Memorandum

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To: Public Record for the 2006 Effluent Guidelines Program Plan
EPA Docket Number OW-2004-0032 (www.epa.gov/edockets/)

Date: August 11, 2005

Re: Photoprocessing

1.0 Introduction

In 1997, EPA published a "Preliminary Data Summary for the Photoprocessing Industry (1997 PDS).

1.1 Industry Profile

Photoprocessing includes facilities in SIC codes 7221, 7335, 7336, and 7384. The 1987 SIC Code Manual defines these SIC codes as follows:

- 7221: Establishments primarily engaged in still or video portrait photography for the general public. Included in this classification are school, home, and transient portrait photographers. Establishments primarily engaged in commercial photography are classified in Industry 7335; those primarily engaged in video tape production other than portrait are classified in Industry 7812; and those primarily engaged in film developing and/or print processing for the trade or for the general public are classified in Industry 7384.

- 7335: Establishments engaged in providing commercial photography services for advertising agencies, publishers, and other business and industrial users. Establishments engaged in still and video portrait photography are classified in Industry 7221, and those primarily engaged in mapmaking are classified in Industry 7389. Establishments primarily engaged in medical photography are classified in Industry 8099. Establishments primarily engaged in producing commercial video tape or films are classified in Industry 7812.

- 7336: Establishments primarily engaged in providing commercial art or graphic design services for advertising agencies, publishers, and other business and

industrial users. Producers of still and slide films are classified here. Establishments primarily engaged in art, except commercial and medical art, are classified in Industry 8999; those engaged in medical art are classified in Industry 8099; and those providing drafting services are classified in Industry 7389.

- 7384: Establishments primarily engaged in developing film and photographic prints and enlargements. Data for retail outlets (kiosks), which are owned and operated by photo finishing laboratories for the pickup and delivery of film, are merged with data for the laboratory which owns them and are not treated as separate establishments. Establishments primarily engaged in processing motion picture and video film for the motion picture and television industries are classified in Industry 7819.

Table 1-1 presents facility counts for the Photoprocessing Category from the U.S. Census and the 1997 PDS.

Table 1-1. Census and 1997 PDS Data

SIC Code	NAICS Code	Number of Establishments[1]		Number of Establishments[2]	
		As Primary Business	As Primary or Secondary Business	1997	2002
7221: Photographic Studios, Portrait	541921: Photographic Studios, Portrait	27,607	32,184	13,245	14,587
7335: Commercial Photography	541922: Commercial Photography (except medical photography)	14,845	18,414	4,298	4,255
7336: Commercial Art and Graphic Design	541430: Graphic design services	31,476	37,264	14,582	15,828
7384: Photofinishing Laboratories	812921: Photofinishing laboratories (except one-hour)	10,430	13,171	7,055	4,723
	812922: One-hour photofinishing				
Total		**84,358**	**101,033**	**39,180**	**39,393**

Sources:

1. 1997 U.S. EPA Photoprocessing Industry PDS
2. U.S. Census Bureau.

No facilities reported to TRI in 2000, and one facility, USGS - EROS DATA CENTER in Sioux Falls, has data in the 2000 PCS. Table 1-2 lists the facility data available in the 2000 TRI and PCS. In addition, the 1997 PDS indicates that the majority of photoprocessing facilities are small in size (less than ten employees), which exempts them from TRI reporting.

Table 1-2. Facility Counts in TRI					
SIC Code	Number of Facilities Reporting to 2000 TRI				Number of Facilities Reporting to PCS 2000
	Direct	Indirect	Both	No Reported Discharge	Direct (Major)
7221	0	0	0	0	0
7335	0	0	0	0	0
7336	0	0	0	0	0
7384	0	0	0	0	1

Source: PCSLoads2000 and TRIReleases2000.

1.2 Wastewater Characteristics

For 2000, no TRI data are available, and PCS contains discharge information for a single facility. There is no central database containing information on indirect dischargers. However, the 1997 PDS provides information on wastewater sources and characterization. Table 1-3 summarizes photoprocessing wastewater streams and their major constituents.

Table 1-3. Aqueous Wastes from Photoprocessing

Solution	Constituents
Prehardeners, Hardeners, and Prebaths	Organic Chemicals Chromium Compounds
Developers	Organic Chemicals
Stop Baths	Organic Chemicals
Ferricyanide Bleaches	Ferricyanide
Dichromate Bleaches	Organic Chemicals Chromium Compounds
Clearing Baths	Organic Chemicals
Fixing Baths	Organic Chemicals Silver Thiocyanate Ammonium Compounds Sulfur Compounds
Neutralizers	Organic Chemicals
Stablilizers	Phosphate

Sound-track Fixer or Redeveloper	Organic Chemicals Ammonium Compouns
Monobaths	Organic Chemicals

Source: 1997 U.S. EPA Preliminary Data Summary for the Photoprocessing Industry

Process water used in photoprocessing consists of a) film and paper wash water; b) solution make-up water; and 3) area and equipment wash water. According to the PDS, photoprocessors typically discharge less than 1,000 gallons of wastewater per day. The PDS also documents 296 million square feet of film and 4,130 million square feet of paper processed per year. Table 1-4 provides information on wastewater flows associated with this industry.

Table 1-4. Total U.S. Commercial Photoprocessing Wastewater Flow for 1994

Wastestream	Flow Demands (mL/sq. ft)		Total U.S. Flow (MGal/year)					
			1994			2003		
	Range	Average	Film	Paper	Film & Paper	Film	Paper	Film & Paper
Developer	paper: 5-30 film: 15-100	paper: 17.5 film: 57.5	4.5	19.1	- -	4.3	15.4	- -
Bleach	5-30	17.5	-	-	20.4	-	-	16.7
Fix	15-100	57.5	-	-	67.2	-	-	54.8
Bleach-Fix	5-30	17.5	-	-	20.4	-	-	16.7
Stabilizer	10-30	20.0	-	-	23.4	-	-	19.1
Wash (per tank)	200-1000	600.0	-	-	700.9	-	-	571.9
Total = Developer + Bleach + Fix + Stabilizer + Three Wash Tanks					2,258			1,843

Source: 1997 PDS and 2003 Photo Manufacturers Association.

1.3 Pollutant Loadings

The PDS also provides an estimate of the pollutant loadings associated with this industry. For purposes of this evaluation, EPA assumed the same concentrations as the 1997 PDS (except where noted for silver) and used the flows from Table 1-4 for 2003 flows. Table 1-5 summarizes the estimated pollutant loadings. As can be seen in Table 2-5, 99% of the toxic load associated with this industry is from silver. While the overall annual TWPE is 300,000, the TWPE per facility is less than 10.

Table 1-5. Pollutant Loadings Estimated for 1994 and 2003

Pollutants of Concern	Concentration (mg/L)[3]		Loads Before POTW Removal (lbs/year)		TWF	TWPE Before POTW % Removal (lbs/year)		POTW % Removal[4]		Loads After POTW Removal (lbs/year)		TWPE (lbs/year)	
	Range	Average	1994	2003		1994	2003	%	Data Source	1994	2003	1994	2003
Ammonia	20-300	160	3.02E+06	2.46E+06	0.0022	6,633	5,413	39%	TRI table	1,839,156	1,500,947	4,046	3,302
Biochemical Oxygen Demand (BOD)	200-3000	1600	3.02E+07	2.46E+07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Oxygen Demand (COD)	400-5000	2700	5.09E+07	4.15E+07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	<10-100	55	1.04E+06	8.46E+05	0.0056	5,804	4,737	83%	CWT/RREL	176,190	143,789	987	805
Silver (ion;after recovery)[1,2]	<0.1-5	10	1.88E+05	1.54E+05	16.47	3,103,576	2,532,847	88%	TRI table	22,085	18,024	363,739	296,850
Sulfates	50-250	150	2.83E+06	2.31E+06	5.60E-06	16	13	NA	NA	NA	NA	NA	NA
Thiosulfate	100-1000	550	1.04E+07	8.46E+06	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (TDS)	300-3000	1650	3.11E+07	2.54E+07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Kjeldahl Nitrogen (TKN)	30-350	190	3.58E+06	2.92E+06	NA	NA	NA	90%	I&S/Steel POTWs	358,032	292,192	NA	NA
Total Suspended Solids (TSS)	<5-50	27	5.09E+05	4.15E+05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	<0.75	0.75	1.41E+04	1.15E+04	0.0051	NA	NA	79%	TRI table	2,948	2,406	15	12
Total			1.34E+08	1.09E+08		3,116,029	2,543,010			2,398,412	1,957,358	368,787	300,969

Source: 1997 Photoprocessing Industry PDS (Orginial data source: 1994 WEF study)

Notes: NA = No TWF available and/or no POTW percent removal available.

1. The value range <0.1 - 5 is low compared to the concentration ranges presented in Table 7.3, for 95 percent silver recovery, combined wastestream (combined with wash water), of 5-20 mg/L. The value of 10 mg/L has been taken to be more realistic.

2. The TWF value is for silver as taken from the TRIReleases2000.mdb database.

3. 2003 concentrations are assumed to be the same as 1994 concentrations. Concentration values from 1994 WEF study.

4. POTW removal values are from the TRI Calculations 2002 database, the POTW removals table, where available. Values were supplemented using POTW Removals from the CWT and Iron and Steel Rulemakings.

1.4 On-Site Treatment Technologies and Pollution Prevention Activities

The 1997 Preliminary Data Summary includes a detailed discussion of control and treatment technologies. These include source reduction, water reduction, and silver recovery technologies. Table 1-6, which is reproduced from the PDS, provides a comparison of various silver recovery and management systems. According to the PDS, silver recovery is almost always practiced to some extent. The most common methods are metallic replacement and electrolytic recovery.

Table 1-6. Silver Recovery Technologies

Technology	Advantages	Disadvantages
Metallic Replacement	Can achieve 99% recovery; Can be used for all silver rich solutions; Low capital and operating and maintenance costs; Simple operation	Must be replaced on schedule; Tendency to channel and cause concentrated silver discharge; efficiency diminishes with use; High smelting and refining costs; effluent not suitable for re-use
Electrolytic Recovery	Can achieve 90% recovery; No additional chemicals released; fix solution can be recycled; Moderate capital costs Low refining costs	Cannot achieve 5 mg/L; Not suitable for silver-poor solutions
Precipitation	Can attain 0.1 mg/L Little maintenance Low to moderate capital costs	High smelting and refining costs; complex operation; operation costs vary from moderate to high; treated solution not suitable for reuse
Evaporation/Distillation	Can reduce wastes up to 90% Virtually zero overflow of silver	High energy requirements; Moderate to high capital cost
Reverse Osmosis	Efficiently recovers silver from dilute silver wastestreams; Reduces effluent volume significantly; No water treatment chemicals required; Purified water is recyclable	Capital and O&M Costs vary significantly; Frequent maintenance of membranes and pumps; works best with dilute solutions

1.5 Code of Management Practice for Silver Dischargers (Silver CMP)

Virtually all discharging photoprocessors discharge indirectly to POTWs. Many POTWs have stringent silver limits in their NPDES permits or need to reduce metals concentrations in biosolids. POTWs have identified photographic facilities as a whole as a major source of silver. In an attempt to provide photoprocessing facilities and POTWs with a cost-effective alternative to numeric limits and monitoring, in 1997, AMSA, the Silver Council and two industry groups for the Photographic industry developed a "Code of Management Practices for Silver Dischargers" (Silver CMP). The Silver CMP provides recommendations on control technologies and management practices for controlling silver discharges to POTWs, and encourages pollution prevention technologies such as water conservation. The recommended practices are defined by a minimum recovery of silver from silver-rich processing solutions (e.g. 90%, 95%, and 99%). The minimum recovery and recommended practices vary with the size of the photoprocessor, defined by flow volume of silver-rich solution and wash water. Four POTWs documented loadings reductions of 20% to 52% over historical baselines after CMP implementation.

1.6 Multimedia Environmental Releases

In addition to silver-laden wastewater, photoprocessors generate solid and hazardous waste. Sludge from photoprocessing silver recovery is usually contract hauled as hazardous waste (D011) (RCRA In Focus). Photoprocessors may also generate hazardous waste from acid regenerants, system cleaners, and photographic activators (D002), dichromate based cleaners (D007).

1.7 Industry Trends

The use of digital photography and digital printing increased in the U.S. from 2002 to 2004. In 2002, digital cameras were owned by 18 percent of adults (Market Research). In 2003, digital cameras were owned in 30 - 50 percent of U.S. households (Photo Industry Reporter). In 2004, shipments of digital still cameras in the U.S. grew by roughly 30 percent (Business Week Online), indicating digital camera use in 60 - 80 percent of U.S. households. Digital photography should decrease the discharge of silver-laden wastewater associated with silver-halide printing.

Contrarily, pictures from digital cameras can still be printed using silver-halide technology, for better quality. Although this is not currently an identified trend, film manufacturers have incentive to establish this trend, to keep their part of the market share (Business Week Online).

1.8 References

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