ADDENDUM TO THE REPORT ENTITLED:

ASSESSMENT OF THE IMPACTS OF INDUSTRIAL DISCHARGES ON PUBLICLY OWNED TREATMENT WORKS

Submitted to the Environmental Protection Agency

JRB ASSOCIATES
A Company of Science Applications, Inc.

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February 25, 1983

Submitted to:

U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C.

In Response to:

EPA Contract No 68-01-5052, DOW 54
JRB Project No. 2-834-03-587-37

EPA Contract No. 68-01-6514, WA #2
JRB Project No. 2-834-03-434-32

Submitted by:

JRB Associates
8400 Westpark Drive
McLean, Virginia 22102

February 25, 1983

Mr. Tom O'Farrell
Office of Water Regulations and Standards
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Tom:

Enclosed is a copy of our third revision of the RIA Addendum Report. A number of specific changes have been made in response to your comments. In addition, certain modelling assumptions have been verified and corrected with the resulting impacts incorporated throughout the report.

Should you have any questions concerning this report or any additional changes you wish made, please do not hesitate to contact me at the above address or by telephoning (703) 821-4619.

Sincerely,

for

Peter Trick
Program Manager

cc: Bill Diamond
Robert Eagen
Bruce Clemens

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INTRODUCTION

The following report is an addendum to a report prepared for the Environmental Protection Agency in conjunction with the Agency's performance of a regulatory impact analysis of the National Pretreatment Program. The original report entitled, "An Assessment of the Impact of Industrial Dischargers on Publicly Owned Treatment Works," (JRB Associates, Nov. 1981) contained data and analytical results on the following:

1) The operation and status of the current pretreatment program
2) The need for pretreatment
3) Six regulatory alternatives for industrial waste control
4) The costs and benefits of the current program and regulatory options.

To generate this contractor report, an extensive computer model was developed. The report and accompanying appendices, therefore, also contained detailed descriptions of the data files and methodologies used to make economic and environmental predictions about the National Pretreatment Program and the alternative approaches for industrial waste control at POTWs.

The original report was made available to the public on December 22, 1981 (46 Fed. Reg. 62098). At this time, the public was invited to submit additional data bearing on the analysis, and to comment on the methodology, data base, options, and preliminary results of the contractor's report.

This addendum report presents new findings for the RIA stemming from data modifications and methodological changes made as a result of public comments, meetings held with interested parties, and additional review by EPA offices. It constitutes a final refinement of the technical work for the Pretreatment RIA.

This addendum report is organized into four chapters:

- Chapter 1 provides the regulatory background for this report and presents a summary of the public comments received on the initial report.

- Chapter 2 gives detailed information on the data modifications and methodological changes made to the RIA model and data bases.

- Chapter 3 presents new findings (paralleling those presented in the tables of the interim report) resulting from the changes described in Chapter 2. Revised predictions are made for environmental improvements attributable to implementation of pretreatment and brief comparisons are made with the original report.

- Chapter 4 takes the new model results and presents a revised comparison of the costs and benefits of the current pretreatment program with the other regulatory options analyzed. Again the results are presented in tables corresponding to those in Chapter 4 of the original report, and brief comparisons are made.

1.0 REGULATORY BACKGROUND AND PUBLIC COMMENTS

1.1 BACKGROUND

EPA issued amendments to the General Pretreatment Regulations on January 28, 1981, which were to have taken effect on March 13, 1981. On January 29, 1981, the Administration froze a number of regulations including the General Pretreatment Regulations (GPR) and postponed their effective dates until March 30, 1981. On February 17, 1981, Executive Order 12291 was issued altering the procedural and substantive review requirement incumbent on Federal agencies for new, existing and pending regulations. Executive Order 12291 was invoked on March 27, 1981, to indefinitely suspend the applicability of the GPR until a regulatory impact analysis (RIA) was prepared by EPA. An RIA is essentially an evaluation of the need for and consequences of a proposed regulatory action and alternatives to this action. The goal of an RIA is to determine if the potential benefits to society outweigh potential costs for any regulatory action.

EPA commenced the Pretreatment Regulatory Impact Analysis in February of 1981 with the formation of an Intra-agency Working Group on Pretreatment. This group assumed responsibility for directing a comprehensive evaluation of the National Pretreatment Program to fulfill the objectives of Executive Order 12291. The group selected an approach which melded in-house analyses with contractor support, drawing on several offices and resources within EPA and employing JRB Associates as the principal consultant to the project. The results of several studies and data collection efforts performed by the Office of Analysis and Evaluation and the Effluent Guidelines Division of OWRS, and the Permits Dvision of OWEP were merged with additional work conducted by JRB Associates and five subcontractors to assess the magnitude of problems caused by indirect industrial dischargers, the efficacy of the Agency's current approach to their control (as embodied in the National Pretreatment Program), and potential alternatives for industrial waste control at POTWs.

Specifically, JRB Associates was contracted to gather data, create an extensive data base and produce a preliminary report which evaluated the environmental, health, and interference impacts of industrial discharges of toxic pollutants to publicly owned treatment works. Additionally, the costs and benefits of possible alternatives were to be examined. Work commenced in April of 1981 and an interim final report was submitted to EPA in November 1981. This report, entitled "An Assessment of the Impacts of Industrial Discharges on Publicly Owned Treatment Works" was made available to the public on December 22, 1981 (46 Fed. Reg. 62099), and a comment period of 45 days to February 5, 1982, was provided. The public was invited to submit additional data for inclusion in the analysis and to comment on the methodology, database, options, and preliminary results of the contractor's report.

Concomitant with the preparation of this technical report, several major regulatory and legislative developments have occurred which affect the status of the National Pretreatment Program and the General Pretreatment Regulations. On February 1, 1982, the amended 1981 General Pretreatment Regulations (except for four provisions) were promulgated (47 Fed. Reg. 4518). Then, in July of 1982, a Federal court in the Third District found that in the course of suspending the General Pretreatment Regulations to allow the RIA to be conducted, EPA failed to follow procedures required in the Administrative Procedures Act (NRDC v. EPA, No. 81-2068). As a result, the court reinstated the General Pretreatment Regulations in their entirety, making their effective date retroactive to March 30, 1981. This was announced in the Federal Register on September 28, 1982 (47 Fed. Reg. 42688). At the same time, EPA issued a proposed rule to modify the removal credits provisions of the General Pretreatment Regulations (47 Fed. Reg. 42698).

1.2 PUBLIC COMMENTS ON THE CONTRACTOR'S REPORT

EPA received 53 formal comments on the Contractor's report for the Pretreatment RIA. This included responses from 18 local governments, eight State governments, two EPA Regions, 19 industrial commenters, five private individuals or consultants, and one public interest/environmental group. Thirty-seven of these respondents directed their remarks solely to the selection of a preferred option. Seventeen comments included both options recommendations, data, and methodological observations. Table 1.1 presents a distillation of the substantive issues raised by these public comments.

EPA and JRB took an extensive look at the validity and the implications of these criticisms. Responses were prepared for each in an in-house exercise to evaluate where modifications to the model or findings were warranted. In many instances, the comments reiterated limitations and assumptions acknowledged in the report for which no better alternatives existed. For instance, the enhancement of municipal sludge disposal options due to improved sludge quality attributable to pretreatment is one of the central goals of the National Pretreatment Program. Quantitative measures of these benefits are therefore crucial to an overall evaluation of the program. Yet, no reliable mechanism could be devised to systematically predict and credit these benefits given the variability in municipal sludge disposal options and State and local restrictions. Thus, the report presents estimates of improvements in sludge quality as predicted by the model, case studies, and the 40 POTW study, but is unable to attach associated monetary or operational benefits to this improvement.

On the other hand, several comments were identified for which time and data were available to permit revisions to the Pretreatment model. A detailed discussion of the data and modelling modifications undertaken in response to comments is presented in Chapter 2. Briefly, this effort included expansion of the stream flow file, revision of the pretreatment technology costs, a model verification study, changes to raw industrial wasteload data where warranted, and validation of the data sources used. In addition, seven major methodological changes were undertaken in response to the comments. These entailed changes to the stream flows and water quality standards employed to predict violations, an analysis of industrial hazardous waste definitions, toxic organics predictions, the method of identifying metal finishers, prediction of POTW inhibition, and the reporting of environmental impact findings.

TABLE 1.1

SUBSTANCE OF THE COMMENTS ON THE JRB REPORT

Data Comments

- Industrial pretreatment technology cost data are too low.
- Raw toxic metals discharge estimates are too high for the iron and steel, the pulp and paper, the metal finishing, leather tanning, textile, and inorganic chemical industries.
- Estimates of current levels of pretreatment in place are too high.
- Electroplater contributions to POTW influent are overstated.
- Removal estimates for primary treatment plants are based on only one facility.
- Data on toxic metal loadings from non-point sources are weak.

Methodological Comments

- The methodology used to identify indirect dischargers (Dun & Bradstreet, PCS, and normalization) is inaccurate.
- The benefits analysis is limited and not representative.
- To do an accurate assessment of economic impacts, plant closures should have been examined.
- Methodological assumption that all industrial residuals are hazardous wastes overstates the costs of industrial sludge disposal.
- Model does not address the impacts on POTWs of the industrial discharge of conventional pollutants.
- Methodology places undue emphasis on water quality exceedances rather than the mass of toxic pollutants discharged in assessing environmental impacts.
- Given that the number of POTWs required to have programs will fluctuate, all quantitative results are unreliable.
- The environmental impacts from the 114 toxic organic pollutants are ignored by modelling total toxic organics instead of individual organic pollutants.
- The Federal Water Quality Criteria are unrealistic, overly restrictive, and should not have been used as the measure of water quality attainment.

TABLE 1.1 (continued)

- 7Q10 stream flows should have been used instead of average annual stream flows to calculate dilution of POTW discharges.
- The model did not address the impacts of bypasses, upsets, inhibition, or groundwater contamination.

Policy Comments

- The report overlooks the administrative difficulties in implementing different regulatory options.
- The report fails to deal with specific provisions of the Pretreatment Regulations such as FDF variances and deadlines for categorical determinations.
- The report should have quantified options in terms of sludge disposal alternatives.
- The report overlooks the incompatiblity of proposed options with the Clean Water Act.
- The report should compare the cost of industrial pretreatment with advanced wastewater treatment by POTWs.

2.0 METHODOLOGY

This chapter summarizes the data and methodological changes made to the model employed in the Pretreatment RIA to estimate the environmental and cost impacts of industrial discharges to POTWs. Section 2.1 reviews briefly the original analytical approach used to evaluate the General Pretreatment Regulations (40 CFR 403) and a range of possible alternative regulatory strategies. Sections 2.2 and 2.3 discuss in detail the input data and methodological changes to this analytic approach. These were undertaken in an attempt to strengthen the initial report and to address public comments.

2.1 PRETREATMENT RIA METHODOLOGY

To assist EPA in assessing impacts of industrial discharges to POTWs, JRB developed a mass-balance computer model of a POTW system which quantifies the environmental benefits and costs for alternative pretreatment programs. JRB developed this mathematical model for the approximately 2000 POTWs across the country required to implement local pretreatment programs under the General Pretreatment Regulations. The model simulates the operation of a single POTW, distributes pounds of priority pollutants from industry among POTWs to allow an assessment of water quality and sludge impacts, and allows aggregation of individual results to national or regional totals. It consists of eleven data sources, including Dun and Bradstreet industrial lists, EGD Industrial data, EPA's Permit Compliance System, STORET, USGS, and EPA's NEEDS Survey, among others. The types of outputs of the model are discussed in the following subsections.

2.1.1 Environmental Measures

The POTW model estimates the following quantitative environmental measures for alternative pretreatment options for each of the 2000 POTWs:

Problem	Measure
Water Pollution	Exceedances of Water Quality Criteria Mass of Pollutants Net Change in Effluent Quality
Sludge Contamination	Volume and Contamination of Municipal Sludge Volume and Contamination of Industrial Sludge
Air Pollution	Mass of Volatile Priority Pollutants Discharged to Air

Most of these measures quantify for comparison among pretreatment options, the volume of pollution reduced, the volume that continues to be discharged and the concentration of toxics in the POTW effluent and in sludges.

Water quality exceedances, used as an indicator of potential water quality problems, were calculated by comparing the concentration of a toxic in the receiving stream to Federal Water Quality Criteria values for those toxics. Where this in-stream concentration was greater than these criteria values, an "exceedance" was said to occur. In the pretreatment RIA, exceedances were calculated for nine heavy metals and cyanide. Due to the lack of data available for individual toxic organics, toxic organics were modeled in aggregate form only.

A parallel effort was made to analyze the significance of changes in the concentration of priority pollutants in municipal sludge resulting from indirect industrial discharges. However, due to the lack of currently existing sludge disposal guidelines, JRB and EPA eventually decided that, given time constraints, no meaningful sludge criteria could be constructed for the pretreatment RIA. Therefore, the report made predictions on sludge quantity and quality both for industry and municipalities. However, given the lack of regulatory triggers, it is assumed that all industrial sludge is hazardous (although some industrial sludges are no longer classified as hazardous by EPA) and all municipal sludge is nonhazardous in calculating associated disposal costs, regardless of sludge quality improvement or degradation under the various options.

2.1.2 Cost Assessment

Having identified the central environmental problems to be controlled under any pretreatment program, and having chosen key criteria used to measure the environmental impacts of alternative programs, it was necessary to identify where the costs of compliance would be sustained so that data could be collected and impacts estimated. The principal actors under any pretreatment strategy are industry, POTWs, States, and the Federal government. A decision was made to limit the cost assessment to the following direct costs:

- Industrial Impacts

  Pretreatment Technology Compliance Costs
  Sludge Disposal Costs

- Municipal Impacts

  POTW Pretreatment Program Development Costs
  POTW Pretreatment Program Operational Costs
  POTW Sludge Disposal Costs

- State Impacts

  State Pretreatment Program Development Costs
  State Pretreatment Program Operational Costs

- Federal Impacts

  EPA Administrative Costs
  Construction Grants for Pretreatment

The POTW Model provided treatment and sludge disposal costs. Administrative costs for municipalities, States and the Federal govermment were based on historical estimates and case study extrapolations.

A number of cost factors had to be excluded due to the lack of adequate data or as a result of regulatory assumptions made above. For example, municipal costs were not reduced to account for savings experienced by POTWs due to the fewer operational problems attributable to an effective pretreatment program. Sludge disposal cost savings similarly could not be passed on to cities where the improvement in sludge quality due to pretreatment facilitates the use of a less expensive disposal option.

2.1.3 Data Limitations

In the pretreatment RIA, the ability to analyze the existing pretreatment program and possible alternatives in a logical and complete manner was often hindered by the lack of available health and environmental data. Solutions were designed to overcome these data deficiencies where possible, but some gaps could not be filled in the time frame of this study. For instance, no single data source had complete data on the number, type, and location of categorical industries discharging to individual POTWs. This information is critical for constructing the raw wasteloads entering POTWs as a result of industrial users. To surmount this inadequacy, Dun and Bradstreet computer lists were searched by SIC codes to identify the universe of categorical industries in the vicinity of a POTW. The Permit Compliance System Data Base was then used to back out direct dischargers holding NPDES permits from this total and these were assigned to the appropriate municipality according to the city name of the POTW as stated on the NEEDS Survey. To ensure model accuracy on a plant-by-plant basis, industrial flows to POTWs were then normalized to approximate those reported in the NEEDS Survey.

In fact, every component variable in the assessment of water quality impacts required assumptions in order to achieve results. The mass and volume of discharge of priority pollutants from all IUs in an industrial category were all assumed to be the same -- equal to those of an average firm. The POTW receiving these wastes was assumed to attain average treatability levels. Perhaps the greatest frustration with data weaknesses was experienced with data on receiving stream characteristics. Stream flows were available for less than half of the stream segments on which the approximately 2000 POTWs are sited. Ambient water quality for all ten toxic pollutant parameters (nine metals and cyanide) were almost uniformly unavailable resulting in the assumption that POTWs are discharging to pristine waters, and the lack of widespread State toxic water quality standards resulted in JRB's use of Federal water quality criteria.

Given that toxic water quality criteria are not widely accepted, that few standards have been adopted by States, that State and local sludge disposal criteria vary, and that there are not Federal sludge guidelines covering all sludge disposal options, there were major shortcomings in the analysis. In an attempt to overcome some of these weaknesses, correct input data errors, and incorporate new input data received, JRB has modified some of the analytical approaches to the pretreatment RIA. A detailed description of these modifications are presented in Sections 2.2 and 2.3 of this chapter.

2.2 DATA INPUT CHANGES

Certain data inputs in the pretreatment model have been altered, either in response to public comment or the acquisition of updated information, in order to revise previous estimates of the impacts of industrial discharges on publicly owned treatment works. These data input changes include industrial pollutant loadings, the average flow from industrial dischargers, estimates of pretreatment technology cost per gallon discharged, and the number of POTWs for which stream flow information is available. These changes are discussed in the following sections.

2.2.1 Industrial Pollutant Loadings

For the original report, the Effluent Guidelines Division of EPA supplied data on the effluent characteristics for each of the categorical industries modeled. The effluent description included specific concentrations for the priority pollutant metals, but only a total concentration of the organic priority pollutants. These effluent characteristics combined with industrial flow (Section 2.2.2) were used for each categorical industry to determine the flow and toxic loading of discharges to POTWs.

Upon review of the industrial pollutant loadings presented in the original RIA report, and on the basis of the comments received from industry, pollutant loadings for certain industrial categories were thought to be suspect. Therefore, each of the pollutant loadings was verified by contacting specific EGD project officers, recalculating all of the data originally supplied by EGD, and utilizing any updated information available since submission of the original report. In some instances, review of these data necessitated changes while in others original estimates were verified by EGD and therefore preserved. The results of this review are presented in Table 2.1 (formerly Table 1.1 of the original report). The table reflects changes in pollutant loadings for the iron and steel, leather tanning, aluminum forming, pulp and paper, and coil coating industries. Additional changes to industrial pollutant loadings and their impacts are reflected in the results of the modelling exercise presented in Chapters three and four of this report.

2.2.2 Industrial Discharger Flow

EGD also provided average flow data for model industrial users in each of the 34 categorical industries. This flow information was combined with the average industrial effluent concentrations provided by EGD to determine the total pollutant load contributed to the POTW by industrial discharges.

As in the case of industrial pollutant loadings, the accuracy of these average flow numbers was brought into question when the pretreatment RIA was released for public comment. Therefore, a verification of the average flow data supplied by EGD was undertaken to determine their accuracy. This verification procedure consisted of recalculating all of the flow numbers from the original EGD data as well as any updated information provided by the EPA project officers. These numbers were then compared to both the average industrial flow numbers presented in Table C3-IV of the RIA appendix, and the average flow numbers actually inserted into the model. Discrepancies were resolved in keeping with the original EGD estimates. It should be remembered that these flow and concentration data are national averages. Values for individual plants within an industrial category may vary considerably.

The results of this verification analysis are presented in Table 2.2. The first column in Table 2.2 shows the average flow listed in Table C3-IV of the RIA Appendix while the second column shows the average flow recalculated from the EGD-supplied data and inserted into the model. The average flow of the model industrial users in the iron and steel, and pulp and paper categories has been revised based on updated information from EGD. In addition, the

TABLE 2.1 COMPARISON OF DIRECT VERSUS INDIRECT DISCHARGES*

Indirect Discharge**

	Total Toxic Metals (Pounds/Year)			Total Toxic Organics (Pounds/Year)		
	RAW	CURRENT	PSES	RAW	CURRENT	PSES
Metal Finishing/ Electroplating	120,000,000	32,000,000	3,500,000	98,000,000	26,100,000	12,100,000
Iron & Steel	10,400,000	3,100,000	42,000	29,000,000	7,200,000	1,200,000
Leather Tanning	5,700,000	4,300,000	400,000	582,000	580,000	580,000
Aluminum Forming	1,200,000	890,000	0	--	210	40
Pulp, Paper, Paperboard	3,800,000	920,000	870,000	1,000,000	1,000,000	1,000,000
Inorganic I & II	3,300,000	1,400,000	50,000	--	--	--
Porcelain Enameling	1,400,000	1,300,000	0	--	--	--
Copper Forming	970,000	970,000	20,000	--	--	--
Organic & Plastics	790,000	707,000	79,000	171,000,000	154,000,000	43,000,000
Textiles	580,000	580,000	570,000	1,050,000	1,050,000	1,050,000
Petroleum Refining	560,000	560,000	560,000	2,000,000	2,000,000	2,000,000
Foundries	1,700,000	330,000	0	220,000	60,000	--
Coil Coating	360,000	210,000	3,600	3,300	1,900	330
Electrical	160,000	160,000	160,000	313,000	230,000	60,000
Battery	2,300,000	150,000	0	103	90	1
Nonferrous	--	130,000	10,000	1,600	630	620
Paint	610,000	130,000	130,000	300,000	40,000	39,000
Steam & Electric	20,000	20,000	2,000	--	--	--
Pesticides	24,000	16,000	0	240,000	240,000	30,000
Timber	6,500	6,200	6,200	110,000	45,000	45,000
Ink	2,000	1,900	600	8,900	1,300	1,300
Pharmaceuticals	53,000	--	--	--	--	--
Totals	154,000,000	48,000,000	6,400,000	304,000,000	193,000,000	61,000,000

Direct Discharge

	Total Toxic Metals (Pounds/Year)			Total Toxic Organics (Pounds/Year)		
	RAW	CURRENT	BAT	RAW	CURRENT	BAT
Metal Finishing/ Electroplating	44,000,000	1,500,000	1,500,000	33,000,000	9,600,000	4,000,000
Iron & Steel	18,400,000	2,360,000	560,000	25,000,000	4,820,000	260,000
Leather Tanning	530,000	83,000	18,000	90,000	15,000	4,000
Aluminum Forming	4,500,000	2,800,000	0	--	410	250
Pulp, Paper, Paperboard	4,600,000	2,600,000	2,600,000	8,600,000	620,000	520,000
Inorganic I & II	7,900,000	700,000	140,000	--	--	--
Porcelain Enameling	270,000	260,000	0	--	--	--
Copper Forming	590,000	590,000	20,000	--	--	--
Organics & Plastics	154,000,000	7,100,000	2,700,000	447,000,000	112,000,000	45,000,000
Textiles	470,000	380,000	220,000	710,000	85,000	52,000
Petroleum Refining	1,300,000	560,000	280,000	5,900,000	20,000	10,000
Foundries	11,000,000	1,700,000	0	1,400,000	390,000	0
Coil Coating	440,000	260,000	4,400	4,000	2,400	0
Electrical	62,000	62,000	62,000	104,000	99,000	19,000
Battery	680,000	200,000	--	77	73	-
Nonferrous	63,000,000	14,000,000	0	19,000,000	6,900,000	600,000
Paint	21,000	5,900	500	80,000	1,300	1,300
Steam & Electric	700,000	700,000	20,000	--	--	--
Pesticides	21,000	11,000	1,000	320,000	15,000	1,000
Timber	--	--	--	--	--	--
Ink	--	--	--	--	--	--
Pharmaceuticals	29,000	11,000	--	--	--	--
Totals	313,000,000	36,000,000	8,100,000	541,000,000	135,000,000	50,000,000

-- Not Available

* Does not include Paragraph 8 subcategories, and based on EPA projections

** Loadings are estimation of pounds discharged into sewers prior to treatment at the POTW

TABLE 2.2
AVERAGE FLOW (CQ MODEL) OF MODEL INDUSTRIAL USER [2]

Category	Average Flow (mgd) Table C3-IV	Average Flow (mgd) Model
1. Adhesives & Sealants	0.0106	0.0106
2. Aluminum Forming	0.0822	0.0822
3. Auto & Other Laundries	0.0062	0.0062
4. Battery Manufacturing	0.0254	0.0254
5. Coal Mining	0.0	0.0
6. Coil Coating	0.065	0.065
7. Copper Forming	0.112	0.112
8. Electrical & Electronic Products	0.088	0.088
9. Electroplating & Job Shops	0.019	0.019
10. Explosives Manufacturing	0.008	0.0008
11. Foundries	0.061	0.061
12. Gum & Wood Chemicals	0.233	0.233
13. Inorganic Chemical Mfg.	0.664	0.664
14. Iron & Steel	0.017	5.638
15. Leather Tanning	0.221	0.221
16. Electroplating & Captive Shops	0.069	0.069
17. Nonferrous Metals	0.041	0.041
18. Ore Mining & Dressing	0.0	0.0
19. Organic Chemical Mfg.	0.802	0.802
20. Paint & Ink Formulating	0.0007	0.0007
21. Pesticides	0.0937	0.0937
22. Petroleum Refining	0.0936	0.936
23. Pharmaceutical Mfg.	0.1561	0.1561
24. Photographic Equip. & Supplies	0.0117	0.0117
25. Plastic & Synthetics	0.802	0.802
26. Plastics Processing	0.01	0.0
27. Porcelain Enameling	0.0067	0.0067
28. Printing & Publishing	0.0028	0.0028
29. Pulp, Paper & Fiberboard	0.878	2.099
30. Rubber	0.0	0.0
31. Soap & Detergent Mfg.	0.0553	0.0553
32. Steam Electric Power Generation	0.1414	0.1414
33. Textile	0.2187	0.2187
34. Timber	0.14457	0.14457
35. Noncategorical Industries	0.113	0.113

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[2] Flow data are national averages

average flow numbers for explosives manufacturing, petroleum refining, and plastics processing are also different from those appearing in Table C3-IV. These numbers were reported incorrectly in Table C3-IV but had been entered correctly into the pretreatment RIA model.

2.2.3 Pretreatment Technology Cost

One of the outputs of the pretreatment RIA model is an estimate of the total cost of pretreatment technology to industry. The Office of Analysis and Evaluation supplied data estimating the total annual cost to each categorical industry installing the pretreatment technology necessary to comply with the pretreatment regulations, excluding costs expended to obtain current levels of treatment. By dividing this number by the total categorical flow for that industry, an estimate of the pretreatment technology cost per thousand gallons of wastewater discharged was derived. This number was then used in the RIA model in conjunction with the total industrial flow calculated for each industry to estimate the pretreatment technology cost per industrial category. This estimate was then summed across categories to arrive at the total cost of industrial pretreatment technology assuming full implementation of categorical standards.

Due to the constantly changing nature of this type of data and questions concerning the accuracy of the estimates as they appear in Table C3-IV of the RIA appendix, new estimates of the pretreatment technology cost per thousand gallons discharged by industrial category were derived and incorporated into this study. Table 2.3 presents the results of this analysis. The first column presents the technology cost estimates as they appeared in Table C3-IV of the RIA appendix and the second column shows the new estimates incorporated into the model for this study. The discrepancies in these two columns reflect incorrect reporting in the RIA appendix and new input data received from EGD since the completion of the RIA.

2.2.4 Stream Flow Data

A total of 2000 POTWs nationwide were estimated by EPA and the States to be subject to the General Pretreatment Regulations. Only 1,839 of these 2,000 POTWs were included in the RIA analysis. The remaining 161 POTWs were found

TABLE 2.3

PRETREATMENT TECHNOLOGY COST/1,000 GALLONS

INDUSTRY	TABLE C3-V APPENDIX C	MODEL
Adhesives & Sealants*	8	n/a
Aluminum Forming	22.00	4.25
Auto & Other Laundries*	--	n/a
Battery Manufacturing	8.20	3.13
Coal Mining*	--	n/a
Coil Coating	2.80	2.74
Copper Forming	1.40	1.44
Electrical	25.00	2.87
Metal Finishing-Job Shops	1.96	4.00
Mech. Products-Captive Shops	3.17	1.65
Explosive Manufacturing*	--	n/a
Foundries	1.80	1.05
Gum & Wood Chemicals*	--	n/a
Inorganic Chemical Manufacturing	0	.85
Iron & Steel	--	.09
Leather Tanning	5.30	3.25
Non-Ferrous Metals	7.90	7.17
Ore Mining & Dressing*	--	n/a
Organic Chemicals Manufacturing	1.30	1.64
Paint & Ink Formulating	34.00	49.50
Pesticides	12.00	6.70
Petroleum Refining	--	.29
Pharmaceutical Manufacturing*	--	n/a
Photographic Equipment*	--	n/a
Plastics & Synthetics	1.30	1.64
Plastics Processing*	--	n/a
Porcelain Enameling	59.00	45.35
Printing & Publishing*	--	n/a
Pulp, Paper & Paperboard	.034	.00
Rubber*	--	n/a
Soaps & Detergents*	--	n/a
Steam Electric	--	.00
Textiles	2.60	.26
Timber*	--	n/a

*Industries not currently required to meet categorical standards.

n/a - not applicable.

to have no flow according to the NEEDS survey -- attributable either to file error or that the plant is currently under construction -- and were, therefore, excluded from the analysis. In order to estimate the water quality impacts resulting from the industrial discharge of toxic pollutants via these POTWs, it was necessary to obtain flow information on the streams receiving these discharges. By utilizing POTW-to-stream dilution, the model calculates the concentration of each pollutant in the receiving water body as a result of the POTW discharges. In the original model, the complete stream data necessary to estimate these in-stream pollutant concentrations were available for only 665 POTWs.

In order to improve the accuracy of the predictions of water quality impacts presented in the RIA analysis, additional receiving stream flows for the 1,839 POTWs modeled have been included in this study. Specifically, receiving stream flows for 853 additional POTWs (bringing the total to 1518) have been incorporated into the computer model. The remaining 321 POTWs discharge into lakes and oceans. As no simplified methodology existed for estimating the dilution of these discharges by dispersion and mixing in these receiving water bodies, they were excluded from the RIA analysis. The additional 853 receiving stream flows were generated from the STORET data base which had been updated since the completion of the RIA.

A comparison of the receiving stream flows reported for the 665 POTWs modeled in the contractor's report and the 1518 POTWs modeled for this report reveals some significant differences. The average receiving stream flow of the 665 POTWs in the initial data file was 13,400 CFS with a median of 547 CFS. For the 1518 POTWs modeled in this report the average receiving stream flow is 8,000 CFS and the median is 160 CFS. This means that the results of the modeling exercise presented in the original RIA report were biased towards higher receiving stream flows and, therefore, higher stream dilutions than are representative of the 2,000 POTWs thought to require pretreatment. An analysis of how these additional stream flows affected predictions of the water quality impacts resulting from the imposition of pretreatment is presented in Chapter 3.

2.3 METHODOLOGICAL CHANGES

The methodology used in the computer modeling exercise to assess the impacts of industrial discharges on POTWs has been revised for this study to reflect a number of criticisms received from public comment on the RIA report. Efforts were made to include the modelling of individual toxic organic pollutants, the use of site specific water quality criteria to measure water quality exceedances, the inclusion of a software package which provides a more detailed accounting of the metal finishing category, a more precise methodology of determining the cost of industrial sludge disposal, and the use of 7Q10 stream flows to calculate water quality exceedances. A detailed description of each of these methodological changes is presented below.

2.3.1 Toxic Organics

At the time the pretreatment RIA was conducted, time constraints and data availability prohibited the estimation of the impact of individual toxic organic pollutants on water quality. Instead, the water quality impacts resulting from industrial discharge of toxic organic pollutants to POTWs were addressed in aggregate form. However, recognizing the importance of the discharge of these toxic organic pollutants to water quality, an effort was made in this study to estimate their impacts on an individual basis.

While individual toxic organic pollutants have been included in the RIA computer model for this study, certain constraints limited the level of detail possible. First, EGD has not entirely verified all organic priority pollutant discharge data from the 34 industrial categories modelled. Therefore, it was necessary to focus our data collection efforts on those industrial categories believed to be the primary contributors of toxic organic pollutants to POTWs. Based on this criterion, the EPA project officers for the organics and plastics, metal finishing, and iron and steel industrial categories were contacted to obtain specific toxic organic pollutant concentrations. More than 100 toxic organic compounds appear on the priority pollutant list - a number unmanageable in this revision. Therefore, the disaggregation of organics was limited to the five most significant pollutants discharged by the three industrial categories selected.

The following methodology was used to select the five toxic organics to be modeled in this report. Data on the total pounds of specific toxic organics discharged by the organics and plastics, metal finishing, and iron and steel categories (supplied by the EGD project officers) were ranked from highest to lowest. The top five organics for each industry in terms of pounds discharged annually, were selected and then compared to determine any similarities between industries. This resulted in a list of eight different toxic organic pollutants. This list was reduced to five based on a calculation which estimated the potential of these eight organics to exceed water quality standards. Where it was clear that an exceeedance could never be calculated, this pollutant was eliminated. This calculation was based on the following equation:

$$\text{potential} = \frac{\text{toxic organic concentration x (1 - removal)}}{\text{threshold value for chronic effects}}$$

where:

(1) Toxic organic concentration equals the highest concentration of a specific organic observed for the three industrial categories supplied by EGD (Table 2.4)

(2) Removal equals the estimated POTW removal for the toxic organic as derived from the 40 POTW study

(3) Threshold value for chronic effects is the concentration taken from the Federal Water Quality Criteria Documents at which chronic aquatic life effects have been observed to occur as a result of the presence of the particular toxic organic pollutant.

Based on the results of this analysis, the toxic organic pollutants modeled in this study include: benzene, toluene, phenols, 1,1,1-trichloroethane, and Bis (2 ethyl-hexyl) phthalate. Having selected both the key industrial contributions and the major toxic organics to be considered in the model, POTW water quality exceedances attributable to these toxic organic discharges were forecast using the same methodology employed for toxic metals. Wasteloads of these five compounds discharged to POTWs were constructed using average pollutant concentrations for each of the three industrial categories. These are presented in Table 2.4. The POTW removals assumed to calculate POTW effluent were 35 percent for primary treatment plants, 79 percent for

TABLE 2.4

CURRENT INDUSTRIAL WASTEWATER CHARACTERISTICS

TOXIC ORGANIC POLLUTANTS (mg/l)

	Iron & Steel[1]	Metal Finishing[1]	Organics & Plastics[1]	Chronic Threshold Levels[2]
Benzene	3.39	.080	8.70	.053
Toluene	1.68	.170	5.70	.175
Phenols	14.84	-	11.10	2.56
1,1,1-Trichloroethane	-	1.90	.0039	.528
Bis (2 Ethyl-Hexyl) Phthalate	-	-	.082	.003

[1] Industrial effluent concentration prior to POTW treatment

[2] Threshold levels in stream concentration triggering water quality exceedances

secondary treatment, and 86 percent for tertiary treatment. These removals were derived from the 40 POTW Study (see Appendix C of the original RIA report) and account for the removal within the POTW.

The resulting concentrations of each toxic organic pollutant in POTW effluent were then compared with water quality benchmarks to predict exceedances. The benchmarks employed were taken from the Federal Water Quality Criteria Documents (45 Fed. Reg. 79318 et seq, November 28, 1980). As with the metals predictions, chronic freshwater aquatic life values were used to determine exceedances. Specific aquatic life criteria have not been recommended for all priority pollutants due to a lack of data. In their place, narrative descriptions of apparent threshold levels for acute and/or chronic effects are presented to convey a sense of toxicity. The lowest values of these apparent threshold levels (ATLs) were used as the modeling surrogate for actual criteria recommendations. For three of the five organic pollutants analyzed, no apparent threshold levels were presented for chronic effects. Since the model relies on chronic freshwater aquatic life criteria as exceedance benchmarks, chronic values for benzene, toluene, and 1,1,1-trichloroethane were input to be one hundredth of the acute threshold level. The last column in Table 2.4 presents the chronic threshold levels employed in the model to determine water quality exceedances. Findings on the sludge and water quality impacts of the discharge of these five toxic organic pollutants to POTWs by the metal finishing, iron and steel, and organic chemicals industries are presented in Chapter 3 of this report.

2.3.2 Modified Water Quality Criteria

Water quality exceedances were predicted in the contractor's report by comparing the in-stream pollutant concentrations calculated in the model to benchmark concentration levels to determine the likelihood of a pollutant exceedance. Due to the lack of widespread State toxic water quality standards with which to evaluate water quality, Federal Water Quality Criteria values were selected as the benchmark for exceedances and, therefore, potential water quality problems. However, the selection of these criteria values as a benchmark evoked heavy criticism in the public comment to the RIA report.

Specifically, it was suggested that these numbers were overly stringent and not representative of actual standards which would be adopted by States.

The Federal Water Quality Criteria were developed by EPA for specific toxic pollutants in order to provide states with guidance in setting specific water quality goals for receiving waters located in their domain. These criteria values are derived by relating the concentration of specific pollutants to information on water hardness, and the presence of aquatic species in the receiving waters. The Federal criteria numbers were set to a level which would be compatible with protecting the vast majority of life in all aquatic communities. Direct application of the Federal criteria as the appropriate value for water quality on that stream has been criticized as too stringent. A more accurate indicator of water quality conditions would be one that is sensitive to the site specific characteristics of receiving waters. For this reason, a set of modified water quality criteria, derived from site specific receiving water characteristics and resident species, has been inserted into the RIA computer model in place of these Federal criteria.

Specific criteria values for some of the pollutants modeled in the RIA were supplied by EPA for each of the streams modeled. These values are based on specific species and water hardness characteristics determinations for groups of receiving streams represented by a unique combination of State and USGS cataloging units. In this report, these specific criteria are inserted in the model for each group of receiving streams, replacing the set of generic Federal criteria values used in the RIA. Table 2.5 presents a comparison of the Federal water quality criteria values for aquatic life (RIA Appendix Table C3-VIII) to the modified criteria values inserted into the model for this Addendum report. For the purpose of comparison, minimum, maximum, and median values for the modified criteria used in the model are shown in Table 2.5. Of the ten pollutants presented in Table 2.5, five of them were not modified and therefore their median values are the same as the Federal criteria values. Median values for two of them, copper and lead, are more stringent, while cadmium and nickel are less stringent. Cyanide remains the same. The water quality impacts predicted by the model after these modified criteria were inserted are presented in Chapter 3.

TABLE 2.5

COMPARISON OF THE FEDERAL WATER QUALITY CRITERIA
FOR AQUATIC LIFE TO THE MODIFIED CRITERIA

Pollutant	Federal Criteria Values (ug/l)	Modified Criteria Values (ug/l) Max.	Median	Min.
Silver (Ag)	.12	--	.12	--
Arsenic (Ag)	440	--	440	--
Cadmium (Cd)	.025	3.8	.038	.001
Total Chromium (Cr)	44	--	44	--
Copper (Cu)	5.6	33.7	3.11	.132
Mercury (Hg)	.2	--	.2	--
Nickel (Ni)	96	712.1	124.7	10.29
Lead (Pb)	3.8	70.2	2.76	.057
Zinc (Zn)	47	--	47	--
Cyanide(Cn)	3.5	5.3	3.5	3.5

2.3.3 Metal Finishing Software Package

The computer model developed for the pretreatment RIA has been modified for this report to include a more detailed accounting of the metal finishing category. Because of the importance of the metal finishing category as a source of toxic pollutant discharges, this software package has been included to better evaluate the impacts of industrial discharges on POTWs.

The metal finishing software package was designed by JRB under contract to EPA to evaluate the environmental impacts of the proposed metal finishing regulations and a range of alternative standards for indirect dischargers. In order to improve the sensitivity of the environmental impacts attributable to metal finishers, this industrial category was divided into several segments The segments selected by EPA for analysis in this project were:

- Captive Shops. Captive shops finish metal parts which they themselves produce. There are two types of captive metal finishing firms:
  - Integrated Captive Shops. This segment of the metal finishing category includes firms which electroplate parts and also provides other metal finishing services (e.g., painting, sintering, and welding).
  - Non-Integrated Captive Shops. These firms only use electroplating processes.
- Electroplating Job Shops. Firms providing both electroplating and metal finishing processes under contract to commercial clients. This subcategory does not distinguish between integrated and nonintegrated firms.

In the original contractor's report, the metal finishing category included only the broader job and captive segments. The identification of the number of IUs in each of these segments served by a POTW was based on two surveys conducted by EPA which directly related the number of indirect dischargers to the number of direct dischargers. This approach was necessitated for the metal finishing category, as opposed to EGD estimates, because of the larger number of sites that were defined as metal finishers according to the SIC Code definition but which generate no wastewater. Therefore, the computer modeling results presented in Chapter 3 of this report include a counting of metal finishing IUs and their contribution of flow and pollutant loading consistent with the methodology used to calculate these variables for all of the other categorical industries modeled. A detailed explanation of this basic methodology can be found in Appendix C-3 of the contractor's report.

2.3.4 Industrial Sludge

Calculations of the incremental cost of industrial sludge disposal as a result of industrial pretreatment received criticism in the public comment on the contractor's report. In the initial report, the RIA computer model generated estimates of the total quantity of industrial sludge generated based on some simplifying assumptions concerning toxic metals and TSS removals. Sludge generated by all industrial categories was assumed to be hazardous, with a disposal cost of $400 per ton of dry solids (including transportation). By applying this disposal cost to the pounds of industrial sludge generated, the total cost for industrial sludge disposal was derived.

In an attempt to provide a more realistic prediction of the total cost for industrial sludge disposal, the following tasks were undertaken in this report:

- Identification of sludges generated by industrial categories which could be classified as nonhazardous
- Verification of the cost per ton of disposing of hazardous sludge.

The methods used and results of these tasks are described in detail below.

The disposal costs of landfilling wastewater pretreatment sludges are expected to vary according to whether or not the sludge would be defined as a RCRA hazardous waste. Such a designation requires that the sludge be disposed in a secure landfill and therefore be subject to average hazardous waste disposal costs. Any nonhazardous pretreatment sludges could be disposed of in a less expensive manner.

An industrial sludge is determined to be a RCRA hazardous waste if it is specifically listed in Subpart D of 40 CFR, Part 261, or if it "fails" one of the four RCRA characteristics in Subpart C of 40 CFR, Part 261. To determine whether a given industrial pretreatment category or subcategory may produce a hazardous sludge (and therefore may pay higher sludge disposal costs), the following sequential procedure was used:

- Each wastewater treatment sludge was compared to sludges listed in Subpart D of 40 CFR, Part 261. If a sludge was found to be a listed hazardous waste, the industry producing that sludge was assumed to be paying secure landfill disposal costs.

- For each industrial category or subcategory not producing a listed RCRA sludge, raw wastewater was evaluated to obtain a conservative estimate on whether the resulting sludge would be EP toxic under Subpart C of 40 CFR, Part 261. The evaluation procedure used a multiplier which was applied to the concentration in mg/l of each SP contaminant in the waste stream. If, after application of the multiplier, the concentration of the contaminant exceeded the EP toxic limit, the sludge was assumed to be potentially hazardous and therefore subject to higher disposal costs. The conservative multiplier was devised by assuming:

  - 100 percent removal of EP contaminants from the raw wastewater

  - 100 percent dissolution of the EP contaminants from the sludge during the EP procedure

  - a low sludge generation rate of .003 lbs/gallon of wastewater to ensure maximum concentration of EP contaminants in the sludge.[1]

- For each industrial category or subcategory not producing a listed RCRA sludge or a raw wastewater with EP contaminants, it was assumed that the sludge would be nonhazardous. This assumption is based on the knowledge that most hazardous sludges are hazardous because they exhibit the characteristic of EP toxicity. Most hazardous sludges would not "fail" the RCRA characteristics of ignitability, corrosivity, or reactivity without also failing the characteristic of EP toxicity.

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[1] This low sludge generation rate was developed based on the professional judgment of individuals knowledgeable in industrial treatment processes.

Based on the results of this review of industrial sludge characterization, wastewater sludges from only a few industrial processes could clearly be classified as nonhazardous. Only wastewater sludges generated by the adhesives and sealants and rubber processing categories are not specifically listed as hazardous under RCRA and meet the EP toxicity tests described above. All other industrial wastewater sludges are either specifically listed or fail the EP toxicity test devised above. Therefore, the contractor's original assumption -- that all industrial sludges are hazardous -- has been accepted in this report.

A telephone survey of the cost of disposing of metal finishing sludges was conducted to determine the accuracy of the assumption that the cost of disposing of hazardous industrial sludge is $400 per dry ton. Metal finishing sludges were chosen for this survey because they represent a fairly hazardous industrial sludge and therefore provide a conservative estimate of the cost of disposing of hazardous sludges. Cost estimates received in the telephone survey included the actual disposal cost per barrel as well as transportation cost estimates. Based on the results of this survey, it was determined that the $400 per dry ton estimate provided in the contractor's report represented a high estimate of the actual cost of disposing of industrial sludges.

2.3.5 Low Stream Flows

The methodology used in the original pretreatment model to forecast water quality exceedances assumed dilution of POTW discharges by stream flows equal to the average annual flows of receiving streams using chronic water quality criteria values as the measure of toxicity. Public comments were received which suggested that this assumption resulted in an understatement of water quality impacts due to the exaggeration of actual stream flows and dilutions. It was suggested that given seasonal stream flow variations, incorporation of low flow values for streams should also be considered in modelling water quality impacts.

The use of low flows, as represented by 7Q10 data, has been performed for this revised report to provide an upper bound for POTW water quality exceedances with and without pretreatment. These low flow values were derived using the same methodology as the derivation of average annual flows described in Section 2.2.4 of this report. The results of this analysis are presented in Table 3-2(A)(B) of this report.

2.3.6 Prediction of Inhibitory Potential at POTWs

The original RIA report contained data showing that industrial discharges of toxic pollutants caused process inhibitions, interference, O&M problems, and upsets at POTWs. However, no systematic method could be developed for the model which made quantitative predictions of the impact of industrial discharges on POTW operations on a national scale under different regulatory options. As one of the central goals of the Pretreatment Program is to protect the integrity of POTW operations, a simplified methodology has now been developed for the RIA model to allow an assessment of the effectiveness of the current program and alternatives in reducing industry-related interference at POTWs. The approach chosen focuses on predicting the inhibitory potential of industrial discharges on POTWs. No attempt was made to estimate increased costs incurred by POTWs or the deleterious impacts on water quality resulting from the occurrence of POTW inhibition.

To predict inhibitory potentials, the model is used to generate estimates of industrial contributions to POTW influent under different pretreatment options. These influent concentrations are then compared with threshold values at which POTW processes are known to experience inhibition. Where the influent concentrations of the selected toxic pollutants resulting from industrial discharges exceed one or more of the inhibition onset values, the POTW is deemed to have the potential to experience a process inhibition. Table 2.6 presents the threshold values used to predict inhibition potential. These were derived from the best judgement of EPA and JRB engineers.

As indicated in Table 2.6, inhibition onset concentrations for nine pollutants are presented for two POTW processes - nitrification and activated

TABLE 2.6

ONSET CONCENTRATIONS FOR PROCESS INHIBITIONS AT POTWS

		ONSET CONC. FOR NITRIFICATION PROCESS INHIBITION (mg/1)	ONSET CONC. FOR ACTIVATED SLUDGE PROCESS INHIBITION (mg/1)
ARSENIC	(AS)	N.A.	0.10
CADMIUM	(CD)	5.00	1.00
CHROMIUM	(CR)*	0.25	1.00
COPPER	(CU)	N.A.	1.00
MERCURY	(HG)	2.00	0.10
NICKEL	(NI)	0.50	1.00
LEAD	(PB)	0.50	0.10
ZINC	(ZN)	N.A.	5.00
TOTAL CYANIDE	(CN)	0.34	0.10

* Including trivalent and hexavalent chromium species

N.A. Not Available

Source: MDSD Data; EPA Cincinnati Lab; and 304(g) Guidance Document Revised Pretreatment Guidelines, Volume II, October 1981.

sludge. As these processes are associated with secondary and tertiary treatment plants, the model does not predict inhibitory potentials at 295 primary POTWs. The methodology assumes the presence of both of these processes for the 1544 POTWs which employ at least secondary treatment. For each of these 1544 POTWs, the inhibitory threshold values for each of the processes are compared to projected POTW influent concentrations.

If influent concentrations at each POTW for any of the nine pollutants exceed onset concentrations, a process inhibition could occur. By comparing the number of POTWs predicted to experience inhibitions under different regulatory schemes, conclusions can be drawn on the effectiveness of pretreatment in protecting POTW operations. These results are presented in Section 3.1.3 of this report.

3.0 FINDINGS

This chapter presents revised findings on the impacts of toxic industrial waste discharge on POTWs. The numerical results included in this chapter are derived primarily from additional modeling efforts undertaken to incorporate revisions suggested in public comments. These results are presented in tables which correspond in form and numbering to those presented in the original RIA report to facilitate a comparison of the new results.

The results in this chapter are based on model runs predicting three levels of industrial pretreatment in place:

(1) Raw Discharge - assumes discharge of toxic industrial waste with no industrial pretreatment

(2) Current Pretreatment - assumes the current level of industrial pretreatment

(3) Full PSES - assumes level of industrial pretreatment resulting from the application of 40 CFR 403 pretreatment requirements, including all Categorical Standards.

These alternatives are cited throughout this chapter as "Raw Discharge," "Current Pretreatment," and "Full PSES," respectively for the comparison of the six regulatory options considered in this report and its predecessor.

This chapter examines the environmental impacts of indirect toxic discharges on water and sludge quality. In particular, numerical results presented here indicate how toxic discharges to POTWs affect ambient water quality, POTW effluent quality, POTW operations, and POTW sludge quality. The analysis pays particular attention to the effectiveness of the Full PSES alternative in mitigating each of the environmental impacts.

The interpretation of this analysis depends upon regulatory provisions and guidelines which define acceptable levels of toxic discharges to the environment. Unfortunately, ambient toxic limits are not in place in many States. State sludge criteria are spotty and varied, and Federal sludge guidelines exist for only a few of the disposal methods available to POTWs. In addition, local sludge management decisions are controlled by site specific variables which could not be adequately generated in a national model. As a result, it is impossible to report with great confidence the absolute severity of environmental impacts. Still, the relative environmental impacts of various pretreatment alternatives can be effectively studied.

3.1 WATER POLLUTION

The POTW model was used to simulate the interaction among industrial users, POTWs, and receiving water bodies. The analysis for this report was conducted on the 1518 POTWs for which stream flow information was complete. Numerical results were then scaled up to apply to 1839 POTWs out of a total population of 2000 POTWs thought by EPA and the States to need pretreatment programs. The model considered the water and sludge quality impacts of eight (8) toxic metals, five (5) toxic organics, and cyanide.

3.1.1 Exceedances of Water Quality Criteria

The POTW model utilized a POTW-to-stream dilution ratio to calculate the ambient concentration of each toxic pollutant discharged from the POTW into a receiving body. This projected ambient concentration is then compared to the appropriate modified Federal water quality criteria to determine whether an exceedance exists for the individual pollutant. In the original report, the absolute values for the Federal water quality criteria were applied to calculate exceedances. For this report, the Federal criteria have been modified on a stream specific basis, where warranted, based on the indigenous species and water hardness of each stream.

For two reasons, model figures for numbers of water quality criteria exceedances should be taken as minimum values. First, the model assumes that all POTWs having secondary treatment in place are meeting the standard removals achievable at a well-operated secondary treatment plant. However, in many instances POTWs may be achieving lower removals which would tend to bias the results in favor of better water quality. Second, the model fails to consider background, ambient levels of toxic pollutants. One would reasonably expect additional exceedances of water quality criteria where background ambient levels of toxic pollutants can be accurately measured.

The tables provided in this section give estimates for number and percentage of POTWs in exceedance of 100 percent and 50 percent of the modified Federal water quality criteria. The former percentage, 100 percent, posits the POTW as the sole contributor of the toxic pollutant to the receiving water body. The latter figure, 50 percent, assumes that other discharge sources contribute toxic pollutants at a rate sufficient to produce ambient concentrations equal to 50 percent of the modified water quality criterion. Consequently, a POTW discharging at a level corresponding to only 50 percent of the water quality criterion will nonetheless produce a pollutant exceedance.

Tables 3.1(A) and (B) provide estimates of criteria exceedances for 100 percent and 50 percent of modified Federal water quality criteria, respectively, when discharges are diluted by average annual stream flow values. Both tables show large numbers of POTW exceedances for silver, cadmium, copper, lead, and cyanide. Lesser but significant numbers of exceedances are predicted for chromium, mercury, nickel, and zinc, and insignificant numbers of exceedances for the five toxic organics. As expected, there are greater numbers of exceedances for all toxic pollutants when the POTW effluent is measured against only 50 percent of the modified water quality criteria. These observations hold for both the raw discharge and current pretreatment alternatives.

The results presented in Tables 3.1(A) and (B) differ from those presented in Table 3.1 of the original RIA report. First, at both 50 and 100 percent of the aquatic life criteria, a greater percentage of POTWs are shown exceeding those criteria than in the original report. The original report also showed very few POTWs exceeding the water criteria for any pollutants other than silver, cadmium, and cyanide, whereas Tables 3.1(A) and (B) show a much larger percentage of POTWs violating copper, mercury, lead, and zinc. Therefore the variety of pollutants causing water quality problems may have been underestimated originally, as well as the number of POTWs experiencing those problems. The differences in these results can be explained by the inclusion of modified criteria values, which are more stringent than the Federal criteria for copper and lead, and additional receiving stream flows

TABLE 3.1

MODEL INDICATORS OF WATER QUALITY EXCEEDANCES USING MEAN FLOWS AND MODIFIED CRITERIA

(A) POTW EXCEEDING 50% OF AQUATIC LIFE WATER QUALITY CRITERIA

	RAW		CURRENT		FULL PSES		PERCENT REDUCTION	
	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	Raw to Full	Current to Full
Silver	1016	55	1014	55	1009	55	1	0
Benzene	8	.4	4	0	2	0	75	50
Toluene	12	1	8	0	5	0	58	38
Cadmium	1347	73	1330	72	1305	71	3	2
Chromium	292	16	216	12	82	4	72	62
Copper	803	44	749	41	688	37	14	8
Mercury	374	20	348	19	325	18	13	7
Nickel	183	10	115	6	42	2	77	63
Lead	869	47	803	44	764	42	12	5
Phenol	0	0	0	0	0	0	0	0
1,1,1-Trichloroethane	0	0	0	0	0	0	0	0
Bis(2 EH) Phthalate	0	0	0	0	0	0	0	0
Zinc	395	21	325	18	262	14	34	19
Cyanide	704	38	672	37	597	32	15	11

(B) POTWS EXCEEDING 100% OF AQUATIC LIFE WATER QUALITY CRITERIA

	RAW		CURRENT		FULL PSES		PERCENT REDUCTION	
	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	Raw to Full	Current to Full
Silver	873	47	870	47	862	47	1	1
Benzene	2	0	1	0	0	0	100	100
Toluene	1	0	1	0	1	0	0	0
Cadmium	1221	66	1197	65	1161	63	5	3
Chromium	193	10	121	6	18	1	91	85
Copper	663	36	602	33	528	29	20	12
Mercury	209	11	183	10	152	8	27	17
Nickel	134	7	67	4	10	.5	92	85
Lead	729	40	643	35	618	34	15	4
Phenol	0	0	0	0	0	0	0	0
1,1,1-Trichloroethane	0	0	0	0	0	0	0	0
Bis(2 EH) Phthalate	0	0	0	0	0	0	0	0
Zinc	228	12	151	8	75	4	67	50
Cyanide	589	32	546	30	454	25	23	17

which on average are lower than those originally modeled, thereby lowering stream dilution.

In order to better evaluate the effects of the Full PSES alternative, two additional columns were presented in Tables 3.1(A) and (B) which show the percentage reduction in pollutant exceedances as a measure of ambient water quality improvement.

The figures for percentage exceedances reduction are less revealing as they relate to the five (5) toxic organics. Because there are few toxic organics exceedances to begin with, figures for percentage exceedances reduction tend to be artifically high or low. It is difficult, at best, to draw firm conclusions regarding the effects of full 403 pretreatment options on these toxic organics with such a small population of initial criteria exceedances.

The numerical results are considerably more revealing as they apply to toxic metals. The figures for percentage exceedances reduction due to application of Full PSES tend to be similar for both the 100 percent and 50 percent water quality criteria cases [see Tables 3.1(A) and (B)]. The Full PSES alternative produced large percentage exceedances reductions for chromium and nickel, lesser but significant reductions for copper, mercury and cyanide, and insignificant reductions for lead, silver, and cadmium. These results were consistent across the 100 percent water quality criteria cases for all nonorganic toxic pollutants with the exception of zinc, which showed large percentage reduction in the 100 percent water quality criteria case, and a somewhat smaller reduction in the 50 percent case. These reductions are somewhat misleading since the highest percentage reductions were for metals with the lowest number of initial exceedances. These observations refer to the eighth column of Tables 3.1(A) and (B), which reflect percentage exceedances reductions in moving from current pretreatment to Full PSES.

Tables 3.2(A) and (B) present predictions of POTW water quality exceedances when POTW effluent is diluted by 7Q10 low flows rather than average annual flows. Not surprisingly, the number of POTWs and the percentage of all POTWs exceeding the modified water quality criteria increase significantly. For example, the percentage of POTWs exceeding 50 percent of

TABLE 3.2

MODEL INDICATORS OF WATER QUALITY EXCEEDANCES USING LOW FLOWS AND MODIFIED CRITERIA

(A) POTW EXCEEDING 50% OF AQUATIC LIFE WATER QUALITY CRITERIA

	R A W		C U R R E N T		F U L L P S E S		PERCENT REDUCTION	
	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	Raw to Full	Current to Full
Silver	1465	80	1465	80	1459	79	.4	.5
Benzene	36	2	12	.6	7	.3	80	42
Toluene	36	3	26	1.4	18	.9	50	44
Cadmium	1635	89	1630	89	1621	88	.8	.5
Chromium	518	27	453	25	285	15	45	37
Copper	1286	70	1262	69	1222	66	5	3
Mercury	894	49	863	47	833	45	7	3
Nickel	328	16	244	13	112	6	66	54
Lead	1352	73	1300	71	1285	70	5	1
Phenol	1	0	0	0	0	0	100	0
111-Trichloroethane	0	0	0	0	0	0	0	0
Bis(2 EH) Phthalate	0	0	0	0	0	0	0	0
Zinc	873	47	816	44	750	41	14	8
Cyanide	1223	66	1193	65	1156	63	5	3

(B) POTWS EXCEEDING 100% OF AQUATIC LIFE WATER QUALITY CRITERIA

	R A W		C U R R E N T		F U L L P S E S		PERCENT REDUCTION	
	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	No. of Exceedances	% POTWs	Raw to Full	Current to Full
Silver	1348	73	1348	73	1342	73	1	.4
Benzene	10	1	3	.2	1	0	91	67
Toluene	11	1	8	1	5	.2	62	38
Cadmium	1558	84	1549	84	1534	83	1	1
Chromium	332	17	252	12	72	4	77	71
Copper	1138	61	1099	59	1043	57	8	5
Mercury	558	30	514	28	471	26	15	8
Nickel	234	11	138	6	33	1.8	85	76
Lead	1230	67	1184	64	1164	63	5	2
Phenol	0	0	0	0	0	0	0	0
1,1,1-Trichloroethane	0	0	0	0	0	0	0	0
Bis(2 EH) Phthalate	0	0	0	0	0	0	0	0
Zinc	495	26	421	22	268	14	46	36
Cyanide	1103	59	1075	58	1022	55	6	5

the criterion value at current levels of pretreatment for cadmium increases from 72 percent to 89 percent, for lead from 44 percent to 71 percent. The numbers remain consistently higher when 100 percent of the criteria are used to determine exceedances.

On the other hand, Table 3.2(A) and (B) indicate that implementation of full pretreatment is somewhat less effective in reducing exceedances when low flows are used to predict exceedances. For example, chromium exceedances are shown to be reduced at Full PSES by 37 percent instead of the 62 percent predicted when annual flows dilute POTW chromium discharges.

3.1.2 Improvement in POTW Effluent Quality

Table 3.5 provides a measure of the improvement in POTW effluent quality in moving from current pretreatment to Full PSES. The figures in the second column are derived as the ratio of the difference between POTW effluent concentrations with and without pretreatment (i.e., Full PSES vs. current pretreatment) to POTW effluent concentration without pretreatment.*

Not surprisingly, the model predicts significant improvement in effluent quality for most toxic pollutants, including seven of eight toxic metals and all five toxic organics. For toxic metals, those experiencing the greatest percentage reductions are nickel (51 percent) and chromium (74 percent); those experiencing the least percentage reductions are silver (4 percent) and cadmium (18 percent). Total metals are reduced 52 percent, total toxic organics, 77 percent, through the application of the Full PSES alternative. Also compared in Table 3.5 are the updated model predictions for effluent quality improvement after pretreatment with those observed in the 40 POTW study, selected case studies, and the original RIA report. Pretreatment is revealed to significantly reduce the concentrations of toxic pollutants in POTW effluent for all but two parameters. An anomaly in the data occurs for cyanide and copper in the case studies and for copper in the 40 POTW study.

$$^{*}\%\ \text{improvement} = \frac{\text{current pretreatment effluent conc.} - \text{Full PSES effluent conc.}}{\text{current pretreatment effluent concentration}}$$

TABLE 3.5

PERCENT IMPROVEMENT IN POTW EFFLUENT QUALITY WITH PRETREATMENT PROGRAM

Pollutant Parameter		40 POTW Study[1]	Model (Addendum)	Model (Original RIA Report)	Selected Case Studies
Silver	(Ag)	0	4	6	n/a
Benzene		100	32	n/a	n/a
Toluene		50	31	n/a	n/a
Cadmium	(Cd)	33	18	26	53
Chromium	(Cr)	33	74	81	62
Copper	(Cu)	(7)	46	57	(56)
Mercury	(Hg)	n/a	31	29	65
Nickel	(Ni)	(9)	51	74	28
Lead	(Pb)	59	22	21	74
Phenol		100	35	n/a	--
1,1,1-Trichloroethane		69	96	n/a	n/a
Bis (2 EH) Phthalate		0	28	n/a	n/a
Zinc	(Zn)	51	38	47	64
Cyanide	(CN)	16	n/a	n/a	(30)
Total Metals		26	52	63	36
Toxic Organics		75	77	70	99

(1) Percent improvements are derived from different cities with and without pretreatment programs.

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While the model predicts consistent improvement for all toxic metal and organic compounds, the percent improvement is slightly lower for metals and slightly higher for organics in this report than predictions made in the original report. Again, this difference can be attributed to the data and methodological changes incorporated in this report.

3.1.3 Potential Interference with POTW Operation

Table 3.6 shows the model predictions for potential nitrification and activated sludge process inhibitions at treatment plants attributable to toxic metals discharged by industrial users to POTWs. For the purposes of this analysis, the universe of POTWs is 1544 -- those plants of the 1839 which have secondary or AWT capability. The analysis assumes the presence of these processes at all 1544 POTWs, instead of determining the actual treatment processes at each plant. Nonetheless, the results provide an indication of the likelihood of process inhibitions due to industrial discharges at POTWs using these treatment processes.

Results are presented for potential process inhibitions at three levels of removal -- raw (assuming no industrial pretreatment), current (assuming a moderate amount of industrial pretreatment currently in place), and Full PSES (assuming that all categorical industries pretreat to comply with Pretreatment Standards for Existing Sources). As evidenced in Table 3.6, the full pretreatment option is extremely effective in preventing potential inhibitions of nitrification and activated sludge processes at POTWs.

3.2 SLUDGE CONTAMINATION

Paralleling findings for water quality improvement, the Full PSES alternative results in substantially improved sludge quality for most toxic pollutants. Table 3.7 shows large reductions in chromium, copper, mercury, nickel, and zinc concentrations (mg/kg, dry wt.), while producing less significant reductions in silver and cadmium concentrations. Overall toxic metal concentrations in sludge decline by 43 percent. Four of the five toxic organic concentrations are reduced by approximately 30 percent through application of the Full PSES alternative. Overall, the toxic organic concentration is reduced by 75 percent. These results are similar to those predicted in the

TABLE 3.6

POTWS PREDICTED TO EXPERIENCE INHIBITION POTENTIALS IN NITRIFICATION, AND ACTIVATED SLUDGE PROCESSES*

NITRIFICATION

		RAW	CURRENT	FULL PSES	% REDUCTION CURRENT TO FULL PSES
ARSENIC	(AS)	N.A.	N.A.	N.A.	N.A.
CADMIUM	(CD)	0	0	0	0
CHROMIUM	(CR)**	376	255	30	88
COPPER	(CU)	N.A.	N.A.	N.A.	N.A.
MERCURY	(HG)	0	0	0	0
NICKEL	(NI)	204	59	0	100
LEAD	(PB)	138	14	0	100
ZINC	(ZN)	N.A.	N.A.	N.A.	N.A.
TOTAL CYANIDE	(CN)	197	94	1	99

ACTIVATED SLUDGE

		RAW	CURRENT	FULL PSES	% REDUCTION CURRENT TO FULL PSES
ARSENIC	(AS)	236	207	171	17
CADMIUM	(CD)	1	0	0	0
CHROMIUM	(CR)**	177	54	2	96
COPPER	(CU)	131	17	0	100
MERCURY	(HG)	0	0	0	0
NICKEL	(NI)	104	14	0	100
LEAD	(PB)	440	229	110	52
ZINC	(ZN)	20	2	0	100
TOTAL CYANIDE	(CN)	430	328	101	69

* Only secondary POTWs and AWTs are considered. (Total of 1544 secondary POTWs and AWTs among 1339 POTWs examined.)

** Including trivalent and hexavalent chromium species.

N.A. Not available.

TABLE 3.7

SLUDGE QUALITY WITH AND WITHOUT PRETREATMENT FROM MODELING EXERCISE

AVERAGE POTW SLUDGE QUALITY (mg/kg dry wt)

	Without Pretreatment (Addendum)	Without Pretreatment (1st Report)	With Pretreatment (Addendum)	With Pretreatment (1st Report)	Percent Improvement (Addendum)	Percent Improvement (1st Report)
Silver (Ag)	45	32	44	32	2	0
Benzene	297	n/a	213	n/a	28	n/a
Toluene	183	n/a	132	n/a	28	n/a
Cadmium (Cd)	36	26	31	21	14	19
Chromium (Cr)	633	831	227	222	64	73
Copper (Cu)	468	563	270	274	42	51
Mercury (Hg)	2	1.3	1	1	50	23
Nickel (Ni)	119	181	46	60	61	67
Lead (Pb)	166	147	141	132	15	10
Zinc (Zn)	838	923	552	547	34	41
Phenols	399	n/a	269	n/a	32	n/a
111-Trichloroethane	29	n/a	1	n/a	96	n/a
Bis(2 EH) Phthalate	2	n/a	2	n/a	0	n/a
Cyanide (CN)	n/a	n/a	n/a	n/a	n/a	n/a
Total Metals	2307	2704	1312	1296	43	52
Toxic Organics	1342	913	330	306	75	67

original modelling results. In the initial report, toxic metal concentrations were found to decrease by 52 percent, toxic organics by 67 percent.

Table 3.8 provides a comparison of the updated POTW model sludge results with the previous model and local case study results. Upon the implementation of pretreatment, all data sources indicate consistent improvement in sludge quality for all parameters examined. The model results appear conservative when compared with actual POTW experiences.

TABLE 3.8

PERCENT IMPROVEMENT IN SLUDGE WITH PRETREATMENT PROGRAM

Pollutant Parameter	Case Studies	Model (Addendum)	Model (Original RIA Report)
Silver	n/a	2	0
Cadmium	20	14	19
Chromium	74	64	73
Copper	51	42	51
Mercury	--	50	23
Nickel	75	61	67
Lead	71	15	10
Zinc	51	34	41
Cyanide	n/a	n/a	n/a
Total Metals	49	43	52
Total Organics	n/a	75	67
Benzene	n/a	28	n/a
Toluene	n/a	28	n/a
Phenol	n/a	32	n/a
1,1,1-Trichlorethane	n/a	96	n/a
Bis(2 EH) Phthalate	n/a	0	n/a

4.0 ANALYSIS OF PRETREATMENT OPTIONS

This chapter presents modelling results pertaining to the environmental impacts and costs of different pretreatment options. These pretreatment options are discussed at greater length in Chapter 4 of the original regulatory impact analysis report. The tables in this chapter are again numbered as they were in the original report to allow comparison.

The following options are examined in this chapter.

1. Existing Program - assumes full implementation of 40 CFR 403 pretreatment program, including mandatory Categorical Standards for 34 industries

2. Existing Program, Reduced Scope - assumes full 403 program, but a reduced number of Categorical Standards; modelled with standard for metal finishing industry only

3. Technology-Based Limits for POTWs - assumes development and imposition of end-of-pipe toxic limits for POTW effluent, and inclusion of these toxic limits in the POTW NPDES permit

4. Water Quality-Based Limits for POTWs - assumes development and imposition of toxic limits for POTW effluent only in cases where water quality standards are violated

5. Local Program for Documented Problems - assumes the development of full 40 CFR 403 programs only in response to documented problems at POTWs

6. Guidance Only - assumes the use of 40 CFR 403 regulation and Categorical Standards as guidance only.

Option 2 in the original regulatory impact analysis considered existing 40 CFR 403 program with reduced scope of application. This option assumes application of national Categorical Standard only to the metal finishing industry - a major source of problem pollutants.

Finally, the tables in this chapter include waivers for Options 1, 2, and 3. A waiver system would allow a POTW to forego development of a complete 40 CFR 403 pretreatment program when no demonstrated water quality problems exist at the POTW. For the purpose of this analysis, a POTW is exempted from pre-treatment requirements if its discharges cause no exceedances of the modified Federal water quality criteria.

4.1 ENVIRONMENTAL EFFECTS OF THE OPTIONS

This section describes the environmental effects of the options. As discussed in Chapter 2, the results for the 2000 POTWs are currently based on modelling the impacts of the options on 1839 POTWs. The remaining 161 POTWs were not included because all of the available information showed that they either had no industrial contribution or that they discharged into other POTWs. Thus, the results of the 1839 POTWs should reasonably represent the total impacts.

This section focuses on the impact of the options on the pass-through of pollutants and the resulting effects on water quality as measured by exceedances. The impact of the options on reducing the number or severity of bypasses and upsets has not been quantified in the model.

4.1.1 Removal of Pollutants

Table 4.2 quantifies the following environmental effects: pounds of toxic organics and toxic metals removed, percent reduction of toxic pollutants in POTW effluent, and the percent reduction of toxic contaminants in effluent sludge. The number of POTWs affected by an option strongly influences the volume of pollutants removed and total cost of treatment. Where the application of the option does not depend on water quality conditions, all 1839 POTWs are affected. If requirements apply only where water quality problems are currently occurring, then the number of POTWs affected is reduced to the model estimate of 1220. This can be compared to the original RIA report where 846 POTWs were predicted to be currently experiencing water quality problems.

As illustrated in Table 4.2, the RIA computer model predicts that 59,000 tons of organics and 19,000 tons of metals will be removed annually by POTWs

TABLE 4-2

IMPACT OF THE OPTIONS ON ENVIRONMENTAL RESIDUALS

OPTION		POTWs AFFECTED	ANNUAL TONS REMOVED		PERCENT IMPROVEMENT IN POTW EFFLUENT		PERCENT IMPROVEMENT IN POTW SLUDGE
			ORGANICS	METALS	ORGANICS	METALS	
1.a	Existing Program	1839	58,887	18,561	76	52	43
1.b	1.a with waiver	1220*	38,865	12,250	76	52	<43
2.a	Existing Program Reduced Scope	1839	19,606	11,246	25	29	25
2.b	2.a with waiver	1220	12,940	7,426	<25	<29	<25
3.a	Tech-Based Limits for POTW	1839	58,887	18,561	76	52	43
3.b	3.a with waiver	1220*	38,865	12,250	<76	<52	<43
4.	Water Quality Limits for POTW	1220*	N.A.	N.A.	N.A.	N.A.	N.A.
5.	Local Program for Documented Problems	1220**	<38,865	<12,250	<76	<52	<43
6.	Guidance Only	1839	0-58,887	0-18,561	0-76	0-52	0-43

N.A. Not Available.

* Assuming no ambient concentration of toxic pollutants.

** Only includes those options that have water quality problems. Does not include those POTWs that have upset or bypass problems, but no chronic water problems.

under the existing 403 program. In addition there is a 77 percent improvement in POTW effluent quality for organics, a 52 percent improvement for metals, and a 43 percent improvement in sludge quality under the existing 403 program. The remaining options result in similar environmental benefits depending on the number of POTWs affected.

In general, the uniform national programs produce the largest reductions in the volume of pollutants discharged into water bodies. This is primarily because the requirements apply to more POTWs than do the other options. The uniform national programs also significantly improve (on a percentage basis) the quality of the POTW effluent discharge and the quality of the sludge.

While the options significantly reduce the volume of the pass-through of toxic pollutants, the ultimate importance of these reductions depends on resulting impacts on water quality. In the following subsection, the impacts on water quality have been analyzed using exceedances as an indicator. Still, there are important water quality impacts even where there are no immediate exceedances since the reduction in pollutant discharges can reduce ambient pollutant levels, facilitating the attainment of water quality objectives downstream. Moreover, exceedances are thresholds values. Often, there are benefits associated with reducing pollution even where there are no exceedances, or where exceedances persist in spite of controls.

4.1.2 Effectiveness In Reducing Water Quality Exceedances

An exceedance is an indicator of the possibility that there may be water quality problems associated with the discharge of a particular pollutant to the environment. In the baseline analysis, current modelling runs predict that 1220 POTWs will experience at least one exceedance at current levels of pretreatment. The estimate of 1220 is low because it does not take into account ambient levels of toxics in the receiving water or the contribution to water quality degradation due to upsets or bypasses at a POTW. In addition, the normalizing assumptions used in modelling industrial discharge loadings and POTW removal efficiencies may affect the estimate of water quality exceedances.

Table 4.3 shows the reduction in the number of exceedances due to the application of each of the options. About 34 POTWs have all exceedances eliminated by most of the options. It is not known how effective Option 4 (water quality-based limits for POTW) would be. At least 34 POTWs would have all exceedances eliminated through this option. Nonetheless, there are limits to the extent that exceedances can be reduced through more stringent controls on industry. Non-industrial sources can contribute significant amounts of some pollutants, and where stream dilution is low, these sources themselves may cause water quality exceedances. Since the Federal back-up for Option 5 is the application of categorical pretreatment standards, it is assumed that 34 municipalities will eliminate all of their exceedances (as in Option 1).

These results can be compared to Table 4.3 in the original RIA report which shows that each of the pretreatment options will result in a minimum of 61 POTWs having all of their pollutant exceedances eliminated. While on the surface the reduction from 61 POTWs to 34 POTWs having all exceedances eliminated seems to weaken the case for pretreatment, the figures can be misleading. As discussed in Chapter 3, the current set of modelling runs show more POTWs with exceedances for a wider variety of pollutants than in the original report. This is due to the additional stream flows, lower dilution and, in some instances, more stringent modified criteria. Since the number of pollutant exceedances per POTW has increased, it becomes much more difficult to eliminate all of the exceedances at any particular POTW. In fact, Tables 3.1(A) and (B) show that on a pollutant by pollutant basis pretreatment is effective in reducing the number of exceedances.

4.2 COMPLIANCE COSTS OF THE OPTIONS

Table 4.4 shows the total annual compliance cost to industry and POTWs as a result of each option. The industrial cost is divided into two components: the additional cost of pretreatment and the cost of disposing of the additional hazardous waste that is generated. The total cost depends significantly on the number of POTWs affected by each option. Excluding the metal finishing only option, the total annual cost (for pretreatment) ranges from approximately \$1.2 to \$1.8 billion. This is compared to original estimates of

TABLE 4-3

EFFECTIVENESS OF THE OPTIONS IN REDUCING EXCEEDANCES*
(Based on a total of 1,839 POTWs)

OPTION		POTWs WITH ONE OR MORE INITIAL EXCEEDANCES*	POTWs WITH ALL EXCEEDANCES ELIMINATED	POTWs WITH ONE OR MORE EXCEEDANCES REMAINING
1.a	Existing Program	1220	34	1186
1.b	1.a with waiver	1220	34	1186
2.a	Existing Program, Reduced Scope	1220	17	1203
2.b	2.a with waiver	1220	17	1203
3.a	Tech-Based Limits for POTW	1220	34	1186
3.b	3.a with waiver	1220	34	1186
4.	Water Quality Limits for POTW	1220	>34	<1186
5.	Local Program for Documented Problems	1220	<34**	>1186
6.	Guidance Only	1220	0-1220	

* It is assumed that there is no ambient concentration of toxic pollutants. If there is an ambient concentration of toxic pollutants, then the number of initial exceedances will be higher.

** Assumed to be limited to the effectiveness of the Federal back-up (Option 1.a). However, the actual effectiveness could be as high as for Option 4 depending on the steps taken by the POTWs.

TABLE 4-4

TOTAL COST OF THE OPTIONS FOR POTWs AND INDUSTRY
(Millions of 1981 dollars)
(Based on a total of 1,839 POTWs)

		POTW COST		ANNUAL INDUSTRY COST		
OPTION		DEVELOPMENT	ANNUAL	PRE-TREATMENT	SLUDGE	TOTAL ANNUAL COST
1.a	Existing Program	63	75	1154	586††	1815
1.b	1.a with waiver	42	50	761	387	1198†
2.a	Existing Program, Reduced Scope	63	75	576	302	953
2.b	2.a with waiver	42	50	380	199	629
3.a	Tech-Based Limits for POTW	63	75	<1154	<586	<1815
3.b	3.a with waiver	42	50	>761	<387	<1198
4.	Water Quality Limits for POTW	42	50	>761	>387	>1198
5.	Local Program for Document Problems*	42	50	<761	<387	<1198
6.	Guidance Only**	30	33	0-761	0-387	<1198

* Assumed to be limited to the cost of the Federal back-up. Actually, the costs could be higher depending on the local programs.

** The extent of local action in the absence of a Federal back-up is not known. While the range reflects a maximum cost equivalent to the existing program with waivers (1.b), the cost could be higher depending on local action.

† Assumes no ambient toxic pollutant levels.

†† This figure is currently being verified in new model runs. It is suspected to be too high.

between $0.9 and $1.9 billion in annual pretreatment costs. The cost of pretreatment under the waiver options has increased due to the increased number of POTWs initially experiencing water quality problems (i.e., 1220 vs. 846) while the cost has decreased slightly for the uniform options as a result of data input changes discussed in Chapter 2.

The total municipal cost contains two components: the program development cost (a one-time cost) and the annual cost of operating the program. Sludge disposal costs for the POTWs are not affected by the improvement in sludge quality because municipal sludges are not now subject to Federal regulations that require more costly disposal. If there were sludge criteria that resulted in more expensive disposal, then some of the options could lower the POTW cost (and possibly the net total cost of both POTWs and industry), potentially affecting the relative cost-effectiveness of the options.

4.3 SUMMARY

The RIA Addendum effort was undertaken to expand and refine the technical basis for the Pretreatment RIA in response to public comments. New stream flow data were incorporated, almost doubling the universe of streams for which predictions, based on actual data, could be made. Revisions were made to a number of key industrial data inputs determining industrial wasteloads, and pretreatment compliance costs. The number of pollutants analyzed was expanded to include selected toxic organic chemicals. New analytic methodologies were employed to answer questions about the effectiveness of pretreatment in preventing POTW interference, and in reducing water quality exceedances when different water quality measures are employed as triggers.

The preceding sections have presented information on the nature of these data and methodological changes, and the new findings resulting from this work. Revised model predictions have been briefly compared with those presented in the initial RIA report to provide a context for assessing the new findings.

Predictions of the values for many of the measures chosen to evaluate pretreatment in the RIA do change as a result of the data and methodological changes. More POTWs are forecast to have water quality exceedances. Estimates of the percent improvement for metals in the POTW effluent and sludge after pretreatment are somewhat lower, while estimates of the percent improvement for toxic organics in effluent and sludge are higher in the RIA Addendum. The cost predictions for the National Pretreatment Program (Option 1) are slightly lower due to decreases in industrial compliance costs, while those for the options based on water quality waivers increase due to the larger universe of POTWs predicted to experience water quality problems.

Overall, the results of the RIA Addendum work reinforce conclusions of the original report concerning the need for and effectiveness of pretreatment in controlling the impacts of industrial discharges of toxic pollutants on POTWs. Industrial pretreatment is still predicted to reduce toxic loadings to POTWs, to lessen the potential for interference at treatment plants, and to decrease the presence and concentration of toxic pollutants in POTW effluent and sludge.