United States
Environmental Protection
Agency

Office of Water
4303

EPA-821-R-96-014
July 1996

EPA Preliminary Study of the Textile Mills Category

PRELIMINARY STUDY

OF THE

TEXTILE MILLS CATEGORY

United States Environmental Protection Agency
Office of Water
Engineering and Analysis Division
401 M Street, S.E.
Washington, DC 20460

May, 1996

PREFACE

This study was conceived and documented by the staff of the Engineering and Analysis Division and fulfills an obligation of EPA under the Consent Decree in Natural Resources Defense Council v Reilly (D.D.C. Civ. No. 89-2980, January 31, 1992).

ACKNOWLEDGEMENTS

The author, Hugh Wise, would like to acknowledge the contribution of Ronald Jordan, who initially organized the study. Besides reviewing the existing regulation, he assisted the Association of Metropolitan Sewerage Agencies (AMSA) with the development of the POTW survey questionnaire and personally retrieved hardcopies of data from the Annual Pollutant Analysis Monitoring (APAM) files of the North Carolina Department of Environmental Managagement (DEM). In addition to AMSA, the author would like to thank members of the American Textile Manufacturing Institute (ATMI) for their cooperation and technical advice. The constructive suggestions and review of the document by Marvin Rubin are also gratefully acknowledged.

TABLE OF CONTENTS

APPENDICES

I. EXECUTIVE SUMMARY

The purpose of this special study is to provide information for determining whether the current effluent limitations guidelines and standards for the textile millls industry, contained within Title 40 of the U.S. Code of Federal regulations at Part 410 (cited as 40 CFR 410), should be revised or updated. This study was conducted to meet EPA's obligations under Section 304(m) of the Clean Water Act, in accordance with the settlement agreement with the Natural Resources Defense Council Inc. and Public Citizen, Inc., entered on January 31, 1992. This study is a compilation of data collected during 1993 and 1994, and includes comparisons with data collected in the late 1970's and early 1980's that support the existing limitations.

The study presents a current profile of the industry, in which the numbers of establishments engaged in the manufacture of textile products were estimated at nearly 6000. Approximately 35-50 percent are engaged in wet processing (dyeing, finishing, printing and coating), and at least 90 percent of these sources discharge their process wastewater to publicly owned treatment works (POTWs). Water conservation programs developed by textile facilities have reduced the total volume of wastewater discharged through more efficient use of process water. Compared with 1980, the industry in 1993 averaged 22 percent less water per pound of fiber processed. A survey of POTWs afforded a review of the pretreatment technologies and innovative "pollution prevention" techniques that are currently being employed by textile users of POTWs.

Pollutant parameters in textile process wastewater were characterized before and after treatment. Available data indicated:(1) Few organic priority pollutants were identified consistently and, when detected, were quantified at very low concentrations (less than 100 ppb); and (2) Metal parameters consistently detected at low levels include: copper, chromium, and zinc. At textile operations using metallized dyes, copper, chromium or nickel are often chelated by organic ligands to form water-soluble metal complexes. While their solubility limits the removal of such metal complexes during biological treatment, complexation also suppresses the immediate and subsequent toxicity (bioavailability) of metal species in the treated wastewater. A joint EPA/Industry research effort is currently being conducted to evaluate a more discriminating analytical technique for measuring potentially bioavailable metal species.

With respect to direct dischargers, the imposition of NPDES permit limits derived from water quality standards for metals, where the new limits are at or below detectable levels, has presented a number of site-specific compliance problems. The main problem is demonstrating compliance where existing analytical methods are unable to measure metals at the level prescribed by the permit limits. A small number of site-specific problems were identified at small POTWs receiving a majority of their flow from textile users, but these problems were found to be unique to these communities.

Although most textile facilities engaged in wet processing discharge their wastewater to POTWs, a survey of POTWs with textile users did not identify any general operational problems that could be related to the lack of categorical pretreatment standards for this industry. Instead of categorical pretreatment standards, each POTW has developed local limits for those parameters it has determined are necessary to assure compliance with its own National Pollutant

Discharge Elimination System (NPDES) permit conditions and sludge standards. POTWs serving textile users generally find the application of local limits, coupled with enough monitoring of selected parameters, adequately controls wastewater discharges from this industry.

II. INTRODUCTION

Section 304(m) of the Clean Water Act [33 U.S.C. 1314(m)], added by the Water Quality Act of 1987, requires EPA to establish schedules for (i) reviewing and revising existing effluent limitations guidelines and standards ("effluent guidelines"), and (ii) promulgating new effluent guidelines. On September 8, 1992, EPA published an Effluent Guidelines Plan (57 FR 41000) in which schedules were established for reviewing existing effluent guidelines and developing new and/or revised effluent guidelines for several industry categories. One of the industries selected for review of existing effluent guidelines was the Textile Mills Point Source Category (40 CFR Part 410).

Issuance of the Effluent Guidelines Plan is also consistent with a Consent Decree entered on January 31, 1992. In a suit filed in U.S. District Court for the District of Columbia (NRDC v. Reilly, D.D.C. No. 89-2980), the Natural Resources Defense Council, Inc. (NRDC) and Public Citizen, Inc., challenged an earlier Effluent Guidelines Plan charging that EPA's plan did not meet the requirements of section 304(m). The Consent Decree subsequently entered into resolved this litigation by establishing, among other things, a schedule for EPA to conduct industry studies and develop new or revised effluent guidelines. The most recent revision of the Effluent Guidelines Plan and its time line was published in the Federal Register on August 26, 1994 (59 FR at 44234)

This study of the textile industry, conducted pursuant to the requirements of Section 304(m) of the 1987 Clean Water Act, was undertaken to indicate whether the wet processing (dyeing, finishing, printing and coating) of textile products currently results in wastewater discharges bearing significant loadings of "toxic" and non-conventional pollutant parameters, and whether these parameters are being adequately controlled. Since 40 CFR Part 410 is without categorical pretreatment standards, another objective of this study was to ascertain whether such standards are needed for adequate control of textile user discharges to POTWs. It is not EPA's intention to use the information and data in this study directly for near-term rulemaking, but to compare the textile mills category to other industry categories being considered for new or revised effluent guidelines.

EPA collected data and information from a variety of sources. The U.S. Department of Commerce, state agencies, and POTW pretreatment programs supplied information for use in the study. The Association of Metropolitan Sewerage Agencies (AMSA) coordinated a survey of POTW pretreatment programs. Trade associations, such as American Textile Manufacturers Institute (ATMI), arranged for site visits to textile facilities. ATMI also provided industry contacts, who were sources of technical information that were helpful in interpreting the analytical data.

III. EXISTING EFFLUENT GUIDELINES

Regulatory and Litigation Background

Effluent limitations for existing sources based on the use of best practicable control technology currently available (BPT) and best available control technology economically achievable (BAT), as well as performance standards for new sources (NSPS) and pretreatment standards for new sources (PSNS) for the Textile Mills Point Source Category were first proposed by EPA in February 1974 (39 FR 4628; February 5, 1974). Final BPT and BAT effluent limitations guidelines for existing sources, NSPS and PSNS were subsequently promulgated in July 1974 (39 FR 24736; July 5, 1974). These regulations imposed effluent limits on discharges of biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total suspended solids (TSS), total chromium, total phenols, sulfide, pH, oil and grease, fecal coliform, and color. In addition, pretreatment standards for existing sources (PSES) were proposed (39 FR 24750; July 5, 1974).

On October 1, 1974, the American Textile Manufacturers Institute (ATMI) filed a petition for review of the promulgated effluent guidelines and standards with the Fourth Circuit of the U.S. Court of Appeals. ATMI was joined in this action by the Northern Textile Association (NTA) and the Carpet and Rug Institute (CRI). The parties involved subsequently filed a joint motion requesting a stay of the petition to allow for a joint EPA/industry study to further evaluate the technical and economic achievability and impact of the regulations. In the joint motion, petitioners withdrew their challenge to the BPT limitations. In response to the joint motion, the Court remanded all the regulations except BPT to EPA for reconsideration.

PSES were promulgated in 1977 (42 FR 26979, May 26, 1977). These pretreatment standards replaced the limits proposed for specific pollutants with general prohibitions (40 CFR Sec 403.5: hydraulic loading, corrosivity, obstructive, and fire/explosion hazards) intended to protect POTW operation and performance.

In 1982, EPA promulgated regulations superseding all existing regulations for the textile mills point source category, except the BPT effluent limitations (47 FR 38810; September 2, 1982) The final rule imposed BPT limits on two new industry subcategories, and revised BAT and NSPS for all subcategories The general prohibitions of PSES and PSNS were reserved, leaving POTW pretreatment programs with the prerogative of applying local limits as necessary to control the wastewater discharges of textile users.

The current effluent limitations and standards for the Textile Mills Point Source Category are codified at 40 CFR Part 410. Textile products and processes that were allocated to the subcategories of Part 410, together with their applicable SIC codes are summarized in Table III-1.

Table III-1

Summary of Subcategories and Applicable SIC Codes

Subcategory and Title	40 CFR Section	Applicable SIC Code(s)
A Wool Scouring	410.10	2299
B. Wool Finishing	410.20	2231
C Low Water Use Processing	410.30	2211,2221,2231,2241,2253,2254,2259, 2273,2281,2282,2284,2295,2296,2298
D. Woven Fabrics Finishing	410.40	2261,2262
E Knit Fabric Finishing	410.50	2251,2252,2257,2258
F. Carpet Finishing	410.60	2273
G Stock & Yarn Finishing	410.70	2269
H. Nonwoven Manufacturing	410.80	2297
I. Felted Fabric Processing	410.90	2299

Effluent Limits and Standards

Effluent limitations for discharges to surface waters were established to control the conventional pollutants: biochemical oxygen demand (BOD), total suspended solids (TSS) and pH; the non-conventional pollutants: chemical oxygen demand (COD), sulfide, and total phenols; and the priority pollutant total chromium. The limitations are production-based mass limits and are presented in terms of pounds of pollutant per 1,000 pounds of product (lb/1000 lb) or, alternatively, kilograms of pollutant per 1,000 kilograms of product (kg/1000 kg).

Definition of Textile Products and Applicability of Limitations

Limitations are applicable to textile products, defined as the final material produced or processed at a textile mill. Applicable products are defined differently in the wool scouring and wool finishing subcategories. For wool scouring, the limitations are based on the dry raw wool as it is received by the wool scouring mill. For wool finishing, the limitations are based on the mass of dry wool and other fibers as received at the mill for processing into wool and blended fibers.

Commissioned P oduction

Integrated mills finish their own textile goods, while others may contract (for a commission) to finish textile goods owned by others. For textile mills qualifying as a commission finisher, the regulation allows a 100 percent (%) increase in the categorical effluent limitations. In order to qualify production as "commission finishing":

1. The mill must be independent (no more than 49% ownership by other companies with greige or integrated operations);
2. The mill owns less than 50% of the textile goods being finished on commission;
3. At least 20% of the commissioned textile goods must be finished by batch (non-continuous) operations; and
4. At least 50% of the commissioned production must be in lots of 5000 yards or less.

Textile mills that qualify as commission finishers are almost exclusively small independent facilities, located mostly in northeastern states. They were allowed exceptional categorical effluent limitations, because they are batch operations (frequent equipment washings) that are engaged in finishing textile goods from a variety of sources. This causes the wasteload to fluctuate, even though the wastewater characteristics are similar to the rest of the textile industry.

The commissioned scouring of wool is also allowed a 100% increase in effluent limitations. In order to qualify production as "commission scouring," the mill must satisfy the first three criteria above. The fourth qualification is not applicable to wool scouring.

IV. INDUSTRY PROFILE

Estimates of Manufacturing Establishments in the Textile Industry Count from 1993 Davison's Textile Blue Book (TBB).

All textile establishments listed in the 1993 Davison's Textile Blue Book (TBB) were counted, with the exception of corporate offices and establishments engaged in the manufacture of synthetic fibers (correctly classified in SIC 28). This count gave a total of 3990 establishments, which are tabulated by state in Table IV-2. To distinguish likely sources of textile process wastewater, a count was made of those listings indicated to be engaged in wet processing (scouring, dyeing, finishing, printing, coating) of textile products. This count gave 1404 establishments, which is approximately 35% of the total (3990) number of establishments listed.

Count from the Census of Manufactures.

Counts of textile establishments for each of the wet processing subcategories of 40 CFR Part 410 were tablulated from the 1992 Census of Manufactures, published every five years by the Department of Commerce. These are summarized in Table IV-1. The regional geographic distribution of all textile establishments reporting production under SIC 22 are illustrated in Charts 2 and 3.[1]

Table IV-1

Count of Establishments by Wet Processing Subcategory

Subpart and Title	SIC Code	1987[1]	1992[1]
A Wool Scouring	2299	551[2]	572
I. Felted Fabric Processing	2299		
B Wool Finishing	2231	118	98
D Woven Fabric Finishing	2261	268	168
	2262	182	178
E Knit Fabric Finishing	2251	161	151
	2252	426	448
	2257	334	388
	2258	240	279
F Carpet Finishing	2273	657	446
G Stock & Yarn Finishing	2269	182	137
		3119	2865
Total establishments reporting under SIC 22		6065	5887

1 From 1992 Census of Manufactures, U.S. Department of Commerce, October 1994

2. Count from Subparts A and I were combined to avoid redundant counting.

1. From 1990 County Business Patterns, U.S. Census Bureau (DRI/McGraw-Hill report, p.5).

Regional Distribution of Textile Facilities

Chart 2: Regional Distribution of SIC 22: 1986

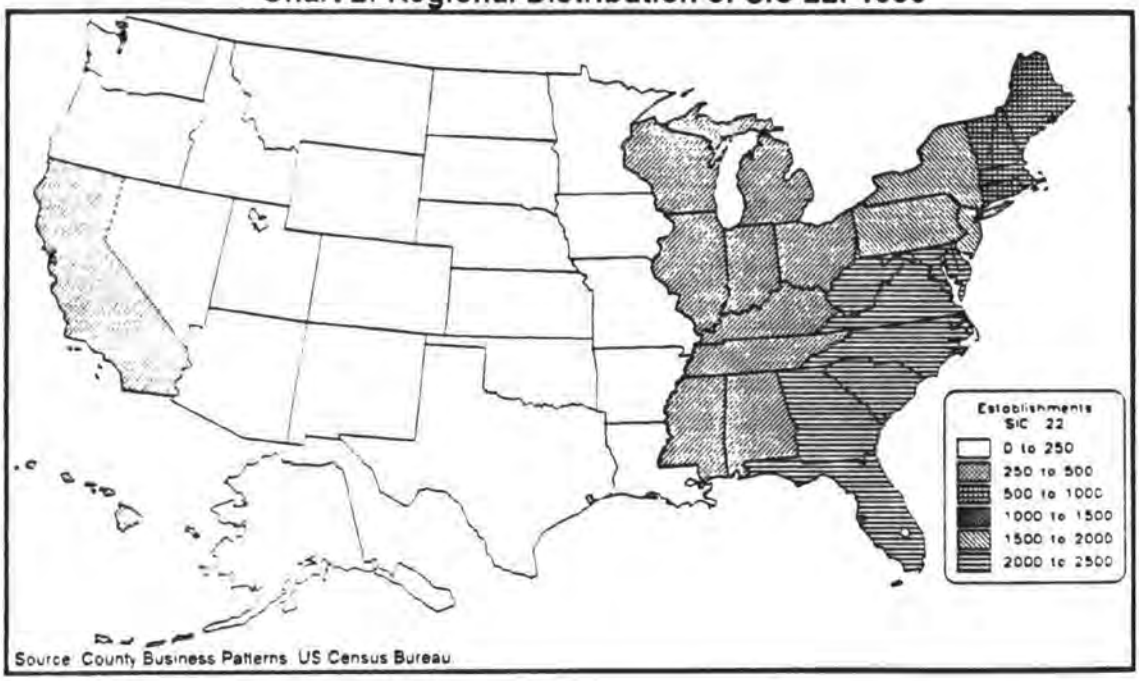

Chart 3: Regional Distribution of SIC 22: 1990

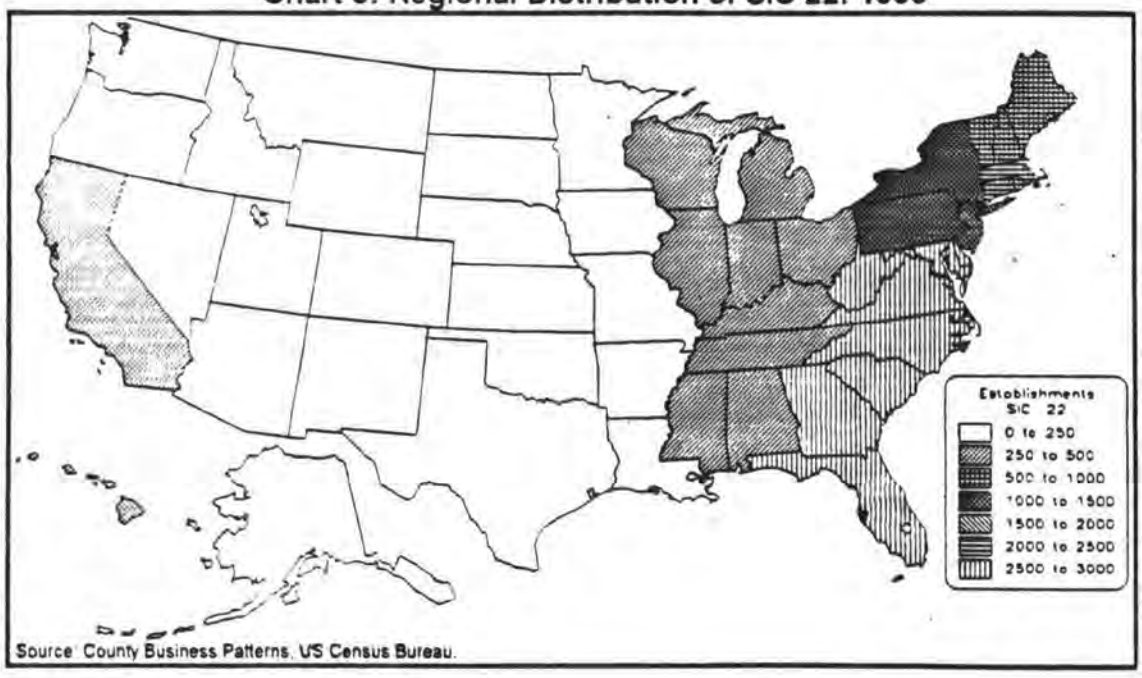

Table IV-2

Count of Establishments Listed in the Textile Blue Book

State	Textile Estab's[1]	Wet Process[2]	Direct Dischargers[3]	Indirect Dischargers
Alabama	176	50	3	47
Arizona	8	2	1	1
Arkansas	7	2	2	0
California	123	43	0	43
Colorado	4	2	0	2
Connecticut	44	19	0	19
Delaware	7	3	0	3
Florida	41	15	0	15
Georgia	492	132	15	117
Hawaii	1	0	0	0
Idaho	2	0	0	0
Illinois	31	13	0	13
Indiana	12	3	0	3
Iowa	9	3	0	3
Kansas	2	2	0	2
Kentucky	22	9	1	8
Louisiana	5	1	0	1
Maine	30	11	3	8
Maryland	14	3	0	3
Massachusetts	157	51	5	46
Michigan	18	2	0	2
Minnesota	14	4	0	4
Mississippi	25	7	4	3
Missouri	18	5	0	5
Nebraska	2	1	0	1
Nevada	1	0	0	0
New Hampshire	30	8	0	8
New Jersey	245	73	2	71
New Mexico	2	1	0	1
New York	282	67	0	67
North Carolina	1136	423	35	388
North Dakota	1	0	0	0
Ohio	32	10	0	10
Oklahoma	2	0	0	0
Oregon	7	4	0	4
Pennsylvania	255	71	3	68
Rhode Island	83	37	1	36
South Carolina	368	236	35	201
Tennessee	87	41	0	41
Texas	42	10	2	8
Utah	4	2	0	2
Vermont	5	3	0	3
Virginia	76	26	12	14
Washington	10	1	1	0
West Virginia	5	2	1	1
Wisconsin	39	6	0	6
	3990	1404	126	1278

1. Listed in 1993 Davison's Textile Blue Book (TBB).
2. Establishments in TBB indicated to be engaged in dyeing, printing, coating, or finishing.
3. From the PCS (see Table IV-4). SIC 22 NPDES permits discharging treated process wastewater

Of a total of 5887 establishments reporting in 1992 (Table IV-1), 2865 (49%) reported production under SIC codes that suggest wet processing is a significant component of their manufacturing operations. Using the 1987 count, about 51 percent of the textile establishments were similarly engaged. In the count taken from the TBB (Table IV-2), about 35 percent of the textile establishments listed appeared to be engaged in wet processing. These evaluations suggest that fewer than half (35-50%) of all establishments manufacturing textile products are likely to be sources of process wastewater. The remaining establishments entail essentially dry manufacturing operations (e.g., yarn, weaving, knitting, etc.) that generate little, if any, process wastewater.

Of the thousands of textile facilities engaged in wet processing, there are only 260 mills that are recognized by the industry as major finishers of textile goods.[2] These include integrated mills that finish their own textile goods exclusively, as well as other mills that are able to accomodate some commission finishing of textile goods owned by others. In general for a major finishing mill to operate profitably, it must have sufficient capacity to finish the greige goods manufactured by at least five textile facilities. None of the major finishers would qualify as "commission finishers" (see page 5) that are eligible for double the categorical effluent limitations.

The counts (by state) of textile establishments listed in the TBB were compared to counts (by geographic region) of SIC 22 establishments reporting annually to the U.S. Department of Commerce's Census of Manufactures. This comparison is represented in Table IV-3, wherein the state counts in TBB were aggregated into roughly the same geographic regions as in the Census data.

Generally, the regional TBB counts were found to be lower than regional counts in the Census data, with the exception of the East S. Central region.[3] This suggests that many textile establishments are not listed in the TBB. The exceptionally low count in the Census data from the East S. Central region may have resulted from facilities mistakenly reporting production under SIC 23 (apparel), instead of correctly under SIC 22.

In explaining why the total number of establishments listed in TBB is lower than the 1992 total in Commerce's Census of Manufactures, TBB's publisher conceded its listing is incomplete. A free listing is offered to any textile facility that can be identified. But those not on the mailing list, or that failed to respond, were not listed. California textile facilities, in particular, appear to be undercounted. These omissions are illustrated by the fact that the TBB gave a total count of only 123 textile establishments in California. But the AMSA survey confirmed a count of 135 textile users of POTWs in three California metropolitan areas (Los Angeles 131; San Diego 2; San Francisco 2).

2 Phone communication. Edward Barnhardt, RMT Hydroscience, Inc., Hilton Head, SC

3. Phone communication with Bruce Nealy - Publisher of Davison's TBB.

Table IV-3

Count of Establishments in the Textile Industry
Textile Blue Book vs. Department of Commerce Census Regions

Region	Total Mills[1]	Total Mills[2]	States
New England	349	500-1000	Connecticut, Maine, Massachusetts, New Hampshire, Vermont, Rhode Island.
Middle Atlantic	782	1000-1500	New York, New Jersey, Pennsylvania.
South Atlantic	2139	2500-3000	Delaware, D.C., Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, W. Virginia.
East N. Central	132	0-250	Illinois, Indiana, Michigan, Ohio, Wisconsin.
West N. Central	46	0-250	Iowa, Kansas, Minnesota, Missouri, Nebraska, N. Dakota, S. Dakota.
East S Central	310	0-250	Alabama, Kentucky, Mississippi, Tennessee.
West S Central	56	0-250	Arkansas, Louisiana, Oklahoma, Texas.
Mountain One	11	0-250	Colorado, Idaho, Montana, Nevada, Utah, Wyoming.
Mountain Two	10	0-250	Arizona, New Mexico.
Pacific One	17	0-250	Alaska, Oregon, Washington.
Pacific Two	124	250-500	California, Hawaii.
	3976		

1 From count of listings by State in the 1993 Davison's Textile Blue Book

2 From count of establishments with textile SIC codes in 1990 County Business Patterns, U.S. Census Bureau (DRI/McGraw-Hill report, p. 5)

Count from EPA's Permit Compliance System (PCS) Database

As a means of estimating the number of direct dischargers in the textile mill category, the PCS computerized database was searched for records of NPDES permits issued under SIC 22. A total of 423 records were found. A review of these records revealed three permits that were incorrectly designated as SIC 22, and two permits were confirmed as no longer active (now discharge to POTWs). Deletion of these permits brought the total number of textile mill NPDES permits to 418. These records are summarized in Table IV-4.

The PCS was searched again to identify parameters that were limited by each of the 418 textile NPDES permits initially retrieved. No specific parameters were found to be associated with many of these permits, perhaps because they were considered "minor" permits. Under EPA policy, monitoring data or parameters for "minor" permits are not required to be reported to the PCS. Other textile NPDES permits retrieved from PCS listed only a few conventional parameters (BOD, TSS, pH, etc.), along with a description of the discharge that indicated it was not process wastewater. Phone contact with some of these permitees revealed these non-process wastewater discharges included storm water, non-contact cooling water, filter backwash, boiler blowdown, etc.

Table IV-4

Summary of Textile Mill Records Extracted from PCS

State	SIC 22 NPDES Permits[1]	SIC 22 NPDES Permits	Permits Reporting Discharge of Process Wastewater[2]	SIC 22 NPDES Permits[3]
Alabama	26	26	3	3
Arizona	1	1	1	0
Arkansas	2	2	2	0
California	2	2	0	0
Connecticut	13	13	0	0
Georgia	43	43	15	5
Illinois	2	2	0	0
Kansas	1	1	0	0
Kentucky	2	2	1	1
Louisiana	1	1	0	0
Maine	9	9	3	1
Maryland	2	2	0	0
Massachusetts	17	17	5	3
Mississippi	6	6	4	2
New Hampshire	3	3	0	0
New Jersey	6	5[4]	2	1
New York	3	3	0	0
North Carolina	102	101[5]	35	0[6]
Ohio	4	4	0	0
Pennsylvania	8	8	3	2
Rhode Island	6	6	1	1
South Carolina	133	132[7]	35	25
Tennessee	5	4[8]	0	0[8]
Texas	2	2	2	1
Virginia	22	21[9]	12	7.[9]
Washington	1	1	1	1
West Virginia	1	1	1	1
	423	418	126	54

1. Records extracted from PCS by EPA (EAD/OST/OW, C. White), 6/1/93. Search variable: SIC 22. Printout listed. NPDES permit number, name of permitee, location of permit by state, county and city.
2. Records extracted from PCS by EPA (EAD/OST/OW, C. White), 7/8/93. Search variables: SIC 22, pollutant parameters Printout listed· pollutant parameters for each NPDES permit. Used to distinguish permits that control the discharge of treated process wastewater.
3. Records extracted from PCS by Versar for EPA (SASD/OST/OW), 10/12/94. Search variables: SIC 22. wastewater flow and pollutant parameters with concentration data.
4. Permit NJ00054330 is no longer active.
5. Permit NC0004685 should have been encoded in PCS under SIC 32 (glass/glass fibers).
6 Failure to extract any records may be caused by monitoring data from North Carolina being reported on a mass basis. Consequently, there is no concentration data encoded in PCS from these permits.
7. Permit SC0040061 is no longer active.
8 Permit TN0002810 should have been encoded in PCS under SIC 28 (synthetic fibers).
9. Permit VA0001601 should have been encoded in PCS under SIC 28 (synthetic fibers).

When a PCS permit listed parameters specified by categorical effluent limits, or other parameters derived from water quality criteria, the permit was judged as being associated with process wastewater. By analyzing the parameters listed for each of these permits, a determination was made that only 122 of the 418 NPDES permits were likely to be sources of treated process wastewater (from dyeing, finishing, printing or coating).

Summary and Implications of the Textile Industry Profile.

Although admittedly undercounted, the total number of textile establishments listed in the 1993 Textile Blue Book was 3990. It was estimated that 1404 (35%) of these were sources of process wastewater. Perhaps overcounted, the 1992 Census of Manufactures indicated a total number of textile establishments at 5887, with 2865 (49%) estimated as being sources of wastewater. A search of the PCS found only 418 NPDES permits issued under SIC 22. Comparing this number of NPDES permits to the respective counts of textile establishments that are sources of wet processing wastewater, it is estimated that 15 (418/2865) to 30 (418/1404) percent have NPDES permits. This would indicate that 70 to 85 percent discharge to POTWs.

A review of the 418 NPDES permits issued under SIC 22 found only 122 that appeared to be valid sources of treated process wastewater. This suggests that 9 percent (122/1404) of the Textile Blue Book wet processors and 4 percent (122/2865) of those estimated from the Census of Manufacturs have NPDES permits, and indicates that 91 to 96 percent of the wet processors in the textile industry discharge to POTWs.

As noted previously, there are 260 mills that are recognized by the industry as major commission finishers for textile goods owned by others. These major sources of process wastewater would be expected to be among the 418 NPDES permits found for the textile industry in the PCS. Since only 122 of the NPDES permits were validated for the entire industry, more than half of the significant finishers must be discharging to POTWs.

Regardless of the accuracy of these counts, one may reasonably conclude that at least 90 percent of the textile facilities that are sources of wet processing wastewater discharge to POTWs. Since the textile mills category (40 CFR Part 410) is without categorical pretreatment standards. it was of interest to investigate whether POTWs find the absence of such standards a problem in adequately controlling discharges from textile users. This question is addressed in Section VI.

V. WATER USE

In 1982 the total water used for wet processing in the textile mills category was estimated at 500 to 600 million gallons/day (mgd).[1] Assuming textile mills operate 345 days/year, this translates to an annual water use by the industry ranging from 172 to 207 billion gallons.

Previous Estimate of Water Use by the Industry

During the previous rulemaking (1982), total water used by the industry was estimated on the basis of wastewater reportedly discharged.[1] An estimate of process wastewater from each of the textile mills subcategories was derived from data collected by EPA industry surveys in 1977 and 1980 (see Table V-1). Although uncorrected for evaporative losses (both in-process and during wastewater treatment), the estimate included wastewater that was not discharged to POTWs or directly to surface waters. Disposition of this wastewater was by several "zero discharge" options. Examples include: spray irrigation (land application), contract hauling and recycle within the facility. The total from all subcategories was estimated at 490 mgd, which is at the lower end of the range noted above. Assuming most textile mills are in operation 345 days/year, this translates to approximately 169 billion gallons/year (bgy).

With the exception of raw wool scouring, water use efficiencies (gal./lb.) presented in Table V-1 are per pound of textile product, rather than per pound of fiber consumed. But since the water used for scouring of raw wool is a very small fraction of the overall wool processing requirements, it was included in the median value of 37.9 gal./lb. of finished wool fabrics. Felted fabrics use a median value of 25.5 gal./lb. of product. Two subcategories that annually consume a large measure of cotton and synthetic fibers are woven fabrics, using up to 24.4 gal./lb. of product; and knit fabrics, using up to 28.8 gal./lb. of product.[2]

Estimate of Current Water Use by the Industry

Lacking data for a direct comparison with the prior estimate of water use per unit of product (fabric), current water use for wet processing in the textile industry was estimated on the basis of fiber consumed. Data in Table V-2 shows the quantities of wool, cotton and synthetic fibers that were annually converted into textile products. While the relative amount of each fiber varied from year-to-year, the total quantity of all fibers annually consumed in the manufacture of textile products increased 36% during the period 1980 to 1993.

To convert a pound of fiber into a finished textile product, current wet processing practices use the following volumes of water: wool fibers 20 gallons; cotton fibers 13 gallons; synthetic fibers 11 gallons.[3] Based on 1993 consumption of each fiber type and its respective water requirement, the annual water use in the textile industry was calculated to be 179 billion gallons (see Table V-3).

1 1982 Development Document for the Textile Mills Category, p. 96.

2. Calculated by adding water requirements for desizing and complex processing of woven fabrics, and adding both simple and complex processing requirements for knit fabrics (from Table V-1).

3 Source: Edward Barnhart, ELBA, Inc., Fripp Island, S C

Table V-1

Estimate of Wastewater Discharged from Textile Mill Category in 1980

Subcategory	Water Used Gal./lb.[2]	Estimated Wastewater Discharged[1] (million gallons/day) Directs (NPDES)[3]	Indirects (to POTW)	Subcat. Total
Wool scouring	1.4	1.0	2.3	3.3
Wool finishing	36.5	10.9	8.2	19.0
Low water use				
General processing	0.8	4.4	16.4	20.8
Water jet weaving	10.4	1.196	1.196	2.392
Woven fabric finishing				
Simple processing	9.2	17.4	34.8	52.2
Complex processing	11.7	25.5	38.6	64.1
Desizing	12.7	59.4	40.0	99.5
Knit Fabric Finishing				
Simple processing	14.1	17.6	62.9	80.6
Complex processing	14.7	11.9	27.9	39.9
Hosiery products	9.0	0.2	6.0	6.2
Carpet finishing	5.6	5.4	23.1	28.5
Stock & Yarn finishing	11.6	21.8	44.8	66.5
Nonwoven	4.8	0.7	3.8	4.5
Felted Fabric processing	25.5	0.2	2.1	2.3
		178	312	490

Daily total for the industry = 490 million gallons
Annual total for the industry (345 days/yr.) = 169 billion gallons.

1 From 1982 Development Document for Textile Mills Category, Table V-3, p. 100. The data was collected by EPA industry surveys in 1977 and 1980. "The estimates were developed by adding the known average discharge values for the mills in each subcategory reporting flow data plus estimates of the average discharge for the mills not reporting flow. The estimates for mills not reporting values were based on the mills's assignment to a specific model. Model assignments were made on the basis of survey information and information about products and production equipment published in the 1978 edition of Davison's Textile Blue Book."

2 Wastewater generated was taken to represent water use, even though it was admittedly uncorrected for evaporative losses

3 Includes wastewater is recycled, sent to a holding pond or septic tank, disposed on land (by spray irrigation), or hauled from site to a landfill by private contractor (1982 Dev. Doc., Table III-8, p 28)

Table V-2

Fiber Consumption by U.S. Textile Mills[1]
(Million Pounds)

Period	Cotton	Synthetic[2]	Wool	Total Mill Consumption
1980	3038.4	8089.5	123.4	11223.3
1981	2715.5	7862.0	138.3	10715.8
1982	2487.9	6775 2	115.7	9378.8
1983	2807.9	8173.9	140.6	11122.4
1984	2714 5	7968.1	142.1	10822.7
1985	2810.5	8225.5	116 6	11152.8
1986	3259.0	8921.7	136.7	12317.4
1987	3753.2	9085.7	142.8	12961.7
1988	3520 3	9217.9	132 7	12848.6
1989	4048.0	9217.6	134.7	13398.4
1990	4115.3	9047 0	132.7	13295.0
1991	4347 5	9102.3	151.5	13601.3
1992	4761 6	9742.7	150 7	14655.0
1993	4937 7	10169 4	156.8	15263.9

1 Source: U S Department of Agriculture Economic Research Service.
2 Same as "man-made" fibers

Table V-3

Current Estimate of Textile Process Wastewater

Year	Fiber	Annual Production[1]	Water to Process Use gal./lb	Annual million gal.	Wastewater Discharged[2] Annual million gal.
1980	Wool	123 4	37.9 [3]	4677	4279
	Cotton	3038.4	24.6 [4]	74745	67271
	Synthetics	8083 5	20.8 [5]	168137	156367
		11245 3	22.0 [6]	247560	227917
1993	Wool	156.6	20.0 [7]	3132	2866
	Cotton	4937 7	13.0 [7]	64190	57771
	Synthetics	10169 4	11.0 [7]	111863	104033
		15263.7	11.7 [6]	179200	164670

1 Million pounds of fiber type converted into finished textile products.
2 Corrected for evaporative losses of process water in dryers and in wastewater treatment. Evaporative loss assumed to be 10% for cotton fiber, 7% for synthetic fibers and 8.5% for wool.
3 From 1982 Development Document for Textile Mills Category, Table V-1, page 97 Average value, uncorrected for evaporative losses
4. Calculated from the ratio 13/20 X 37.9.
5. Calculated from the ratio 11/20 X 37.9
6 Calculated from total fiber consumption and total water used or discharged.
7 Average value, uncorrected for evaporative losses.
Source: Ed Barnhart, ELBA, Inc., Fripp Island, S.C.

Comparing total water used in 1980 based on survey data (169 billion gallons), with total water used in 1993 calculated from fiber consumption and current water use efficiencies (179 billion gallons), it would appear that the industry is currently using about 6% more water. While there was little increase in water use, consumption of all fiber types increased 36% during this period (see Table V-2). This indicates a substantial improvement in the efficient use of water.

Using total fibers consumed (11223.3 million lbs.) as a measure of textile production in 1980 and total water used (169,100 million gal.) previously estimated for that year, 1980 water use efficiency was calculated at 15.1 gal./lb. of product. At the same water use efficiency, 1993 fiber consumption would project a total use of 230,000 million gallons by the industry. The estimated use of only 179,200 million gallons by the industry at the higher fiber consumption level of 1993 can be explained by a more efficient use of water for wet processing. The industry's water use efficiency for all types of fibers in 1993 was calculated at 11.7 gal./lb., which is 22% less water per pound of fiber processed than was used in 1980. This recognizes the achievement of water conservation programs developed at textile mills throughout the industry.

VI. CHARACTERIZATION and PRETREATMENT of PROCESS WASTEWATER

In order to characterize an industry's process wastewater, it must be sampled before treatment or mixing with non-process wastewater. The data available for characterization is almost exclusively from monitoring reports for NPDES permits. But this data characterizes treated process wastewater. Textile facilities discharging process wastewater to POTWs (referred to as "textile users") are a better source of data for characterizing textile process wastewater, provided the wastewater is sampled before it is discharged to the POTW sewer connection.

Data to support the characterization of untreated (raw) process wastewater in the textile mills category was drawn from a POTW that was part of a survey conducted cooperatively with the Association of Metropoliltan Sewerage Agencies (AMSA), and from two POTWs that were involved in North Carolina's Annual Pollutant Analysis Monitoring (APAM) program.

All industrial users (IUs) discharging process wastewater to a POTW are regulated under 40 CFR Part 403, where Appendix C lists textile mills as an industrial category that is subject to national categorical pretreatment standards.[1] POTWs in the AMSA survey had developed specific local limits for pollutant parameters listed in the national pretreatment standards,[2] and local limits for parameters that are mandated by the categorical pretreatment standards of its industrial users. Since the textile mills category (40 CFR Part 410) has no specific categorical pretreatment standards, the POTWs applied local limits for selected parameters to the IU permits of textile users only to the extent necessary to ensure renewed and continued compliance with the POTW's NPDES permit, and with standards for the use or disposal of the POTW's waste sludge.[3]

The AMSA Survey

As noted previously (Section V), most textile manufacturing facilities engaged in wet processing of textile products discharge their process wastewater to POTWs. Many of the larger metropolitan POTWs are members of AMSA, who agreed to assist EPA in this study by sending their POTW members an information request developed jointly by EPA and AMSA. Out of 153 AMSA members receiving an information request, 99 POTWs responded. Only 25 of the respondents reported receiving wastewater discharges from industrial users that manufacture textile products classified under SIC 22. These respondents conveyed information about 33 POTWs with a total of 251 textile users.

---

1. The word "Categorical" is used in the title of Appendix C to include a number of listed industrial categories that do not have categorical pretreatment standards with specific limitations (other than pH, or reference to prohibitions embodied in the general pretreatment regulations).
2. Section 403.5(a) and 403.5(b).
3. Section 403.5(c)(1).

The North Carolina APAM Database

Beginning in 1988, selected new and renewed NPDES permits carried a requirement for an annual priority pollutant scan and whole effluent toxicity (WET) testing. This database was to be used to define any "pollutants of concern" that might characterize discharges of "complex" wastewater, defined as wastewater from industrial sources discharged at a flow rate greater than 0.5 million gallons per day (mgd). These annual monitoring requirements continued to be added to selected new and renewed NPDES permits until late 1993, when the practice was halted until the collected data could be encoded and analyzed.

The APAM database contains data collected by the Department of Environmental Management (DEM) from 158 NPDES permits issued by North Carolina. Hard copies of priority pollutant analyses reported by thirty (30) textile mills with NPDES permits were obtained from this uncoded data collection, which fortuitously included data from a POTW's textile user. The POTW (at Valdese, NC) was requested to send additional priority pollutant data that its eight(8) other textile users had been required to submit as part of the POTW's pretreatment program. Through the assistance of the North Carolina DEM, another POTW (at Star, NC) was identified with data characterizing wastewater discharged from its four(4) textile users.

Textile User Component of POTW Wastewater

Since most textile manufacturing establishments discharge their wastewater to POTWs, it was of interest to characterize the textile user component of wastewater received by POTWs. Provided a POTW has adequate capacity and is being operated so as to consistently achieve nominal levels of treatment (not always the case), the impact of textile user discharges will depend on whether this wasteload component is a significant portion of the POTW's total daily wasteload. When the textile user component is relatively small, the impact is likely to be minimal regardless of variations in the loading and treatability of the textile wastewater. As the textile user component becomes proportionately larger, the POTW's operations are more likely to be affected.

Although wastewater loading is a product of parameter concentrations and flow, the textile user flow component of a POTW's total flow may portend the potential impact of the associated wasteload on POTW operations. The AMSA survey form requested the POTW to give the average daily wastewater discharge (gallons/day) of each of its textile users. POTWs were also asked for each textile user's flow as a percentage of the POTW's average daily flow, but did not request the POTW's average daily flow. A number of the POTWs failed to respond to this question, or had textile user flows that were insignificant relative to the POTW's flow. For this reason, the POTW'S average daily flow and that of each of its textile users was requested from a number of the POTWs in the survey. The flow of each of the POTWs in the AMSA survey relative to the combined flow from its textile users is summarized in Table VI-1. Flow data for individual textile users of each POTW are listed in Appendix II-3.

Wastewater flow to POTWs in the AMSA survey, with the exception of two small suburban POTWs in Greenville, SC, ranged from 3.3 to 332 mgd. On average, the textile user component at these POTWs amounted to only 1% of the wastewater being treated daily by the POTW.

Table VI-1

Textile User (TU) Component of POTW Flows - AMSA Data

City/POTW	Mean TU Flow, mgd	Total TU Flow, mgd	POTW Flow, mgd	TU/POTW Percent
Boston. MA				
Deer Island		0.028	300	0.009
Nut Island		0.095	150	0.06
Cleveland, OH				
Cuyahoga (Southerly)		0.181	135	0.13
Chicago, IL (MWRDGC)		0.417	19	2.2
Columbus, GA	0.53	5.837	28	20.8
Denver, CO (MWRD)		0.032	160	0.02
Elizabeth. NJ (JMEUC)		0.04	67	0.06
Greenville. SC				
Mauldin	0.283	3.396	20	17.0
Lakeside		0.031	0.35	8.8
Pelham		0.012	5.2	0.2
Taylor		0.474	3.3	14.3
Slater-Marietta		0.055	0.35	15.7
Knoxville. TN		0.425	21	0.02
Little Ferry. NJ		0.937	76	1.2
Los Angeles. CA (LA Co.)				
Carson	0 135	6 066	328	1.85
Long Beach		0 098	16	0.6
Los Coyotes		0 779	33	2 4
Los Angeles. CA (LA City)				
Hyperion		2.43	332	0.73
Glendale		0.248	20.3	0.01
Orange County. CA	0.223	2.015	232	0.87
Nashville. TN		0.2015	32.9	0.76
Newark. NJ	0.292	9.11	290	3.14
Philadelphia. PA		0.331	227	0.15
Phoenix. AZ		0.0096	150	<0.001
Portland. OR		0.0502	57	0.09
Providence. RI		1.544	21.8	7.0
Rockford. IL		0.04	29	0.14
Sayreville. NJ		0.015	75	0.02
San Diego. CA		0.0145	180	<0.0001
San Francisco. CA		0.012	67	<0.02
St Louis. MO		0.0185	120	0.015
St. Paul. MN		0.0335	235	0.01
Tacoma. WA		0.000518	23	0.002
	Totals	35	3454	1 % Avg.

The 33 POTWs listed had a total of 251 textile users.
Average discharge of textile users: 0.139 mgd

For POTWs receiving less than 100 mgd, the flow component from the POTW's textile users averaged slightly more than 2 percent. As noted previously, such a small flow component from textile users is not likely to have a significant impact on POTW operations.

A POTW's textile user flow component is likely to be higher in a community that abounds in textile manufacturing. Two POTWs in the AMSA survey (Columbus, GA and Greenville, SC), with total wastewater flows less than 30 mgd and textile user flow components ranging from 17 to 21 percent, experienced temporary operational problems that were attributed to wastewater from textile users (see pages 30 and 31 for details). But beyond these two examples, POTW responses to the AMSA survey gave no indication that textile user wastewater typically cause serious problems for POTW operations, or jeopardize compliance with its NPDES permit.

The textile user component of wastewater flow at two additional POTWs (Valdese, NC and Star, NC) were identified through the North Carolina APAM database. The textile user components of wastewater being treated at these two POTWs are summarized in Table VI-2. Flows from individual textile users of these two POTWs are listed in Appendix II-3.

Table VI-2

Textile User (TU) Component of POTW Flows - APAM Data

City/POTW	Mean TU Flow, mgd	Total TU Flow, mgd	Avg. POTW Flow, mgd	TU/POTW Percent
Valdese, NC	0 3	3.66	6.2	59
Star, NC	0 1	0.415	0.576	72

While both of these POTWs had a high wastewater flow component from textile users, neither had operational problems in treating the wastewater. In complying with water quality criteria, however, the experiences of the two POTWs were quite different. The Valdese POTW had few compliance problems that could not be resolved with the cooperation of its textile users. The situation at the Star POTW was unique, in effect portraying a worst case senario.

Even with the cooperation of it textile users, the Star POTW found compliance with the water quality standards in its NPDES permit virtually precluded by the exceedingly low flow of its receiving stream. Initially not allowed to dilute its treated effluent more than 1 percent for the testing of whole effluent toxicity (WET), the Star POTW's saline effluent had difficulty passing the test. After textile users altered bleaching and dyeing processes to reduce the salinity to a minimum, and the POTW was authorized an increase in the allowed dilution of effluent to 10 percent, WET results were improved but remained marginal.

Subsequently, a technical effort was initiated and largely underwritten by Fruit of the Loom (FOL) to further reduce the toxicity of treated effluent at the Star POTW. After correcting operational problems at the POTW. FOL began adding appropriate doses of cationic flocculants to the influent in order to flocculate soluble organics (dyes, surfactants, etc.) via anionic functional groups. This was followed by the addition of coagulants to insolubilize the resulting floc. After

several months of this treatment, the POTW's effluent more consistently passed the WET test and the biological integrity of the receiving stream exhibited substantial improvement.

Identification of Pollutant Parameters in Textile User Wastewater

One section of the AMSA survey form requested a listing of those pollutant parameters for which the POTW has effluent monitoring data. The intent was to identify parameters that are monitored at textile user sources. and POTWs that are potential reservoirs of numerical data. The parameters identified are those for which there are local limits, and indicate the parameters that POTWs have some reason to believe may be present in textile users' process wastewater. The parameters that POTWs reported monitoring at textile users are summarized in Table VI-3. The local limits and responses of individual POTWs are presented in Appendix II-2.

The parameter most frequently identified was pH, which is easy to measure and can be monitored concomitantly with other parameters. After pH (monitored at 85% of the textile users), the parameter most often monitored at textile users by POTWs was BOD (80%). Other parameters often monitored included TSS (57%), COD (35%), O&G (31%) and sulfide (25%). Metals routinely monitored were: copper (51%), chromium (46%), zinc (45%), lead, cadmium, nickel (43%), and silver (38%). Less frequently monitored were: Arsenic (21%) and Mercury (17%): and monitored at less than 1% of the textile users were: Antimony, Selenium, Boron and Molybdenum

The reason many POTWs monitor BOD in textile users' wastewater is because the loading of this parameter commonly serves as a basis for the fee schedule that is charged to a POTW's industrial users (IUs). The local limit for BOD loading in industrial wastewater usually derives from the POTW's design capacity remaining after the demand for treating domestic wastewater has been satisfied. The remaining design capacity is allocated among its IUs. When an IU's discharge exceeds its allocated BOD loading limit, the IU must pay a surcharge calculated by a rate formula. An IU's discharge of excessive BOD to the sewer in slug amounts will interfere with POTW operations by temporarily exceeding the POTW's capacity to accomodate shock loads of high strength wastewater.

How POTWs Select Parameters and Set Monitoring Schedules

Textile user permits issued by a POTW pretreatment program typically require certain parameters to be monitored initially. The initial menu may include parameters selected from the baseline monitoring report (BMR), which identifies chemicals that were analyzed in the IU's wastewater. Parameters may also be selected from the textile user's permit application, which lists chemicals (raw materials, solvents, etc.) purchased for use in the facility's manufacturing processes. Purchased chemicals must be accompanied by Material Safety Data Sheets (MSDS), which list other chemicals that may be present. Any of this information in the permit application may be used to select the pollutant parameters to be limited in the IU permit, as well as identifying the textile users that are potential sources of specific organic chemicals.

Table VI-3

Summary of Parameters Monitored by POTWs at Textile Users (TUs)

Parameter	TUs[1]	Per cent[2]
BOD	201	80
TSS	142	57
COD	88	35
pH	213	85
O&G total	48	19
O&G petroleum	31	12
TPH	13	5
Conductivity	12	5
Temperature	17	7
1,1,1-Trichloroethylene	1	<1
Tetrachloroethylene	2	1
VOCs	8	3
Acids/BN	2	1
PCBs	3	1
Acids (Method 625)	1	<1
TTO	15	6
Pesticides	1	<1
Phenols	5	2
CTAS (surfactant)	2	1
MBAS (surfactant)	1	<1
Ammonia-N	12	5
TKN	5	2
Phosphorus	13	5
Sulfide	63	25
Sulfate	2	1
Cyanide	39	15
Antimony	1	<1
Arsenic	53	21
Cadmium	108	43
Chromium	116	46
Chromium +6	12	5
Copper	129	51
Iron	3	1
Lead	109	43
Mercury	43	17
Molybdenum	2	1
Nickel	108	43
Selenium	1	<1
Silver	98	39
Zinc	112	45

1 Number of textile users at the 25 POTWs in the AMSA survey that monitor this parameter.

2 Per centage of the 251 textile industry users in the AMSA survey that monitor this parameter.

Initially, these parameters are monitored to verify the menu of chemicals suggested by the textile user's application. Subsequent monitoring serves to check the continuing validity of the initial parameter assessment, as well as documenting continuing compliance with local limits for the parameters in the textile user's permit. This information could also prove useful in mediating violations of the POTW's NPDES permit, or in assuring compliance with waste sludge standards.

Once a monitoring record of a textile user's discharge is established, and it becomes apparent that certain of the parameters initially selected are not found at significant levels (relative to local limits), these parameters are often deleted from the user's monitoring menu. The record may also convince the POTW that the user's discharge can be monitored less frequently, thereby avoiding unnecessary monitoring costs for both POTW and user.

This pattern of selecting parameters and setting monitoring schedules for textile users became evident from a review of the responses of individual POTWs (see Appendix II-2). The parameters limited in textile user permits were found to vary among POTWs, and reflect differences in the parameters that were regulated in the respective NPDES permits of the POTWs. While all of a POTW's textile users were subject to the same local limits, the same parameters were not always monitored with the same frequency at every textile user. POTW pretreatment programs selected parameters and monitoring schedules that were appropriate for individual textile users.

Quantitation of Characteristic Metal Parameters

Quantitative data to characterize metals in both pretreated and untreated wastewater being discharged to POTWs by textile users was obtained from a POTW in the AMSA survey (Providence, RI) and two POTWs (Valdese, NC and Star, NC) in the APAM database. Average concentrations and local limits for metal parameters at each of the POTWs are summarized in Tables VI-4, VI-5 and VI-6. A detailed listing of the textile user data from each of these three POTWs are shown in Appendix II-4.

A review of the data for metal parameters in textile user wastewater shows that, with few exceptions, average metal concentrations were well below the local limits of the respective POTWs Local limits were exceeded by the average concentrations of antimony, copper and zinc in the Burke Mills' discharge in Table VI-5, but this was the result of the high concentrations measured in 1990. During the period 1990 to 1993, the concentrations of these metals were progressively reduced below local limits (see Appendix II-4). For example, antimony was reduced from 16.9 to 0.6 mg/L; copper from 4.1 to 0.4 mg/L; and zinc from 5.2 to 0.08 mg/L.

Burke attributed reductions in concentrations of these metals to improvements in the efficiency of their dyeing process at lower dyebath loadings of the metallized dyes (pollution prevention). The reduction in zinc was explained by a change to higher priced process chemicals with less zinc impurity. Although prominent in the Burke analyses, antimony is generally not detected in textile user wastewater. Only a limited number of textile users are engaged in applying antimony-containing formulations to fabrics to impart flame retardant properties.

Table VI-4

Data from Textile Users Discharging to POTW (Bucklin Point) at East Providence, RI

		Textile Users of Bucklin Point POTW				
Parameters	LL[1]	1	2	3	4	5
Cadmium	110	1	4	0.7	--	0.8
Chromium	2770	55	44	--	--	138
Copper	1200	977 [2]	307	80	315	79
Lead	690	27	--	--	--	13
Nickel	1620	77	46	--	--	38
Silver	400	14	18	--	43	11
Zinc	1670	408	309	34	68	148

		Textile Users of Bucklin Point POTW				
Parameters	LL[1]	6	7	8	9	10
Cadmium	110	--	685	4	2	5
Chromium	2770	446	25	33	51	163
Copper	1200	264	3670	60	73	77
Lead	690	6	550	--	31	38
Nickel	1620	2	340	137	37	18
Silver	400	25	100	--	15	--
Zinc	1670	432	2938	408	336	118

1 Local limit, maximum concentration, ug/L (ppb)
2 Averaged from 53 observations.

Averaged concentrations are ug/L (ppb) Not detected averaged as zero.
Codes Blank = No data reported. (--) = Analyzed, but not detected.

Textile Users
1. Slater Screen Print Corp
2 Crown Yarn Dye Co
3 Rochambeau Worsted
4. Slater Dye Works
5 Microfibres, Inc
6 Murdock Webbing
7 R.I. Textile Co.
8 Elizabeth Webbing Mills, Health-Tex facility
9. Elizabeth Webbing Mills, dyehouse facility
10. Worcester Textile Co. (discharges to Field's Point POTW in Providence, RI, and is subject to different local limits)

Table VI-5

Data from Textile Users Discharging to POTW at Valdese, NC

Parameter	LL[1]	Textile Users of Valdese POTW 1	2	3	4	5
Antimony		4845	--	204	6	20
Arsenic	100	9	--	4	12	
Beryllium		25	--			
Cadmium	200	1.5	13	--	6	4
Chromium	500	135	40	--	8	4
Copper	500	1325	10	31	52	276
Lead	100	75	40	--	43	10
Mercury	100	0.6	--	--	0.05	0.2
Nickel	250	100	47	--	12	7
Selenium		2 6	--			
Silver	30	--	6.6	--	5	--
Zinc	500	2015	33	109	104	293

Parameters	LL[1]	Textile Users of Valdese POTW 6	7	8	9
Antimony		--	--	--	2.5
Arsenic	100	12	--	2	--
Cadmium	200	--	--	6	--
Chromium	500	31	135	9	74
Copper	500	328	212	319	138
Lead	100	100	--	40	4
Mercury	100	--	--	--	--
Nickel	250	238	--	20	71
Silver	30	--	--	--	--
Zinc	500	367	60	120	106

1 Local limit, maximum concentration, ug/L (ppb).

Averaged concentration unit, ug/L (ppb). Not detected averaged as zero.
Codes: Blank = No data reported, (--) = Analyzed, but not detected.

Textile Users:
1. Burke Mills
2. Neuville Industries
3 Valdese Textiles
4 OMS Textiles
5. Valdese Weavers.
6. Alba-Waldensian
7. Adams Millis-Drexel
8. Carolina Mills
9. Valdese Manufacturing

Table VI-6

Data from Textile Users Discharging to POTW at Star, NC

Parameters	LL[1]	Textile Users of Star POTW 1	2	3	4
Arsenic		3		8	
Cadmium		0.15	1.1	--	
Chromium	100	4	22 .	22	
Copper	200	120.[2]	437.[3]	82	168
Lead		8	3	10	1.3
Mercury		0.05	0.08	0.08	0.05
Molybdenum		13			
Nickel		0.8			
Zinc	500	232.[2]	540.[4]	183	150
Chloride, mg/L		929	359	1032	876
Conductance, umho		4474	3326	4908	3725

1. Local limit, maximum concentration, ug/L (ppb)
2 Average of 31 observations
3. Average of 47 observations
4 Average of 43 observations

Averaged concentration unit· ug/L (ppb) Not detected averaged as zero.
Codes. Blank = No data reported. (--) = Analyzed, but not detected.

Textile Users
1 Clayson Knitting Co
2 Fruit of the Loom Co
3. Montgomery Hosiery Mills
4. Pine Hosiery Mills

Quantitation of Characteristic Organic Parameters

Organic priority pollutants are generally not characteristic of textile user wastewater. Analyses of wastewater samples taken at textile users' regularly detected very few specific organic parameters, other than chloroform, and concentrations typically approached the lowest level detectable by the test method. Chloroform was the organic parameter most frequently observed, probably because of its potential for being generated in the hypochlorite (chlorine + caustic) bleaching process. Another source is the potable water supply typically used for wet processing, which averages about 80 ppb chloroform as a consequence of disinfection with chlorine.

Although the POTW at East Providence, RI, monitored textile users' wastewater for the organic parameter TTO (total "toxic" organics), TTO volatiles were observed only twice near the detection limit of the analytical method. The POTW at Star, NC, did not require textile users to monitor for specific organic parameters. Average concentrations for specific organic parameters in wastewater being discharged to the POTW at Valdese, NC, are summarized in Table VI-7. Detailed listings of specific organic parameters that were quantified in analyses of the wastewater of textile users discharging to each of these three POTWs is shown in Appendix II-4.

Table VI-7

Data from Textile Users Discharging to POTW at Valdese, NC.

Parameters	Textile Users of Valdese POTW 1	2	3	4	5	6	7	8	9
Acrolein	--	132	--	--	--	--	--	--	--
Chloroform	--	535	9	15	--	4	--	23	5
Di-n-butyl phthalate	--	--	--	--	--	--	--	--	*
Di(2-ethylhexyl) phthalate	*	*	--	--	--	*	--	--	*
Ethylbenzene	--	--	--	13	--	--	--	--	--
Naphthalene	--	--	--	156	--	--	7	--	--
Xylenes	--	--	--	110	--	--	--	--	--

Concentration unit: ug/L (ppb)
There are no local limits for specific organic parameters.
Codes * = detected, but attributable to sample contamination; (--) = not detected

Textile Users:
1 Burke Mills
2. Neuville Industries
3. Valdese Textiles
4 OMS Textiles
5 Valdese Weavers
6. Alba-Waldensian
7 Adams Millis-Drexel
8. Carolina Mills
9 Valdese Manufacturing

Pretreatment Technologies and Practices Employed by Textile Users

In responding to another section of the AMSA survey, 96 textile users (out of a total of 251) indicated that their process wastewater was pretreated by one or more technologies before being discharged to the POTW. The pretreatment technologies employed by textile users and reported in the AMSA survey may be summarized as follows.

Equalization - Storage basins above and below ground, as well as ponds, were reportedly used for retention and mixing (equalizing) of wastewater from various in-plant processes. In one case, a sluice gate was installed for the control of peak flow. Provisions for wastewater equalization afford a more consistent wastewater and avoid surges of more concentrated wastewater (so-called "slugs") from being discharged to the POTW.

Oil-Water Separation - Centrifugation was employed for the separation of lanolin from wool processing wastewater, before it was discharged to the POTW.

Neutralization - Among textile users, control of pH is the pretreatment most widely practiced. Many have installed systems that control pH automatically. In order to neutralize (pH 6-9) the wastewater prior to discharge to the POTW, soda ash (sodium carbonate), caustic (sodium hydroxide) and acetic acid were all reportedly in use for adjusting pH.

Temperature Control - The National Pretreatment Standards (40 CFR Section 403.5) prohibit the discharge of hot wastewater in amounts that will cause the temperature of wastewater received at the POTW to be raised above 40°C (104°F). In accordance with this requirement, some textile users have installed heat exchangers to cool wastewater prior to discharge to the POTW. The heat recovered has also been used to pre-heat water being supplied to dyeing machines, thereby reducing energy costs.

Filtration - Various types of filters are utilized by textile users to control suspended solids (TSS). Chemical flocculents are used to enhance the effectiveness of filtration. Textile users reported removal of floc and solids by: filter media in columns, "Hydrosieve" filter, rotating drum filter and cotton fiber drum filter.

Screening - Lint can present a problem in wastewater, when it becomes woven in combination with hair and other fibrous detritus into stringy rope-like mats. Various types of screens are utilized to control lint in wastewater discharged to POTWs. The metal screens average 40 mesh, with finer screens ranging from 120 to 200 mesh. Textile users reported removing lint with: static screens. shaker screens, trench screens, double basket strainers, Sweco screen and screen filters. A pre-screen filter (3/8" mesh) was utilized by one textile user to protect lint screens from blockage by small pieces of fabric.

Sedimentation - Textile users reported the use of gravity separation to satisfy pretreatment requirements for control of solids. Most employed some type of clarifier, or sedimentation chamber. One textile user referred to this as a "settling pit."

Color Removal - Generally. textile users remove color by oxidative destruction of the dyes. The most widely used pretreatment is bleaching with sodium hypochlorite solution, where chlorine is the oxidant. Another oxidant that was used was potassium permanganate solution. One textile user reduced the color intensity of a portion of its process wastewater by equalizing it with other colorless (perhaps reactive) wastewater in a holding pond prior to discharge.

Sulfide Oxidation - Some textile users reported pretreating wastewater to diminish sulfide concentration by oxidation with hydrogen peroxide.

Biological - While biological treatment is exclusively used by direct dischargers to meet NPDES permit limits, few textile users in the AMSA survey reported biological pretreatment. Examples of biological pretreatment reported by textile users included: an extended aeration system (package plant); a bio-tower, with solids recovery by dissolved air floatation (DAF).

POTW user fees are typically based on the BOD load of industrial users' wastewater. When an industrial user's discharge exceeds the BOD load allocated by the POTW, the user usually pays a surcharge calculated by a formula published with the local limits. Although the BOD load of textile user wastewater is usually well below the maximum permitted, increased production coupled with process changes can sometimes result in a textile user's BOD load exceeding the maximum permitted. If the POTW is already operating near its design capacity for BOD load, and an additional allocation is unavailable from other users, the POTW may require pretreatment.

An example of this was reported by one POTW in the AMSA survey. In order to comply with pretreatment requirements in a court-ordered upgrade, one textile user had to install a complete activated sludge process, which included: primary clarifier, aeration, secondary clarifier, aerobic digester, and thickener (for sludge dewatering).

Impact of Textile Process Wastewater on POTWs

Generally, textile user discharges were not problematic at the POTWs surveyed in this study. This conclusion was reached after reviewing responses to Section A of the AMSA survey, and after phone conversations with staff responsible for pretreatment programs at most of the POTWs involved. In those cases where monitoring data has confirmed a textile user's discharge is out of compliance with its IU permit, or there are reasonable grounds for suspecting that textile user discharges are causing problems at the POTW, textile users and the POTW pretreatment program enter into a cooperative effort to resolve the difficulty. A remedy is often achieved by textile users modifying one or more manufacturing processes to the extent practicable, or by installing pretreatment technology so as to comply with local limits.

The AMSA survey asks three questions about the impact of textile process wastewaters being discharged to POTWs.

1. (A-4) Does it "pass through" the POTW, or cause "interference"?
   Survey responses: Yes = 4; No = 21
2. (A-5) Does it cause a nuisance, or otherwise impair POTW operations?
   Survey responses: Yes = 5; No = 20
3. (A-6) Were additional capital or O&M costs incurred by the POTW that could be attributed specifically to textile wastewater?
   Survey responses: Yes = 2; No = 23

The following synopses of the "yes" responses serve as examples of problems that textile user discharges sometimes present to POTWs, as well as the technical remedies that were employed in these cases to resolve the problems.

POTW at Columbus, GA

Response to A-4: The pretreatment system at a textile user's plant (0.6 MGD) was taken off-line for approximately 8 weeks to repair the aeration basin. During this time, the POTW exceeded its permit limits for BOD and TSS. The POTW could not specifically attribute these exceedances to excessive BOD loading from the textile user. But since the wastewater lacked pretreatment, unidentified constituents in the textile user's discharge were alleged to have been responsible for an inhibitory effect on the POTW's treatment efficiency (interference).

Response to A-5: (a) A textile user's (2 MGD) discharge was suspected of having caused excessive foaming problems in the POTW grit chamber for about 2 weeks during the initial operation of a new dyeing process; (b) A textile user's discharge with excessive conductivity and dissolved solids was suspected of causing corrosion problems in a collection system pump station.

POTW at Columbus, GA (continued)

Response to A-6: To meet their NPDES permit limits for BOD and TSS during episodes such as those described in the A-4 response, the POTW uses polymeric flocculants. These "chemical costs" are recovered by surcharging its industrial users (IUs) an additional fee. Simply because of their potential as a source of wastewater with high BOD and TSS concentrations, textile facilities are among the POTW's users that are surcharged during these excursions. Surcharges allocated to textile users of the POTW were not given.

POTW at Greenville, SC

Response to A-4: In the Fall of 1986, the POTW (Travelers Rest East) began to consistently violate its TSS limits. This continued for 6-8 months, until polymer addition became necessary to bring TSS within limits. These violations began close to the time a textile user (Kreiger) installed a bleach line, which raised the pH and substantially increased the BOD of its discharge to the POTW. This discharge affected the POTW's operation by raising its influent pH by 1.2 units and doubling its BOD loading rate. Consequently, the POTW's design load for BOD was reached at only 60% of its design flow.

The textile user's new bleach line also changed the treatability of its wastewater. Contributing to the problem was a variation in the types of sizes (e.g. CMC vs. starch) being removed from the textile goods being processed, which resulted in a microbial food source of varying biodegradability. It was suggested that the type of surfactants being used with the bleach line might have also contributed to the problem.

Remedies: Two textile users (Kreiger and M-TEX) were required to install automatic pH control systems. In addition, the two users were required to install equalization tanks to intercept wastewater from static scour and finishing boxes, as well as finish mix tanks. The equalized wastestream was to be incrementally mixed ("bled in") with other plant wastewaters before being discharged to the POTW. Kreiger was also required to halve its BOD/COD load by pretreatment to come into compliance with the limits of its industrial user permit. Unless this user's BOD load was reduced, the POTW would have continued to have trouble maintaining acceptable dissolved oxygen levels and MLSS in the aeration basin. It was anticipated that these measures would allow the POTW to control TSS in its effluent without the addition of polymer flocculant.

Response to A-6: The sewer authority obtained an Administrative Consent Order against the textile user (Krieger) to recover the cost of the polymer needed to control TSS during the period of the POTW operational problems.

POTW at Chicago, IL.

Response to A-5: Investigating complaints of noxious odors, POTW personnel repeatedly detected ammonia concentrations in excess of short- term limits in the vicinity of a textile user's facility from 1981 to 1992. This nuisance prompted the POTW to issue several violations during this time period. To eliminate the odors in the vicinity of its facility, the textile user eventually

POTW at Chicago, IL (continued)

upgraded an existing ammonia scrubber and rerouted in-plant sewer lines. This nuisance did not affect wastewater treatment operations at the POTW.

POTW at Philadelphia, PA.

Response to A-5: Nuisances prohibited by general pretreatment regulations occurred, but these incidents did not significantly affect wastewater treatment operations at the POTW. Description of incidents: (a) Sewer outside textile user's facility became choked by felt and jute; and (b) Hot wastewater from a wool scouring textile user caused fogging at the POTW.

POTW (Bucklin Point) at East Providence, RI.

Response to A-5: Red dye passed through the POTW (Bucklin Point) on several occasions. While the dye did not adversely affect wastewater treatment operations, it did present the POTW with a compliance problem (see below). The textile user responsible for the discharge was identified and agreed to install a pretreatment system to remove color. The textile user has experienced operational difficulties in fully implementing the new system.

The POTW recognizes color as a largely aesthetic parameter. But in 1993 a specific clause prohibiting the discharge of wastewater with "objectionable" color was added to its NPDES permit.

POTW at Nashville, TN

Reponse to A-5: Foaming and poor settling of solids in primary clarifier attributed to a textile user. This was a transient occurrence and did not significantly affect wastewater treatment operations at the POTW.

Pollution Prevention at Textile Users

The AMSA survey also asked respondents to indicate the "types of pollution prevention techniques (defined by several examples) that are being utilized," or are under consideration, at their textile IU facilities. Respondents reported a number of these techniques had been implemented in order to reduce regulatory liability and improve operating efficiency. These changes may be summarized as follows.

Alternative Process Chemicals - When technically feasible, process chemicals were changed to use more biodegradable/water-soluble chemicals and dyes; use pigment solutions with lower volatiles content; eliminate ammonia (alternative unreported); discontinue use of mineral petroleum products as solvents (alternative unreported).

Pollution Prevention (continued)

Process Changes - Dyeing process was altered to use less dyestuff. Dyeing cycles were shortened. More precise calculation of the amount needed resulted in less pigment per run. Dye systems were converted to others that are less water-intensive. Conversion of batch to continuous bleach ranges. Began recovery of sizing for reuse. Inventory control was improved by "production labelling," which also lowered levels of contaminants in wastewater. Overall chemical usage was reduced by limiting services to clients.

Equipment Changes - Installation of more efficient dye machinery. Batch replaced with continuous dyeing machines, which decreased water use. Conversion to liquor and ratio dyeing equipment. Evaluation of a dye machine that will use recycled dye. Replaced conventional atmospheric rotaries with pressure equipment, which offers better containment of volatiles and improved workplace environment. Upgraded efficiency of boiler. Existing lint screens replaced with revolving lint screens (continuously self-cleaning). Grates were installed to retain wastewater detritus (rags. trash, etc.).

Water Reuse - Rinses from latex pump cleaning were reused in process. Print screen rinse water was reused for rinsing. The last rinse of a scouring machine was reused in the first and second scours. On a washing line, water from the last rinse bath was reused in the first bath. Rinse water from later stages (3rd or 4th rinse) being considered for reuse in earlier stages. Sizing was reused after being removed from fabric by counterflow washing.

Water Recycle - Roller dryer was equipped with a water recycle bath. A system was installed to recycle pump seal cooling water. Condensers were installed to capture water exhausted from dryer for recycle to process.

Water Conservation - Volume of process wastewater was reduced by changing from regular batch ("piece") dyeing to a dyebath schedule known as "color sequencing," or dyeing in a sequence of batches that progress from light to dark colors. The dye beck is merely drained (no rinse) after each batch, and only rinsed with water upon completion of the sequence.
Process water was conserved by keeping the number of dyeing cycles to a minimum. Non-contact cooling water was reclaimed for process use. Condensate from steam lines was recycled. Boiler was modified to give more concentration cycles between blowdowns. Less frequent boiler blowdown reduced the total volume of wastewater discharged. Water conservation training was provided for employees.

Heat Recovery - Heat exchangers are used to recover heat that would otherwise be wasted.
Heat exchangers were installed for individual dye becks. Heat exchanger ("economizer") in boiler stack was used to preheat water. Steam was more efficiently cogenerated by preheating boiler feed with water returned from in-plant heat exchangers. This also reduced the volume of boiler blowdown.

VII. CHARACTERIZATION of FINAL EFFLUENTS

The Permit Compliance System (PCS)

The PCS is a computerized information management system that serves as a repository for monitoring, compliance and enforcement data, as well as conditions for NPDES permits. Compliance with NPDES permits is verified via Monthly Discharge Monitoring Reports (DMRs). DMR data is entered into the PCS by EPA Regional Offices or States, and may include concentration or quantity data (as specified in the permit) for each parameter that is measured at each permitted outfall.

Parameters Limited in Textile Mills NPDES Permits

The PCS database was searched for NPDES permits issued under SIC 22. While 413 NPDES permits were identified, only 122 of these permits were validated (see Appendix VII) as being applicable to the discharge of treated process wastewater. The others were apparently for non-contact cooling water, filter backwash, storm water, etc. Still others were for expired NPDES permits, where the textile facilities now discharge to a POTW. There were also at least three NPDES permits that had presumably been issued and encoded in the PCS under an incorrect SIC code (i.e., the permitted facility should not have been assigned to the textile mills category).

The 122 validated permits for textile facilities were reviewed to identify the parameters that had been limited. This would give an indication of the parameters, beyond those in the categorical standards, that had been added to permits in order to assure compliance with limitations based on water quality standards or other site-specific conditions. Parameters regulated by categorical standards are listed in Table VII-1, while additional parameters are listed in Table VII-2.

Regulated by categorical standards, BOD, COD, TSS, chromium, sulfide, phenols (total) and pH were the parameters most frequently limited in the NPDES permits of textile facilities. Although "phenols (total)" is the parameter regulated in NPDES permits and monitored by permitees, for some permits the parameter had been incorrectly encoded in the PCS as "phenol single compound." This confusion apparently stems from the listing of the regulated parameter in some subcategories (40 CFR Part 410) as "phenols," while in other subcategories it is shown as "phenol." Oil & Grease was limited less frequently, mostly in permits issued to textile mills processing wool.

Among the other pollutant parameters, ammonia, phosphorus, chlorine (residual) and fecal coliform were the most common. Ammonia and phosphorus are generated by the biodegradation of sanitary wastewater (human waste) and nitrogen-containing dyes. Fecal coliform and chlorine (residual) are a consequence of the wide-spread practice of mixing sanitary wastewater with process wastewater in order to obtain nutrients to support biological treatment systems. Chromium is the metal most frequently found on textile NPDES permits, because it is regulated by categorical standards. Zinc and copper are the next most frequently limited metals on the permits of textile facilities, as reported in Table VII-2.

Table VII-1

NPDES Permit Parameters Regulated by Categorical Standards

Parameter	Facilities Reporting	Percentage of Total (122)
BOD[1]	117	96
BOD[2]	1	< 1
COD[3]	99	81
COD[4]	14	11
TSS[5]	116	95
Chromium[6]	106	87
Chromium[7]	5	4
Sulfide[8]	101	83
Phenols[9]	105	86
Oil & Grease[10]	22	18
Oil & Grease[11]	1	< 1
Oil & Grease[12]	1	< 1
pH	120	98

PCS Parameter Descriptors

1 BOD, 5-Day (20 deg C)
2. BOD, Carbonaceous 05 Day 20C
3. Oxygen demand, chem. (high level)
4 Oxygen demand chem (low level)
5. Solids, total suspended
6. Chromium total (as Cr)
7. Chromium, hexavalent (as Cr)
8 Sulfide, total (as S)
9. Phenols, total
10. Oil & Grease Freon extract-grav method
11 Oil & Grease (soxhlet extract), total
12 Oil & Grease (Freon extr.-IR method) total recov.

Specific organic chemicals were found to be limited on very few permits. In such cases, it is likely that an organic chemical was initially identified in the analysis of treated effluent for the permit application, and this prompted the permitting authority to require additional monitoring of the chemical by limiting it in the permit. Also, an organic chemical (e.g., formaldehyde) may have been limited in the permit because it was known to be in process use at the facility. Organic priority pollutants were collectively limited on some permits under the parameter TTO (total "toxic" organics)

The North Carolina Annual ollutant Analysis Monitoring (APAM) Database

Beginning in 1988, new and renewed NPDES permits selected by the state permitting authority carried a requirement for an annual priority pollutant scan and whole effluent toxicity (WET) testing. The stated intention was to use this database to define any "pollutants of concern" that might characterize discharges of "complex wastewater," which was defined as wastewater being discharged from industrial sources at a flow rate greater than 0.5 million gallons per day (mgd). These annual monitoring requirements continued to be added to selected new and renewed NPDES permits through late 1993, when the practice was halted until the collected data could be encoded and analyzed.

The APAM database contains data collected from 158 industrial NPDES permits, but only 29 were NPDES permits of textile mills. One was fortunately the permit of a POTW (Valdese)

Table VII-2
Additional NPDES Permit Parameters

Parameter	Facilities Reporting	Percentage of Total (122)
Coliform[1]	50	41
Coliform[2]	24	20
Turbidity, NTU	1	<1
Solids, settleable	6	5
Solids, total dissolved	3	2.4
Surfactants (MBAS)	4	3
Color (ADMI units)	13	11
Color (Pt-Co units)	15	12
Specific conductance	2	1.6
Inorganics		
Oxygen, dissolved	73	60
Cyanide, total (as CN)	7	6
Ammonia[3]	2	1.6
Nitrogen[4], ammonia	48	39
Nitrogen[5], total	29	24
Nitrogen[6], Kjeldahl	6	5
Nitrogen[7], nitrate	1	<1
Nitrogen[8], NO_2 + NO_3	1	<1
Phosphorus, total	40	33
Chlorine total resid	50	41
Chloride, (as Cl)	11	9
Fluoride, total (as F)	1	<1
Sulfate, total	1	<1
Hydrogen sulfide	1	<1
Hardness, total (as $CaCO_3$)	1	<1
Organics		
TOC[9]	1	<1
TTO[10]	17	14
Chlorodibromomethane	1	<1
Dichlorobromomethane	1	<1
Chloroform	2	1.6
Methylene chloride	1	<1
1,1-Dichloroethylene	1	<1
Trichloroethylene	1	<1
Formaldehyde	3	2.4
Di(2-ethylhexyl) phthalate	2	1.6
4-Chloro-m-cresol	1	<1
2,4-Dimethylphenol	1	<1
Dieldrin	1	<1
4,4`-DDD	1	<1

Parameter Descriptors:

1. Coliform, fecal general
2. Coliform, fecal MF, M-FC broth, 44.5° C
3. Ammonia (as N) + unionized ammonia
4. Nitrogen, ammonia total (as N)
5. Nitrogen, total
6. Nitrogen, Kjeldahl total (as N)
7. Nitrogen, Nitrate, total (one det. as N)
8. Nitrite + Nitrate, total (one det. as N)
9. Total organic carbon
10. Total "toxic" organics

Table VII-2 (continued)
Additional NPDES Permit Parameters

Parameter	Facilities Reporting	Percentage of Total (122)
Metals		
Aluminum, total	1	<1
Antimony, total	2	1.6
Arsenic, total (as As)	2	1.6
Beryllium, total	1	<1
Cadmium, total (as Cd)	3	2.4
Cobalt, total	1	<1
Copper, total (as Cu)	37	30
Lead, total (as Pb)	12	10
Mercury, total (as Hg)	7	6
Nickel, total (as Ni)	7	6
Selenium total	1	<1
Silver, total (as Ag)	4	3
Zinc, total (as Zn)	44	36
Whole Effluent Toxicity (WET)		
48-hr acute toxicity test[1]	23	19
48-hr acute toxicity test[2]	18	15
7-day chronic toxicity test[3]	48	39
Acute toxicity test[4]	2	1.6

1 LF P/F statre 48-hr acu Daphnia pulex
2 LF P/F statre 48-hr acu Pimephales promel
3 LF P/F statre 7-day chr Ceriodaphnia
4 Toxicity, final conc toxicity units

with a substantial flow component from textile users. Although 28 permits had been issued correctly under SIC 22 (the primary code for textile facilities), two permits had been issued under an incorrect primary SIC code. The correct primary codes were obtained from these two facilities and forwarded to the state coordinator in charge of electronic data transfer to EPA's Permit Compliance System (PCS).

Compiled directly from the standard form on which North Carolina required participating labs to submit analytical results, these data are shown in Appendix III-2. The reported concentrations of priority pollutants were averaged and are summarized in Table VII-3. The APAM data summaries reflect the parameters and range of concentrations being discharged directly to surface waters from textile sources.

Evaluation of the APAM Data Summaries

The data in Table VII-3 identify the priority pollutant parameters and average concentrations that characterize treated wastewater being discharged by 30 textile facilities in North Carolina. Table VII-4 shows how frequently the parameters were identified, and tabulates their average and maximum concentrations at each of the participating textile facilities. These concentrations are also compared to the technology-based BAT effluent limitations of two other industrial categories: metal finishing (MF) and organic chemicals, plastics and synthetic fibers (OCPSF).

Table VII-3

Summary of North Carolina APAM Data

Parameters	Textile Mills 1	2	3	4	5	6	7	8	9	10
Bromomethane (10)	--	21	--	--	--	--	--	--	--	--
Trichloroethylene (5)	--	--	--	--	--	--	--	8	--	--
Antimony (50)	83	--	--	--	472	--	--	--	57	97
Arsenic (10)	--	--	--	--	--	71	113	--	19	33
Chromium (5)	--	35	--	--	175	--	--	--	19	--
Copper (2)	82	6	91	13	107	20	30	273	230	75
Lead (10)	--	--	--	--	34	12	--	--	13	--
Mercury (0.2)	--	--	--	0.2	--	--	1.3	0.2	--	0.2
Nickel (10)	--	--	--	--	18	11	--	--	28	--
Silver (5)	--	--	--	--	--	--	19	--	35	--
Zinc (10)	40	60	59	58	85	61	181	106	441	31

Parameters	11	12	13	14	15	16	17	18	19	20
Bromodichloromethane(5)	--	6	--	--	--	--	5	--	--	5
Chloroform (5)	--	9	--	--	--	--	26	243	--	13
Dibromochloromethane(5)	--	5	--	--	--	--	--	--	--	--
Methylene chloride (5)	--	--	--	--	12	--	--	--	--	--
1,1,1-Trichloroethane (5)	--	--	--	208	--	--	--	--	--	--
1,2,4-Trichlorobenzene(5)	--	--	--	--	--	--	--	190	--	--
Antimony (50)	--	123	150	--	--	580	--	--	--	--
Arsenic (10)	--	13	--	--	--	--	49	13	--	--
Cadmium (2)	--	3	2.5	--	6	--	--	3	--	3
Chromium (5)	--	--	5	--	--	96	7	35	508	16
Copper (2)	47	57	25	250	70	290	53	117	15	36
Lead (10)	--	53	45	10	90	--	--	26	--	13
Mercury (0.2)	--	--	--	0.2	--	--	0.5	--	0.5	--
Nickel (10)	--	--	--	--	--	--	--	34	--	14
Zinc (10)	167	76	35	413	128	90	680	76	95	147

Concentration unit: ug/L (ppb) Code: (--) = Not detected.

Averaging criteria Not detected averaged as zero If the concentration average was less than the "quantitation limit target" (indicated parenthetically) specified by the APAM reporting form, the average is represented in this table as not detected.

Textile Mills:

1. American Thread - Charlotte
2. Burlington Industries - Forest City
3. Burlington Industries - Wake Forest
4. Burlington Industries - Cordova
5. Chatham Manufacturing - Elkin
6. Cone Mills - Greensboro
7. Cone Mills - Cliffside
8. Cleveland Mills - Lawndale
9. Cranston Print Works - Fletcher
10. Delta Mills - Maiden
11. Fieldcrest Cannon - Eden
12. Fieldcrest Cannon - Salisbury
13. Fieldcrest Cannon - Laurel Hill
14. Glen Raven Mills - Altamahaw
15. Grover Industries - Grover
16. Guilford Mills - Kenansville
17. Huffman Finishing - Granite Falls
18. Minnette Textiles - Grover
19. Monarch Hosiery Mills - Burlington
20. National Spinning - Washington

Table VII-3 (cont.)
Summary of North Carolina APAM Data

Parameters	Textile Mills 21	22	23	24	25	26	27	28	29	30
Bromodichloromethane(5)	--	14	--	--	--	--	--	--	--	--
Chloroform (5)	--	21	5	--	9	--	--	--	--	--
Ethylbenzene (8)	--	--	22	--	--	--	--	--	--	--
Methylene chloride (5)	--	--	--	--	--	--	--	--	7	--
Tetrachloroethylene (5)	--	--	--	--	--	16	--	--	--	--
Antimony (50)	--	--	--	64	--	76	--	--	--	95
Arsenic (10)	--	11	--	29	--	13	--	--	--	--
Cadmium (2)	--	--	--	6	--	3.6	--	--	--	2.5
Chromium (5)	--	--	118	19	--	--	50	6	21	17
Copper (2)	41	143	26	10	13	152	140	45	476	278
Lead (10)	--	--	--	--	--	20	--	--	23	28
Mercury (0 2)	--	--	--	--	0.2	0.4	--	--	1.6	--
Nickel (10)	45	--	10	13	--	12	--	50	--	--
Zinc (10)	219	36	79	43	24	109	36	40	57	382

Concentration unit: ug/L (ppb). Code: (--) = Not detected
Averaging criteria Not detected averaged as zero If the concentration average was less than the "quantitation limit target" (indicated parenthetically) specified by the APAM reporting form, the average is represented in this table as not detected

Textile Mills
21 Schneider Mills - Taylorsville
22 StevcoKnit Fabrics - Wallace
23 Stowe-Pharr Mills - McAdenville
24 Swift Textiles - Erwin
25 Tuscarora Yarns - China Grove
26 United Piece Dye Works - Edenton
27. WestPoint Pepperell - Elizabethtown
28. WestPoint Pepperell - Wagram
29 WestPoint Pepperell - Lumberton
30 WestPoint Pepperell - Hamilton

Like untreated or pretreated textile user process wastewater discharged to POTWs (see Section VI), metal priority pollutant parameters predominantly characterize treated effluent. Copper and zinc were found at every textile mill, while chromium, lead, antimony and arsenic were reported less frequently. The summaries in Table VII-4 show average concentrations of these metals in treated textile wastewater are lower than their respective BAT effluent limitations in the MF and OCPSF categories. This suggests that, at least at these 30 textile mills, these metal parameters are being effectively controlled well below technology-based standards by the existing treatment systems. While concentrations of copper and chromium in treated effluent sometimes exceeds water quality standards, the metals are often present bound in an organic complex that manifests low toxicity for aquatic organisms (WET testing).

Textile wastewater is characterized by low levels of a limited number of volatile organics from the list of priority pollutants. Chloroform is most frequently observed, sometimes in association with bromodichloromethane. Often used for wet processing, potable water supplies in the U.S. average 83 ppb chloroform as a consequence of disinfection with chlorine. Bromomethane, dibromochloromethane, methylene chloride and tetrachloroethylene were each found at only one textile facility, and maximum concentrations were 20 ug/L (ppb) or less. This level approximates the lower limits of quantitation for the analytical methods that were used. In fact, methylene chloride may well be a contaminant introduced by the lab performing the analysis. Hypochlorite

bleaching (chlorine + caustic) is the most likely source of chloromethanes. Bromomethanes result from low levels of bromine in commercially available chlorine.

Semi-volatile organic parameters were absent, except for 1,2,4-trichlorobenzene. Phthalates were reported, but their detection was attributable to contamination of the wastewater sample by: a) use of plasticized tubing in the sampler; or b) use of phthalate-tainted anhydrous sodium sulfate in the analytical procedure. The acid fraction (i.e., substituted phenols) are apparently not characteristic of textile wastewater, since these organics were not detected in any of the APAM analyses reviewed for this study.

Possible Process Sources of the Parameters

Copper is an integral part of metallized dyes that are widely used within the industry. While zinc salts are used as a dyeing auxillary, they are also used for color destruction in discharge printing. There are also complexed metal dyes based on chromium and nickel. Lead is associated with pigments that may be used in printing on fabrics. Oxides of antimony are used to impart flame retardant properties to fabrics. Arsenic in process wastewater often results from the commission finishing of foreign cotton (e.g., from Egypt), where arsenical pesticides were used in its cultivation.

As noted previously, the most likely source of chloroform is hypochlorite bleaching, which uses chlorine and caustic These chemicals form chloroform by reaction with alcohol, aldehyde or ketone groups that may be appended to soluble humic substances (e.g., fulvic acids) found in the potable water supply used for wet processing of textile products. Likewise, chloroform may also result from the chlorination of treated wastewater to meet permit limits for fecal coliform. Chloroform from this source is expected to diminish, as textile facilities increasingly disinfect only segregated sanitary wastewater.

Two organic parameters (1,2,4-trichlorobenzene and 1,1,1-trichloroethane) that are used as carrier solvents for the application of disperse dyes to polyester were found only once in the treated wastewater of different textile mills (14 and 18 in Table VII-3). The textile mills may have used these solvents at one time, but have eliminated these parameters from the process wastewater by changing to alternative carrier solvents that are not on the priority pollutant list (e.g., biphenyl). Although naphthalene did not appear in this data, it is also used as a solvent (carrier) for the application of disperse dyes to polyester.

Qualitative Data From The PCS

As a basis for estimating the environmental impact of wastewater discharges from textile facilities (see Section IX), EPA used a computer routine called the Effluent Data Statistics (EDS) to generate annual loading values (quantities) from the PCS. The EDS selects concentration and flow data from the PCS for computation of loadings, but the routine does not retain the selected values in readily accessible memory. Thus, despite its utility in retrieving data from the PCS for estimating parameter loadings, the EDS routine precludes ready assessment of the input data (concentration and/or flow).

Table VII-4

Evaluation of APAM Data Summaries

Parameters	QLC[1]	No. of Tex Fac[2]	Max. Conc.	Avg.[3] Conc.	BAT Eff Limit MF[4]	BAT Eff Limit OCPSF[5]
Bromomethane	5	1	21			
Bromodichloromethane	5	14	14	8		
Chloroform	5	5	243	63		21
Dibromochloromethane	5	1	5			
Ethylbenzene	8	1	22			32
Methylene chloride	5	2	12	10		40
Tetrachloroethylene	5	1	16			22
1,1,1-Trichloroethane	5	1	208			21
1,2,4-Trichlorobenzene	5	1	190			68
Antimony	50	10	580	180		
Arsenic	10	10	113	36		
Cadmium	2	8	6	3.7	260	
Chromium	5	15	508	75	1710	1110
Copper	2	30	476	107	2070	1450
Lead	10	12	90	31	430	320
Mercury	0.2	10	1.6	0.5		
Nickel	10	10	50	24	2380	1690
Silver	5	2	35	27	240	
Zinc	10	30	680	135	1480	1050

1 "Quantitation limit" concentration. Concentration unit: ug/L (ppb)

2. Number of textile facilities (from 30 with APAM data) where the parameter was found at an average concentration at or above the "quantitation limit" concentration specified by the APAM reporting form.

3. Average includes only concentration values above the quantitation limit. The average does not include a value of zero where a parameter was not found above this concentration criteria.

4. Metal Finishing Category (40 CFR Part 433). Maximum for monthly average.

5. Organic Chemicals, Plastics and Synthetic Fibers (40 CFR Part 414). Maximum for monthly average.

Although denying recovery of concentration data, the EDS routine did identify the priority pollutant parameters that are mited in NPDES permits of textile facilities nationwide. The concentrations of some of these same parameters were quantified in the North Carolina APAM database. Since data from both PCS and APAM characterize treated wastewater from textile processing, a parameter's concentration range in PCS data is likely to be similar to its concentration in the APAM data.

Out of 122 NPDES permits in the PCS that were found to be valid outfalls for discharges of treated process wastewater from textile facilities, the EDS routine identified only 59 with usable data for calculation of parameter loadings. Parameters for which loadings were calculated by the EDS routine are tabulated in Appendix III and summarized in Table VII-5.

Table VII-5

Priority Pollutant Parameters Retrieved from PCS by EDS Routine

Parameters	Textile Facilities[1]	Percent of Total[2]
Bromodichloromethane	1	<2
Chloroform	3	5
Dibromochloromethane	1	<2
Di(2-ethylhexyl) phthalate	2	3
Cyanide	1	<2
Antimony	2	3
Arsenic	4	7
Cadmium	2	3
Chromium	40	68
Copper	16	27
Lead	6	10
Thallium	1	<2
Zinc	25	42

1 Number of textile facilities (out of 59 total) that reported this parameter.
2 Percentage of the 59 textile facilities reporting this parameter.

As in Table VII-4, chloroform is the organic priority pollutant most frequently detected at low levels in textile process wastewater. With the exception of chromium, there are no technology-based effluent limitations for other priority pollutant parameters in the textile mills category. Copper and zinc often characterize process wastewater from dye baths (or becks), so it is not surprising to find these two metal parameters limited in textile NPDES permits through the application of water quality standards.

While some textile permits have initial monitoring requirements for priority pollutants and other unregulated parameters, data from both the PCS and the North Carolina APAM indicate only a few organic priority pollutant parameters characterize treated textile wastewater, and concentrations are nominally low.

VIII. COST of WASTEWATER TREATMENT

Cost of Wastewater Treatment

Since the promulgation of effluent limitations and standards in 1983, most of the textile industry has continued investing in water pollution control systems needed to comply with both categorical discharge standards and POTW local limits. NPDES permits based upon more stringent water quality standards have spurred investment in additional capital improvements for systems that pretreat wastewater before discharge to POTWs.

In 1991, total pollution abatement costs for the industry amounted to 0.4% of the value of shipments. Pollution abatement equipment accounted for 2.7% of the industry's total capital expenditures. Of the capital expenditures for pollution abatement equipment, 84% went towards the purchase of equipment for water pollution control. It is likely that equipment for wastewater treatment was given priority in order to meet the requirements of new or revised NPDES permits. The operating expenses for water pollution control systems were 2.3% of profits.[1]

Industry Investment Cycle

Although the U.S. had been a net importer of textiles since 1982, the trade deficit decreased steadily after 1987. The movement of the domestic industry away from commodity products has left the bulk textiles market to producers with lower labor costs. All categories of broadwoven fabrics have been particularly hard hit. The ability of foreign competition to capture this part of the market became evident in the early 1980s. The U.S. textile industry became competitive by investing in capital equipment that is capable of producing high quality products that consumers can readily distinguish from lower-priced products. In order to remain competitive with foreign producers, the domestic industry has continued to invest in capital equipment. This is expected to become increasingly important, if global trade restrictions are loosened by the North American Free Trade Agreement (NAFTA) and the General Agreement on Trade and Tariffs (GATT).[2]

Since 1983, the industry has continued investing in more efficient production equipment, computer controlled in many cases. Batch dyeing machinery has been replaced by continuous dyeing machines that transfer dyes more efficiently and use less water. Conventional atmospheric rotary dryers have been replaced by reduced pressure equipment, which offer better containment of volatiles.

Purchase of new equipment usually follows from interest created by exhibits at trade shows. Domestic manufacturers of production equipment particpate in a U.S. exhibit every two years, while foreign manufactures exhibit every four years in Europe. This gradual upgrade of production equipment alters the usual long-term investment cycle that characterizes other industries.

---

1 Original source "1991 Survey of Manufacture," compiled annually by the Bureau of the Census and published by the U.S Department of Commerce. Exerpted from a report by DRI/McGraw-Hill, "Status of the US Textile Manufacturing Industry," December, 1993.

2 Ibid, DRI/McGraw-Hill report, page 35

IX. ENVIRONMENTAL ASSESSMENT

Pursuant to the selection of two industries for development of new or revised categorical regulations (see Section II), EPA ranked six industrial categories according to their respective estimated annual loadings (pounds per year) of an inventory of pollutant parameters and selected chemicals that were reportedly discharged to both surface waters and POTWs in 1992. Aside from ranking, the loading estimates are useful as a weighted menu of chemicals that are characteristic of textile process wastewater.

Parameter loadings were estimated from NPDES monitoring data in EPA's Permit Compliance System (PCS), and from estimated "releases" to wastewater that industries reported on Form R to EPA's 1992 Toxic Release Inventory (TRI). The PCS database derives from monthly discharge monitoring reports (DMRs) required by NPDES permits (direct dischargers). In contrast, the TRI embodies estimated amounts of chemicals reported by sources that discharge both to POTWs (indirect dischargers) and directly to surface waters.

Loading Estimates from the PCS Database

As a comprehensive source of NPDES monitoring data, the PCS has a number of limitations (see Appendix IV-1). Monitoring data has not been encoded for many NPDES permits in the PCS, because only permits considered "major" are required to submit monthly discharge monitoring reports (DMRs) to the PCS. Even if encoded, it is also not always possible to directly retrieve data in the units of choice from all NPDES permits in the PCS. For example, out of 122 NPDES permits in the PCS that were validated as discharging treated process wastewater from textile facilities, the EDS computer routine identified only 59 with usable data for estimating the annual loadings of pollutant parameters that were monitored in textile wastewater discharges.

Depending on monitoring requirements imposed by the permits, concentrations may be reported in different units. The EDS routine estimates loadings only for records with both concentration and corresponding flow data, and assumes each facility operates thirty days per month. After adjusting the PCS's different measures of concentration and flow to compatible units, the EDS routine multiplies concentration and flow values to estimate loadings for each parameter.

The total annual loadings of individual parameters estimated from textile facilities' PCS data are summarized in Table IX-1. The estimated annual loadings of parameters for individual NPDES permits are tabulated in Appendix IV-1. This Appendix also presents summaries of: limitations of the PCS database; assumptions that were made in data selection; and criteria that were used to edit parameter loading estimates and data outliers.

Table IX-1

Total Estimated Annual Parameter Loadings - PCS Database

Parameters	Permits Monitored	LBYO[1]	LBYE[2]
Ammonia	10	48784	48784
Chlorine	10	86598	86598[3]
Sulfide	10	32254	71118
Bromodichloromethane	1	2	2
Chloroform	3	25	25
Di(2-ethylhexyl) phthalate	3	17	19
Formaldehyde	2	986	986
Cyanide	1	4	4
Antimony	2	72	72
Arsenic	4	85	111
Cadmium	2	191	191
Chromium	8	1639	1825
Chromium +6	2	5142	5142
Copper	10	25218	25228
Lead	6	28	29
Silver	4	1132	1133
Zinc	10	233856	233856

1. Calculated minimum amount discharged annually (pounds per year). Calculation assumed a concentration value of ZERO, when reported concentration was below detection limit.
2. Calculated maximum amount discharged annually (pounds per year). Calculation assumed a concentration value of HALF DETECTION LIMIT, when reported concentration was below detection limit.
3. Calculated maximum amount of chlorine at HALF DETECTION LIMIT is inappropriate, because most textile facilities with NPDES permits dechlorinate treated effluent prior to discharge For this reason, the amount was estimated using an assumed concentration value of ZERO

Ammonia, chlorine and sulfide are among the inorganic chemical parameters that were most frequently monitored. It follows that sulfide, a parameter with BPT and BAT limitations in every wet-processing subcategory of the regulation (40 CFR Part 410), would be frequently limited in NPDES permits of textile facilities. This would also explain the monitoring of chromium, which is limited in several subcategories. Even though categorical limits for copper and zinc are unspecified, these are the metal parameters most frequently limited in textile NPDES permits. The greater availability of monitoring data for copper and zinc probably accounts for the higher loadings estimated by the EDS routine for these metals, in comparison with loadings estimated for the other metals.

As noted in Section VII of this report, metals characteristic of textile wastewater are being effectively controlled well below concentration levels of technology-based standards in other industrial categories by technologies currently employed within the textile industry's existing treatment systems. The loadings of organic chemicals in wastewaters discharged by textile facilities are effectively controlled by limitations on BOD_5, COD and TSS in the NPDES permits. This is evidenced by the low concentrations of the few organics from the priority pollutant list that are routinely measured in treated textile wastewaters (see Table VII-4).

Loading Estimates from the TRI Database

The TRI database has a number of limitations as a comprehensive source of chemical release data (see Appendix IV-3). It does not include all textile facilities or TRI-listed chemicals in use at those facilities. Only textile facilities using minimum threshold amounts of TRI-listed chemicals on site are required to report estimated releases on Form R. Reporting thresholds: TRI-listed chemicals that are "manufactured or processed" on-site in excess of a 25,000 lbs/yr, or "otherwise used" on-site in excess of 10,000 lbs/yr. While the TRI database is useful for identifying chemicals that might be expected to be found in an industry's wastewater, the reporting thresholds compromise the accuracy of wastewater loading estimates for these chemicals.

The 1992 TRI records of 228 textile facilities were accessed to obtain the amounts of TRI-listed chemicals that each of these facilities reported as annual releases to POTWs, or from on-site treatment systems to surface waters. Estimated releases to surface waters may include process outfalls (e.g., pipes, open trenches) and stormwater runoff, if applicable. This industry's experience with the 1990 stormwater permitting requirements indicated that few, if any, textile facilities have discharges other than those to POTWs, or from on-site treatment systems. The amounts of TRI-listed chemicals that textile facilities reported in 1992 as being released to surface waters and POTWs are summarized in Table IX-2. Releases of these chemicals that were reported by individual textile facilities are tabulated in Appendix IV-3.

Releases are typically estimated from the quantities of TRI-listed chemicals that a textile facility annually purchases for its manufacturing processes. It follows that chemicals used in the largest quantities will be the chemicals with the highest estimated releases. Table IX-2 indicates that, of the total number of textile facilities (228) that submitted Form R to the TRI database, relatively few facilities reported the release of any given chemical. This suggests that only a limited number of textile facilities use that chemical, or the amount used annually by many facilities was below the reporting threshold.

Only five organic chemicals in Table IX-2 are from the priority pollutant list: dichloromethane, di(2-ethylhexyl) phthalate, naphthalene, toluene, and tetrachloroethylene. These chemicals are shown to be among those ranking lower in total amount discharged annually. This is consistent with the concentration-based effluent monitoring data in Section VII, which indicates that these five chemicals are not found at significant levels in treated textile wastewater discharged to surface waters, or in either untreated or pretreated wastewater discharged to POTWs.

Several chemicals in Table IX-2 have recently been removed from the TRI list and Form R reporting requirements. These include acetone (FR 60 at 31643); ammonium sulfate, ammonium nitrate and water-dissociable ammonium salts (FR 60 at 34172); and sulfuric acid (FR 60 at 34182). Non-ionic surfactants (ethoxylates of alkylphenol and long-chain alcohols) no longer have to be reported as "glycol ethers." Eliminating the estimated releases of these chemicals will significantly reduce the total annual wastewater loading reported to the TRI database by the textile industry.

Table IX-2

Total 1992 Chemical Loadings Reported - TRI Database

Chemical	Facilities Reporting(%)[1]	Surface Waters[2]	POTW[3]	Annual Total
Acetone	11 (5)	37750	17493	55243
Acrylic acid	1	0	2463	2463
Benzyl chloride	1	0	12000	12000
Biphenyl	23 (10)	3890	664638	668528
n-Butanol	1	1566	0	1566
Butylbenzyl phthalate	2	250	500	750
Cresol (mixed isomers)	1	0	2	2
Cumene	1	245	0	245
Decabromodiphenyl oxide	16 (7)	3300	112656	115956
Dichloromethane	2	0	14	14
Diethanolamine	3	26700	47800	74500
Di(2-ethylhexyl) phthalate	3	250	3553	3803
Dyes: CI Basic Green 4	1	0	2900	2900
CI Disperse Yellow 3	1	0	755	755
Ethylene glycol	19 (8)	18295	621162	639457
Formaldehyde	11 (5)	683	88542	89225
Glycol ethers	27 (12)	43504	329849	373353
Methanol	20 (9)	2877	219727	222604
Methylethyl ketone (MEK)	3	252	2354	2606
Methylisobutyl ketone (MIBK)	2	0	255	255
Naphthalene	2	6410	0	6410
Toluene	3	250	260	510
Tetrachloroethylene	10 (4)	770	66681	67451
1,2,4-Trichlorobenzene	12 (5)	952	73344	74296
1,1,1-Trichloroethane	1	250	0	250
Trichloroethylene	1	250	0	250
1,2,4-Trimethylbenzene	8 (4)	2234	67589	69823
Xylene (mixed isomers)	14 (6)	2296	220021	222317
Ammonia	62 (27)	34851	943583	978434
Ammonium nitrate (solution)	3	9866	0	9866
Ammonium sulfate (solution)	38 (17)	965	2571414	2572379
Chlorine	21 (9)	39696	219905	259601
Hydrochloric acid	9 (4)	0	45124	45124
Phosphoric acid	4	0	115	115
Sulfuric acid	19 (8)	6000	1278439	1284439

1 Out of 228 records retrieved from the 1992 TRI database, this number of textile facilities reported an estimated release of the chemical Shown in parenthesis as a percentage of 228.

2. Reported amount (pounds) released annually to surface waters. Includes releases from on-site treatment systems, process outfalls (e.g., pipes, open trenches) and stormwater runoff.

3. Reported amount (pounds) released annually to POTWs.

Table IX-2 (cont.)

Total 1992 Chemical Loadings Reported - TRI Database

Chemical	Facilities Reporting(%)	Surface Waters[1]	POTW[2]	Annual Total
Antimony	1	0	250	250
Antimony compounds	12 (5)	1521	51013	52534
Barium compounds	2	24	5	29
Cadmium compounds	2	3	8	11
Chromium	1	512	0	512
Chromium compounds	20 (9)	3210	122262	125472
Cobalt compounds	3	250	411	661
Copper	1	0	278	278
Copper compounds	18 (8)	2479	86349	88828
Lead compounds	4	17	41	58
Nickel	1	0	131	131
Nickel compounds	2	0	2673	2673
Zinc compounds	13	103	32334	32437

1. Reported amount (pounds) released annually to surface waters.
2. Reported amount (pounds) released annually to POTWs.

Comparison of Loading Estimates from PCS vs. TRI

The estimated releases reported to the TRI database do not include TRI-listed chemicals that are used or produced in quantities below reporting thresholds. Even so, the total annual load for any given chemical reported to the TRI database far exceeds the chemical's total annual load calculated from the PCS (NPDES permits). The obvious explanation for this difference is that at least 90% of the textile facilities engaged in wet processing discharge to POTWs (Section IV) and, therefore, do not report data to the PCS. Thus, the PCS database reflects the loadings of no more than about 10% of the of the total number of textile facilities that discharge wet processing wastewater.

When the two databases are compared on a basis of average annual load per facility, and when the loads of a chemical calculated from the PCS are compared to TRI loads reported as being discharged to surface waters (i.e., associated with NPDES permits), there is less difference between a chemical's loading estimate derived from the two databases. The data for such a comparison are summarized in Table IX-3.

Widely used in textile wet processing, ammonia and copper (from copper-based premetallized dyes) are two chemicals for which data are frequently reported to both the PCS and the TRI database by textile facilities. The availability of data for ammonia and copper in both databases made these two chemicals logical choices for comparing annual loadings derived from the two databases.

While the PCS listed 418 NPDES permits issued under SIC 22, only 122 could be validated as sources of treated process wastewater (pages 12, 34). Of the 122 NPDES permits, a computer routine (EDS, Appendix IV-1) identified only 10 permits with usable data for

Table IX-3

Annual Loadings From Textile Wet Processors Discharging to Surface Waters

Variable	PCS		TRI	
	Ammonia	Copper	Ammonia	Copper
Number of SIC 22 facilities in database	122	122	228	228
Facilities with usable or reported data	10	10	62	8
Facilities discharging to surface waters	10	10	6.2	1.8
Total annual loading, lbs/yr	48,784[1]	25,218[1]	34,851[2]	2,479[2]
Average annual loading per facility, lbs/yr	4,878	2,522	5,621	1,377

1. Total annual loading estimated by computer routine (EDS) from the PCS database.
2. Total annual loading released to surface waters from facilities that reported these two parameters to the TRI database.

estimating the textile industry's total annual loading for ammonia and copper (Table IX-1, p. 45). From these totals, an average annual loading per facility was calculated for each of the two parameters.

Under SIC 22, the 1992 TRI showed 228 facilities that use or produce TRI-listed chemicals in quantities that exceeded mandatory reporting thresholds (p. 46). While 62 of these facilities reported the release of an estimated annual loading of ammonia, only 18 facilities reported an estimated release of "copper compounds" (Table IX-2, p. 48). Assuming 10% of these facilities discharge to surface waters (i.e., have NPDES permits), an annual loading per facility would be averaged on a basis of 6.2 facilities for ammonia and 1.8 facilities for copper.

Applications of TRI Chemicals in Textile Processing

It is obvious from Table IX-2 that some TRI-listed chemicals are more widely used in larger quantities than others. Some applications of these chemicals at textile facilities are listed in Table IX-4.

Disperse dyes are the only practical means of coloration for polyester and cellulose acetate fibers. Applied as an aqueous dispersion, these water-insoluble dyes will not readily penetrate the fibers interstices. Dye carriers, such as **biphenyl**, act as a solvent that expands the fibers, enabling disperse dyes to penetrate the fiber interstices at lower temperatures and ambient pressure. The carrier assists in the uniformity of dye distribution in the fabric and also increases the rate of dyeing. After dyeing is completed, the carrier solvent is removed from the fabric in a heated drying chamber. This contracts the fibers, leaving the dye trapped (heat set) in the fiber interstices.

Formaldehyde is used to impart shape-retaining properties ("permanent press") to fabrics by crosslinking the fibers through chemical bonding. Commercially available as an aqueous solution, the 37% formaldehyde typically contains 11% **methanol**.

Table IX-4
Applications of TRI Chemicals in Textile Processing

TRI Chemical	Textile Process Application
Acetone[1]	Solvent for acetate fiber manufacture
Biphenyl	Dye carrier in polyester dyebaths
Decabromodiphenyl oxide	Flame retardant
Ethylene glycol	Wetting agent
Formaldehyde	Finishing cotton fabrics (perm. press)
Glycol ethers (surfactants)	Textile scouring (washing)
Methanol	Finishing cotton fabrics (perm. press)
Naphthalene	Dye carrier in polyester dyebaths
Tetrachloroethylene	Dry cleaning
1,2,4-Trichlorobenzene	Dye carrier in polyester dyebaths
1,2,4-Trimethylbenzene	Dye carrier in polyester dyebaths
Xylene (mixed isomers)	Solvent
Ammonia	pH control
Ammonium sulfate	pH control in nylon dyebaths
Chlorine	Bleaching
Sulfuric acid	Neutralization
Antimony compounds	Flame retardant
Copper compounds	Metallized dyes
Chromium compounds	Metallized dyes
Zinc compounds	Dyeing and printing auxiliary, Finishing catalyst

1. Manufacturers of cellulose acetate fibers purchased by textile mills specify the acetone content present in the fiber as a contaminant Because acetone is both volatile and water soluble, it accrues in water from the HVAC (heating, ventilation, and air conditioning) system, and in wastewater from slashing operations (application of sizing)

Nonylphenol ethoxylates and long-chain ethoxylates are nonionic surfactants that are commonly used to scour (wash) textile products. In 1992, the EPA required these surfactants to be reported in the TRI chemical category. "**glycol ethers.**" EPA has subsequently discontinued this requirement, and these surfactants are no longer reported on Form R.

Ammonia finds some use in controlling pH and viscosity of polymer emulsions in fabric coating operations The main use of ammonia is dyeing nylon, where control of pH is critical to the uniform application of the dye. Ammonia is used to establish the initial pH at 7. The pH is lowered by the evolution of ammonia, during the programmed heating of the dyebath. **Ammonium sulfate** (recently delisted from the TRI) buffers the dyebath at pH 5, where it is held for the duration of the dyeing cycle. In commerce, ammonium sulfate is used almost exclusively as a fertilizer material and is an important source of nutrient sulfur and nitrogen. Absorbed on suspended solids (sludge), that are routinely wasted from biological treatment systems and spread on agricultural lands, this textile process chemical would be expected to benefit soils and enhance productivity.

Chlorine is used mainly for bleaching, especially white socks. Minor uses are for disinfection of treated wastewater and occasionally color removal from wastewater.

Sulfuric acid is used mainly for pH adjustment, but is also used for "carbonizing" (oxidation of organic matter) raw wool. When used to neutralize high pH wastewater, sulfuric acid is chemically changed to a sulfate salt. Thus, reporting the release of sulfuric acid in wastewater is misleading. The same criticism could be leveled at estimated releases for the other mineral acids (hydrochloric and phosphoric), which are converted respectively to chlorides and phosphates.

Antimony compounds are used in combination with **decabromodiphenyl oxide** to give fabrics flame-retardant properties.

APPENDICES

APPENDIX I

Additional Notes on Water Use

11-04-94 Ed Barnhart, ELBA, Inc.

1. 1993 textile production data from U.S. Dept. of Agriculture, Economic Research Service.
2. Estimates of water use per pound of fiber processed.

a. Wool fiber (scoured): finishing into textile product uses an average of 20 gal./lb.
b. Cotton fiber: conversion into finished textile products uses an average of 13 gal./lb.
c. Synthetic fiber: conversion into finished textile products, uses an average of 11 gal./lb.

11-09-94 Ed Barnhart, ELBA, Inc.

There are less than 50 woolen mills currently operating in U.S. They are located mostly in MA and lower ME, with a few in NH. Only 5 of these mills still scour wool, compared to 11 mills reportedly scouring in 1980 (Dev. Doc., Sept. 1982, Tables V-1, V-2, pp 97,98). On average these mills use about 200.000 gal/day. Virtually all imported wool has been scoured in the country of origin, so wet processing of wool in U.S. is now limited almost entirely to finishing. Water use is variable for wool processing, but ranges from 15-25 gal./lb. A good average is 20 gal/lb.

11-10-94 Jeff Silliman, Milliken Corp.

Question: How many days a year does a textile mill operate?
Depends on business conditions Because the days of operation are pegged to sales more than holidays, the days of operation are reduced when sales fall off. The larger textile mills would like to operate 7 days/week, but do not want to accumulate excess inventories. Can operate fewer days, but prefer to use fewer machines and operate 7 days/week. Suggested using 355 operating days/year as a reasonable assumption.

11-25-94 Ed Barnhart, ELBA, Inc

Question: How many days a year does a textile mill operate?
Suggested using 345 operating days/year as a reasonable assumption.

APPENDIX II-1

AMSA POTWs and Their Textile Users

Boston, MA - Massachusetts Water Resources Authority
Deer Island POTW
Emtex, Inc.
Synthon Industries, Inc.
TYCA Corp.
Nut Island POTW
Draper Properties, Inc.
International Paper, Vertec Div.
Tamfelt, Inc

Cuyahoga Heights, OH - Northeast Ohio Regional Sewer District
Phoenix Dye Works
Ohio Knitting Mills, Inc

Chicago, IL - Metropolitan Water Reclamation Districts of Greater Chicago
Industrial Coatings Group, Inc.
Rubens & Marble, Inc.
Western Piece Dyers & Finishers, Inc

Columbus, GA - Columbus Water Works
Bibb Co
Fieldcrest Mills, Inc . Broadway Div. (Permit 91-026-01)
Fieldcrest Mills, Inc . E&P Div (Permit 91-025-01)
Swift Textiles, Inc . 6th Ave (Permit 91-009-01)
Swift Textiles, Inc . Flatrock (Permit 91-008-01)
Swift Spinning Mills (Permit 91-006-01)
Meritas Yarns, Inc
Omi Georgia, Inc.
Wellington Sears Co.. 1st Ave (Permit 91-002-02)
Wellington Sears Co.. Cusseta (Permit 91-007-02)
Columbus Mills, Inc.

Denver, CO - Metro Denver
Rocky Mountain Dye & Finishing

Elizabeth, NJ - Joint Meeting of Essex & Union Counties
Fablok Mills, Inc.

Greenville, SC - Western Carolina Regional Sewer Authority
Mauldin Road POTW (Travelers Rest)
Carisbrook Yarns
JPS Industrial Fabrics - Dunean Front (Permit 1154C)
JPS Industrial Fabrics - Dunean Back (Permit 1164C)
JPS Automotive Fabrics - Parker (Permit 0364C)---> Low water
Judson Plant - Div. of Milliken & Co.
KM Fabrics
Krieger Textile Corp.
M-TEX Corp. (formerly EMB-TEX)
Palmetto State Finishing

AMSA POTWs and Textile Users (cont.)

Mauldin Road POTW (cont)
- Specialty Shearing & Dyeing, Inc.
- U.S Finishing
- Woven Electronics (formerly Southern Weaving)
- Wunda Weve Carpets, Inc

Lakeside POTW
- Bibb Towels (JPS White Horse)

Pelham POTW
- Cardinal Garment Dye Corp.

Slater-Marietta POTW
- JPS Industrial Fabrics - Slater (Permit 0424C)

Taylors POTW
- Greenville Finishing
- JPS Automotive Fabrics - Bleachery (Permit 0675C)
- JPS Automotive Fabrics - Kuster (Permit 0665C)
- Orion Finishing (formerly BES)

Knoxville, TN - Knoxville Utilities Board
- Appalachian Finishing Werks

Little Ferry, NJ - Bergen County Utilities Authority
- Advanced Fiber Technologies
- Beacon Looms
- H & W Shoe Supplies Co
- Marijon Dyeing & Finishing Co
- Spinnerin Yarn Co.. Inc

Los Angeles, CA - L A Sanitation District
- American International Textiles
- Artesia Dyeing & Printing, Inc (Permit 13066)
- Artesia Dyeing & Printing, Inc (Permit 12330)
- Artistic Dyers, Inc.
- Atlas Carpet Mills
- Bentley Mills
- Cal-Pacific Dyeing & Finishing Corp.
- California Webbing Industries
- Care-Tex Industries, Inc
- Chemtex Print USA, Inc
- Coloramerica Textile Processing, Inc.
- Colortex Dyeing & Finishing, Inc.
- Cotton Club
- Delta Dyeing & Finishing, Inc.
- Downtown Dyers
- Dynamic Dye & Laundry
- E & J Dye House
- EKPG
- E T.C. Carpet Mills, Ltd.
- F & J Metro Dyeing, Inc
- Factory, Inc.
- Flamingo Textile Mills, Inc
- Formosa Dyeing & Finishing, Inc.
- Giant Merchandising

AMSA POTWs and Textile Users (cont.)

L.A. Sanitation District (cont.)
- Grace Kimmy Designs
- L.A. Airline, Inc
- L.A. Dye & Print Works, Inc. (Permit 12817)
- L.A Dye & Print Works, Inc. (Permit 12818)
- L.A. Dye & Print Works, Inc (Permit for by-pass only)
- L A. Dye & Print Works, Inc (Permit 11216)
- L.A. Dye & Wash Co., Inc. (Permit 12943)
- L.A. Dye & Wash Co., Inc. (Permit 13074)
- Long Beach Dyeing & Finishing
- Lorber Industries
- Louie Bernard, Inc
- Pacific Combing
- Pacific Continental Textile, Inc
- Pacific Fabric Printers
- Pan Pacific Yarn
- Polytex Thread Mills
- Pomona Textile Co., Inc
- Rainbow Textile Co
- S.S Dyeing & Finishing
- Santa Fe Dye & Finish Co. (not SIC 22 --> SIC 23)
- Shing Jye Supplies, Inc.
- Somitex Prints of California
- Southern California Dyeing & Finishing (not SIC 22 --> SIC 23)
- Spectrum Dyeing & Finishing
- Sun Dyeing & Finishing Corp.
- Sung Do International, Inc
- Texlon Corp
- Texollini, Inc
- Tissurama Industries, Inc
- Toyoshima America, Inc (not SIC 22 --> SIC 23)
- Triple A Garment Care (not SIC 22 --> SIC 23)
- Tuftex Carpet Mills, Inc.
- U S. Boys, Inc
- U S Garment Processing (not SIC 22 --> SIC 23)
- U S Namesung Textile, Inc. (ot SIC 22 --> SIC 23)
- Uni Hosiery Co , Inc.
- United Thread Manufacturing Corp
- Western Dyeing & Finishing Co
- Western Tex Industries, Inc

Los Angeles, CA - City of Los Angeles

Hyperion POTW
- ABC Dye House, Inc
- Bruck Braid Co
- California Dye House
- City Dyeing & Finishing Co. (Permit 488879)
- City Dyeing & Finishing Co. (Permit 488887)
- Coast Arrow, Inc.
- Colormax Industries, Inc
- Coloring Button Dyers
- Color Master Garmet Dyeing & Finishing

AMSA POTWs and Textile Users (cont.)

Hyperion POTW (cont)
- Dara, Inc
- David S. Gibson, Inc
- Dixie Trimming Co.
- Double "A" Wash & Dye
- Dyetech Corp.
- Dye to Match
- Fashion Art International
- Foid Garment Dyeing - Div. of Fashion Out
- In California, Inc.
- J & J Tee Shirts & Fashions, Inc
- Kesbaf Knittng, Inc (Permit 449694)
- Kesbaf Knitting, Inc. (Permit 449702)
- Koo's Manufacturing Co.
- L.A. Dye Works, Inc (Permit 473088)
- L.A Dye Works, Inc. - Rainbow Div (Permit 484357)
- L.A Dye & Print Works, Inc
- M & D Buttons & Lace Dyers
- Maria Kipp, Inc
- Matchmaster, Inc. (Permit 478475)
- Matchmaster Dyeing & Finishing, Inc. (Permit 465176)
- Matchmaster Dyeing & Finishing, Inc. (Permit 404107)
- Matchmaster Dyeing & Finishing, Inc. (Permit 404115)
- MW Graphics/Melvin Wyner
- Modern Button Co of California, Inc
- Only in USA
- Pico Dyeing & Finishing Co
- Pour le Bebe, Inc (Baby Guess)
- Rainbow Button Dyers
- S & A Button Dyers
- Sealmaster W.T Co . Inc (dba Elite Dyers)
- Sharon & Joyces Clothing, Inc
- SNS Brothers, Inc.
- S & S Dye House
- Super Yarn Mart
- Uni Hosiery Co., Inc
- Washington Garment Dyeing & Finishing, Inc
- Western Dye House (Permit 12417) Account serviced by LA Co.
- Western Dye House (Permit 12418)
- Western Synthetic Felt Co

Glendale POTW
- A & H California, Inc
- Almore Dye House
- Avi Levy
- Caravan Fashion Enterprises
- Color Fabric Processing, Inc
- New Hero

AMSA POTWs and Textile Users (cont.)

Orange County, CA - O.C. Sanitation Districts
- American Continental Cherokee (Error: not SIC 22 --> 2335 or 2339)
- Anaheim Mills Corp.
- Chroma Systems Partners
- Crazy Shirts, Inc. (Error: not SIC 22 --> 2396)
- Dye Technique
- Margaretis Textile Service
- Pharr-Palomar, Inc.
- Primatex Industries (Error not SIC 22 --> 2396)
- Royal Carpet Mills
- Saba Textiles
- Saliba Center USA (Error· not SIC 22 --> 2396)
- Sees Color Textile
- U S Dyeing & Finishing
- Vans, Inc.

Nashville, TN - Nashville & Davidson Co Dept of Water & Sewerage Services
- Springs Industries, Inc

Newark, NJ - Passaic Valley Sewerage Commissioners
- A & S Dyers
- Apollo Dyeing & Finishing Co
- Baltic Dyeing & Finishing Co
- Champion Dyeing & Finishing Co
- Columbia Textile Services, Inc
- Como Textile Prints, Inc.
- Coral Dyeing & Finishing Corp
- Craft Textile Printing Co.
- Crestany Textile Processors
- Dye-Tex Corp
- E & W Textile Processors, Inc
- Fairfield Textiles
- International Veeling Corp.
- Interstate Dyeing & Finishing
- Leader Dyeing & Finishing
- Manner Textile Processing
- Messbrenner Prints, Inc
- North Jersey Skein Dye Co
- Paragon Dyeing & Finishing
- Paterson Bleachery & Chemicals
- Pauls Dyeing
- Perennial Print Corp.
- Poughkeepsie Finishing
- Rainbow Dye & Finishing
- Renco Finishing Corp.
- Safer Textile Processing Corp
- Signature Cloth Co.
- Sunbrite Dye Co.
- Superior Dyeing Corp.
- Thomas Henshall Silk Finishing
- Thorn, Inc
- Trio Dyeing & Finishing

AMSA POTWs and Textile Users (cont.)

Newark, NJ (cont.)
- Uni Trade Co
- United Veil Dyeing & Finishing
- Zenith Dyeing & Finishing

Philadelphia, PA - Philadelphia Water Dept
- Anchor Dyeing & Finishing Co
- Delaware Valley Wool Scouring Co.
- General Felt Industries
- Globe Dye Works

Phoenix, AZ - City of Phoenix
- Arizona Garment Finishers

Portland, OR - City of Portland
- Columbia Wool Scouring Mills

East Providence, RI (Bucklin Point) - The Narragansett Bay Commission
- Conrad-Jarvis Corp
- Crown Yarn Dye Co . Inc
- Elizabeth Webbing Mills - Dyehouse
- Elizabeth Webbing Mills - Healthtex Facility
- Glencairn Manufacturing Co
- Greenhalgh Mills, Inc
- Hope Webbing
- Microfibres, Inc
- Murdock Webbing
- Providence Braid Co
- R I Textile Co.
- Rochambeau Worsted
- Slater Finishing Co
- Slater Dye Works, Inc
- Slater Screen Print Corp
- Tastex Corp.
- Union Wadding Co.

Providence, RI (Field's Point)
- Worcester Co

Rockford, IL - Rock River Water Reclamation District
- Cellusuede Products, Inc.

Sayreville, NJ - Middlesex County Utilities Authority
- J & J Worldwide Absorbant Products & Materials Research

San Diego, CA - S D Metropolitan Wastewater Dept
- Webb Designs
- California Dept of Corrections

San Francisco, CA - City & County Dept. of Public Works
Southeast Water Pollution Control Plant
- Color Me, Inc (Simply Cotton)
- Hueline, Inc

AMSA POTWs and Textile Users (cont.)

St. Louis, MO - Metropolitan St. Louis Sewer District
Marchem Coated Fabrics
St. Louis Dyeing & Processing Co

St. Paul, MN - Metropolitan Waste Control Commission
Minnesota Knitting Mills
Bro-Tex Corp

Tacoma, WA - City of Tacoma Public Works & Sewer Utility
Post Industrial Press
Otto Screen Printing
Sportswear Services, Inc.

Total POTWs = 31 Total Textile Users: 255 - 4 = 251

APPENDIX II-2

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users

Parameter	1	a	2	a	3	a	b	4	a	5	a	b
BOD	-	-	-	s	-	-	-	-	-	-	-	-
TSS	-	s	-	s	-	s	s	-	-	-	s	s
COD	-	s	-	s	-	-	-	-	-	-	s	s
Conductivity	-	-	-	-	s	x	-	-	-	-	-	-
O&G total	p	x	p	-	n	-	x	-	-	n	x	-
pH	n	x	n	x	n	x	x	n	x	n	x	x
Temp.	p	-	p	-	p	x	x	p	-	p	-	-
Chlorine (resid)	-	-	n	-	-	-	-	-	-	-	-	-
Sulfide	-	-	-	-	n	-	-	-	-	-	-	-
Perchloroethylene	-	-	-	-	-	-	-	n[1]	-	-	-	-
Cyanide	n	x	n	-	n	-	-	n	x	n	-	-
Arsenic	n	x	-	-	-	-	-	n	x	-	-	-
Boron	-	-	n	-	-	-	-	-	-	-	-	-
Cadmium	n	x	n	-	-	-	-	n	x	n	-	x
Chromium	n	x	n	-	n	-	-	n	x	n	-	x
Copper	n	x	n	-	n	-	-	n	x	n	-	x
Lead	n	x	n	-	n	-	-	n	x	n	-	x
Mercury	n	x	n	-	-	-	-	n	x	n	-	-
Molybdenum	-	-	-	-	-	-	-	n	x	-	-	-
Nickel	n	x	n	-	-	-	-	n	x	n	-	x
Selenium	-	-	n	-	-	-	-	n	x	-	-	-
Silver	n	x	n	-	n	-	x	n	x	-	-	-
Zinc	n	x	n	-	n	-	-	n	x	n	-	x

p = prohibition adopted from Section 403 5(b).
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge.
x = monitored at textile user.
- = local limit unspecified/not monitored at textile user.

POTW at.
1. **San Francisco, CA** Monitors parameters at.
a. 3 textile SIUs
2 **Phoenix, AZ** Monitors parameters at·
a. 1 textile IU[2]
3. **San Diego, CA**[3] Monitors parameters at:
a. Webb Designs
b. California Dept. of Corrections
4. **Denver, CO** Monitors parameters at·
a. Rocky Mountain Dye & Finishing
5. **St. Paul, MN** Monitors parameters at:
a. Minnesota Knitting Mills, Inc.
b. Bro-Tex Corp.

1. Beyond the numeric limitation, the discharge of dry-cleaning waste, including new and used perchloroethylene, is prohibited entirely by local limits of the Denver POTW.
2. Now reclassified as an IU, which cancels former SIU monitoring requirements (2X/yr).
3 Textile users have been monitored for metals in the past, but such low levels were found that monitoring at textile users was discontinued. Silver is monitored at the prison only because of the photo lab.

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	b	c	d	e	f	2	a	b
BOD	-	-	-	-	-	-	-	-	s	s
TSS	-	-	-	x	-	-	-	-	s	s
COD	-	-	-	-	-	-	-	-	-	-
O&G total	p	x	x	-	-	x	-	n	x	x
TPH	p	x	-	x	-	-	-	n	x	x
pH	n	x	x	x	x	x	x	n	x	x
Temp.	p	-	-	-	-	-	-	-	-	-
Phenols	-	-	-	-	-	-	-	p	x	-
Ammonia-N	-	-	-	-	-	-	-	-	-	-
TKN	-	-	-	-	-	-	-	n	x	x
TTO	-	-	-	-	-	-	-	-	-	x
VOCs	p	x	x	x	-	-	-	-	-	-
VOCs (601)	-	-	-	-	-	-	-	-	-	-
PCBs	n	x	x	x	-	-	-	-	-	-
Acids (625)	n	-	-	-	-	-	-	-	-	-
Pesticides	n[1]	x	-	-	-	-	-	-	-	-
Cyanide	n	-	-	-	-	-	-	n	x	x
Antimony	n	-	-	-	-	-	-	-	-	-
Arsenic	n	-	-	-	-	-	-	p	x	x
Cadmium	n	-	-	x	-	-	x	p	x	x
Chromium +6	n	-	-	x	-	-	x	p	x	x
Chromium	n	-	-	x	-	-	x	p	x	x
Copper	n	x	x	-	-	-	x	n	x	x
Lead	n	-	x	x	-	-	x	p	x	x
Mercury	p	-	-	-	-	-	-	p	x	x
Molybdenum	p	-	-	-	-	-	x	-	-	-
Nickel	n	-	-	-	-	-	x	p	x	x
Silver	n	-	-	-	-	-	-	p	x	x
Zinc	n	x	x	x	-	-	x	p	x	x

p = prohibition adopted from Section 403 5(b)
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge.
x = monitored at textile user
- = local limit unspecified/not monitored at textile user

POTW at
1. **Boston, MA** (Metropolitan) Monitors parameters at.
a. International Paper (Vertac Div)
b. Draper Properties
c. Synthon Industries
d. TYCA Corp.
e. TamFelt, Inc.
f. EmTex, Inc.
2. **Little Ferry, NJ** Monitors parameters at·
a. 3 textile SIUs
b. 2 textile SIUs

1 Pesticides, as well as acrolein, Demeton, Lindane, Methoxychlor, etc., analyzed by EPA Method 608.

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	2	a	3	a	4	a	5	a
BOD	-	s	-	s	-	-	-	s	-	s
TSS	-	s	-	s	-	-	-	s	-	s
COD	-	s	-	s	-	-	-	-	-	s
O&G total	n	-	-	-	-	-	-	-	-	-
O&G/TPH	n	-	n	-	-	-	n	x	n	x
pH	n	x	n	x	-	-	n	x	n	x
Temperature	-	-	-	-	-	-	-	-	n	x
Phenols	-	-	-	-	-	-	n	-	-	-
Ammonia-N	n	-	-	-	-	-	p	x	-	-
Sulfide	n	x	-	-	-	-	-	-	-	-
Sulfate	n	x	-	-	-	-	-	-	-	-
TTO	-	-	-	-	-	-	n[1]	x	-	-
VOCs	-	-	-	-	-	-	-	-	p	x
Acids/BN	-	-	-	-	-	-	-	-	p	x
Acids (Method 625)	n	x	-	-	-	-	-	-	-	-
Solvents	-	-	-	-	n[2]	-	-	-	-	-
Cyanide	n	-	p	-	n	-	-	-	n	x
Arsenic	n	-	p	-	-	-	-	-	n	x
Cadmium	n	x	p	-	n	-	n	x	n	x
Chromium VI	-	-	-	-	n	-	-	-	n	x
Chromium	n	x	p	-	n	-	n	x	n	x
Copper	n	x	p	x	n	-	n	x	n	x
Lead	n	x	p	-	n	-	n	x	n	x
Mercury	n	-	p	-	-	-	n	-	n	x
Nickel	n	x	p	-	n	-	n	x	n	x
Silver	n	-	p	-	-	-	n	x	n	x
Zinc	n	x	p	x	n	-	n	x	n	x

p = prohibition adopted from Section 403 5(b)
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge.
x = monitored at textile user
- = local limit unspecified/not monitored at textile user.

POTW at

1 **Portland, OR** Monitors parameters at.
a Columbia Wool Scouring Mills
2 **Sayreville, NJ**[3] Monitors parameters at
a Johnson & Johnson
3. **Cuyahoga Heights, OH** Monitors paramaters at:
a 2 textile SIUs
4. **Knoxville, TN** Monitors parameters at.
a 2 textile SIUs.
5 **Tacoma, WA** Monitors parameters at
a. Sportswear Services, Inc.
1 other textile IU not monitored

1. TTO = Volatiles as defined by the Electroplating Categorical Pretreatment Standards.
2. Solvents = carbon tetrachloride, tetrachloroethylene, chlorobenzene, o-chlorobenzene, cresols, cresylic acid, nitrobenzene, toluene, carbon disulfide, isobutanol, spent CFCs, MEK
3 The surrounding towns monitor BOD, TSS, and COD at the confluence of their sewers with the POTW's trunk line These measurements are used by the POTW to assess the towns' respective user charges.

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	2	a	b	c	3	a	b	4	a
BOD	-	s	-	s	s	s	-	s	s	-	s
TSS	-	s	-	s	s	s	-	s	s	-	s
COD	-	-	-	-	-	-	-	s	s	-	-
pH	n	x	n	x	x	x	n	x	x	n	x
Temp.	-	-	-	-	-	-	p	x	x	-	-
O&G total	n	x	-	-	-	-	n	x	x	-	-
Sulfide	n	x	-	-	-	-	-	-	-	-	-
Phenols	-	-	-	-	-	-	p[1]	x	x	-	-
TTO	-	-	n[2]	x	-	-	-	-	-	-	-
TICH	p[3]	-	-	-	-	-	-	-	-	-	-
Cyanide	n	x	n	-	-	-	n	-	-	-	-
Antimony	-	-	-	-	-	-	n	-	x	-	-
Arsenic	n	x	n	-	-	-	n	-	-	n	-
Cadmium	n	x	n	x	x	x	n	-	-	n	-
Chromium	n	x	n	x	x	x	n	-	-	n	-
Copper	n	x	n	x	x	x	n	-	-	n	-
Lead	n	x	n	x	x	x	n	-	-	-	-
Molybdenum	-	-	-	-	-	-	-	-	-	n	-
Mercury	p	-	n	-	-	-	n	-	-	n	-
Nickel	n	x	n	x	x	x	n	-	-	n	-
Silver	n	x	n	x	x	x	n	-	-	-	-
Zinc	n	x	n	x	x	x	n	-	-	n	-

p = prohibition adopted from Section 403 5(b).
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge
x = monitored at textile user
- = local limit unspecified/not monitored at textile user

POTW at:
1 **City of Los Angeles, CA** Monitors parameters at
a 15 textile SIUs
38 textile IUs not monitored
2 textile users not monitored at present (not expected to violate local limits)
2. **Orange County, CA** Monitors parameters at:
a. 3 textile SIUs.
b 6 textile SIUs
c. 2 textile SIUs
1 textile IU not monitored.
3 **St. Louis, MO** Monitors parameters at.
a. St. Louis Dyeing & Processing Co
b. Marchem Coated Fabrics Div
4. **Newark, NJ**[4] Monitors parameters at
a. 35 textile users

1. Phenols (total) monitored for screening If response is significant, then analyze for phenol by 625.
2 TTO = Purgeable halocarbons (EPA Method 601) and Purgeable aromatics (EPA Method 602)
3. TICH = Total Identifiable Chlorinated Hydrocarbons
4. Numeric limits for metals (indicated by 'n') await approval by NJDEP When approved, numeric limits for these metals will be added to the local limits and, at least initially, monitored at textile users

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	2	a	b	c
BOD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	s	s	-
TSS	-	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	n	s	s	s
TS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x
COD	-	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	n	-	-	-
pH	n	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	n	x	x	x
Temperature	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p	x	x	x
O&G petrol	p	x	x	x	x	x	x	x	-	-	-	-	x	x	-	-	-	n	-	-	-
Conductivity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p	x	x	x
Phenols (total)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-	-
Sulfide	p	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	p	-	x	-
Phosphorus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p	x	x	x
TCE	p[1]	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-
Cyanide	n	x	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	n	-	-	-
Arsenic	n	x	x	-	-	x	-	-	x	x	-	x	-	-	-	-	-	n	-	-	-
Cadmium	n	x	x	x	-	-	x	-	x	x	x	x	x	x	x	x	x	n	-	-	-
Chromium	n	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	n	-	-	-
Copper	n	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	n	-	-	-
Lead	n	x	x	x	x	-	-	-	x	x	x	x	x	x	x	x	x	n	-	-	-
Mercury	n	x	x	-	-	x	-	x	x	x	-	x	-	x	-	-	-	n	-	-	-
Nickel	n	x	x	x	x	-	x	x	x	x	x	x	x	x	-	x	x	n	-	-	-
Silver	n	x	x	x	-	-	-	x	x	x	x	x	x	x	-	-	x	n	-	-	-
Zinc	n	x	x	x	x	-	x	-	x	x	x	x	x	x	-	x	x	n	-	-	-

p = prohibition adopted from Section 403 5(b).
n = numeric limit (maximum concentration)
s = monitored as a basis for calculating POTW IU surcharge
x = monitored at textile user
- = local limit unspecified/not monitored at textile user.

POTW at:

1 **County of Los Angeles, CA** Monitors parameters at 54 textile users.

a	5 textile SIUs	e	1 textile SIU	i	7 textile SIUs	m.	1 textile SIU
b	6 textile SIUs	f	1 textile SIU	j	5 textile SIUs	n.	1 textile SIU
c.	10 textile SIUs	g	1 textile SIU	k.	1 textile SIU	o.	2 textile SIUs
d	1 textile SIU	h	7 textile SIUs	l	1 textile SIU	p.	4 textile SIUs

11 textile users not monitored

2. **Columbus, GA** Monitors parameters at 10 textile users:

a 7 textile SIUs
b. 2 textile SIUs
c 1 textile SIU
1 textile user not monitored

1 TCE = tetrachloroethylene. This POTW does not routinely monitor organic priority pollutants at textile users The TCE was detected in only one sample from several textile users selected to be checked for VOCs.

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	b	c	d	e	f	g	h	i	j	k	m	n	2	a	b	c	3	a	b
BOD	n	s	s	s	s	s	s	s	s	s	s	s	s	s	-	s	s	s	-	s	s
TSS	n	x	x	x	x	x	x	x	x	x	x	x	x	x	-	s	s	s	-	s	s
COD	n	-	x	x	-	-	x	x	-	x	x	x	x	-	-	-	-	-	-	-	-
pH	n	x	x	x	x	x	x	x	x	x	x	x	x	x	n	x	x	x	n	x	x
O&G total	p	-	-	-	-	-	x	-	-	-	-	-	-	-	n	x	-	x	n	x	x
TPH	p	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia-N	p	-	-	x	-	-	-	-	-	x	x	-	x	-	-	-	-	-	-	-	-
Phosphorus	p	-	-	-	-	-	-	-	-	-	x	x	-	-	n	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-
CTAS[1]	p	-	-	x	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
MBAS[2]	p	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
TCE[3]	p	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
PCE[4]	p	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-
VOCs	p	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
Cyanide	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	-	-	n	-	-
Arsenic	n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-
Cadmium	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-
Chromium	n	x	x	-	x	-	-	-	-	-	-	-	-	-	n	x	x	x	n	x	-
Copper	n	x	x	x	-	x	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-
Lead	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-
Mercury	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-
Nickel	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-
Silver	n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-
Zinc	n	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	x	x	n	-	-

p = prohibition adopted from Section 403.5(b)
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge
x = monitored at textile user
- = local limit unspecified/not monitored at textile user

POTW at
1 **Greenville, SC** Monitors parameters at 20 textile users.

a 2 textile SIUs	d 1 textile SIU	g. 3 textile SIUs	j. 1 textile SIU	n. 1 textile SIU
b 1 textile SIU	e 2 textile SIUs	h. 4 textile SIUs	k. 1 textile SIU	
c 1 textile SIU	f. 1 textile SIU	i. 1 textile SIU	m 1 textile SIU	

2 **Chicago, IL** Monitors parameters at
a. 1 textile SIU (Western Piece Dyeing & Finishing)
b. 1 textile SIU (Industrial Coatings)
c 1 textile SIU (Rubens & Marble)
3. **Philadelphia, PA** Monitors parameters at:
a 2 textile SIUs (Anchor, Globe)
b. 2 textile SIUs (DV Wool Scour, General Felt)

1 CTAS = Cobalt Thiocyanate Active Substances (nonionic surfactants).
2. MBAS = Methylene Blue Active Substances (anionic surfactants)
3 TCE = 1,1,1-Trichloroethane (methylchloroform).
4. PCE = Perchloroethylene (Tetrachloroethylene).

Parameters With POTW Local Limits and Monitored in 1993 at Textile Users (cont.)

Parameter	1	a	b	c	d	e	f	g	h	i	j	2	a	3	a	4	a
BOD	n	s	s	s	s	s	s	s	s	s	s	-	s	-	s	n	s
TSS	n	s	s	s	s	s	s	s	s	s	s	-	s	-	s	n	s
COD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	s	n	-
pH	n	x	x	x	x	x	x	x	x	x	x	n	x	n	x	n	x
Temperature	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	p	-
O&G total	n	-	x	-	x	x	-	x	x	-	x	n	x	n	-	n	x
TPH	p	-	x	-	x	-	-	-	x	-	-	P	-	n	-	-	-
Phenols (total)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-
Sulfate	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-
Ammonia-N	-	-	-	-	-	-	-	-	-	-	-	-	-	n	x	-	-
VOCs	p	-	-	-	x	-	-	-	-	-	-	-	-	n	-	-	-
Acids/BN	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-	-
TTO[1]	n	-	-	x	-	-	-	-	-	x	x	-	-	-	-	-	-
TROPs[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-	-
TOPPOCs[3]	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-	-
Cyanide	n	-	-	-	-	-	-	-	-	-	-	n	-	n	-	n	-
Arsenic	n	-	-	-	-	-	-	-	-	-	-	n	-	n	-	n	-
Cadmium	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-
Chromium +6	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	n	-
Chromium	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-
Copper	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-
Lead	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-
Mercury	n	-	-	-	-	-	-	-	-	-	-	n	-	n	-	n	-
Molybdenum	-	-	-	-	-	-	-	-	-	-	-	-	-	n	-	-	-
Nickel	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-
Selenium	n	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	n	x	x	x	x	x	-	-	-	-	-	n	-	n	-	n	-
Zinc	n	x	x	x	x	x	-	-	-	-	-	n	-	n	x	n	-

p = prohibition adopted from Section 403 5(b)
n = numeric limit
s = monitored as a basis for calculating POTW IU surcharge
x = monitored at textile user
- = local limit unspecified/not monitored at textile user

POTW at:

1 **East Providence, RI** (Bucklin Point) Monitors parameters at 18 textile users

a 1 textile SIU
b 2 textile SIUs
c 5 textile SIUs
d 1 textile SIU
e 1 textile SIUs
f 2 textile SIUs
g. 2 textile SIUs
h. 1 textile SIU
i 1 textile SIU
j 2 textile SIU

2 **Elizabeth, NJ** Monitors parameters at·

a Fablok Mills, Inc

3. **Rockford, IL** Monitors parameters at·

a Cellusuede Products, Inc.

4 **Nashville, TN** Monitors parameters at.

a 1 textile SIU (Springs)

1. TTO = total "toxic" organics. A collective parameter for the organic priority pollutants, i.e , VOCs (volatiles) and Acids/Base Neutrals (extractables) measured by EPA Methods 624 and 625.
2. TROPs = "Toxic-reactive" organic pollutants Specific chemicals defined in Appendix A of local limits.
3 TOPPOCs = Total organic priority pollutants of concern. Specific chemicals defined in Appendix B of local limits.

APPENDIX II-3

Flow Data for Textile Users Discharging to AMSA POTWs

POTW/Textile Users	Average Flow, mgd	
POTW[1a]	300	
Synthon Industries	0.0085	
TYCA Corp.	0.0085	
Emtex	0.011	
Total from textile users	0.0280	0.009% POTW
POTW[1b]	150	
International Paper	0.0095	
Draper Properties	0.085	
Tamfelt	0.0005	
Total from textile users	0.0950	0.06% POTW
POTW[2]	135	
Phoenix Dye Works	0.17605	
Ohio Knitting	0.005	
Total from textile users	0.181	0.13% POTW
POTW[3]	19	
Western Piece Dyers & Finishers	0.189	
Industrial Coatings Group	0.224	
Rubens & Marble	0.004	
Total from textile users	0.417	2.2% POTW
POTW[4]	28	
Bibb Co.	0.030	
Fieldcrest Mills - Broad.	0.614	
Fieldcrest Mills - E&P	3.045	
Swift Textiles - 6th Ave.	0.342	
Swift Textiles - Flatrock	0.700	
Meritas Yarns	0.0036	
Omi Georgia	0.00063	
Swift Spinning Mills	0.0728	
Wellington Sears - 1st Ave	0.0042	
Wellington Sears - Cusseta	0.015	
Columbus Mills	1.010	
Total from textile users	5.837	20.8% POTW

1 Boston, MA - Massachusetts Water Resources Authority.
1a. Deer Island POTW
1b. Nut Island POTW
2 Cuyahoga, OH - Southerly Water Pollution Control Facility
3. Chicago, IL - Metro. Water Reclamation District of Greater Chicago.
4. Columbus, GA - Columbus Water Works.

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[5]	160	
Rocky Mountain Dye & Finishing	0.032	0.02% POTW
POTW[6]	67	
Fablok Mills	0.040	0.06% POTW
POTW[7a]	20	
Carisbrook Yarns	0.993	
JPS Industrial Fabrics-Dunean Front	0.041	
JPS Industrial Fabrics-Dunean Back	0.205	
JPS Automotive Fabrics-Parker	0.020	
Judson	0.021	
KM Fabrics	0.072	
Krieger Textile	0.073	
M-Tex	0.073	
Specialty Shearing & Dyeing	0.545	
U.S. Finishing	0.849	
Woven Electronics	0.182	
Wunda Weve	0.322	
Total from textile users	3.396	17.0% POTW
POTW[7b]	0.35	
Bibb Towels	0.031	8.8% POTW
POTW[7c]	5.2	
Cardinal Garmet Dye	0.012	0.2% POTW
POTW[7d]	3.3	
Greenville Finishing	0.160	
JPS Automotive Fabrics-Bleachery	0.077	
JPS Automotive Fabrics-Kuster	0.207	
Orion Finishing	0.030	
Total from textile users	0.474	14.3% POTW

5 Denver, CO - Metro Wastewater Reclamation District
6 Elizabeth, NJ - Joint Meeting of Essex & Union Counties
7 Greenville, SC - Western Carolina Regional Sewer Authority
7a Mauldin POTW
7b. Lakeside POTW
7c Pelham POTW
7d Taylor POTW

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[7e]	0.35	
JPS Industrial Fabrics-Slater	0.055	15.7% POTW
POTW[8]	21	
Appalachian Finishing Werk (Mag.)	0.225	
Appalachian Finishing Work (Gill)	0.200	
Total from textile users	0.425	0.02% POTW
POTW[9]	76	
Advanced Fibers	0.0052	
Beacon Looms	0.0018	
H&W Shoe Supplies	0.00025	
Marijon Dyeing & Finishing	0.680	
Spinnerin Yarn	0.250	
Total from textile users	0.937	1.2% POTW
POTW[10a]	16	
Long Beach Dyeing & Finishing	0.098	0.6% POTW
POTW[10b]	33	
Formosa Dyeing & Finishing	0.060	
SS Dyeing & Finishing	0.019	
Tuftex Carpet Mills	0.700	
Total from textile users	0.779	2.4% POTW
POTW[10c]	13	
Pomona Textile Co.	0.0405	0.3% POTW
POTW[10d]	85	
Bentley Mills	0.650	
United Thread Manufacturing	0.003	
Total from textile users	0.653	0.8% POTW

7e Slater-Marietta POTW
8 Knoxville, TN - Knoxville Utilities Board.
9. Little Ferry, NJ - Bergen County Utilities Authority
10. Los Angeles, CA - L A Sanitation District
10a Long Beach - Wastewater Reclamation Plant
10b Los Coyotes - Wastewater Reclamation Plant
10c Pomona - Wastewater Reclamation Plant
10d. San Jose Creek - Wastewater Reclamation Plant

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[10e]	11	
Artistic Dyers	0.0087	
Rainbow Textile Co.	0.0095	
Shing Jye Supplies	0.0005	
Total from textile users	0.0187	0.2% POTW
POTW[10f] (Carson Joint WPCP, LA San. Dist.)	328	
American International	0.100	
Artesia Dyeing & Printing (13066)	0.017	
Artesia Dyeing & Printing (12330)	0.0895	
Atlas Carpet	0.00005	
Cal-Pacific Dyeing & Finishing	0.211	
California Webbing Industries	0.016	
Care-Tex Industries	0.017	
ChemTex Print USA	0.00967	
Coloramerica Textile Processing	0.260	
Colortex Dyeing & Finishing	0.720	
Cotton Club	0.020	
Delta Dyeing & Finishing	0.145	
Downtown Dyers	0.010	
E&J Dye House	0.060	
EKPG	0.004	
E.T.C. Carpet Mills	0.180	
F&J Metro Dyeing	0.006	
Factory Inc.	0.0185	
Flamingo Textile Mills	0.0198	
Giant Merchandising	0.001	
Grace Kimmy Designs	0.0002	
LA Dye & Print (12817)	0.010	
LA Dye & Print (12818)	0.200	
LA Airline Inc.	0.00015	
LA Print Works	0.020	
LA Dye & Wash Co. (12943)	0.037	
LA Dye & Wash Co. (13074)	0.0001	
Lorber Industries	0.600	
Louie Bernard	0.0035	
Pacific Combining	0.0025	
Pacific Continental	0.450	
Pacific Fabrics	0.090	

10e Whittier Narrows - Wastewater Reclamation Plant

10f Los Angeles Sanitation Dist - Carson Joint Water Pollution Control Plant.

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[10f] (continued)		
Pan Pacific Yarn	0.0015	
PolyTex Thread Mills	0.011	
Sumitex Prints of California	0.350	
Spectrum Dyeing & Finishing	0.012	
Sun Dyeing & Finishing	0.0038	
Sung Do International	0.195	
Texlon Corp.	0.017	
Texollini Inc.	0.050	
Tissurama Industries	0.970	
Uni Hosiery Co	0.015	
US Boys Inc.	0.046	
Western Dyeing & Finishing	0.778	
WesternTex Industries	0.300	
Total from textile users	6.066	1.85% POTW
POTW[11]	232	
Anaheim Mills	0.357	
Chroma Systems Partners	0.350	
Crazy Shirts	0.007	
Dye Technique	0.029	
Pharr-Palomar	0.001	
Royal Carpet	0.370	
Saba Textiles	0.200	
Sees Color Textile	0.300	
US Dyeing & Finishing	0.400	
Vans. Inc.	0.0006	
Total from textile users	2.015	0.87% POTW
POTW[12]	32.9	
Springs Industries	0.250	0.76% POTW
POTW[13]	227	
Anchor Dyeing & Finishing	0.225	
Delaware Valley Wool Scouring	0.011	
General Felt Industries	0.001	
Globe Dye Works	0.094	
Total from textile users	0.331	0.15% POTW

10f. Los Angeles Sanitation Dist - Carson Joint Water Pollution Control Plant
11. Orange County, CA - O C Sanitation Districts
12 Nashville, TN - Metropolitan Water Services
13 Philadelphia, PA - Northeast Water Pollution Control Facility

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[14]	150	
Arizona Garment Finishers	0.0096	<0.001% POTW
POTW[15]	57	
Columbia Wool Scouring	0.0502	0.09% POTW
POTW[16a]	332	
ABC Dye House	0.0549	
Bruck Braid	0.010	
California Dye House	0.0352	
City Dyeing & Finishing	0.4257	
Coast Arrow	0.0002	
Colormax Industries	0.132	
Coloring Button Dyers	0.0002	
Color Master Garment Dyeing & Fin.	0.0016	
Dara Inc.	0.0005	
David S. Gibson	0.0017	
Dixie Trimming Co.	0.0024	
Double "A" Wash & Dye	0.170	
DyeTech Corp.	0.0065	
Dye to Match	0.0191	
Fashion Art International	0.0005	
Foid Garment Dyeing	0.0425	
In LA California	0.0209	
J&J Tee Shirts & Fashions	0.0021	
Kesbaf Knitting Co.	0.0504	
Koo's Manufacturing Co	0.020	
LA Dye Works	0.0002	
LA Dye Works (Rainbow)	0.2868	
LA Dye & Print Works	0.2945	
M&D Buttons & Lace Dyers	0.0002	
Maria Kipp	0.0011	
Matchmaster Inc.	0.0005	
Matchmaster Dyeing & Finishing	0.697	
MW Graphics	0.0001	
Modern Button Co. of California	0.001	
Only in USA	0.0012	
Pico Dyeing & Finishing	0.0059	
Pour le Bebe	0.0069	

14 Phoenix, AZ
15 Portland, OR
16a. Hyperion Treatment Plant, City of Los Angeles, CA.

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[16a] (continued)		
Rainbow Button	0.0001	
S&A Button Dyers	0.0004	
Sealmaster W.T.	0.0048	
Sharon & Joyces Clothing	0.0012	
SNS Brothers	0.0003	
S&S Dyehouse	0.001	
Super Yarn Mart	0.0072	
Uni Hosiery	0.0057	
Washington Garment Dyeing & Finish.	0.1068	
Western Dye House	0.181	
	2.43	0.73% POTW
POTW[16b]	20.3	
A&H California	0.004	
Almore Dye House	0.1389	
Avi Levy	0.004	
Caravan Fashion Enterprises	0.0008	
Color Fabric Processing	0.094	
New Hero	0.0067	
	0.2484	0.01% POTW
POTW[17]	290	
A&L Dyers	0.01	
Apollo Dyeing & Finishing	0.078	
Baltic Dyeing & Finishing	0.078	
Champion Dyeing & Finishing	0.107	
Columbia Textile Service	3.099	
Como Textile Prints	0.274	
Coral Dyeing & Finishing	0.26	
Craft Textile Printing	0.242	
Crestany Textile Processors	0.019	
Dye-Tex Corp.	0.499	
E&W Textile Processors	0.06	
Fairfield Textiles	0.046	
International Veeling Corp.	0.092	
Interstate Dyeing & Finishing	0.117	
Leader Dyeing & Finishing	0.714	
Manner Textile Processing	0.102	

16a. Hyperion Treatment Plant, City of Los Angeles, CA
16b Glendale Treatment Plant, City of Los Angeles, CA
17 Newark, NJ, Passaic Valley Sewerage Commissioners

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[17] (continued)		
Messbrenner Prints	0.528	
North Jersey Skein Dye	0.034	
Paragon Dyeing & Finishing	0.055	
Paterson Bleachery & Chemicals	0.051	
Pauls Dyeing	0.043	
Perennial Print	0.249	
Poughkeepsie Finishing	0.706	
Rainbow Dye & Finishing	0.116	
Renco Finishing	0.07	
Safer Textile Processing	0.338	
Signature Cloth	0.249	
Sunbrite Dye	0.111	
Superior Dyeing Corp.	0.114	
Thomas Henshall Silk Finishing	0.002	
Thorn Inc.	0.139	
Tico Dyeing & Finishing	0.27	
Uni Trade Co.	0.015	
United Veil Dyeing & Finishing	0.09	
Zenith Dyeing & Finishing	0.133	
Total from textile users	9.11	3.14% POTW
POTW[18]	29	
Cellusuede	0.040	0.14% POTW
POTW[19]	75	
Johnson & Johnson	0.015	0.02% POTW
POTW[20]	180	
Webb Designs	<0.0005	
California Dept of Corrections	0.014	
Total from textile users	0.0145	<0.0001% POTW
POTW[21]	21.8	
Crown Yarn Dye	0.110	
Elizabeth Webbing, Health-Tex	0.00001	
Elizabeth Webbing Mills	0.240	
Glencairn Mfg.	0.00001	

17. Newark, NJ - Passaic Valley Sewerage Commissioners
18 Rockford, IL - Rock River Water Reclamation District.
19 Sayreville, NJ - Middlesex County Utilities Authority
20 San Diego, CA - Point Loma Plant
21 East Providence, RI - Bucklin Point Facility

Flow Data for Textile Users Discharging to AMSA POTWs (cont.)

POTW/Textile Users	Average Flow, mgd	
POTW[21] (cont.)		
Conrad-Jarvis Corp.	0.0000211	
Greenhalgh Mills	0.105	
Hope Webbing	0.017	
Microfibres	0.167	
Murdock Webbing	0.020	
Providence Braid Co.	0.00003	
R.I. Textile Co.	0.0012	
Rochambeau Worsted	0.116	
Slater Finishing	0.0226	
Slater Dye Works	0.2805	
Slater Screen Print	0.264	
Tastex Corp.	0.0003	
Union Wadding Co.	0.040	
Worcester Textile Co.	0.150	
Total from textile users	1.544	7.0% POTW
POTW[22]	67	
Color Me (Simply Cotton)	0.003	
Hueline	0.009	
Total from textile users	0.012	<0.02% POTW
POTW[23]	120	
Marchem - Coated Fabrics Div.	0.0055	
St. Louis Dyeing & Processing	0.013	
Total from textile users	0.0185	0 015% POTW
POTW[24]	235	
Minnesota Knitting	0.0235	
Bro-Tex	0.010	
Total from textile users	0.0335	0.01% POTW
POTW[25]	23	
Post Industrial Press	0.000276	
Otto Screen Printing	0.000242	
Total from textile users	0.000518	0.002% POTW

21 Providence, RI - Bucklin Point Facility
22 San Francisco, CA - Southeast Water Pollution Control Plant.
23 St Louis, MO - Metropolitan St Louis Sewer District
24. St. Paul, MN - Metropolitan Waste Control Commission
25 Tacoma, WA - Central Wastewater Treatment Plant

Flow Data for Textile Users Discharging to POTW at Valdese, NC

Textile Users	Average Flow, mgd	
Valdese POTW	6.0 - 6.25	
Alba Waldensian	0.16	
Burke Mills	0.476	
Carolina Mills	0.84	
Dolly Hosiery	0.01	
Kathy Hosiery	0.021	
OMS Textiles	0.613	
Valdese Manuf. (Meridian)	0.846	
Robinson Hosiery	0.034	
Valdese Textiles	0.234	
Valdese Weavers	0.312	
Neuville Industries	0.116	
Total from textile users	3.662	58.6% POTW

Notes:
Flow: Daily average 6 - 6.5 mgd (5.5 mgd, or 88%, is industrial wastewater).
Valdese has a population of 3000. Number employed by textile users was not investigated.

Flow Data for Textile Users Discharging to POTW at Star, NC

Textile Users	1993 Average Flow, mgd	1994 Average Flow, mgd
POTW	0.594	0.558
Clayson Knitting	0.0922	0.0881
Fruit of the Loom	0.2936	0.27035
Montgomery Hosiery Mills	0.0266	0.0278
Pine Hosiery Mills	0.0155 (assumed)	0.0155
Total from textile users	0.4279 72% POTW	0.4018 72% POTW

Notes:
Flow: Design 0.6 mgd. Daily average 0.55 - 0.6 mgd (72% is industrial wastewater). Star, NC, has a population of only 200, but 2000 are employed at the four textile users. Thus, the community and surrounding area are heavily dependent on the textile users for employment.
Special problem: Textile user discharges are saline (> 6000 mg/L chloride). POTW discharges to a small stream with 7q10 approximating 0 cfs. For this reason, it has been required to use 99% treated effluent (only 1% dilution allowed) in the WET, and has had trouble meeting this water quality standard in its NPDES permit.

APPENDIX II-4

Analyses of Textile User Discharges to POTW (Bucklin Point) at East Providence, RI

POTW Flow Capacity: 46 mgd; Current Average Daily Flow: 23 mgd

		Sampling Episode									
Parameter	LL*	1	2	3	4	5	6	7	8	9	
Cadmium	110	--	--	--	--		--	--	3	--	7
Chromium	2770	--	--	--	--	--	--	--	--	494	
Copper	1200	40	32	770	1070	1610	1230	422	884	2640	
Lead	690	--	--	--	--	--	--	--	28	215	
Nickel	1620	--	--	--	--	--	20	12	16	648	
Silver	400	--	--	--	--	70	40	--	16	--	
Zinc	1670	230	150	480	460	370	220	334	315	1110	

	Sampling Episode										
	10	11	12	13	14	15	16	17	18	19	20
Copper	1160	69	880	680	530	850	300	530	380	800	280
	21	22	23	24	25	26	27	28	29	30	31
Copper	220	900	730	390	530	500	840	530	460	950	560
	32	33	34	35	36	37	38	39	40	41	42
Copper	1190	900	600	840	460	380	650	1110	1170	2260	1590
	43	44	45	46	47	48	49	50	51	52	53
Copper	3820	560	3750	1180	2720	320	890	610	530	460	300

	Sampling Episode										
Parameter	54	55	56	57	58	59	60	61	62	63	64
Cadmium	--	13	--	1	--	2	--	--	--	--	
Chromium	68	14	--	93	--	--	--	--	--		
Copper	361	500	175	190	8	79	152	--	33	1160	69
Lead	--	--	--	--	--	--	--	--	--		
Nickel	45	138	--	--	--	--	--	--	--		
Silver	67	4	--	--	--	--	--	40	46		
Zinc	788	262	102	85	3	34	66	30	105		

Code: -- = not detected; Blank = metal not analyzed in episode. Concentration unit = ug/L (ppb)
* Local limit, max conc. (24-hr composite sample).

Sampling Episodes:
1-53: Slater Screen Print Corp. (020-030-0697)
54-57. Crown Yarn Dye Co., Inc.
58-60: Rochambeau Worsted
61-64: Slater Dye Works (020-029-0697)

Analyses of Textile User Discharges to POTW at East Providence, RI (cont.)

Parameter	LL*	Sampling Episode 1	2	3	4	5	6	7	8	9	10	11
Cadmium	110	--	--	--	--	4	--	--	--	1370	12	--
Chromium	2770	164	19	27	61	446	197	694	--	49	18	42
Copper	1200	90	22	40	30	247	232	296	220	7120	43	71
Lead	690	22	--	--	--	42	--	11	--	1100	--	--
Nickel	1620	--	--	80	140	40	--	4	--	680	379	22
Silver	400	51	2	--	--	--	7	42	--	200	--	--
Zinc	1670	56	5	600	620	502	456	407	65	5810	363	241

Parameter	LL*	Sampling Episode 12	13	14	15	16	17	18	19	20	21	22
Cadmium	110	--			7	--	1	--	7	--	--	--
Chromium	2770	40			15	56	--	--	236	--	50	88
Copper	1200	20	60	106	15	54	129	156	54	76	30	87
Lead	690	--			123	--	7	--	90	--	--	25
Nickel	1620	10			175	25	--	17	40	--	--	--
Silver	400	--			--	--	4	93	11	--	--	--
Zinc	1670	620			373	232	190	246	250	229	830	145

Parameter	LL*	Sampling Episode 23	24	25	26	27	28	29	30	31	32
Cadmium	110	--			--					20	20
Chromium	2770	100	100	180	130	100	110	120	310	390	170
Copper	1200	70			70					80	
Lead	690	50									
Nickel	1620	--			70					--	
Silver	400	--			--					--	
Zinc	1670	130	80	60	70	90	140	280	110	30	160

Code: -- = not detected, Blank = metal not analyzed that episode Concentration unit: ug/L (ppb)
* Local limit, maximum concentration (24-hr composite sample)

Sampling Episodes
1-5. Microfibres, Inc
6,7 Murdock Webbing
8,9: R.I. Textile Co.
10-14. Elizabeth Webbing Mills, Health-Tex facility
15-21· Elizabeth Webbing Mills, dyehouse facility
22-32: Worcester Textile Co (discharges to Field's Point POTW in Providence, RI and is subject to different local limits)

Analyses of Textile User Discharges to POTW at Valdese, NC

Parameters	LL[1]	Sampling Episode 1a	1b	1c	1d
Chloroform	x	--	14	--	--
Di(2-ethylhexyl) phthalate	x	*	--	--	--
Antimony	x	16890	940	1000	550
Arsenic	100	2	--	--	--
Cadmium	200	--	4	2	--
Chromium	500	170	160	8	203
Copper	500	4080	602	220	397
Lead	100	200	80	20	--
Mercury	100	1	1	--	0.4
Nickel	250	320	20	20	40
Silver	30	--	--	--	--
Zinc	500	5200	2160	620	80

Code x = unspecified, * = detected[2], (--) = not detected. Concentration = ug/L (ppb)

Textile User
1. Burke Mills[3]
1a. 1990 - Lab Burlington Research Labs, Blue Ridge Labs (metals)
1b 1991 - Lab Blue Ridge Labs
1c 1992 - Lab Blue Ridge Labs
1d 1993 - Lab Blue Ridge Labs

1. Local limit, maximum concentration allowed.
2 The textile user's process was not the source of phthalates detected in these wastewater samples The phthalates detected are attributable to contamination of sample (by use of plasticized tubing in sampling device), and/or laboratory procedures (leaching from anhydrous sodium sulfate used to dry extract). Phthalate concentrations reported by the lab are not given here, so that statistical summaries will not inadvertently include data that would inaccurately characterize the textile user's process wastewater.
3 Reduction in metal concentrations over time are attributable to a more judicious use of progressively higher quality process chemicals, and switch to non-metallized dyes.

Source of metals:
Zinc salts were used as a dyeing auxillary chemical. Lower concentration of zinc reflects a switch to other metal salts. Also, zinc (up to 1 ppm) is often added to potable water supplies to inhibit corrosion in pumps and the distribution system.

Antimony is applied to fabric as a flame retardant. Only those textile facilities that so treat fabrics are a source of this metal. This is the reason the metal is seldom detected in textile user wastewater

Analyses of Textile User Discharges to POTW at Valdese, NC. (cont.)

Parameters	LL[1]	Sampling Episode 1a	1b	1c	1d	2a
Acrolein	x	--	527	--	--	--
Chloroform	x	1100	--	203	838	9
Naphthalene	x	--	--	--	--	--
Di(2-ethylhexyl) phthalate	x	*	*	--	--	--
Antimony	x	--	--	--		204
Arsenic	100	--	--	27		--
Beryllium	x	--	--	100		--
Cadmium	200	--	--	40		--
Chromium	500	--	--	120		--
Copper	500	--	--	30		31
Lead	100	--	--	160		--
Mercury	100	--	--	--		--
Nickel	250	--	--	140		--
Selenium	x	--	--	8		--
Silver	30	--	--	20		--
Zinc	500	--	--	100		109

Code x = unspecified. * = detected[2]. (--) = not detected. Concentration = ug/L (ppb)

Textile Users
1 Neuville Industries[3]
1a 1990 - Lab PACE
1b 1991 - Lab Bold Research Labs
1c 1992 - Lab
1d 1993 - Lab

2 Valdese Textiles
2a 1991 - Lab. PACE

1. Local limit, maximum concentration allowed
2. The textile user's process was not the source of phthalates detected in these wastewater samples The phthalates detected are attributable to contamination of sample (by use of plasticized tubing in sampling device), and/or laboratory procedures (leaching from anhydrous sodium sulfate used to dry extract). Phthalate concentrations reported by the lab are not given here, so that statistical summaries will not inadvertently include data that would inaccurately characterize the textile user's process wastewater.
3. Two different labs failed to detect metals in '90 and '91, but metals were detected in '92 by an unidentified lab Since the '92 concentrations were below local limits, the POTW did not require analysis of metals in 1993

Analyses of Textile User Discharges to POTW at Valdese, NC (cont.)

Parameters	LL[1]	Sampling Episode 1a	1b	1c	1d	2a	2b	2c
Chloroform	x	24	7	29	--	--	--	--
Ethylbenzene	x	33	18	--	--	--	--	--
Xylenes	x	438	--	--	--	--	--	--
Naphthalene	x	45	255	253	69	--	--	--
Di-n-butyl phthalate	x	--	*	--	--	--	--	--
Di(2-ethylhexyl) phthalate	x	--	--	--	*	--	--	--
Antimony	x	--	--	22	--	--	40	20
Arsenic	100	10	5	--	--	--	16	20
Cadmium	200	12	--	10	2	5	2	5
Chromium	500	14	--	10	10	3	--	
Copper	500	53	33	85	37	220	74	536
Lead	100	152	--	20	--	20	10	--
Mercury	100	--	--	--	0 2	0.4	0.2	--
Nickel	250	40	--	8	--	20	--	--
Silver	30	15	--	5	--	--	--	--
Zinc	500	166	136	75	40	100	180	600

Concentration = ug/L (ppb)
Code. x = unspecified, * = detected[2], (--) = not detected

Textile Users:
1 OMS Textiles[3]
1a 1990 - Lab· Water Technology and Controls
1b 1991 - Lab· WT&C (metals). Burlington Research (organics)
1c 1992 - Lab: AAES Labs
1d. 1993 - Lab Blue Ridge Labs

2 Valdese Weavers
2a 1990 - Lab Dexter Corp
2b 1991 - Lab. Blue Ridge Labs
2c 1992 - Lab. Blue Ridge Labs

1. Local limit, maximum concentration allowed
2 The textile user's process was not the source of phthalates detected in these wastewater samples. The phthalates detected are attributable to contamination of sample (by use of plasticized tubing in sampling device), and/or laboratory procedures (leaching from anhydrous sodium sulfate used to dry extract). Phthalate concentrations reported by the lab are not given here, so that statistical summaries will not inadvertently include data that would inaccurately characterize the textile user's process wastewater.
3 In 1993, OMS Textiles was in bankruptcy. For this reason, the facility could not legally function under that name Consequently, they submitted samples of wastewater for analysis under the name Quality Textile Finishers of America

Analyses of Textile User Discharges to POTW at Valdese, NC. (cont.)

Parameters	LL[1]	Sampling Episode 1a	2a	3a	4a	4b
Chloroform	x	4	--	23	5	--
Toluene	x	--	7	--	--	--
Di-n-butyl phthalate	x	--	--	--	--	*
Di(2-ethylhexyl) phthalate	x	*	--	--	--	*
Antimony	x	--	--	--	--	5
Arsenic	100	12	--	2	--	--
Cadmium	200	--	--	6	--	--
Chromium	500	31	135	9	143	4
Copper	500	328	212	319	143	132
Lead	100	100	--	40	--	8
Mercury	100	--	--	--	--	--
Nickel	250	238	--	20	81	61
Silver	30	--	--	--	--	--
Zinc	500	367	60	120	66	145

Code x = unspecified, * = detected[2], (--) = not detected. Concentration = ug/L (ppb)

Textile Users
1. Alba-Waldensian
1a 1990 - Lab Gen Eng Labs (organics). PACE (metals)

2. Adams Millis-Drexel
2a. 1991 - Lab Research & Analytical Labs

3. Carolina Mills
3a 1992 - Lab· Blue Ridge Labs

4 Valdese Manufacturing
4a. 1991 - Lab:
4b 1992 - Lab. PACE

1 Local limit, maximum concentrat n allowed.

2 The textile user's process was not the source of phthalates detected in these wastewater samples. The phthalates detected are attributable to contamination of sample (by use of plasticized tubing in sampling device), and/or laboratory procedures (leaching from anhydrous sodium sulfate used to dry extract). Phthalate concentrations reported by the lab are not given here, so that statistical summaries will not inadvertently include data that would inaccurately characterize the textile user's process wastewater.

Analyses of Textile User Discharges to POTW at Star, NC

Clayson Knitting Co.

Average Flow: 0.0881 mgd = 15% of POTW's average flow.

Parameter	1993 Sampling Episodes					
	July	August	Sept.	Oct.	Nov.	Dec.
BOD, mg/L	167	90	179	153	324	195
	67					
COD, mg/L	561					
TSS, mg/L	16	13	34	25	22	
Total Solids, mg/L			34			
pH	9 4	8.4	9.2		9.0	
O&G, mg/L		15	41	28	37	44
Chloride, mg/L		606	731	1040	822	1320
Conductance, umho		3660	3920	4760	4700	5880
Arsenic		--	--	6		6
Cadmium		0.6	--	--		--
Chromium	15	--	--	--	11	--
Copper	18	30	103	272	135	270
	760	40	12	190	176	
	28	23	140	117	230	
	22	46	135			
	21		100			
	28					
	13					
	22					
	20					
	10					
Lead		2	10	9	20	--
Mercury		0 2	--	--		--
Molybdenum		38	15	14	10	--
Zinc	443	180	447	186	277	240
	467	195	17	177	188	
	274	17	242	128	248	
	204	162	277			
	320		215			
	277					
	249					
	257					
	126					

Code: -- = not detected, metal concentration = ug/L (ppb)

Analyses of Textile User Discharges to POTW at Star, NC

Clayson Knitting Co. (cont.)

Parameter	1994 Sampling Episodes January	February	March	April	May	June
BOD, mg/L	187	367	187	246	165	248
TSS, mg/L	29	20	34	11	20	32
pH	9.7	9.2	10	10.6	9.4	8.4
O&G, mg/L		16	12	25	11	28
Chloride, mg/L	1030	849	829	749	768	722
Conductance, umho	5500	4230	4270	4240	4260	3800
Copper	110	40	280	310	80	50
Lead	10	5	6	9	--	19
Molybdenum	70	--	--	--	--	--
Nickel	--	5	--	--	--	--
Zinc	180	191	276	214	160	370

Code -- = not detected Concentration of metals = ug/L (ppb)

Fruit of the Loom

Average Flow: 0.27035 mgd = 45% of POTW's average flow.

Parameters	1993 Sampling Episodes July	August	Sept.	Oct.	Nov.	Dec.
BOD, mg/L	190	184	292	352	353	271
COD, mg/L	711					
TSS, mg/L	20		64	56	48	59
Total Solids, mg/L		22				
pH	7 8	7 8	7.8	9.0	7.4	5 6
O&G, mg/L		42	106	54	59	23
Chloride, mg/L		783	474	363	353	264
Conductance, umho		4230	3520	2900	3410	3280
Cadmium		1	--	0.6		--
Chromium	8	9	17	12	13	70
Copper	335	278	354	517	317	560
	360	520	773	270	378	
	178	882	334		38	
	767	376	598			
	630	315	521			
	622	649	300			
	546	396	460			
	455	410	470			
	498	910	545			
	683	664	333			
	249	354	432			
			560			
			332			
Lead		--	5	14	--	--
Mercury		0.3	--	--		--

Code: -- = not detected Concentration of metals = ug/L (ppb)

Analyses of Textile User Discharges to POTW at Star, NC

Fruit of the Loom (cont.)

	1993 Sampling Episodes					
Parameters	July	August	Sept.	Oct	Nov.	Dec.
Zinc	790	480	505	506	514	333
	818	561	605	415	394	
	495	805	161		290	
	586	1760[1]	338			
	440	514	360			
	520	806	377			
	549	507	464			
	752	562	526			
	568	586	370			
	789	743	367			
	393	505	607			
			804			
			469			

	1994 Sampling Episodes					
Parameters	Jan	Feb.	March	April	May	June
BOD, mg/L	235	586	314	268	214	421
TSS, mg/L	71	80	75	64	38	102
pH	7 9	7 2		7.7	7.3	7.4
O&G, mg/L		25		27	13	27
Chloride, mg/L	259	258	220	284	360	334
Conductance, umho	3110	2830	2910	3190	3410	3800
Chromium	--	--	--	--	--	140
Copper	290	280	350	250	520	560
Lead	4	--	--	--	--	8
Zinc	380	1420[1]	1620[1]	934	750	3700[1]

Code -- = not detected Concentration of metals = ug/L (ppb)

1. Zinc concentration spikes resulted from the use of zinc-contaminated sample bottles by Burlington Research (lab that performed the analyses) Upon resampling with bottles that were pre-washed with acid, zinc analyzed at nominal levels.

Analyses of Textile User Discharges to POTW at Star, NC

Montogmery Hosiery Mills

Average Flow: 0.0278 mgd = 4.6% of POTW's average flow.

	1993 Sampling Episodes					
Parameter	July	August	Sept.	Oct.	Nov.	Dec.
BOD, mg/L	102	85	100	90	188	134
COD, mg/L	409					
TSS, mg/L	8	26		16	7	6
Total Solids, mg/L			2			
pH	8.3	6.9	9.0		8.5	6.0
O&G, mg/L		9	11	18	7	17
Chloride, mg/L		1280	1530	988	1680	1500
Conductance, umho		4660	5810	4040	6390	5780
Arsenic		--	--	21		10
Cadmium		--	--	--		--
Chromium	22	7	11	25	69	--
Copper	150	50	20	160	120	70
Lead		8	33	7	--	--
Mercury		0 3	--	--	--	
Zinc	181	181	162	65	93	448

	1994 Sampling Episodes					
Parameters	Jan	Feb.	March	April	May	June
BOD, mg/L	146	396	131	107	114	91
TSS, mg/L	13	18	10	24	24	22
pH	9 5	7.0	7.4	8.0	7 7	7.3
O&G, mg/L		24	30	21	3	10
Chloride, mg/L	1870	1280	109	218	297	607
Conductance, umho	7210	4610	3840	3900	4550	3200
Copper	50	90	70	40	80	40
Zinc	250	133	409	70	80	120

Code: -- = not detected Concentration of metals = ug/L (ppb)

Analyses of Textile User Discharges to POTW at Star, NC (cont.)

Pine Hosiery Mills

Average Flow: 0.0155 mgd = 2.6% of POTW's average flow

	1993 Sampling Episodes					
Parameter	July	August	Sept.	Oct.	Nov.	Dec.
BOD, mg/L	13	58	12	104	33	72
COD, mg/L	249					
TSS, mg/L	2		14	12		5
Total Solids, mg/L		14			5	
pH	7 4	7.4	8.2	7.6	7.4	
O&G, mg/L		4	40	39	23	13
Chloride, mg/L		1300	1160	567	574	400
Conductance, umho		5030	4400	2440	2600	1700
Copper	40	70	70	90	--	--
Lead		--	3	9	--	--
Mercury		0 2	--	--		--
Zinc	78	190	257	165	116	88

	1994 Sampling Episodes					
Parameter	Jan	Feb	March	April	May	June
BOD, mg/L	107	72	146	156	118	141
TSS, mg/L	13	9	33	18	10	16
pH	8 2	7 6	9 4	9.5	6.0	8.7
O&G		9	6	5	1	29
Chloride, mg/L	1360	95	995	2160	32	992
Conductance, umho	7400	568	4220	8090	553	3970
Copper	430	--	--	1280	--	30
Lead	2	--	--	--	--	--
Zinc	490	1690[1]	34	65	120	50

1. Zinc spike resulted from the use of zinc-contaminated sample bottle by Burlington Research (lab that performed the analyses) Upon resampling with bottles that were pre-washed with acid, zinc was analyzed at nominal levels

Code: -- = not detected. Concentration of metals = ugm/L (ppb)

APPENDIX III-1

Textile Mill NPDES Permits in the North Carolina APAM Database

NC0000094 Cranston Print Works - Fletcher
NC0000876 Cone Mills - Greensboro
NC0001210 Monarch Hosiery Mills - Burlington
NC0001376 Burlington Industries - Wake Forest
NC0001406 Swift Textiles - Erwin
NC0001627 National Spinning - Washington
NC0001643 Fieldcrest Cannon - Eden
NC0001961 WestPoint Pepperell - Hamilton
NC0002305 Guilford Mills - Kenansville
NC0003450 StevcoKnit Fabrics - Wallace
NC0003522 WestPoint Pepperell - Elizabethtown
NC0003867 United Piece Dye Works - Edenton
NC0003913 Glen Raven Mills - Altamahaw
NC0004120 Cleveland Mills - Lawndale
NC0004235 Minnette Textiles - Grover
NC0004243 American Thread - Charlotte
NC0004286 Tuscarora Yarns - China Grove
NC0004391 Grover Industries - Grover
NC0004405 Cone Mills - Cliffside
NC0004618 WestPoint Pepperell - Lumberton
NC0004812 Stowe-Pharr Mills - McAdenville
NC0005312 Chatham Manufacturing - Elkin
NC0005479 Fieldcrest Cannon - Laurel Hill
NC0005487 Fieldcrest Cannon - Salisbury
NC0005762 WestPoint Pepperell - Wagram
NC0006025 Burlington Industries - Forest City
NC0006190 Delta Mills - Maiden
NC0025135 Huffman Finishing - Granite Falls
NC0034860 Schneider Mills - Taylorsville
NC0043320 Burlington Industries - Cordova

APPENDIX III-2

North Carolina Annual Pollutant Analysis Monitoring (APAM) Data

Parameters	Sampling Episodes 1a	1b	1c	1d	2a	2b	2c	2d	2e
Chloroform	--	--	--	--	--	17	16	12	--
Dibromochloromethane	--	--	--	--	--	5	--	--	--
Methylene chloride	--	--	--	9	--	--	--	--	--
Di(2-ethylhexyl) phthalate	--	x	x	x	x	x	x	x	x
Di-n-butyl phthalate	--	--	--	--	--	--	x	x	--
Antimony	--	330	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	7	--	--	--
Chromium	17	--	--	--	--	--	--	--	--
Copper	116	94	69	47	40	20	--	--	4
Mercury	--	0.2	--	--	--	--	0.2	--	0.6
Nickel	--	--	--	--	40	--	--	--	--
Zinc	27	72	22	37	100	21	--	--	--

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0004243** Plant: American Thread - Charlotte
1a. 1989 - Lab: Environmental Testing
1b. 1991 - Lab: Commonwealth Labs of SC, Greenville, SC.
1c. 1992 - Lab: Pace Labs, Asheville, NC.
1d. 1993 - Lab: Pace Labs

2. **NC 0004286** Plant: Tuscarora Yarns - China Grove
(Fieldcrest Cannon, Kannapolis, NC)
2a. 1988 - Lab: EMS Labs, Charlotte, NC.
2b. 1989 - Lab: Burlington Research, Burlington, NC
2c. 1990 - Lab: Burlington Research
2d. 1991 - Lab: Burlington Research
2e. 1992 - Lab: Burlington Research

Notes: Anhydrous sodium sulfate used to dry the solvent extract. Received in plastic jars, anhydrous sodium sulfate often has plasticizer adhering to its surface Unless precautions are taken to remove the phthalates by prewashing with solvent and/or by baking, phthalates will leach into the concentrated extract. Other sources of phthalate contamination are: use of plasticized tubing in the automatic sampler; and heavily plasticized rubber gloves that may be worn by sampling personnel. The plant admitted having used Tygon (plasticized) tubing in the automatic sampler in 1992 (2e), which could account for phthalates found in samples previous to 1992. In 1988 (2a), 32 ppb di(2-ethylhexyl) phthalate was reported in the sample, but 66 ppb was found in the blank! The blank was obtained by drawing reagent water through the sampling pump prior to the commencement of sampling. In 1a, the detection limit for the base/neutral analytes was 100 ug/L (sample diluted because of interference), which may be the reason phthalates were not detected in this sample. In 1c, di(2-ethylhexyl) phthalate was footnoted as a "possible laboratory contaminant."

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	2a	2b	2c	2d	3a	3b	3c
Bromodichloromethane	--	9	--	--	--	--	--	--	--	--
Chloroform	54	660	16	--	--	5	--	--	--	--
1,1,1-Trichloroethane	--	7	--	--	--	--	--	--	--	--
Trichloroethylene	--	--	--	--	--	--	--	--	--	24
Di(2-ethylhexyl) phthalate	--	x	--	--	--	--	--	--	--	x
Di-n-butyl phthalate	--	x	--	--	--	--	--	--	--	x
1,2,4-Trichlorobenzene	30	540	--	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	--	--	51	--
Arsenic	--	20	20	--	--	--	--	--	--	--
Cadmium	10	--	--	--	--	--	--	--	--	--
Chromium	--	100	5	260	320	980	470	--	--	--
Copper	--	160	190	--	10	30	20	240	220	360
Lead	70	--	8	11	--	14	--	--	--	--
Mercury	--	--	--	--	1.1	0.7	--	0.3	--	0.4
Nickel	50	--	52	19	--	--	--	--	--	--
Zinc	--	88	139	36	31	172	142	219	46	53

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0004235** Plant: Minnette Textiles - Grover
1a. 1988 - Lab: Burlington Research
1b. 1990 - Lab: Burlington Research
1c. 1992 - Lab: HydroLogic, Asheville, NC/Morrisville, NC

2. **NC 0001210** Plant: Monarch Hosiery Mills - Burlington
2a. 1989 - Lab: Burlington Research, Burlington, NC
2b. 1990 - Lab: Burlington Research
2c. 1991 - Lab: Burlington Research
2d. 1992 - Lab: Burlington Research

3. **NC 0004120** Plant: Cleveland Mills - Lawndale
3a. 1990 - Lab: Burlington Research, Burlington, NC.
3b. 1991 - Lab: Burlington Research
3c. 1992 - Lab: Burlington Research

Notes. 1,2,4-trichlorobenzene (TCB) is used as a carrier solvent for disperse dyes. Although it was not identified in 1c (1992) when analyzed by a different lab, it is also possible that the plant discontinued the use of the product that was the source of TCB The source of chloroform and bromodichloromethane is likely to be the potable water supply

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d		2a	2b	2c	2d
Chloroform	--	--	--	--		20	--	--	--
Ethylbenzene	--	--	--	--		--	--	--	88
Methylene chloride	26	--	--	--		--	--	--	--
Toluene	--	--	--	12		--	--	--	17
1,1,2-Trichloroethane	--	--	--	--		--	--	--	13
Di(2-ethylhexyl) phthalate	--	--	x	--		--	--	--	--
Di-n-butyl phthalate	--	--	x	--		--	--	--	--
Arsenic	17	--	--	--		--	--	--	--
Cadmium	--	6	--	--		2.5	--	--	--
Chromium	--	5	80	--		100	--	210	160
Copper	1100	170	200	240		24	--	30	50
Lead	-- 90	--	--		5	--	--	20	
Mercury	0.6 5.4	--	0.3		--	--	--	0.6	
Nickel	-- --	--	--		19	--	--	20	
Zinc	62 71	59	36		70	--	103	144	

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above "quantitation limit target" concentration specified in the APAM reporting form

1. **NC 0004618** Plant. WestPoint Pepperell - Lumberton
1a. 1987 - Lab: Oxford Labs, Wilmington, NC
1b. 1989 - Lab: Burlington Research, Burlington, NC
1c. 1990 - Lab: Burlington Research
1d. 1992 - Lab: Southern Testing & Research Labs, Wilson, NC

2. **NC 0004812** Plant: Stowe-Pharr Mills - McAdenville
2a. 1989 - Lab: EMS Labs, Charlotte, NC
2b. 1990 - Lab: Par Labs, Charlotte, NC
2c. 1991 - Lab: Par Labs
2d. 1992 - Lab: Par Labs

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	2a	2b	2c	3a
Methylene chloride	12	--	--	--	--
Di(2-ethylhexyl) phthalate	--	--	--	x	x
Di-n-butyl phthalate	--	--	--	--	--
Antimony	--	*	*	--	580
Arsenic	--	*	*	--	--
Cadmium	6	*	*	--	--
Chromium	--	*	*	6	96
Copper	70	*	*	45	290
Lead	90	*	*	--	--
Nickel	--	*	*	50	--
Zinc	128	*	*	40	90

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above "quantitation limit target" concentration specified in the APAM reporting form.
* = no data reported

1. **NC 0004391** Plant: Grover Industries - Grover
1a. 1987 - Lab: Burlington Research, Burlington, NC

2. **NC 0005762** Plant: WestPoint Stevens ('94) - Wagram
(J.P. Stevens ---> WestPoint Pepperell in '89)
2a. 1989 - Lab: Microbac Environmental Lab, Fayetteville, NC
2b. 1991 - Lab: Microbac Environmental Lab
2c. 1993 - Lab: Microbac Environmental Lab

3. **NC 0002305** Plant: Guilford Mills - Kenansville
3a. 1993 - Lab: Heritage Labs

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d	1e	2a	2b	3a	3b	3c
Bromodichloromethane	--	--	--	--	--	--	--	--	--	18
Chloroform	--	--	--	--	--	--	--	--	18	9
Dibromochloromethane	--	--	--	--	--	--	--	--	--	16
Methylene chloride	15	--	--	--	--	--	--	11	--	--
Di(2-ethylhexyl) phthalate	x	x	x	x	x	x	--	x	--	--
Di-n-octyl phthalate	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	--	x	--	--	--	--	x	--	x	x
Antimony	830	380	520	330	321	300	--	300	24	46
Arsenic	--	--	11	--	26	--	--	13	26	--
Cadmium	--	3	--	--	3.5	5	--	8	--	--
Chromium	194	220	120	149	192	--	10	--	7	--
Copper	117	88	180	79	72	20	30	--	80	90
Lead	--	--	170	--	--	90	--	160	--	--
Mercury	--	--	--	--	0.5	--	0.2	--	--	--
Nickel	--	22	70	--	--	--	--	--	--	--
Zinc	76	150	100	39	58	51	20	141	15	73

Concentration unit: ug/L (ppb)
Codes x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0005312** Plant: Chatham Manufacturing - Elkin
1a. 1988 - Lab: CompuChem Labs (sent data to Radian R&A)
1b. 1989 - Lab: Radian Research & Analytical Labs, Kernersville, NC
1c. 1990 - Lab: Radian R&A Labs
1d. 1991 - Lab: Radian R&A Labs
1e. 1992 - Lab: Radian R&A Labs

2. **NC 0005479** Plant: Fieldcrest Cannon - Laurel Hill
2a. 1990 - Lab: EnviroTech Mid-Atlantic, Blacksburg, VA
(Virginia Tech Research Center)
2b 1992 - Lab: Burlington Research, Burlington, NC

3. **NC 0005487** Plant: Fieldcrest Cannon - Salisbury
(North Carolina Finishing)
3a. 1990 - Lab: EnviroTech Mid-Atlantic, Blacksburg, VA
3b. 1991 - Lab: Burlington Research, Burlington, NC
3c. 1992 - Lab: Burlington Research

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d	2a	2b	2c	2d	2e
Bromomethane	--	--	85	--	--	--	--	--	--
Dibromochloromethane	--	7	--	--	--	--	--	--	--
Di(2-ethylhexyl) phthalate	--	x	--	--	x	x	--	--	--
Di-n-butyl phthalate	--	--	--	--	--	--	x	--	--
Antimony	--	--	--	--	300	187	--	--	--
Arsenic	--	--	--	--	18	40	31	74	--
Chromium	22	38	30	50	--	--	5	--	--
Copper	7	17	--	--	15	110	--	160	90
Mercury	--	--	--	--	--	--	1	--	--
Nickel	20	--	--	--	--	--	--	--	--
Zinc	50	54	57	79	21	71	24	28	13

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0006025** Plant: Burlington Industries - Forest City (J.C. Cowan plant)
1a 1989 - Lab: EMS Labs, Charlotte, NC
1b. 1990 - Lab: Pace Labs, Tampa, FL
1c 1991 - Lab: Pace Labs, Asheville, NC
1d. 1992 - Lab: Pace Labs

2. **NC 0006190** Plant: Delta Mills - Maiden
2a. 1989 - Lab EMS Labs, Charlotte, NC
2b. 1990 - Lab: Burlington Research, Burlington, NC
2c 1991 - Lab: Burlington Research
2d. 1992 - Lab Burlington Research
2e. 1993 - Lab: Burlington Research

Note
Phthalates absent in 2d (1992) and 2e (1993) After studying the phthalate contamination problem in 1991, this lab began routinely prewashing (hexane/methylene chloride) the anhydrous sodium sulfate before using it to dry the solvent extract of the wastewater sample

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d	1e	2a	2b	2c	2d	2e
Methylene chloride	--	13	--	--	--	--	--	--	--	--
Di(2-ethylhexyl) phthalate	x	--	x	x	--	--	--	--	--	--
Di-n-octyl phthalate	x	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	--	--	--	--	x	--	--	--	--	--
Antimony	--	--	--	--	--	--	320	--	--	--
Arsenic	--	--	--	--	--	20	47	14	27	36
Cadmium	--	--	--	--	--	16	14	--	--	--
Chromium	--	--	--	--	--	74	23	--	--	--
Copper	--	100	20	196	137	27	12	--	9	--
Lead	--	--	--	--	--	40	--	--	--	--
Mercury	--	--	--	--	--	--	0.3	--	--	--
Nickel	--	--	--	25	--	22	42	--	--	--
Silver	--	--	--	--	--	10	--	--	--	--
Zinc	--	160	--	41	92	70	41	39	49	18

Concentration unit: ug/L (ppb)
Code: x = detected. but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0001376** Plant: Burlington Industries - Wake Forest
1a. 1987 - Lab: Industrial & Environmental Analysts (IEA), RTP, NC
1b. 1989 - Lab: IEA
1c. 1990 - Lab: IEA
1d. 1991 - Lab: Research & Analytical Labs
1e. 1992 - Lab: Research & Analytical Labs

2. **NC 0001406** Plant: Swift Textiles - Erwin
2a. 1989 - Lab: "37724" ?
2b. 1990 - Lab: "37724" ?
2c. 1991 - Lab: Chemical & Environmental Technology, RTP, NC
2d. 1992 - Lab: C & E Technology
2e. 1993 - Lab: C & E Technology

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	2a	2b	3a	3b	4a	4b	4c
Bromodichloromethane	--	--	--	--	10	--	--	--	--
Chloroform	6	--	--	--	25	--	--	11	--
1,1,1-Trichloroethane	106	310	--	--	--	--	--	--	--
Di(2-ethylhexyl) phthalate	--	--	x	--	x	--	x	x	--
Di-n-octyl phthalate	--	--	--	--	x	--	--	--	--
Di-n-butyl phthalate	--	--	--	--	--	--	x	--	--
Arsenic	--	--	--	--	--	--	190	44	106
Cadmium	--	--	--	--	6	--	4	--	--
Chromium	--	--	100	--	33	--	5	--	--
Copper	230	40	110	170	65	7	--	50	40
Lead	20	--	--	--	26	--	--	--	--
Mercury	0.4	--	--	0.3	--	--	--	0.6	3.4
Nickel	--	--	--	--	27	--	--	11	--
Silver	--	--	--	--	--	--	7	50	--
Zinc	665	161	43	29	275	18	427	89	26

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0003913** Plant: Glen Raven Mills - Altamahaw
1a. 1991 - Lab: Burlington Research, Burlington, NC
1b. 1992 - Lab: Burlington Research

2. **NC 0003522** Plant. WestPoint Pepperell - Elizabethtown
2a. 1990 - Lab: Burlington Research, Burlington, NC
2b. 1991 - Lab: Southern Testing & Research Labs, Wilson, NC

3. **NC 0001627** Plant: National Spinning - Washington
3a. 1987 - Lab: Environment 1, Greenville, NC
3b. 1992 - Lab: James R. Reed, Newport News, VA

4. **NC 0004405** Plant: Cone Mills - Cliffside
4a. 1990 - Lab: Burlington Research, Burlington, NC
4b. 1991 - Lab: Burlington Research
4c. 1992 - Lab: Burlington Research

Notes: In Plant 1, the methylchloroform may have been used as a solvent, or may have had some other use, such as a dye carrier In Plant 3, phthalates were detected in 1987 (3a), but not in 1992 (3b) by a different lab. In the interim, the source of phthalate contamination (sodium sulfate) had become widely recognized.

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	2a	2b	2c	2d	3a	3b	3c
Bromodichloromethane	--	--	--	--	--	--	--	--	27	14
Bromoform	--	--	--	--	--	--	--	--	8	--
Chloroform	--	--	--	--	--	--	--	8	19	37
Dibromochloromethane	--	--	--	--	--	--	--	--	24	5
Di(2-ethylhexyl) phthalate	x	x	x	--	--	x	x	--	--	--
Di-n-butyl phthalate	--	--	--	--	--	x	--	x	x	x
Antimony	--	--	--	--	380	--	--	--	52	--
Arsenic	--	--	--	10	--	--	--	10	--	22
Cadmium	--	--	--	--	8	2	--	--	--	--
Chromium	5	--	--	60	8	--	--	9	--	--
Copper	40	20	80	162	340	280	330	140	170	120
Lead	--	--	--	--	110	--	--	--	--	--
Nickel	--	--	--	--	--	10	--	--	--	9
Selenium	--	--	--	--	15	--	--	--	--	--
Zinc	293	99	108	952	502	42	30	42	--	67

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0001643** Plant: Fieldcrest Cannon - Eden
1a. 1989 - Lab: Burlington Research, Burlington, NC
1b. 1991 - Lab: Burlington Research
1c. 1992 - Lab: Burlington Research

2. **NC 0001961** Plant: WestPoint Pepperell - Hamilton
2a. 1988 - Lab: Oxford Labs, Wilmington, NC
2b. 1989 - Lab: Burlington Research, Burlington, NC
2c. 1990 - Lab: Burlington Research
2d. 1992 - Lab: Southern Testing & Research Labs, Wilson, NC

3. **NC 0003450** Plant: Stevcoknit Fabrics - Wallace
3a. 1990 - Lab: Burlington Research, Burlington, NC
3b. 1991 - Lab: Burlington Research
3c. 1992 - Lab: Burlington Research

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d	1e	2a	2b	2c	2d
Methylene chloride	--	--	--	--	--	--	--	*	--
Toluene	--	6	--	--	--	--	--	--	--
Tetrachloroethylene	--	81	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--	*	--
Di(2-ethylhexyl) phthalate	--	--	--	--	--	--	--	x	x
Di-n-butyl phthalate	--	--	--	x	x	--	--	--	--
Antimony	380	--	--	--	--	--	--	--	--
Arsenic	67	--	--	--	--	--	--	--	--
Cadmium	15	3	--	--	--	--	--	--	5
Chromium	--	13	--	7	--	--	--	--	--
Copper	150	170	250	79	110	60	--	105	--
Lead	100	--	--	--	--	--	--	31	--
Mercury	--	0.3	0.7	0.9	--	--	--	--	0.4
Nickel	50	11	--	--	--	--	76	73	31
Selenium	5	--	--	--	--	--	--	--	--
Silver	--	7	10	--	--	--	--	--	7
Zinc	167	89	113	94	84	190	--	268	416

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.
* = detected in method blank.

1. **NC 0003867** Plant: United Piece Dye Works - Edenton
1a. 1988 - Lab: Burlington Research, Burlington, NC
1b. 1990 - Lab: Burlington Research
1c. 1991 - Lab: Burlington Research
1d. 1992 - Lab: Burlington Research
1e. 1993 - Lab: Burlington Research

2. **NC 0034860** Plant: Schneider Mills - Taylorsville
2a. 1989 - Lab: General Engineering Lab (Environmental Testing)
2b. 1990 - Lab: Pace
2c. 1991 - Lab: Hydro Analytical Labs
2d. 1992 - Lab: Industrial & Environmental Analysts (IEA), RTP, NC

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	2a	2b	2c
Bromodichloromethane	--	--	14	--	--	--
Chloroform	9	20	48	--	--	--
Di-n-butyl phthalate	--	--	x	--	--	--
Antimony	--	--	--	--	170	--
Arsenic	60	78	10	15	--	42
Cadmium	--	--	--	4	--	--
Chromium	16	--	6	17	40	--
Copper	90	50	20	69	480	140
Lead	--	--	--	--	40	--
Mercury	1.4	--	--	0.2	--	--
Nickel	20	--	--	35	50	--
Silver	--	--	--	6	100	--
Zinc	119	1240	680	112	890	320

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0025135** Plant. Huffman Finishing - Granite Falls
1a. 1990 - Lab: Burlington Research, Burlingtonl, NC
1b. 1991 - Lab: Burlington Research
1c. 1992 - Lab. Burlington Research

2 **NC 0000094** Plant: Cranston Printworks - Fletcher
2a. 1989 - Lab: CompuChem
2b. 1992 - Lab. Pace
2c. 1993 - Lab: Pace

North Carolina APAM Data (cont.)

Parameters	Sampling Episodes 1a	1b	1c	1d	2a	2b	2c	2d
Methylene chloride	--	14	--	--	--	--	--	--
1,1,1-Trichloroethane	11	--	--	--	--	--	--	--
Di(2-ethylhexyl) phthalate	x	x	--	x	x	--	--	x
Di-n-butyl phthalate	x	--	--	--	x	--	x	x
Butylbenzyl phthalate	--	x	--	--	--	--	--	--
Antimony	--	--	--	49	--	--	--	--
Arsenic	--	--	--	--	--	180	88	17
Chromium	7	--	--	--	8	5	--	--
Copper	20	10	10	10	51	10	10	10
Lead	--	--	--	--	38	10	--	--
Mercury	--	--	--	0.7	--	--	--	--
Nickel	--	--	--	--	44	--	--	--
Silver	9	--	--	--	5	--	--	--
Zinc	50	72	56	54	70	70	44	61

Concentration unit: ug/L (ppb)
Codes: x = detected, but attributable to sample contamination.
(--) = not detected above the "quantitation limit target" concentration specified in the APAM reporting form.

1. **NC 0043320** Plant: Burlington Industries - Cordova
1a. 1989 - Lab. Burlington Research
1b. 1990 - Lab· Burlington Research
1c. 1991 - Lab: Burlington Research
1d. 1992 - Lab: Burlington Research

2. **NC 0000876** Plant: Cone Mills - Greensboro
2a. 1989 - Lab· Cone Mills Technical Center
2b. 1990 - Lab. AquaTech Environmental Consultants
2c. 1991 - Lab: Burlington Research
2d. 1992 - Lab: Burlington Research

Notes.
Phthalates were generally not detected after labs began pre-washing or baking the anhydrous sodium sulfate used to dry the solvent (methylene chloride) extract However, some plants were still using Tygon tubing with their compositing samplers

APPENDIX III-3

Validated[1] NPDES Permits from PCS

Alabama

AL0001627 Avondale Mills - Sylacauga
AL0002968 WestPoint Stevens (Pepperell) - Opelika
AL0021997 Masland Carpets - Atmore

Arkansas

AR0000892 Burlington Industries - Monticello
AR0045101 Fruit of the Loom - Mississippi Co.

Arizona

AZ0022659 Bisbee-Douglas Int'l Airport - Douglas

Georgia

GA0000060 Rabun Apparel - Rabun Gap
GA0000213 Thomaston Mills - Thomaston
GA0000345 Lindale Manuf - Lindale
GA0000850 Galey & Lord - Shannon
GA0001791 Chicopee - Hall Co.
GA0002038 Coats America - Stephens Co.
GA0002224 Bibb Co. - Monroe Co.
GA0002712 Jefferson Mills - Jackson Co.
GA0003115 William Carter - Barnesville
GA0003280 King Finishing - Screven Co.
GA0003409 Dundee Mills - Spaulding Co.
GA0003697 Mohawk Commercial Carpets - Laurens Co.
GA0003760 Forstmann - Laurens Co.
GA0003778 Forstmann - Louisville
GA0024104 Fieldcrest Cannon - Lyerly

Kentucky

KY0002445 Jockey Int'l - Carlisle

Maine

ME0000116 Cascade Woolen Mill - Oakland
ME0001902 Guilford of Maine - Guilford
ME0002526 Robinson Manuf - Oxford

Massachusetts

MA0001538 Guilford Industries - Douglas
MA0003697 Veratec - Griswoldville
MA0004171 Worcester Spinning & Finishing - Leicester
MA0005355 Theave Inc. - Norton

Mississippi

MS0000876 Denton Mills - New Albany
MS0001848 Burlington Denim - Stonewall
MS0035882 Kimberly Clark - Corinth
MS0047759 Greenville Manuf. - Greenville

New Jersey

NJ0004324 Fiber Technology Group - Buena (Landisville)
NJ0004901 Oxford Textile - Oxford

---

1 Selected from 413 textile (SIC 22) NPDES permits extracted from PCS, 7/8/93. Validation means these permits were issued for control of pollutant parameters in textile process wastewater.

Validated NPDES Permits from PCS (cont.)

North Carolina

NC0000094 Cranston Print Works - Fletcher
NC0000817 Wilmington Corp. - Wilmington
NC0000876 Cone Mills - Greensboro
NC0001210 Monarch Hosiery - Altamahaw
NC0001376 Burlington Industries - Wake Forest
NC0001406 Swift Textiles - Erwin
NC0001627 National Spinning - Washington
NC0001643 Fieldcrest Cannon - Eden (Source APAM data, not in PCS under SIC 22__)
NC0001651 Culp Inc. - Guilford Co.
NC0001961 WestPoint Pepperell - Hamilton
NC0002305 Guilford Mills - Kenansville
NC0003450 Stevcoknit Fabrics - Wallace
NC0003522 WestPoint Stevens (Pepperell) - Elizabethtown
NC0003867 U.S. Piece Dye Works - Edenton
NC0003913 Glen Raven Mills - Altamahaw
NC0004120 Cleveland Mills - Lawndale
NC0004235 New Minette Textiles - Grover
NC0004243 Coats American - Charlotte
NC0004286 Fieldcrest Cannon - China Grove
NC0004391 Grover Industries - Tryon
NC0004405 Cone Mills - Cliffside (Source: APAM data, not in PCS under SIC 22__)
NC0004618 WestPoint Pepperell - Lumberton
NC0004812 Stowe-Pharr Mills - McAdenville
NC0005312 Chatham Manuf Acquisition Corp - Elkin
NC0005355 Surratt Hosiery Mill - Denton
NC0005479 Fieldcrest Cannon - Laurel Hill
NC0005487 Fieldcrest Mills - Spencer
NC0005762 J.P. Stevens - Wagram
NC0006025 Burlington Industries - Forest City
NC0006033 JPS Autoproducts - Cramerton (Gaston Co.)
NC0006190 Delta Mills - Maiden
NC0007927 Arlene Hosiery Mill - Hickory
NC0025135 Huffman Finishing - Granite Falls
NC0034860 Schneider Mills - Taylorsville
NC0043320 Burlington Industries - Cordova
NC0080993 Spartan Mills - Cliffside

Pennsylvania

PA0008231 Gold Mills Dyehouse - Pine Grove
PA0009172 Chloe Textiles - Middletown
PA0013765 Industrial Parks, Ltd. - Bangor

Rhode Island

RI0000191 Kenyon Industries - Charlestown

South Carolina

SC0000213 Mohawk Commercial Carpet - Liberty
SC0000264 Greenwood Mills - Liberty
SC0000299 Fieldcrest Cannon - Abbeville
SC0000353 Milliken - Abbeville
SC0000426 Blair Mills - Belton
SC0000477 Milliken - Pendleton
SC0000485 La France Industry - La France

Validated NPDES Permits from PCS (cont.)

South Carolina (cont.)

SC0000591 J.P Stevens - Clemson
SC0000990 Plusa - Jamestown
SC0001163 Greenwood Mills - Orangeburg Co.
SC0001341 Veratec - Bethune
SC0001368 Cone Mills - Carlisle
SC0001490 Reeves Bros. - Bishopville
SC0001601 Woodside Mills - Fountain Inn
SC0001805 Mohasco Industries - Dillon
SC0002135 CCX Fiberglass Products - Walterboro
SC0002151 Delta Mills - Wallace
SC0002453 Spartan Mills - Startex
SC0002500 Dixie Yarns - Chesterfield Co.
SC0002569 Albany International - St Stephens
SC0002704 Galey & Lord - Society Hill
SC0002747 Milliken - Valley Falls (Spartanburg Co.)
SC0003093 Milliken - Barnwell
SC0003051 Milliken - Union Co
SC0003182 Milliken - Blacksburg
SC0003191 Milliken - Marietta
SC0003255 Springs Industries - Lancaster Co
SC0023264 Wateree Textiles - Camden
SC0035157 Oneita Industries - Fingerville
SC0035947 Spring City Knitting Co - Gaffney
SC0040363 National Dye Works - Lynchburg
SC0043419 Fashion Fabrics of America - Orangeburg

Texas

TX0000698 WestPoint Pepperell (Mission Valley) - New Braunfels
TX0000701 WestPoint Pepperell - New Braunfels

Virginia

VA0001295 WestPoint Pepperell - Keysville
VA0001376 Halifax Damask Mills - South Boston
VA0001538 Bibb Co - Brookneal
VA0001554 Liberty Fabrics - Patrick Co.
VA0001643 Burlington Industries - Halifax Co
VA0001651 Burlington Industries - Mecklenburg Co.
VA0001678 Burlington Industries - Pittsylvania Co
VA0001864 Aileen Inc. - Edinburg
VA0003051 Virginia Dyeing Corp - Emporia
VA0003069 Boykins Narrow Fabrics - Boykins
VA0004677 Burlington Industries - Glasgow
VA0050822 J.P. Stevens - Drakes Branch

Washington

WA0000230 Pendleton Woolen Mills - Washougal

West Virginia

WV0001261 Kellwood Co - Spencer

APPENDIX III-4

Summary of Parameters With Data Reported to the PCS by Textile Mills

Parameters	Textile Mills 1	2	3	4	5	6	7	8	9	10
Ammonia	*	*	*	*						
Chlorine	*								*	
Sulfide	*	*		*	*	*	*	*	*	
Bromodichloromethane									*	
Chloroform					*				*	
Dibromochloromethane					*					
Antimony							*		*	
Arsenic					*					
Cadmium									*	
Chromium		*		*		*	*		*	*
Copper	*	*		*	*	*	*		*	*
Lead	*	*		*						
Thallium							*			
Zinc	*	*		*	*		*		*	*

* = indicates data was available for the parameter

Textile Mills:
1. Avondale Mills - Sylacauga, AL
2. WestPoint Pepperell - Opelika, AL
3. Masland Carpets Inc. - Atmore, AL
4. Rabun Apparel Inc - Rabun Gap, GA
5. Thomaston Mills - Thomaston, GA
6. Chicopee - Gainesville, GA
7 Coats American Inc. - Toccoa, GA
8. Jefferson Mills - Jefferson, GA
9. William Carter Co. - Barnesville, GA
10. King Finishing Co - Augusta, GA

Summary of Parameters With Data Reported to the PCS by Textile Mills (cont.)

Parameters	Textile Mills 11	12	13	14	15	16	17	18	19	20
Ammonia				*		*			*	*
Chlorine	*			*				*		*
Sulfide		*	*	*	*	*		*	*	
Chloroform	*									
Di(2-ethylhexyl) phthalate	*									
Arsenic	*									
Chromium		*	*		*	*	*	*	*	
Copper							*			*
Lead						*				
Silver						*				
Zinc	*						*			

Parameters	21	22	23	24	25	26	27	28	29	30
Ammonia					*	*				*
Chlorine	*				*	*			*	
Cyanide									*	
Sulfide	*	*	*	*	*	*	*	*	*	
Formaldehyde			*							*
Di(2-ethylhexyl) phthalate				*						
Cadmium				*						
Chromium	*	*		*	*		*	*	*	
Copper	*			*						
Lead				*						
Silver				*						
Zinc	*			*				*	*	

* = indicates data was available for the parameter

Textile Mills:

11 Dundee Mills Griffin, GA
12. Forstman & Co.- Dublin, GA
13 Forstman & Co - Louisville, GA
14 Jockey Intrn'l - Carlisle, KY
15 Guilford of Maine - E Douglas, MA
16. Veratec Inc. - Griswoldville, MA
17 Tweave Inc - Norton, MA
18 Robinson Manuf - Oxford, ME
19. Burlington Denim - Stonewall, MS
20. Kimberly-Clark Corp. - Corinth, MS
21 Oxford Textile Inc - Oxford, NJ
22. Gold Mills Dyehouse - Pine Grove, PA
23 Chloe Textiles - Middletown, PA
24 Kenyon Industries - Kenyon, RI
25. Greenwood Mills - Greenwood, SC
26 Mohawk Industries - Bennettsville, SC
27 Milliken & Co - Abbeville, SC
28. Milliken & Co. - Pendleton, SC
29 LaFrance Industries - Mt. Vernon, SC
30 WestPoint Stevens - Clemson,SC

Summary of Parameters With Data Reported to the PCS by Textile Mills (cont.)

Parameters	Textile Mills 31	32	33	34	35	36	37	38	39	40
Ammonia						*		*	*	
Chlorine	*			*	*	*	*			
Sulfide	*	*	*	*			*	*		*
Chromium	*		*	*	*		*	*	*	*
Copper				*					*	
Zinc				*					*	

Parameters	Textile Mills 41	42	43	44	45	46	47	48	49	50
Ammonia		*			*	*			*	
Chlorine	*			*		*	*	*		
Sulfide	*	*	*	*	*			*	*	
Arsenic				*						*
Chromium	*	*	*	*	*				*	

* = indicates data was available for the parameter

Textile Mills

31 Plusa Inc - Jamestown, SC
32 Veratec - Bethune, SC
33 Cone Mills - Carlisle, SC
34 Reeves Bros. - Bishopville, SC
35 Mohawk Industries - Dillon, SC
36 CCX Fiberglass - Walterboro, SC
37 Delta Mills - Wallace, SC
38. Spartan Mills - Startex, SC
39. Dixie Yarns - Chesterfield, SC
40. Galey & Lord - Society Hill, SC
41 Milliken & Co. - Union, SC
42 Milliken & Co. - Barnwell, SC
43 Milliken & Co. - Blacksburg, SC
44 Milliken & Co. - Marietta, SC
45 Springs Industries - Grace, SC
46 Wateree Textiles Co. - Camden, SC
47 Milliken & Co. - Campobello, SC
48 Spring City Knitting - Gaffney, SC
49. Fash Fabrics of America - Orangeburg, SC
50 Mission Valley Textiles - New Braunfels, TX

Summary of Parameters With Data Reported to the PCS by Textile Mills (cont.)

Parameters	Textile Mills 51	52	53	54	55	56	57	58	59
Ammonia							*		*
Chlorine			*		*				*
Sulfide	*	*		*	*	*	*	*	*
Chromium	*	*		*	*	*	*	*	*
Chromium +6				*					*
Copper	*			*					
Lead	*								
Zinc	*		*	*					

* = indicates data was available for the parameter

Textile Mills:
51. The Bibb Co. - Brookneal, VA
52. Liberty Fabrics - New York, VA
53 Burlington Industries - Halifax, VA
54. Burlington Industries - Clarksville, VA
55. Burlington Industries - Altavista, VA
56 Aileen Inc - Edinburg, VA
57. Virginia Dyeing Corp - Emporia, VA
58. Pendleton Woolen Manuf - Washougal, WA
59. Kellwood Co - Spencer WV

APPENDIX IV-1

Estimated Loadings of Parameters From The PCS Database

Methodology

Limitations of the PCS Database

1. Industry classification of some NPDES permits is inaccurate.
(a) Some NPDES permits were originally encoded under an incorrect primary SIC code, and the permit's PCS record remains unrevised. Example: the NPDES permits of two OCPSF plants (SIC 28) were retrieved as textile facilities (SIC 22). Can cause the number of permits in an industry to be overstated or understated.
(b) Some NPDES permits are archaic. or currently invalid. Can cause the number of permits in an industry to be overstated.

2. The list of an industry's NPDES permits may be incomplete.
(a) Only facilities considered "major" (defined as those with discharges posing "the greatest threat to human health or the environment") are required to submit monthly DMRs to the PCS.
(b) Both outfalls and pollutant parameters may be missing from the record of individual facilities, because they are only required to report data for those parameters that are specified in the NPDES permit conditions

3 Data entry errors
(a) Manual transcription errors
(b) Unit of measure in the monthly discharge reports (DMRs) encoded incorrectly.

4. Several loading estimates based on the use of maximum concentration and flow were extremly large. Parameter loadings estimated from the PCS database are subject to these and other possible errors.

Assumptions in Data Selection

1. Loadings can only be estimated when records are available with valid concentration and corresponding flow Depending on the monitoring requirements imposed by the permit, concentration may be reported in many different units in the PCS. EDS adjusts 26 different measures (units) of concentration and three of flow to obtain units that are compatible for estimating parameter loadings. Gaps of incompatible data in the record of some parameters may cause loadings to be underestimated.

2. When both quantity and concentration are available, EDS first uses the reported parameter loading value. EDS then estimates parameter loading from discharge flow and concentration. The EDS routine selects concentration measurements from the PCS in the following order of preference:

Avg daily conc. > Max. daily conc. > Min. daily conc.

3 In many cases, both a net (excludes parameter loading of raw process water) and gross concentration for a single parameter and discharge outfall were reported to the PCS When both net and gross values were reported, net concentrations were used Gross values were used only when net concentrations were unavailable.

4 Multiple monitoring locations at a facility were assumed to represent independent outfalls. If two monitoring locations are actually on the same outfall, double counting can occur Such estimates would overstate the actual loading of some parameters.

5. Thirty operating days per month were assumed in the calculations.

Editing Criteria for Estimated Loadings

The parameter loading data obtained from the PCS by the EDS computer routine were edited according to the following criteria.

1. Exclude loadings for conventional and non-conventional parameters (e.g., BOD, TSS, Oil & Grease, COD, total phenols) that represent groups of chemicals.
2. Exclude loadings for "relatively non-toxic" anion and cation parameters (e.g., phosphorus, phosphate, chloride, sulfate, sulfite, nitrogen, nitrite, sodium chloride, and sodium).
3. When concentration and quantity of a chemical parameter are reported as "below the detection limit," process the data as half the detection limit, if the parameter was detected at anytime; and as zero, if the parameter was never detected.
4. If multiple parameters are reported for the same chemical at the same discharge pipe, use the parameter with the maximum loading reported.
5. Calculate a facility's total loading of a chemical parameter by summing the parameter's loadings across all discharge pipes.

Editing Criteria for Outliers

Loading values were identified as outliers and eliminated, if they met the following criteria.

1. Were at least 3X as large as the next highest PCS value and the highest TRI (1992) value for that chemical
2 Failed Roxner's outlier test statistic, assuming a log-normal distribution of values for a chemical across all of the industries
3 Accounted for more than 30% of the total load for the chemical across all industries

The contractor's memo, in summarizing outlier editing criteria, noted that loading values for some chemicals (e.g , chlorine, copper and zinc) estimated from PCS data far exceeded the largest annual loading estimated from TRI data The contractor further explains that "high" loading estimates from PCS data were retained, even though qualifying as an outlier because the estimate was at least 3X as large as the highest TRI loading estimate for that chemical. But this criterion is based on a faulty premise, namely that a chemical loading calculated from PCS data bears some consistency with loadings of the chemical that were reported to the TRI.

There is no reason to expect loading values estimated from PCS data would be similar to loading values from TRI data, because the two databases are founded upon dissimilar data. The TRI loadings derive from estimated losses of process chemicals to wastewater, where the amount that was released to surface waters (includes treated effluent and stormwater runoff) or to POTWs was estimated by assuming the loss of a percentage of the total amount of the chemical used annually by the facility. In contrast, the PCS data derive from measured concentrations and flows (treated effluent only) that were reported by NPDES permits.

Estimated Parameter Loadings - PCS Database

Parameter	NPDES	LBYO[1]	LBYE[2]
Ammonia	AL0001627	2119	2119
	AL0002968	3382	3382
	AL0021997	826	826
	GA0000060	4112	4112
	MA0003697	894	894
	SC0000299	2993	2993
	SC0000591	3771	3771
	SC0002500	617	617
	SC0003255	24120	24120
	SC0043419	5950	5950
Chlorine	GA0003115	1511	1511
	GA0003409	1751	1751
	SC0000264	73836	4045303
	SC0000990	639	647
	SC0001490	398	470
	SC0001805	979	979
	SC0002135	2902	2902
	SC0002453	1099	1099
	SC0035947	1036	1036
	VA0001678	2447	2447
Sulfide	AL0001627	4595	4595
	GA0000213	6387	6387
	PA0008231	4585	4585
	SC0000477	3380	3380
	SC0001341	291	28173
	SC0002704	8121	8121
	SC0003093	1526	1526
	SC0003182	4910	4910
	SC0003191	1872	1872
	SC0003255	7569	7569
Bromodichloromethane	GA0003115	2	2
Chloroform	GA0000213	0 03	0 03
	GA0003115	2	2
	GA0003409	21	21
Dibromochloromethane	GA0000213	0 01	0 01
Di(2-ethylhexyl) phthalate	GA0003409	3	3
	RI0000191	11	13
	SC0002135	3	3
Formaldehyde	PA0009172	74	74
	SC0000591	912	912
Cyanide	SC0000485	4	5
Antimony	GA0002038	44	44
	GA0003115	28	72
Arsenic	GA0000213	68	88
	GA0003409	8	8

1 Amount discharged annually (pounds per year) Calculation assumed a concentration value of ZERO, when reported concentration was below detection limit

2 Amount discharged annually (pounds per year) Calculation assumed a concentration value of HALF DETECTION LIMIT, when reported concentration was below detection limit

Estimated Parameter Loadings - PCS (cont.)

Parameter	NPDES	LBYO	LBYE
Arsenic	SC0003191	6	12
	TX0000698	33	111
Cadmium	GA0003115	191	191
	RI0000191	0 2	0 4
Chromium	AL0002968	188	188
	GA0003280	149	149
	GA0003778	125	138
	GA0003760	446	446
	RI0000191	174	174
	SC0001368	277	277
	SC0003182	136	136
	SC0003255	144	317
Chromium +6	VA0001651	5135	5135
	WV0001261	7	7
Copper	GA0000060	46	46
	GA0000213	170	180
	GA0002038	206	206
	GA0003115	8767	8767
	GA0003280	14	14
	GA0003409	610	610
	NJ0004901	71	71
	RI0000191	178	178
	SC0001490	777	777
	VA0001651	14379	14379
Lead	AL0001627	3	3
	AL0002968	2	2
	GA0000060	13	13
	MA0003697	5	6
	RI0000191	5	5
	VA0001538	0 1	0 1
Silver	MA0003697	2	2
	RI0000191	0 5	1
	VA0001651	943	943
	VA0001678	187	187
Zinc	GA0000213	677	677
	GA0002038	332	332
	GA0003115	46168	46168
	GA0003409	576	576
	NJ0004901	277	277
	RI0000191	124	124
	SC0000477	576	576
	SC0001490	1138	1138
	SC0002500	146	146
	VA0001651	183842	183842

APPENDIX IV-2

Textile Facilities in TRI Database

Almore Dye House	N. Hollywood, CA
Anchor Dyeing & Finishing	Philadelphia, PA
Andrex Industries	Asheville, NC
Amerbelle Corp	Vernon, CT
American & Efird Inc	Mount Holly, NC
American & Efird Inc	Salisbury, NC
Amoco Fabrics Co	Hazelhurst, GA
Anglo Fabrics Co	Webster, MA
Anvil Knitwear	Kings Mountain, NC
Atlas Carpet Mills	Los Angeles, CA
Avon Mills	Sylacauga, AL
Baltic Dyeing & Finishing	Passaic, NJ
BASF Corp	Sylvania, GA
Bassett-Walker Inc	Martinsville, VA
Bekaert Corp	Rogers, AR
Belding Corticelli Thread	Hendersonville, NC
BGF Industries	Altavista, VA
Bibb Co	Rockingham, NC
Bibb Co (Whitehorse plant)	Greenville, SC
Bibb Co	Columbus, GA
Bloomsburg Mills	Monroe, NC
Burke Mills	Valdese, NC
Burlington House Finishing	Burlington, NC
Burlington House	Monticello, AR
Burlington Industries	Rabun Gap, GA
Burlington Industries	Statesville, NC
Burlington Menswear	Raeford, NC
Cascade Woolen Mill	Oakland, ME
Carisbrook Industries	Glens Falls, NY
Carleton Woolen	Winthrop, ME
Caron International	Rochelle, IL
Champion Dye & Finishing	Paterson, NJ
Chatham Mfg	Elkin, NC
Chem-Tech Finishers	Dalton, GA
Cheraw Dyeing & Finishing	Cheraw, SC
Cinderella Knitting	Gastonia, NC
Clarksville Finishing	Clarksville, VA
Coats American Inc	Toccoa, GA
Collins & Aikman	Roxboro, NC
Collins & Aikman	Dalton, GA
Collins & Aikman	Albemarle, NC
Columbus Coated Fabrics	Columbus, OH
Concord Fabrics	Washington, GA
Copeland Inc	Burlington, NC
JC Cowan Finishing	Forest City, NC
Cramerton Automotive Fabrics	Cramerton, NC
Cranston Print Works	Webster, MA
Cranston Print Works	Fletcher, NC
Cross Creek Apparel	Mount Airy, NC
Dan River Inc	Danville, VA

Textile Facilities in TRI (cont.)

Delta Mills Marketing	Wallace, SC
Dixie Yarns Inc	Tryon, NC
Dixie Yarns Inc	Chattanooga, TN
Dorado Processing	Woonsocket, RI
Dumaine Towel Mill	Fieldale, VA
Duro Finishing	Fall River, MA
Duro Textile Printers	Fall River, MA
Dyersburg Fabrics	Dyersburg, TN
Dyersburg Steel Cord	Dyersburg, TN
Eastland Woolen	Corinna, ME
Facemate Corp	Chicopee, MA
Fashion Fabrics of America	Orangeburg, SC
Freudenberg-Nonwoven	Hopkinsville, KY
Freudenberg-Nonwoven	Lowell, MA
Fiberweb NA Inc	Washougal, WA
Fieldcrest Cannon	Kannapolis, NC
Fieldcrest Cannon	Eden, NC
Fieldcrest Cannon	Calhoun Falls, NC
Firestone Fiber & Textile	Gastonia, NC
Forstmann & Co	E. Dublin, GA
Forstmann & Co	Milledgeville, GA
Forstmann & Co	Louisville, GA
Galey & Lord Inc	Society Hill, SC
Gehring Tricot	Dolgeville, NY
GenCorp Polymer	Columbus, MS
General Tire Inc	Barnesville, GA
Glamourette Fashion	Quebradillas, PR
Glenoit Mills Inc	Tarboro, NC
Glen Raven Mills	Anderson, SC
Glen Raven Mills	Altamahaw, NC
Gold Mills Dyeing	Pine Grove, PA
Golding Industries	Marion, SC
Goldtex Inc	Goldboro, NC
Graniteville Co	Graniteville, SC
Graniteville Co (Greg plant)	Graniteville, SC
GS Roofing Products	N Charleston, SC
Guilford Mills	Greensboro, NC
Guilford Mills	Kenansville, NC
L. Hamrick Inc	Gaffney, SC
Hanes Dye & Finishing	Winston-Salem, NC
Harriss & Covington	High Point, NC
Holliston Mills Inc	Church Hill, TN
Homestead Industries	Claremont, NH
Hope Valley Dyeing	W. Warwick, RI
Hornwood Inc	Lilesville, NC
Hurt Finishing	Hurt, VA
International Paper	Lewisburg, PA
International Woolen	Sanford, ME
Interstate Dye & Finishing	Paterson, NJ
Ithaca Industries	Robbins, NC
Ithaca Industries	Wilkesboro, NC
Ithaca Industries	Clinton, SC

Textile Facilities in TRI (cont.)

WG Humphrey	Toccoa, GA
Joan Fabrics Corp	Lowell, MA
Joan Fabrics Corp	Fall River, MA
Joan Fabrics Corp	Newton, NC
JP Stevens	Wagram, NC
Kayser-Roth Corp	Arecibo, PR
Kayser-Roth Corp	Ashboro, NC
Kayser-Roth Corp	Graham, NC
Kayser-Roth Corp	Lumberton, NC
Kayser-Roth Corp	Prosperity, SC
Kimberly-Clark	La Grange, GA
King Finishing	Dover, GA
Kingstree	Kingstree, SC
Lees Commercial Carpet	Glasgow, VA
Liberty Fabrics	Jamesville, NC
Liberty Fabrics	Gordonsville, VA
Liberty Fabrics	Woolwine, VA
LA Dye & Print Works (1 & 2)	Los Angeles, CA
Lowell Bleachery	Griffin, GA
Lyerly Rug Mill	Lyerly, GA
3M Corp	Freehold, NJ
Magee Carpet Co	Bloomsburg, PA
Magnolia Finishing	Blacksburg, SC
Malden Mills Industries	Lawrence, MA
Manner Textile	Haledon, NJ
Marjon Dyeing & Finishing	E Rutherford, NJ
JB Martin Co	Leesville, SC
Masland Industries	Carlisle, PA
Mayo Knitting Mill	Tarboro, NC
Microfibres South	Winston-Salem, NC
Milliken & Co	Belton, SC
Milliken & Co	Abbeville, SC
Milliken & Co	Marietta, SC
Milliken & Co	La Grange, GA
Milliken & Co (Elm plant)	La Grange, GA
Milliken & Co (Valw plant)	La Grange, GA
Mohawk Carpet Corp	Dillon, SC
Mohican Mills	Lincolnton, NC
Moretz Mills Inc	Newton, NC
Morganton Dyeing & Finishing	Morganton, NC
Mount Vernon Mills	Trion, GA
Multitex Corp of America	Calhoun, GA
National Felt Co	Easthampton, MA
National Spinning Co	Washington, NC
North Bergen Piece Dye	N Bergen, NJ
North Carolina Finishing	Salisbury, NC
Oxford Textile	Oxford, NJ
Park Avenue Finishing	Burlington, NC
Pennaco Hosiery	Grenada, MS
Perennial Print Corp	Paterson, NJ
Phoenix Mfg	London, KY
Pioneer Finishing	Fall River, MA

Textile Facilities in TRI (cont.)

Plusa Inc	Jamestown, SC
Poughkeepsie Finishers	Paterson, NJ
Precision Fabrics	Greensboro, NC
Renco Finishing	Fair Lawn, NJ
Rice Hosiery	High Point, NC
Robinson Mfg	Oxford, ME
Rochambeau Worsted	Manville, RI
Rock Hill Printing	Rock Hill, SC
Rockland Bamberg Inc	Bamberg, SC
Rockland Bleach & Dye	Baltimore, MD
Rogers Corp	Rogers, CT
Royalty Carpet Mills	Irvine, CA
Russell Corp	Alexander City, AL
Santee Print Works	Sumter, SC
Sara Lee Hosiery	Winston-Salem, NC
Sara Lee Hosiery	Lumberton, NC
Sara Lee Hosiery	Rockingham, NC
Sara Lee Hosiery	Florence, SC
Sara Lee Hosiery	Bennettsville, SC
Sara Lee Hosiery	Hartsville, SC
Sara Lee Hosiery	Marion, SC
Scottsboro Rug Co	Scottsboro, AL
Schuylkill Haven Bleachery	Schuylkill, PA
Seville Dyeing	Woonsocket, RI
Shaw Industries (Plants 1,2,4,8)	Dalton, GA
Shaw Industries	Cartersville, GA
Shaw Industries	Andalusia, AL
Slane Hosiery Mill	High Point, NC
South Carolina Elastic Co	Landrum, SC
Southern Phenix Textiles	Phenix City, AL
Spartan Mills	Startex, SC
Springs Bath Fashion	Nashville, TN
Springs Industries	Calhoun, GA
Springs Industries	Lyman, SC
Stanly Knitting Mills	Oakboro, NC
Sunbrite Dye Co	Passaic, NJ
Superba Print Works	Mooresville, NC
Swift Textiles Inc	Columbus, GA
Swift Textiles Inc	Erwin, NC
Synthetics Finishing	Long View, NC
Synthetics Finishing	Hickory, NC
Talon Inc	Lake City, SC
Tee Jays Mfg Co	Florence, AL
TexiLeather	Toledo, OH
TexPrint Inc	Macon, GA
Thomaston Mills	Thomaston, GA
Threads USA	Gastonia, NC
Tietex Corp	Spartanburg, SC
Travis Knits Inc	Cherryville, NC
Unifi Inc	Madison, NC
Unifi Inc	Mayodan, NC
Unifi Inc	Reidsville, NC

Textile Facilities in TRI (cont.)

United Piece Dye Works	Edenton, NC
US Finishing	Greenville, SC
US Textiles Corp	Charlotte, NC
Vanity Fair Mills	Monroeville, AL
Wansona Mfg	Wadesboro, NC
Warwick Dyeing	W. Warwick, RI
Wehadkee Yarn Mills	Talladega, AL
Wellman Inc	Johnsonville, SC
Western Piece Dyers	Chicago, IL
WestPoint Pepperell	Columbus, GA
WestPoint Pepperell	Lumberton, NC
WestPoint Pepperell	La Grange, GA
WestPoint Pepperell	Opelika, AL
WestPoint Pepperell	Valley, AL
WestPoint Pepperell	Lanett, AL
WestPoint Pepperell	Hamilton, NC
WestPoint Pepperell	Biddeford, ME
Winston Mills Inc	Swannanoa, NC

APPENDIX IV-3

Estimated Loadings of Parameters from the TRI Database

Description of TRI Database

The TRI database of chemical "releases" from textile facilities was compiled from their 1992 submittals of the reporting form (Form R), an annual requirement in order to comply with Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA, or Title III of the 1986 Superfund Amendments and Reauthorization Act). Section 313 contains a list of chemicals that are required to be reported on Form R. A completed Form R must be submitted for each chemical on the Section 313 list that is "manufactured or processed" at a facility in excess of 25,000 pounds per year. Chemicals that are "otherwise used" in excess of 10,000 pounds per year at a facility must also be reported.

Facilities must report estimated quantities of both "routine and accidental releases" of chemicals listed in Section 313, as well as the maximum amount of the listed chemicals on-site during the calendar year. With the total amount of a chemical used each year as a maximum value, the so-called "releases" are merely individual facility estimates of the amount that is annually lost to wastewater or other media. The estimates may be based on monitoring data (e.g., of treated effluent) or measurements of the amount of a chemical that was transferred off-site (e.g., to a POTW). Estimates may also be based on mass balance calculations, such as the amount of a chemical in "wastes" entering and leaving process equipment. The accuracy of these estimates is likely to be marginal and the computation is not necessarily consistent from one facility to another.

Assumptions and Limitations of the Estimated Loadings

1. TRI does not include all process chemicals in use at all textile facilities. Only facilities reporting releases of chemicals listed in Section 313 and meeting minimum threshold requirements are required to report to TRI.
2. Includes only facilities identified by primary SIC codes for textile products.
3. Textile facilities releasing under 1000 pounds of a chemical may submit a range of the "release/transfer" amount for the chemical. In this study, the OPPT criteria were followed by assuming:

   5 pounds for loads reported as 0 to 10;
   250 pounds for loads reported as 10 to 499;
   750 pounds for loads reported as 500 to 999.

4. The accuracy and comparability of TRI loading estimates are unknown. There is no assurance that the loadings of chemicals in TRI records were consistently estimated by reporting textile facilities.

Estimated Parameter Loadings - TRI Database

Parameter	Textile Facility	Location	Loading[1]
Acetone	Gehring Tricot	Dolgeville, NY	1600
	Goldtex Inc.	Goldboro, NC	198
	Guilford Mills	Greensboro, NC	14654
	L Hamrick Inc	Gaffney, SC	2
	SC Elastic Co	Landrum, SC	750
	Kingstree	Kingstree, SC	4500[2]
	Glen Raven Mills	Anderson, SC	250
	Milliken & Co	Belton, SC	29000[2]
	Kimberly-Clark	La Grange, GA	5
	WG Humphrey	Toccoa, GA	3500[2]
	Russell Corp	Alexander City, AL	34
Acrylic acid	Wehadkee Yarn Mills	Talladega, AL	2463
Benzyl chloride	Talon Inc	Lake City, SC	12000
Biphenyl	Malden Mills Ind	Lawrence, MA	37314
	Dorado Processing	Woonsocket, RI	10114
	Seville Dyeing	Woonsocket, RI	82160
	Sunbrite Dye Co.	Passaic, NJ	14883
	Marjon Dyeing & Fin.	E Rutherford, NJ	15737
	Gold Mills Dyeing	Pine Grove, PA	23[2]
	Schuylkill Haven Blea	Schuylkill, PA	2082
	United Piece Dye Wrk	Edenton, NC	5[2]
	Travis Knits Inc	Cherryville, NC	35727
	Cinderella Knitting	Gastonia, NC	24258
	Anvil Knitwear	Kings Mountain, NC	9500
	Bloomsburg Mills	Monroe, NC	11100
	Stanly Knitting Mills	Oakboro, NC	4207
	Burlington Industries	Rabun Gap, GA	3826[2]
	Concord Fabrics	Washington, GA	30400
	Multitex Corp of Am	Calhoun, GA	34270
	Springs Industries	Calhoun, GA	47350
	Shaw Industries (P-2)	Dalton, GA	15800
	Chem-Tech Finishers	Dalton, GA	223946
	Wehadkee Yarn Mills	Talladega, AL	19
	Tee Jays Mfg Co (P-1)	Florence, AL	14088
	Tee Jays Mfg Co (P-2)	Florence, AL	49870
	Vanity Fair Mills	Monroeville, AL	1813
n-Butanol	Lees Commercial Carp	Glasgow, VA	1566[2]
Butylbenzyl phthalate	Collins & Aikman	Roxboro, NC	250
	Southern Phenix Tex	Phenix City, AL	250
Cresol (mixed isomers)	Wehadkee Yarn Mills	Talladega, AL	2
Cumene	Oxford Textile	Oxford, NJ	245[2]
Decabromodiphenyl oxide	Malden Mills Ind.	Lawrence, MA	750
	Joan Fabrics Corp.	Lowell, MA	16
	Joan Fabrics Corp.	Fall River, MA	4
	Rockland Bleach & D	Baltimore, MD	45970
	Microfibres South	Winston-Salem, NC	250
	Burlington House Fin	Burlington, NC	660

1. Annual release (pounds) to POTW.
2 Annual release (pounds) to surface waters. This includes releases from on-site treatment systems, process outfalls (e.g. pipes, open trenches) and stormwater runoff.

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Decabromodiphenyl oxide	Guilford Mills	Greensboro, NC	4962
	Precision Fabrics	Greensboro, NC	6200
	Collins & Aikman	Roxboro, NC	1143
	Superba Print Wrks	Mooresville, NC	250
	Joan Fabrics	Newton, NC	250
	Rockland Bamberg Inc	Bamberg, SC	51451
	Tietex Corp	Spartanburg, SC	250
	Milliken & Co	Abbeville, SC	3300[2]
	Graniteville Co	Graniteville, SC	250
	WestPoint Pepperell	Columbus, GA	250
Dichloromethane	Wehadkee Yarn Mills	Talladega, AL	9
	Feudenberg Nonwoven	Hopkinsville, KY	5
Diethanolamine	Malden Mills Ind.	Lawrence, MA	28000
	Robinson Mfg.	Oxford, ME	26700[2]
	Carleton Woolen	Winthrop, ME	19800
Di(2-ethylhexyl) phthalate	Joan Fabrics Corp.	Lowell, MA	3
	Graniteville Co	Graniteville, SC	3300
	Southern Phenix Tex	Phenix City, AL	250
Dyes: CI Basic Green 4	Dyersburg Fabrics	Dyersburg, TN	2900
CI Disperse Yellow 3	Pioneer Finishing	Fall River, MA	755
Ethylene glycol	Cranston Print Works	Webster, MA	8730
	Marjon Dyeing & Fin	E. Rutherford, NJ	27776
	BGF Industries	Altavista, VA	1900
	Dan River, Inc.	Danville, VA	18802
	Liberty Fabrics	Jamesville, NC	1369[2]
	Fieldcrest Cannon	Kannapolis, NC	7020
	Mohican Mills	Lincolnton, NC	10547
	Burke Mills Inc	Valdese, NC	65000
	Cranston Print Wrks	Fletcher, NC	13220[2]
	Wellman Inc	Johnsonville, SC	374461
	Galey & Lord Inc	Society Hill, SC	220[2]
	Delta Mills Marketing	Wallace, SC	1456[2]
	Milliken & Co	Marietta, SC	2030[2]
	Graniteville Co (Greg)	Graniteville, SC	50000
	Kimberly-Clark	La Grange, GA	250
	Mt. Vernon Mills	Trion, GA	39269
	Swift Textiles Inc	Columbus, GA	11500
	Wehadkee Yarn Mills	Talladega, AL	327
	Fiberweb NA Inc	Washougal, WA	5580
Formaldehyde	Renco Finishing	Fair Lawn, NJ	180
	Firestone Fib & Tex	Gastonia, NC	250
	WestPoint Pepperell	Lumberton, NC	242[2]
	Belding Corticelli Th	Hendersonville, NC	82000
	L Hamrick Inc	Gaffney, SC	3600
	GS Roofing Products	N. Charleston, SC	1400
	Magnolia Finishing	Blacksburg, SC	291[2]
	General Tire Inc	Barnesville, GA	90

1. Annual release (pounds) to POTW.
2. Annual release (pounds) to surface waters.

Estimated Parameter Loadings - TRI (cont.)

Parameters	Textile Facility	Location	Loading[1]
Formaldehyde	Milliken & Co	La Grange, GA	200
	Concord Fabrics	Washington, GA	750
	Wehadkee Yarn Mills	Talladega, AL	72
Glycol ethers	Liberty Fabrics	Gordonsville, VA	9548
	Dumaine Towel Mill	Fieldale, VA	40500
	Lees Commercial Carp	Glasgow, VA	2996[2]
	Unifi Inc.	Madison, NC	100
	Guilford Mills	Greensboro, NC	18445
	National Spinning Co	Washington, NC	7500[2]
	Fieldcrest Cannon	Kannapolis, NC	29800
	Mohican Mills	Lincolnton, NC	11096
	Swift Textiles Inc	Erwin, NC	250[2]
	Chatham Mfg	Elkin, NC	620[2]
	Golding Industries	Marion, SC	9651
	Galey & Lord Inc	Society Hill, SC	1800[2]
	Milliken & Co	Marietta, SC	930[2]
	Magnolia Finishing	Blacksburg, SC	723[2]
	Graniteville Co	Graniteville, SC	750
	Graniteville Co (Greg)	Graniteville, SC	7800
	Milliken & Co (Elm)	La Grange, GA	1171
	King Finishing	Dover, GA	25000[2]
	Burlington Industries	Rabun Gap, GA	2935[2]
	Shaw Industries (P-1)	Dalton, GA	46159
	Shaw Industries (P-4)	Dalton, GA	6300
	Shaw Industries (P-2)	Dalton, GA	36600
	Shaw Industries (P-8)	Dalton, GA	50000
	Shaw Industries (P-2)	Dalton, GA	17500
	Mt. Vernon Mills	Trion, GA	26874
	Russell Corp	Alexander City, AL	17555
	Avondale Mills	Sylacauga, AL	750[2]
Isopropanol[3]	L Hamrick Inc	Gaffney, SC	5000
Methanol	BGF Industries	Altavista, VA	1900
	Firestone Fib & Tex	Gastonia, NC	750
	American & Efird	Mount Holly, NC	71450
	NC Finishing	Salisbury, NC	250[2]
	Bibb Co	Rockingham, NC	250
	Burlington Industries	Statesville, NC	14000
	Belding Corticelli Th	Hendersonville, NC	100000
	Galey & Lord Inc	Society Hill, SC	50[2]
	Delta Mills Marketing	Wallace, SC	2565[2]
	Bibb Co (Whitehorse)	Greenville, SC	200
	Graniteville Co (Greg)	Graniteville, SC	3000
	WestPoint Pepperell	La Grange, GA	273
	Concord Fabrics	Washington, GA	3300
	Bibb Co	Columbus, GA	2129
	Wehadkee Yarn Mills	Talladega, AL	232
	Tee Jays Mfg Co	Florence, AL	21585

1 Annual release (pounds) to POTW.

2 Annual release (pounds) to surface waters.

3 Reporting error. Isopropanol not manufactured at this textile facility.

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Methanol	Vanity Fair Mills	Monroeville, AL	708
	WestPoint Pepperell	Opelika, AL	1[2]
	WestPoint Pepperell	Valley, AL	11[2]
	WestPoint Pepperell	Lanett, AL	130
Methylethyl ketone	Graniteville Co	Graniteville, SC	2100
	GenCorp Polymer	Columbus, MS	4
	TextiLeather	Toledo, OH	250
Methylisobutyl ketone	Graniteville Co	Graniteville, SC	250
	GenCorp Polymer	Columbus, MS	5
Naphthalene	Gold Mills Dyeing	Pine Grove, PA	10[2]
	Galey & Lord Inc	Society Hill, SC	6400[2]
Toluene	Graniteville Co	Graniteville, SC	250
	GenCorp Polymer	Columbus, MS	5
	TextiLeather	Toledo, OH	5
Tetrachloroethlylene	Park Avenue Finishing	Burlington, NC	15316
	Bloomsburg Mills	Monroe, NC	5
	American & Efird Inc	Mount Holly, NC	3000
	American & Efird Inc	Salisbury, NC	1400
	Synthetics Finishing	Long View, NC	5
	Synthetics Finishing	Hickory, NC	5
Tetrachloroethylene	Andrex Industries	Asheville, NC	250
	Delta Mills Marketing	Wallace, SC	770[2]
	Russell Corp	Alexander City, AL	43942
	Wehadkee Yarn Mills	Talladega, AL	2758
1,2,4-Trichlorobenzene	Hope Valley Dyeing	W. Warwick, RI	2119
	Clarksville Finishing	Clarksville, VA	250[2]
	Unifi Inc.	Mayodan, NC	250
	Unifi Inc	Reidsville, NC	250
	WestPoint Pepperell	Hamilton, NC	447[2]
	United Piece Dye Wrk	Edenton, NC	5[2]
	Travis Knits Inc	Cherryville, NC	25278
	JC Cowan Finishing	Forest City, NC	250[2]
	Hornwood Inc	Lilesville, NC	2200
	Mohican Mills	Lincolnton, NC	9997
	Wansona Mfg	Wadesboro, NC	250
	Cheraw Dyeing & Fin	Cheraw, SC	33000
1,1,1-Trichloroethane	Glen Raven Mills	Altamahaw, NC	250[2]
Trichloroethylene	Forstmann & Co	E. Dublin, GA	250[2]
1,2,4-Trimethylbenzene	Renco Finishing	Fair Lawn, NJ	4000
	Manner Textile	Haledon, NJ	750
	Oxford Textile	Oxford, NJ	817[2]
	Gold Mills Dyeing	Pine Grove, PA	12[2]
	Park Avenue Finishing	Burlington, NC	37597
	Travis Knits Inc	Cherryville, NC	25242
	Guilford Mills Inc	Kenansville, NC	5[2]
	Galey & Lord Inc	Society Hill, SC	1400[2]

1. Annual release (pounds) to POTW.
2 Annual release (pounds) to surface waters.

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loadings[1]
Xylene (mixed isomers)	Anglo Fabrics Co.	Webster, MA	17500
	Pioneer Finishing	Fall River, MA	19022
	Amerbelle Corp.	Vernon, CT	62400
	N. Bergen Piece Dye	N. Bergen, NJ	10615
	Interstate Dye & Fin	Passaic, NJ	6147
	Poughkeepsie Finish	Paterson, NJ	9200
	Oxford Textile	Oxford, NJ	196[2]
	Park Avenue Finishing	Burlington, NC	26655
	Precision Fabrics	Greensboro, NC	400
	Threads USA	Gastonia, NC	3226
	Stanly Knitting Mills	Oakboro, NC	16106
	Santee Print Wrks	Sumter, SC	48000
	Galey & Lord Inc	Society Hill, SC	2100[2]
	Graniteville Co	Graniteville, SC	750
Ammonia	National Felt Co.	Easthampton, MA	16862
	Malden Mills Ind.	Lawrence, MA	125322
	Freudenberg Nonwoven	Lowell, MA	487
	Duro Finishing	Fall River, MA	250
	Duro Textile Printers	Fall River, MA	5
	Baltic Dyeing & Fin	Passaic, NJ	13983
	Sunbrite Dye Co.	Passaic, NJ	1797
	Marjon Dyeing & Fin	E. Rutherford, NJ	26700
	Renco Finishing	Fair Lawn, NJ	1200
	Perennial Print Corp.	Paterson, NJ	750
	Champion Dye & Fin	Paterson, NJ	3735
	3M Corp.	Freehold, NJ	270000
	Carisbrook Ind.	Glens Falls, NY	36428
	International Paper	Lewisburg, PA	490
	Rockland Bleach & D	Baltimore, MD	5142
	Clarksville Finishing	Clarksville, VA	3652[2]
	Lees Commercial Carp	Glasgow, VA	3478[2]
	Hurt Finishing	Hurt, VA	8000[2]
	Microfibres South	Winston-Salem, NC	12000
	Sara Lee Hosiery	Winston-Salem, NC	12585
	Copland Inc	Burlington, NC	3150
	Rice Hosiery	High Point, NC	15435
	Fieldcrest Cannon	Eden, NC	5600
	Goldtex Inc.	Goldsboro, NC	188212
	Precision Fabrics	Greensboro, NC	3000
	Collins & Aikman	Roxboro, NC	10787
	JC Cowan Finishing	Forest City, NC	2367[2]
	Firestone Fib & Tex	Gastonia, NC	2200
	Superba Print Wrks	Mooresville, NC	250
	American & Efird	Mount Holly, NC	8533
	NC Finishing	Salisbury, NC	250[2]
	Sara Lee Hosiery	Lumberton, NC	12762
	Sara Lee Hosiery	Rockingham, NC	3272

1. Annual release (pounds) to POTW
2 Annual release (pounds) to surface waters

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Ammonia	Synthetics Finishing	Long View, NC	750
	Rockland Bamberg Inc	Bamberg, SC	6342
	Santee Print Wrks	Sumter, SC	18000
	L Hamrick Inc	Gaffney, SC	2
	Springs Industries	Lyman, SC	750
	Sara Lee Hosiery	Florence, SC	10431
	Sara Lee Hosiery	Bennettsville, SC	5072
	Sara Lee Hosiery	Hartsville, SC	4665
	Golding Industries	Marion, SC	10204
	Sara Lee Hosiery	Marion, SC	26930
	Fieldcrest Cannon	Calhoun Falls, SC	6175[2]
	Rock Hill Printing	Rock Hill, SC	1275
	Graniteville Co	Graniteville, SC	250
	Graniteville Co (Greg)	Graniteville, SC	5
	General Tire Inc	Barnesville, GA	890
	Milliken & Co (Valw)	La Grange, GA	200
	BASF Corp	Sylvania, GA	10000
	Burlington Industries	Rabun Gap, GA	4399[2]
	Collins & Aikman	Dalton, GA	4214
	Lyerly Rug Mill	Lyerly, GA	4000[2]
	Forstmann & Co	E. Dublin, GA	2000[2]
	Forstmann & Co	Milledgeville, GA	7077
	TexPrint Inc	Macon, GA	4
	WestPoint Pepperell	Columbus, GA	250
	Scottsboro Rug Mill	Scottsboro, AL	13340
	Southern Phenix Tex	Phenix City, AL	10
	Phoenix Mfg	London, KY	250
	Western Piece Dyers	Chicago, IL	42500
	Burlington House	Monticello, AR	10
Ammonium nitrate (solution)	Lowell Bleachery	Griffin, GA	1400[2]
	Thomaston Mills	Thomaston, GA	250[2]
	Coats American Inc	Toccoa, GA	8216[2]
Ammonium sulfate (solution)	Kayser-Roth Corp.	Arecibo, PR	113315
	Duro Finishing	Fall River, MA	2436
	Warwick Dyeing	W. Warwick, RI	1240
	WestPoint Pepperell	Biddeford, ME	78305
	Cascade Woolen Mill	Oakland, ME	21003
	Amerbelle Corp.	Vernon, CT	44350
	Sunbrite Dye Co.	Passaic, NJ	83900
	Carisbrook Ind	Glens Falls, NY	83800
	Hanes Dye & Finishing	Winston-Salem, NC	3800
	Kayser-Roth Corp.	Ashboro, NC	26395
	Park Avenue Finishing	Burlington, NC	208254
	Copland Inc.	Burlington, NC	5000
	Kayser-Roth Corp	Graham, NC	47700
	Ithaca Industries	Robbins, NC	32000
	Precision Fabrics	Greensboro, NC	1900
	Mohican Mills	Lincolnton, NC	87250

1. Annual release (pounds) to POTW
2 Annual release (pounds) to surface waters.

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Ammonium sulfate (solution)	NC Finishing	Salisbury, NC	250[2]
	US Textile Corp	Charlotte, NC	980
	Kayser-Roth Corp	Lumberton, NC	50000
	Ithaca Industries	Wilkesboro, NC	130000
	Kayser-Roth Corp	Prosperity, SC	54000
	Ithaca Industries	Clinton, SC	18000
	Fieldcrest Cannon	Calhoun Falls, SC	250[2]
	Milliken & Co	Marietta, SC	460[2]
	Shaw Industries	Cartersville, GA	179000
	Springs Industries	Calhoun, GA	156000
	Shaw Industries (P-4)	Dalton, GA	18000
	Shaw Industries (P-1)	Cartersville, GA	58000
	Shaw Industries (P-2)	Dalton, GA	362000
	Shaw Industries (P-2)	Dalton, GA	212000
	Chem-Tech Finishers	Dalton, GA	42340
	Lyerly Rug Mill	Lyerly, GA	5[2]
	Forstmann & Co	Milledgeville, GA	27458
	Scottsboro Rug Mill	Scottsboro, AL	1235
	Vanity Fair Mills	Monroeville, AL	210950
	Pennaco Hosiery	Grenada, MS	19400
	Atlas Carpet Mills	Los Angeles, CA	10703
	Royalty Carpet Mills	Irvine, CA	180700
Chlorine	Glamourette Fashion	Quebradillas, PR	591
	Bassett-Walker Inc.	Martinsville, VA	17321
	Hurt Finishing	Hurt, VA	900[2]
	Slane Hosiery Mill	High Point, NC	58250
	Harriss & Covington	High Point, NC	500
	Mayo Knitting Mill	Tarboro, NC	5
	Cramerton Automotive	Cramerton, NC	32000[2]
	JC Cowan Finishing	Forest City, NC	750[2]
	Stanly Knitting Mills	Oakboro, NC	660
	NC Finishing	Salisbury, NC	250[2]
	Morganton Dyeing & F	Morganton, NC	25500
	Moretz Mills Inc	Newton, NC	65000
	Spartan Mills	Startex, SC	1100[2]
	Plusa Inc	Jamestown, SC	550[2]
	Mohawk Carpet Corp	Dillon, SC	799[2]
	Wellman Inc	Johnsonville, SC	640
	Rock Hill Printing	Rock Hill, SC	1410
	Graniteville Co (Greg)	Graniteville, SC	240[2]
	Lowell Bleachery	Griffin, GA	1200[2]
	Hollston Mills Inc	Church Hill, TN	1247[2]
	Almore Dye House	N. Hollywood, CA	50688
Hydrochloric acid	Facemate Corp.	Chicopee, MA	5
	Pioneer Finishing	Fall River, MA	31
	Dorado Processing	Woonsocket, RI	1209
	Seville Dyeing	Woonsocket, RI	1294
	Renco Finishing	Fair Lawn, NJ	600

1 Annual release (pounds) to POTW.
2 Annual release (pounds) to surface waters

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Hydrochloric acid	Poughkeepsie Finish	Paterson, NJ	41400
	Wehadkee Yarn Mills	Talladega, AL	330
	Caron International	Rochelle, IL	250
	LA Dye & Print Wrks	Los Angeles, CA	5
Phosphoric acid	Perennial Print Corp.	Paterson, NJ	100
	Concord Fabrics	Washington, GA	5
	LA Dye & Print Wrks1	Los Angeles, CA	5
	LA Dye & Print Wrks2	Los Angeles, CA	5
Sulfuric acid	Glamourette Fashion	Quebradillas, PR	1
	Facemate Corp	Chicopee, MA	5
	National Felt Co.	Easthampton, MA	10718
	Rochambeau Worsted	Manville, RI	16200
	Homestead Ind	Claremont, NH	750
	International Woolen	Sanford, ME	44950
	Eastland Woolen	Corinna, ME	280000
	Anchor Dyeing & Fin	Philadelphia, PA	27000
	Firestone Fib & Tex	Gastonia, NC	5
	American & Efird	Mount Holly, NC	20000
	Winston Mills Inc	Swannanoa, NC	11600
	Dixie Yarns Inc	Tryon, NC	250
	Fashion Fabrics of Am	Orangeburg, SC	6000[2]
	US Finishing	Greenville, SC	841000
	Kimberly-Clark	La Grange, GA	250
	Swift Textiles Inc	Columbus, GA	250
	Vanity Fair Mills	Monroeville, AL	25207
	Dixie Yarns Inc	Chattanooga, TN	3
	Caron International	Rochelle, IL	250
Antimony	Collins & Aikman	Roxboro, NC	250
Antimony compounds	Joan Fabrics Corp.	Lowell, MA	6
	Rockland Bleach & D	Baltimore, MD	22986
	Burlington House Fin	Burlington, NC	280
	Superba Print Wrks	Mooresville, NC	250
	Synthetics Finishing	Long View, NC	5
	Joan Fabrics	Newton, NC	5
	Rockland Bamberg Inc	Bamberg, SC	25726
	Milliken & Co	Abbeville, SC	1500[2]
	Graniteville Co	Graniteville, SC	1500
	Columbus Coated Fab	Columbus, OH	21[2]
	TextiLeather Corp	Toledo, OH	5
	Western Piece Dyers	Chicago, IL	250
Barium compounds	Columbus Coated Fab	Columbus, OH	24[2]
	TextiLeather Corp	Toledo, OH	5
Cadmium compounds	Columbus Coated Fab	Columbus, OH	3
	TextiLeather Corp	Toledo, OH	5
Chromium	Lees Commercial Carp	Glasgow, VA	512[2]

1. Annual release (pounds) to POTW
2. Annual release (pounds) to surface waters.

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Chromium compounds	Malden Mills Ind.	Lawrence, MA	104288
	Duro Finishing	Fall River, MA	124
	Carleton Woolen	Winthrop, ME	190
	Amerbelle Corp.	Vernon, CT	5200
	Masland Ind.	Carlisle, PA	247
	Magee Carpet Co.	Bloomsburg, PA	250
	Clarksville Finishing	Clarksville, VA	750[2]
	Liberty Fabrics	Woolwine, VA	41[2]
	Hurt Finishing	Hurt, VA	23[2]
	Guilford Mills	Greensboro, NC	2729
	Collins & Aikman	Albemarle, NC	250
	Burlington Menswear	Raeford, NC	1289
	Chatham Mfg	Elkin, NC	1100[2]
	Graniteville Co	Graniteville, SC	250
	Graniteville Co (Greg)	Graniteville, SC	2900
	Forstmann & Co	Louisville, GA	750[2]
	Forstmann & Co	E. Dublin, GA	540[2]
	Vanity Fair Mills	Monroeville, AL	4536
	Columbus Coated Fab	Columbus, OH	4
	TextiLeather Corp	Toledo, OH	5
Cobalt compounds	Masland Ind.	Carlisle, PA	161
	Collins & Aikman	Albemarle, NC	250
	Guilford Mills Inc	Kenansville, NC	250[2]
Copper	Wehadkee Yarn Mills	Talladega, AL	278
Copper compounds	Malden Mills Ind.	Lawrence, MA	4100
	Duro Textile Printers	Fall River, MA	1326
	Seville Dyeing	Woonsocket, RI	5166
	Rogers Corp.	Rogers, CT	250
	Schuylkill Haven Blea	Schuylkill, PA	33
	Bassett-Walker Inc.	Martinsville, VA	40739
	Cross Creek Apparel	Mount Airy, NC	267
	WestPoint Pepperell	Hamilton, NC	182[2]
	WestPoint Pepperell	Lumberton, NC	248[2]
	JP Stevens	Wagram, NC	632[2]
	Galey & Lord Inc	Society Hill, SC	1400[2]
	Graniteville Co (Greg)	Graniteville, SC	3100
	Russell Corp	Alexander City, AL	2285
	Wehadkee Yarn Mills	Talladega, AL	2835
	Tee Jays Mfg Co	Florence, AL	18130
	Dyersburg Fabrics	Dyersburg, TN	8100
	Bekaert Steel Cord	Dyersburg, TN	5
	Bekaert Corp	Rogers, AR	13
Lead compounds	Amoco Fabrics Co	Hazlehurst, GA	5
	Shaw Industries	Andalusia, AL	1
	TextiLeather Corp	Toledo, OH	5
	Columbus Coated Fab	Columbus, OH	30

1. Annual release (pounds) to POTW.
2 Annual release (pounds) to surface waters

Estimated Parameter Loadings - TRI (cont.)

Parameter	Textile Facility	Location	Loading[1]
Nickel	Wehadkee Yarn Mills	Talladega, AL	131
Nickel compounds	Russell Corp	Alexander City, AL	137
	Wehadkee Yarn Mills	Talladega, AL	2536
Zinc (fume or dust)[3]	Glenoit Mills Inc.	Tarboro, NC	250
Zinc compounds	Joan Fabrics Corp.	Lowell, MA	4
	JB Martin Co	Leesville, SC	750
	Wellman Inc	Johnsonville, SC	1133
	Graniteville Co (Greg)	Graniteville, SC	250
	Springs Industries	Calhoun, GA	9082
	Scottsboro Rug Mill	Scottsboro, AL	4300
	Shaw Industries	Andalusia, AL	66
	Springs Bath Fashion	Nashville, TN	12385
	Bekaert Steel Cord	Dyersburg, TN	250
	Columbus Coated Fab	Columbus, OH	250
	TextiLeather Corp	Toledo, OH	250
	Burlington House	Monticello, AR	3600
	Bekaert Corp	Rogers, AR	14

1. Annual release (pounds) to POTW
2 Annual release (pounds) to surface waters
3 Reporting error. Not used in textile processing