ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 413

[FRL 1263-8]

Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This regulation limits the concentrations or mass and requires pretreatment of certain pollutants which may be introduced into publicly owned treatment works by operations in the Electroplating Point Source Category. The purpose is to limit those pollutants which interfere with, pass through, or are otherwise incompatible with the operation of such treatment works. The Clean Water Act requires these standards to be issued.

DATES: Effective date: The regulations shall become effective October 9, 1979.

Compliance date: The compliance date shall be October 12, 1982.

FOR FURTHER INFORMATION CONTACT: Ernst P. Hall, Effluent Guidelines Division, (WH-552) Environmental Protection Agency, 401 M St. S.W., Washington, D.C. 20460. (202) 426-2576.

Organization of this Notice

SUPPLEMENTARY INFORMATION: On March 28, 1974, EPA promulgated a regulation adding Part 413 to Chapter 40 of the Code of Federal Regulations (39 FR 11510). That regulation (the "Phase I regulation") with subsequent amendments (the "Phase II regulation") (40 FR 18130, April 24, 1975) established effluent limitations guidelines for existing sources in five subcategories, and standards of performance and pretreatment standards for new sources in one subcategory. Revisions and additions setting forth effluent limitations guidelines based on "best available technology economically achievable" (BAT), pretreatment standards for new and existing sources, and standards of performance for new sources were also proposed for five subcategories (30 FR 11515, March 28, 1974 and 40 FR 18140, April 24, 1975). The history of rulemaking for the category by the Agency prior to December 1976 is described in greater detail in 41 FR 53018 (December 3, 1976).

On December 3, 1976, the Agency suspended the promulgated effluent limitations guidelines based on "best practicable control technology currently available" (BPT). The effluent limitations guidelines based on BAT, new source performance standards, and pretreatment standards for Subpart A of the Electroplating Point Source Category (41 FR 53018) were revoked. The Agency also withdrew its notices of proposed rulemaking for the category (41 FR 53070). The Agency took this action to reevaluate the appropriateness of the limitations and standards established earlier in light of new data and further analysis.

On July 12, 1977, the Agency issued interim final pretreatment standards which incorporated the additional study and analysis (42 FR 35834, July 12, 1977). However, these standards applied only to cyanide, hexavalent chromium, and pH and required plants discharging less than 152,000 liters (40,000 gallons) per day to comply only with amenable cyanide standards. On May 14, 1979 these standards were suspended (44 FR 15029). Therefore, as of this date no pretreatment standards are in effect for this industry.

On February 14, 1978 pretreatment standards were proposed that would require all plants to control hexavalent chromium, lead, cyanide and cadmium (43 FR 6560). In addition, plants discharging more than 38,000 liters (10,000 gallons) per day would be required to control discharges of additional metals. The Agency, after making certain changes in response to comments received, is promulgating this regulation in final form.

Pretreatment standards are being promulgated for process wastewater pollutants introduced into publicly owned treatment works (POTW) from existing sources which fall within the following subcategories of the Electroplating Point Source Category: Electroplating of Common Metals Subcategory (Subpart A); Electroplating of Precious Metals Subcategory (Subpart B); Anodizing Subcategory (Subpart D); Coatings Subcategory (Subpart E); Chemical Etching and Milling Subcategory (Subpart F); Electroless Plating (Subpart G) and Printed Circuit Boards (Subpart H). The content of the standards is discussed in detail below under Summary of Standards.

I. Legal Authority

This regulation is being promulgated pursuant to section 307(b) of the Clean Water Act, as amended, 33 U.S.C. § 1317(b) (the Act), which requires the establishment of pretreatment standards for pollutants introduced into publicly owned treatment works. This regulation is also being promulgated in compliance with the Settlement Agreement in *Natural Resources Defense Council Inc. v. Train*, 8 ERC 2120 (D.D.C. 1976), as modified March 9, 1979.

II. Summary of Standards

This regulation establishes "categorical" pretreatment standards, containing specific numerical limitations based on an evaluation of available technologies in a particular industrial subcategory. The specific numerical limitations are arrived at separately for each subcategory, and are imposed on pollutants which may interfere with, pass through, or otherwise be incompatible with publicly owned treatment works (POTW). For plants with a daily flow of 38,000 liters (10,000 gallons) per day or more, the promulgated standards specifically limit indirect discharges of cyanide and the following metals: lead, cadmium, copper, nickel, chromium, zinc, and silver. Additionally, these regulations limit total metal discharge which is defined as the sum of the individual concentrations of copper, nickel, chrome and zinc. For plants with a daily process wastewater flow of less than 38,000 liters (10,000 gallons), these standards limit only lead, cadmium, and cyanide in order to limit the closure rate in the industry while contributing to significant environmental improvement.

The hexavalent chromium limitations which appeared in the proposed regulation have not been included in this final regulation. The Agency believes that hexavalent chromium limitations are probably unnecessary where total chromium limitations are established. Accordingly, plants discharging 10,000 gallons per day or more will be required to meet a total chromium limitation as originally proposed. The Agency also has eliminated the hexavalent chromium limitation for plants discharging less than 10,000 gallons per day. This was done in order to help reduce the cost of this regulation to the industry. The Agency believes that in most instances the environmental effect of eliminating this requirement will not be significant.

Alternative mass-based standards which are equivalent to the concentration-based standards are also set forth in this regulation. These optional standards may replace the concentration standards where mutually agreed to by the discharger and the publicly owned treatment works. The methodology which was used to develop these limitations is set forth in the Development Document.

Optional TSS limitations have been promulgated by the Agency to reduce self-monitoring costs. TSS and pH limitations replace the Cu, Ni, Cr, Zn, and total metal limitations. Indirect dischargers using this optional limitation are prohibited from using strong chelating agents, must reduce hexavalent chromium wastewaters, and are required to neutralize their wastewater streams with calcium oxide or calcium hydroxide.

The present regulation should be read in conjunction with the General Pretreatment Regulation, 40 CFR Part 403, 43 FR 27736 (June 26, 1978). That regulation governs abnormal discharges which interfere with publicly owned treatment works and establishes mechanisms and procedures for enforcing national categorical pretreatment standards for existing and new sources. The General Pretreatment Regulation prohibits discharges into a POTW with a pH lower than 5.0 and discharges of such volume or strength as to cause POTW interference. These provisions require indirect dischargers of less than 10,000 gallons per day to install pH control and to slowly bleed their toxic waste batch dumps into a POTW.

III. Overview

These pretreatment standards cover all firms performing operations in the Electroplating Point Source Category that introduce effluent into publicly owned treatment works. These operations include electroplating, anodizing, conversion coating, electroless plating, chemical etching and milling, and the manufacture of printed circuit boards. These standards cover both firms performing these processes as their primary line of business and so-called captive operations that perform these processes as part of the manufacture of a product. The plants covered by these regulations are found throughout the United States but are concentrated in heavily industrialized areas.

The printing and publishing industry (SIC 2700) and the iron and steel industry (SIC 3300) are excluded from this pretreatment regulation even though they perform similiar operations. Future electroplating point source category regulations are expected to cover electroplating operations in these industries as well.

The standards require limitations on the discharge of pollutants that are toxic to human beings as well as to aquatic organisms. These pollutants include cadmium, lead, chromium, copper, nickel, zinc, silver, and cyanide. The Agency has put a high priority on the reduction of these pollutants from the nation's waters, primarily because of their toxic nature.

These standards cover a large number of indirect discharges that account for a significant amount of the toxic substances under consideration entering the environment. Revised estimates by the Agency indicate that compliance with these standards could prevent up to 140 million pounds per year of toxic pollutants from entering the ambient waters or concentrating in the sludge from municipal treatment systems.

The Agency's estimate of the quantity of metal pollutants which would be prevented from being discharged into POTWs by this regulation has increased from 40,000,000 to 140,000,000 pounds per year. This revised estimate is based on projected mean concentrations of each pollutant removed as a result of compliance with the regulation. This estimate increased because of a substantial increase in calculated industrial process flow for the plants affected by this regulation and the use of mean instead of median raw waste pollutant values. The Agency's estimate of pollutants discharged to POTWs indicates that electroplating is a major contributor of these pollutants to POTWs.

However, this environmental improvement is not attained without a significant economic impact. Economic analyses by the Agency indicate that many firms whose primary business is metal finishing or printed circuit board manufacturing are vulnerable to adverse economic impact.

After considerable restudy and based on public comments, the Agency believes it has found methods of reducing the projected economic impact of these pretreatment standards without seriously compromising the environmental improvement that this regulation would accomplish. Most importantly, plants whose metal finishing process wastewater flow is less than 10,000 gallons per day must meet a less stringent level of control than do plants with greater flows. Because of their high toxicity, however, cadmium, lead, and cyanide are controlled for all flows. Reducing the requirements on these smaller facilities (or facilities with smaller flows) significantly reduces the projected economic impact of the standards while relaxing controls on less than three percent of the flow to publicly owned treatment works.

Nonetheless, the projected economic impacts of these standards are a major concern to the Agency. The potential adverse effects of this regulation can be substantially reduced through the use of Small Business Administration economic injury loans.

The Agency has been working with the Small Business Administration to insure that loans and other financial assistance programs will be available to eligible firms affected by these standards.

On December 27, 1977, the President signed the Clean Water Act, P.L. 95-217, 91 Stat. 1566, which made significant changes in the Federal water pollution control laws. Included in the amendments is a provision allowing, under certain conditions, a variance from categorical pretreatment standards based on pollutant removal by municipally owned treatment works. This amendment to Section 307(b) of the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, provides:

"If, in the case of any toxic pollutant under subsection (a) of this section introduced by a source into a publicly owned treatment works, the treatment by such works removes all or any part of such toxic pollutant and the discharge from such works does not violate that effluent limitation or standard which would be applicable to such toxic pollutant if it were discharged by such source other than through a publicly owned treatment works, and does not prevent sludge use or disposal by such works in accordance with section 405 of this Act, then the pretreatment requirements for the sources actually discharging such toxic pollutant into such publicly owned treatment works may be revised by the owner or operator of such works to reflect the removal of such toxic pollutant by such works."

The list of toxic pollutants specified under section 307(a) is a list of pollutants reprinted in the House of Representatives Committee Print No. 95-30, which includes all the pollutants controlled by present pretreatment regulations. Information on how removal allowance may be obtained can be found in the General Pretreatment

Regulations, 40 CFR Part 403, 43 FR 22736 (June 26, 1978).

IV. Technical Basis for Standards

The technical analysis upon which this regulation is based includes an identification of the principal wastewater pollutants generated by this category, a consideration of the extent to which these pollutants pass through publicly owned treatment works or are incompatible with publicly owned treatment works, and a study of the various pretreatment technologies which are available for controlling the discharge of such pollutants. Information gathered in a technical study of direct and indirect dischargers for this category was the primary basis for assessing available pretreatment technologies. Data gathered earlier in support of the direct discharge limitations under sections 301 and 304 as well as data submitted by industry were used also. The data and the analysis used in developing these limitations are summarized in Section XII. The details of these studies are set forth in the "Development Document for Existing Source Pretreatment Standards for the Electroplating Point Source Category" (the Development Document).

V. Upset and Net-Gross Provisions

The Upset provision contained in this regulation was modeled after § 122.14(1) of the National Pollutant Discharge Elimination System (NPDES) regulations, 40 CFR Part 122. An explanation of § 122.14(1) is contained in the preamble to the NPDES regulations, 44 FR 32863 (June 7, 1979). The primary difference between the two regulations is that in the electroplating pretreatment regulation an Industrial User must submit notice of an upset to its POTW and Control Authority. In the NPDES regulation, a direct discharger notifies the Regional EPA Administrator or the Director of the State water pollution control agency of an upset.

The net-gross provision contained herein was modeled after § 122.16(e) and (f) of the NPDES regulations. An explanation of § 122.16(e) and (f) is contained in the preamble to the NPDES regulations, 44 FR 32865 (June 7, 1979). The primary difference between the two regulations is procedural: Industrial Users apply to EPA for net-gross credits within sixty days after the applicable categorical pretreatment standard is promulgated, whereas direct dischargers apply for credits at the time they apply for NPDES permits. For purposes of this provision, no net-gross credit shall be given for pollutants found in city water even if the water originates from the same source to which the User's POTW discharges.

VI. Monitoring Requirements

The Agency is specifying self-monitoring requirements as a part of the regulation for this category. The meaning of "average performance" is also detailed and provision is made for calculating performance requirements as a function of the number of samples taken during the sample period.

The self-monitoring frequently required for individual dischargers is a function of the plant's electroplating wastewater discharge. The minimum self-monitoring frequency requirement varies from once per month for plants discharging less than 38,000 liters (10,000 gallons) per day to three times per week for plants discharging more than 950,000 liters (250,000 gallons) per day. The minimum self-monitoring frequency requirements were set to minimize economic impacts while maximizing the control of discharges.

As a part of the Agency's approach to self-monitoring, the Agency is also defining average performance requirements. The Agency originally had proposed daily maximum limitations and 30 day average limitations. Comments from both dischargers and publicly owned treatment works operators indicated a great deal of uncertainty as to the application of the 30 day limitation and the associated self-monitoring cost. Since the self-monitoring requirements are now part of the regulation and do not require self-monitoring for 30 consecutive days, a great deal of attention was directed to defining "average limitations". The new mechanism for determining average limitations makes the average limitation a function of the number of samples included in the average. This approach is consistent with the statistical method used for determining the limitations and with the statistical principle that the fewer the number of measurements in a sample, the more variable will be the average of the measurements. Mathematically, the standard deviation of sample means is inversely proportional to the square root of the number of measurements in the sample. A table has been provided to allow the POTW and the discharger to calculate an appropriate average limitation for each pollutant for any number of individual self-monitoring samples.

Some commenters asked that average limitations be eliminated entirely. This alternative was rejected because it would lessen the extent of real control over the operation of the treatment systems. It is axiomatic that an average is more representative of the overall operation of any system than is a single measurement. Statistically, the more measurements in an average, the greater the "power" of statistical tests. From a regulatory standpoint it is desirable to develop measures of plant performance with the maximum power or statistical usefulness in drawing conclusions about the overall performance of the system.

Average limitations calculated through use of the table provided in the regulation are of equal stringency. Thus, a treatment system capable of meeting the average limitation for thirty samples should also meet a limitation calculated on the basis of six samples.

The method developed for calculating average limitations for numbers of samples can be used by the POTW, State, or municipality to develop local limitations. At a minimum, the local control authority must set average limitations based on the minimum number of self-monitoring samples required to be taken per month. In addition, the local authority and the discharger must calculate and apply average limitations based on the actual number of samples taken per month. If the discharger chooses to take more samples than the minimum number required, then he must report all samples and meet limitations based on the actual number of samples.

VII. Economic Impact Analysis

Executive Order 12044 requires EPA and other federal agencies to perform regulatory analyses of certain regulations, 43 FR 12661, March 23, 1978. EPA's proposed regulations for implementing Executive Order 12044 require a Regulatory Analysis for major significant regulations involving annual compliance costs of $100 million or more, or meeting other specified criteria, 43 FR 29891, July 11, 1978. When these criteria are met, the proposed regulations require EPA to prepare a formal Regulatory Analysis, including an economic impact analysis and an evaluation of regulatory alternatives, such as: 1) alternative types of regulations; 2) alternative stringency levels; 3) alternative timing; and 4) alternative methods of ensuring compliance.

Section 6(b) (6) of Executive Order 12044 exempts from the requirements of the order regulations "that are issued in response to an emergency or which are governed by short-term statutory or judicial deadlines." The pretreatment standards for electroplaters are subject to a court ordered requirement of promulgation by May 15, 1977, *NRDC* v. *Train*, 8 ERC 2120 (D.D.C. 1976). Further delay in the promulgation of these standards would not be in the interest of the environment or the Nation, and would subject the Agency to a possible citation for contempt of court. Accordingly, the pretreatment standards for existing sources in the electroplating point source category are exempt from a formal Regulatory Analysis, as decided by the Director of the Office of Analysis and Evaluation. Nonetheless, this rulemaking satisfies most of the substantive requirements for a Regulatory Analysis. Although the Clean Water Act does not require consideration of alternative timing, or alternative methods of ensuring compliance, EPA has considered alternative stringency levels, and alternative types of regulations. Moreover, the Agency has performed a detailed analysis of the economic impacts of the regulation. A complete description of the analysis is set out in a report entitled "Economic Analysis of Pretreatment Standards for Existing Sources in the Electroplating Point Source Category" (August, 1979). This document is available on request from Ms. Sandra Jones, Office of Analysis and Evaluation (WH-586), U.S. Environmental Protection Agency, 401 M St. S.W., Washington, D.C. 20460.

(a) Background.—The primary financial data for this analysis were supplied by respondents to surveys of over 11,000 establishments identified as engaged in electroplating operations by Dun & Bradstreet lists, Underwriters Laboratories lists, or in the subscription list of a major trade journal. Over 2,100 responses to these surveys were coded for analysis by a computer program to determine the impacts of compliance with the regulations on the respondents' short-term viability and long-term profitability.

The computer program was used to compare the investment requirements for compliance, and associated annual costs, with balance sheet and income statement information to determine the projected financial status of the plants after all compliance requirements had been met. If the plant's estimated profitability, after compliance, was negative, or if the projected debt retirement burden, after investment, was too high to be paid out of the annual cash flow, the computer analysis indicated that the plant was a candidate for closure.

To guide the choice of parameters and assumptions for the economic analysis, the Agency and its contractors consulted with bankers, equipment suppliers, municipal government officials, economic development experts, municipal treatment works officials, professional groups, and electroplaters in three communities where pretreatment ordinances similar to EPA's proposed regulations were in effect. The communities were: Grand Rapids, Michigan; Muncie, Indiana; and Waterbury, Connecticut.

Although the data gathered in these three cities were not intended to verify the economic analysis of the national impacts of the pretreatment standards, they did indicate that the assumptions used in the analysis were substantially correct. A full description of the Agency's findings in the three cities is presented in a report entitled "Analysis of Economic Impacts of Pretreatment Ordinances on the Metalfinishing Industry in Three Communities" (October 21, 1977). This document is available on request from Ms. Sandra Jones, Office of Analysis and Evaluation (WH-586), U.S. Environmental Protection Agency, 401 M St., S.W., Washington, D.C. 20460.

(b) Coverage of the regulations.—These pretreatment standards for plants discharging to publicly owned treatment works (POTW) apply to three groups of electroplating operations: 1) Independent shops performing the metal finishing processes covered by the regulations as their primary line of business (job shops); 2) Independent manufacturers of printed circuit boards (printed board manufacturers); and 3) Captive establishments performing the regulated processes as part of the manufacture of some product by the same firm (captive shops). Summary statistics on the job shops, printed board manufacturers, and captive shops that discharge to publicly owned treatment works are presented in Table 1 below. For captive shops, which do not sell their services to other firms, the average value added by metal finishing is shown in place of sales.

Table 1.—*Summary Characteristics of the Three Industry Sectors (Indirect Dischargers)*

	Job shops	Printed board manufacturers	Captive shops
Number of Plants	2,734	327	4,722
Total Employment (1,000's)	62.8	20.6	2,930
Total Production Employment (1,000's)	46.8	11.9	87.0
Total Sales (million of dollars per year)	1,889	494	5,077
Total Process Water Flow (million gallons per day)	88.3	6.1	1,163

Table 1 shows the preponderance, among indirect dischargers, of production employment, value of metal finishing services, and process water flow, in the captive sector of the industry.

(c) Costs. The economic analysis considers two cost components. The first is the capital cost, or the amount of investment required for installation of pollution control equipment to comply with the regulations. Capital cost estimates are based on the total cost of equipment that the Agency estimates will enable a discharger to meet the pretreatment standards, including the planning required to design a treatment system, and the installation of the system itself. To the extent that there are other less expensive systems, not considered by the Agency, that will achieve the same treatment levels at less cost, the Agency's estimated capital costs are an overstatement of the capital outlays that dischargers in the industry will face. Capital costs shown here are based on extensive observation of equipment in place in the industry, and on manufacturers' quotations for design, supply and installation of treatment equipment.

The second relevant cost component is the total annual cost of compliance for each plant. The annual cost is the sum of all the outlays required in each year for operation and maintenance (O&M) of the pollution control system, sludge disposal, energy usage associated with the operation of the system, and principal and interest payments on the initial investment. The annual costs shown below are adjusted for the tax reductions associated with reduced profitability of the plant.

Table 2 presents the estimated total capital and annual costs of compliance with the regulations, for all indirect dischargers in each of the three sectors described above, and for all indirect dischargers in the electroplanting point source category. These costs represent the increments between reported levels of treatment in the industry and levels required by the pretreatment standards. In Table 2, and throughout this report, all costs are expressed in 1976 dollars.

Table 2.—*Estimated Capital and Annual Costs of Compliance*

[In thousands of dollars]

	Capital cost	Annual cost
Job Shops	$187,600	$62,500
Printed Board Manufacturers	18,500	6,800

Table 2.—*Estimated Capital and Annual Costs of Compliance*—Continued

[In thousands of dollars]

	Capital cost	Annual cost
Captive Shops	1,134,400	424,600
Total All Regulated Facilities	1,340,500	493,900

As Table 2 demonstrates, a large proportion of the capital and annual cost of compliance is incurred in the captive sector of the industry. Captive shops are projected to spend more than five times the amounts required of all independent shops combined, for both the initial investment in equipment and the subsequent annual costs of compliance. This disparity reflects the much larger flows from production processes in captive plants, and the consequent higher average cost of installation of larger tanks and treatment facilities. The average estimated capital cost for captive shops is $240,000, and the average estimated capital cost for job shops is $87,400.

(d) Impacts on the Job Shop Sector. Independent metal finishing job shops may suffer significant adverse economic impacts as a result of the regulations. EPA estimates that 587 metal finishing job shops, employing 9,653 workers, may close as a result of the regulations. This represents 19.9 percent of the job shops in the industry (21.5 percent of the indirect dischargers), and 13.9 percent of the employment in the job shop sector (15.4 percent of employment in job shops that discharge to publicly owned treatment works).

Industry has criticized certain assumptions used in EPA's economic model, claiming that if more realistic assumptions were made, closure rates in the job shop subcategory would be between 30 percent and 60 percent or higher. These estimates were derived by selectively changing assumptions which industry argues minimize closures while ignoring others which maximize closures. Moreover, industry estimates do not consider the potential effect of SBA loans, which could reduce closures in the job shop subcategory to as low as 5.4 percent.

EPA's economic model, like all models, is a simplification of reality to allow an estimation of economic impacts. The 19.9 percent closure rate EPA estimates is an approximation, not a "worst case" outside limit. Nevertheless, due to the use of some very conservative assumptions and the enormous potential impact of SBA assistance, which EPA did not even consider in its model, there is no reason to conclude that real world closures will be as high as those predicted by industry.

Because of the wide variety of products plated, the proportion by which production in the industry might decline as a result of the regulation would have little meaning. The 587 plants that are projected possibilities for closure, however, represent $251 million in sales, 12.4 percent of estimated sales for all job shops (13.3 percent of the sales of indirect dischargers). The job shops projected to close account for only four percent of the profits before tax generated by indirect dischargers in the job shop sector, although profits in plants that do not close will also decline, in the short run, as a result of compliance with the regulations.

The average price of electroplating services from job shops is expected to rise by approximately 7.0 percent as a result of the regulations.

(e) Impacts on the printed board manufacturers.—The impacts of the regulations on the manufacturers of printed circuit boards are not expected to be as great as on the job shops. The Agency estimates that 10 manufacturers of printed circuit boards, employing 321 workers, may close. These plants are 2.5 percent of all printed circuit board manufacturers (3.1 percent of the printed circuit board indirect dischargers), and represent 1.3 percent of employment in this sector (1.6 percent of employment in printed board plants that discharge to publicly owned treatment works).

The price of printed circuit boards is expected to rise by approximately 1.7 percent as a result of the increase in production costs caused by the treatment requirements of the regulations.

(f) Impacts on captive shops.—Captive shops in the industry are not expected to suffer severe adverse impacts from the regulations. None of the plants where metal finishing operations occur is projected to close as a result of the regulation; however, captive plating lines in as many as 140 plants may be shut down, as the plants turn to job shops for their supply of plating services. These 140 plants employ approximately 2,610 metal finishing workers, or about 2.2 percent of the wet metal finishing employees in the captive sector (3.0 percent of employees in captive shops that are indirect dischargers).

The final cost of production of those products produced by firms with captive operations is expected to rise by one percent or less as a result of the regulations.

(g) Combined impacts of the regulations.—It is difficult to combine most of the impacts described above into a single set of statistics that would express the effects of the regulations on the electroplating point source category as a whole. Potential plant closures, for instance, are meaningful as a measure of impact only for independent job shops and printed board manufacturers. One parameter that can be used to judge the aggregate impacts of the regulation is the percentage employment loss for the industry as a whole. The total number of jobs that may be affected is 12,584. This represents 5.9 percent of the 214,000 estimated employees in the category. There are 94,000 total employees in the independent firms plus 120,000 metal finishing employees in the captive shops. Among indirect dischargers, the projected employment impact is 8.6 percent of 146,000 jobs.

(h) Limits of the analysis.—The discussion above has mentioned some of the limitations, such as the difficulty of estimation of production impacts, that are inherent in the economic analysis of the electroplating industry. Beyond these, there are two major drawbacks to the plant-level financial analysis performed by the Agency. They are in the estimation of employment and price effects.

The Agency's estimate of employment impact due to the regulation is based on the employment represented by the plants that are projected to close. Because the Agency's analysis concentrates on the ability of individual plants to bear the costs of compliance, it cannot compare market equilibrium price and production levels before and after compliance. Therefore, the Agency cannot predict the growth effects on plants that successfully comply with the pretreatment standards.

In the past, however, the demand for electroplating services has appeared to be extremely price inelastic, and growing, because of the small percentage of cost of production that electroplating represents for all of the products that require metal finishing, and because of the lack of alternatives to the metal finishing production step. This strong demand suggests that the customers of any plating shops that close are likely to turn to surviving metal finishers for their plating services, and that these finishers will increase production and employment in response to their new customers' requests. Any increase in employment due to this process will reduce the net employment loss in the industry below the gross projected employment losses described above.

Because electroplating represents only a small portion of the final product cost, the price increases described above are overstatements of the percentage increases in the prices of the finished goods. The cost of plating does not exceed 6 percent of the aggregate cost of production in any manufacturing sector. This means that an increase of 7.0 percent in plating costs, as projected above for job shops, translates into an increase of less than 0.5 percent in the prices of the products that job shops plate.

(i) SBA financial assistance.—All of the estimated impacts of the regulations on job shops and printed circuit board manufacturers can be dramatically reduced by federal financial assistance programs for small business. The plant closures projected in the economic analysis result from the unavailability of long-term financing and high commercial interest rates, which lead to annual carrying costs on loans which are larger than can be supported by the plants' annual cash flow. SBA Economic Injury Loans, for which almost all electroplating job shops qualify, are available at interest rates substantially below commercial rates, and for periods up to 30 years. Details of the SBA loan program are presented in Section XI of this document.

To test the effect of Economic Injury Loans, EPA reestimated the impacts of the regulations, assuming availability of 20-year loans (to correspond to the average lifetime of pollution abatement equipment), at an interest rate of 6.75 percent. This sole change in the assumptions of the analysis reduced the projected closures in the job shop sector from 19.9 to 5.4 percent of the firms, and projected employment loss from 13.9 to 6.7 percent of the jobs. In absolute terms, SBA loans could reduce the number of projected job shop closures from 587 to 148, and the estimated employment loss in the job shop sector from 9,653 to 4,670.

The economic impacts of these pretreatment standards clearly depend in large measure on the effective delivery of Economic Injury Loans to electroplaters. The Environmental Protection Agency has worked closely with the SBA to ensure that these loans are delivered expeditiously. Future efforts to facilitate the delivery of SBA loans will include the expansion of a current memorandum of understanding with SBA adding specific references to steps that will be taken to aid electroplaters. In addition, the Agency is examining private sources of expertise in SBA programs to develop a mechanism for dissemination of information about the Economic Injury Loan Program and to provide all assistance necessary to secure prompt delivery of investment capital to eligible electroplating firms.

VIII. Environmental Considerations

The Electroplating Point Source Category consists of an estimated 9400 firms discharging effluent from metal finishing processes either directly to the Nation's waters or indirectly through publicly owned treatment works (POTWs). Of these, an estimated 6600 discharge approximately one billion gallons a day of metal finishing process water to publicly owned treatment works and are covered by these pretreatment standards.

The pollutants discharged by these plants include the following substances toxic to human beings and aquatic organisms: cadmium, lead, chromium (both hexavalent and trivalent), copper, nickel, zinc, silver, and cyanide. These pollutants are only partially removed by municpal treatment systems and pass through to the Nation's waters in varying degrees. The fraction of the metals that does not pass through the municipal system concentrates in the municipal sludge where it hampers the use of the sludge as fertilizer and soil conditioner. These pollutants can also interfere with the efficient operation of the publicly owned treatment works.

The Nation's water quality will be improved by these standards. Cities that have promulgated and enforced similar regulations on metal finishers in the past report substantial reductions in toxic pollutants.

Environmental considerations are discussed in more detail in the section entitled Technical Summary and Basis for Regulations under subsection (2)(ii) of Section XII below entitled, "Origins and Characteristics of Wastewater Pollutants."

IX. Availability of Documents

The EPA technical and economic reports which support this regulation are available for inspection at the EPA Public Information Reference Unit, Room 2922 (EPA Library), Waterside Mall, 401 M St., S.W., Washington, D.C. 20460, at all EPA Regional Offices, and at State Water Pollution Control Offices.

Copies of the technical development document will be available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Copies of the economic analysis document will be available through the National Technical Information Service, Springfield, Virginia 22151.

X. Compliance Schedule

Section 307(b) of the Clean Water Act specifies "a time for compliance not to exceed three years from the date of promulgation" of the standard. Because of the high projected economic impact of these pretreatment standards, the Agency believes that the maximum compliance deadline as set forth in section 307(b) should apply. The time for compliance with these categorical pretreatment standards will thus be three years from the effective date of these regulations. States or local governments may wish to adopt the substantive pretreatment standards and make these standards part of the state laws or local ordinances.

XI. Small Business Administration Financial Assistance

The analysis of the economic impact of these pretreatment standards indicates that Small Business Administration (SBA) financial assistance could significantly reduce the adverse impact of these standards. EPA estimates that the projected closure rates for metal finishing job shops of 19.9 percent could possibly be reduced to 5.4 percent by the use of available SBA loan programs by firms that meet applicable criteria. This would prevent the closing of 439 firms and loss of 4,923 jobs. The Agency has been working with the Small Business Administration to insure that these benefits of fewer closures will be realized. The intent of this work has been to make sure that all firms that must comply with these pretreatment standards and that are eligible for SBA assistance will be helped without undue delay.

There are two SBA programs that may be important sources of funding for the Electroplating Point Source Category. They are the SBA's Economic Injury Loan Program and Pollution Control Financing Guarantees.

Section 8 of the Federal Water Pollution Control Act (FWPCA) authorizes the SBA, through its Economic Injury Loan Program, to make loans to assist any small business concern in effecting additions to or alterations in equipment, facilities, or methods of operation, in order to meet water pollution control requirements under the FWPCA if the concern is likely to suffer a substantial economic injury without such assistance. This program is open to firms of 250 or fewer employees and in some instances to firms employing up to 1000 employees. Thus, this program is open to essentially all independent job shops in the Electroplating Point Source Category. Loans can be made either directly by SBA or through a bank using an SBA guarantee of ninety percent of the loan. The interest on direct loans depends on the cost of money to the federal government and is currently set at 7⅜ percent. Loan repayment periods may extend up to thirty years depending on the ability of the firm to repay the loan and the useful life of the equipment. SBA loans made through banks are at somewhat higher interest rates and are currently at 11¼ percent.

Analyses by the Environmental Protection Agency indicate that many firms in the Electroplating Point Source Category would be eligible for direct and indirect SBA loans. For further details on the Federal loan program write or telephone any of the following individuals at EPA Headquarters or in the ten EPA Regional offices:

Coordinator—Mr. Sheldon Sacks, Environmental Protection Agency, Financial Assistance Coordinator, Office of Analysis & Evaluation (WH-586), 401 M Street SW., Washington, D.C. 20460, Telephone: (202) 755-3624.
Region I—Mr. Glenn John, Environmental Protection Agency, J. F. Kennedy Federal Office Building, Room 2203, Boston, Massachusetts 02203, Telephone: (617) 653-6570.
Region II—Mr. Gerald DeGaetano, Air & Environmental Applications Section, Environmental Protection Agency, 26 Federal Plaza, New York, New York 10007, Telephone: (212) 264-4711.
Region III—Mr. Chuck Sopp, Environmental Protection Agency, Curtis Building, 3EN40, 6th and Walnut Streets, Philadelphia, Pennsylvania 19106, Telehone: (215) 597-9433.
Region IV—Mr. John Hurlebaus, Environmental Protection Agency, 345 Courtland Street, N.E., Atlanta, Georgia 30308, Telephone: (404) 881-4793.
Region V—Mr. Chester Marcyn, Contingency Plan Coordinator, Surveillance and Analysis Branch, Enforcement Division, Environmental Protection Agency, 536 South Clark Street, Chicago, Illinois 60605, AC (213) 353-2316.
Region VI—Ms. Jan Horn, Attorney, Water Enforcement Division, Water Division, Environmental Protection Agency, 1st International Building, 1201 Elm Street, Dallas, Texas 75270, Telephone: (214) 767-2760.
Region VII—Mr. Donald Sandifer, Engineering Branch, Water Division, Environmental Protection Agency, 324 East 11th Street, Kansas City, Missouri 64106, Telephone: (816) 374-2725.
Region VIII—Mr. Gerald Burke, Sanitary Engineer, Office of Grants, Water Division, Environmental Protection Agency, 1860 Lincoln Street, Denver, Colorado 80203, Telephone: (303) 837-3961.
Region IX—Ms. Linda Powell, Permits Branch, Enforcement Division, Environmental Protection Agency, 215 Fremont Street, San Francisco, California 94111, Telephone: (415) 556-3450.
Region X—Mr. Dan Bodien, Special Technical Advisor, Enforcement Division, Environmental Protection Agency, 1200 6th Avenue, Seattle, Washington 98101, Telephone: (206) 442-1270.
Headquarters—Mr. Donnel Nantkes, Legal Counsel, Grants Contracts and General Administration Division, Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, Telephone: (202) 426-8830.

Interested persons may also contact the Assistant Regional Administrators for Finance and Investment in the Small Business Administration Regional offices for more details on Federal loan assistance programs. For further information, write or telephone any of the following individuals:

Region I—Mr. Russell Berry, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 60 Batterymarch, 10th Floor, Boston, Massachusetts 02203, Telephone: (617) 223-3891.
Region II—Mr. John Axiotakis, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 26 Federal Plaza, New York, New York 10007, Telephone: (212) 264-1452.
Region III—Mr. David Malone, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 1 Bala Cynwyd Plaza, 231 St. Asapas Road, West Lobby, Suite 646, Bala Cynwyd, Pennsylvania 19004, Telephone: (215) 596-5962.
Region IV—Mr. Merritt Scoggins, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 1401 Peachtree Street, N.E., Atlanta, Georgia 30309, Telephone: (404) 881-2009.
Region V—Mr. Larry Cherry, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 219 South Dearborn Street, Chicago, Illinois 60604, Telephone: (312) 353-4533.
Region VI—Mr. Donald Beaver, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 1720 Regal Row, Suite 230, Dallas, Texas 75202, Telephone: (214) 749-1265.
Region VII—Mr. Richard Whitley, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 911 Walnut Street, 23rd Floor, Kansas City, Missouri 64106, Telephone: (816) 374-3927.
Region VIII—Mr. James Chuculate, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 1405 Curtis Street, Executive Tower Building—22nd Floor, Denver, Colorado 80202, Telephone: (303) 327-3988.
Region IX—Mr. Charles Hertzberg, Assistant Regional Administrator for Finance and Investment, Small Business Administration, 450 Golden Gate Avenue, San Francisco, California 94102, Telephone: (415) 556-7782.
Region X—Mr. Jack Welles, Regional Administrator for Finance and Investment, Small Business Administration, 710 2d Avenue, Dexter Horton Bldg.—5th floor, Seattle, Washington 98104, Telephone: (206) 399-5679.

In addition to the Economic Injury Loan Program, the Small Business Investment Act, as amended by Public Law 94-305, authorizes SBA to guarantee the payments on qualified contracts entered into by eligible small businesses to acquire needed pollution facilities when the financing is provided through taxable and tax-exempt revenue or pollution control bonds. This program is open to all eligible small businesses including electroplating and metal finishing firms. Bond financing with SBA's guarantee of the payments makes available long term (20-25 years), low interest (usually 5 to 7 percent) financing to small businesses on the same basis as that available to larger national or international companies. For further details on this program write to the SBA, Pollution Control Financing Division, Office of Special Guarantees, 1815 North Lynn Street, Magazine Bldg., Rosslyn, Virginia 22209, (703) 235-2900.

XII. Technical Summary and Basis for Regulation

This section summarizes the basis for pretreatment standards for existing sources in the electroplating point source category.

(1) General methodology

The pretreatment standards were developed in the following manner: The point source category was first studied to determine whether separate standards were appropriate for different segments within the category. The raw waste characteristics for each such segment were then identified. This included an analysis of: the source, flow, and volume of water used in the process employed; the sources of waste and wastewaters; and the constituents of all wastewater. The compatibility of raw waste characteristics with municipal treatment works was then considered. Wastewater constituents suspected of passing through or interfering with publicly owned treatment works were identified.

The Agency identified the control and treatment technologies existing within each segment. This included identification of each distinct control and end-of-pipe treatment process which exists or is capable of being designed for each segment. It also included a determination of the effluent quality resulting from the application of each of the technologies in terms of the amount of constituents and the chemical, physical, and biological characteristics of pollutants. The problems, limitations, and reliability of each treatment and control technology were identified. The Agency additionally studied the non-water quality environmental impacts, of such technologies upon other pollution problems, including air, solid waste, noise, and radiation. The energy requirements of each control and treatment technology as well as the capital cost and the other annual costs to operate and maintain the installed technology, were determined.

The information, as outlined above, was then evaluated to determine the appropriate levels of technology. In identifying such technologies, the Agency considered various factors. These included the total cost of application of technology, the age of equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, non-water quality environmental impacts (including energy requirements), and other factors.

The data upon which the above analysis is based included EPA permit applications, EPA sampling and inspections, consultant reports, and industry submissions.

(2) Summary of technical analysis

(i) Subcategorization. Previous regulations for the electroplating point source category subcategorized the industry on the basis of the processes employed. Electroplating was separated from electroplating-related metal finishing processes because electroplating always requires the action of an electrical current to deposit a metallic coating on the basis material. Electroplating-related metal finishing processes may not require a current and may or may not deposit a metallic coat on the basis material. The processes of anodizing, conversion coating, chemical etching and milling are different enough to warrant separate subcategories. Anodizing, usually performed on aluminum, converts the surface of the object to the metal oxide. Conversion coating refers principally to chromating and phosphating. Each of these processes chemically forms a thin protective coat on the treated object. An electrical current may or may not be applied. Chemical etching and milling involve the dissolution of the basis material.

In restudying the industry for the purpose of establishing pretreatment regulations, the Agency decided that printed circuit board manufacturing and electroless plating also warrant separate subcategorization because of the unique mixture of electrolytic and electroless plating operations found in these processes. Additionally, these processes produce pollutants which may render normal waste treatment techniques ineffective if proper safeguards are ignored. Finally, this subcategorization is consistent with the existing structure of the industry, each subcategory tending to be oriented toward individual processes or identifiable markets which do not overlap significantly.

Separate analyses were conducted for the common metals, precious metals, electroless, and printed circuit board subcategories. For the concentration-based limitations, no significant differences were found between these subcategories. Accordingly, the limitations for these subcategories are identical, with the exception of silver in the precious metals subcategory. Since differences in water use were found between several subcategories, the optional-mass based standards are different in several of these subcategories. The details of this analysis are given in the Development Document.

(ii) Origins and characteristics of waste water pollutants. Wastewater from this industry comes from pretreatment and post treatment operations as well as the actual metal finishing and electroplating steps. The known significant pollutants and pollutant properties from these operations include pH, total suspended solids, cyanide, chromium, copper, nickel, zinc, cadmium, lead, aluminum, and various precious metals and organic compounds. The present study indicates that many of these pollutants may occur together and that their individual concentrations may exceed 100 mg/l.

Wastewater results from the following operations in this industry: (1) rinsing to remove films of processing solution from the surface of work pieces at the site of each operation, (2) rinsing away spills, (3) washing the air that passes through ventilation ducts so as to remove spray from the air before it is exhausted, (4) dumping of spent solutions, (5) washing of equipment, and (6) discharging cooling water used in heat exchangers to cool solutions in metal finishing processes. Approximately 90 percent of the water consumed is in rinsing. That used as cooling water is usually recycled for rinsing. Plating solutions that are dumped should be slowly trickled into the rinse waters prior to treatment.

Many of the pollutants which are generated are toxic pollutants which have potential for environmental or POTW damage. Since none of the metals are destroyed when introduced into a POTW, they either pass through to the POTW effluent or concentrate in the POTW sludge. Cyanide also can pass through a POTW, and both cyanide and the metals can interfere with the POTW treatment processes. The problems associated with the toxic pollutants are as follows:

Inhibition of POTW Processes

All of the metals and cyanide are known to inhibit the operations of a POTW at sufficiently high concentrations. Threshold process influent concentrations for inhibition of activated sludge processes as given in the Federal Guidelines for State and Local Pretreatment Programs (EPA-430/9-76-017) are as follows:

Pollutant	Conc. (mg/l)
Cd	10-100
CN,T	0.1-5
Cr,VI	1-10
CR,III	50
Cu	1
Ag	5
Pb	0-1
Ni	1-2.5
Zn	0.08-10

For anaerobic digestion and nitrification processes, the threshold inhibition concentrations differ. In the case of nitrification processes especially, the threshold numbers are usually lower.

Limitation of Sludge Use

Since the metals are not destroyed, that fraction which does not pass through the POTW is incorporated into sludge. Depending on sludge disposal methods, these metals could contaminate the air, the water, or in some cases enter the human food chain. In addition, sewage sludge is a valuable solid conditioner with about 30 percent currently being applied to land (about half of this amount to agricultural cropland, the remainder to golf courses, nurseries, home lawns and gardens, etc.). Land application is, in general, the least expensive and most environmentally beneficial use of sludges. Metal contamination of sludge can have various effects which limit the amount of sludge which can be applied to cropland. These effects are described below. Concentrations in sludge were taken from Appendix VII, page 7, of "Municipal Sludge Management: Environmental Factors" (EPA 430/9-77-004). Food and Drug Administration (FDA) recommendations for cadmium and lead are summarized in Appendix IX of the same reference. Unless noted otherwise, data on soil levels of these metals and discussion of adverse effects on crops are based on information contained in "Considerations Relating to Toxic substances in the Application of Municipal Sludge to Cropland and Pastureland" (EPA 560/8-76-004) and "Application of Sewage Sludge to Cropland: appraisal of Potential Hazards of the Heavy Metals to Plants and Animals" (EPA 430/9-76-013).

Cadmium—A study of 189 sewage sludges showed that sewage sludge contains 3 to 3410 mg/kg (dry basis) of cadmium (mean = 110 mg/kg; median = 16 mg/kg). These concentrations, are significantly greater than those normally found in soil (0.01 to 7 mg/kg, with 0.06 mg/kg being the mean). Data show that cadmium can be incorporated into crops, including vegetables and grains, from contaminated soils. Although the crops themselves show no adverse effects from soils with levels up to 100 mg/kg cadmium, these contaminated crops could have a significant impact on human health.

Three federal agencies have already recognized the potential adverse human health effects posed by the use of sludge on cropland. The FDA recommends that sludges containing cadmium concentrations over 20 mg/kg should not be used on agricultural land. The Department of Agriculture (USDA) also recommends limitations on the total cadmium from sludge that may be applied to land. Under Section 4004 of Resource Conservation and Recovery Act (RCRA), the EPA will shortly promulgate limits on the amount of sludge that can be landspread, based on annual and cumulative cadmium application rates. Under Section 405 of the Clean Water Act, additional restrictions will be placed on sludge for home use, based on cadmium content. All these federal restrictions are designed to prevent excessive cadmium additions to the human diet.

Chromium—A study of 180 sewage sludges showed that sewage sludge contains 10 to 99,000 mg/kg (dry basis) of chromium (mean = 2620 mg/kg; median = 890 mg/kg). Most crops absorb relatively little chromium even when it is present in high levels in soils, but chromium in sludge has been shown to reduce crop yields in concentrations as low as 200 mg/kg.

Copper—A study of 205 sewage sludges showed copper levels of 84 to 10,400 mg/kg, with 1210 mg/kg as the mean value and 850 as the median value. These concentrations are significantly greater than those normally found in soil, which usually range from 18–80 mg/kg. Copper toxicity may develop in plants from application of sewage sludge contaminated with copper. Livestock have been poisoned by eating plants contaminated with copper.

Lead—A study of 189 sludges showed lead levels ranging from 13 to 19,700 mg/kg (dry basis) (mean=1360 mg/kg; median=500 mg/kg). Since the normal range of lead content in soil is from 2 to 200 mg/kg, application of contaminated sewage sludge to the soil will generally increase the soil's lead content.

Data indicate that the application to cropland of sludge containing excessive lead levels may increase the lead concentration in crops grown on acid soils. Generally, roots accumulate more lead than do plant tops. For above ground crops, significant impacts can occur when sludge is applied as a surface dressing while crops are growing. In light of the potential human health effects, the FDA has recommended that sludge containing more than 1000 mg/kg of lead should not be used on agricultural land for crops used directly in the food chain.

Nickel—A study of 165 sludges showed nickel concentrations ranging from 2 to 3520 mg/kg (dry basis), with a mean of 320 mg/kg and a median of 82 mg/kg. Nickel toxicity may develop in plants from application of sewage sludge on acid soils. Nickel reduces yields for a variety of crops including oats, mustard, turnips, and cabbage.

Zinc—Data from 208 sludges show a zinc range of 101 to 27,800 mg/kg (dry basis), with a mean of 2790 mg/kg and a median of 1740 mg/kg.

These concentrations are significantly greater than those normally found in soil, with observed values of 10 to 300 mg/kg, with 50 mg/kg being the mean. Therefore, application of sewage sludge to soil will generally increase the concentration of zinc in the soil. Zinc can be toxic to plants, depending upon soil pH. Lettuce, tomatoes, turnips, mustard, kale, and beets are especially sensitive to zinc contamination.

Examples of effects of pretreatment on sludge quality. Pretreatment programs have been effective in reducing metals concentrations in sludge. Three examples are cited below.

Buffalo, New York: Sludge concentration (mg/kg—dry basis).

Pollutant	Before pretreatment (actual)	After pretreatment (projected)
Cd	100	50
Cr	2,540	1,040
Cu	1,570	330
Pb	1,800	605
Ni	315	115
Zn	2,275	364

Grand Rapids, Michigan: Sludge concentration (mg/kg—dry basis).

Pollutant	Before pretreatment (actual)	After pretreatment (actual)
Cr	11,000	2,700
Cu	3,000	2,500
Ni	3,000	1,700
Zn	7,000	5,700

Muncie, Indiana: Sludge concentration (mg/kg—dry basis).

Pollutant	Before pretreatment (actual)	After pretreatment (actual)
	(1972)	(1976)
Cd	23	9.5
Cr	2,000	675
Ni	8,500	150
Zn	5,800	2,700
Pb	8,500	1,000
Cu	1,750	700

Pass Through and Effects on Receiving Water

None of the pollutants are completely removed from wastewater by average POTWs; part of the pollutant load passes through to the POTW effluent and subsequently contaminates the receiving water. Pass through data and some of the effects on receiving water are summarized below. Data on pass through were calculated (as 100 percent minus percent removal) from the removability data given on page 6–45 of "Federal Guidelines: State and Local Pretreatment Programs" (EPA 430/9-76-017b). POTW effluent data were taken from pages 6–39 to 6–41 of the same reference.

Cadmium—Data from 110 POTWs show that 75 percent of the primary plants, 57 percent of the trickling filter plants and 66 percent of the activated sludge plants allowed over 90 percent of the influent cadmium to pass through to the POTW effluent. Only 2 of the 110 POTWs allowed less than 20 percent pass through, and none allowed less than 10 percent pass through. Data from 145 POTWs show POTW effluent concentrations ranged from 0.001 to 1.97 mg/l (mean 0.028 mg/l, standard deviation 0.167).

The cadmium which passes through the POTW to the effluent is discharged to ambient surface water. Cadmium is toxic to aquatic organisms at levels typically observed in POTW effluents. For example, the Cadmium Ambient Water Quality Criteria Document (PB-292-423) cites:

- 96 hr. LC50 for chinook salmon is reported as 0.0018 mg/l,
- 96 hr. LC50 for rainbow trout is reported as 0.0013 mg/l, and
- 48 hr. LC50 for the invertebrate cladoceran is reported as 0.007 mg/l.

Besides providing an environment for aquatic organisms, surface water is often used as a source of drinking water or irrigation water. For states with drinking water or irrigation water standards, the most common cadmium standard is 0.01 mg/l. Chronic ingestion of cadmium via drinking water and from use of contaminated irrigation water has been documented as the cause of itai-itai disease in humans.

Cadmium has no known biological benefits for humans and is capable of causing kidney damage when present in significant amounts; there is suggestive evidence that cadmium may be a carcinogen. For these reasons, it is prudent to restrict environmental sources of cadmium as much as possible.

Chromium—The amount of chromium which passes through to the POTW effluent depends on the type of treatment processes used by the POTW. Data from 138 POTWs show that 56 percent of the primary plants allowed more than 80 percent pass through to POTW effluent. More advanced treatment reduces pass through, with median pass through values for trickling filter and activated sludge treatments being about 60 percent. Data from 179 POTWs show POTW effluent concentrations ranging from 0.003 to 3.2 mg/l total chromium (mean = 0.197, standard deviation = 0.48), and from 0.002 to 0.1 mg/l hexavalent chromium (mean = 0.017, standard deviation = 0.020).

The chromium which passes through the POTW is discharged to ambient surface water. Chromium is toxic to aquatic organisms at levels observed in POTW effluents.

- trivalent chromium significantly impaired the reproduction of *Daphnia magna* at levels of 0.3 to 0.5 mg/l (J. Fish Res. Board Can., 29: 1691, 1972).
- hexavalent chromium retards growth of chinook salmon at 0.0002 mg/l (Hanford Bio. Am. Rep., 1957)

Hexavalent chromium is also corrosive, and a potent human skin sensitizer.

Besides providing an environment for aquatic organisms, surface water is often used as a source of drinking water. Because hexavalent chromium can be reduced to trivalent chromium in the environment, and trivalent chromium can possibly be oxidized to hexavalent chromium by chlorine or other agents, the National Interim Primary Drinking Water Standards are based on total chromium, the limit being 0.05 mg/l.

Copper—In data from 156 POTWs, the median pass through was over 80 percent for primary plants and about 40–50 percent for trickling filter and activated sludge treatment plants. POTW effluent concentrations (based on data from 192 plants) ranged from 0.003 to 1.8 mg/l (mean = 0.126, standard deviation = 0.242).

The copper which passes through the POTW to the effluent is discharged to ambient surface water. Copper is toxic to aquatic organisms at levels typically observed in POTW effluents, for example:

- 48-hour LC50 for *Daphnia Magna* in soft water is 0.02 mg/l (J. Fish Res. Board Can., 29: 1972).
- 96-hour LC50 for the chinook salmon is 0.017 mg/l (Chapman, G. A., 1975. Toxicity of Copper, Cadmium, and Zinc to Pacific Northwest Salmonids. US EPA, Corvallis, OR).
- 96-hour TL50 for the fathead minnow is 0.023 mg/l (Water Pollut. Int. J. 10:453, 1966).

Lead—Data from 124 POTWs show median pass through values to be over 80 percent for primary plants. About half of the trickling filter and activated sludge plants allow over 60 percent pass through. Lead concentrations in POTW effluents (based on data from 157 POTWs) ranged from 0.003 to 1.8 mg/l (mean = 0.106, standard deviation = 0.222).

The lead which passes through the POTW to the effluent is discharged to ambient surface water. Lead is toxic to aquatic organisms at levels typically observed in POTW effluents, for example:

- 48-hour LC50 for *Daphnia magna* is 0.45 mg/l (J. Fish Res. Board Can., 29:1691).
- 48-hour LC50 for rainbow trout is 0.9 mg/l (Water Res. 2:723, 1968).

Besides providing an environment for aquatic organisms, surface water is often used as a source of drinking water. The National Interim Primary Drinking Water Regulation limit lead in drinking water to 0.05 mg/l.

The major risk of lead in drinking water is to small children, where the water is one of several sources which result in a well documented, serious problem of excess lead levels in the body. As a result of the narrow range between the lead exposure of the average American in everyday life and exposure which is considered excessive, (especially in children) it is imperative that lead in water be maintained within strict limits. The estimated maximum safe level of lead intake is 600 μg/day. Potential sources of exposure are diet, water, dust, air, etc. Levels of lead in many urban children indicate overexposure. High body levels of lead can result in serious consequences (chronic brain or kidney damage, or acute brain damage); therefore, lead in water should be limited to the lowest practicable level.

Nickel—Data from 109 POTWs indicate that nickel pass through was greater than 90 percent for 82 percent of the primary treatment plants. Median pass through for trickling filter and activated sludge plants was greater than 80 percent. Data from 149 POTWs show POTW effluent concentrations ranging from 0.003 to 40 mg/l (mean=0.411, standard deviation=3.279).

The nickel which passes through the POTW is discharged to ambient surface water. Nickel is toxic to aquatic organisms at levels typically observed in POTW effluents, for example:

- 50 percent reproductive impairment of *Daphnia magna* at 0.095 mg/l (J. Fish Res. Board Can., 29:1691, 1972).
- morphological abnormalities in developing eggs of *Limnaea palustris* at 0.230 mg/l (Bio. Bulletin 125:508, 1963).
- 50 percent growth inhibition of aquatic bacteria at 0.020 mg/l (Curr. Sci. 45:578–580, 1976).

Since surface water is often used as a drinking water source, nickel passed through a POTW becomes a possible drinking water contaminant.

Zinc—Data from 148 POTWs show the median pass through values to be 70–80 percent for primary plants, 50–60 percent for trickling filter plants, and 30–40 percent for activated sludge process plants. POTW effluent concentrations of zinc (based on data from 198 POTWs) ranged from 0.009 to 3.6 mg/l (mean=0.330, standard deviation=0.464).

The zinc which passes through the POTW to the effluent is discharged to ambient surface water. Zinc is toxic to aquatic organisms in concentrations typically observed in POTW effluents, for example:

- 96-hour LC50 for the cutthroat trout is 0.090 mg/l (Sport Fishing Abstract 13665, 1971).
- 96-hour LC50 for the chinook salmon is 0.103 508, 1963 mg/l (Chapman, G. A., 1975. Toxicity of Copper, Cadmium and Zinc to Pacific Northwest Salmonids. USEPA, Corvallis, Or).
- 48-hour LC50 for *Daphnia magna* is 0.100 mg/l (J. Fish Res. Board Can. 29:1691, 1972).

Cyanides—Cyanide may theoretically be destroyed in a POTW, but data indicate that much of it passes through to the POTW effluent. One primary plant showed 100 percent cyanide pass through, and the mean pass through for 14 biological plants was 71 percent. Data from 41 POTWs indicate the effluent concentrations range from 0.002 to 100 mg/l (mean = 2.518, standard deviation = 15.6). (If the plant with an effluent of 100 mg/l is removed from the data base as an outlier, the mean becomes 0.081 mg/l for 40 POTWs).

The cyanide which passes through to the POTW effluent is discharged into ambient surface water. There is considerable evidence documenting cyanide toxicity to aquatic organisms at levels at or below those typically observed in POTW effluents.

Cyanides are more toxic to fish than to lower aquatic organisms such as midge larve, crustaceans, and mussels. Toxicity to fish is a function of chemical form and concentration, and is influenced by the rate of metabolism (temperature), the level of dissolved oxygen, and pH. In laboratory studies free cyanide concentrations ranging from 0.05 to 0.15 mg/l have been proven fatal to sensitive fish species including trout, bluegills, and fathead minnows (EPA 600/3-76-038). Long term sublethal concentrations of cyanide as low as 0.01 mg/l have been shown to affect the ability of fish to function normally, e.g. reproduce, grow, and move freely (G. Leduc, 1966, Ph.D Thesis, Oregon State Univ., Corvallis).

Cyanide may exist as free cyanide (CN anion), hydrogen cyanide (HCN), or as a complex with metals. In the absence of metals, free cyanide and hydrogen cyanide are in an equilibrium, which is highly dependent upon pH. At pH values below 7.0, over 99 percent of the cyanide is present at HCN. At pH values of 8.0, 9.0, and 10.0 the HCN percentage decreases to 93.3 percent, 58 percent and 13 percent, respectively. Since HCN is the most toxic form of cyanide, it is clear that decreasing pH (increasing acidity) results in greater toxicity. Temperature increase also results in increased toxicity (2-3 fold over 10°C), as does reduction in dissolved oxygen content.

Cyanide forms complexes with metal ions present in wastewater. All these complexes exist in equilibrium with HCN. Therefore, the concentration of free cyanide present is dependent on the pH of the water and the relative strength of the metal-cyanide complex. The cyanide complexes of zinc, cadmium and copper may dissociate to release free cyanide. Also, where these complexes occur together, synergistic effects have been demonstrated. Zinc, copper, and cadmium cyanide are more toxic than an equal concentration of sodium cyanide.

Another problem associated with cyanide pass through is possible chlorination of cyanide to highly toxic cyanogen chloride, which is subsequently released to the environment. This chlorination reaction may occur as part of the POTW treatment, or subsequently as part of the disinfection treatment for surface drinking water preparation.

Data for Grand Rapids, Michigan, show a significant decline in cyanide concentrations downstream from the POTW after pretreatment regulations were enacted. Concentrations fell from 0.06 mg/l before to 0.01 mg/l after pretreatment was required.

Silver—Data from a recent EPA study of several POTWs show that silver treatability is quite variable, but that a significant portion of the influent silver (25 percent to 75 percent) is likely to pass through to the POTW effluent.

The Silver Ambient Water Quality Criteria Document (PB-292-441) provides the following information: The toxicity of silver to aquatic organisms has long been recognized. Dosages of 0.000001 to 0.5 mg/l of silver have been reported as sufficient to sterilize water. Various toxic effects on aquatic life have been reported. For example:

- 96-hr LC50 for rainbow trout has been reported as 6.5 $\mu g/l$ to 28.8 $\mu g/l$.
- 96 hr LC50 for the water flea (*Daphnia Magna*) has been reported as 1.5 $\mu g/l$.
- Bioconcentration of silver up to 368 times has been reported.

(iii) Treatment and control technology.—The Agency has studied wastewater treatment and control technologies for this industry to determine the best practicable pretreatment technologies. This study showed that although there are differences between subcategories in the types and quantities of wastes generated, the same general treatment technologies are available to this entire industrial segement.

Electroplating wastes are typically treated by a number of sequential control techniques. General practice includes segregation and individual treatment of the wastes containing cyanide and chrome followed by the removal of metals by pH adjustment and clarification or filtration in a common treatment system. Therefore, the present pretreatment limitations for this category are based on the following control techniques: cyanide oxidation, chrome reduction, metal precipitation using pH adjustment and solids removal. For plants with process flows of less than 10,000 gallons per day, pretreatment limitations are based on removal of lead, cadmium, and cyanide only. The use of these technologies formed the basis of the pretreatment standards which are being established. However, this does not preclude the use of other wastewater treatment techniques which provide equivalent or better levels of treatment. These treatment technologies are discussed in detail in the development document.

Chrome reduction.—Reduction of hexavalent chrome to trivalent chrome is practiced widely and typically uses sulfur dioxide at a pH of approximately two.

Seventy-one plants sampled by the Agency had operating chrome reduction facilities. The number of data points from each plant varied from one to 133. The data from each plant were averaged into a single number so that all plants were considered equally. Approximately 60 percent of these plants already meet the limitations specified by the regulation.

Cyanide destruction.—Cyanide must be treated before treatment for metals removal may take place. If this is not done, soluble metal cyanide complexes will form rather than insoluble metal hydroxides.

Cyanide destruction is generally done in a two-stage oxidation treatment system using chlorine or hypochlorite. The first stage of the reaction oxidizes cyanide to cyanate, and the second oxidizes cyanate to nitrogen and carbon dioxide.

The cyanide limitation set by this regulation is based on two stage treatment and careful separation of iron, nickel, and certain other metal bearing wastes from cyanide waste treatment technologies. This latter segregation practice is standard good housekeeping procedure and is well established within the industry.

Seventy-one plants sampled during this study had cyanide oxidation facilities. The data from each plant were treated in the same manner as the data on chrome reduction. The limitations set by this regulation based on cyanide oxidation are currently achieved by approximately 60 percent of the plants sampled.

pH Adjustment.—All of the plants sampled in this study controlled pH. Typically, the pH is adjusted by adding an acid (such as hydrochloric or sulfuric) or a base (lime or caustic) to the waste stream in an agitated tank. Control of pH is achieved by adding sufficient amounts of acid or base to the waste to maintain the pH in the desired range.

Metals removal.—The adjustment of the pH of electroplating wastes to 8.0 or above causes the dissolved metals to form insoluble metal hydroxides. These compounds can be removed from the wastewater by solids separation techniques such as gravitational settling or filtration. Both methods are in general use within the industry and were used by plants sampled by the Agency. A detailed analysis of the performance of these techniques is given in the development document.

The limitations specified by this regulation are based on the Agency's assessment of the performance of the preceding technologies. This assessment includes an analysis of the variability which is inherent in the normal operation of these technologies and the procedures of laboratory analysis. The Agency estimates that consistent compliance with these limitations will require firms to achieve the following long-term averages:

Pollutant	Long-term average (mg/l)
CN,T	0.15
Cu	1.4
Ni	1.4
Cr,T	1.8
Zn	1.4
Pb	0.2
Cd	0.4
Ag	0.4
Total metals	4.2

Firms which operate close to or at the daily maximum or thirty day limitations would be expected to violate these limitations frequently.

Finally, the Agency carefully excluded data for plants which were diluting untreated or inadequately treated process waste water with nonprocess or sanitary waste. Dilution of this sort is counter to the intent of this regulation and must not be used as an aid in achieving these limitations.

(iv) Cost estimates for control of wastewater pollutants.

Cost information was obtained from industry, engineering firms, equipment suppliers, government sources, and available literature. Whenever possible the Agency used costs based on actual industrial installations or engineering estimates for projected facilities as supplied by contributing companies.

The cost information was used to estimate the cost of treatment plants for electroplating establishments of various sizes and compositions. Eighty-one model plants were used to characterize the treatment costs associated with this category. These models and a summary of the costing methodology are available for public inspection at the EPA Public Information Reference Unit, Room 2922, (EPA Library), Waterside Mall, 401 M St., S.W., Washington, D.C. 20460.

(v) Energy requirements and nonwater quality environmental impacts.

The energy costs related to the implementation of these regulations are generally limited to the electricity required for liquid transfer pumps and agitator motors.

The major non-water quality consideration associated with these pretreatment standards is the generation of metal-bearing solid wastes which must be disposed of by the industrial user. The Agency realizes that the treatment technologies will result in solid wastes with relatively high concentrations of toxic metals. However, the quantity of wastes will be significantly lower than the quantity of municipal sludge which would be contaminated by the metals in the absence of regulation and should present a less environmentally burdensome disposal problem.

The Agency has estimated the 1976 cost for disposing of these solid wastes in an environmentally safe manner to be $0.12 per gallon. However, to allow for a margin of safety, the estimate has been raised to $0.25 per gallon. This cost has been included in the cost analysis for this regulation.

No significant increase in noise, radiation, air pollution, or thermal pollution will result from the implementation of these pretreatment standards.

XIII. Summary of Public Participation

Numerous agencies and groups have participated at various stages in the development of these pretreatment standards. The Agency solicited comments when proposed pretreatment standards were published on March 28, 1974 (Phase I) and on april 24, 1975 (Phase II). Many agencies and groups were also consulted in the course of developing the proposed regulations. Similar opportunities for public participation were also provided in the related development of Phase I and Phase II regulations based upon best practicable control technology currently available. Furthermore, a public hearing on pretreatment standards for the electroplating industry was held on June 10, 1974. On December 3, 1976, the agency announced that the regulations which had been previously proposed or promulgated would be reevaluated. Since that time the Agency has reconsidered the formulation of pretreatment standards and other regulations in light of all comments which have been received. The Agency has also continued to consult with and receive comments from interested agencies and groups. Furthermore, at the request of the National Association of Metal Finishers, the Agency has released split samples of process wastewater for duplicate analysis as well as additional data on the electroplating plants that were selected for sampling and study as a basis for reevaluating the regulations. Comments were sought after the promulgation of the interim final pretreatment regulations on July 12, 1977 and additional comments were requested in conjunction with the proposal of this regulation on February 14, 1978. A public hearing was held on June 22 and June 23. 1978.

The following are the principal agencies and groups consulted in the development of regulations: (1) Effluent Standards and Water Quality Information Advisory Committee (established under section 515 of the Act); (2) all State and Territorial Pollution Control Agencies; (3) Department of Interior; (4) Department of Commerce; (5) Department of Defense; (6) Department of the Treasury; (7) Water Resources Council; (8) Council on Environmental Quality; (9) Office of Management and Budget; (10) Department of Housing & Urban Development; (11) Council on Wage & Price Stability; (12) Tennessee Valley Authority; (13) Water Resources Council; (14) U.S. Post Office; (15) Nuclear Regulatory Commission; (16) Energy Research and Development Administration; (17) National Association of Metal Finishers; (18) Metal Finishers Suppliers Association; (19) American Electroplating Society; (20) Institute of Printed Circuits; (21) Alberts Plating Works, Inc.; (22) American Hot Dip Galvanizers; (23) American Society of Mechanical Engineers; (24) Hudson River Sloop Restoration, Inc.; (25) The Conservation Foundation; (26) Environmental Defense Fund, Inc.; (27) Natural Resources Defense Council; (28) The American Society of Civil Engineers; (29) Water Pollution Control Federation; (30) National Wildlife Federation; (31) American Institute of Chemical Engineers; (32) New England Interstate Water Pollution Control Commission.

Comments on the proposed regulations which were published on February 14, 1978, were received from the following: City of Detroit; Metal Finishing Suppliers' Association; Enviro-Services; U.S. Brass; Andco; City of Rockford, Illinois; Keystone Steel and Wire; Ohio EPA; City of Richmond. Virginia; Lancy Engineers; Thomas J. Rouzie, NPDES Engineer; Olin Chemical Corporation; Bob Johns, Engineer; Western Electric; New York State—Environmental Conservation; Eastman Kodak; Iowa Department of Environmental Quality; Air Transport Association; Briggs and Stratton; Cutler Hammer; Howard K. Bell; Hampton Roads Sanitary District; General Electric; Dow Corning; Hayes International Corp.; Automated Medical Systems; Xerox; Nassau County, New York; Atlantic Richfield; FCM Division—Gulf Western Industries; City of Phoenix, Arizona; Ford Motor Company;

Grimes; U.S. Department of Interior; Wald Manufacture; Utica Tool; Phelps Dodge Refining Corp.; County of Monroe, New York; Pelton & Crane; Department of Public Works, San Francisco, California; Metro District Commission, Massachusetts; Industrial Management Council; Buffalo Sewer Authority; Deere & Co.; City of Los Angeles; City of Grand Rapids; National Association of Store Fixture Manufactures; International Paper Company; Environmental Services; City of Los Angeles; Foregger Air Products; Magnavox Corporation; City of San Diego, California; Graphic Communication Industries; Westvaco Corporation; City of Milwaukee, Wisconsin; E. I. DuPont; General Motors Corporation; American Electroplaters Society; U.S. Chamber of Commerce; Natural Resources Defense Council; Plumbing Manufacturers' Institute; State of Kentucky; Digital Equipment Corporation; Chrome-Rite Company; American Iron & Steel Inst.; Ford; Department of the Army; Guzman Assoc.; Reynolds; General Telephone; Department of Commerce; National Association of Metal Finishers; Oklahoma City; New York City; Apollo Metals; Institute for Interconnecting and Packaging Electronic Circuits.

The major issues raised by these commenters following the publication of the proposed regulations are as follows:

Comment; High closure rates render the regulation impractical and unachievable.

Response: Congress realized that some businesses would close as a result of the promulgation of technology-based standards. Congress determined that long term environmental benefits were more important than short term dislocations. The Administrator has considered the costs and benefits of this regulation, as evidenced by his exemption of small platers from some requirements.

Comment: Many commenters questioned the need for national electroplating standards, preferring local limitations, at least where the local treatment works is in compliance with its NPDES permit. These commenters argued that local authorities would be more responsive to local conditions, including water quality conditions, and that local controls would avoid redundant treatment by electroplaters and the publicly owned treatment works.

Response: EPA considered the issue of local versus national standards in promulgating the General Pretreatment Regulation, 40 CFR Part 403, 43 FR 27736 (June 26, 1978). The Agency pointed out in the preamble to those regulations that many pollutants released into the nation's navigable waters are a national problem because they are persistent in the environment, bioaccumulate, and enter food chains. Moreover, a number of the pollutants discharged by industrial users of publicly owned treatment works are substances for which there is evidence of carcinogenicity, mutagenicity, or teratogenicity. Others are known to have acute toxic effects on human or aquatic organisms. Congress recognized the national scope of this problem in enacting section 307 (b)(1) of the Clean Water Act, which requires EPA to set national pretreatment standards for pollutants which interfere with the treatment works, pass through, or are otherwise incompatible with the publicly owned treatment works.

Congress also recognized the strong local interest in pretreatment standards. In Section 510 of the Clean Water Act, Congress specifically allowed states and municipalities to set limits more stringent than federal standards. However, section 510 expressly forbids any State from adopting or enforcing a standard *less* stringent than a national standard.

To avoid redundant treatment, Congress provided that under certain circumstances a publicly owned treatment works can allow local dischargers a variance from national standards to account for removal achieved by the publicly owned treatment works. The conditions under which such a variance may be obtained are described in 40 CFR 403.7, 43 *FR* 27748 (June 26, 1978).

A publicly owned treatment works' ability to meet its NPDES permit is not a sufficient reason to modify categorical pretreatment standards. Publicly owned treatment works permit limitations usually require only secondary treatment of some conventional pollutants and do not usually contain limitations on toxic and other pollutants.

Nor are satisfactory local water quality conditions a sufficient reason to modify national standards. Since many toxic industrial pollutants do not degrade but concentrate in bottom sediments, they are not acknowledged in water quality measurements. Moreover, by virtue of their persistence and bioaccumulation, toxic pollutants can concentrate downstream of local water quality measuring stations.

Comment: The data base used to establish cyanide standards is inadequate or inappropriate. Specific situations included: (1) an electroplating waste treatment facility with over capacity at the time of sampling, (2) plants with integrated waste treatment systems, (3) plants generating a very low percentage of cyanide waste, (4) treatment processes and operating levels during sampling periods were not described, (5) the extreme range of CN,A and CN,T concentrations in treated effluents, and (6) the omission of consideration of cost of spill control.

Response: (1) The Agency, in developing this regulation, sampled operating plants with a total of several hundred days of testing. Plants with underutilized and overtaxed waste treatment facilities were included unless a specific malfunction was identified. Therefore, any effects of underutilization should have been taken into account by these statistical analyses. (2) Plants with integrated waste treatment systems and those generating only a small percentage of CN waste were eliminated from the data base. (3) An extensive range of the processes used was included in this sampling program. However, plants with a very low percentage of cyanide wastewater were not included in the analysis. (4) The treatment processes and operating levels during sampling are fully described in plant visit reports and are summarized in the detailed data base. Because of the volume of data, it was impossible to include all of it in the Development Document. However, this data is available for public review. (5) Free cyanide oxidation and precipitation of complexed cyanides is a very effective technology when operated correctly. The Agency's data base clearly illustrates this. Those plants that did not meet the limits were very similar (raw process wastewater, process operations, etc.) to those plants that did meet the limits. (6) The Agency did not consider spill controls because handling drippages and spills were assumed be a normal part of existing electroplating operations. Exceptional spills may be subject to the upset provisions described in this regulation or the General Pretreatment Regulations, 40 CFR 403.

Comment: Although data on 123 plants had been collected, not all were used in subsequent analyses.

Response: Screening criteria applied to the data from 123 plants determined that data from 67 plants were usable. The screening criteria were designed to eliminate plants which were improperly designed or clearly improperly operated. Such plants do not represent the performance of best practicable technology and should not be considered in setting pretreatment standards. Removal from the data base resulted from excessively high TSS values, out of tolerance pH or temperature differential in the clarifier, and low pollutant values in the raw waste load. Certain other plants have subsequently been eliminated as a result of information provided by participants.

Comment: EPA should examine separately the data for job shops because they cannot achieve CN,A limits.

Response: EPA believes there is no basis for subcategorizing on the basis of job shops versus captive shops. There tend to be proportionately fewer job shops in the data base than are found across the electroplating category because proportionally more job shops are indirect dischargers and hence are inclined not to have treatment facilities. It should also be noted that the Agency is only limiting CN,T, not CN,A, above the flow cutoff.

Comment: The 12 cents per gallon 1976 sludge disposal cost proposed by the Agency is too low. Moreover, costs have risen due to state requirements of sludge disposal since 1976 and will rise further due to the forthcoming Resource Conservation and Recovery Act (RCRA) requirements for sludge disposal.

Response: The sludge disposal cost proposed by the Agency of 12 cents per gallon was based on 1976 costs to haul and dispose of sludge. Sludge disposal practices in 1976 generally included disposal in secure industrial landfills or in municipal sanitary landfills.

According to the comments received, sludge disposal costs in 1979 typically ran between 25 cents and 50 cents per gallon and are expected to run even higher after RCRA requirements become effective. These comments are not relevant to the cost of sludge disposal in 1976, the year on which all other costs of complying with this regulation and the economic conditions of the platers are based.

The Agency believes the 12 cent per gallon estimate is an appropriate 1976 cost. However, to allow a generous margin of safety, that figure has been raised to 25 cents per gallon. The net effect of increased sludge hauling and disposal costs on job shop closures and unemployment was found to be marginal.

Comment: The costs of enforcement of the regulations were not included in the cost model.

Response: Enforcement costs are determined by the local jurisdiction and distributed among users by the local publicly owned treatment works. Such costs are not technology costs.

Comment: The cyanide limitation should be keyed to the water quality criterion for cyanide.

Response: The limitations set forth in this regulation are technology based and are not directly related to the toxicity of a pollutant. Water quality criteria, however, are based on toxicity considerations because they are the Agency's best assessment of the concentrations required for the protection and propagation of fish, shellfish and wildlife. Accordingly, technology-based limitations and water quality criteria are unrelated requirements and are used for different purposes.

Comment: The total metals limitation is overly strict for platers who plate numerous metals and is not necessary. Several commenters pointed out that the sum of the limitations for the individual metals exceeded the total metals limitations and, therefore, the total metals limitation was unduly strict.

Response: The commenters are correct in saying that the total metals limitation imposes a more stringent limitation on platers who plate numerous metals than would a regulation which specified only limitations on individual metals. This is recognized and was intended. The individual limitations would be unjustifiably lenient for plants plating three or more metals. For these plants, which tend to have lower individual concentrations of metals in treated effluent, the total metals limitation more accurately represents the level of treatment which can be attained by the model technology. Some commenters have assumed that all of the metals are being discharged at concentrations at or near their individual limitations; if this is true it is an indication that the treatment system is not operating properly. It must be emphasized that a well operated treatment system normally should have effluent concentrations much below the one day maximum values on which the regulation's limitations are based.

Comment: The reason why EPA chose a cut-off point of 38,000 liters (10,000 gallons) per day is unclear and the level at which the cut-off is set is not adequately justified.

Response: The Agency received a wide variety of comments regarding the setting of a cut-off level of 38,000 liters (10,000 gallons) per day. The regulation requires dischargers whose flow is below the cut-off to meet limitations on cyanide amenable to chlorination (CN,A), lead (Pb), and cadmium (Cd). Dischargers whose flow exceeds the cut-off are required to meet limits on total cyanide (CN,T), lead, cadmium, copper (Cu), nickel (Ni), zinc (Zn), total chromium (Cr), silver (Ag), and total regulated metals (TRM).

The Agency's intention in setting the cut-off limit was to reduce the economic impact of the regulation while maximizing the environmental benefit obtained. There is no quantitative method to determine an optimum cut-off figure, so the decision on the cut-off level rested on consideration of the relative economic and environmental impacts of the various levels. The level of 38,000 liters per day was chosen as a compromise. The levels considered were: no cutoff; 38,000; 61,000; 76,000; 114,000; and 152,000 liters per day. The numeric cut-offs correspond to 10,000; 16,000; 20,000; 30,000; and 40,000 gallons per day.

Because the major economic impact of the regulation is expected to fall on job shops, the analysis concentrated on the relative impact of the various levels on the job shop sector. Since the Agency was concerned primarily with the sensitivity of the economic and environmental impacts to the cut-off level, the analysis used a sample data base which was not corrected for exact correlation between the sample and the total population, but which was expected to properly reflect the relative magnitude of the effects of varying the cut-off level. The sample also was not adjusted for potential reductions of flow by dischargers to meet the various cut-off levels. Therefore, the estimates of economic impact are probably overstated and the estimates of environmental impact are probably understated. The indicators of impact chosen for comparison were closure rates and percent of untreated discharges. The balancing was intended to reduce the closure rates while minimizing the percentage of untreated discharge. The results of the analysis are presented in the table below.

Flow cut-off[1]	Closure rate[2]	Untreated flow[3]
None	25.6	0
10,000	20.5	3
16,000	19.2	6
20,000	18.3	8
30,000	17.5	13
40,000	17.5	20

[1] Gallons per day.
[2] Percent of job shops.
[3] Percent of job shop flow.

As the table illustrates, even the maximum flow cut-off considered (40,000 gallons per day) results in an estimated unadjusted closure rate of 17.5 percent. Setting the cut-off this high was unacceptable because a number of very large job shops could reduce flow to 40,000 gallons per day and thereby avoid the limitations on copper, nickel, chrome, zinc, and silver. The closure rate is relatively insensitive to the flow cut-off below the 40,000 gallon per day level. However, the percentage of untreated flow is sensitive to cut-off levels. For instance, between the 10,000 and 16,000 gallon per day levels the closure rate decreased by only 1.3 percent but the percentage of untreated flow doubled from 3 percent to 6 percent. Higher cut-off levels showed a continuation of the trend toward rapid increase in untreated flow and small decreases in closure rates.

Besides showing that increasing the cut-off limit above 10,000 gallons per day resulted in minimal decreases in the closure rate at the expense of large increases in untreated flow, the study showed that a significant reduction in the unadjusted closure rate estimate was obtainable by setting the cut-off level at 10,000 gallons per day. This reduced the unadjusted closure rate by over 5 percent while allowing only 3 percent of the discharge to go untreated. Based on the above analysis, the Agency decided that there was more benefit to setting a cut-off level at 10,000 gallons per day than at a higher level.

The Agency has distinguished between cyanide, lead, and cadmium and the other regulated metals. Lead and cadmium pose human health problems and cyanide is both extremely toxic to aquatic organisms and is discharged in large quantities. These three pollutants have a greater potential for causing damage than the others.

Some commenters said that since few platers will meet the cut-off criteria, the limit should be set at a higher level. The data available to the Agency show this to be an unfounded concern; approximately 40 percent of the job shop platers discharge less than 10,000 gallons per day. The Agency is concerned that the opposite may be true. In performing the analysis upon which the 10,000 gallon per day level was based, the Agency assumed that only plants which were presently discharging less than 10,000 gallons per day would qualify. In reality, many platers who are discharging more than 10,000 gallons per day can probably reduce their flow and come under the cut-off limit. As a result, the percentage of untreated flow may be significantly higher than that calculated. The Agency will continue to monitor the performance of the industry to determine whether the cut-off level should be adjusted in the future.

Alternative bases for setting cut-off levels were considered by the Agency but were rejected. In particular, the Agency considered setting the cut-off on the basis of the amount of chemicals used by the platers and on the total number of pounds of pollutants discharged. Both of these alternatives were rejected because they would be extremely difficult to monitor. Water usage is easily determinable and is believed to be as directly related to the impact of the discharge on the POTW as any other parameter considered.

Comment: Concentration-based standards penalize those facilities employing water conservation or reuse techniques. Other commenters believe that concentration-based standards do not penalize such facilities.

Response: The Agency recognizes that concentration-based standards do not encourage water conservation or reuse techniques. However, such standards do not necessarily penalize conservation. This regulation includes opitonal mass-based standards as well as concentration-based standards. These additional standards used the same data base and assumptions as did the concentration-based standards. The details of the development of these standards are given in the Development Document.

Comment: Platers may not know if strong chelating agents are present in their rinse waters and therefore would not know if they qualify for TSS monitoring. Two issues were most often raised: First, many chemical suppliers do not readily divulge the composition of their formulations; and, second, some of the strong chelating agents should be identified.

Response: The term "strong chelating agents" is defined as all compounds which, by virtue of their chemical structure and amount, form soluble metal complexes which are not removed by subsequent metals control techniques such as clarification or filtration. Most suppliers, if requested, will identify the existence of chemicals that may form strong metal complexes. However, if a plater cannot determine if strong chelates are absent from his processes, then the TSS monitoring surrogate cannot be used. Examples of strong chelating agents are cyanide, ammonia, EDTA, quadrol, HEDTA, NTA and DTPA (and other amino polycarboxylic acid-type chelates). Citric acid, tartaric acid, Rochelle salts, thiourea, and gluconic acid are weak chelating agents.

Comment: Since total suspended solids is a compatible pollutant and the basis for user charges in some municipalities, it is not a proper indicator pollutant.

Response: Total suspended solids are used as an indicator of the effectiveness of treatment to remove toxic metals. The optional alternative limitation on TSS was not developed to limit TSS *per se.* Consequently, a POTW will not be permitted to allow credits for TSS removal based on removal by the publicly owned treatment works.

Comment: The derivative of the alternate TSS limitations is indirect and unclear and does not ensure compliance with metals limitations. An alternative method was suggested based on conversion of allowable concentrations of metals to equivalent hydroxide concentrations.

Response: The Agency reviewed the methodology used to calculate the TSS monitoring limitations for the proposed regulation and designed a new methodology suggested by a commenter. One commenter proposed an approach to setting the limitations based on the use of metal hydroxide equivalents to calculate TSS as a function of the individual metals limitations. Theoretically, a metal concentration would be measured as TSS if all of the metal were in its metal hydroxide form. To obtain a value for the metal hydroxide concentration, each metal concentration is multiplied by the ratio of the atomic weights of the metal hydroxide to the metal. The commenter suggested that TSS can be calculated by converting each individual metal limitation to a hydroxide equivalent and summing the copper, nickle, chrome, and zinc equivalents. However, the resulting TSS value would overestimate an equivalent TSS value for total metals.

A modification of this approach was constructed by calculating a weighted hydroxide constant which is the ratio of the sum of the hydroxide equivalents of the long term average concentrations of the individual metals divided by the sum of the long term average concentrations of the metals. The weighted hydroxide constant is multiplied by the long term average of the total regulated metals (derived by a regression method) and by the variability factor for the total regulated metals. The resulting limitations are then adjusted upward to reflect the portion of other metals typically in raw waste, such as iron, tin, and aluminum.

Comment: The alternative TSS limits cannot be achieved with the technology specified.

Response: Six out of 21 of the plants in the Agency's data base meet the TSS daily maximum of 20 mg/1. Therefore, the TSS alternate limitation is achievable using existing clarifiers or other solids removal equipment.

Comment: Prohibition of dilution would be almost impossible to enforce and monitor.

Response: Section 403.12(b)(4) of the General Pretreatment Regulation requires all users of publicly owned treatment works to report their average and maximum flows within 180 days after the promulgation of any categorical pretreatment standard. These data could indicate possible dilution by pointing out increases in water use. This does not guarantee, however, that dischargers will accurately report their water use. However, falsifying reports is a violation of Section 308 of the Clean Water Act and is punishable by civil and criminal penalties under Section 309 of the Act.

Comment: The effluent limitations exceed water quality standards and, therefore, implicity assume that dilution will prevent damage to the environment.

Response: The limitations set in this regulation are technology based standards. There is no direct relationship between technology based limits and water quality criteria. If compliance with these technology based standards does not allow the publicly owned treatment works to meet stringent water quality based limitations in its permit, then it may require more extensive pretreatment.

Comment: What is meant by "electroplating process water"?

Response: The term "process wastewater" is defined in 40 CFR 401.11(q). In general, electroplating process wastewater includes all waters used for rinsing, alkaline cleaning, acid pickling, and other metal finishing operations; it also includes waters which come about from spills, batch dumps, and scrubber blowdown. Cooling water which does not come in contact with the product or waste by-products is not included in electroplating process wastewater definition.

Comment: Data presented in Section XII do not support the need for regulating silver. Monetary considerations will limit the amount of silver discharged by electroplaters.

Response: Silver is acutely toxic to humans and aquatic life. Certain fish species are extremely sensitive to silver, as concentrations of less than 10 $\mu g/l$ kill half the fish in four days. Only high concentrations of silver would interfere with POTW treatment processes. However, 25 to 75 percent of the silver introduced to a POTW is discharged, untreated, to surface waters. While it is probably true that the value of silver provides strong economic incentives for electroplaters to recover silver wastes, there are some operations which could discharge toxic levels of silver to a POTW and a significant number of platers do not remove silver from their effluent. The Agency prefers to rely on regulation to control the discharge of pollutants even though there may be economic incentives to voluntary control.

Comment: Cyanide is compatible with POTWs and therefore the limits should be higher. At 10 mg/l total cyanide, POTWs destroy cyanide to concentration levels which will not cause problems when discharged to streams. The commenters cite several examples of POTWs with high removal efficiencies (98 percent) for cyanide as justification for higher limits.

Response: While some cyanide is treated in a POTW with well acclimated organisms, the typical POTW shows significant pass through of cyanide. The Federal Guidelines for State and Local Pretreatment Programs (EPA-430/9-76-017) contains data on cyanide removability for 22 POTWs. Cyanide pass through for these plants ranged from 2 percent to 100 percent, with an average pass through of 69 percent. Data from an ongoing EPA study of POTWs (Contract EPA-68-01-3857) showed 55 percent pass through in one plant and 16 to 79 percent pass through of cyanide in another. Both of these plants are activated sludge plants currently meeting the secondary treatment criteria. These data all indicate that a significant portion of the cyanide is likely to pass through a typical POTW into receiving water, where it can cause environmental damage.

Comment: EPA's cited inhibition levels are too low and are unsupported by data.

Response: Data on inhibition levels were taken from Section E of "Federal Guidelines: State and Local Pretreatment Programs" (EPA-430/9-76-017), and the data references cited therein. The limits set in the electroplating pretreatment regulations, however, were not based on these inhibition levels but rather on best practicable treatment technology. All of the pollutants which are proposed for regulation are known to have the potential to interfere with POTW processes. Actual interference, however, is a function of the pollutant concentration and the characteristics of each POTW.

Comment: Each city has its own unique mix of industry. Non-electroplaters contribute a large amount, even more than 50 percent in some cases, of these pollutants in specific cities.

Response: Since not all electroplaters plate the same metals, not all electroplaters' wastes contain all the pollutants under consideration. Therefore, for any given city it is relatively easy to find one or more of these pollutants present which are mostly discharged by non-electroplaters. However, the national overview suggests that electroplaters are a large industrial source of these pollutants—the largest single controllable source in many cases. Electroplaters' average raw waste concentrations are far higher than residential background levels of these pollutants. Data show electroplaters, a single industry, to be contributing a large part of the pollution entering a number of POTWs. For Monroe County, NY, electroplaters contribute 31 percent of the total cyanide, 78 percent of the copper, 98 percent of the nickel, 66 percent of the zinc and 41 percent of the cadmium found in the POTW influent (comments from County of Monroe, NY, April 14, 1978). The data from the 1974 study of New York City by L. Klein, *et al.*, show electroplaters responsible for 43 percent of the chromium, 62 percent of the nickel, and 33 percent of the cadmium found in POTW influents. These data reinforce the necessity of regulating electroplaters.

Comment: EPA fails to distinguish between beneficial and toxic levels of metals and between the various forms in which a given metal can be present.

Response: While some of the metals are essential elements (e.g., zinc), they do not degrade in the human body but rather bioaccumulate. Continued accumulation to above-normal levels can be toxic. The toxicity of a metal is related to the form that it takes in the environment. While it is the metallic ion that has the actual toxic property, the different forms can be converted to each other in the environment.

Comment: Runoff is a major contributor to the pollutant load in POTWs. Since runoff is a major factor, the electroplating regulations will have little or no impact.

Response: EPA recognizes that in systems with combined storm and sanitary sewers, metals runoff loadings can be sizeable, although intermittent. For example, the 1974 study by L. Klein, *et al.* in New York City estimated that runoff contributions to POTWs were: copper=14 percent; chromium=9 percent; nickel=10 percent; zinc=31 percent; and cadmium=12 percent. The electroplaters' contribution to the POTW loads in the same study were: copper=12 percent; chromium=43 percent; nickel=62 percent; zinc=13 percent; and cadmium=33 percent. These data indicate that, except for copper and zinc, the electroplaters' contribution to the POTW was substantially higher than the contribution from runoff. Cities with separate storm and sanitary sewers would be expected to show far less contribution from runoff. In considering the impact of electroplaters versus the impact of runoff, EPA concludes that from a national standpoint there are cities where both can contribute significantly to a POTW. Electroplaters are the largest controllable source of the metals in many cases. Data cited in Section XII about sludge quality in Grand Rapids, Muncie, and Buffalo demonstrate that pretreatment regulations do have a favorable impact on sludge quality.

Comment: The electroplating industry contributes only 0.015 percent of the total cadmium flow to the environment and only 0.27 percent of the total cadmium flow to surface waters.

Response: EPA maintains that the figures cited above, which were taken from a report submitted with the comments, are too low. The numbers are based partly on estimates from "unpublished calculations" of the amount of cadmium discharged by electroplaters. In deriving the 0.27 percent figure, the commenter's estimate of 1.567 kkg/yr cadmium indirectly discharged to POTWs by electroplaters is far below any of the other estimates available to EPA. For example, calculations based on EPA's screening data (assuming 17 percent of the job shops and 30 percent of the captives have treatment in place and that treatment removes 90 percent of the cadmium in the raw waste) show 310 kkg/yr indirectly discharged to POTWs. Another study (EPA-600/5-77-002) estimated 514 kkg/yr, while a third study (cited in EPA-560/6-77-032) estimated 143 kkg/yr. The numbers cited in the comment underestimate the amount of cadmium discharged directly to receiving waters by electroplaters. In examining other figures in the report, the Agency concludes that the report's estimated contributions from non-electroplaters were too high, due to double counting of emissions and to assumptions which EPA disputes. Furthermore, the report's use of "total cadmium flow to the environment" as a basis for comparison is misleading. Not all of the cadmium discharged to the environment is likely to be as environmentally mobile as electroplaters' waste or have the same potential for causing environmental damage. In summary, EPA disagrees with the commenter's conclusions and also disagrees with the methodology used to reach those conclusions.

Comment: A paper given by EPA scientists at the 50th annual conference of the WPCF (October 1977) concludes that "health effects from cadmium in municipal sludge applied to agricultural land are not expected to be a problem." Why then is EPA persisting in raising the sludge issue?

Response: The same paper also states, "The conservative approach would be to stop application of cadmium to soil since a dependence [upon limits] on either the total or annual loading rate could be wrong. However, because of the immediacy of the issue, the realization that some of the questions will be answered in the near future, and that in the interim either approach would be acceptable, it would appear logical to apply limits on either or both." Calculations on which the conclusion quoted in the comment were based emphasized good management practices of not more than one kg/ha annual cadmium application and neutral pH. Even if these conditions are met, the paper goes on to say, "if a person eats a normal diet and uses municipal sludge to amend the soil where practically all of his food is grown, it would be prudent to assure that such sludge contains less than 60 ppm cadmium." At 40 percent POTW removal efficiency for cadmium and 1400 lbs of sludge generated per million gallons of wastewater, a POTW influent of only 25 μg/l is needed to cause a sludge concentration of about 60 ppm. At 60 percent POTW removal efficiency, the influent concentration necessary is about 17 μg/l. Electroplaters' raw wastes have been measured to be on the order of one thousand times higher in concentration than these numbers thus demonstrating that potential for sludge problems certainly exists in those areas where electroplaters are located.

Aside from human health considerations, there are strong policy and economic reasons for requiring pretreatment of cadmium. Sludge without cadmium is a valuable resource. Moreover, alternative sludge disposal methods, such as incineration and landfilling, are more expensive than land disposal and can cause environmental problems.

Comment: Higher limits of CN, A are possible without endangering sewer workers. Also, hexavalent chromium is reduced in municipal sewer lines and a total chromium limit is sufficient to protect against sludge discharges.

Response: Although limits on hexavalent chromium appeared in the proposed regulation, hexavalent chromium is not limited in this promulgated regulation. Indirect dischargers below the flow cutoff have no requirement to reduce hexavalent chromium, whereas indirect dischargers above the cutoff will generally need to reduce hexavalent chromium and to precipitate trivalent chromium to achieve the total chromium limitations. The decreased benefit to the environment of POTW operation due to the elimination of the hexavalent chromium limitations is not thought to be significant on a national scale.

The CN, A limitation for indirect dischargers with flows greater than 10,000 gallons per day has been omitted; now only CN, T is limited. Small indirect dischargers still have a CN, A limitation, although at a high level. This limitation is based on technological considerations.

Comment: A cost-benefit analysis should have been performed to show the environmental benefits to be derived from the promulgation of the regulations.

Response: The pollutants regulated are toxic materials determined to have a potential for passing through or interfering with a POTW. The standards are then based on the best practicable technology currently available. The Agency assessed the costs and economic impacts of the standards and estimated the expected pollutant removal from industrial wastewaters. However, a strict cost benefit analysis was not conducted and was discouraged by Congress during development of the Clean Water Act.

Comment: Flow changes cause large variations in clarifier performance.

Response: Within wide influent limits, properly designed and sized clarifiers produce a fairly constant effluent concentration of the treatable pollutant parameters, even though mass loadings may change. If influent flow fluctuations result from production changes, both concentration and mass based standards should be met.

Comment: EPA understated the costs by neglecting certain cost elements.

Response: The Agency used computerized cost estimation techniques to estimate treatment costs at individual facilities and for the electroplating point source category. The Agency used a base year of 1976 for cost estimates and believes that the cost model is accurate to within 20 percent for predicting industry-wide costs. Estimated costs for individual facilities may show wider variation due to special site conditions.

The cost input data comes from a number of sources including on-site surveys, waste treatment equipment manufacturers, and previous EPA projects. The model has been checked by comparing estimated capital and maintenance costs to actual costs.

One commenter stated that the cost estimates for investment, operation and maintenance, and energy were excessively low. As an example, the commenter estimates the capital cost of a continuous pH control system for a wastewater flow of two gallons per minute to be $21,390. The Agency's estimate for a batch system was $1,452 which includes a 94 gallon holding tank. The Agency believes its estimate is realistic for a batch pH control system that is part of a total treatment system.

Operation and maintenance costs for pH control were also questioned by this commenter. The Agency estimated annual O & M costs for a two gallon per minute system at $286 per year. Total operating costs for a treatment system including clarification are prorated to individual unit processes. For facilities with total daily flows of less than 2,000 gallons per day (2 gpm), the Agency believes the prorated O & M estimate for pH control to be accurate. Monitoring costs are computed separately based on flow of the process wastewater.

Power costs for the two gallon per minute pH control system were estimated to be $8 per year. The smaller pH control systems require minimal electrical power to provide one turnover per minute and thus the Agency believes this estimate to be reasonable.

Comment: The total cyanide limitation may not be achievable because ferrocyanides build up in plating solutions as a result of good dragout recovery. Ferrocyanides are not effectively treated by chlorine oxidation. Does EPA require that steel not come in contact with cyanide plating solutions?

Response: If the commenters have achieved good dragout recovery, they may want to consider the optional mass based limitations. Secondly, steps can be taken to reduce ferrous or iron contaminants in the plating solutions through better control of pre-plating rinsing, and substitution of nonferrous tanks and anode baskets. Thirdly, the specified model technolgy when correctly operated and maintained, reduces total cyanide to concentrations within the limits of this regulation. Following the oxidation of free cyanide, ferrocyanides are removed by clarification. This second step cannot be ignored when evaluating the effectiveness of the model technology.

Comment: The Agency's data base supporting the cyanide limitations is flawed by analytical uncertainties.

Response: The commenter requested reconsideration of the cyanide limitations for several reasons. First, some of the plants which submitted data to EPA do not use approved analytical testing methods for cyanide. In response to this comment EPA discarded the data submitted by those plants known to be using improper methods. Second, the commenter had an independent laboratory sample some of the same plants that EPA's contractor had sampled. The independent laboratory found concentrations of cyanide in the plant effluents which were significantly higher than those measured by EPA's contractor.

The commenter who provided the data from the independent laboratory pointed out that the EPA may have observed low CN concentrations because most of the plants sampled "may have been much more careful during the [EPA's] sampling than during the [independent laboratory's] sampling" because the EPA sampling may have found violations of the discharger's permit. If this is the case, then it is clearly not an adequate reason for invalidating the EPA data base. The agency expects waste treatment plants to be operated carefully whether an EPA monitor is present or not.

The commenter also felt that the alleged discrepancy may have arisen because the EPA contractor overestimated the capabilities of the laboratories they used. Assuming for argument's sake that the contractor's data was invalid, the Agency examined the impact of removing all of the contractor's data from the data base. The result was cyanide limits about twice as stringent as those originally calculated. This indicated that the EPA contractor tended to report higher cyanide values than other sources, including the companies themselves, the commenter's laboratory, and another EPA contractor whose qualifications were not challenged. Since the contractor's data were higher than the majority of the data but lower than the commenter's data, there appears to be no consistent bias toward either high or low in the contractor's data.

Third, the commenter questioned the validity of the data base because values appeared in it which were below the limits of accuracy of the methods employed. The Agency does not accept this as a valid criticism of the data base. The commenter is confusing inaccuracies in individual measurements with inaccuracies in statistical analysis of a number of measurements. The data base was used to determine the median concentration and variability characteristic of a large number of individual plants. Any individual measurement in the data is subject to a number of sources of error. However, when the data is aggregated, the effects of errors in individual measurements should cancel each other unless there is a consistent bias in all of the measurements. Some measurements are low, others are high. If the low values were eliminated from the data, there would be no counteraction to the high values. Therefore, it would be incorrect to remove low values from the data base.

The commenter does not allege any consistent bias in the data.

Finally the commenter performed a study of laboratories which had performed cyanide analysis during collection of the data base. The study showed that the laboratories had errors of up to 100 percent in analyzing known concentrations of cyanide. The result of the commenter's test tended to show that there was consistent bias in the values reported by the laboratories in favor of higher reported values. The average true total cyanide concentration in nine samples submitted to the laboratories was 0.487 mg/l; the average measured concentration was 0.557. The laboratories tended to report measured values of total cyanide 14 percent higher than the true values. The average true amenable cyanide concentration in nine samples was 0.0517. The average measured concentration was 0.073. The laboratories tended to report measured values of amenable cyanide 41 percent higher than the true values. Therefore, if the Agency accepted the commenter's data it would adjust the cyanide limitations downward. However, the commenters test was very limited in scope and probably not reliable as an indicator of true bias. The Agency's data base is composed of hundreds of measurements and therefore the effects of individual errors is more likely to be cancelled.

The fact that the laboratories surveyed by the commenter tended to report slightly higher values of cyanide than were actually present would be of concern had EPA not made provision for such variation in setting the limitations. Laboratories were found to report measured values as much as 100 percent different from the true values. However, the maximum daily cyanide limitations were set by determining the median performance of the plants studied and then setting maximum daily limitations 500 percent higher to account for variation in analysis, sampling, and plant performance. Thus provision has been made for analytical error in setting the limits. The 30 sample limitations were set 50 percent higher than the median performance level, because the average of 30 samples would tend to have a smaller variability due to the cancelling of individual errors as discussed above.

Comment: Indirect dischargers participating in the economic survey may have indicated that cadmium and zinc plating is conducted but ignored mentioning chromium plating or chromating if they were an integral part of zinc or cadmium plating. To the extent chromium plating and chromating were undercounted, treatment costs to reduce hexavalent chromium are ignored.

Reponse: Respondents to the economic survey indicated the specific processes employed in their facility. Chrome plating and chromating were among the choices available to the respondents. Also, cadmium and zinc plating frequently occurs without chromium plating or chromating. Therefore, the automatic inclusion of chromium plating and chromating automatically with cadmium or zinc plating is not warranted.

Comment: Will technology installed under this pretreatment regulation (BPT analog) be consistent with the future pretreatment regulation (BAT analog) to become effective no later than July 1984?

Response: The goal of the Agency, in the development of BAT level pretreatment standards shall be end-of-pipe treatment technology compatible with the model technology of this regulation and in-process changes to recycle raw materials, reduce dragout, and reuse or reduce water flow.

Comment: Some of the plants in the Agency's data base (6050, 6051, 6053, 6079, 6081, 6087, 6358, 19050, 19051, 36540) should be omitted from the CN, A data base because the cyanide wastewaters were an insignificant portion of the total electroplating flow or the plating lines with cyanide had integrated treatment.

Response: The Agency agrees that integrated treatment systems should produce a higher effluent quality and cost more than the end-of-pipe cyanide oxidation systems costed as part of the model technology. Therefore, data from plants utilizing integrated treatment have been omitted from the data base. The Agency also omitted data from those plants where it was reasonable to presume that cyanide wastewaters were a small portion of the total raw waste load. Contrary to suggestion, plant 6079 was kept in the data base because it does not use integrated treatment systems and because approximately 30 percent of the plant flow originates from cyanide plating

Comment: Do low pollutant concentrations in the effluents from treatment systems sampled by EPA result from the efficiency of the treatment process or dilution of process water?

Response: Effluent limitations were calculated from a data base screened by several criteria. One criterion for consideration was that the raw waste concentration of a metal pollutant must be at least 1.0 mg/l. Plants with a significant proportion of non-electroplating wastewaters also were excluded from the data base. If a facility had installed hexavalent chromium and cyanide treatment systems, and if the flows from these processes were significant, then the effluent concentrations to these systems were presumed to require treatment.

Comment: Several industry representatives advocated the application of technology to allow for the treatment of commingled waste from several operations. One commenter went on to state that combined treatment of wastewaters has been standard practice by municipalities and industry.

Response: The Agency in many cases supports the combined treatment of industrial wastewaters; often where the waste streams complement one another, there are economies of scale and improved operation. Cost estimates were based on separate treatment of process wastewaters. If treatment limitations cannot be met by commingled treatment, the separate treatment of wastes is required.

Comment: The 30-day limits should be eliminated because they were derived from statistical methods rather than from actual data, and because plants are expected to exhibit skewed variability, not normal variability as assumed by the Agency. A commenter cited hypothetical examples of plants which meet the daily limits while not meeting the 30-day limitations.

Response: The Agency has employed statistical methods to derive these limitations; however, the statistical methods were applied to actual data. The Agency agrees that the statistical distribution of pollutant concentrations in effluent wastewaters is skewed. The data indicate that the underlying statistical distribution of pollutant concentrations is log-normal, which is highly skewed when presented as arithmetic values but which can be normalized by conversion to logarithms. The statistical methods employed, including these based on the log-normal distribution, are consistent with the statistical characteristics that the data exhibit. The Agency has not assumed arithmetic normal variability in application of statistical methods.

It may be possible to construct hypothetical examples of effluent concentrations that conform to daily limitations but not average limitations as noted by the commenter. However, a plant with an appropriate and properly operated wastewater treatment system consistently will meet both daily and average standards. A plant that repeatedly violates either or both standards must be regarded at best as a marginal plant and, consequently, requires adjustments of the treatment or operating practices.

Comment: Plants that plate only one metal will be unable to meet the proposed limitations.

Response: The Agency's analysis, as reported in the development document for the proposed regulation, does predict that a plater of one metal on average will have a higher concentration of that metal than a plater of more than one metal. This does not demonstrate, however, that a single metal plater cannot meet the final regulation.

In particular, the Agency's regression model is based on an implicit assumption that the predicted pollutant discharge is a function of TSS in the effluent and the ratio of the given metal to total metals in the untreated wastewater. Accordingly, this analysis reflects the number of metals plated only indirectly through changes in the aforementioned ratio.

In response to the issue raised by this commenter, the Agency, in a separate analysis, has determined that EPA data base plants with large metal ratios meet the limitation with approximately the same frequency as do all plants in the data base. The Agency therefore believes that the commenter's assertion is not supported. However, this analysis should not be interpreted to mean that the regression model does not apply. Specifically the model, which is a function of only two variables, has been used to describe certain interactions among variables over a large range of circumstances. It is a representation of a norm which is an aggregate approximation in that the model does not fit any single case exactly. Single metal platers and those with excessively high metal rates are at the fringes of the region to which the model applies. In these circumstances there are other important factors, such as those cited below, which are not incorporated into the model directly. This consideration and other analyses described here indicate that the model's predictive power is less accurate for single metal platers. The Agency used the model by evaluating it at specific combinations of the two independent variables resulting in appropriate standards for all platers.

From an engineering standpoint, the wastewater pH can be adjusted to optimize the treatment system reduction of a single metal. This approach can and should be used whenever there is a relatively large amount of one metal in the wastewater.

In developing this regulation the Agency also found that limitations for copper for the common metals plating subcategory were essentially the same as those independently derived for copper in the printed circuit board subcategory. Thus, for copper these two sets of limitations were combined into one set for both subcategories. The Agency found the same equivalence between common metals nickel and electroless nickel.

Finally, it should be mentioned that these limitations are less stringent than those originally proposed. The daily maximum standard for zinc, for instance, is 23 percent higher than that proposed.

Comment: The hexavalent chromium limitations proposed by the Agency are too stringent, are unnecessary, and are based on analytical procedures which are unreliable at the levels involved.

Response: These final regulations do not set limitations for hexavalent chromium. For the purposes of this regulation, hexavalent chromium limitations are probably unnecessary where total chromium limitations are established. Accordingly, plants discharging 10,000 gallons per day or more will be required to meet a total chromium limitation but not a hexavalent chromium limitation as originally proposed. The Agency also has eliminated the hexavalent chromium limitation for plants discharging less than 10,000 gallons per day. This was done in order to reduce the cost of this regulation to the industry. The Agency believes that in most instances the environmental effect of eliminating this requirement will be insignificant. However, local control authorities should be aware that some indirect dischargers, by reducing their flows (without reducing the quantities of pollutants), may be able to avoid meaningful regulation. In such instances, particularly for small or sensitive POTWs, local control authorities may want to establish hexavalent chromium limitations for plants discharging less than 10,000 gallons per day.

Comment: Companies conserving water should be given higher allowable concentration based limits.

Response: Use of mass-based limitations may have the effect of allowing water-conserving indirect dischargers to discharge higher concentrations of pollutions than allowed by the concentration based standards. However, if the resulting allowable concentrations should cause an adverse impact on the POTW, stricter standards may be imposed by the local control authority.

Comment: Many electroplaters have not yet begun to practice water conservation. Since water conservation can significantly reduce the cost of treatment, any analysis of economic impact which does not take this into account is invalid.

Response: An economic analysis which does not take into account possible treatment cost reductions achievable by water conservation is conservative. This is a BPT level pretreatment regulation which considers end-of-pipe treatment. BAT level pretreatment regulations, now underway, will address in-plant process changes. A plant by plant evaluation of the feasibility and current extent of water conservation is necessary for this analysis.

Comment: Should monitoring be flow or time proportional or are grab samples adequate?

Response: The monitoring may be by either composite or grab samples. The statistical analyses of the data used to determine variability of effluent concentrations were based largely on grab samples. Therefore, the extra variability of individual grab samples has been factored into the analysis. However, flow or time proportional compositing of samples gives a better indication of treatment plant performance and should be encouraged.

Comment: The pretreatment standards should not apply to combined waste streams. Captive electroplating facilities which combine wastewaters from other categorical processes should not be responsible for meeting the regulation; it is difficult to relate effluent quality from a combined treatment facility to the electroplating operations.

Response: As with other concentration-based standards, final pollutant limitations shall be based on that portion of the flow that is generated by the electroplating processes. The concentration-based limitations appearing in this regulation shall be applied to the flow originating from electroplating operations; therefore, the limitations will depend upon the proportional flow from other non-electroplating wastewater streams. For example, if electroplating process wastewater is diluted by an equal volume of once-through cooling water, then the electroplating limitations for this facility would be half of the value stated in the regulation.

Comment: Several commenters have requested clarification of the point at which monitoring should occur, or, alternatively, to which waste streams the limitations apply.

Response: The effluent limitations set out in this regulation apply to electroplating process waters only. As pointed out in the discussion of dilution, process wastewaters are limited to rinses, plating baths, and cleaning baths; they do not include non-contact cooling waters, sanitary wastes, or waters used in other plant operations. The Agency recognizes that in some cases the electroplating wastes are combined with other waste streams either before or after treatment. If monitoring is performed on the combined streams, then the concentration based limits required by this regulation must be adjusted to reflect the actual volume of the electroplating process waters. For example, if the monitoring location is such that the monitored stream is composed of one-half electroplating wastes and one-half other wastes, then the allowable concentration will be one-half the value required by the regulation. If the allowable concentration after adjustment for other waste streams is below the levels detectable, then a monitoring location upstream from the mixing point must be chosen. Since the mass based limitations are not a function of flow, there should be no adjustment of those limitations. Somewhat related to this question is the point at which the 38,000 liter per day flow is determined. The regulation is very clear that the 38,000 liter per day cutoff figure refers to "electroplating process wastewater."

Comment: Does the daily maximum concentration equal the maximum allowable instantaneous value attained at some time during the day?

Response: No, the Agency does not require continuous determination of pollutant concentrations throughout a day but is requiring that a sample be taken and that all the regulated pollutant concentrations in the sample be less than the daily maximum values.

Comment: The analytical method for total cyanide is inaccurate in the range of concentrations which platers will be required to meet. Furthermore, the development of the total cyanide limitations failed to adequately take into account the sources of variability in observed effluent concentrations of total cyanide.

Response: All scientific observations have some degree of uncertainty. The commenter states that the Agency has failed to discriminate between sources of uncertainty in the concentration of total cyanide due to analytical and sampling methods and within-day and day-to-day variations in effluent concentrations. The commenter misconstrues the objective of this regulatory activity. The objective of the Agency is to establish values of effluent concentration which can be met by a properly designed and operated treatment system. This was done by determining the median measured effluent concentration achieved by 71 plants. This analysis indicated that out of 560 measured concentrations of total cyanide, more than half were less then 0.15 mg/l. (See Development Document, Section XII.) This median value was adjusted to account for within-plant variability by deriving a daily maximum variability factor of 5.2 based on the actual performance of eleven (11) plants for which 199 observations were available.

No attempt was made to quantify the individual sources of variability; however, the Agency has determined the magnitude of the aggregate variability. The four sources of variability mentioned by the commenter are necessarily reflected in the measured values upon which the regulation is based. Although it might be of academic value to determine the magnitude of the individual sources of variability, such a determination is not necessary in setting effluent limitations.

Statements by the commenter seem to indicate the commenter's belief that the effluent limitations should be based on the "true" concentration of pollutants. The commenter argues that a discharger could be held in violation of the standards if, due to analytical inaccuracies, a measured concentration of the pollutant was higher than the standard even though the "true" concentration was below the regulated limit. The commenter ignores the fact that the data upon which the standards are based are, of necessity, measured values and therefore incorporate differences between the "true" values and the measured values.

Comment: Concentrated sludge from pretreatment will be more environmentally hazardous than dilute municipal sludge. EPA has not looked at this risk.

Response: The Clean Water Act clearly has adopted the strategy of concentrating pollutants to smaller volumes. The Agency recognizes that the sludges generated from this industry are generally hazardous and must be disposed of properly. However, the quantity of sludge generated by the industry is miniscule in comparison to the quantity of municipal sludge contaminated by toxic pollutants. If these toxic pollutants are removed from municipal sludge, the sludge can be used as a fertilizer.

Comment: The use of an indirect, rigorous, statistical derivation of these limitations based upon an estimated TSS level, a regression equation, and limited effluent data is a highly questionable approach.

Response: In these final limitations, the regression approach was employed only for the common metals within the common metals subcategory. The TSS value is not estimated in this approach; however, the value used is judged to be indicative of the performance of properly operating treatment systems. The approach used all the appropriate data available to the Agency. The Agency disagrees that the approach is highly questionable.

Comment: The data presented in the Development Document do not seem to support the conclusion that the same standards should apply to effluents with and without chelating agents. This aspect of the pretreatment analysis should be given further review.

Response: The Agency agrees that this question merits further review and that the data presented in the 1978 document do not strongly support the cited conclusion. The Agency, consequently, has reexamined the question and has taken a more appropriate approach. Specifically, the Agency derived limitations for electroless plating of nickel and copper in which chelating agents are widely used. When these results were compared to the corresponding limitations for the common metals subcategory, where chelates are not as commonly used, the concentration based limitations for the common metals subcategory were actually somewhat higher. The Agency, therefore, has made a conservative decision to apply the common metals Ni and Cu limitations to all three subcategories.

Comment: The long term average is calculated from all the data while the variability factor is calculated from a subset of the data. This is an inconsistent procedure.

Response: The long term average computations are based on all appropriate data and the variability factor computations are based on a subset of the data. Specifically, variability factors are derived from those plants for which there are at least ten observations available. The Agency rationale is as follows: In the derivations of the limitations, the estimated average for a given plant is equally likely to be above or below the unknown true value for that plant. This assertion follows from the lognormality assumption which has been demonstrated to be reasonable for this and other industries, and this assertion holds irrespective of the number of individual observations on which the average is based. The same assertion, however, does not apply in general to the estimate of a plant level variance, of which the variability factor is a function. For instance, for a given plant the estimate of the variance has two degrees of freedom when it is derived from three individual observations. A direct consequence of the lognormality assumption is that this estimate will fall below the true unknown value with probability 0.64 and above with probability 0.36. These probabilities, of course, approach 0.50 as the number of individual observations increases. Estimates with such properties would bias downward the estimate of the overall single variability factor to be applied across plants. Estimates of plant level variance based on a small number of observations were, therefore, excluded from the variability computations.

Comment: A plater of more than one metal could meet the limitation for each individual metal but not the limitation on total metals. Therefore, the limitation on total metals provides an advantage to a firm which plates a single metal and should be deleted.

Response: For the common metals subcategory, the number of metals plated is a factor in the derivation of the standards. The data base on which the regulation rests indicates that plants can meet both total and individual metals limitations. It could be argued perhaps that the total metals limitation is less stringent for a plant plating one metal than for a multimetal plant, but by the same token, the limitation on the single metal is more stringent for a plant plating that metal than for a multimetal plant. The Agency has determined that standards for individual and total metals are required and are equitable for plants plating one or more metals. Note that under the new limitations the ratio of total metals to the sum of the individual metals has increased over the ratio in the proposed regulations.

Comment: The Roberts-Jackson method for measuring cyanide amenable to chlorination is more accurate than the colorimetric methods used at present. The Agency should collect a new data base using the Roberts-Jackson method before promulgating a regulation.

Response: The Roberts-Jackson method of analysis for amenable cyanide may offer an improvement in accuracy over present methods as suggested by some commenters. Unfortunately, there are at present insufficient data on the performance of this method. Nonetheless, the Agency is continually studying alternative analytical methods. Whenever any method is demonstrated, with a sufficient data base, to provide superior results to an approved method at reasonable cost, its adoption will be considered.

Comment: The analytical methods for detection of certain regulated substances are too inaccurate at the concentrations specified in the regulation. It is claimed that a plater could have a true concentration of a pollutant that was within the regulation but be found to be out of compliance because of analytical error. Particular problems are cited for hexavalent chromium and for cyanides, especially cyanide amenable to chlorination.

Response: It is impossible to observe the true concentration of a pollutant in a practical situation; therefore, the regulation and its enforcement must be based on observed measurements rather than unobservable true values. The standards for concentration are based on methods which the Agency acknowledges to contain error. Nevertheless, the data base on which the regulation rests indicates that well-run plants can consistently achieve effluents for which the measured concentrations of all regulated pollutants, including cyanides and hexavalent chromium, are within the limits. In determining the compliance of an individual plant, the issue is not the exact value of the pollutant but that the true value be low enough that measured levels are within the daily and average limits. A plant which is out of compliance because of analytical error (a case which is not detectable in any practical situation) is at best a marginal plant and is not achieving the effluent quality of which the industry is capable.

Comment: The text is unclear as to whether the term "total precipitable metals in the raw waste load" includes iron and calcium, or whether these, like aluminum, were excluded in the regression analysis. In the event that these and other coagulant aids such as polyelectrolytes were not included in the regression analysis, one would expect the C99/average ratio and the variability factors to be understated.

Response: The "total precipitable metals in the raw waste load" includes Cr (total), zinc, copper, nickel, cadmium, lead, silver, tin, iron, and mercury. The variability factor is a function only of the variability of the effluent metal of interest.

Economics

Comments submitted to EPA on its economic analyis of the impacts of the proposed pretreatment standards fell into three general groups. They were: 1) comments on the data used in the analysis; 2) comments on the economic models used in the analysis; and 3) comments on the interpretation and use of the estimated economic impacts. Each of these three groups is addressed separately below.

I. Comments on the Data

EPA used two primary sources of data in its economic analysis. These were the responses to financial surveys mailed by the Agency to metal finishing operations, and technical data gathered independently by the Agency on plating processes, wastewater characteristics, and the costs and space requirements of pollution control equipment needed to meet the standards. Comments on the data concentrated on costs of compliance, space requirements, and the availability and sufficiency of pollution abatement equipment currently in place in the industry.

A. Costs of Compliance

Of the cost data the Agency used to estimate economic impacts, those to which comments were addressed were: 1) the capital cost of compliance; 2) the operating and maintenance (O&M) costs of compliance; 3) the cost of space for housing pollution abatement equipment; 4) the cost of disposal of sludges generated by water pollution control equipment; and 5) the cost of monitoring to demonstrate compliance.

1. Capital Costs.—Comments on EPA's estimated capital cost of compliance criticized the estimates for their failure to account satisfactorily for installation costs. The costs also were criticized for general understatement of actual costs.

EPA based its cost estimates for pollution control equipment on two sources: the costs reported by metal finishing firms for actual installed equipment that EPA observed and monitored during engineering plant visits, and the quotations of manufacturers of pollution control systems. In both cases, the reported costs reflected the full cost of purchase of the systems, from engineering design of the needs of the individual plants, through purchase and delivery of the equipment, to site preparation, installation, and plumbing modifications. The prices that resulted may seem low to commenters because the costs are reported in 1976 dollars, for consistency with the rest of the analysis.

2. Operation and Maintenance (O&M) Costs.—Several comments addressed EPA's estimation of O&M costs of compliance, either to claim that O&M costs were neglected by the Agency, or to assert that EPA's estimates of O&M costs were too low. Some commenters who felt that the estimates were too low said that depreciation and the cost of routine internal monitoring of equipment performance should have been included as part of O&M costs. Others thought that O&M costs, as a percentage of capital cost, were greater than the 12 percent estimated by the Agency. Some commenters referred to the Agency's Analysis of Economic Impacts of Pretreatment Ordinances on the Metal Finishing Industry in Three Communities, (the Three Cities Study) where O&M costs higher than 12 percent of capital cost were reported.

The Agency explicitly included O&M costs as part of the costs of compliance with the regulation. The cost figures used for estimation of the O&M costs follow common engineering rules for chemical costs and the operating cost of the equipment components. Depreciation was not counted as part of O&M costs, because depreciation was included separately in the analysis of annual costs. The Agency used a straight-line depreciation rule, over the life of the investment loan, to estimate annual depreciation. Depreciation was computed separately from O&M cost to allow flexibility in the decision rules assumed for depreciation.

The cost of monitoring by the plant to determine the treatment performance of equipment was also counted separately, as was the cost of monitoring for compliance reporting (see Section on "The cost of monitoring to demonstrate compliance" below). The Agency believes that the monitoring and reporting schedule required by this regulation will generate sufficient data for internal plant quality control needs. The use of 12 percent of capital cost, as an estimate of O&M costs for the purposes of economic analysis, is based on empirical analysis of the average O&M cost across technical plant models, as a proportion of the capital cost for a treatment system with several individual components. The methods the Agency used to estimate costs in its economic analysis are discussed below, under "Regression Equations for Cost."

The 12 percent of capital cost average is not comparable with the ratios in the Three Cities Study, for two reasons. First, the Agency does not know the years for which investment costs and O&M costs were reported in all cases. Therefore, it is not possible to compute deflated O&M costs as a percentage of capital costs. In one case, capital costs were quoted in 1970–1971 dollars, but O&M costs were given in 1977 dollars. Second, it is not possible to determine from the responses to questions about O&M in the Three Cities Study whether cost elements were included in O&M that were counted as separate items in the economic analysis. Depreciation is one such expense. Therefore, the Agency is not able to determine the utility of O&M estimates from the Three Cities Study.

3. Space Costs.—Some commenters said that the Agency had underestimated the cost of space for housing pollution control equipment. When space is used for productive or nonproductive purposes, the plant bears the overhead cost of the space, either in rent or in real estate taxes and the cost of not putting the space to other productive uses. Several commenters also claimed that the Agency had not taken into account the cost of external space required for construction of treatment facilities.

In its analysis of economic impacts, the Agency examined plant survey responses to determine, for each plant, whether internal space is available. If any space is available, then the plant already bears an overhead cost for space which is not a result of the requirements of the pretreatment standards. There may still be some economic cost to the use of such space for nonproductive purposes, rather than maintaining its availability for future additions to productive capacity. This cost cannot be estimated accurately by the Agency with the data now available. However, the economic cost will not be an immediate financial burden to the plant, and would not, if estimated, affect the Agency's estimates of potential closure rates, employment losses, or price increases. The question of space availability will be addressed below.

In the case of treatment systems requiring the use of external space, the Agency explicitly included the cost of purchase of land, even though the firm may own idle land already. This cost was computed by multiplying the space requirements of the treatment system by average land prices. Rural land was priced at $2,000 per acre, suburban land at $10,000 per acre, and urban land at $75,000 per acre. This cost is reported in EPA's Economic Analysis of the Proposed Pretreatment Standards (December, 1977), on page F–26.

4. The Cost of Monitoring to Demonstrate Compliance.—Some commenters thought that the Agency had neglected the cost of monitoring necessary for the demonstration of compliance with the pretreatment standards in its economic analysis. This is not the case. The Agency included the cost of sampling and analysis, at $80 per sample, according to a schedule that varies with the daily process wastewater flow of the plant. This monitoring schedule is the same as the schedule now required by the regulation, and the same sampling and analysis costs have been included in the economic analysis (see Economic Analysis of Proposed Pretreatment Standards for Existing Point Sources in the Electroplating Point Source Category (December, 1977), p. F–25).

6. Space Requirements.—Comments on the space requirements for pollution control equipment included claims that in many cases job shops do not have sufficient space available, at any cost, for pollution control equipment.

The Agency took the issue of space constraints into account by costing a diatomaceous filter, rather than a clarifier, for treatment of metals in those urban plants that reported little interior expansion space. This represents the least space-intensive system that is known to be able to achieve the standards at reasonable cost. Those plants that have absolutely no interior expansion space available for addition of pollution control equipment, and no access to adjacent land, may qualify for fundamentally different factor variances from the standards. Section 403.13 of EPA's General Pretreatment Regulations for Existing and New Sources of Pollution, 40 CFR Part 403, 43 FR 27736 (June 26, 1978), provides for variances from categorical pretreatment standard requirements for plants that have different "Age, size, land availability, and configuration" characteristics from those considered by the Agency in the development of regulations.

7. Equipment in Place.—In its analysis of economic impacts, EPA applied compliance costs to each plant only for necessary equipment that had not already been installed at the plant. If a plant reported in a survey response that a specific treatment component was installed, the Agency assumed in its analysis that no further investment was necessary for the treatment that component was designed to achieve. Several commenters took issue with this assumption, on the ground that the Agency had no information about the treatment performance of the equipment, which was often installed to satisfy local ordinances, and that local ordinances are less stringent than EPA's standards.

Although local ordinances may lead to installation of equipment that is not sufficient to achieve compliance with EPA's standards, commenters did not supply examples of such local ordinances. Data available to the Agency indicate that frequently such local standards are compatible with, or more stringent than, EPA's standards. In cases where local treatment requirements are less stringent than EPA's, there may be instances in which a plant has installed equipment for treatment of its most concentrated wastes only. The requirments of some local standards are so weak that they do not force plants to install pollution abatement equipment at all. The existence of local standards that vary from EPA's standards does not necessarily imply that plants have installed insufficient equipment to achieve EPA's standards.

EPA examined the plant models for which the assumption of sufficient equipment in place was used. The ability of treatment equipment, if properly operated and maintained, to achieve EPA's standards is based on its design flow capacity and the chemistry of the waste streams it is designed to treat. In most cases the chemistry of the waste stream is unlikely to have changed since the treatment equipment was installed. Therefore, the prime measure of treatment equipment suitability is the design flow capacity of the system. EPA analyzed a sample of 205 plant models for potential economic impacts. Of these, ten simultaneously reported equipment in place with a design flow less than 90% of process wastewater flow, received credit for the equipment in place, and fell among the plants not projected to close. Of these ten plants, EPA estimates that two would close even if all reported equipment in place were useless. This would change EPA's estimates of plant closure by less than one percentage point.

Moreover, the Agency's survey did not request plants with diatomaceous filters installed to report the presence of those filters. Although some plants may have considered filters to be "advanced treatment," and reported it as such in their responses, these components were ignored in EPA's evaluation of equipment in place. Thus, the Agency included costs of compliance for some plants that will not actually incur these costs.

II. The Economic Analysis

EPA used two analytical computer models in its economic impact analyses for the regulation. The first of these models was designed to estimate the costs of compliance for plants subjected to economic and financial analysis. This enabled the Agency to study the economic impacts of the regulation on plants that did not supply sufficient technical information for a detailed engineering analysis of their costs of compliance. The second model the Agency used is an economic impact model designed to identify plants likely to have difficulty with compliance, and to project the financial situations of independent firms after installation of pollution control equipment.

The comments on EPA's economic analysis fell into two categories: 1) comments on the analytical techniques used in the models, and on the methods by which plant model results were projected to national estimates of economic impacts; and 2) comments on the behavioral and financial assumptions used in the analysis.

A. Analytical Techniques

Comments on the analysis addressed the validity of the methods used to assign compliance costs, the empirical verification of closure projections, the estimation of the number of metal finishing establishments, and the statistical techniques by which EPA projected economic impacts for its sample of plant models to estimates of impacts for the entire industry.

1. *Regression equations for cost.*—One commenter noted that the method of assigning costs to plant models, by regression on the costs and flows for plants in the technical data base, yielded costs that differed from manufacturers' quotations for the same equipment. The commenter felt that EPA's procedure led to a general understatement of cost in the economic analysis.

An examination of available suppliers' quotations for equipment cost shows that the regression results slightly understate suppliers' estimates of cost for plants with relatively lower flow, and slightly overstate suppliers' quotations for plants with larger flows. This comparison is indicative of some variation between EPA's capital cost estimates and actual costs, but is not sufficient to call the Agency's estimates into doubt. The equipment suppliers' quotations shown in EPA's economic analysis of the proposed pretreatment standards (p. G-5) were based on a small, unrepresentative sample of suppliers. Suppliers' quotations vary regionally, and by quality of equipment. The agency's technical analysis included equipment manufacturers' quotations as one element of cost, but did not rely entirely on them. Capital costs of compliance were calculated on the basis of individual plant needs, and then compared with actual costs experienced by electroplaters. The regression analysis used to derive cost estimates for economic analysis yielded the best functional fit of the relationship between system design flow and cost.

2. *The closure model.*—Two comments addressed the closure model. The first was that the analysis was not a mathematical economic model based on empirical evidence, but a string of associated assumptions about the behavior of electroplaters in response to the regulation. The second was that the model needed to be verified empirically before it could be used to support regulation.

Although the economic analysis model is not a set of linear equations, and is not an econometric model, it is nevertheless a mathematical model. The model expresses the financial decisions facing a firm as algebraic formulae, and compares the results with normative criteria for continued performance of each operation.

Although the model might be given apparent credibility by comparison of its projections with observed behavior of firms in the industry, such a comparison is not possible with data available to the Agency. Furthermore, such a comparison would be inconclusive. Because such a model is necessarily a simplification of the choices facing each firm, and of the rules by which the firm's decisions are made, it cannot capture the unique history and setting of each firm. There are a number of variables that cannot be captured adequately in summary survey responses for the purpose of projecting closure decisions. These include managerial expertise, the commitment of the owners to the firm, perceptions of the firm by its customers and bankers, local economic conditions, the degree of local enforcement, and the possible availability of less expensive second-hand equipment. The number of unquantifiable variables precludes straightforward prediction of the impacts of this regulation.

3. *Estimation of numbers of electroplating job shops.*—Some commenters felt that EPA had underestimated the number of electroplating shops in the United States, and had therefore underestimated the absolute magnitude of the costs and economic impacts of the pretreatment standards. Many of these commenters based their conclusions on estimates of the number of electroplating shops in individual states or regions of the nation, and derived estimates of the total number of metal finishers by extrapolation on the basis of population proportions.

The method of estimating total numbers of electroplating shops by estimating the number in a locality and extrapolating to the national level has two faults. First, the lists of local electroplaters may include misclassified firms, or firms that are no longer in business. This leads to overestimation of the number of local electroplating shops. Furthermore, there may be metal finishing firms that perform processes not covered by the regulations.

Even if estimates of the number of local electroplating shops covered by the regulation are accurate, however, it is difficult to use simple rules for estimating the number of shops in the nation as a whole from the number in a restricted area. The most common method is to use population estimates for the region under consideration, to determine the percentage of the national population that the region represents, and to assume that this percentage applies to the number of electroplating shops in the region as a percentage of the national number of shops. This method relies on a constant number of electroplaters per capita throughout the United States. However, the number of electroplaters per capita varies from state to state. The 1972 Census of Manufactures reports 742 electroplating shops in California (population 20 million), and only 494 in New York (population 18 million). The number of electroplaters per capita in California is 1/26,954, and the number of electroplating shops per capita in New York is 1/36,437. The per capita number of shops in California is 35 percent greater than the corresponding number for New York. The assumption of a constant proportionality between the number of metal finishing shops and population is invalid.

EPA's estimates of the number of electroplating job shops performing processes covered by the regulations are based on the pattern of responses to a survey mailed to a sample of over 2,000 plants listed as metal finishing job shops by Dun's Market Indicators (DMI). The DMI lists approximately 5,000 electroplating job shops, and this number coincides approximately with Census of Manufactures estimates. The pattern of the 444 responses to the survey indicates that roughly 60 percent of those listed perform processes covered by the regulations. The details of the process by which EPA arrived at these estimates are provided in Appendix A of EPA's Economic Analysis of Proposed Pretreatment Standards for Existing Sources in the

Electroplating Point Source Category. This discussion shows that EPA's estimates of the number of electroplating shops are more likely to be accurate than estimates based on local observations.

4. Scaling Sample Results.—Comments on EPA's method of projecting plant model results for a sample of job shops to aggregated economic estimates of impact on the job shop sector of the industry addressed two issues. These were the adequacy of EPA's corrections for non-response bias in its survey results and the appropriateness of the parameters used by EPA to scale sample estimates to population projections.

EPA mailed a financial survey to a sample of job shops. When the responses to the survey were received, the Agency selected a sample of non-respondents to the mail survey, and performed an abbreviated telephone survey of this sample. Responses to both surveys were used for EPA's characterization of the job shop sector.

The comments on this procedure note that there were non-respondents to the telephone survey, who were therefore not included in EPA's data base. The comments suggested that these non-respondents would be smaller, less viable firms, with a higher propensity to fail than the firms that responded to the two surveys.

An associated question of bias was introduced by the fact that EPA performed a telephone survey of only the non-respondents to the mail survey. This group did not include those respondents to the mail survey whose responses were inadequate for the purposes of economic analysis. One commenter felt that the telephone survey sample should have been drawn from a pool that included inadequate mail responses, as well as non-responses to the mail survey.

The second issue addressed by the comments on EPA's scaling method was the examination of parameters for possible corrections of sample results. The Agency determined that no single operating or financial parameter was sufficiently correlated with projected plant closure to allow that use of the variable as a correction factor. The comments suggested that combinations of variables, rather than single parameters, might better be tested for correlation with projected closure. They also suggested that the lack of correlation between variables and projected closure was a result of the structure of the model rather than a reflection of conditions in the industry.

The question of non-response bias can easily be misunderstood. EPA did not use the characteristics of non-respondents and plants with inadequate responses to the mail survey as the basis for its estimates of closure impacts for the industry. The survey responses were designed to characterize the size, structure, and composition of the industry on which the impacts might operate. All of the mail survey respondents were adequate for this purpose, whether their responses were sufficient for closure analysis or not. Therefore, the sample chosen for the telephone survey was correct for characterization, in combination with all mail survey respondents, of the job shop sector of the electroplating industry. The telephone survey achieved a 92 percent response rate, which allowed, even if the non-respondents to the telephone survey were very different from the respondents, considerable accuracy in the estimation of flow, employment and sales distributions across all job shops.

Only if some of the parameters for which data was gathered in the surveys had shown correlations with projected closure would the question of bias in the survey instruments have become important for aggregate job shop closure estimates. In that case, small variations in the distributions of population parameters might influence the aggregate impact estimates. But a thorough statistical examination of the sample of plant models used for closure analysis showed no such correlation. The Agency had no choice, in this situation, but to conclude that the projected closure rate for job shops in the sample was the best choice of an estimated closure rate for the job shop sector as a whole.

The fact that none of the descriptive variables gathered for job shops, such as size, water use, and age, is correlated with projected closures of plants in the financial data base reflects the nature of the job shop sector, rather than the structure of the closure model. Examination of the survey responses shows particularly weak correlations between process wastewater flow, which largely determines cost, and the financial variables that influence a firm's ability to afford capital investment in treatment equipment. Because the sample of firms eligible for closure analysis was relatively small, no conclusive relationships between projected closure and combinations of operating parameters could be established.

B. Assumptions of the Economic Analysis

Four assumptions used in the economic analysis were addressed in the comments. They were: 1) the assumption of owner equity infusion to avert plant closure; 2) the assumption of full cost pass through in each plant, by which revenues were assumed to increase by the amount of treatment costs; 3) the interest rate used in the analysis; and 4) the assumption of the availability of commercial credit for firms with a projected coverage ratio, after compliance, of less than 1.5.

1. Owner equity infusion.—In the economic impact analysis, EPA assumed that plant owners, rather than allow the plating operation to fail, would temporarily reduce their own compensation from the plant, to a level of not less than $15,000 if necessary. The comments directed at this assumption challenged the idea that owners would settle for an annual compensation of $15,000 out of plant revenues. These commenters pointed out that in most cases this income would represent an undesirably low rate of return on the owners' investment, and criticized the choice of $15,000 as an arbitrary and unsupported level to which owners' compensation might be reduced.

One misunderstanding reflected by the comments is the notion that EPA was willing to assume a constant future annual income of as little as $15,000 for each owner in cases where this assumption was invoked. This is not the case. The economic analysis assumed that owners would forego some of their compensation, down to a minimum of $15,000 for one year only, if by so doing they might avoid closure of the job shop, and comply with the pretreatment standards. The owner equity infusion decision rule reflects the personal commitment that would lead a small businessman threatened with failure to accept a reduction in a salary for one year to save this business. Although EPA's selection of $15,000 as the floor amount beyond which salary reductions would not be accepted is not based on data regarding previous owner equity infusions, the $15,000 figure is reasonable. The U.S. Bureau of the Census reports that for 1976, the year in which all economic measurements in the model is taken, 50 percent of all American families lived on less than $15,000 per year ("Money Income of Families and Persons in the United States).

In EPA's closure analysis, the owner equity infusion assumption was invoked 15 times for a sample of 205 plant models. The average amount that these 15 plants needed out of owners' compensation to survive was $10,170. In only two cases did projected salaries for one year go below $16,000. If EPA had chosen $20,000 per year as the minimum salary floor, closures would have risen by only 1.9 percentage points.

2. Pricing assumptions.—EPA assumed in its economic analysis that each electroplating job shop would pass the cost of compliance on to its customers in the form of price increases. The price increases the Agency assumed were those necessary to raise annual revenue by an amount equal to the annual cost of compliance for each plant. This assumption attracted attention from a number of commenters. The comments were directed at both the magnitude of the average industry price increase that EPA's assumption implied and the associated variability in price increases among platers. Commenters believed that an industry-wide price increase would result in decreased demand for plating services, and consequent decline in industry revenues. Comments also challenged the assumption that some platers could raise prices by more than others, without consequent loss of market share to their competitors.

In its choice of assumptions about pricing behavior, EPA had to make two decisions. The first decision was whether to assume a uniform rate of price increase for all electroplating job shops. The second decision, regardless of the answer to the first, was the selection of a rule by which each plant's price increase should be determined.

A uniform price increase for all producers is a rule that might prevail in an industry like agriculture, characterized by many anonymous producers of undifferentiated goods whose differences in geographic location are small. Neither of these conditions holds in the case of electroplating job shops. The variety of customers and services alone suggests that uniform price increases would be the exception, rather than the norm, for electroplaters. Furthermore, the large size and weight of many of the products that are plated, combined with the small portion of total production costs represented by plating and finishing, suggests that transportation costs can be a large deterrent to competition between platers in widely scattered regions. The pattern of location of electroplaters, close to customers they serve, is a qualitative measure of the cost advantages of geographic proximity.

Since a uniform price increase is not a reasonable assumption, the second decision was on the amount of price increase that each plant could sustain without losing business, either to substitute processes or to its competitors.

The Agency chose to use the assumption that each job shop would increase prices by the amount necessary to increase its revenues by the same amount as its annual costs of compliance. The Agency does not expect that this simplifying assumption will be exactly reflected in the industry's response to the regulation. However, the cost pass through rule is a reasonable choice as a pricing assumption, for several reasons.

First, the assumption falls between two possible patterns of pricing behavior. In a market characterized by pure competition, with many producers of undifferentiated products, the price increase is likely to be uniform. In such a market the more efficient high volume producers would heavily influence the price of the product. For reasons discussed above, this is not a reasonable characterization of the electroplating industry.

In a highly differentiated market, where each producer enjoys partial or complete monopoly power, prices for each firm might be expected to rise until former levels of return on equity and profitability had been reached. Although comments submitted on the pretreatment standards reflected the dependence of some customers on a small number of specialized platers, this model of pricing behavior is not likely to hold uniformity. The pricing rule used in the Agency's analysis allows variable price increases, but does not allow for maintenance of profit rates or percentage returns on investment that prevailed before compliance with the regulation.

Second, the plants for which projected price increases are lowest are those with treatment equipment already in place. If the treatment equipment was installed, as some commenters suggested, to comply with state or municipal pretreatment standards, then these plants will be located in distinct geographical areas, separate from the plants with higher projected price increases. These geographic differences will reduce or eliminate market competition between plants with different increases in production costs.

Third, the projected plant closures are not likely to occur simultaneously. As some plants in each region and product market close, their customers will turn to the remaining job shops for some portion of the plating services that they received from the plants that closed. This process will increase the volume of plating services demanded of job shops that do not close, and make it easier for them to raise prices to the projected levels.

Finally, EPA's pricing assumption leads to an average price increase, weighted by sales, of 7.0 percent. This increase is not expected to lead to a reduction in aggregate levels of plating services demanded, either through customer changes to substitute processes or through a decline in the quantity demanded of the finished goods for which electroplating is one production step. For reasons of durability, appearance, and resistance to corrosion, many products require metal finishing. For most of these products there is no substitute process. Even if all of the increased prices for metal finishing were passed on to consumers of the finished goods, the prices of these goods would increase by less than one percent. This increase is not expected to lead to a noticeable decrease in the quantity demanded of finished goods.

A thorough analysis of pricing behavior in the industry would require detailed information on regional markets for each plating process, and market changes over time. The Agency has determined that such an analysis would be excessively expensive and time consuming. Furthermore, the complexity of pricing decision rules for imperfectly competitive markets would prolong such a study well beyond the time needed to gather data.

The indeterminacy of future industry pricing flexibility leads to a corresponding uncertainty about the degree or direction of the error introduced in the economic analysis by the EPA's pricing assumptions. Job shop plant closures may be underestimated for some regional markets where keen price competition precludes differential price increases among metal finishers. However, EPA may have overestimated plant closures among metal finishers that provide specialized services.

Even if the choice of this pricing assumption were to cause estimates of economic impact to be understated, this effect would be offset by highly conservative assumptions in other parts of the analysis. Most notable among these are the assumptions that none of the adversely affected plants will receive assistance from the Small Business Administration and that these plants will not reduce process wastewater flow at the time of compliance. The latter assumption means that every plant is assumed to purchase equipment large enough to treat present flow whereas, in fact, many plants will be able to reduce flow and thus save on the cost of the equipment. Other conservative assumptions include restricting financing sources to commercial banks, assigning capital costs to plants that reported advanced waste treatment systems in place and purchasing new rather than used equipment.

4. *Credit availability.*—EPA assumed in its analysis that sufficient investment credit for installation of treatment equipment would be available from commercial banks, if a simple financial test could be satisfied. The variable used for the test was projected coverage ratio, after investment, i.e., the ratio of cash flow to fixed payment obligations. If a plant's projected coverage ratio was 1.5 or greater, the Agency assumed in its analysis that a bank would make the necessary credit available.

Comments on this assumption pointed out that banks customarily consider a wide variety of financial and other variables in their loan decisions, and concluded that the coverage ratio test was excessively simplistic. The commenters argued that even if the coverage ratio were an appropriate single test, the level that plants would need to achieve in order to receive commercial credit would be higher than 1.5. Several commenters suggested that 2.0 would be a better level of projected coverage ratio to use for a test of credit availability.

EPA is aware that banks do not customarily employ one ratio as a test of the desirability of extending credit to loan applicants. Many of the considerations that banks employ, such as management experience and past credit performance, are difficult to quantify for modeling purposes. Many other data, such as historical financial performance of the applicant's firm, are not available for analysis. The nature of the data, the analytical requirements of the model, and the purpose of the economic study necessitate simplification in the estimation of conditions under which bank loans can be made available. Similar restrictions led to consideration of bank credit only, without regard for other external sources of capital.

Three standard financial measures used to evaluate the creditworthiness of a firm are the current ratio (current assets divided by current liabilities), the capitalization ratio (debt divided by total assets), and the profitability ratio (profit after taxes divided by sales). These ratios capture the financial status of the firm by taking into account the relative levels of liquidity, debt, assets, sales and profits. The coverage ratio, which includes the debt, profits, and cash flow of a firm, covers the most essential of these measures.

Most banks are reluctant to assign independent levels of acceptability to each of the important financial ratios. Instead, bankers are likely to apply their own experience, training and judgment to a simultaneous evaluation of all three ratios, accepting borderline levels for one if the other two seem sound. This practice is not susceptible to analysis by fixed logical decision rules. Therefore, EPA selected the coverage ratio as a proxy for the financial measures embodied in the other three. Examination of 29 plant models whose coverage ratios were close to 1.5 showed that the coverage ratio test led to the same conclusions about the number of closures as the independent use of the financial ratios mentioned above.

The assumption that plant owners would offer personal guarantees in order to receive credit for plants whose projected coverage ratios are 1.5, is based on the strength of commitment to their business that EPA imputed to job shop owners. A plant with a projected coverage ratio of 1.5 is by definition a plant that is projected to be profitable after compliance. The offer of a personal guarantee transfers some of the risk inherent in financial projections from the bank to the owner. The bank, as a lending institution, was assumed to be less willing to accept the added margin of risk than an owner whose knowledge of the firm is better, and whose continuation in business may depend on acceptance of the risk in order to secure a loan. The assumption of personal guarantees by owners is therefore reasonable, if the future operation of a profitable firm depends on it.

III. Use and Interpretation of the Economic Analysis

General comments on EPA's economic analysis fell into two groups: 1) Impacts that EPA did not consider, and 2) mitigating factors for the impacts.

A. Additional Impacts

Comments on impact measures that EPA did not estimate addressed two major areas: 1) Secondary impacts of the regulations on customers of electroplaters, and 2) impacts on industry structure.

1. Secondary Impacts.—The pretreatment standards could affect the economy at large, either through price increases as a direct result of increased costs of production, or through a temporary shortage of essential electroplating services, causing bottlenecks in the production of plated goods, additional price increases for the services of the remaining plants, and, possibly, plant closures in the industries that are customers of electroplaters. Comments on this issue said that EPA failed to consider secondary impacts in its assessment of economic impacts and claimed that the secondary impacts in some local markets could be very high.

A detailed estimate of secondary production, price, employment and closure impacts of the regulation would require extensive data on the markets in which electroplaters operate, including suppliers as well as customers, and a model of the behavior of those markets. A comprehensive analysis of the aggregate impacts on the economy would have to include a study of manufacturers of pollution abatement equipment, and data on the interactions of the customers and suppliers of electroplaters. Either analysis requires more data than the Agency currently possesses. Neither survey responses nor publicly available information are sufficient to allow thorough analysis of the markets for electroplating. Accordingly, the Agency has not performed a quantitative analysis of the secondary economic impacts of the regulation.

There is information available, however, to allow qualitative judgment of the nature and direction of the impacts of the regulation on the customers of electroplaters. Such impacts would be felt through the increased cost of plating services, or the temporary reduction in services available, or both.

EPA estimates the sales-weighted average price increase for electroplating services from job shops to be 7.0 percent. Census data for value added, compiled for aggregate production groups at the four digit SIC level, show that electroplating contributes a small percentage to the cost of production in each group. Electroplating represents less than two percent of the cost of production in most groups and does not exceed 6 percent of the cost of production for any. This means that a 7.0 percent increase in the cost of electroplating represents a price increase of less than 0.14 percent in the final cost of most electroplated goods, and a maximum price increase of 0.42 percent for the aggregated costs of production in any sector.

These price increases should be easily passed through to customers by the industries that employ the services of electroplaters. Because the industries where electroplating is performed contribute only a portion to the sum of goods and services in the entire economy, an average price increase of less than 0.14 percent for electroplated goods is likely to have negligible overall inflationary impacts.

The second way that the regulation can affect consumer industries is through the closure of some electroplating operations, and the consequent short-term reduction in the availability of electroplating. This may be a problem for some manufacturers, but it is not expected to last long.

The closure of some firms in the industry, and the consequent loss of some percentage of current production, may have several consequences. One national result may be an added inducement to new entrants into the industry, as the demand for electroplating services increases relative to the diminishing supply. Another result will be for plants in compliance with the pretreatment standards to attempt to expand their productive capacity. Another result will be that some manufacturing customers of electroplating job shops will open new captive plating lines, or rely more heavily on the services of existing lines. Even if none of these consequences were to result, data from the plants in EPA's closure sample indicate strongly that plants projected to survive are likely to have sufficient excess capacity already to cover the production lost because of plant closures. The best measure the Agency has of excess capacity is the degree to which those plants that are not projected to close have production lines that are idle through one or more daily work shifts. The Agency does not have data to estimate the excess capacity available within each distinct plating group, or to determine the degree to which periodic peaks in demand will cause difficulty, but the available measures of capacity indicate that production bottlenecks should not be excessive even in the short run.

2. Industry structure.—Some commenters noted that the regulations would result in changes in industry structure, with smaller plants disappearing from the industry and larger plants achieving dominance. Others felt that "small plants" would tend to proliferate.

The Agency believes that the structure of the metal finishing industry may change as a result of the regulation, but does not believe that the nature of the change can be determined from available data. Factors that might encourage a shift to larger independent plants and captive plants include the economies of scale that can be realized in wastewater treatment, and the increased minimum cost of entry to the industry, due to pollution control requirements. The effect of the minimization of treatment requirements for platers with small flow is likely to be the opposite, however, and this may create a balance between the tendencies toward smaller and larger plants. The result may be an increase in smaller plants, or an increase in larger, more efficient plants, or both, with a decrease in the percentage of medium sized plants. The disagreement of commenters on this issue reflects the indeterminancy of the result.

B. Mitigating Factors on Economic Analysis

Several factors not included in EPA's analysis may operate to reduce observed economic impacts of the regulation below EPA's estimates. Two of these were addressed by commenters. They were: 1) the effect of SBA loan programs on economic impacts; and 2) the effect of a three year compliance period for the regulation, as against the single year assumed by EPA in its analysis.

1. SBA loans.—As a supplement to its economic analysis, EPA studied the effect of credit that might be available under SBA's Economic Injury Loan Program on job shop closure estimates. With the assumption of 20-year loans at 6.75 percent interest, the Agency estimates that economic impacts can be significantly reduced. For example, projected job shop closure rates dropped from 19.9 percent to 5.4 percent under the assumption of SBA loans.

Several commenters doubted that Economic Injury Loans would be available to electroplaters. The reasons given in the comments for this skepticism were the amount of paperwork involved to obtain the loans, the lack of sufficient SBA funds, the ineligibility of most electroplaters for the loans, because of low profitability, and the general ignorance of and distrust in SBA programs among electroplaters. As empirical evidence of the problems with the Economic Injury Loan Program, commenters pointed out that only $4 million in loans had been issued for pollution control investments since 1973.

EPA is aware of the problems that electroplaters might encounter with SBA programs, and did not include any assumptions about SBA loans in the primary economic analysis. Because the programs exist and are well funded, the Agency feels that an understanding of the potential assistance that SBA can provide is an essential feature of interpretation of the economic effects of the regulation.

EPA estimates that the total amount required to achieve the reductions in impacts indicated by SBA loan analysis is approximately $65 million. Although this amount is not small, it is far less than $100 million that was appropriated for Economic Injury Loans in Fiscal Year 1979, out of which $4.5 million had been disbursed by July 1, 1979. The appropriate comparison is to the funds available, not the funds already disbursed.

In its analysis of the effects of SBA loans, EPA used the same credit criteria that it used for bank loans. Since Economic Injury Loan applications require two rejections of loan applications from commercial banks, it is likely that EPA substantially underestimated the number of firms that would qualify for Economic Injury Loans.

Problems with perceptions of SBA loan programs, and the reluctance of electroplaters to apply for SBA loans, are matters that require continued effort on the part of EPA and SBA. The two agencies continue to work closely toward improving the efficiency of Economic Injury Loan processing. In addition, EPA is investigating the possibility of engaging the services of private organizations to publicize the loans and expedite the paperwork. EPA's contacts with such intermediary firms have already been initiated, and will continue after promulgation of this regulation.

2. Compliance period.—EPA noted in its economic impact analysis that the study assumed a one-year compliance period for the regulations. Dischargers in the industry have three years to comply with the regulation. This discrepancy is likely to lead to a reduction of observed impacts below EPA's estimates. Comments on this issue said that, since the total amount of investment captial required for compliance would not change, the effect of spreading the investment over three years instead of one would be negligible.

EPA does not believe that significant reductions in estimated plant closures or price increases will necessarily result from the three year compliance period. However, the net effect of a longer compliance period will be to allow firms to schedule their investments efficiently and to allow their customers to adjust to new sources of supply in the event of plant closures. The magnitude of impacts projected by EPA might change only slightly, but the transition to full compliance can be effected in a more orderly fashion over three years than over one.

In consideration of the foregoing, 40 CFR Part 413 is revised to read as follows:

Dated: August 9, 1979.

Douglas M. Costle,

Administrator.

PART 413—ELECTROPLATING POINT SOURCE CATEGORY

General Provisions

Subpart A—Electroplating of Common Metals Subcategory

Subpart B—Electroplating of Precious Metals Subcategory

Subpart C—Electroplating of Specialty Metals Subcategory [Reserved]

Subpart D—Anodizing Subcategory

Subpart E—Coatings Subcategory

Subpart F—Chemical Etching and Milling Subcategory

Subpart G—Electroless Plating Subcategory

Subpart H—Printed Circuit Board Subcategory

Authority: Secs. 301, 304(g), 307(b) and (d), 308, 309, 402, 405, 501(a) of the Clean Water Act, as amended (33 U.S.C. §§ 1311, 1314(g), 1317(b) and (d), 1318, 1319, 1322, 1325, and 1341(a)).

General Provisions

§ 413.01 Applicability.

(a) This Part shall apply to any electroplating operations in which metal is electroplated on any basis material and to related metal finishing operations as set forth in the various subparts, whether such operations are conducted in conjunction with electroplating or conducted independently.

(b) Operations similar to electroplating which are specifically excepted from coverage of this Part include: (1) Electrowinning and electrorefining conducted as a part of nonferrous metal smelting and refining (40 CFR 421); (2) Metal surface preparation and conversion coating conducted as a part of coil coating (40 CFR 465); (3) Metal surface preparation and immersion plating or electroless plating conducted as a part of porcelain enameling (40 CFR 466); and (4) electrodeposition of active electrode materials, electroimpregnation, and electroforming conducted as a part of battery manufacturing (40 CFR 461).

(c) Metallic platemaking and gravure cylinder preparation conducted within printing and publishing facilities, and continuous strip electroplating conducted within iron and steel manufacturing facilities which introduce pollutants into a publicly owned treatment works are exempted from the pretreatment standards for existing sources set forth in this Part.

§ 413.02 General definitions.

In addition to the definitions set forth in 40 CFR 401 and the chemical analysis methods set forth in 40 CFR 136, both of which are incorporated herein by reference, the following definitions apply to this Part:

(a) The term "CN,A" shall mean cyanide amenable to chlorination as defined by 40 CFR 136.

(b) The term "CN,T" shall mean cyanide, total.

(c) The term "Cr,VI" shall mean hexavalent chromium.

(d) The term "electroplating process wastewater" shall mean process wastewater generated in operations which are subject to regulation under any of subparts A through H of this Part.

(e) The term "total metal" is defined as the sum of the concentration or mass of Copper (Cu), Nickel (Ni), Chromium (Cr) (total) and Zinc (Zn).

(f) The term "strong chelating agents" is defined as all compounds which, by virtue of their chemical structure and amount present, form soluble metal complexes which are not removed by subsequent metals control techniques such as pH adjustment followed by clarification or filtration.

(g) The term "control authority" is defined as the POTW if it has an approved pretreatment program; in the absence of such a program, the NPDES State if it has an approved pretreatment program or EPA if the State does not have an approved program.

§ 413.03 Monitoring requirements.

(a)(1) Each source subject to the pretreatment standards of this Part shall collect and analyze representative samples of electroplating process wastewater not less frequently than the following self-monitoring schedule:

Self-monitoring schedule

Flow (liters per day)	Frequency of monitoring	Number of analyses[1]
0–38,000	Once per month	6
38,000–190,000	Twice per month	12
190,000–380,000	Once per week	26
380,000–950,000	Twice per week	52
over 950,000	Thrice per week	78

[1] Per 6 month reporting period.

All process wastewaters regulated by Subparts A through H of this Part shall be added together when determining the frequency of self-monitoring.

(2) Each source subject to the pretreatment standards of this Part shall analyze the first representative sample of final effluent taken during each six months reporting period for all pollutants regulated by the appropriate subcategories. If regulated pollutants are found in concentrations less than 0.10 mg/l and the owner or operator attests that such pollutants are not a part of the raw materials or process, then analysis

of such regulated pollutants may be omitted during the remainder of the six month period.

(3) Each source shall retain the data collected during self-monitoring for three years and provide to the control authority as directed.

(4) Chemical analyses shall be performed in accordance with the methods and procedures specified in 40 CFR 136.

(b) For the purpose of enforcement of pretreatment standards, consecutive samples taken and analyzed shall be considered as being taken on consecutive days even though one or more non-sampling days intervene. In applying the pretreatment standards where more than one but less than 30 samples have been taken and analyzed during any month, the following formula shall be used to establish the standard for each pollutant which the average of the samples shall not exceed:

$L_x = L_{30} + F/(L_1 - L_{30})$

Where:

L_x=Standard not to be exceeded by the average of X consecutive samples.

L_1=Maximum for any one day.

L_{30}=Standard not to be exceeded by the average of 30 consecutive days.

F=Multiplier for number of samples analyzed (from table below).

Table—Values of F

No. Samples:	F
1	1.00
2	0.597
3	0.430
4	0.335
5	0.266
6	0.223
7	0.186
8	0.167
9	0.141
10	0.127
11	0.114
12	0.109
13	0.089
14	0.077
15	0.064
16	0.058
17	0.052
18	0.045
19	0.039
20	0.033
21	0.030
22	0.026
23	0.023
24	0.020
25	0.016
26	0.013
27	0.010
28	0.007
29	0.003
30	0.000

§ 413.04 Upsets.

The following upset provisions shall apply to process wastewaters introduced into publicly owned treatment works from sources subject to limitations of Subparts A through H of this Part.

(a) "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based pretreatment standards because of factors beyond the reasonable control of the Industrial User. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(b) An upset shall constitute an affirmative defense to an action brought for noncompliance with this standard if the requirements of paragraph (c) are met.

(c) A User who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the User can identify the specific cause(s) of the upset;

(2) The facility was at the time being operated in a prudent and workman-like manner and in compliance with applicable operation and maintenance procedures;

(3) The User has submitted the following information to its POTW and Control Authority within 24 hours of becoming aware of the upset (if this information is provided orally, a written submission must be provided within five days):

(i) A description of the indirect discharge and cause of noncompliance;

(ii) The period of noncompliance, including exact dates and times, and/or if not corrected, the anticipated time the noncompliance is expected to continue;

(iii) Steps being taken and planned to reduce, eliminate and prevent recurrence of the noncompliance.

(d) In any enforcement proceeding the User seeking to establish the occurrence of an upset shall have the burden of proof.

(e) In the usual exercise of prosecutorial discretion, Agency enforcement personnel will ordinarily review any claims that noncompliance was caused by an upset. No determinations made in the course of the review constitute final Agency action subject to judicial review. Users will have the opportunity for a judicial determination on any claim of upset only in an enforcement action brought for noncompliance with technology-based pretreatment standards.

(f) The User shall control production and all discharges upon reduction, loss, or failure of its treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

§ 413.05 Net/Gross.

Except as provided in paragraphs (a)–(c) of this section, the pretreatment standards shall not be adjusted for pollutants in the intake water.

(a) Any Industrial User wishing to obtain a credit for intake pollutants must apply for it within 60 days after the effective date of this standard. Application shall be made to the Enforcement Office of the EPA region where the User is located. Upon request of the Industrial User, this standard will be calculated on a "net" basis, i.e., adjusted to reflect credit for pollutants in the intake water, if the User demonstrates:

(1) its intake water is drawn from the same body of water into which the discharge from its publicly owned treatment works is made; and

(2) the pollutants present in the intake water will not be entirely removed by the treatment systems operated by the user; and

(3) the pollutants in the intake water do not vary chemically or biologically from the pollutants limited by this standard; and

(4) the User does not significantly increase concentrations of pollutants in the intake water, even if the total amount of pollutants remains the same.

(b) Standards adjusted under this paragraph shall be calculated on the basis of the amount of pollutants present after any treatment steps have been performed on the intake water by or for the discharger. Adjustments under this paragraph shall be given only to the extent that pollutants in the intake water which are limited by this standard are not removed by the treatment technology employed by the discharger.

(c) The EPA Regional Enforcement Office shall require the User to conduct additional monitoring (i.e., for flow and concentration of pollutants) as necessary to determine continued eligibility for and compliance with any adjustments. The User shall notify the Regional Enforcement Office if there are any significant changes in the quantity of the pollutants in the intake water or in the level of water treatment provided.

(d) The EPA Regional Enforcement Office shall consider all timely applications for credits for intake pollutants plus any additional evidence that may have been submitted in response to the EPA's request. The EPA Office shall then make a written determination of the applicable credit(s), if any; state the reasons for its determination; state what additional monitoring is necessary; and send a copy of the determination to the applicant and the applicant's Publicly Owned Treatment Works. The decision of the Regional Enforcement Office shall be final.

Subpart A—Electroplating of Common Metals Subcategory

§ 413.10 Applicability: Description of the electroplating of common metals subcategory.

The provisions of this subpart apply to discharges of pollutants in process wastewaters resulting from the process in which a ferrous or nonferrous basis material is electroplated with copper, nickel, chromium, zinc, tin, lead, cadmium, iron, aluminum, or any combination thereof.

§ 413.11 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area plated expressed in square meters (square feet).

(b) The term "operation" shall mean any step in the electroplating process in which a metal is electrodeposited on a basis material and which is followed by a rinse; this includes the related operations of alkaline cleaning, acid pickle, stripping, and coloring when each operation is followed by a rinse.

§ 413.12 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can effect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
Copper	160	80
Nickel	160	80
Cr, Total	160	80
Cr,VI	16	8
Zinc	160	80
CN, Total	160	80
CN, A	16	8
Fluoride	6400	3200
Cadmium	96	48
Lead	160	80
Iron	320	160
Tin	320	160
Phosphorus	320	160
TSS	6400	3200
pH	Within the range 6.0 to 9.5.	
	(English units) pounds per million square feet per operation	
Copper	32.7	16.4
Nickel	32.7	16.4
Cr, Total	32.7	16.4
Cr,VI	3.3	1.6
Zinc	32.7	16.4
CN, Total	32.7	16.4
CN, A	3.3	1.6
Fluoride	1308	654
Cadmium	19.2	9.6
Lead	32.7	16.4
Iron	65.4	32.7
Tin	65.4	32.7
Phosphorus	65.4	32.7
TSS	1308	654
pH	Within the range 6.0 to 9.5.	

(b) The post plating steps of chromating, phosphating and coloring, if followed by a rinse, may be included under the term "operation" for the purpose of calculating effluent discharges, providing such steps are an integral part of the plating line.

(c) Stripping, where followed by a rinse and conducted in conjunction with electroplating for the purpose of salvaging improperly plated parts, may be included under the term "operations" for the purpose of calculating effluent discharges.

(d) Electroless plating on non-metallic materials for the purpose of providing a conductive surface on the basis material, preceding the actual electroplating step, forming an integral step in the plating line and followed by a rinse may be included under the term "operation" for the purpose of calculating effluent discharges.

(e) For any point source subject to such effluent limitations with a total employment of less than 11 persons, with a discharge from the establishment of waste water generated from the metal finishing process of less than 7,800 liters per hour (2,061 gallons per hour) and with a production rate of less than 4.9 sq m per hour per employee (52.7 sq ft per hour per employee), the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
CN, A	16	8
CN, Total	160	80
Flow	Equalize	
pH	Within the range 6.0 to 9.0.	
	(English units) pounds per million square feet per operation	
CN, A	3.3	1.6
CN, Total	32.7	16.4
Flow	Equalize	
pH	Within the range 6.0 to 9.0	

(f) Pursuant to section 308 of the Act, a point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a). For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

Note.—At 41 FR 53016, Dec. 3, 1976, § 413.12 was suspended indefinitely.

§ 413.14 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section

307(b) of the Act for a source within the common metals subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the common metals subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart. After October 12, 1982:

(a) No User introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 l (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may be applied in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	29	9
Cu	176	70
Ni	160	70
Cr	273	98
Zn	164	70
Pb	23	12
Cd	47	20
Total metals	410	195

(e) For wastewater sources regulated under paragraph (c) of this section, the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes, and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0.	

Subpart B—Electroplating of Precious Metals Subcategory

§ 413.20 Applicability: Description of the electroplating of precious metals subcategory.

The provisions of this subpart apply to indirect discharges of process wastewaters resulting from the process in which a ferrous or nonferrous basis material is plated with gold, silver, iridium, palladium, platinum, rhodium, ruthenium, or any combination of these.

§ 413.21 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area plated expressed in square meters (square feet).

(b) The term "operation" shall mean any step in the electroplating process in which a metal is electrodeposited on a basis material and which is followed by a rinse: this includes the related operations of alkaline cleaning, acid pickle, stripping, and coloring when each operation is followed by a rinse.

§ 413.22 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can effect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
Copper	160	80
Nickel	160	80
Cr, Total	160	80
CrVI	16	8
Zinc	160	80
CN, Total	160	80
CN, A	16	8
Fluoride	6400	3200
Cadmium	96	48
Lead	160	80
Iron	320	160
Tin	320	160
Phosphorus	320	160
TSS	6400	3200
pH	Within the range of 6.0 to 9.5.	
	(English units) pounds per million square feet per operation	
Copper	32.7	16.4
Nickel	32.7	16.4
Cr, Total	32.7	16.4
CrVI	3.3	1.6
Zinc	32.7	16.4
CN, Total	32.7	16.4
CN, A	3.3	1.6
Fluoride	1308	654
Cadmium	19.2	9.6
Lead	32.7	16.4
Iron	65.4	32.7
Tin	65.4	32.7
Phosphorus	65.4	32.7
TSS	1308	654
pH	Within the range of 6.0 to 9.5.	

(b) The post plating steps of chromating, phosphating and coloring, if followed by a rinse, may be included under the term "operation" for the purpose of calculating effluent discharges, providing such steps are an integral part of the plating line.

(c) Stripping, where followed by a rinse and conducted in conjunction with electroplating for the purpose of salvaging improperly plated parts, may be included under the term "operations" for the purpose of calculating effluent discharges.

(d) Electroless plating on non-metallic materials for the purpose of providing a conductive surface on the basis material, preceding the actual electroplating step, forming an integral step in the plating line and followed by a rinse may be included under the term "operation" for the purpose of calculating effluent discharges.

(e) For any point source subject to such effluent limitations with a total employment of less than 11 persons, with a discharge from the establishment of waste water generated from the metal finishing process of less than 7,800 liters per hour (2,061 gallons per hour) and with a production rate of less than 4.9 sq m per hour per employee (52.7 sq ft per hour per employee), the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged:

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
CN, A	16	8
CN, Total	160	80
Flow	Equalize	
pH	Within the range 6.0 to 9.0	
	(English units) pounds per million square feet per operation	
CN, A	3.3	1.6
CN, Total	32.7	16.4
Flow	Equalize	
pH	Within the range 6.0 to 9.0	

(f) Pursuant to section 308 of the Act, a point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a). For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

Note.—At 41 FR 53018, Dec. 3, 1976, § 413.22 was suspended indefinitely.

§ 413.24 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the electroplating of precious metals subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the electroplating of precious metals subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart. After October 12, 1982:

(a) No user introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l): Maximum for any 1 day	Pretreatment standard (mg/l): Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 L (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l): Maximum for any 1 day	Pretreatment standard (mg/l): Average of daily values for 30 consecutive monitoring days shall not exceed—
Ag	1.2	0.5
CN,T	0.8	0.20
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation): Maximum for any 1 day	Pretreatment standard (mg/sq m-operation): Average of daily values for 30 consecutive monitoring days shall not exceed—
Ag	47	20
CN,T	29	9
Cu	176	70
Ni	160	70
Cr	273	98
Zn	164	70
Pb	23	12
Cd	47	20
Total metals	410	195

(e) For wastewater sources regulated under paragraph (c) of this section, the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.54
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0	

Subpart C—Electroplating of Specialty Metals Subcategory [Reserved]

Subpart D—Anodizing Subcategory

§ 413.40 Applicability: Description of the anodizing subcategory.

The provisions of this subpart apply to discharges of process wastewater resulting from the anodizing of ferrous or nonferrous materials.

§ 413.41 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area plated expressed in square meters (square feet).

(b) The term "operation" shall mean any step in the anodizing process in which a metal is cleaned, anodized, or colored when each such step is followed by a rinse.

§ 413.42 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, maunufacturing processes, products produced, treatment technology available, energy requirements and costs) which can affect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
Copper	160	80
Nickel	160	80
Cr, Total	160	80
CrVI	16	8
Zinc	160	80
CN, Total	160	80
CN, A	16	8
Fluoride	6400	3200
Cadmium	96	48
Lead	160	80
Iron	320	160
Tin	320	160
Phosphorus	320	160
TSS	6400	3200
pH	Within the range 6.0 to 9.5	
	(English units) pounds per million square feet per operation	
Copper	32.7	16.4
Nickel	32.7	16.4
Cr, Total	32.7	16.4
CrVI	3.3	1.6
Zinc	32.7	16.4
CN, Total	32.7	16.4
CN, A	3.3	1.6
Fluoride	1308	654
Cadmium	19.2	9.6
Lead	32.7	16.4
Iron	65.4	32.7
Tin	65.4	32.7
Phosphorus	65.4	32.7
TSS	1308	654
pH	Within the range 6.0 to 9.5	

(b) The post plating steps of chromating, phosphating and coloring, if followed by a rinse, may be included under the term "operation" for the purpose of calculating effluent discharges, providing such steps are an integral part of the plating line.

(c) Stripping, where followed by a rinse and conducted in conjunction with electroplating for the purpose of salvaging improperly plated parts, may be included under the term "operations" for the purpose of calculating effluent discharges.

(d) Electroless plating on non-metallic materials for the purpose of providing a conductive surface on the basis material, preceding the actual electroplating step, forming an integral step in the plating line and followed by a rinse may be included under the term "operation" for the purpose of calculating effluent discharges.

(e) For any point source subject to such effluent limitations with a total employment of less than 11 persons, with a discharge from the establishment of waste water generated from the metal finishing process of less than 7,800 liters per hour (2,061 gallons per hour) and with a production rate of less than 4.9 sq m per hour per employee (52.7 sq ft per hour per employee), the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
CN, A	16	8
CN, Total	160	80
Flow	Equalize	
pH	Within the range 6.0 to 9.0	
	(English units) pounds per million square feet per operation	
CN, A	3.3	1.6
CN, Total	32.7	16.4
Flow	Equalize	
pH	Within the range 6.0 to 9.0	

(f) Pursuant to section 308 of the Act, a point source subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a). For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

Note.—At 41 FR 53018, Dec. 3, 1976, § 413.42 was suspended indefinitely.

§ 413.44 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the anodizing subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the anodizing subcategory establish the concentration of polluants or polluant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart. After October 12, 1982:

(a) No User introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 l (10, 000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	29	9
Cu	176	70
Ni	160	70
Cr	273	98
Zn	164	70
Pb	23	12
Cd	47	20
Total metals	410	195

(e) For wastewater sources regulated under paragraph (c) of this section, the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatent works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0.	

Subpart E—Coatings Subcategory

§ 413.50 Applicability: Description of the coatings subcategory.

The provisions of this subpart apply to discharges resulting from the chromating, phosphating or immersion plating on ferrous or nonferrous materials.

§ 413.51 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area processed expressed in square meters (square feet).

(b) The term "operation" shall mean any step in the coating process in which a basis material surface is acted upon by a process solution and which is followed by a rinse; plus the related operations of alkaline cleaning, acid pickle, and sealing, when each operation is followed by a rinse.

§ 413.52 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can effect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result, these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establisb for the discharger effluent limitations in NDPES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available.

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed
	(Metric units) milligrams per square meters per operation	
Copper	160	80
Nickel	160	80
Cr, Total	160	80
CrVI	16	8
Zinc	160	80
CN, Total	160	80
CN, A	16	8
Fluoride	6400	3200
Cadmium	96	48
Lead	160	80
Iron	320	160
Tin	320	160
Phosphorus	320	160
TSS	6400	3200
pH	Within the range 6.0 to 9.5.	
	(English units) pounds per million square feet per operation	
Copper	32.7	16.4
Nickel	32.7	16.4
Cr, Total	32.7	16.4
CrVI	3.3	1.6
Zinc	32.7	16.4
CN, Total	32.7	16.4
CN, A	3.3	1.6
Fluoride	1308	654
Cadmium	19.2	9.6
Lead	32.7	16.4
Iron	65.4	32.7
Tin	654	32.7
Phosphorus	654	32.7
TSS	1308	654
pH	Within the range 6.0 to 9.5.	

(b) The post plating steps of chromating, phosphating and coloring, if followed by a rinse, may be included under the term "operation" for the purpose of calculating effluent discharges, providing such steps are an integral part of the plating line.

(c) Stripping, where followed by a rinse and conducted in conjunction with electroplating for the purpose of salvaging improperly plated parts, may be included under the term "operations" for the purpose of calculating effluent discharges.

(d) Electroless plating on non-metallic materials for the purpose of providing a conductive surface on the basis material, preceding the actual electroplating step, forming an integral step in the plating line and followed by a rinse may be included under the term "operation" for the purpose of calculating effluent discharges.

(e) For any point source subject to such effluent limitations with a total employment of less than 11 persons, with a discharge from the establishment of waste water generated from the metal finishing process of less than 7,800 liters per hour (2,061 gallons per hour) and with a production rate of less than 4.9 sq m per hour per employee (52.7 sq ft per hour per employee), the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged.

Effluent characteristic	Effluent limitations: Maximum for any 1 day	Effluent limitations: Average of daily values for 30 consecutive days shall not exceed—
	(metric units) milligrams per square meters per operation	
CN, A	16	8
CN, Total	160	80
Flow	Equalize	
pH	Within the range 6.0 to 9.0	
	(English units) pounds per million square feet per operation	
CN, A	3.3	1.6
CN, Total	32.7	16.4
Flow	Equalize	
pH	Within the range 6.0 to 9.0	

(f) Pursuant to section 308 of the Act, a point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a). For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

Note.—At 41 FR 53018, Dec. 3, 1976, § 413.52 was suspended indefinitely.

§ 413.54 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the coatings subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the coatings subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart. After October 12, 1982:

(a) No user introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l): Maximum for any 1 day	Pretreatment standard (mg/l): Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 liters (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l): Maximum for any 1 day	Pretreatment standard (mg/l): Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation): Maximum for any 1 day	Pretreatment standard (mg/sq m-operation): Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	30	9
Cu	170	69
Ni	162	69
Cr	285	100
Zn	162	69
Pb	22	10
Cd	50	22
Total metals	410	198

(e) For wastewater sources regulated under paragraph (c) of this section the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/1)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0.	

Subpart F—Chemical Etching and Milling Subcategory

§ 413.60 Applicability: Description of the chemical etching and milling subcategory.

The provisions of this subpart apply to discharges of process wastewaters resulting from the chemical milling or etching of ferrous or nonferrous materials.

§ 413.61 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area exposed to process chemicals expressed in square meters (square feet).

(b) The term "operation" shall mean any step in the chemical milling or etching processes in which metal is chemically or electrochemically removed from the work piece and which is followed by a rinse; this includes related metal cleaning operations which preceded chemical milling or etching, when each operation is followed by a rinse.

§ 413.62 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.

In establishing the limitations set forth in this section, EPA took into account all information it was able to collect, develop and solicit with respect to factors (such as age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements and costs) which can effect the industry subcategorization and effluent levels established. It is, however, possible that data which would affect these limitations have not been available and, as a result these limitations should be adjusted for certain plants in this industry. An individual discharger or other interested person may submit evidence to the Regional Administrator (or to the State, if the State has the authority to issue NPDES permits) that factors relating to the equipment or facilities involved, the process applied, or other such factors related to such discharger are fundamentally different from the factors considered in the establishment of the guidelines. On the basis of such evidence or other available information, the Regional Administrator (or the State) will make a written finding that such factors are or are not fundamentally different for that facility compared to those specified in the Development Document. If such fundamentally different factors are found to exist, the Regional Administrator or the State shall establish for the discharger effluent limitations in the NPDES permit either more or less stringent than the limitations established herein, to the extent dictated by such fundamentally different factors. Such limitations must be approved by the Administrator of the Environmental Protection Agency. The Administrator may approve or disapprove such limitations, specify other limitations, or initiate proceedings to revise these regulations.

(a) The following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged by a point source subject to the provisions of this subpart after application of the best practicable control technology currently available:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
Copper	160	80
Nickel	160	80
Cr, Total	160	80
CrVI	16	8
Zinc	160	80
CN, Total	160	80
CN, A	16	8
Fluoride	6400	3200
Cadmium	96	48
Lead	160	80
Iron	320	160
Tin	320	160
Phosphorus	320	160
TSS	6400	3200
pH	Within the range 6.0 to 9.5.	
	(English units) pounds per million square feet per operation	
Copper	32.7	16.4
Nickel	32.7	16.4
Cr, Total	32.7	16.4
CrVI	3.3	1.6
Zinc	32.7	16.4
CN, Total	32.7	16.4
CN, A	3.3	1.6
Fluoride	1308	654
Cadmium	19.2	9.6
Lead	32.7	16.4
Iron	65.4	32.7
Tin	65.4	32.7
Phosphorus	65.4	32.7
TSS	1308	654
ph	Within the range 6.0 to 9.5.	

(b) The post plating steps of chromating, phosphating and coloring, if followed by a rinse, may be included under the term "operation" for the purpose of calculating effluent discharges, providing such steps are an integral part of the plating line.

(c) Stripping, where followed by a rinse and conducted in conjunction with electroplating for the purpose of salvaging improperly plated parts, may be included under the term "operations" for the purpose of calculating effluent discharges.

(d) Electroless plating on non-metallic materials for the purpose of providing a conductive surface on the basis material, preceding the actual electroplating step, forming an integral step in the plating line and followed by a rinse may be included under the term "operation" for the purpose of calculating effluent discharges.

(e) For any point source subject to such effluent limitations with a total employment of less than 11 persons, with a discharge from the establishment of waste water generated from the metal finishing process of less than 7,800 liters per hour (2,061 gallons per hour) and with a production rate of less than 4.9 sq m per hour per employee (52.7 sq ft per hour per employee), the following limitations establish the quantity or quality of pollutants or pollutant properties, controlled by this section, which may be discharged:

Effluent characteristic	Effluent limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days shall not exceed—
	(Metric units) milligrams per square meters per operation	
CN, A	16	8
CN, Total	160	80
Flow	Equalize	
pH	Within the range 6.0 to 9.0.	
	(English units) pounds per million square feet per operation	
CN, A	3.3	1.6
CN, Total	32.7	16.4
Flow	Equalize	
pH	Within the range 6.0 to 9.0.	

(f) Pursuant to section 308 of the Act, a point sources subject to the provisions of this subpart shall maintain records of production expressed in sq m or sq ft as defined in § 413.11 for the purpose of determining compliance with the effluent limitations in § 413.12(a). For the purpose of complying with the requirements of this paragraph, a discharger may establish a correlation between area plated and another parameter, such as ampere-hours used in plating.

Note.—At 41 FR 53018, Dec. 3, 1976, § 413.62 was suspended indefinitely.

§ 413.64 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the chemical milling and etching subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the chemical milling and etching subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart.

After October 12, 1982:

(a) No User introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 l (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	29	9
Cu	176	70
Ni	160	70
Cr	273	98
Zn	164	70
Pb	23	12
Cd	47	20
Total metals	410	195

(e) For wastewater sources regulated under paragraph (c) of this section the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0.	

Subpart G—Electroless Plating Subcategory

§ 413.70 Applicability: Description of the electroless plating subcategory.

The provisions of this subpart apply to discharges resulting from the electroless plating of a metallic layer on a metallic or nonmetallic substrate.

§ 413.71 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area plated expressed in square meters (square feet).

(b) The term "electroless plating" shall mean the deposition of conductive material from an autocatalytic plating solution without application of electrical current.

(c) The term "operation" shall mean any step in the electroless plating process in which a metal is deposited on a basis material and which is followed by a rinse; this includes the related operations of alkaline cleaning, acid pickle, and stripping, when each operation is followed by a rinse.

§ 413.74 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the electroplating of electroless plating subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the electroless plating subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart.

After October 12, 1982:

(a) No User introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 l (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	29	9
Cu	176	70
Ni	160	70
Cr	273	98
Zn	164	70
Pb	23	12
Cd	47	20
Total metals	410	195

(e) For wastewater sources regulated under paragraph (c) of this section, the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromium wastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0.	

Subpart H—Printed Circuit Board Subcategory

§ 413.80 Applicability: Description of the printed circuit board subcategory.

The provisions of this subpart apply to the manufacture of printed circuit boards, including all manufacturing operations required or used to convert an insulating substrate to a finished printed circuit board. The provisions set forth in other subparts of this category are not applicable to the manufacture of printed circuit boards.

§ 413.81 Specialized definitions.

For the purpose of this subpart:

(a) The term "sq m" ("sq ft") shall mean the area of the printed circuit board immersed in an aqueous process bath.

(b) The term "operation" shall mean any step in the printed circuit board manufacturing process in which the board is immersed in an aqueous process bath which is followed by a rinse.

§ 413.84 Pretreatment standards for existing sources.

For the purpose of establishing pretreatment standards under section 307(b) of the Act for a source within the printed circuit board subcategory, the provisions of Part 403 of this chapter shall apply. The following categorical pretreatment standards for an existing source within the printed circuit board subcategory establish the concentration of pollutants or pollutant properties of effluent which may be introduced into a publicly owned treatment works by a source subject to the provisions of this subpart. After October 12, 1982:

(a) No User introducing wastewater pollutants into a publicly owned treatment works under the provisions of this subpart shall augment the use of process wastewater or otherwise dilute the wastewater as a partial or total substitute for adequate treatment to achieve compliance with this standard.

(b) For a source discharging less than 38,000 liters (10,000 gal) per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,A	5.0	1.5
Pb	0.6	0.3
Cd	1.2	0.5

(c) For plants discharging 38,000 l (10,000 gal) or more per calendar day of electroplating process wastewater the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Cu	4.5	1.8
Ni	4.1	1.8
Cr	7.0	2.5
Zn	4.2	1.8
Pb	0.6	0.3
Cd	1.2	0.5
Total metals	10.5	5.0

(d) Alternatively, the following mass-based standards are equivalent to and may apply in place of those limitations specified under paragraph (c) of this section upon prior agreement between a source subject to these standards and the publicly owned treatment works receiving such regulated wastes:

Pollutant or pollutant property	Pretreatment standard (mg/sq m-operation)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	67	20
Cu	401	160
Ni	365	160
Cr	623	223
Zn	374	160
Pb	53	27
Cd	107	45
Total metals	935	445

(e) For wastewater sources regulated under paragraph (c) of this section, the following optional control program may be elected by the source introducing treated process wastewater into a publicly owned treatment works with the concurrence of the control authority. These optional pollutant parameters are not eligible for allowance for removal achieved by the publicly owned treatment works under 40 CFR 403.7. In the absence of strong chelating agents, after reduction of hexavalent chromwastes and after neutralization using calcium oxide (or hydroxide) the following limitations shall apply:

Pollutant or pollutant property	Pretreatment standard (mg/l)	
	Maximum for any 1 day	Average of daily values for 30 consecutive monitoring days shall not exceed—
CN,T	0.8	0.23
Pb	0.6	0.3
Cd	1.2	0.5
TSS	20.0	10.0
pH	Within the range 7.5 to 10.0	

[FR Doc. 79-27905 Filed 9-6-79; 8:45 am]
BILLING CODE 6560-01-M