s were present and in what amounts. This was accomplished by reviewing historic records and conducting an intensive sampling program at residential and commercial sites plant influents and effluents.

These local limits were developed in accordance with EPA guidance and with active support and involvement during the nearly two period of the study. Ultimately from this study thirty pollutants were identified as requiring a local limit. Silver being one of them.

PUBLIC MEETING

On March 24, 1993, a public meeting was held to obtain comments from individuals and industry on the results of the Comprehensive Limit Study and the revisions to Section 28-8 of the Phoenix City Code which pertain to prohibited substances and discharge limitations for discharges to the sewer. This meeting was attended by representatives of the City of Phoenix and the partner Cities that discharge into the Phoenix WWTPs.

The meeting was also attended by over 200 members of the public. Due to the strong representation of the photoprocessing industry at this meeting the City changed its approach to implementation of these limit. Consequently the City of Phoenix made significant revisions to the regulatory discharge permit system used to enforce the City’s ordinance.

NEW REGULATORY STRATEGIES

On June 30, 1993, the City Council of Phoenix revised the wastewater discharge limits that are imposed on industrial users of the City sanitary sewer system. The revised ordinance allows the Water Services Director to establish additional classes of industrial users potentially subject to regulation. By using a "tiered" permit approach it allows the City to appropriately regulate other classes of industrial users that would be over regulated if they were classified as a Significant Industrial User (SIU).
The classes of permits are as follows:

Class A permits will apply to Significant Industrial Users which are business that discharge more than 25,000 per day. Class A permits will impose numeric discharge limits.

Class B permits will apply to all other industrial users and will be identified by business activity, process of concern, or by the discharge of a specific pollutant. The Class B permit does not contain numeric limits, but may have performance requirements such as the implementation of BMPs. In the case of silver image processing, a Code of Practice for silver recovery will be required. As part of this requirement, recordkeeping will be necessary on the amount of silver that has been recovered. As of this writing, there are no permitting fees or other charges associated with the issuance of Class B permits.

The revised ordinance also provides an administrative appeals process for all sewer users to appeal City issued permits. This provision provides 20 days after receipt of a permit to appeal the permit requirements to the Water Services Director.

LIMITS

The revised limits were established as a result of the Comprehensive Limit Study and were based on technical basis for limiting the discharge of certain pollutants of concern. Local limits no longer will apply in a blanket fashion to all dischargers, but only to holders of certain types of permits.

In the case of photoprocessing silver is the pollutant of concern. However, silver levels being discharged to the treatment plants are very low. This is believed to be because of the extensive amount of voluntary silver recovery currently being implemented by the industry. In order to maintain the status quo, the photoprocessing industry will be asked to institutionalize these recovery practices, in the form of required best management practices (BMPs). Furthermore, the City is working with and is cooperating fully with the industry in determining what these BMPs should be and how to best implement them.

As most of the labs in the photoprocessing industry are not considered to be SIUs (25,000 gallons of discharge per day) the City will not issue a discharge permit containing numeric effluent limits. The permit contains requirements to operate acceptable silver recovery systems. Failure to comply with less stringent requirements, however, may subject a discharger to additional regulation.

CASE STUDIES

Two case studies will be discussed to illustrate how the photoprocessing is coping with the revised sewer ordinance. The SIU case study will show the extensive procedures and tight control that is necessary to consistently meet the .5 ppm mg/L limit. The commercial case study will show how the use of Code of Practice for silver recovery meets the Phoenix City code requirements.
SIU CASE STUDY

User: Major Photofinishing Lab
Water Usage: 30,000 gal per day approx.
Silver Discharge Limit: 0.5 mg/L
Silver Recovery Equipment: 2 - Hallmark FX3016 Electrolytic Silver Recovery Units, 2 - CPAC BF8 Electrolytic Silver Recovery Units, 1 - Degenkolb Engineering 45 gallon/min Dual Tank Series Recycling Ion Exchange System

Our SIU case study lab processes Kodachrome K-14, E-6, R-3, C-41, RA-4, and black and white films and papers. All color processes use a Split Bleach Fix technology to facilitate the recovery of silver from conventional fixes.

This case study has adopted a concept of "guaranteed compliance" and is taking every step to insure the guarantee the .5 mg/L silver discharge limit with an ample margin to compensate for any spikes that may occur.

All fix tanks have closed loop electrolytic recovery. The CPAC units handle the fixer for the reversal film processes, K-14 and E-6. The Hallmark units handle silver recovery for C-41, R-3, and RA-4. Silver levels are maintained at 300 to 500 milligrams per liter.

A Fluid Level Alarm system and redundant pump stations ensure that accidental spills and overflows do not occur.

Overflow from the fixer tanks and all wash waters from washes following fixers are run through the Degenkolb ion exchange system. This ion exchange system has the capability to remove silver from the effluent to meet the .5 mg/L limit. The ion exchange resins are stripped of their silver regularly with ammonium thiosulfate. The resulting fixer contains 3 to 5 gm/L and is used as a basis to make new fixer replenisher.

The analysis of their discharge has been facilitated by the installation of an atomic absorption spectrophotometer. Output of the Degenkolb is continually monitored. The use of an Isco Composite Sampler is used to obtain three composite samples per week. The overall discharge is maintained to a level of .20 to .24 mg/L.

Recordskeeping is achieved by recording information to in-house developed computer spread sheets.

The city requires them to submit a sample on a monthly basis to a certified lab using EPA methodology. The city collects their samples every six months. The monthly samples and the cities samples are used as a basis to authenticate compliance.
COMMERCIAL CASE STUDY

User: Commercial/Professional Lab
Water Usage: 3,500 gal per day approx.
Silver Discharge Limit: None - Code of Practice for Silver Recovery in place
Silver Recovery Equipment: Dual Hallmark Mark 15 metallic replacement cartridges.

This small commercial lab processes E-6, R-3, C-41, RA-4 Bleach/Fix, and Black and White films and papers. All processes are conventional.

Fixer and bleach-fixe effluent is pumped to a holding tank. The effluent is about 35 percent fixer and 65 percent bleach-fix. The effluent is then metered through the two metallic replacement cartridges and the disposed to the sewer. Daily tests are performed at the effluent exit from the first metallic replacement cartridge with Ag test paper. When break through occurs the second metallic replacement cartridge is put into position one and a new cartridge is put into position two.

Recordskeeping is achieved by recording information and forms that outline square feet of film and paper processed. Silver recovery record forms are also used to record silver discharge levels between to the two metallic replacement cartridges. Total effluent through put is also recorded.

In the initial city testing program, split samples were taken but the results from the state certified lab differed greatly the results the city obtained. This lab is not required to do monthly samples, but are required to maintain the silver recovery is optimum working order.