***** This Report Contains No Confidential Business Information (CBI) *****

Economic Assessment for the Proposed Listing of Wastewater Treatment Sludge from the Production of Triarylmethane (TAM) Dyes and Pigments, and Spent Filter Aids from Azo, Anthraquinone, or Triarylmethane Dyes, Pigments, and Colorants

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REVIEW BY THE OFFICE OF MANAGEMENT AND BUDGET (OMB)

The entire unredacted version of this document was reviewed by OMB personnel. These OMB personnel were cleared for review of Confidential Business Information (CBI) submitted to the Office of Solid Waste (OSW). OMB has approved the unredacted version of this document without changes.

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REDACTED VERSION OF THE ECONOMIC ASSESSMENT DOCUMENT

This redacted, or non-CBI version of the Economic Assessment document, is submitted to the docket for public review. EPA has removed data and analytical findings from this report due to business confidentiality concerns.

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1.0 EXECUTIVE SUMMARY

The Agency is proposing to list as hazardous two waste streams generated by the dyes and pigments industries. The wastes are wastewater treatment sludge from the production of triarylmethane (TAM) dyes and pigments (K167) (excluding TAM pigments using aniline as a feedstock), and spent filter aids from the production of azo, anthraquinone (AQ), and TAM dyes and pigments (K168). The proposed action is a concentration-based listing.

The proposed waste listing may also result in impacts on land disposal facilities which have disposed of the wastes considered in this rulemaking. Because of the proposed listing, leachate from these landfills may be hazardous under the Derived-from Rule. Also, when the leachate from these two wastes mixes with leachate from other wastes disposed in these landfills the entire leachate quantity may be considered hazardous under the Mixture Rule.

Executive Order No. 12866 requires that regulatory agencies determine whether a new regulation constitutes a significant regulatory action. The estimated costs and potential economic impacts of this proposed waste listing indicate this action is not an economically significant regulatory action, as defined by the Executive Order. The action will result in estimated costs to the dyes and pigments industries of between *[Relevant data are not included at the present time due to confidentially concerns.]* on an annualized basis. Estimated impacts on the potentially affected land disposal facilities are highly variable, depending on the regulatory option required. Under the standard listing option, costs are estimated to range as high as *[Relevant data are not included at the present time due to confidentially concerns.]* per year on an annualized basis, with impacts being experienced for approximately five years, the period that the hazardous constituents are expected in the landfill leachate. The other regulatory scenario considered, temporarily deferring the leachate from regulation as hazardous if it is appropriately managed under the Clean Water Act, results in only minor cost impacts, approximately *[Relevant data are not included at the present time due to confidentially concerns.]* per year. Regardless of what management scenario is adopted, the regulation will not have an annual effect on the economy of $100 million or more.

The organic dyes and pigments industries produce dyes and pigments for a wide variety of intermediate and end users including the automotive, textile, printing, and plastics industries. According to data for 1992 there were approximately 80 facilities in operation in the U.S. The total production for the industries has been in the range of 220,000 to 240,000 tons per year in the 1992 through 1994 time period, the most recent for which production data are available. The total value of production in the industries is estimated to be slightly more than $2 billion per year, based on data from 1993 through 1995.

This proposed rule potentially affects *[Relevant data are not included at the present time due to confidentially concerns.]* dye and pigment facilities. Based on responses to RCRA 3007 Questionnaires, these facilities generate approximately *[Relevant data are not included at the present time due to confidentially concerns.]* short tons[1] of the waste considered in this proposed listing. To complete the impact analysis, 100 percent of this waste is assumed to exceed the concentrations for hazardous constituents and is therefore affected by this proposed rulemaking. While the facilities reported different baseline waste management practices, for purposes of estimating cost impacts, it was assumed that the baseline practice is *[Relevant data are not included at the present time due to confidentially concerns.]* Compliance waste management requirements include incineration of the waste in off-site Subtitle C incinerators with subsequent disposal of the ash in a Subtitle C landfill. Stabilization is assumed to be unnecessary. Analytical, administrative, and transportation costs also are included in the cost assessment to derive overall cost impact estimates.

The economic impact analysis for dye and pigment facilities was based on four model facilities generating *[Relevant data are not included at the present time due to confidentially concerns.]* tons of waste per year. Waste generation rates were found to range from *[Relevant data are not included at the present time due to confidentially concerns.]* tons of waste per ton of product. Accordingly, overall dye and pigment product quantities affected by the rulemaking are estimated to range from *[Relevant data are not included at the present time due to confidentially concerns.]* tons of product, or less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of overall industry production. Impacts on the model plants are estimated to range from *[Relevant data are not included at the present time due to confidentially concerns.]* percent of total sales, depending on the waste generation rates of the various facilities, and the value of the products produced, which are estimated to range from $6,500 to $18,000 per ton.

The economic impact analysis for the landfills potentially affected by the proposed listing was based on *[Relevant data are not included at the present time due to confidentially concerns.]* tons of waste per day. Under the standard listing regulatory scenario, costs are estimated to be higher than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales for small landfills which transport leachate to POTWs. The standard scenario impacts are greater than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales for all landfill sizes modeled which manage leachate via truck transport to POTWs; this management method is anticipated for approximately five of the 10 landfills impacted.

[1] This analysis specifies quantities in U.S. tons (2,000 lbs), unless otherwise noted.

The alternative leachate regulatory option provides a temporary deferral of the leachate from regulation as hazardous waste if it is appropriately managed under the Clean Water Act. Impacts for the individual landfills under this scenario are minor, less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of gross sales.

While benefits from the proposed rule have not been quantified, the Agency has evaluated the potential toxicity and intrinsic hazard of constituents present in the waste streams, the fate and mobility of these chemicals, and the likely exposure routes for the contaminants. Clearly the major benefit associated with this rulemaking is to place wastestreams the Agency has determined could pose a risk to human health and the environment into the hazardous waste management system. When wastestreams are placed in this system, the risk associated with their disposal is minimized.

This analysis also describes the Agency's consideration of the Regulatory Flexibility Act, the Unfunded Mandates Reform Act, Executive Order 12875 (Enhancing the Intergovernmental Partnership), Executive Order 13045 (Protection of Children from Environmental Health Risks and Safety Risks), Executive Order 12898 (Environmental Justice), Tribal Governments Analysis (Executive Order 13084), and Regulatory Takings. The agency found that the proposed rule would have no significant impact under any of the Executive Orders or Acts mentioned above.

2.0 INTRODUCTION

This assessment presents a cost and economic impact analysis corresponding to the proposed rule to list two dyes and pigments industry wastes. The wastes are wastewater treatment sludge from the production of triarylmethane (TAM) dyes and pigments (excluding TAM pigments using aniline as a feedstock), and spent filter aids from the production of azo, anthraquinone (AQ) and triarylmethane dyes and pigments.

Executive Order No. 12866 (58 FR 51735, October 4, 1993) requires that regulatory agencies determine whether a new regulation constitutes a significant regulatory action. A significant regulatory action may be defined as economically significant or procedurally significant.

Economic Significance:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;

Procedural Significance:

- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in Executive Order 12866.

This analysis is primarily designed to address the economic significance of the proposed rule. To accomplish this, EPA estimated the costs and potential economic impacts upon generators of the aforementioned dyes and pigments production wastes. Potential impacts on landfill facilities are also examined.

2.1 Background and Purpose

In 1989, the Environmental Defense Fund (EDF) sued the Agency, in part, for failing to meet statutory deadlines of Section 3001(e)(2) of RCRA.[2] To resolve most of the issues of the case, EDF and EPA entered into a consent decree which was approved by the court on June 18, 1991. The consent decree set out an extensive series of deadlines for promulgating RCRA rules and for completing certain studies and reports. The consent decree obligated the EPA to promulgate a final listing determination for azo/benzidine dye and pigment production wastes.

On December 22, 1994, the Agency published the proposed action: *Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Dye and Pigment Industries; Hazardous Waste Listing Determination Policy; and CERCLA Hazardous Substance Designation and Reportable Quantities: Proposed Rules.* This action proposed listing, as hazardous, five wastes generated during the production of dyes and pigments due to evidence indicating unacceptable risks to human health and the environment resulting from existing management practices for these wastes. Under this action, the Agency proposed to defer action on three additional wastes due to insufficient information. Over the past four years the Agency has collected additional data and conducted additional analyses to move forward with a proposed listing for two of the deferred waste streams: spent filter aids and TAM wastewater treatment sludge. Under today's action EPA is proposing not to list the third deferred waste stream, AQ wastewater treatment sludge.

This analysis estimates how facilities in the dyes and pigments industries may be affected by the proposed waste listing. Estimates of the cost and economic impacts of the regulation are determined nationwide and on both a facility-specific and industry-wide basis. Benefits from the regulation are discussed qualitatively.

One disposal practice reported for the two wastes has been municipal landfills. Because of the proposed listing, collected leachate from these landfills (cells) may be hazardous under the Derived-from Rule. Also, when the leachate from these two wastes mixes with leachate from other wastes disposed in these landfills the entire leachate quantity may be considered hazardous under the Mixture Rule. Because of the changing regulatory status of these leachate volumes, the affected landfills may also experience increases in management costs. These impacts are also addressed in this report.

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[2] EDF v. Reilly; Civ. No. 89-0598 D.D.C.

2.2 Need For Regulatory Action

While waste produced by dye and pigment facilities already is regulated to a certain extent, certain waste streams generated by these facilities still pose both human health and ecological risks. Current disposal practices for both spent filter aids and TAM wastewater treatment sludge have the potential to pollute soil and water. To date, the market and other private sector institutions have failed to address pollution issues associated with these two wastestreams for several reasons.

First, because individuals not responsible for the pollution bear the costs in human health and ecological damages, no incentive exists for dye and pigment facilities to incur the additional costs for implementing pollution control measures. In this case, the private industry costs of production do not fully reflect the human health and environmental costs of management of these two wastestreams. This situation, referred to as "environmental externality," represents a type of market failure discussed in OMB's Guidelines.[3] A non-regulatory approach, such as educational outreach programs, would be largely ineffective because the people who are made aware of the potential health risks (e.g., those people living near landfills where these two wastestreams are disposed) have limited ability to reduce exposure without incurring significant costs.

Second, the parties harmed by the pollution of soil and water cannot obtain compensation from dye and pigment facilities through legal or other means due to the high transaction costs involved and the difficulty in establishing a causal relationship between the damage incurred and activity at the dye or pigment facility. Establishing a direct link between a specific dye or pigment facility and human health and other damages incurred may be especially difficult since under current practices many facilities dispose of wastes in landfills where it is co-mingled with many other wastes.

To internalize the environmental costs and to correct market distortions, Federal government intervention is necessary. Therefore, EPA is proposing to list spent filter aids and TAM wastewater treatment sludge as hazardous.

2.3 Scope of Study and Data Sources

This study is an assessment of the potential impacts that may be borne by the dyes and pigments industries, for which the additional waste listings are being proposed. These industries produce literally hundreds of different products, typically in batch processes. Impacts to selected categories of the waste management industry are also examined.

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[3] Office of Management and Budget (OMB). January 1996. *Economic Analysis of Federal Regulations Under Executive Order 12866,* 3-5.

The primary source of information used to establish baseline conditions in the dyes and pigments industries is from *[Relevant data are not included at the present time due to confidentially concerns.]* The *[Relevant data are not included at the present time due to confidentially concerns.]* data used in this analysis represent the total number of facilities believed to be generating TAM and spent filter aid waste and therefore, affected by the proposed listing. Other sources provide the following information on these industries:

- The Census Bureau, 1992 Census of Manufacturers, reported that there were 38 synthetic dye and 42 synthetic pigment establishments (NAICS Code 325132) and over 3,300 sanitary landfills and associated establishments in the U.S. in 1992.

- The U.S. International Trade Commission reported total dye and pigment production to be approximately 230,000 tons of product in the U.S. in 1994.

- Various industry trade periodicals (e.g., *Chemical Week* and *Chemical Marketing Reporter*) which report on general trends in the dye and pigment industries, including anticipated growth rates.

- The *Solid Waste Digest* reported national average tipping fees at sanitary landfills of almost $36 per ton for non-hazardous petroleum contaminated wastes.

2.4 Limitations of Analysis

This analysis does not capture all of the variables that may affect a generator's decision to manage the proposed waste streams. Further, it does not reflect impacts on sales volumes for the affected entities as a whole, but rather only the impacts on the individual product lines associated with the proposed waste streams.

2.5 Organization of Report

This report is divided into eight sections. Section 3 presents a profile of the dyes and pigments industries. This includes available economic profile data, such as products manufactured, profiles of facilities, market structure, an assessment of the market value of industry shipments, and product imports and exports.

Section 4 presents the waste management cost analysis; this includes nationwide unit and facility costs and prices for the baseline and post regulatory compliance. Section 5 documents the economic impacts of the regulation, and Section 6 presents a qualitative summary of anticipated benefits expected from the regulation. Section 7 discusses Regulatory Flexibility Act requirements, and Section 8 addresses other regulatory issues.

3.0 DYES AND PIGMENTS INDUSTRIES PROFILE

The organic dyes and pigments industries produce dyes and pigments for a wide variety of intermediate and end users including the automotive, textile, printing, and plastics industries. This chapter profiles the characteristics of the industries.

3.1 Organic Dyes Industry Characteristics

This section presents an economic profile of the organic dyes industry which is classified under the North American Industry Classification System (NAICS) 325132, Synthetic Organic Dye and Pigment Manufacturing. The following subsections describe selected characteristics of the organic dyes industry including products and processes, affected facilities, market structure, industry production and value, and industry imports and exports.

3.1.1 Overview of Products and Processes

The Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD) defines dyes as "intensely colored or fluorescent organic substances which impart color to a substrate by selective absorption of light." When applied, dyes penetrate the substrate in a soluble form, after which they may or may not become insoluble. The structure of dyes is temporarily altered during the application process and colors are imparted only by selective absorption.

Dyes are used to color fabrics, leather, paper, ink, lacquers, varnishes, plastics, cosmetics, and some food items. According to information published by ETAD, over 2,000 individual dyes of various colors and types are manufactured, many in quantities of less than 50,000 pounds per year[4]. This large number is attributable to the many different types of materials to which dyes are applied and the different conditions of service for which dyes are required.

Synthetic dyes are derived in whole or in part from cyclic intermediates. Approximately two-thirds of the dyes consumed in the United States are consumed by the textile industry to dye fabrics; about one-sixth are used for coloring paper; and the rest are used primarily in the production of organic pigments and in the dyeing of leather and plastics.[5]

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[4] *Pollution Prevention in The Dye Manufacturing Industry*, U.S. Dye Manufacturers Operating Committee of ETAD, October 1994.

[5] "Synthetic Organic Chemicals United States Production and Sales, 1991, "USITC Publication 2607, February 1993."

Commercial dyes are sold in several physical forms including granular, powders, liquids, and pastes. The dyes contain colorant concentrations ranging from approximately 5 to 100 percent.[6] The form of the dye usually is dictated by its intended application. Dyes may be synthesized in water, filtered, washed, and sold as a water-wet filter press cake. Filter press cake also can be dried in ovens, ground into fine particulate, and sold as dry color.

Organic dyes are classified in several ways including their chemical structure or class, general dye chemistry, and application process. Chemical structure classifications include azos, triarylmethanes, diphenylmethanes, anthraquinones, stilbenes, methines, polymethines, xanthenes, phthalocyanines, and sulfurs. Common application process classes include acid, basic, direct, reactive, disperse, vat, and solvent. Using general dye chemistry, textile dyestuffs are grouped into 14 categories or classes: acid dyes, direct (substantive dyes), azoic dyes, disperse dyes, sulfur dyes, fiber reactive dyes, basic dyes, oxidation dyes, mordant (chrome) dyes, developed dyes, vat dyes, pigments, optical/fluorescent brighteners, and solvent dyes.

This proposed waste listing analysis targets TAM wastewater treatment sludges and spent filter aid waste streams resulting from the production of azo, anthraquinone, or triarylmethane dyes, pigments, and colorants. The processes for developing these dyes, their primary uses, and limitations, when applicable, are described below.

Azo Dyes

Azo dyes are formed by a diazotization reaction, which involves forming a diazonium ion from an aromatic amine using nitrous acid. A typical azo dye manufacturing process may include the following steps: slurry of raw materials, pre reaction of raw materials, diazotization reaction, clarification, coupling reaction, isolation, filtration or concentration, drying, standardizing, packaging, and shipping. Azo dyes produce a range of colors with excellent fastness properties. Azos are used essentially for all organic dye applications including natural and synthetic substrates.

[6] ibid.

Anthraquinone Dyes

Anthraquinone dyes typically are formed by a Freidel-Crafts reaction in which phthalic anhydride and benzene are reacted in the presence of aluminum chloride to form o-benzoylbenzoic acid. Closure of the aromatic ring in the intermediate gives the corresponding anthraquinone. Most domestic producers of anthraquinone dyes import the intermediates needed for their products. Substitutions on anthraquinone rings, which produce the final dye product, may include nitro-, halo-, sulfonic, carboxylic, hydroxy, ether, and amino-groups. The general manufacturing process used in the production of anthraquinone dyes is similar to the process used for azo dyes.

Anthraquinone dyes are used in the dyeing of wool and cotton and in the dyeing and printing of cellulosic/synthetic fibers. These dyes generally are used for violet, blue, and green shades.

Triarylmethane Dyes

Triarylmethane dyes are mainly derivatives of colorless triphenylmethane and diphenylnaphthylmethane characterized by a central carbon atom joined to three aromatic rings. These dyes are synthesized industrially by one of four processes: the aldehyde, ketone, diphenylmethane, and benzotrichloride methods. These processes are named for the manner in which the central carbon atom is incorporated into the dye. The choice of process is determined by the structure of the dye manufactured. The general manufacturing process used in the production of triarylmethane dyes is similar to the process used for azo dyes.

Triarylmethane dyes are used primarily in the production of printing and duplicating inks and in dyeing polyacrylonitrile and other synthetic fibers. These dyes can be produced inexpensively, but, because of their poor light and wash fastness, they are less marketable than other dye classes.

3.1.2 Profile of Industry Facilities - Organic Dyes

A 1992 census report[7], the most recent data available, provides some limited information on the organic dye industry. In 1992, there reportedly were 38 establishments listed under Standard Industrial Classification (SIC) 28652, Synthetic Organic Dyes. An estimated 5,200 individuals were employed by the industry and total industry wages were approximately $207 million.

[7] Industrial Organic Chemicals, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1992.

3.1.3 Market Structure

There are significant barriers to entry in both the dyes and pigments industries in terms of capital investment and environmental liability. Both dyes and pigments are produced by organic synthesis, which translates into capital- and time-intensive requirements, making economies of scale a necessity. During the 1980s, many smaller businesses either closed or were acquired by larger companies.

The smaller dye producers that remain operating today typically supply niche markets not serviced by the large producers because of profitability, environmental concerns, or small volumes. When the larger producers leave a market segment or discontinue a product line, the smaller producers usually acquire the manufacturing technology and take over the market share. This has enabled some small producers to exist in a competitive market.

In 1994, it was reported that U.S. owned companies held 20 to 25 percent of the market with European-owned U.S. subsidiaries holding the rest.[8] Currently, the majority of the U.S. dye business is controlled by European-owned companies in the United States.

Consolidation continued during the mid-1990s and is expected to continue through the year 2000 as the industry faces increasing pressure from the growth of low-cost producers in Asia and other developing countries. Recent news articles indicate that many of the large multinationals have begun opening up facilities in cities such as Hong Kong in an effort to remain competitive.

3.1.4 Industry Production and Value

The U.S. International Trade Commission's (USITC) production data for the five year period from 1990 through 1994 indicated that dye production was highest in 1993 at approximately 160,000 tons. Production declined in 1994 to approximately 156,000 tons. Dye manufacturing plants were at 100 percent capacity from 1989 to 1990, while in 1991, manufacturing was at 90 percent of capacity.[9] More recent production and utilization information is not available.

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[8] Chemical Economic Handbook, Dyes-Supply and Demand-U.S. Producing Companies, SRI International, 1994.

[9] ibid.

The average unit value of all dyes has varied from approximately $6,000 to $6,800 per ton during the 1990 through 1993 period; data for 1994 are not available. Generally, changes in the U.S. production of synthetic dyes followed overall changes in U.S. economic activity during 1987-91.[10] See Table 3-1 for a summary of average unit prices for dyes during 1990-93. Industry experts have predicted that the demand for organic dyes will increase between 2.0 and 2.5 percent annually through the end of the century.[11]

Table 3-1. Total Production and Average Per Unit Values For Organic Dyes

Year	U.S. Production (1,000 Tons)	Unit Value ($/Ton)
1990	114.4	$6,774
1991	117.7	$6,466
1992	150.7	$6,052
1993	160.0	$6,300
1994	156.0	NA

Source: *Synthetic Organic Chemicals United States Production and Sales, Various Years*, USITC Publications.
NA-Not available

Environmental Regulation

Environmental and occupational health and safety regulations began to affect the cost of manufacturing organic dyes and overall production as early as the mid-1970s. While industry experts assert that production costs have increased significantly due to evolving environmental regulations, it is difficult to quantify a company's costs on a product basis since for many companies, capital and human resource expenditures are applied to many different products and functions.[12]

[10] "Synthetic Organic Chemicals United States Production and Sales, 1992," USITC Publication 2607, February 1994.

[11] "Chemical Industry Shipments Could Reach $405 billion," Chemical Market Reporter, December 22, 1997.

[12] ibid.

3.1.5 Industry Imports and Exports of Dyes

Statistics on imports and exports of dyes are not readily available from the USITC. However, import and export data are available for synthetic organic coloring matter (Harmonized Tariff Schedule (HTS) 3204), which consists primarily of dyes and pigments as well as other minor volume items such as lakes and toners. Import and export data are presented below for the period 1992 through 1998 for HTS 3204, which represents dyes and pigments, combined.

Table 3-2. Synthetic Organic Coloring Matter (HTS 3204) Import and Export Data

Year	U.S. Imports (1,000 Tons)	U.S. Exports (1,000 Tons)
1992	66.2	45.1
1993	74.4	52.4
1994	79.8	63.1
1995	77.1	66.6
1996	85.6	64.1
1997	99.6	79.9
1998	104.7	89.4

Source: Data compiled from the U.S. Department of Commerce, the U.S. Treasury, and the USITC.

As Table 3-2 shows, during the period 1992 through 1998 imports increased by more than 50 percent. During this same time, exports increased even more dramatically both in percentage terms as well as in total volume. However, despite this growth in exports, the U.S. continues to be a net importer of dyes and pigments.

Considering only dyes, import and export data are readily available only through 1994. In 1994, U.S. dye imports (approximately 60,00 tons) represented approximately 38 percent of total estimated U.S. dye production (156,000 tons), while U.S. exports (approximately 25,000 tons) made up just 16 percent of overall U.S. dye production.

Imports from India, the People's Republic of China, Taiwan, the Republic of Korea, and other lesser developed countries are expected to increase. These countries have become more sophisticated in the manufacture of dyes and are providing more consistent and better quality dyes. These countries are expected to be economically competitive since their labor costs are significantly lower and they typically have much less stringent environmental regulations.

Significant factors affecting the demand for U.S. exports and competition in international markets include foreign tariff and non tariff barriers. This is apparent in the Canadian market, which does not have a dye industry and imposes few or no restrictions on dye trading. Canada has thus become one of the world's principal dye export markets.

3.2 Organic Pigments Industry Characteristics

Similar to organic dyes, the organic pigments industry is classified under NAICS 325132, Synthetic Organic Dye and Pigment Manufacturing. The following subsections describe selected characteristics of the organic pigments industry.

3.2.1 Overview of Products and Processes

The Color Pigment Manufacturers' Association (CPMA) defines pigments as "colored, black, white, or fluorescent particulate organic or inorganic solids, which usually are insoluble in, and essentially physically and chemically unaffected by, the vehicle or substrate in which they are incorporated." According to the CPMA, the primary difference between pigments and dyes is that pigments are insoluble in the substance during the application process while dyes are soluble in the substrate. Pigments retain a crystalline or particulate structure and impart color by selective absorption or by scattering of light.

The approximate percentage of synthetic organic pigments by use during 1991-1995 was as follows: inks (60%), paints and coatings (25%), plastics (10%), and other (5%). Pigments are used primarily in printing inks. There are fewer pigments produced than dyes, however, pigment batches generally are larger in size. In 1995, approximately 72,000 tons of inorganic pigments were produced in the U.S.[13]

Organic pigments are derived in whole or in part from benzenoid chemicals and colors and are described as being toners or lakes. These pigments essentially are the same in final form, but differ in their preparation method. A lake is an organic pigment produced by the interaction of a soluble dye, a precipitant, and absorptive inorganic substrate. A toner is an insoluble dye produced as a powder; some toners are extended by the inclusion of a solid diluent.

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[13] "Industry and Trade Summary Synthetic Organic Pigments," USITC Publication 3021, February 1997.

The general process used in the manufacture of pigments is similar to the process used for dyes. The manufacture of pigments, however, often requires further processing of the press cake resulting from earlier processing. The pigments are processed.....

[Relevant data are not included at the present time due to confidentially concerns.]

3.2.2 Profile of Industry Facilities - Organic Pigments

The 1992 Census of Manufacturers,[14] the most recent data available, provides some information on the organic pigment industry. In 1992, there reportedly were 42 establishments listed under SIC Code 28653, Synthetic Organic Pigments, Lakes, and Toners. An estimated 4,500 individuals were employed by the industry and total industry wages were approximately $166 million.

3.2.3 Market Structure

During the 1980s, the colored pigments industry was dramatically restructured due to globalization of pigment markets, competitive factors, and the increasing cost of plant improvements to meet governmental standards, particularly in the United States. A number of smaller producers, unable to compete with larger international firms, closed their plants or were acquired by larger firms, primarily Western European or Japanese. Product lines were realigned

[14] Industrial Organic Chemicals, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1992.

toward more profitable higher-value pigments. Production of some lower-value pigments ceased or was transferred to countries in regions with lower labor costs and lower environmental standards.[15]

Consolidation continued during the early 1990s and today the synthetic organic pigments industry is a specialty segment of the chemical industry and accounts for only a small portion of total chemical industry sales. The synthetic organic pigments industry is comprised of a few large multinational companies and a number of smaller pigment companies that specialize in a few product lines. Sales of organic pigments make up a relatively small portion of the multinational's overall chemical sales.

3.2.4 Industry Production and Value

The synthetic organic pigments industry is a mature, slow growth industry, whose products are purchased by intermediate industries according to specific requirements for a final product. Inks account for over half of total pigment sales followed by paints and coatings, and plastics. The highest growth rate in organic pigment production is expected in plastics applications, where development and use of specialty high performance organic products continues to increase.[16]

Due to its end-uses, pigments consumption generally is dependent on general business conditions. Coatings and plastics are purchased in large quantities by the housing and automobile industries, both highly cyclical industries. Colored inks are used in advertising, which to a lesser extent also is cyclical.

In recent years two developments have impacted the costs, production schedules, and competitiveness of the pigments industry in most of the world's developed countries: 1) the cost and uncertain availability of chemical intermediates and 2) stricter environmental regulations.[17]

Sales of synthetic organic pigments in the U.S. may take place through one of three distribution channels, which are: 1) directly from producer or importer to pigment consumer, 2) indirectly through distributors, or 3) indirectly through other pigment manufacturers. Published list prices are available, however, prices fluctuate frequently based on supply and demand. Quantity discounts also reportedly influence pricing significantly. Table 3-2 provides the average per-ton unit values at the distributor level for all organic pigments during 1990-1995.

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[15] Chemical Economic Handbook, Organic Colored Pigments-U.S. Producing companies, SRI International, 1994.

[16] ibid.

[17] Industry and Trade Summary Synthetic Organic Pigments," USITC Publication 3021, February 1997.

Table 3-3. Total Production and Average Per-Unit Values For Organic Pigments			
Year	**U.S. Production** (1,000 Tons)	**U.S. Value** (million dollars)	**Value per Ton** (dollars)*
1991	56.4	837	$14,840
1992	62.6	965	$15,415
1993	65.6	1,053	$16,052
1994	69.9	1,116	$15,966
1995*	71.5	1,154	$16,139

Source: *Industry and Trade Summary Synthetic Organic Pigments*, USITC Publication 3021, February 1997.
*At distributor level.

The value of U.S. aggregate production of synthetic organic pigments increased by 38 percent during 1991-95, from $847 million to an estimated $1.2 billion. The quantity of pigments produced followed a similar pattern and increased by approximately 28 percent during 1991-95, from 56,000 tons to an estimated 72,000 tons. In terms of quantity, trends in organic pigment consumption during 1991-95 exhibited more cyclical behavior, declining in 1993-94 after a large increase in 1992 (which followed a slowdown in the economy in 1990 and early 1991). One industry expert commented that "from a historical perspective, 1994 was a year when demand for pigments outstripped the capacity to produce and could very well be a high watermark for capacity utilization."[18]

Chemical Intermediates

During the manufacturing process, certain advanced chemical intermediates are produced. These intermediates are critical to a specific class of pigments, have their own markets, and are traded worldwide. Industry experts have noted that these intermediates can account for as much as 60 percent of the cost of a pigment thus, making them a critical factor in determining a pigment's ultimate price.[19] During the 1980s several of the major manufacturers ceased production of many of the intermediates used in the production of pigments. This was partly due to supply shortages, but also due to increased regulations in Western Europe, Japan and the United States.[20]

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[18] Industry and Trade Summary Synthetic Organic Pigments," USITC Publication 3021, February 1997.

[19] ibid.

[20] ibid.

This shortage of pigments resulted in significant price increases in the pigments industry. In an attempt to counter price increases, many U.S. manufacturers as well as pigment manufacturers in other industrialized countries sought new intermediate supply sources in developing countries and/or temporary suspensions of U.S. duties on imported intermediates. It has been reported, however, that to date, developing countries do not have sufficient capacity to meet industry needs. As a result of these shortages, chemical intermediate prices have increased on average about 20 percent since 1990.[21]

Environmental Regulation

Environmental and occupational health and safety regulations began to affect the cost of manufacturing organic pigments as early as the mid-1970s. While industry experts assert that production costs have increased significantly due to evolving environmental regulations, it is difficult to quantify a company's costs on a product basis since for many companies, capital and human resource expenditures are applied to many different products and functions.[22]

3.2.5 Industry Imports and Exports

The U.S. International Trade Commission (USITC) reports that the pigments industry is a global industry with imports having a significant impact on the U.S. market. The industry is very cyclical and therefore during economic slow downs, firms may be compelled to lower price and profit margins in order to maintain their market share.

Pigments are characterized by technical requirements as well as by color. In recent years, imports of lower technical requirement pigments have increased, with the Republic of Korea and Japan being the major suppliers. Unlike dyes, the U.S. remains a net exporter of pigments. See Table 3-4 for information on U.S. imports and exports during 1991-1995.

Imports

The major synthetic organic pigments suppliers to the United States have been Germany (38%), Japan (16%), Switzerland (11%), and the United Kingdom (8%). In 1995, these four countries accounted for 73 percent of the value of organic pigments imports while the four largest European suppliers located in Germany, Switzerland, the United Kingdom, and France accounted for 63 percent of the U.S. imports. Japan has been a major source of ink-related imports.[23]

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[21] ibid.

[22] ibid.

[23] ibid.

During the 1990s, China and India have emerged as important suppliers. Each country increased its sales to the U.S. from less than $1 million in 1989 to over $12 million and $7 million, respectively in 1995. China, India, and Taiwan together were responsible for eight percent of U.S. synthetic organic pigment imports. These three countries primarily export commodity pigments and, according to industry experts, important to both country's competitive positions is their ability to maintain low unit values relative to more advanced industrial suppliers. Analysts expect this trend to continue and note that increased Chinese imports place downward pressure on a large number of lower priced pigments, resulting in reduced profit margins for domestic manufacturers.[24] See Table 3-4 for information on U.S. imports and exports during 1991-95.

Exports

The primary export markets for U.S. synthetic organic pigments are Canada (20%), Belgium (17%), the United Kingdom (11%), and Japan (7%). During 1991-95, total U.S. organic pigments exports increased 50 percent from $200 million in 1991 to $299 million in 1994, with a slight decline in 1995. Reportedly, European countries are expensive producers in select products. In response, Canadian purchasers are purchasing more from the U.S. The most significant export products for U.S. producers were reported to be mid-value ink pigments in terms of volume, and higher performance ink and coatings pigments in terms of value. A large portion of U.S. exports to Europe were believed to be sales by large European-owned multinational companies with production facilities in the U.S.[25] See Table 3-4 for information on U.S. imports and exports during 1991-95.

Table 3-4. U.S. Imports and Exports 1991-1995 - Organic Pigments

Year	U.S. Imports ($million)**	U.S. Imports (1,000 Tons)	U.S. Exports ($million)**	U.S. Exports (1,000 tons)
1991	$208	15.2	$200	23.9
1992	$244	16.6	$223	27.2
1993	$267	18.9	$267	32.8
1994	$306	20.1	$299	38.5
1995*	$306	20.7	$283	38.5

Source: *Industry and Trade Summary Synthetic Organic Pigments*, USITC Publication 3021, February 1997.
*Values estimated.
**At distributor level.

[24] ibid.

[25] ibid.

U.S. imports ranged from a low of 27 percent of U.S. pigment production in 1991 to as high as 29 percent of production in 1995. Exports grew more substantially, representing 42 percent of production in 1991 and rising to as high as 55 percent of production in 1994.

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4.0 HAZARDOUS WASTE GENERATION AND MANAGEMENT

Two wastes generated during the production of dyes and pigments are proposed for listing as hazardous under RCRA. The first section of this chapter examines the two wastes, the quantity generated, current management practices, compliance management practices after listing, and the costs of managing these wastes by the dye and pigment manufacturers. Information on quantities of waste generated and current management practices are based on the 1998 update to the RCRA 3007 Questionnaire which includes information reported by *[Relevant data are not included at the present time due to confidentially concerns.]* affected facilities owned and operated by *[Relevant data are not included at the present time due to confidentially concerns.]* dye and pigment manufacturers.

The second section of the chapter examines the landfills affected by the proposed listing. It addresses the amount of leachate generated and current and compliance waste management options and costs.

4.1 Dye and Pigment Hazardous Wastes

The two wastes proposed for this listing are spent filter aids, diatomaceous earth, or absorbents used in the production of azo, anthraquinone, or triarylmethane (TAM) dyes or pigments (K167) and wastewater treatment sludge from the production of TAM dyes and pigments (K168). The generation of spent filter aids and TAM wastewater treatment sludge is common to both the dyes and pigments industries.

K167 - Spent filter aids, diatomaceous earth, or absorbents used in the production of azo, anthraquinone, or triarylmethane dyes or pigments:

[Relevant data on process are not included at the present time due to confidentially concerns.]

K168 - Wastewater treatment sludge from the production of TAM dyes and pigments (excluding triarylmethane pigments using aniline as a feedstock):

[Relevant data on process are not included at the present time due to confidentially concerns.]

The process flow diagram previously contained on this page was omitted due to business confidentiality concerns.

4.1.1 Annual Hazardous Waste Quantities and Number of Waste Streams

Annual hazardous waste quantities are estimated on a plant specific level for each newly listed waste. This section describes the development of the annual hazardous waste quantities considered in this analysis.

Methodology

The waste streams considered in this assessment are reported and analyzed as combined quantities.

[Relevant information from the remainder of this paragraph is not included at the present time due to business confidentially concerns.]

Data Limitations

Waste quantity data only are reported for *[Relevant data are not included at the present time due to confidentially concerns.]* dye and pigment waste streams. Information regarding other waste quantities or management practices at the facilities were not available. For example, transportation cost savings (over the estimates presented) may be realized if other wastes are co-managed with the waste streams currently proposed to be listed. *[Relevant data are not included at the present time due to confidentially concerns.]* of the facilities report that they *[Relevant data are not included at the present time due to confidentially concerns.]* Consequently, the costs for managing these wastes may be higher than estimated because of the Mixture Rule, which would require that the complete volume of waste be considered hazardous. *[Relevant data are not included at the present time due to confidentially concerns.]* Some facilities did not report a waste quantity for 1997, when appropriate, quantities were estimated based on 1991 reported waste volumes.

Waste Summary

All information previously contained in this section has been omitted due to business confidentiality concerns.

4.1.2 Current (Baseline) and Compliance Waste Management Practices

Current waste management practices are provided in the update to the RCRA 3007 Questionnaire by facilities in the dyes and pigments industries. Future post listing compliance waste management practices assume the promulgation of land disposal restrictions (LDRs). The compliance management practice assumed is RCRA Subtitle C hazardous waste incineration, with disposal of the resulting ash in a Subtitle C landfill. Stabilization of the incinerator ash is not assumed given the lack of hazardous metal constituents in the wastes. Table 4-1 summarizes the baseline and compliance waste management practices for the two wastes impacted by the listing.

While most facilities currently manage their wastes in *[Relevant data are not included at the present time due to confidentially concerns.]* ..... Currently, the most common management methods are *[Relevant data are not included at the present time due to confidentially concerns.]* Other management practices reported include: *[Relevant data are not included at the present time due to confidentially concerns.]*

The assumed compliance management practice for all waste is RCRA Subtitle C incineration. *[Relevant data are not included at the present time due to confidentially concerns.]*

Table 4-1. Listing of Baseline and Compliance Management Practices

Baseline Management Practice	Compliance Management Practice
[Relevant data are not included at the present time due to confidentially concerns.]	Subtitle C Incineration and Subtitle C Landfill of Ash
	Subtitle C Incineration and Subtitle C Landfill of Ash
	Subtitle C Incineration and Subtitle C Landfill of Ash
	Subtitle C Incineration and Subtitle C Landfill of Ash
	[Relevant data are not included at the present time due to confidentially concerns.]

4.1.3 Regulatory Options

The following three regulatory options for the management of the two waste streams examined in this assessment were considered:

1. *No Listing-Status Quo:* If these two waste streams are not listed as hazardous, the affected facilities will not be required to comply with RCRA Subtitle C regulations. Thus, they will not incur incremental management and administrative costs required under RCRA Subtitle C. However, per EPA's human health risk assessment for the groundwater pathway, these facilities may be subject to future long-term human health and environmental liabilities for groundwater damages associated with unlined off-site landfills. In addition, if no regulation is promulgated, these facilities may choose to construct and dispose these wastes in unlined on-site landfills. Management in off-site municipal solid waste (lined) landfills may pose minimal future liability. However, the Agency has no mechanism in place to assure placement in properly lined landfills with leachate collection. Future liabilities from industrial landfills may decrease if EPA passes RCRA Subtitle D regulations controlling leachate releases, which are currently under development. However, since these regulations are not in place, future private and social liability costs from groundwater damages may be triggered from litigation (i.e., third-party damage claims by neighboring private individuals and businesses or local or state government entities), property transfers, or abandoned property cleanup (i.e., Brownfield or Superfund remediation).

2. *Concentration Based Listing:* The Agency is proposing a concentration-based listing given the wide variation in the types of constituents and concentrations present in these two waste streams. Facilities may test each batch of waste or selected batches that will represent the potential maximum constituent concentrations that may be observed given the various products manufactured. At a minimum, four representative samples of the waste are collected and each analyzed for the constituents of concern. Once again, the samples must be adequate to determine the maximum levels of constituents that may be present in the waste. Facilities may apply process knowledge (knowledge of the constituents in the waste based on the materials, degradation products, and manufacturing processes used) to document that a constituent is not present in the waste. In addition, at least one representative sample of the "nonhazardous" waste must be analyzed every calendar year it is generated and when there is a process change that may adversely impact the concentration of constituents in the waste (e.g., increase the concentration of hazardous constituents in the waste). Based on the results of initial waste analysis, a more tailored list of the constituents of concern in the waste may be created and tested for in the analyses conducted annually. If concentrations exceed regulatory limits, the waste is regulated under RCRA Subtitle C and the facility will incur incremental management, administrative, and analytical costs. If managed under RCRA Subtitle C, future long-term human health and environmental liabilities for groundwater damages will be

minimal. As a sensitivity analysis, the Agency evaluated a situation where facilities decide to conduct no sampling and always manage their waste under RCRA Subtitle C to save on initial and annual sampling and analytical costs.

3. *Standard Listing (Includes all Wastes):* If these two waste streams are listed as hazardous, the affected facilities will be required to comply with RCRA Subtitle C regulations. Thus, they will incur incremental management and administrative costs required under RCRA Subtitle C, but, analytical costs associated with the Concentration Based Listing will not be incurred. If managed under RCRA Subtitle C, future long-term human health and environmental liabilities for groundwater damages will be minimal. However, the standard listing will effectively define as hazardous all of the waste generated, regardless of the presence or concentration of hazardous constituents.

This assessment examines the economic impacts to the affected facilities based on Option 2, Concentration Based Listing. This assessment also examines the scenario where facilities conduct no sampling/analysis and always manage their waste under RCRA Subtitle C. This sensitivity scenario is similar to Option 3 above.

4.1.4 Current (Baseline) Management and Compliance Management, Administrative and Sampling Costs

Baseline Management Costs

Costs for current (baseline) waste management practices were not provided by the affected facilities in response to the update of the RCRA 3007 Questionnaire. Baseline management and transportation costs have been estimated using unit costs from R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998), unless otherwise noted. The unit costs for the baseline management methods are presented in Table 4-2.

Compliance Management Costs

Cost estimates for compliance management activities have been derived using unit costs from R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998) and additional data on incineration unit prices obtained from the authors of this reference, Agency knowledge, and Agency contractor knowledge. Cost estimates for compliance transportation and analytical activities have been derived using unit costs from R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998) and vendor quotes from an analytical laboratory. The unit costs for managing and sampling the waste under both baseline and compliance scenarios are presented in Table 4-2.

Table 4-2. Summary of Management, RCRA Administrative and Sampling Unit Costs	
Management Practice	**Unit Cost[1]**
[Relevant data are not included at the present time due to confidentially concerns.]	*[Relevant data are not included at the present time due to confidentially concerns.]*
Subtitle D/Municipal Landfill (excluding transport)	$74.67/ton or $69.14/Jumbo Bag
[Relevant data are not included at the present time due to confidentially concerns.]	*[Relevant data are not included at the present time due to confidentially concerns.]*
[Relevant data are not included at the present time due to confidentially concerns.]	*[Relevant data are not included at the present time due to confidentially concerns.]*
[Relevant data are not included at the present time due to confidentially concerns.]	*[Relevant data are not included at the present time due to confidentially concerns.]*
Transportation in Jumbo Bags (0-200 miles)	$52.72/ton or $48.82/Jumbo bag
Transportation for Each Mile over 200 miles	$0.17/ton/mile or $0.16/Jumbo bag/mile
RCRA Part 262 Administrative Compliance Costs: Initial Costs - evaluate regulations listing new wastes and review packaging, labeling and manifest procedures/programs Annual Costs - completing manifests, packaging and labeling, and biennial reporting	Initial Cost: $700/facility Annual Cost: $900/facility
Sampling and Analytical Testing for Total Concentrations	11 Constituents: $153/sample 32 Constituents: $246/sample 84 Constituents: $476/sample
Sampling and Analytical Testing for TCLP Concentrations	11 Constituents: $173/sample 32 Constituents: $305/sample 84 Constituents: $629/sample

[1] 1998 Dollars

Because there are fewer Subtitle C incinerators than Subtitle D and C landfills, total transport distances likely will increase with the promulgation of the rule. Transportation distances are assumed to be the following: 50 miles to the nearest Subtitle D landfill, 200 miles to the nearest Subtitle C landfills, and 200 miles to the nearest Subtitle C incinerator. The distances for the latter two management methods were chosen based on the proximity of the *[Relevant data are not included at the present time due to confidentially concerns.]* nearest commercial Subtitle C landfill and incineration facility. However the transportation unit costs are based on a minimum fixed fee (i.e., flat charge) up to 200 miles. Therefore, the cost to transport a load 10 miles is assumed to be the same as 200 miles. The assumed distances to Subtitle D landfills and Subtitle C incinerators do not change the transportation costs per ton or jumbo bag given that RCRA administrative costs (e.g., manifests) are treated separately below. It also is assumed that at least four shipments will be required each year due to the 90-day hazardous waste storage time limitation. This storage time limitation increases the shipment frequency and associated compliance costs for some facilities.

RCRA Administrative and Sampling Compliance Costs

Facilities generating the proposed waste listings are subject to Part 262 of RCRA. Compliance activities for Part 262 are briefly described below.

RCRA Part 262 standards regulate generators of hazardous waste. All facilities producing a newly listed waste will be subject to this standard. There are four primary requirements specified in the Part 262 standards. First, plants generating hazardous waste must obtain an EPA identification number. Second, an approved manifest system must be established for those facilities shipping wastes off site. Third, before transporting hazardous waste off site, a series of pre-transport requirements must be satisfied such as labeling, marking, and placarding. Fourth, specified record keeping and reporting rules are applicable.

All of the facilities affected by this proposed listing are assumed to have already been effected by the previous proposed listing (*Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Dye and Pigment Industries; Hazardous Waste Listing Determination Policy; and CERCLA Hazardous Substance Designation and Reportable Quantities; Proposed Rules*, December 22, 1994). Therefore, minimal incremental administrative costs are assumed to be incurred as a result of this listing. The incremental costs associated with adding an additional waste stream to the compliance activities under RCRA Part 262 are included in the incremental costs for this listing. The administrative and ongoing costs are based on estimates for activities required by 40 CFR Part 262 made for the previous ruling.

The incremental costs for this listing associated with RCRA Part 262 are estimated based on the assumption that the facilities are currently hazardous waste generators and that all wastes are managed off site. The initial (i.e., one-time) costs to evaluate regulations listing the new wastes and review procedures/programs for packaging, labeling and manifesting wastes are estimated to be $700 per facility. The annual costs associated with additional time required for completing manifests for newly listed wastes, additional packaging and marking, and completing the biennial report are estimated to be $900 per year per facility. Initial costs are annualized assuming a discount rate of 7 percent over 20 years (i.e., using a capital recovery factor (CRF) of 0.09439). The annualized costs associated with RCRA Part 262 are therefore estimated to be $1,000 per year ($66 in annualized initial costs [$700 at 7% over 20 years] + $900 in annual costs = $966 ~ $1000).

Sampling and analytical costs in this analysis are based on the assumption that all batches produced at each facility will be sampled in the first year to determine the concentration level of the hazardous constituents. Sampling needs are assumed to be reduced in subsequent years. Sampling frequency in the first year for small, medium, large, and extra large facilities were assumed to be 4, 6, 12, and 18, respectively. Sampling frequencies of 1, 2, 4, and 6 are assumed for each subsequent year. For purposes of this assessment, first year sampling costs are annualized over a period of 20 years (as with the administrative costs described above).

Sampling costs are based on the expected assumption that *[Relevant data are not included at the present time due to confidentially concerns.]*. Sampling costs include the costs to take the sample, package, transport, analyze, and report the results. The analysis costs were estimated assuming analysis for total concentrations. The annualized sampling costs for *[Relevant data are not included at the present time due to confidentially concerns.]* are estimated to be $153/sample, and the sampling costs for *[Relevant data are not included at the present time due to confidentially concerns.]* are estimated at $246/sample. Sampling and analytical unit costs for determining total and TCLP concentrations for *[Relevant data are not included at the present time due to confidentially concerns.]* constituents are presented in Table 4-2.

In completing this analysis it is assumed that RCRA Parts 264 and 270 do not apply. Part 264 addresses standards for owners and operators of hazardous waste treatment, storage and disposal facilities. The assumption is made in completing this assessment that all facilities will be following the hazardous waste accumulation regulations from CFR Part 262.34 (i.e., accumulation time) and therefore Part 264 does not apply. Part 270 (i.e., permitting) applies to facilities with on-site treatment units subject to Part 264. It is assumed that all waste affected by this ruling will continue to be managed off site. Therefore, no permitting is required for existing or future units. The waste streams affected by this ruling are generated in small quantities at each facility. It is not economical to construct on-site treatment units such as incinerators for these quantities of waste. However, if the facilities constructed an on-site incinerator to handle the wastes under the previous listing, the compliance costs for management of wastes subject to this listing would be less than estimated in this analysis by utilizing those existing on-site incinerators.

4.1.5 Corrective Action Compliance Costs

Incremental corrective action costs associated with unpermitted facilities include the cost to conduct a RCRA Facility Investigation (RFI), a Corrective Measures Study (CMS), and remediate solid waste management units (SWMUs) and areas of concern (AOCs). Because of the previous listing, all of the *[Relevant data are not included at the present time due to confidentially concerns.]* affected by this proposed rule will already have triggered the above corrective action compliance costs if they generated enough of the previously proposed wastes warranting the construction of an on-site RCRA-permitted storage or incineration facility. Therefore, all applicable corrective action compliance costs are included with the incremental costs for the previous proposed listing. Furthermore, none of the *[Relevant data are not included at the present time due to confidentially concerns.]* generate filter aid and TAM sludge waste in large enough quantities to warrant seeking a RCRA Part B permit for constructing and operating an on-site storage or incineration facility. It will be more cost effective to operate 90-day accumulation areas, which do not require a RCRA permit, prior to shipping wastes off site for incineration. As a result, no incremental costs for corrective action compliance are assumed to be incurred in response to this proposed listing.

4.1.6 Incremental Compliance Costs

The total costs for baseline management and each compliance management, analytical and administrative activity are calculated based on the unit costs listed in Table 4-2. Table 4-3 presents an example calculation for a hypothetical facility. The table demonstrates how the costs for baseline and compliance are derived for both the expected and worst-case scenarios. Similar calculations are performed for each of the *[Relevant data are not included at the present time due to confidentially concerns.]* and the cumulative results are presented in Table 4-4. Table 4-4 presents the aggregate nationwide baseline, compliance, and incremental compliance costs derived for the management of both waste streams, assuming 100 percent of all wastes contain one or more constituent concentrations greater than their hazardous regulatory level identified in the listing. The range in analytical costs reflects a situation where facilities decide to conduct no sampling and always manage their waste under RCRA Subtitle C to save on initial and annual sampling and analytical costs.

For the three regulatory options assessed, incremental compliance costs for Option 1, No Listing, are zero. Incremental compliance costs for *[Relevant data are not included at the present time due to confidentially concerns.]*. It is possible that some wastes will not exceed regulatory limits which will reduce the expected range of incremental compliance costs. Incremental compliance costs for Option 3, Standard Listing, includes all costs in Table 4-4 except analytical costs. The expected incremental compliance cost for the Standard Listing is *[Relevant data are not included at the present time due to confidentially concerns.]*.

Table 4-3. Example Incremental Compliance Cost Estimate for a Facility Generating 30 Tons or 33 Jumbo Bags[1] of Waste Per Year				
Cost Item	**Expected Case**		**Worst Case**	
	Assumptions	Calculations	Assumptions	Calculations
Baseline				
Management	*[Relevant data are not included at the present time due to confidentially concerns.]*			
Transportation				
Total Baseline Costs				
Compliance				
Management	*[Relevant data are not included at the present time due to confidentially concerns.]*			
Transportation	*[Relevant data are not included at the present time due to confidentially concerns.]*			
Initial Analytical				
Annual Analytical				
Administrative				
Total Compliance Costs	*[Relevant data are not included at the present time due to confidentially concerns.]*			
Incremental Costs				
[Relevant data are not included at the present time due to confidentially concerns.]				

Table 4-4. Aggregate Nationwide Baseline, Compliance, and Incremental Cost Estimates ($1998)		
	Annual Costs for Industry	
	Expected	**Worst Case**
Baseline		
Management and Transportation [1]	*[Relevant data are not included at the present time due to confidentially concerns.]*	
Total Baseline Costs		
Compliance		
Management and Transportation	*[Relevant data are not included at the present time due to confidentially concerns.]*	
Analytical [2]	$0 - $6,000	$0 - $9,000 [3]
Administrative	$13,000	$13,000
Total Compliance Costs	*[Relevant data are not included at the present time due to confidentially concerns.]*	
Incremental (Compliance Total less Baseline Total)		
Average Incremental Cost per Ton		
[Relevant data are not included at the present time due to confidentially concerns.]		

4.2 Leachate Management Costs for Municipal and Industrial Waste Landfills Containing Dye and Pigment Industry Wastes

Disposal practices for these two organic dye and pigment industry wastes include municipal landfills. In 1991 (56 FR 50978, October 9, 1991) EPA promulgated municipal solid waste (MSW) landfill management design and operating criteria under Subtitle D of RCRA, effective October 9, 1993. Design criteria require the installation of leachate collection systems at new landfills (or lateral expansions of existing landfills). Subsequently, leachate derived from the two wastes traditionally has been collected and recirculated, treated, or disposed. Because of the proposed listing, collected leachate from these landfills (i.e., cells) are hazardous under the Derived-from Rule. Also, when the leachate from these two wastes mixes with leachate from other wastes disposed in these landfills, the entire leachate quantity is considered hazardous under the Mixture Rule. Neither of these rules apply if the concentrations for the constituents of concern in the leachate do not exceed regulatory limits based on a concentration based listing. Even though EPA has not developed management design criteria for industrial waste landfills, many of these landfills have been designed according to MSW landfill regulations in preparation of future federal regulations or to meet current state regulations.

Therefore, many industrial waste landfills also collect leachate that will be considered hazardous under the proposed listing. By changing the regulatory status of this leachate to be covered under Subtitle C of RCRA, MSW and industrial landfills that have accepted these wastes may be subject to an increase in leachate management costs.

Based on a review of the 1992 RCRA 3007 Questionnaire and 1998 Update, the Agency estimates that approximately *[Relevant data are not included at the present time due to confidentially concerns.]* have received these two organic dye and pigment industry wastes and also have leachate collection systems. It is highly probable that these *[Relevant data are not included at the present time due to confidentially concerns.]* are located within 50 miles of the organic dyes and pigments facilities.[26]

4.2.1 Regulatory Options

The following three leachate management regulatory options are evaluated:

1. *No List:* Do not list the filter aids and TAM wastewater treatment sludge as hazardous wastes. Leachate generated at MSW landfills is subject to management requirements under Subtitle D of RCRA. Leachate generated at industrial waste landfills is subject to applicable state and local regulations.

2. *Clean Water Act Temporary Deferral (Two-Year Impoundment Deferral):* Upon promulgation/signature of listing these wastes the landfill leachate is deferred from being regulated as hazardous under RCRA Subtitle C if it is appropriately managed under the Clean Water Act (e.g., NPDES discharge, POTW disposal via pipeline, and trucking to an off-site POTW) or through recirculation. After two years, impoundments will no longer be allowed to apply this deferral. If the leachate is managed in a surface impoundment after two years the impoundment will be subject to regulation under Subtitle C. This regulatory option assumes that landfill operators will avoid Subtitle C regulation by building tank systems to replace their impoundments before the two-year deadline. However, after two years these impoundments can still be used for emergency storage of exempt leachate and it will continue to remain exempt from Subtitle C regulation. This is the Agency's preferred option.

3. *Standard Listing:* Treat the leachate as hazardous waste and subject to full Subtitle C regulation under the Derived-from and Mixture Rules unless under the concentration based listing the constituents of concern do not exceed regulatory limits. Existing exemptions apply under the Standard Listing regulatory option including the wastewater treatment tank exemption. On-site tanks and associated piping are not Subject to Subtitle C permits and standards if either of the following two exclusions are applicable: Industrial Point Source exclusion (excludes leachate/wastewater once it is directly discharged under a NPDES permit), and, domestic sewage exclusion (excludes hazardous waste introduced into sewers en route to POTWs). In addition, leachate collection tanks are considered to be an integral part of the leachate collection system at Subtitle C landfills and do not need to meet Subpart J

[26] Each facility is assumed to dispose of waste in the region in which it is located.

standards for tanks. Leachate collected and recirculated back into the landfill the Agency considers not to be "actively managed" outside the landfill unit and therefore does not trigger listing regulations. Off-site shipment, direct discharge to a POTW not through a sewer line, and management in impoundments are management practices that are not exempt.

4.2.2 Baseline Leachate Management Practices

Comments received by the RCRA Docket Information Center, Office of Solid Waste, pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169-K172), provide a sample of how leachate management is distributed. Data on leachate management practices and quantities were received for 58 landfills operated by Browning-Ferris Industries (BFI), Waste Management, Inc. (WMX), members of the National Solid Waste Management Association, Superior Services, and the West Contra Costa Landfill. The distribution of management practices for these landfills are assumed to be representative of the landfills that likely received spent filter aids and TAM wastewater treatment sludge from organic dyes and pigments facilities.

Table 4-5 presents the distribution of leachate management practices and the application of this distribution to the population of landfills affected by the proposed dye and pigment waste listings. In addition, these data also were used to predict the number of surface impoundments that manage leachate. Reported leachate management practices from the most to least prevalent are trucking to an off-site POTW (31%), discharge via pipe to an off-site POTW (21%), recirculation back into the landfill for dust control and possible treatment or attenuation with wastes present in landfill (19%), trucking a portion of the volume to an off-site POTW and recirculating the majority of the leachate (12%), direct discharge to surface water via an NPDES permit (9%), and evaporation in a pond (2%). Approximately 7 percent of the landfills do not generate any leachate (or condensate from methane off-gas treatment) because they are located in an arid climate. Applying this distribution of management practices to the population of *[Relevant data are not included at the present time due to confidentially concerns.]* which received the two dye and pigment manufacturing wastes produces the following results: *[Relevant data are not included at the present time due to confidentially concerns.]*

Approximately 14 percent of the landfills utilize surface impoundments in their leachate management practices. These impoundments are used for either evaporating leachate, oxidation treatment (assume biological) of leachate prior to discharge, temporary storage prior to recirculation, and emergency storage. The distribution of landfills utilizing surface impoundments in their leachate management practices from most to least prevalent is as follows: NPDES discharge (7%), recirculation only (3%), trucking to off-site POTW and recirculation (2%), and evaporation pond (2%). The remaining landfills (86%) do not utilize surface impoundments in their management practices (see Table 4-5). For the population of *[Relevant data are not included at the present time due to confidentially concerns.]* the landfill that discharge directly to a NPDES outfall is assumed to utilize a surface impoundment for biological oxidation purposes prior to discharge.

Table 4-5. Distribution of Leachate Management Practices for Landfills that Received Petroleum Wastes								
	Trucked to POTW	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**Evaporation Pond**	**No Leachate/ Condensate**	**Total**
BFI Sample [1]	11 [2]	2	6	5	1 (1 SI)	0	2	27
WMX Sample [1]	5	5 (1 SI)	4 (2 SI)	6 (1 sewer, 1 recirc.)	2 (2 SI)	1 (1 SI)	2	25
NSWMA Survey [1]	Yes (assume 2)		Yes (assume 1)		Yes (assume 1)			4
Superior Services [1]					1 (1 SI)			1
West Contra Costa Landfill [1]				1				1
No. of Landfills Conducting Each Leachate Management Practice	18 (0 SI)	7 (1 SI)	11 (2 SI)	12 (0 SI)	5 (4 SI)	1 (1 SI)	4 (0 SI)	58 (8 SI)
Leachate Management Distribution (SI Distribution)	31.0% (0.0%)	12.1% (1.7%)	19.0% (3.4%)	20.7% (0.0%)	8.6% (6.9%)	1.7% (1.7%)	6.9% (0.0%)	100% (13.7%)
Extrapolation of Petroleum Sample Leachate Management Distribution to Total Population of Landfills Receiving Dye and Pigment Wastes								
No. of Landfills Conducting Each Leachate Management Practice [3,4]	*[Relevant data are not included at the present time due to confidentially concerns.]*							

SI: Surface Impoundment; Yes: The survey reported this leachate management practice was being conducted. The number of survey respondents conducting this practice was not provided and had to be assumed.

[1] Comments received by RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169, K170, K171, and K172), published August 6, 1998, FR 151, Vol. 63. Document Nos. PR3A-00008, PR3A-L0001, PR3A-00002, PR3A-00006, and PR3A-00007.

[2] One landfill only generates condensate (no leachate) that is trucked to an off-site POTW. Document No. PR3A-0008.

[3] In 1996, approximately 2,400 MSW landfills were reported in the contiguous U.S. U.S. EPA, *Characterization of Municipal Solid Waste in the United States: 1997 Update*, EPA530-R-98-007, May 1998, pp. 11. The industrial landfill leachate collection system requirements have yet to be proposed under RCRA Subtitle D. Therefore, it is unknown how many of these landfills had leachate collection systems to comply with state regulations.

[4] *[Relevant data are not included at the present time due to confidentially concerns.]*

4.2.3 Leachate Quantities

The Agency used leachate data provided by BFI and WMX as a representative sample of leachate generation quantities. Average annual generation quantities per landfill were estimated for each leachate management practice. The data were divided by leachate management practice because the quantity of leachate to be managed often dictates the chosen management practice.

Leachate quantities are dependent upon the geographic location, area, leachate collection system design, and operation of the landfill. The Agency does not have site-specific data on landfills to assess these factors at landfills which have received spent filter aids and TAM wastewater treatment sludge.

Leachate quality (chemical strength) and quantity are reduced in the first few years after closure. The chemical strength goes up for a while after closure (increase in biological oxygen demand, BOD) and then declines over time. The quantity, especially with a good final cover, also declines with time. A "closed" landfill (i.e., one no longer accepting waste but having not applied the final cover) will experience a decline in leachate flows over time even though rainwater can still penetrate the landfill. The decline in leachate at a closed landfill is associated with the fact that the leachable material in the landfilled has already leached out. This decrease in leachate volume will most likely be associated with an increase in leachate chemical strength.

Leachate quantities dramatically reduce when the landfill is capped. A capped landfill minimizes the amount of precipitation that will penetrate through the landfill. Capping of a landfill cell does not always immediately follow closure. There may be permit issues that delay capping. In addition, many landfills wait until several cells close before they cap them because it makes more economic sense to cap several cells at one time.

The implementation of leachate collection systems (LCS) became a requirement under the Subtitle D MSW landfill regulations in 1993. Therefore, leachate from these two waste streams at least has been collected since then. Since MSW landfills are typically operated as a series of cells (i.e., cut-and fill trenches) the Agency assumed that one landfill cell is opened and closed every year.[27] Leachate generation from closed cells declines with time. To develop leachate quantity estimates, the Agency assessed two different cases representing different declining rates of leachate generation from closed cells. For a conservative case, the Agency assumed a linear decrease in leachate quantity (and quality) collected over a 10-year period (i.e., 10 percent reduction per year) and for an expected case, the Agency assumed a linear decrease in leachate quantity (and quality) collected over a 5-year period (i.e., 20 percent reduction per year). The methodology used to calculate the annual leachate quantity generated per landfill is presented in Appendix A.

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[27] Temple, Barker & Sloane/Clayton Environmental Consultants, ICF Incorporated, DPRA Incorporated, and American Management Systems, Inc., *Regulatory Impact Analysis for the Final Criteria for Municipal Solid Waste Landfills*, prepared for Regulatory Analysis Branch, Office of Solid Waste, U.S. Environmental Protection Agency, December 1990, p. II-23. Approximately 65 percent of all MSWLFs used a cut-and-fill (cell) method according to EPA's 1986 Municipal Solid Waste Landfill Survey of 1,250 facilities.

Table 4-6 presents the conservative and expected case for average annual quantities of leachate and condensate managed under each management practice. Average annual quantities are lower for the conservative case because the quantity is spread over a longer time period (i.e., 10 years instead of 5 years). The average leachate and condensate quantities for the 5-year expected case from highest to lowest amount are the following:

- 5.0 million gallons per year per landfill discharge via a NPDES-permitted outfall (only one data point),
- 4.2 million gallons per year per landfill discharged via pipe to a POTW,
- 2.0 million gallons per year per landfill trucked to an off-site POTW,
- 1.6 million gallons per year per landfill, for which a portion is trucked to off-site POTW and the remainder is recirculated, and;
- 0.6 million gallons per year per landfill that is recirculated.

The average leachate and condensate quantities for the 10-year conservative case from highest to lowest amount are the following:

- 4.6 million gallons per year per landfill discharge via a NPDES-permitted outfall (only one data point),
- 3.9 million gallons per year per landfill discharged via pipe to a POTW,
- 1.8 million gallons per year per landfill trucked to an off-site POTW,
- 1.5 million gallons per year per landfill for which a portion is trucked to off-site POTW and the remainder is recirculated, and;
- 0.5 million gallons per year per landfill that is recirculated.

TABLE 4-6. TEN-YEAR AND FIVE-YEAR ANNUAL LEACHATE MANAGEMENT QUANTITIES AND CAPACITIES [1]				
Management Practice	**Cost Component**	**No. of Landfills w/ Quantity Data**	**10-Year Conservative Case Average Annual Quantity**	**5-Year Expected Case Average Annual Quantity**
Trucked to POTW	Leachate Management	*[Relevant data are not included at the present time due to confidentially concerns.]*	1,583,600 gal/LF/yr	1,727,700 gal/LF/yr
	Condensate Management		211,700 gal/LF/yr	230,900 gal/LF/yr
	Storage Tank Upgrade		369,700 gallon capacity/LF	369,700 gallon capacity/LF
	Piping Upgrade		23,700 feet/LF	23,700 feet/LF
Truck to POTW/ Recirculate	Leachate Management[2]		1,453,900 gal/LF/yr	1,586,100 gal/LF/yr
	Condensate Management		1,000 gal/LF/yr	1,100 gal/LF/yr
	Storage Tank Upgrade		375,000 gallon capacity/LF	375,000 gallon capacity/LF
	Piping Upgrade		1,300 feet/LF	1,300 feet/LF
Recirculate	Leachate Recirculated		522,500 gal/LF/yr	570,000 gal/LF/yr
	Condensate Recirculated[3]		3,300 gal/LF/yr	3,600 gal/LF/yr
POTW Hardpipe	Piped to POTW		3,869,600 gal/LF/yr	4,221,400 gal/LF/yr
NPDES	NPDES Discharge		4,620,000 gal/LF/yr	5,040,000 gal/LF/yr
	Switch SI to Tank System		4,073,300 gal/yr/SI x 4 SI present at 5 LFs in sample	4,073,300 gal/yr/SI x 4 SI present at 5 LFs in sample

LF: Landfill; SI: Surface Impoundment

[1] Appendix A demonstrates how the average annual leachate and condensate quantities are calculated. Tank capacities, piping lengths and surface impoundment capacities are calculated as simple averages. Quantity and capacity data were obtained from public comments received by RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169, K170, K171, and K172), August 6, 1998, FR 151, Vol. 63. Document Nos. PR3A-00008, PR3A-L0001, PR3A-00002, PR3A-00006, and PR3A-00007.

[2] Leachate volume data provided by BFI did not indicate what percentage of the volume is recirculated and what percentage is trucked off site a POTW. A 50/50 split was assumed for the BFI sites.

[3] One site trucks 500 gallons of condensate to an off-site POTW, yet, recirculates 35,000 gallons per month of leachate. EPA assumes this landfill will begin recirculating its condensate to avoid tank storage capacity and pipe upgrade and commercial hazardous wastewater treatment costs.

4.2.4 Baseline Leachate Management Costs

Baseline (current) leachate and condensate management cost data were provided by BFI and WMX. These data were used to develop average unit cost estimates on a per year and per landfill basis for each leachate management practice. Average leachate management unit costs (1998 dollars) from most to least expensive management practice were estimated as follows: truck to an off-site POTW ($0.07/gallon), truck a portion to an off-site POTW and recirculate the remaining fraction ($0.05/gallon), discharge to an NPDES outfall ($0.04/gallon; one data point), discharge via pipe to POTW ($0.03/gallon), and recirculate ($0.01/gallon). Industry-provided unit costs decline in a trend that one would expect given the nature of the activities involved. For this part of the analysis, the Agency used only unit cost estimates derived from industry cost data to estimate baseline leachate management costs (Table 4-7).

For baseline management practices where industry did not provide cost estimates, the Agency estimated unit costs. For unlined surface impoundments, the Agency derived unit costs. Three landfill owners provided estimates of the leachate volumes they manage in impoundments (20,000 gallons/year, 200,000 gallons/year, and 12,000,000 gallons/year). The average of the three reported leachate volumes is 4,073,333 gallons per year. When estimating the size of the impoundments for developing cost estimates, the Agency assumed a two-day retention time and 365 operating days per year based on engineering judgement for the equalization, treatment, or temporary storage impoundments which result in the following capacities: 110 gallons, 1,100 gallons, and 65,750 gallons. Assuming a leachate density similar to water (7.48 gallons per cubic foot), an impoundment depth of 8 feet, and a conversion factor of 43,560 square feet per acre results in the following impoundment sizes for the three leachate generation rates: 0.00004 acres, 0.0004 acres, and 0.024 acres. In developing the baseline cost estimate the agency assumed a minimum size of 0.1 acres (66' x 66' x 8') which allows for more than a magnitude of error in the sizing assumptions. Baseline unlined impoundment cost estimates include excavation and indirect costs (e.g., engineering, contractor's overhead and profit, and contingency) and are annualized over the 20-year remaining operating life of the landfill and the 10-year conservative case and 5-year expected case RCRA-regulated life of the landfill.[28,29]

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[28] Used baseline cost estimates developed for the EPA/OSW, *Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries*, November 28, 1994, for unlined surface impoundments. Inflated the cost estimate to 1998 dollars assuming a 5 percent annual inflation rate.

[29] EPA/OSW, *Additional Listing Support Analysis for the Petroleum Listing Determination*, February 26, 1998, based on the municipal landfill survey conducted by OSW in 1986, as reported in "National Survey of Solid Waste (Municipal) Landfill Facilities", EPA/530-SW88-034, September 1988. The average age of a facility (from the year waste was first placed in the landfills to the time of survey) is 18.6 years (including closed and active units) and the average remaining life of a facility (from the time of survey to the year landfills were expected to be filled) is 21.3 years (including active and planned units).

Table 4-8 presents the estimated baseline unit cost per landfill per year for each leachate management practice. A sensitivity analysis also is presented in Table 4-8 illustrating how unit cost estimates change depending on whether a 5-, 10- or 20-year period of amortization of costs is chosen to reflect the period under RCRA regulation and the remaining life of the landfill. The calculation of annual baseline O&M unit costs per landfill is demonstrated in Appendix B.

Table 4-7. Leachate Management Unit Costs (1998 dollars)			
Baseline Management Practice	**Baseline Unit Costs**	**Compliance Management Practice**	**Compliance Unit Costs**
Truck and Discharge in Nonhazardous POTW	$0.0703/gallon of leachate[1] $0.0603/gallon of condensate[1]	Truck and Discharge in Hazardous POTW Disposal Fee	Combination of Hazardous POTW Disposal Fee and Transportation Costs listed below.
Nonhazardous POTW Discharge Fee	$1.50/1000 gallons[2]	Hazardous POTW Disposal Fee	$1.75/gallon[3] - $2.96/gallon[2]
Transportation to POTW (0-200 mi)	$0.0688/gallon of leachate[1] $0.0588/gallon of condensate[1]	Transportation to POTW (0-200 miles)	$0.0688/gallon of leachate[1] $0.0588/gallon of condensate[1]
Transportation to POTW 200+ miles	Not Applicable	Transportation to POTW (200+ miles)	$2.48/mile[2] 6,000 gal tanker and 250 miles = $0.10/gal.
Unlined Surface Impoundment (0.1 acres)	$6,000/SI[5] ($600/yr; $900/yr; $1,500/yr)[4]	Switch SI to Tank System – Aggregate of Unit Costs Below	$270,200/SI ($25,500/yr; $34,600/yr; $52,700/yr)[4]
		Sludge Removal Upon Closure of Unlined Surface Impoundment [5] (0.1 acres, 0.1% solids collected for 20 years, 50% collection efficiency)	$17.69/MT ($1.67/MT/yr; $2.52/MT/yr; $4.31/MT/yr)[4]
		New Tank System [6] (size: 16,730 - 19,010 MT/yr; 25,000 gallon capacity)	$16,600/yr; $22,600/yr; $34,300/yr[10] capital - $119,500 initial O&M - $5,600/yr 5-yr O&M - $6,300/5-yr closure - $64,800 after 20 years
		Annual Sludge Removal [5] (0.1% solids and 50% collection efficiency)	$460/MT removal - $7/MT transportation - $28/MT treatment - $425/MT
		MT = metric ton	

Table 4-7. Leachate Management Unit Costs (1998 dollars)			
Baseline Management Practice	**Baseline Unit Costs**	**Compliance Management Practice**	**Compliance Unit Costs**
Storage Tank Upgrade	Not Applicable	Storage Tank Upgrade[1]	Capacity — Annual Cost[7, 9] 750 gal — $200/yr 20,000 gal — $5,200/yr 48,000 gal — $4,500/yr 150,000 gal — $38,900/yr 178,000 gal — $46,200/yr 250,000 gal — $649,000/yr[8] 280,000 gal — $72,700/yr 500,000 gal — $130,000/yr 1,000,000 gal — $260,000/yr 2,000,000 gal — $520,000/yr
Piping Upgrade	Not Applicable	Piping Upgrade[1]	$20/foot
Truck to Nonhazardous POTW	$0.0703/gallon of leachate[1] $0.0603/gallon of condensate[1]	Truck to Hazardous POTW	Combination of Hazardous POTW Disposal Fee and Transportation Costs listed above.
Tank Upgrade Piping Upgrade	Not Applicable Not Applicable	Tank Upgrade Piping Upgrade	$1,017,000/LF[1] $473,000/LF[1]
Truck to Nonhazardous POTW/Recirculate	$0.0474/gallon of leachate[1] $0.0800/gallon of condensate[1]	Truck to Hazardous POTW/Recirculate	Combination of Hazardous POTW Disposal Fee and Transportation Costs listed above.
Tank Upgrade Piping Upgrade	Not Applicable Not Applicable	Tank Upgrade Piping Upgrade	$1,050,000/LF[1] $25,000/LF[1]
Recirculate	$0.013/gallon of leachate[1] $0.040/gallon of condensate[1]	Recirculate	Same as Baseline
POTW Hardpipe	$0.031/gallon of leachate[1]	POTW Hardpipe	Same as Baseline
NPDES Discharge	$0.040/gallon of leachate[1]	NPDES Discharge	Same as Baseline
Switch SI to Tank System	Not Applicable	Switch SI to Tank System	$270,200/SI ($25,500/yr; $34,600/yr; $52,700/yr)[10]

Table 4-7. Leachate Management Unit Costs (1998 dollars)			
Baseline Management Practice	**Baseline Unit Costs**	**Compliance Management Practice**	**Compliance Unit Costs**

[1] Unit cost data were obtained from public comments received by RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169, K170, K171, and K172), August 6, 1998, FR 151, Vol. 63. Document Nos. PR3A-00008, PR3A-L0001, PR3A-00002, PR3A-00006, and PR3A-00007. Unit costs are calculated as simple averages of the reported data.

[2] R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998).

[3] Back-calculated from a Browning-Ferris Industries estimate of $52 million per year in total O&M compliance costs to treat leachate from landfills that have received any petroleum wastes (Comments received by the RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169-K172), August 6, 1998, FR 151, Vol. 63; PR3A-00008).

[4] Annualized inflated cost assuming a discount rate of seven percent over 20 years, 10 years, and 5 years and a no salvage value, respectively (i.e., capital recovery factors of 0.09439, 0.14238, and 0.24389, respectively).

[5] Inflated cost in the EPA/OSW, *Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries*, November 28, 1994, to 1998 dollars assuming a 5 percent annual inflation rate.

[6] Inflated cost in the EPA/OSW/EMRAD, *Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C*, January 10, 1998, pp. 3-43 and 3-44, to 1998 dollars assuming a 5 percent annual inflation rate.

[7] Average of industry provided values in cost analysis excluding the noted outlier.

[8] This data point is assumed to be an outlier and not included in developing average unit costs.

[9] Annualized inflated cost assuming a discount rate of seven percent over 20 years and no salvage value (i.e., capital recovery factor of 0.09439).

[10] Annualized inflated cost assuming a discount rate of seven percent over 20 years with no salvage value, 10 years with a 10 percent salvage , and 5 years with a 20 percent salvage value, respectively (i.e., capital recovery factors of 0.09439, 0.14238, and 0.24389, respectively).

Table 4-8. Baseline Unit Cost Data (Million $/Landfill/Year; 1998 Dollars)						
Management Practice	**Cost Component**	**No. of Landfills with Quantity and Cost Data**	**5-Year Amortization**	**10-Year Amortization**	**20-Year Amortization**	
			5-Year Expected Generation Case	**10-Year Conservative Generation Case**	**5-Year Expected Generation Case**	**10-Year Conservative Generation Case**
Trucked to POTW	Leachate Management [1]		$0.14	$0.13	$0.05	$0.09
	Condensate Management [1]		$0.02	$0.02	$0.01	$0.01
TOTAL UNIT COST			$0.15	$0.15	$0.06	$0.10
Truck to POTW/ Recirculate	Leachate Management [1]		$0.08	$0.08	$0.03	$0.05
	Condensate Management [1]		$0.00	$0.00	$0.00	$0.00
TOTAL UNIT COST			$0.08	$0.08	$0.03	$0.05
Recirculate	Leachate Recirculation [1]		$0.01	$0.01	$0.00	$0.01
	Condensate Recirculation [1]		$0.00	$0.00	$0.00	$0.00
TOTAL UNIT COST			$0.01	$0.01	$0.00	$0.01
POTW Hardpipe	Piped to POTW [1]		$0.15	$0.14	$0.06	$0.09
NPDES	NPDES Discharge [1]		$0.23	$0.22	$0.09	$0.14
	Switch SI to Tank System [2] (4 out of every 5 LFs assumed to have a SI -- see Table 4-5)		$0.001 ($0.001/yr/SI x 4 SI / 5 LF)	$0.001 ($0.001/yr/SI x 4 SI / 5 LF)	$0.001 ($0.001/yr/SI x 4 SI / 5 LF)	
TOTAL UNIT COST			$0.23	$0.22	$0.09	$0.14

Table 4-8. Baseline Unit Cost Data (Million $/Landfill/Year; 1998 Dollars)						
Management Practice	**Cost Component**	**No. of Landfills with Quantity and Cost Data**	**5-Year Amortization**	**10-Year Amortization**	**20-Year Amortization**	
			5-Year Expected Generation Case	**10-Year Conservative Generation Case**	**5-Year Expected Generation Case**	**10-Year Conservative Generation Case**

[1] Landfill unit costs are calculated by combining the leachate quantity in Table 4-6 with the baseline (nonhazardous) unit cost in Table 4-7 and the capital recovery factor (CRF) for the amortization period using the methodology for annualizing costs presented in Appendix B.
[2] Landfill unit costs are calculated by multiplying the unlined surface impoundment unit cost in Table 4-7 by the expected probability a landfill will operate a surface impoundment (Table 4-5) in their leachate management practice times the CRF for the amortization period.
5-year CRF = 0.24389 assuming a 7 percent discount rate; 10-year CRF = 0.14238 assuming a 7 percent discount rate; and
20-year CRF = 0.09439 assuming a 7 percent discount rate.

4.2.5 Compliance Leachate Management Practices

Under the Standard Listing regulatory option, the leachate collected from landfill cells that received these two waste streams will be managed according to the requirements specified under Subtitle C of RCRA. Under Subtitle C, leachate trucked off site must be managed at a RCRA permitted treatment, storage, or disposal (TSD) facility (e.g., aqueous treatment). See Appendix C for a summary of current hazardous leachate (F039) management practices. The practice of recirculating leachate back into landfills is exempt from Subtitle C regulation because it is never considered by the Agency to be managed. Discharging directly to a POTW via a sewer is exempt from RCRA regulation and subject to CWA and local regulation. Discharging directly to a POTW via a "hardpipe" is subject to RCRA regulations and alternative management practices such as trucking off site, recirculating, or discharging to a sewer or an NPDES permitted outfall will need to be implemented. Tank and piping systems must meet the design requirements specified under 40 CFR 262 (accumulation) and 264 (storage) unless exempted as a wastewater treatment tank regulated under the Clean Water Act. In addition, surface impoundments must meet the design requirements under 40 CFR 264 and associated land disposal restriction (LDR) pretreatment requirements. Therefore, the Agency assumes that wastewater treatment tank systems will be constructed to replace impoundments to avoid RCRA Subtitle C regulation.

Under the Clean Water Act temporary deferral regulatory option, the Agency will defer the leachate from being regulated as hazardous under Subtitle C if it is appropriately managed in tank systems under the Clean Water Act (including POTWs) or through recirculation. If the leachate is managed in a surface impoundment it is subject to regulation under Subtitle C and the Agency assumes that wastewater treatment tank systems will be constructed to avoid Subtitle C regulation. The Agency assumes landfill operators will have the tank systems constructed and ready for operation at the end of the two-year deferment period. The Agency assumes that landfill operators will close their impoundments within the next two years to avoid Subtitle C regulation and triggering corrective action.

Under a No List regulatory option, leachate quantities generated at MSW landfills will continue to be regulated under Subtitle D of RCRA and leachate quantities generated at industrial waste landfills will be subject to state and local regulations. However, the Agency currently is in the process of proposing design and operating criteria under Subtitle D for industrial waste landfills. No changes in management practice will be required under a no list decision.

4.2.6 Compliance Leachate Management Costs

Cost estimates for compliance management and transportation activities have been derived using unit costs from R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998), annualized costs developed in the previously proposed organic dye and pigment hazardous waste listings (K162-K166), and the recent final listing of four petroleum refining waste streams (K069-K172). Table 4-9 presents the estimated compliance unit capital and O&M costs per landfill per year for each leachate management practice based on a 5-year, 10-year, and 20-year period of

amortization of costs to reflect the period under RCRA regulation and the remaining life of the landfill. Additional unit cost data on a per gallon, mile, or metric ton basis used to derive these compliance per landfill unit costs are presented in Table 4-7. All costs are, or have been adjusted to 1998 dollars.

Because there are fewer commercial treatment/POTW facilities permitted to receive manifested hazardous wastewaters (i.e., leachate), total transport distances are assumed to increase with the promulgation of the rule from 50 miles to 200 miles. A range of unit costs for hazardous waste management in a commercial POTW ($1.75 - $2.96/gallon) are used in the cost estimate, excluding transportation. The lower-end unit cost reflects the potential discounts a landfill operator may receive as a steady customer.[30] The upper-end unit cost reflects the typical unit cost currently paid by remediation firms on a one-time basis.[31]

Costs for replacing an unlined surface impoundment with a tank system were approximated using estimates developed in previous EPA hazardous waste listings. The cost for closure of an existing unlined impoundment (prior to expiration of the two-year deferral date) includes pumping free liquid from the impoundment, pumping sludge (20 years accumulation) from the impoundment, transportation and disposal of sludge at a POTW, excavation of two-feet of contaminated soil, transportation and disposal of contaminated soil at a Subtitle D municipal landfill, and indirect costs (e.g., contractor's overhead and profit and contingency). The Agency assumed the leachate contained 0.1 percent solids and a collection efficiency of 50 percent for estimating sludge generation amounts. The costs for sludge management assume transportation and disposal at a POTW. Compliance one-time costs estimated for impoundment closure are annualized over a 20-year operating life and the 10-year conservative case and 5-year expected case RCRA-regulated life of the landfill.[32]

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30 Back-calculated from a Browning-Ferris Industries estimate of $52 million per year in total O&M compliance costs to treat leachate from landfills that have received any petroleum wastes (Comments received by the RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169-K172), August 6, 1998, FR 151, Vol. 63; PR3A-00008).

31 R.S. Means, Environmental Remediation Cost Data, 4th Annual Edition (1998).

32 Used compliance cost estimates presented in the EPA/OSW, *Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries*, November 28, 1994, for unlined surface impoundments inflated to 1998 dollars assuming a 5 percent annual inflation rate.

Table 4-9. Compliance Unit Cost Data (Million $/Landfill/Year; 1998 Dollars)						
Management Practice	**Cost Component**	**No. of Landfills with Quantity Data**	**5-Year Amortization**	**10-Year Amortization**	**20-Year Amortization**	
			5-Year Expected Generation Case	**10-Year Conservative Generation Case**	**5-Year Expected Generation Case**	**10-Year Conservative Generation Case**
Trucked to POTW	Leachate Management[1]		$3.58 - $5.92	$3.46 - $5.71	$1.39 - $2.29	$2.29 - $3.79
	Condensate Management[1]		$0.48 - $0.79	$0.46 - $0.76	$0.18 - $0.31	$0.31 - $0.51
	Tank Upgrade[2]		$0.20	$0.13	$0.10	
	Piping Upgrade[2]		$0.09	$0.06	$0.04	
TOTAL UNIT COST			$4.35 - $7.00	$4.13 - $6.69	$1.71 - $2.74	$2.74 -$4.44
Truck to POTW/ Recirculate	Leachate Management[1]		$3.29 - $5.43	$3.17 - $5.24	$1.27 - $2.10	$2.10 - $3.48
	Condensate Management[1]		$0.00 - $0.00	$0.00 - $0.00	$0.00 - $0.00	$0.00 - $0.00
	Tank Upgrade[2]		$0.20	$0.13	$0.10	
	Piping Upgrade[2]		$0.00	$0.00	$0.00	
TOTAL UNIT COST			$3.50 - $5.64	$3.31 - $5.38	$1.38 - $2.21	$2.21 - $3.59
Recirculate	Leachate Recirculation		$0.01	$0.01	$0.00	$0.01
	Condensate Recirculation		$0.00	$0.00	$0.00	$0.00
TOTAL UNIT COST			$0.02	$0.01	$0.00	$0.01
POTW Hardpipe	Piped to POTW		$0.15	$0.14	$0.06	$0.09

Table 4-9. Compliance Unit Cost Data (Million $/Landfill/Year; 1998 Dollars)						
Management Practice	**Cost Component**	**No. of Landfills with Quantity Data**	**5-Year Amortization**	**10-Year Amortization**	**20-Year Amortization**	
			5-Year Expected Generation Case	**10-Year Conservative Generation Case**	**5-Year Expected Generation Case**	**10-Year Conservative Generation Case**
NPDES	NPDES Discharge		$0.23	$0.22	$0.09	$0.14
	Switch SI to Tank System[3] (4 out of every 5 LFs assumed to have a SI -- see Table 4-5)		$0.042 ($0.053/yr/SI x 4 SI / 5 LF)	$0.028 ($0.035/yr/SI x 4 SI / 5 LF)	$0.021 ($0.026/yr/SI x 4 SI / 5 LF)	
TOTAL UNIT COST			$0.27	$0.25	$0.11	$0.16
RCRA	Initial Analytical Costs - Total Concentrations (4 samples)		$0.0001 11 constituents	$0.0001 32 constituents	$0.0001 11 constituents	$0.0001 32 constituents
RCRA	Annual Analytical Costs - Total Concentrations (1 sample per year)		$0.0002 11 constituents	$0.0003 32 constituents	$0.0002 11 constituents	$0.0003 32 constituents
RCRA	Administrative Costs - Off-site Management		$0.004	$0.003	$0.001	$0.002
RCRA	Administrative Costs - On-site Management		$0.001	$0.001	$0.000	$0.000

[1] Landfill unit costs are calculated by combining the leachate quantity in Table 4-6 with the compliance (hazardous) unit cost in Table 4-7 and the capital recovery factor (CRF) for the amortization period using the methodology for annualizing costs in Appendix B.

[2] Landfill unit costs are calculated by multiplying the tank upgrade or piping upgrade unit cost in Table 4-7 times the CRF for the amortization period and assuming that after 20 years the tanks have no salvage value, after 10 years the tanks have a 10 percent salvage , and after 5 years the tanks have a 20 percent salvage value. The unit costs are adjusted accordingly to account for the salvage value of the tank system at the end of the amortization period.

[3] Landfill unit costs are calculated by multiplying the closure unlined surface impoundment and installation of new tank unit cost in Table 4-7 by the expected probability a landfill will operate a surface impoundment (Table 4-5) in their leachate management practice times the CRF for the amortization period.

5-year CRF = 0.24389 assuming a 7 percent discount rate.
10-year CRF = 0.14238 assuming a 7 percent discount rate.
20-year CRF = 0.09439 assuming a 7 percent discount rate.
SI = surface impoundment
LF = landfill
NPDES = National Pollution Discharge Elimination System

For tank systems, the Agency assumed a cone-roofed carbon steel tank with a two-day retention time capacity is installed, including site work, piping, foundation and supports, and indirect costs (e.g., engineering, contractor's overhead and profit, and contingency).[33] Compliance costs include removing sludge from the tank and managing it as a hazardous waste (even though the Agency has yet to list this wastewater treatment sludge as hazardous). The Agency assumed the leachate contained 0.1 percent solids and a collection efficiency of 50 percent for estimating sludge generation amounts. The costs for sludge management include sludge removal, transportation and hazardous waste landfill disposal.[34]

Facilities generating the proposed waste listings are subject to Part 262 of RCRA, which regulate generators of hazardous waste. All facilities producing a newly listed waste will be subject to this standard. There are four primary requirements specified in the Part 262 standards. First, plants generating hazardous waste must obtain an EPA identification number. Second, an approved manifest system must be established for those facilities shipping wastes off site. Third, before transporting hazardous waste off site, a series of pre transport requirements must be satisfied such as labeling, marking, and placarding. Fourth, specified record keeping and reporting rules are applicable (see Table 4-10 for unit cost estimates).

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[33] Used compliance cost estimates presented in the EPA/OSW/EMRAD, *Background Documents for the Cost and Economic Impact Analysis of Listing Four Petroleum Refining Wastes as Hazardous Under RCRA Subtitle C*, January 10, 1998, pp. 3-44, for tank system costs inflated to 1998 dollars assuming a 5 percent annual inflation rate.

[34] Used compliance cost estimates presented in the EPA/OSW, *Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries*, November 28, 1994, for sludge removal, transportation and management inflated to 1998 dollars assuming a 5 percent annual inflation rate.

Sampling and analytical costs in this analysis are based on the assumption that four leachate samples will be collected and analyzed at each facility in the first year to determine the concentration level of the hazardous constituents. Only one sample is assumed to be necessary in subsequent years. Sampling costs are based on the expected assumption that *[Relevant data are not included at the present time due to confidentially concerns.]* will be tested; a worst case scenario is based on the assumption that sampling analyses will be required for *[Relevant data are not included at the present time due to confidentially concerns.]* Sampling costs include the costs to take the sample, package, transport, analyze, and report the results. The analysis costs were estimated assuming analysis for total concentrations. The annualized sampling/analysis costs for *[Relevant data are not included at the present time due to confidentially concerns.]*

In completing this analysis it is assumed that RCRA Part 262, accumulation tank design standards are applicable. Part 264 addresses standards for owners and operators of hazardous waste treatment, storage and disposal facilities. For purposes of developing a cost estimate, it is assumed that wastewater treatment tank systems constructed to replace surface impoundments will be designed to meet Part 264 design requirements even though they are excluded as being regulated under CWA. Part 270 (i.e., permitting) applies to facilities with on-site treatment units subject to Part 264. It is assumed no permitting is required for existing or future units because of the wastewater treatment tank exemption under RCRA and that tanks will be operated under the accumulation standards. Part 270 permitting standards are not applicable.

Table 4-10. RCRA Administrative Costs (1998 Dollars) [1]					
RCRA Part	Activity	Initial Items	Initial Cost [2]	Periodic Items	Periodic Cost
262	Generator Requirements: New listing (i.e., facility currently a hazardous waste generator) and new wastes managed off-site	Assess current waste generation and management practices, evaluate regulations listing the new wastes, and review procedures for packaging and labeling.	$1,200	Additional time for completing manifest for newly listed wastes, packaging and marking, and annual portion of biennial report.	$1,000/yr
262	Generator Requirements: New listing and all new wastes managed on-site	Assess current waste generation and management practices, evaluate regulations listing the new wastes, and review procedures for packaging and labeling.	$1,000	Additional time for annual portion of biennial report.	$0/yr [3]
262	Generator Requirements: First listing (i.e., facility not currently a hazardous waste generator) and new wastes managed off-site	Become aware of and understand responsibilities under regulations, assess current waste generation and management practices, obtain EPA ID number, review and determine applicable DOT requirements, develop procedures for manifesting, packaging, and labeling, and purchase file cabinet for storing manifests and reports.	$2,700	Complete manifest, packaging and labeling of hazardous waste for off-site shipment, annual portion of biennial report, and filing exception report.	$1,700/yr
262	Generator requirements: First listing and all new wastes managed on-site	Become aware of and understand responsibilities under regulations, assess current waste generation and management practices and obtain EPA ID number.	$1,600	Annual portion of biennial report.	$200/yr

[1] Inflated unit costs in the EPA/OSW, *Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries*, November 28, 1994, to 1998 dollars assuming a 5 percent annual inflation rate.

[2] Initial cost estimates are overstated because they include initial sampling and analytical costs for making the hazardous waste determination. These costs have been calculated and added in as a separate line item for this proposed listing (see Table 4-9) compared to the proposed organic dyes and pigments listings from 1994 because of the Concentration Based Listing regulatory option.

[3] Due to rounding to the nearest hundred dollars.

4.2.7 Incremental Compliance Costs

Incremental compliance unit costs on a per landfill per year basis are presented in Table 4-11. These unit costs are multiplied by the number of affected landfills in each leachate management category to derive total incremental compliance costs. Total incremental compliance costs for the *[Relevant data are not included at the present time due to confidentially concerns.]* affected landfills that received these two waste streams are presented in Table 4-12.

Overall, total cost impacts to the affected landfills are estimated to range from *[Relevant data are not included at the present time due to confidentially concerns.]* million under the Standard Listing regulatory option. This range accounts for uncertainty in the amount of hazardous leachate generated, the amortization period chosen by landfill operators, and the hazardous waste POTW/TSD price. However, the upper bound may be considerably lower as the result of possible savings gained through contract negotiations for repeat customers who provide consistent revenue streams to shipping companies through their regularly scheduled shipments of leachate. It also is likely that not all landfills that received dye and pigment wastes in 1992 have leachate collection systems. This may also lower the cost estimates.

Expected, or most likely, total cost impacts are estimated assuming the anticipated five-year leachate generation case, a five-year amortization period, and the industry-expected hazardous POTW/TSD price of $1.75 per gallon. This results in total cost impacts of approximately *[Relevant data are not included at the present time due to confidentially concerns.]* per year over a five-year period. Both the range of total cost impacts and expected total cost impacts assume that all leachate will test hazardous. Under a concentration based listing, the constituents of concern may not exceed regulatory limits. To the extent this occurs, cost impacts will be reduced.

Incremental costs are estimated to range from *[Relevant data are not included at the present time due to confidentially concerns.]* annually, depending on the chosen amortization period for the Clean Water Act temporary deferral regulatory option. Only one of the affected landfills is expected to currently operate a surface impoundment. Incremental costs are estimated to be zero under the No List regulatory option.

Table 4-11. Incremental Unit Cost Data (Million $/Landfill/Year; 1998 Dollars) [1]				
Management Practice	**5-Year Amortization**	**10-Year Amortization**	**20-Year Amortization**	
	5-Year Expected Generation Case	**10-Year Extended Generation Case**	**5-Year Expected Generation Case**	**10-Year Extended Generation Case**
Trucked to POTW	*[Relevant data are not included at the present time due to confidentially concerns.]*			
Truck to POTW/ Recirculate				
Recirculate				
POTW Hardpipe				
NPDES				

[1] Incremental unit costs are calculated by subtracting baseline landfill unit costs in Table 4-8 from the summed compliance management, transportation, analytical, and RCRA administrative unit costs in Table 4-9.

Table 4-12. Incremental Compliance Cost Estimates for Landfills that Received Dye and Pigment Wastes (1998 Dollars)							
	Trucked to POTW	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**No Leach./ Condensate**	**Total**
Standard Listing Regulatory Option							
Ten-Year Extended Generation Case: 10-Year Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							
Five-Year Expected Generation Case:5-Year Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							
Ten-Year Extended Generation Case:20-Year Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							

Table 4-12. Incremental Compliance Cost Estimates for Landfills that Received Dye and Pigment Wastes (1998 Dollars)							
	Trucked to POTW	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**No Leach./ Condensate**	**Total**
Five-Year Expected Generation Case:20-Year Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							
Clean Water Act Temporary Deferral Regulatory Option (Two-year Impoundment Replacement Deferral) (Surface Impoundments Converted to Tank Systems) [1]							
Ten-Year Extended Generation Case: 10-Year Capital Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							
Five-Year Expected Generation Case: 5-Year Capital Amortization							
Incremental Compliance Cost (million $/LF)							
Affected Population (million $/year)							

Table 4-12. Incremental Compliance Cost Estimates for Landfills that Received Dye and Pigment Wastes (1998 Dollars)							
	Trucked to POTW	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**No Leach./ Condensate**	**Total**
Ten-Year Extended and Five-Year Expected Generation Case: 20-Year Capital Amortization							
Incremental Compliance Cost (million $/LF)	*[Relevant data are not included at the present time due to confidentially concerns.]*						
Affected Population (million $/year)							
[Relevant data are not included at the present time due to confidentially concerns.]							

SI: Surface Impoundment
LF: Landfill

5.0 ECONOMIC IMPACT ANALYSIS

The economic impacts are presented in this chapter for the dyes and pigments industries as well as the landfill industry. The first section of the chapter (5.1) addresses the dyes and pigments impacts; the second section (5.2) addresses the landfill impacts.

5.1 Impacts on the Dyes and Pigments Industries

The organic dyes and pigment industries produce dyes and pigments for a wide variety of intermediate and end users. However, only *[Relevant data are not included at the present time due to confidentially concerns.]* facilities generate TAM wastewater treatment sludge and/or spent filtering aids and would be potentially affected by this rule making.

5.1.1 Methodology

An economic impact analysis of the proposed rulemaking was conducting by using the incremental management costs derived in Chapter 4.0 of this report in conjunction with estimated waste generation and production rates. Model facilities were developed based on four annual representative waste generation rates of *[Relevant data are not included at the present time due to confidentially concerns.]* tons/year. Information regarding waste generation rates, production rates, and product sales was derived from responses to RCRA 3007 Questionnaires and from U.S. International Trade Commission Reports.[35] Specific data from the RCRA 3007 Questionnaires were not used in formulating the model facilities.

Waste Generation Rates

Waste generation rates, especially the generation of spent filter aids, are variable in the dyes and pigments industries, depending on the product being manufactured. A representative range of waste generation factors was used to estimate a range of production rates for the four model facilities. The range of waste generation rates indicated in the RCRA 3007 Questionnaires was from approximately *[Relevant data are not included at the present time due to confidentially concerns.]* Consequently, for a facility producing *[Relevant data are not included at the present time due to confidentially concerns.]* The estimated ranges for each of the model facilities are provided in Table 5-1.

Product Prices and Total Sales

Like waste generation rates, product prices for individual dyes and pigments also are variable. For instance, data from the U.S. International Trade Commission in 1994 indicate that Acid Blue 324 dye was valued at over $18,400 per ton while Direct Blue 86 dye commanded a value of only about $5,500 per ton; wide variations also are apparent with pigment product prices.

[35] "Synthetic Organic Chemicals, U.S. Production and Sales," U.S. International Trade Commission, Publications 2810 and 2933; November 1994 and November 1995.

Data provided in U.S. International Trade Commission Reports served as a basis for approximating average industry prices. In order to reflect the price variability that is present in the industries, a range of prices was used to estimate total gross sales for each of the three model facilities. The price range selected, while certainly not inclusive of all dye and pigment products (as indicated by the examples cited above), is believed to be representative of the production at individual facilities. The range of prices used to complete the analysis is $6,500/ton to $18,000/ton.[36] Therefore, for a facility generating 5 tons of waste a year and producing between 31-50 tons of product a year, annual gross sales could range from $201,500 to $900,000. Gross sales estimates are provided for each of the four model facilities in Table 5-1 It should be noted that individual facilities are likely to produce a variety of products not all of which will be affected by the proposed rulemaking. The gross sales estimates presented in Table 5-1 only reflect sales of affected product lines and do not reflect aggregate sales for any one facility.

5.1.2 Estimated Cost Impacts

To examine the potential cost impacts of the proposed rulemaking, baseline management costs were compared with compliance management costs for each of the four model facilities. Costs were calculated using the unit costs listed in Table 4-2 and the methodology presented in Table 4-3. Table 5-2 presents the estimated baseline and compliance management costs under expected and worst case scenarios for each of the three model facilities.

5.1.3 Economic Impact Analysis

To examine the potential economic impact of the proposed rulemaking on each of the four model facilities, the impact of the incremental costs (Table 5-2) on annual sales of affected product lines (Table 5-1) is considered. Table 5-3 highlights the economic impact on each of the model facilities by presenting incremental costs as a percent of sales.

As Table 5-3 shows, impacts are expected to range from just under *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales of affected products. Facilities producing higher value dyes and pigments will experience impacts in the lower end of the range.

The actual economic impact will likely be dependent on the individual dyes and pigments which are produced in batch processes. For example, if the production of a dye or pigment is impacted by the regulation, and there are close substitutes for the product, it is possible that the production of the impacted dye or pigment may be curtailed. Conversely, products with unique applications may have a more inelastic demand, and prices of these dyes/pigments will increase, and largely offset the production cost increases associated with the rulemaking. A more definitive analysis based on the individual products is beyond the scope of this study.

[36] 1998 dollars.

It is important to consider that this rulemaking affects less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of the overall combined production of the dyes and pigments industries. Consequently, while an impact of up to *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales may be experienced on selected product lines, overall impacts on the industries are expected to be *[Relevant data are not included at the present time due to confidentially concerns.]* .

Table 5-1. Model Facility Production and Sales From Affected Product Lines			
Model Facility Waste Quantity Generated (Tons)	**Product Ranges (Tons)**	**Annual Gross Sales Ranges ($1,000)**	**Midpoint of Annual Gross Sales Ranges ($1,000)**
[Relevant data are not included at the present time due to confidentially concerns.]		$201-$900	$551
		$1,222-$5,400	$3,311
		$3,660-$16,200	$9,930
		$7,313-$32,400	$19,856

Table 5-2. Model Facility Baseline and Compliance Management Costs						
	Expected Costs			Worst Case Costs		
Annual Waste Quantity Generated (Tons)[1]	Annualized Baseline Management Costs[2]	Annualized Compliance Management Costs[4]	Annualized Incremental Management Costs[6]	Annualized Baseline Management Costs[7]	Annualized Compliance Management Costs[9]	Annualized Incremental Management Costs[15]
[Relevant data are not included at the present time due to confidentially concerns.]				*[Relevant data are not included at the present time due to confidentially concerns.]*		
[Relevant data are not included at the present time due to confidentially concerns.]						

Table 5-3. Incremental Costs as a Percent of Sales							
				Annualized Waste Management Incremental Costs		Costs as a Percent of Gross Sales (Affected products only)	
Representative Facility Size (Waste Quantity in Tons)	Product Ranges (Tons)	Annual Gross Sales Ranges ($1,000)[1]	Midpoint of Annual Gross Sales Ranges (1,000)	Expected ($1,000)	Worst Case ($1,000)	Expected (percent)	Worst Case (percent)
[Relevant data are not included at the present time due to confidentially concerns.]							

[1] 1998 dollars.

5.1.4 International Trade Impact Analysis

The dyes and pigments industries are international in scope, and many of the individual facilities affected by this proposed rulemaking may be owned by foreign firms with other facilities overseas. It is possible that the proposed rule could result in the curtailment of individual product lines, with the production being effectively transferred overseas. Naturally this would serve to increase the U.S. trade deficit. However, the expected impact on trade would be negligible.

5.2 Impacts on the Landfill Industry

To examine the potential economic impacts on landfills generating leachate from the proposed listed wastes, average incremental compliance costs were considered in relation to tipping fees for three different sized landfills. The models were assumed to accept 250, 750, and 1,500 tons of waste per day. These sizes were selected as representative of the industry, based on recent survey information, provided in the *Solid Waste Digest*.[37]

5.2.1 Annual Landfill Sales

Annual landfill sales were derived for each of the models using an average national tipping fee of $35.81 per ton.[38] For purposes of this analysis, it was assumed that the landfills operated approximately 286 days a year (5 and one half days/week). Therefore, approximate annual sales for a landfill that, on average accepts 750 tons of waste per day, would be $7.68 million (750 tons/ day*286 days*$35.81/ton).

It is important to note that actual leachate generation rates may vary depending on the overall size of the landfill, rainfall patterns, and other factors. However, EPA was unable to distinguish among these different factors due to a lack of site-specific data, and consequently impact estimates are based on average leachate generation rates for all of the facilities which supplied data.

5.2.2 Incremental Annual Compliance Costs as a Percent of Sales

Incremental annual compliance costs depicted in Table 4-12 were used to calculate potential economic impacts. Incremental costs were examined for both the Standard Regulatory Option and the Clean Water Act Temporary Deferral Option. For each option incremental costs were considered for seven management practices. In estimating the potential economic impacts of the Standard Regulatory Option, expected incremental compliance costs based on a five-year

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[37] *Solid Waste Digest*, "Solid Waste Price Index," October 1998.

[38] ibid.

amortization schedule were used. Incremental compliance costs for the analysis of the Clean Water Act Temporary Deferral Option are based on a 20-year capital amortization schedule. Previously, in Table 4-12, alternative amortization schedules were presented for the standard listing option. This information was presented partially because for landfills owned by governmental entities, the funding mechanisms may be based on 10 and 20 year amortization, which corresponds more closely to the expected life of capital equipment. The five year amortization corresponds more closely to the actual leachate generation. For illustrating impacts on individual facilities in the remainder of this section, the five year amortization is used for the standard listing option.

Table 5-4 presents the cost impacts on each of the model landfill facilities. Under the standard listing option, facilities which would have to truck the leachate to a POTW would face costs in excess of *[Relevant data are not included at the present time due to confidentially concerns.]* percent of revenue for all landfill models: in fact actual costs for some of the smaller landfills represent over *[Relevant data are not included at the present time due to confidentially concerns.]* percent of total revenues. Impacts in relation to overall revenue are below *[Relevant data are not included at the present time due to confidentially concerns.]* percent for all other technologies in the standard listing scenario. Under the Clean Water Act temporary deferral option, costs are estimated to be less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales for all facilities.

5.2.3 Public versus Private Landfills

The cost impacts expressed as a percentage of landfill revenues are dependent on the regulatory scenario and the management technology, as illustrated previously in Table 5-4. However, to better understand the effects of the impacts, it also is important to consider the ownership and size of the affected landfill facilities. Unfortunately, information is not available regarding the ownership of the specific landfills receiving the dye and pigment waste in question. However, the landfills will be a mix of public and privately held facilities.

Historically, landfills have been predominately owned by governmental entities (states, counties, and local towns and villages). In an assessment completed in 1990, it was estimated that over 80 percent of the US municipal solid waste landfills were owned by governmental entities.[39] With the promulgation of more stringent regulations addressing the operation of landfills, the number of landfills has declined, and ownership patterns may be shifting more to private facilities. In 1990 for example, there were over 6,000 municipal solid waste landfills,[40] compared with less than 3,600 in 1996.[41] Unfortunately, scheduling and resource limitations prevented the collection of more recent information on landfill ownership patterns.

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[39] Temple, Barker & Sloan, et al., Regulatory Impact Analysis for the Final Criteria for Municipal Solid Waste Landfills, December 1990.

[40] ibid.

[41] EPA, List of Municipal Solid Waste Landfills, June 1996, EPA530-R-96-006.

5.2.4 Government Owned Landfills

Publicly owned landfills which are affected by the proposed rule may pass on the increased costs to their own customers, raise tax rates in order to cover the cost increases, or even decrease other services in cases where the governmental entity is constrained by its own budget. In order to pass the costs on to their own customers they will need to raise tipping fees in accordance with the levels of impact shown on Table 5-4, depending on the regulatory option adopted.

Tax increases necessary to offset the costs depend on the size of the population served by the facility. For purposes of estimating this impact, the number of households served is estimated based on average household generation rates. In characterizing municipal solid waste in the US, it was estimated that per capita daily generation rates of landfilled wastes were approximately 2.5 pounds in 1995-1996.[42] Considering a typical household of four, daily generation rates would be approximately 10 pounds per day. Further, EPA estimated that 55 to 65 percent of the waste generated was residential waste.[43] Consequently a landfill receiving 750 tons of waste per operating day, for example, 60 percent of which is residential, would serve approximately 117,500 households (750 tons * 286 operating days * 2,000 lb/ton / 365 days per year / 10 lbs of waste/household/day = 117,500 households served). Using these assumptions, possible cost impacts on a household basis are presented in Table 5-5 for the three sizes of landfills considered. Considering the costs expected under the standard listing, residential costs range from *[Relevant data are not included at the present time due to confidentially concerns.]* per household, per year. Under the Clean Water Act temporary deferral, residential impacts are all expected to be less than *[Relevant data are not included at the present time due to confidentially concerns.]* per household, per year.

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[42] EPA, Characterization of Municipal Solid Waste in the United States: 1997 update, May 1998, EPA530-R-98-007.

[43] Ibid.

Table 5-4. Cost Impacts as a Percent of Revenue for Landfills that Received Dye and Pigment (K167 - K168) Wastes							
Landfill Size (Tons of Refuse/Day)	**Annual Facility Revenue ($million)[1, 2]**	**Truck to POTW**	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**No Leachate or Condensate**
Cost Impacts as a Percent of Revenues							
Standard Regulatory Option Expected Generation Case: 5-Year Amortization							
250	$2.6[3]	*[Relevant data are not included at the present time due to confidentially concerns.]*					
750	$7.7						
1,500	$15.4						
Clean Water Temporary Deferral Option (Surface Impoundments Converted to Tank System) - Conservative and Expected Generation Case: 20-Year Amortization							
250	$2.6[3]	*[Relevant data are not included at the present time due to confidentially concerns.]*					
750	$7.7						
1,500	$15.4						

[1] Assumes facilities operate a total of 286 days/year.

[2] Assumes a tipping fee of $35.81/ton of waste (1998$).

[3] Annual facility revenue was calculated as follows: (daily waste accepted by landfill*286 days*tipping fee). In example, for a landfill accepting approximately 250 tons of waste/day aggregate sales were calculated as follows: (250 tons/day* 286 days* $35.81).

[4] *[Relevant data are not included at the present time due to confidentially concerns.]*

5.2.5 Privately Owned Landfills

Privately owned landfills will either pass the higher costs of operation on to their customers and/or experience lower levels of profitability as a result of the proposed listing. Because only a limited number of landfills will be affected, the opportunity to pass on the costs will be dependant on how close they are to alternative waste management facilities. It will also depend on their baseline operating costs, and tipping fees. Clearly the higher cost facilities will have more difficulty in raising tipping fees in a competitive market.

Robert Morris Associates data indicate that for landfill facilities (reported as SIC 4953), average levels of profit before taxes during the 4/96-3/98 period were approximately 6.7 percent of sales, on a before tax basis.[44] The increases in cost associated with the standard listing option represents a minimum of *[Relevant data are not included at the present time due to confidentially concerns.]* percent of baseline profit before tax for any facility required to truck leachate to a POTW. Other management technologies under the standard listing option represent less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of baseline before tax profits. Under the Clean Water Act temporary deferral option, the impacts of profitability–even assuming no price increases, are generally modest to moderate, representing less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of baseline profit before taxes.

[44] Robert Morris Associates, Annual Statement Studies, 1998.

TABLE 5-5. REPRESENTATIVE IMPACTS ON USER HOUSEHOLDS							
Landfill Size (Tons of Refuse/Day)	**Estimated Number of Households Served**	**Truck to POTW**	**Truck to POTW/ Recirculate**	**Recirculate Only**	**POTW Hardpipe**	**NPDES**	**No Leachate or Condensate**
Potential Cost Impacts Per Household							
Standard Regulatory Option							
250	39,200	*[Relevant data are not included at the present time due to confidentially concerns.]*					
750	117,500						
1,500	235,000						
Clean Water Act Temporary Deferral Option (Surface Impoundments Converted to Tank System)							
250	39,200	*[Relevant data are not included at the present time due to confidentially concerns.]*					
750	117,500						
1,500	235,000						

6.0 QUALITATIVE BENEFITS

A qualitative benefits analysis of the proposed listing of filter aids and TAM wastewater treatment sludges is presented in this chapter. The benefits analysis addresses human health benefits projected as a result of the proposed listing. The analysis also examines potential benefits specifically related to children's health. Waste minimization also is covered as a potential benefit from this proposed action. The analysis incorporates findings from, and is consistent with, the risk analysis conducted in support of this action. Incremental individual and/or population benefits are not available for incorporation into this benefits analysis.

6.1 Human Health Risk Assessment

In determining whether waste generated from the production of dyes and pigments meets the criteria for listing a waste as hazardous as set out at 40 CFR 261.11, the Agency initially evaluated the potential toxicity and intrinsic hazard of *[Relevant data are not included at the present time due to confidentially concerns.]* constituents likely to be present in the waste streams. The fate and mobility of these chemicals, the likely exposure routes, the current waste management practices, and plausible management practices were examined. Based on this assessment of the wastes, the constituents listed in Table 6-1 are those for which we are proposing were deemed to present the most significant risks.

One objective of a human health risk assessment is to estimate the number of chronic health impacts that could be avoided as a result of the implementation of the proposed rule. This would include the exposures by drinking contaminated water from residential wells located near the source of contamination, consuming food products contaminated by blowing dust or vapors, and otherwise being exposed directly to contaminated soil and water. The Agency did not estimate the population risks from current practices or the incremental risk reduction from future actions as a result of the proposed regulation. However; one benefit associated with this rulemaking is to place wastestreams the Agency has determined could pose a risk to human health and the environment into the hazardous waste management system. When wastestreams are placed in this system, the risk associated with their disposal is minimized by the requirements of this system.

Table 6-1. Spent Filter Aid and TAM Waste Constituents for Proposed Risk-Based Concentrations

Constituents
[Relevant data are not included at the present time due to confidentially concerns.]

Constituents (continued)
[Relevant data are not included at the present time due to confidentially concerns.]

6.1.1 Protection of Children from Environmental Health Risks and Safety Risks

On April 21, 1997, the President signed an Executive Order (13045) entitled, "Protection of Children from Environmental Health Risks and Safety Risks." The Executive Order requires all economically significant rules,[45] that concern an environmental health risk or safety risk that may disproportionately affect children, to comply with requirements of the Executive Order. Because EPA does not consider this proposed rule to be economically significant, it is not subject to Executive Order 13045. Furthermore, the proposed rule is expected to reduce risks posed by the hazardous constituents in the listed waste streams by requiring more appropriate and safer management practices. The environmental health risks or safety risks addressed by this action are not expected to have a disproportionate effect on children.

6.2 Waste Minimization Opportunities

Regulatory compliance costs for the dyes and pigments industries may be lowered through use of waste minimization practices. A previously issued guidance document on pollution prevention, recycling, and reuse practices for the dye manufacturing industry[46] offers a number of general and specific alternatives. Engineering site visits[47], particularly at newer facilities, show that a number of these practices are economically and technically feasible. These visits also pointed out areas of improvement needed at all facilities, most notably reduction of wastewater volume.

While specific cost reductions are not available and tend to be highly dependent on the manufacturing processes at each facility, the following waste minimization opportunities for specific plant operations and waste streams may decrease compliance costs through reduction in waste volume at dye and pigment facilities.

Filter Aid, Filter Bags, Filter Cloths: The method of filtration is critical in determining the amount of solid and liquid washwater waste produced by this process. Use of filter aids should be discouraged and filtering devices that use reusable membranes, filter cloths, or filter cartridges should be considered as alternatives. Centrifugation, while capital intensive, also may have application in reducing the amount of filtration and associated solid waste required.

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[45] An economically significant rule is defined by Executive Order 12866 as any rulemaking that has an annual effect on the economy of $100 million or more, or would adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health, or safety, or State, local, or tribal governments or communities.

[46] "Pollution Prevention Guidance Manual for the Dye Manufacturing Industry," Doc. No. EPA/741/B-92-001.

[47] Ten engineering site visit reports were prepared by SAIC for critical (based on plant size and chemistry used) dye and pigment facilities between late -1991 and mid-1993 in support of this listing.

Dust and Fines: Dust and fines should be collected dry whenever practicable and returned to the product stream. Specifically designed enclosed rooms have proven effective for reducing the amount of dust reaching off-gas treatment.

Automation and Computerization: Automated handling and measurement of raw materials and products has resulted in reduced spillage and lower concentrations of contaminants in wastewater. Fewer off-spec product batches are produced as well, thereby reducing the amount of solid waste leaving the facility. Computerized tracking of inventory, processing, and waste volumes results in fewer off-spec products and better tracking of the sources of liquid and solid wastes.

Process Integration, Product Scheduling, Dedicated Equipment: All waste streams should be viewed as potential raw materials for recycle to other parts of the same facility and also adjacent off-site facilities. Product scheduling should encourage long term planning and the development of sequencing strategies and analytical tools to minimize cross-contamination of equipment and products. Large batches of relatively few products made in dedicated equipment is ideal where practicable.

7.0 REGULATORY FLEXIBILITY ACT SCREENING ANALYSIS

The purpose of this screening analysis is to answer a series of questions regarding the potential impacts of the proposed dyes and pigments waste listing on small entities. This analysis was conducted per the requirements of the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA). Some of the key questions to answer include:

1. Is the rule subject to SBREFA notice-and-comment rulemaking requirements?
2. What types of entities will be subject to the rule?
3. What types of small entities will be subject to the rule, if any?
4. Will small entities be adversely affected by the rule?
5. Will the rule have a significant economic impact on a substantial number of small entities?

In practice, questions 2-5 above are answered to the extent possible, the results of which are used to answer question one. More specifically, questions 2-5 will be used to identify what category of rule this may be in the SBREFA regulatory process. These consist of three categories starting with Category 1, which is defined as follows:[48]

[48] Source: U.S. EPA. 1997(Feb. 5). EPA Interim Guidance for Implementing the Small Business Regulatory Enforcement Fairness Act (SBREFA) and Related Provisions of the Regulatory Flexibility Act (RFA). Prepared by the EPA SBREFA Task Force.

Category 1: Rule presumed *[Relevant data are not included at the present time due to confidentially concerns.]*

A. Less than 1% impact on sales experienced by any number of affected small entities; or

B. A 1% or more impact on sales experienced by less than 100 small entities; or

C. A 1% or more impact on sales experienced by less than 20% of all affected small entities, and no more than 999 small entities affected.

Categories 2 and *3* have similar criteria with progressively greater expected impacts on small entities. For instance, the minimum impact level for both *Categories* 2 and 3 increases to 1 percent or greater of sales for some *Category* 2 cases and moves to 3 percent or greater for other *Category* 2 Cases and for all *Category* 3 cases. For all *Category 2* and *3* impacts, the minimum number of small entities affected is 100.

This screening analysis indicates that this rule is likely to be a *Category 1* rule with regard to SBREFA and RFA, falling under *Criteria B*, as described above. Accordingly the rule *[Relevant data are not included at the present time due to confidentially concerns.]*

7.1 Effects on Small Business

To best demonstrate the potential impact of proposed dye and pigment waste regulations on small entities, the following section outlines the types of entities affected; presents summary data for all dye and pigment producers; characterizes small entities according to size criteria set by the Small Business Administration (SBA); identifies the number of small entities potentially affected; and presents a range of economic effects and potential significant impacts for both small and large entities.

Because specific landfills potentially affected by this waste listing have not been identified, it is unknown if any of them are indeed small facilities according to SBA definitions. However even if all *[Relevant data are not included at the present time due to confidentially concerns.]* facilities are small (an unlikely occurrence), impacts would still fall under the *[Relevant data are not included at the present time due to confidentially concerns.]* classification, since less than *[Relevant data are not included at the present time due to confidentially concerns.]* entities would be impacted.

7.1.1 Type and Number of Entities Affected

The proposed waste listings will affect an estimated *[Relevant data are not included at the present time due to confidentially concerns.]* dye and pigment manufacturers, all of which are private businesses. In total, these *[Relevant data are not included at the present time due to confidentially concerns.]* companies producing dyes and pigments (SAIC, date unknown, "Market Share Summary Data"). Of the affected manufacturers, *[Relevant data are not included at the present time due to confidentially concerns.]* are multi-plant companies, and as such are international in scope, with several plants located throughout the world.

7.1.2 Type and Number of Small Entities Affected

The RFA and SBREFA provide no specific guidelines for defining small entities. These statutes (and EPA guidance) do authorize agencies to use general SBA definitions for small businesses, or adopt alternative definitions where appropriate in accordance with specific procedures. The SBA size standard for small businesses in the dyes and pigments industry, which is part of cyclic crudes and intermediates (NAICS 325132) is 750 employees (13 CFR 121.201). This and all size standards apply to the owners or parent corporation, of the business, and not individual plant operations which are most directly affected by this proposed regulation.

Of the dye and pigment producing companies potentially affected by the regulation, a maximum of *[Relevant data are not included at the present time due to confidentially concerns.]* are small businesses under the SBA size standard. No other small entities are known to be affected; however it is possible that some of the landfills affected by this rulemaking may be small according to the SBA size standards for landfills (less than $5 million in sales). Because specific landfills receiving dye and pigment waste have not been identified in available information, further assessment of the impacts on small facilities is not possible.

7.1.3 Economic Effect on Small and Large Entities

Data are not available on the financial status of the small entities in question, as they are privately held companies. However, the preliminary estimate of the impact on these companies, assuming that 100 percent of all wastes are managed as Subtitle C, is expected to be no more than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of gross sales for the product lines affected.

The overall impact to the entire affected population of dye and pigment companies is expected to range from *[Relevant data are not included at the present time due to confidentially concerns.]* percent of gross sales. While the impacts estimated for the large companies are expected to be somewhat lower in percentage terms, the differences *[Relevant data are not included at the present time due to confidentially concerns.]* .

It is important to recognize that the preliminary impacts presented above are based on only the sales of the dyes and pigments which are directly associated with the waste generated. For instance, an individual company may produce 100 different dyes, but spent filter aids may only be generated in the production of 20 of them. In this case, the impact estimate of *[Relevant data are not included at the present time due to confidentially concerns.]* percent of gross sales only represents the sales value of the products associated with the generation of the proposed waste streams, and not on overall company sales.

For the landfills potentially affected by the rule, impacts are *[Relevant data are not included at the present time due to confidentially concerns.]* under the standard listing option. Landfills which transport leachate to POTWs, for instance, are expected to experience impacts in excess of *[Relevant data are not included at the present time due to confidentially concerns.]* percent of sales. Impacts to landfills under the Clean Water Act temporary deferral represent less than *[Relevant data are not included at the present time due to confidentially concerns.]* percent of revenues.

7.1.4 Potential for Significant Impacts on Small Entities

Based on the findings above, it appears the proposed waste listing *[Relevant data are not included at the present time due to confidentially concerns.]* . Furthermore, the Agency preferred Clean Water Act temporary deferral option *[Relevant data are not included at the present time due to confidentially concerns.]* small landfill facilities. The proposed rule, therefore would be a *[Relevant data are not included at the present time due to confidentially concerns.]* for regulatory flexibility purposes.

8.0 OTHER REGULATORY ISSUES

This section describes the Agency's response to other rulemaking requirements established by statute and executive order, within the context of the proposed listing of the dye and pigment wastes.

8.1 Environmental Justice (Executive Order 12898)

EPA is committed to addressing environmental justice concerns and is assuming a leadership role in environmental justice initiatives to enhance environmental quality for all residents of the United States. The Agency's goals are to ensure that no segment of the population, regardless of race, color, national origin, or income bears disproportionately high and adverse human health and environmental impacts as a result of EPA's policies, programs, and activities, and that all people live in clean and sustainable communities. In response to Executive Order 12898 and to concerns voiced by many groups outside the Agency, EPA's Office of Solid Waste and Emergency Response formed an Environmental Justice Task Force to analyze the array of environmental justice issues specific to waste programs and to develop an overall strategy to identify and address these issues (OSWER Directive No. 9200.3-17).

It is not certain whether the environmental problems addressed by the proposed listing for dye and pigment wastes could disproportionately effect minority or low income communities, due to the location of some dye and pigment facilities as well as landfills receiving dye and pigment wastes. The affected facilities are distributed throughout the country and many are located *[Relevant data are not included at the present time due to confidentially concerns.]* . Because the proposed rule reduces environmental risks associated with the management of the waste streams, the Agency believes that this rule will not result in adverse human health and environmental impacts. It is, therefore, not expected to result in any disproportionately negative impacts on minority or low income communities relative to affluent or non-minority communities.

8.2 Executive Order 12875 and the Unfunded Mandates Reform Act

Executive Order 12875, "Enhancing the Intergovernmental Partnership" (October 26, 1993), calls on federal agencies to provide a statement supporting the need to issue any regulation containing an unfunded federal mandate and describing prior consultation with representatives of affected state, local, and tribal governments. The Unfunded Mandates Reform Act (UMRA) of 1995, supersedes Executive Order 12875, reiterating the previously established directives while also imposing additional requirements for federal agencies issuing any regulation containing an unfunded federal mandate.

Title II of the UMRA, P.L. 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions by State, local, and tribal governments and the private sector. Under section 202 of UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed rules and final rules for which the Agency published a notice of proposed rulemaking if those rules contain "Federal mandates" that may result in the expenditure by State, local, and tribal governments , in the aggregate, or to the private sector, of $100 million or more in any one year. If a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives. Under section 205, EPA must adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule, unless the Administrator publishes with the final rule and explanation why that alternative was not adopted. The provisions of section 205 do not apply when they are inconsistent with applicable law.

EPA has determined that this proposed rule *[Relevant data are not included at the present time due to confidentially concerns.]* As determined in Chapter 4 of this assessment, the annual cumulative impact on the *[Relevant data are not included at the present time due to confidentially concerns.]* dye and pigment facilities affected by this proposed rule is expected to be approximately *[Relevant data are not included at the present time due to confidentially concerns.]* Impact estimates for the landfills affected by this rulemaking are much more variable, depending on the regulatory option required. Under the standard listing option, impacts are estimated to range from *[Relevant data are not included at the present time due to confidentially concerns.]* per year, assuming costs are amortized over a five year period, corresponding to the generation of the leachate. Conversely, under the Clean Water Act Temporary Deferral option, costs are estimated to be approximately *[Relevant data are not included at the present time due to confidentially concerns.]*

8.3 Regulatory Takings (Executive Order 12630)

Executive Order 12630, "Government Actions and Interference with Constitutionally Protected Property Rights" (March 15, 1988), directs federal agencies to consider the private property takings implications of proposed regulation. Under the Fifth Amendment of the U.S. Constitution, the government may not take private property for public use without compensating the owner. Though the exact interpretation of this takings clause as applied to regulatory action is still subject to an ongoing debate, a framework for interpretation has been established by legal precedent through a series of prominent court cases.

This economic assessment found no indication that this proposed rulemaking would result in a regulatory taking, as defined above by the 1988 Executive Order, or by legislation considered in recent Congressional bills. Property would not be physically invaded or taken for public use. In addition, this rulemaking will not deprive property owners of economically beneficial or productive use of their property, or directly reduce the property's value. Furthermore, this proposed rule is not likely to interfere with reasonable investment-backed expectations because it does not ban production of any affected dye and/or pigment products.

8.4 Tribal Governments Analysis (Executive Order 13084)

Under Executive Order 13084, "Consultation with Tribal Governments," the EPA may not issue a regulation that is not required by statute, that significantly or uniquely affects the communities of Indian tribal governments, or that imposes substantial direct compliance costs on those communities, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by the tribal governments. If the mandate is unfunded, the EPA must provide the Office of Management and Budget, in a separately identified section of the preamble to the rule, or proposed rule, a description of the extent of our prior consultation with representatives of affected tribal governments, a summary of their concerns, and a statement supporting the need to issue the regulation. Also, Executive Order 13084 requires the EPA to develop an effective process permitting elected and other representatives of Indian tribal governments to, "provide meaningful and timely input in the development of regulatory policies on matters that significantly or uniquely affect their communities."

For many of the same reasons described in the Unfunded Mandates Reform Act discussion, the requirements of Executive Order 13084 do not apply to this proposed rulemaking. While Executive Order 13084 does not provide a specific gauge for determining whether a proposed regulation "significantly or uniquely affects" and Indian tribal government, this proposal does not impose substantial direct compliance costs on tribal governments and/or their communities. Tribal communities are not known to own or operate any dye or pigment manufacturing facilities, nor are these communities disproportionately located adjacent to or near such facilities. Finally, tribal governments will not be required to assume any administrative or permitting responsibilities associated with this proposed rule.

APPENDICES

Appendix A

Methodology for Calculating Leachate Quantity

The methodology used to calculate the annual leachate quantity generated per landfill is presented in Tables A.1 and A.2. Table A.1 presents a conservative case where the Agency assumed a linear decrease in leachate quantity (and quality) collected over a 10-year period (i.e., 10 percent reduction per year). Table A.2 presents an expected case where the Agency assumed a linear decrease in leachate quantity (and quality) collected over a 5-year period (i.e., 20 percent reduction per year). Leachate generation data for 15 landfills operated by BFI and WMX that truck their leachate to an off-site POTW are presented in the column under the year 1999.[49] The remaining columns in the tables present leachate quantity estimates over the 10-year or 5-year period assuming a 10 percent or 20 percent annual reduction in quantity, respectively. The summed 10-year or 5-year total quantity is annualized over the 10-year or 5-year period by dividing it equally among the years.

[49] Public comments received by RCRA Docket Information Center, Office of Solid Waste pursuant to the Notice of Data Availability and Request for Comment on the newly listed Petroleum Refinery Wastes (K169, K170, K171, and K172), published August 6, 1998, FR 151, Vol. 63. Document Nos. PR3A-00008, PR3A-L0001, PR3A-00002, PR3A-00006, and PR3A-00007.

Table A.1. 10-Year Conservative Leachate Generation Case: Annual Leachate Quantity (gallons/landfill/year)										
Landfill	**1999 (100%)**	**2000 (90%)**	**2001 (80%)**	**2002 (70%)**	**2003 (60%)**	**2004 (50%)**	**2005 (40%)**	**2006 (30%)**	**2007 (20%)**	**2008 (10%)**
Estimate of the gallons of leachate generated per landfill per year. Estimates assume that collected leachate volumes from the last 10-years worth of closed and operating cells which received the two waste streams will decline 10 percent annually.										
BFI-A	5,184,000	4,665,600	4,147,200	3,628,800	3,110,400	2,592,000	2,073,600	1,555,200	1,036,800	518,400
BFI-B	2,448,000	2,203,200	1,958,400	1,713,600	1,468,800	1,224,000	979,200	734,400	489,600	244,800
BFI-C	1,200,000	1,080,000	960,000	840,000	720,000	600,000	480,000	360,000	240,000	120,000
BFI-D	36,000	32,400	28,800	25,200	21,600	18,000	14,400	10,800	7,200	3,600
BFI-E	3,720,000	3,348,000	2,976,000	2,604,000	2,232,000	1,860,000	1,488,000	1,116,000	744,000	372,000
BFI-F	7,200,000	6,480,000	5,760,000	5,040,000	4,320,000	3,600,000	2,880,000	2,160,000	1,440,000	720,000
BFI-G	3,600,000	3,240,000	2,880,000	2,520,000	2,160,000	1,800,000	1,440,000	1,080,000	720,000	360,000
BFI-H	5,100,000	4,590,000	4,080,000	3,570,000	3,060,000	2,550,000	2,040,000	1,530,000	1,020,000	510,000
BFI-I	4,200,000	3,780,000	3,360,000	2,940,000	2,520,000	2,100,000	1,680,000	1,260,000	840,000	420,000
BFI-J	1,104,000	993,600	883,200	772,800	662,400	552,000	441,600	331,200	220,800	110,400
WMX-O	4,000,000	3,600,000	3,200,000	2,800,000	2,400,000	2,000,000	1,600,000	1,200,000	800,000	400,000
WMX-P	1,000,000	900,000	800,000	700,000	600,000	500,000	400,000	300,000	200,000	100,000
WMX-Q	700,000	630,000	560,000	490,000	420,000	350,000	280,000	210,000	140,000	70,000

Table A.1. 10-Year Conservative Leachate Generation Case: Annual Leachate Quantity (gallons/landfill/year)										
Landfill	**1999 (100%)**	**2000 (90%)**	**2001 (80%)**	**2002 (70%)**	**2003 (60%)**	**2004 (50%)**	**2005 (40%)**	**2006 (30%)**	**2007 (20%)**	**2008 (10%)**
WMX-R	1,500,000	1,350,000	1,200,000	1,050,000	900,000	750,000	600,000	450,000	300,000	150,000
WMX-X	2,200,000	1,980,000	1,760,000	1,540,000	1,320,000	1,100,000	880,000	660,000	440,000	220,000
Total	43,192,000	38,872,800	34,553,600	30,234,400	25,915,200	21,596,000	17,276,800	12,957,600	8,638,400	4,319,200
10-Yr Avg.	237,556,000 gallons / 15 landfills / 10 years ==> **1,583,700 gallons/landfill/year**									

Table A.2. 5-Year Expected Leachate Generation Case: Annual Leachate Quantity (gallons/landfill/year)					
Landfill	**1999 (100%)**	**2000 (80%)**	**2001 (60%)**	**2002 (40%)**	**2003 (20%)**
Estimate of the gallons of leachate generated per landfill per year. Estimates assume that collected leachate volumes from the last 5-years worth of closed and operating cells which received the two waste streams will decline 20 percent annually.					
BFI-A	5,184,000	4,147,200	3,110,400	2,073,600	1,036,800
BFI-B	2,448,000	1,958,400	1,468,800	979,200	489,600
BFI-C	1,200,000	960,000	720,000	480,000	240,000
BFI-D	36,000	28,800	21,600	14,400	7,200
BFI-E	3,720,000	2,976,000	2,232,000	1,488,000	744,000
BFI-F	7,200,000	5,760,000	4,320,000	2,880,000	1,440,000
BFI-G	3,600,000	2,880,000	2,160,000	1,440,000	720,000
BFI-H	5,100,000	4,080,000	3,060,000	2,040,000	1,020,000
BFI-I	4,200,000	3,360,000	2,520,000	1,680,000	840,000
BFI-J	1,104,000	3,200,000	2,400,000	1,600,000	800,000

Table A.2. 5-Year Expected Leachate Generation Case: Annual Leachate Quantity (gallons/landfill/year)					
Landfill	**1999 (100%)**	**2000 (80%)**	**2001 (60%)**	**2002 (40%)**	**2003 (20%)**
WMX-O	4,000,000	800,000	600,000	400,000	200,000
WMX-P	1,000,000	560,000	420,000	280,000	140,000
WMX-Q	700,000	1,200,000	900,000	600,000	300,000
WMX-R	1,500,000	1,760,000	1,320,000	880,000	440,000
WMX-X	2,200,000	883,200	662,400	441,600	220,800
Total	43,192,000	34,553,600	25,915,200	17,276,800	8,638,400
5-Yr Avg.	129,576,000 gallons / 15 landfills / 5 years ==> **1,727,700 gallons/landfill/year**				

Appendix B

Example Calculation of Baseline, Compliance and Incremental Operation and Maintenance Costs

How the annual baseline operation and maintenance (O&M) unit costs per landfill are calculated is demonstrated in Table B.1. The 10-year conservative leachate generation case is used as an example assuming a 7 percent discount rate, the industry average unit cost for trucking leachate off site to a POTW ($0.07/gallon), the upper end unit cost estimate for off-site hazardous wastewater POTW management of $3.063 per gallon ($2.96/gallon for treatment plus $0.103/gallon for transportation) and a 10-year amortization of O&M costs. Leachate quantities are derived in Table A.1. The total baseline O&M cost is calculated by multiplying the unit cost ($0.070/gallon) times the leachate quantity. The baseline present worth costs is calculated by discounting the 10 years of annual baseline O&M costs to December 31, 1998 dollars using a 7 percent discount rate. Compliance O&M costs are calculated in a similar manner. Incremental O&M costs are calculated by subtracting the baseline O&M cost estimate from the compliance O&M cost estimate.

Table B.1. 10-Year Conservative Leachate Generation Case: Annualized O&M Cost Calculation Example for Trucking to an Off-site POTW/TSD Facility (Million $, 1998 Dollars)										
	1999 (100%)	**2000 (90%)**	**2001 (80%)**	**2002 (70%)**	**2003 (60%)**	**2004 (50%)**	**2005 (40%)**	**2006 (30%)**	**2007 (20%)**	**2008 (10%)**
Leachate Quantity for 15 LF (gal)	43,192,000	38,872,800	34,553,600	30,234,400	25,915,200	21,596,000	17,276,800	12,957,600	8,638,400	4,319,200
Baseline O&M Cost ($0.070/gal)	$3.04	$2.73	$2.43	$2.13	$1.82	$1.52	$1.21	$0.91	$0.61	$0.30
Baseline PW (mill. $98)[1]	$3.04	$2.55	$2.12	$1.74	$1.39	$1.08	$0.81	$0.57	$0.35	$0.17
Baseline O&M Cost[1]	*[Relevant data are not included at the present time due to confidentially concerns.]*									
Compliance O&M Cost ($3.063/gal)	*[Relevant data are not included at the present time due to confidentially concerns.]*									
Compl. PW (mill. $98)[1]										
Compl. O&M Cost[1]	*[Relevant data are not included at the present time due to confidentially concerns.]*									
Incremental O&M Cost ($2.993/gal)	*[Relevant data are not included at the present time due to confidentially concerns.]*									
Incr. PW (mill. $98)[1]										
Increment. O&M Cost[1]	*[Relevant data are not included at the present time due to confidentially concerns.]*									

[1] A discount rate of 7 percent is assumed to calculate present worth costs in December 31, 1998 dollars.
PW: Present Worth

Appendix C

Summary of Current Hazardous Leachate (F039) Management Technologies

The Agency conducted queries of the 1995 Biennial Report System (BRS) National Oversight Database on the EPA waste code F039 pertaining to its current generation and management.[50] The EPA code F039 is defined as leachate resulting from the treatment, storage, or disposal of more than one EPA listed waste. A query was made on the generation data (Form GM) to determine how generators of F039 are reporting the management of their leachate. A second query also was made on the quantities reported received by TSDs (Form WR) to provide a sense of the commercial availability of permitted facilities able to receive and manage hazardous leachate. How F039 wastes are reported managed represents a good approximation of how the municipal/industrial landfills will manage leachate derived from the two dye and pigment wastes under RCRA Subtitle C.

In 1995, a total of 161 large quantity generators (LQGs) reported generating only an F039 waste. The number increases to 231 if the query includes all LQGs that reported generating multiple EPA-code wastes where F039 is one of the codes included in the list.

Several LQGs reported managing their F039 waste using multiple management techniques. The 161 LQGs reported managing all or a portion of their F039-only leachate quantity through on- or off-site recovery (8% of LQGs), thermal destruction (50%), aqueous treatment (62%), sludge and other treatment (35%), and disposal (50%) practices. The aqueous treatment and other treatment management practices likely are the primary management methods for collected leachate. This confirms the compliance management assumption that landfills will truck leachate off site to RCRA-permitted TSDs that treat aqueous wastes. F039 liquid (e.g., recovered oil) and sludge residues generated from primary management are managed by recovery, thermal destruction, and disposal management practices. Table 4-9 presents the distribution of reported management practices by generators for F039 hazardous leachate.

In 1995, a total of 51 TSDs reported receiving F039-only waste for management. These TSDs report managing all or a portion of the F039-only leachate received using recovery (3 TSDs), thermal destruction (19 TSDs), aqueous treatment (8 TSDs), sludge and other treatment (11 TSDs), and landfill disposal (10 TSDs) practices. Aqueous and other treatment appear to be commercially available and viable management methods for treating hazardous leachate confirming the validity of the compliance management assumption used in the cost and economic impact analyses.

[50] Refined 1997 BRS data were not available at the time of this analysis.

Table C.1. 1995 Distribution of Management Practices for 161 LQGs of F039-Only Hazardous Leachate		
Management Practice	**Number of LQGs[1]**	**Percent 0f 161 LQGs**
Recovery		
Metal Recovery	4	2.5%
Other Recovery	9	5.6%
SUBTOTAL	13	**8.1%**
Thermal Destruction		
Incineration	72	44.7%
Energy Recovery	5	3.1%
Fuel Blending	4	2.5%
SUBTOTAL	81	**50.3%**
Aqueous Treatment		
Aqueous Inorganic Treatment	17	10.6%
Aqueous Organic Treatment	61	37.9%
Aq. Inorganic and Organic Treatment	22	13.7%
SUBTOTAL	100	**62.1%**
Sludge and Other Treatment		
Stabilization	25	15.5%
Other Treatment	31	19.3%
SUBTOTAL	56	**34.8%**
Disposal		
Landfill	43	26.7%
Deep Well Injection	28	17.4%
Direct Discharge to POTW	4	2.5%
Direct Discharge to NPDES Outfall	1	0.6%
Other Disposal	4	2.5%
SUBTOTAL	80	**49.7%**
Unknown Management		
Transfer Facility	35	21.7%
No Reported Management Code	11	6.8%
SUBTOTAL	46	**28.6%**

[1] Large quantity generators (LQGs) may report more than one management practice for managing F039 leachate and its treatment residuals. One may be the primary treatment and the other(s) may be the residual management practices. Data Source: 1995 Biennial Reporting System National Oversight Database.

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