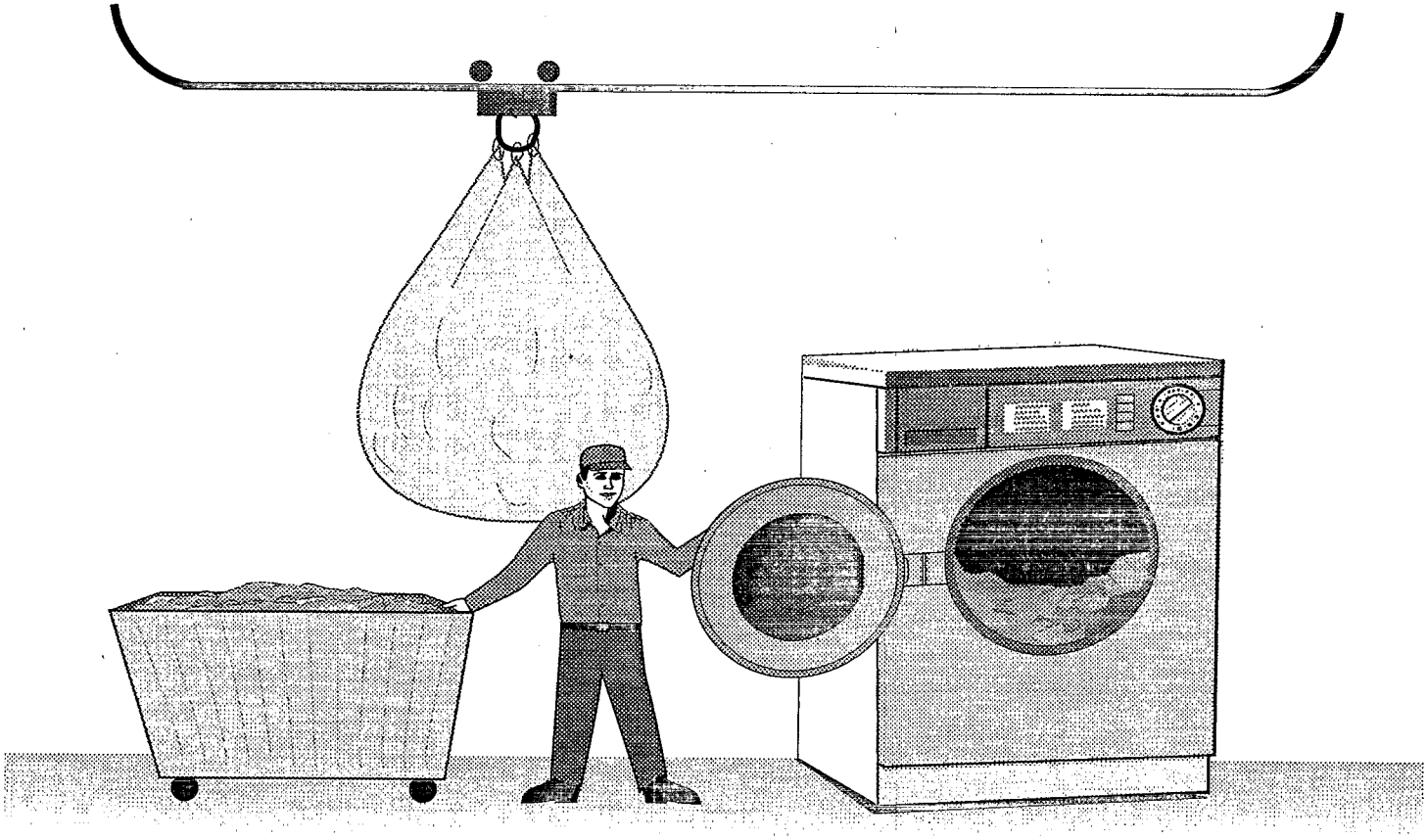
United States
Environmental Protection
Agency

Office of Water
(4303)

EPA 821-R-97-005
November 1997

EPA

Cost-Effectiveness Analysis for Proposed Pretreatment Standards for Existing and New Sources for the Industrial Laundries Point Source Category



COST-EFFECTIVENESS ANALYSIS FOR PROPOSED PRETREATMENT STANDARDS FOR EXISTING AND NEW SOURCES FOR THE INDUSTRIAL LAUNDRIES POINT SOURCE CATEGORY

FINAL REPORT

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November 1997

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SECTION ONE

INTRODUCTION

This report supports the proposed Pretreatment Standards for the Industrial Laundries Point Source Category (IL Standards). In this document, EPA compares the total annualized cost of each of four regulatory options to the corresponding effectiveness of that option in reducing the discharge of pollutants. EPA evaluates the effectiveness in terms of costs per pound of pollutant removed, weighted by the relative toxicity of the pollutant (toxic weighting factor). The rationale for this measure, referred to as "pounds-equivalent removed," is described later in this document.

Section Two discusses EPA's cost-effectiveness methodology and identifies the pollutants included in the analysis. This section also presents EPA's toxic weighting factors for each pollutant and considers the removal efficiency of each option. Section Three presents the results of the cost-effectiveness analysis. In Section Four, the cost-effectiveness value for the proposed regulatory option is compared to cost-effectiveness values for other proposed and promulgated rules. Appendix A presents data on pollutants and pollutant removals, and Appendix B presents data on annualized costs for each of the regulatory options.

SECTION TWO

BACKGROUND AND METHODOLOGY

Cost-effectiveness (CE) is evaluated as the incremental and average annualized cost of a pollution control option in an industry or industry subcategory per incremental and total pound equivalent of pollutant (i.e., pound of pollutant adjusted for toxicity) removed by that control option. The cost-effectiveness analysis primarily enables EPA to compare the removal efficiencies of regulatory options under consideration for a rule. A secondary use is to compare the cost effectiveness of the proposed option for the IL Standards to that of pretreatment standards for other industries.

EPA ranks options in order of increasing pound equivalents removed to identify the point at which increased removal of pollutants is no longer cost-effective. Generally, EPA determines this to be where costs (per pound equivalent removed) increase sharply, that is, where relatively few incremental pounds are removed for steady increases in cost. The accompanying figure (Figure 2-1) shows this point as Point A, where the cost-effectiveness curve becomes nearly vertical. Increases in removals beyond this point come only at relatively high unit costs, which, in many cases, EPA will determine exceed the benefit of the increased removals to society.

A number of steps must be undertaken before a cost-effectiveness analysis can be performed. There are five steps that define the analysis or generate data for use in the cost-effectiveness calculation:

- Determine the wastewater pollutants of concern (priority and other pollutants).
- Estimate the relative toxic weights (the adjustments to pounds of pollutants to reflect toxicity) of the pollutants of concern.
- Define the regulatory pollution control options.
- Calculate pollutant removals for each pollution control option.
- Determine the annualized cost of each pollution control option.

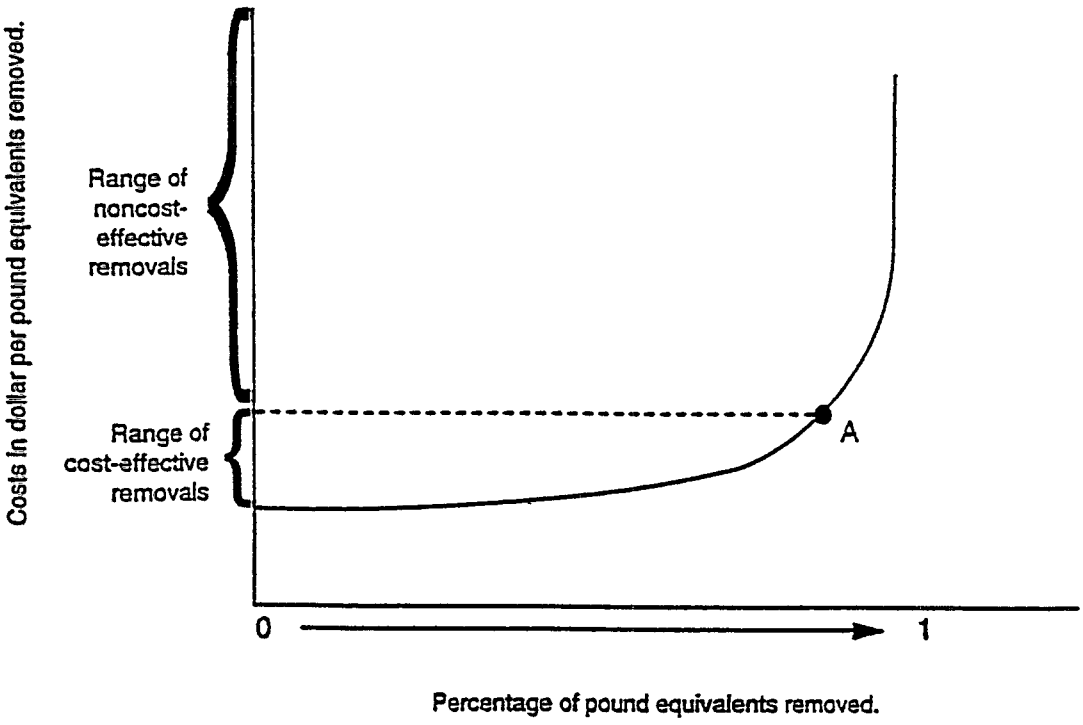

Figure 2-1. Cost effectiveness

All of these factors are used in the calculation of the cost-effectiveness values, which can then be compared for each regulatory option under consideration. The following sections discuss the five preliminary steps and the cost-effectiveness calculation and comparison methodologies.

2.1 POLLUTANTS OF CONCERN

Under the IL Standards, a number of priority and other nonconventional pollutants are regulated. Some of the factors considered in selecting pollutants for regulation include toxicity, frequency of occurrence in wastestream effluent, and amount of pollutant in the wastestream. The list of regulated pollutants for each regulatory option is presented in Appendix A.

2.2 TOXIC WEIGHTING FACTORS

Cost-effectiveness analyses account for differences in toxicity among the pollutants using toxic weighting factors. These factors are necessary because different pollutants have different potential effects on human and aquatic life. For example, a pound of zinc in an effluent stream has a significantly different effect than a pound of PCBs. Toxic weighting factors for pollutants are derived using ambient water quality criteria and toxicity values. For most industries, toxic weighting factors are derived from chronic freshwater aquatic criteria. In cases where a human health criterion has also been established for the consumption of fish, the sum of both the human and aquatic criteria are used to derive toxic weighting factors. The factors are standardized by relating them to a "benchmark" toxicity value that was based on the toxicity of copper when the methodology was developed.[1] Appendix A presents the toxic weighting factors used for the regulated pollutants in the cost-effectiveness analysis of the industrial laundries industry.

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[1] Although the water quality criterion has been revised (to 12.0 µg/l), all cost-effectiveness analyses for effluent guideline regulations continue to use the "old" criterion of 5.6 µg/l as a benchmark so that cost-effectiveness values can continue to be compared to those for other effluent guidelines. Where copper is present in the effluent, the revised higher criterion for copper results in a toxic weighting factor for copper of 0.467 rather than 1.0.

Examples of the effects of different aquatic and human health criteria on freshwater toxic weighting factors are presented in Table 2-1. As shown in this table, the toxic weighting factor is the sum of two criteria-weighted ratios: the "benchmark/old" copper criterion divided by the human health criterion for the particular pollutant and the "benchmark/old" copper criterion divided by the aquatic chronic criterion. For example, using the values reported in Table 2-1, 11 pounds of the benchmark chemical (copper) pose the same relative hazard in freshwater as one pound of cadmium because cadmium has a freshwater toxic weight 11 times as large as the toxic weight of copper (5.16/0.467=11.05).

2.3 POLLUTION CONTROL OPTIONS

Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS) options are proposed. Because there are no direct discharges in the Industrial Laundry Industry, Best Available Technology (BAT), New Source Performance Standards (NSPS), and Best Practicable Control Technology (BPT) are not considered. This cost-effectiveness analysis was performed for four pollution control options for indirect dischargers: OC, organics control using a steam-tumbling process; CP, chemical precipitation treatment of wastewater from industrial laundry items; DAF, dissolved air flotation treatment of wastewater from industrial laundry items; and COMBO, either chemical precipitation or dissolved air flotation of wastewater from industrial laundry items (as defined in Table 2-2). A zero-discharge option is not considered within the analysis.

2.4 POLLUTANT REMOVALS

The pollutant loadings have been calculated for each facility under each regulatory option for comparison with baseline loadings. The postregulatory removals under each regulatory option are presented in Appendix A.

Pollutant removals are calculated directly as the difference between current and post-treatment discharges. Removals are then weighted using the toxic weighting factors and are reported in pound equivalents (see Appendix A for pound-equivalent removals for all pollutants by pollutant and option).

TABLE 2-1

EXAMPLES OF TOXIC WEIGHTING FACTORS BASED ON COPPER FRESHWATER CHRONIC CRITERIA

Pollutant	Human Health Criteria (μg/l)	Aquatic Chronic Criteria (μg/l)	Weighting Calculation	Toxic Weighting Factor
Copper[a]	---	12.0	5.6/12.0	0.467
Cadmium	84	1.1	5.6/84 + 5.6/1.1	5.16
Naphthalene	41,026	370	5.6/41,026 + 5.6/370	0.015

[a]Although the water quality criterion for copper has been revised (to 12.0 μg/l), the cost effectiveness analysis used the previous criterion (5.6 μg/l) to facilitate comparisons with cost-effectiveness values for other effluent limitations guidelines. The revised higher criteria for copper results in a toxic weighting factor for copper equal to 0.467 instead of 1.0, which was the result of the previous criterion.

Notes: Human health and aquatic chronic criteria are maximum contamination thresholds. Units for criteria are micrograms of pollutant per liter of water.

Sources: EPA, 1997c.

TABLE 2-2

REGULATORY OPTIONS CONSIDERED IN THE COST-EFFECTIVENESS ANALYSIS

Option	Description
OC	Organics control using a steam-tumbling process.
CP	Chemical precipitation treatment of wastewater from industrial laundry items; linen supply wastewater does not require treatment. If untreated, the treated and untreated streams are combined prior to discharge.
COMBO	Either chemical precipitation or dissolved air flotation of wastewater from industrial laundry items; linen supply wastewater does not require treatment. If untreated, streams are combined prior to discharge. Uses the higher long-term average of the two technologies.
DAF	Dissolved air flotation treatment of wastewater from industrial laundry items; linen supply wastewater does not require treatment. If untreated, streams are combined prior to discharge.

Note: The CP, COMBO, and DAF options correspond to CP-IL, COMBO-IL, and DAF-IL in EPA's *Development Document for Proposed Pretreatment Standards for the Industrial Laundries Point Source Category*, September, 1997. (EPA, 1997a).

Total removals for each option are then calculated by summing the removals for all pollutants under each option.

One additional step is undertaken to calculate final reductions in pollutant loadings for indirect dischargers because of the ability of POTWs to remove pollutants, measured as POTW removal efficiencies. Appendix A presents the POTW removal efficiencies for 47 pollutants.

POTW removal efficiencies are used as follows. If a facility is discharging 100 pounds of cadmium in its effluent stream to a POTW and the POTW has a removal efficiency for cadmium of 38 percent, then the cadmium discharged to surface waters is only 62 pounds. If the regulation results in a reduction of cadmium in the effluent stream such that total cadmium discharged to the POTW is 50 pounds, then the amount discharged to surface waters is calculated as 50 pounds multiplied by the POTW removal efficiency factor (1 - 0.38 or 0.62 times 50 pounds equals 31 pounds). The cost-effectiveness calculations then reflect the fact that the actual reduction of pollutant discharged to surface water is not 50 pounds (the change in the amount discharged to the POTW), but 31 pounds (the change in the amount actually discharged to surface water). Pollutant removals calculated in this way are presented in Table 2-3.

2.5 ANNUALIZED COSTS OF COMPLIANCE

Under each regulatory option, annualized costs of compliance have been developed (see EPA, 1997a and 1997b). The derivation of these costs is summarized briefly below.

EPA derived the pretax costs (including the state and federal governments' share of compliance costs)[2] of purchasing, installing, and operating pollution control equipment. EPA annualized any capital costs at 7 percent[3] over 16 years and added these costs to the annual costs of operating the pollution control

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[2] Every dollar spent on compliance can be applied against a firm's taxable income. Due to various tax mechanisms such as accelerated depreciation, this reduction means that firms face only about 70 percent of compliance costs after taxes.

[3] Source of real cost of capital: Office of Management and Budget (OMB), undated.

TABLE 2-3

TOTAL POLLUTANT REMOVALS BY REGULATORY OPTION

Option	Pounds Removed	Pound Equivalents Removed
OC	570.205	5,278
CP	27,308,247	407,358
COMBO	27,028,386	402,253
DAF	28,552,783	402,921

Source: see Tables A-1 through A-4.

equipment. The aggregate annual pretax costs by option are presented in Table 2-4. Appendix B presents the calculations used to arrive at the aggregate annual costs figures presented in Table 2-4.

2.6 CALCULATION OF THE COST-EFFECTIVENESS VALUES

Cost-effectiveness values are calculated separately for each regulatory option. Options first are ranked in ascending order of pounds equivalent of pollutants removed. The incremental cost-effectiveness value for a particular control option is calculated as the ratio of the incremental annual cost to the incremental pounds equivalent removed. Average cost-effectiveness values for each option are calculated as total dollars for the option divided by total pounds equivalent removed by the option. The incremental effectiveness values are viewed incrementally in comparison to the baseline (zero costs/zero removals) for OC and to the preceding regulatory option (for all subsequent options). Cost-effectiveness values are reported in units of dollars per pound equivalent of pollutant removed.

For the purpose of comparing cost-effectiveness values of options under review to those of other promulgated rules, compliance costs used in the cost-effectiveness analysis (which are in 1993 dollars) are adjusted to 1981 dollars using *Engineering News Record*'s Construction Cost Index (CCI) (see Table 2-4 for compliance costs in 1981 dollars). This adjustment factor is calculated as follows:

Adjustment factor = 1981 CCI/1993 CCI = 3,535/5,210 = 0.6785

The equation used to calculate incremental cost effectiveness is:

$$CE_k = \frac{ATC_k - ATC_{k-1}}{PE_k - PE_{k-1}}$$

where:

CE_k= Cost-effectiveness of Option k

ATC_k= Total annualized treatment cost under Option k

PE_k= Pound equivalents removed by Option k

TABLE 2-4

AGGREGATE ANNUAL COST BY REGULATORY OPTION

Option	Cost $1993	Cost $1981
OC	$59,431,680	$40,324,395
CP	$123,384,085	$83,716,102
COMBO	$131,269,784	$89,066,549
DAF	$159,931,631	$108,513,611

Source: see Table B-1

The numerator of the equation, ATC_k minus ATC_{k-1}, is simply the incremental annualized treatment cost in going from Option k-1 (an option that removes fewer pound equivalent pollutants) to Option k (an option that removes more pound equivalent pollutants). The denominator is similarly the incremental removals achieved in going from Option k-1 to k. Thus, cost-effectiveness measures the incremental unit cost of pollutant removal of Option k (in pound equivalents) in comparison to Option k-1.

Average cost-effectiveness values can also be derived by setting ATC_{k-1} to zero and by setting the pollutant loadings (PE_{k-1}) to the current loading. These values can be used, with caution, to compare an option to previously promulgated effluent limitations guidelines.

2.7 COMPARISONS OF COST-EFFECTIVENESS VALUES

Because the options are ranked in ascending order of pound equivalents of pollutants removed, any option that has higher costs but lower removals than another option immediately can be identified (the cost-effectiveness value for the next option becomes negative). When negative values are computed for Option k, Option k-1 will be noted as "dominated" (having a higher cost and lower removals than Option k). Option k-1 is then removed from the cost-effectiveness calculations, and all cost-effectiveness values within a regulatory grouping are then recalculated without the "dominated" option. This process continues until all "dominated" options are eliminated. The remaining options can then be presented in terms of their incremental cost-effectiveness values and are considered viable options for regulatory consideration.

SECTION THREE

COST-EFFECTIVENESS RESULTS

In this cost-effectiveness analysis, EPA evaluates four PSES options. The CP, DAF, and COMBO options assume only that wastewater from industrial laundry items will be treated (linen supply wastewater would not require treatment). If untreated, the treated and untreated streams are combined prior to discharge. The remaining option, OC, requires the entire wastestream to be treated using a steam tumbling process (see Table 2-2). Table 3-1 presents the cost-effectiveness data and results.

A brief glance at Table 3-1 will reveal that COMBO and DAF are both dominated options, that is, CP removes more pound equivalents at a lower cost than COMBO and DAF. Thus, the only nondominated (and thus potentially cost-effective) options are OC and CP. Table 3-2 shows the incremental cost-effectiveness of these two options to be $7,640 and $108, with average cost effectiveness of $7,640 and $206.

TABLE 3-1

COST-EFFECTIVENESS RESULTS FOR POLLUTION CONTROL OPTIONS

Option	Total Annual		Incremental		Incremental Cost Effectiveness ($1981) ($/lb. equiv.)	Average Cost Effectiveness ($1981) ($/lb. equiv.)
	Pound Equivalents Removed (lbs.)	Cost ($1981)	Pound Equivalents Removed (lbs.)	Cost ($1981)		
OC	5,278	$40,324,395	5,278	$40,324,395	$7,640	$7,640
COMBO	402,253	$89,066,549	396,975	$48,742,154	$123	$221
DAF	402,921	$108,513,611	667	$19,447,063	$29,138	$269
CP	407,358	$83,716,102	4,437	($24,797,509)	($5,588)	$206

TABLE 3-2

COST-EFFECTIVENESS RESULTS FOR POLLUTION CONTROL OPTIONS

Option	Total Annual		Incremental		Incremental Cost Effectiveness ($1981) ($/lb. equiv.)	Average Cost Effectiveness ($1981) ($/lb. equiv.)
	Pound Equivalents Removed (lbs.)	Cost ($1981)	Pound Equivalents Removed (lbs.)	Cost ($1981)		
OC	5,278	$40,324,395	5,278	$40,324,395	$7,640	$7,640
CP	407,358	$83,716,102	402,080	$43,391,707	$108	$206

SECTION FOUR

COMPARISON OF COST-EFFECTIVENESS VALUES WITH PROMULGATED RULES

As discussed in Section Two, incremental cost-effectiveness is the appropriate measure for comparing one regulatory option to an alternative, less stringent regulatory option for the same rule. Some believe that it may also be used to compare cost-effectiveness across rules when considering how the last increment of stringency in one rule compares to the last increment of stringency in another. For comparing the overall cost-effectiveness of one rule to another, average cost-effectiveness may be a more appropriate measure, but must be considered in context with caution. (Average cost-effectiveness can be thought of as the "increment" between no regulation and the selected option, for any given rule.

Table 4-1 presents the incremental cost-effectiveness values for the IL Standards and pretreatment standards issued for other industries. The numbers presented here for this rulemaking are pretax costs, whereas many of the numbers presented for other effluent guidelines are after-tax costs—that is, the costs actually faced by the firms, not the total cost of the equipment (which is subsidized by reductions in taxable income). Thus direct comparisons between this rulemaking and others cannot be made easily. The equivalent after-tax cost, however, is approximately 70 percent of pretax costs. The number reported for the industrial laundry industries is for the preferred option, CP. As the table shows, the $108 per incremental pound equivalent removed associated with the traditional cost-effectiveness calculations is in the range of cost-effectiveness values seen for other rules.

TABLE 4-1

INDUSTRY COMPARISON OF PSES COST-EFFECTIVENESS FOR INDIRECT DISCHARGERS
(Toxic and Nonconventional Pollutants Only; Copper-Based Weights[a]; $ 1981)

Industry		PE Currently Discharged (thousands)	PE Remaining at Selected Option (thousands)	Cost-Effectiveness of Selected Option(s) ($/PE removed)
Aluminum Forming		1,602	18	155
Battery Manufacturing		1,152	5	15
Canmaking		252	5	38
Coal Mining[b]		NA	NA	NA
Coastal Oil and Gas[b]		NA	NA	NA
Coil Coating		2,503	10	10
Copper Forming		34	4	10
Electronics I		75	35	14
Electronics II		260	24	14
Foundries		2,136	18	116
Industrial Laundries		2,002	1,594	108
Inorganic Chemicals I		3,971	3,004	9
Inorganic Chemicals II		4,760	6	<1
Iron and Steel		5,599	1,404	6
Leather Tanning		16,830	1,899	111
Metal Finishing		11,680	755	10
Nonferrous Metals Forming		189	5	90
Nonferrous Metals Manufacturing I		3,187	19	15
Nonferrous Metals Manufacturing II		38	0.41	12
Offshore Oil and Gas[b]		NA	NA	NA
OCSPSF[c]		5,210	72	34
Pharmaceuticals[c,d]	A/C	897	47	47
	B/D	90	0.5	96
Plastics Molding and Forming		NA	NA	NA

TABLE 4-1 (continued)

Industry	PE Currently Discharged (thousands)	PE Remaining at Selected Option (thousands)	Cost-Effectiveness of Selected Option(s) ($/PE removed)
Porcelain Enameling	1,565	96	14
Pulp and Paper[d]	9,539	103	65

[a]Although toxic weighing factors for priority pollutants varied across these rules, this table reflects the cost-effectiveness at the time of regulation.

[b]Industry has no known or expected indirect discharges.

[c]Reflects costs and removals of both air and water pollutants.

[d]Proposed.

SECTION FIVE

REFERENCES

U.S. EPA, 1997a. *Technical Development Document for Proposed Pretreatment Standards for Existing and New Sources for the Industrial Laundries Point Source Category*. November.

U.S. EPA, 1997b. *Economic Analysis for Proposed Pretreatment Standards for Existing and New Sources for the Industrial Laundries Point Source Category*. November.

U.S. EPA, 1997c. *Toxic and Pollutant Weighting Factors for Proposed Pretreatment Standards for Existing and New Sources for the Industrial Laundries Point Source Category*. November.

OMB, undated. "Memorandum to the regulatory working group on economic analysis of federal regulations under Executive Order 12866." Sally Katzen.

APPENDIX A

SUPPORTING DOCUMENTATION FOR COST-EFFECTIVENESS ANALYSIS: POLLUTANT LOADINGS ANALYSIS

Table A-1
Industry Loads and Removals by Pollutant
OC Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	45,282	11,176	0%	11,176	4.30E-03	48
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	16,645	12,000	0%	12,000	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	3,049	6,230	28%	4,486	1.80E-02	81
N42	2-PROPANONE	160,369	80,343	80,026	84%	12,804	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	12,774	0	63%	0	4.30E-03	0
N54	4-METHYL-2-PENTANONE	19,278	13,376	5,902	0%	5,902	1.20E-04	1
N58	ALPHA-TERPINEOL	12,512	6,820	5,691	0%	5,691	1.00E-03	6
AL	ALUMINUM	673,267	673,267	0	88%	0	6.40E-02	0
SB	ANTIMONY	32,101	32,101	0	72%	0	1.90E-01	0
AS	ARSENIC	13,013	13,013	0	40%	0	4.00E+00	0
BA	BARIUM	71,391	71,391	0	35%	0	2.00E-03	0
N64	BENZOIC ACID	78,273	78,273	0	81%	0	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5.30E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	133,020	0	60%	0	1.10E-01	0
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	113,260,559	0	91%	0	0.00E+00	0
B	BORON	34,470	34,470	0	14%	0	1.80E-01	0
T67	BUTYL BENZYL PHTHALATE	30,064	17,432	12,632	86%	1,768	2.30E-02	41
CD	CADMIUM	5,561	5,561	0	91%	0	5.20E+00	0
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	265,197,924	0	82%	0	0.00E+00	0
T7	CHLOROBENZENE	2,714	897	1,816	0%	1,816	2.90E-03	5
T23	CHLOROFORM	125,352	129,011	(3,659)	0%	(3,659)	2.10E-03	(8)
CR	CHROMIUM	14,533	14,533	0	91%	0	2.70E-02	0
CO	COBALT	5,264	5,264	0	4%	0	1.10E-01	0
CU	COPPER	122,556	122,556	0	84%	0	4.70E-01	0
T68	DI-N-BUTYL PHTHALATE	10,143	10,143	0	75%	0	1.20E-02	0
T69	DI-N-OCTYL PHTHALATE	11,339	11,339	0	0%	0	2.20E-01	0
T38	ETHYLBENZENE	44,621	14,363	30,258	0%	30,258	1.40E-03	42
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	1,111,476	0	83%	0	5.60E-03	0
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	73,452	0	92%	0	1.80E+00	0
N95	M-XYLENE	21,366	14,595	6,770	0%	6,770	1.50E-03	10
MN	MANGANESE	23,929	23,929	0	41%	0	1.40E-02	0
HG	MERCURY	174	174	0	0%	0	5.00E+02	0
T44	METHYLENE CHLORIDE	35,480	16,778	18,701	0%	18,701	4.20E-04	8
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	417,706	269,217	0%	269,217	4.30E-03	1,158
N103	N-DOCOSANE	12,325	12,325	0	65%	0	8.20E-05	0
N104	N-DODECANE	172,443	82,141	90,302	0%	90,302	4.30E-03	388
N105	N-EICOSANE	163,512	163,512	0	0%	0	4.30E-03	0
N106	N-HEXACOSANE	17,892	10,905	6,987	65%	2,445	8.20E-05	0
N107	N-HEXADECANE	78,453	78,453	0	0%	0	4.30E-03	0
N114	N-OCTACOSANE	11,308	8,100	3,209	65%	1,123	8.20E-05	0
N115	N-OCTADECANE	66,428	66,428	0	0%	0	4.30E-03	0
N116	N-TETRACOSANE	15,405	15,405	0	65%	0	8.20E-05	0
N117	N-TETRADECANE	112,217	112,217	0	0%	0	4.30E-03	0
N118	N-TRIACONTANE	14,897	10,494	4,403	65%	1,541	8.20E-05	0
T55	NAPHTHALENE	38,713	18,592	20,121	0%	20,121	1.50E-02	302
NI	NICKEL	14,777	14,777	0	52%	0	3.60E-02	0
N119	O+P XYLENE	10,774	7,906	2,868	0%	2,868	8.50E-03	24
HEM	OIL AND GREASE (AS HEM)	35,873,692	35,873,692	0	87%	0	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	19,102	38,772	99%	388	4.30E-02	17
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,649	0	95%	0	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,560	0	80%	0	4.70E+01	0
T85	TETRACHLOROETHENE	42,026	3,817	38,209	0%	38,209	7.40E-02	2,827
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	5,760	0	65%	0	3.00E-01	0
TI	TITANIUM	13,986	13,986	0	69%	0	2.90E-02	0
T86	TOLUENE	72,921	42,062	30,858	0%	30,858	5.60E-03	173
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	80,496,673	0	71%	0	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	13,242,028	0	65%	0	1.00E-01	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	62,793,110	0	91%	0	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	933	2,976	0%	2,976	9.30E-05	0
T87	TRICHLOROETHENE	3,334	892	2,443	0%	2,443	6.30E-02	154
V	VANADIUM	1,658	1,658	0	42%	0	6.20E-01	0
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	194,171	0	77%	0	5.10E-02	0
	Totals	**575,722,778**	**575,024,870**	**697,908**		**570,205**		**5,278**

Source: Development Document (EPA, 1997a).

Table A-2
Industry Loads and Removals by Pollutant
CP Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	4.30E-03	107
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	3,080	6,199	28%	4,463	1.80E-02	80
N42	2-PROPANONE	160,369	160,369	0	84%	0	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	3,513	9,261	63%	3,427	4.30E-03	15
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	1.20E-04	0
N58	ALPHA-TERPINEOL	12,512	12,512	0	0%	0	1.00E-03	0
AL	ALUMINUM	673,267	413,096	260,172	88%	31,221	6.40E-02	1,998
SB	ANTIMONY	32,101	16,110	15,991	72%	4,477	1.90E-01	851
AS	ARSENIC	13,013	13,011	2	40%	1	4.00E+00	4
BA	BARIUM	71,391	57,034	14,356	35%	9,332	2.00E-03	19
N64	BENZOIC ACID	78,273	78,273	0	81%	0	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	30	0	61%	0	5.30E+00	1
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	82,027	50,993	60%	20,397	1.10E-01	2,244
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,929,464	6,331,095	91%	569,799	0.00E+00	0
B	BORON	34,470	29,154	5,316	14%	4,571	1.80E-01	823
T67	BUTYL BENZYL PHTHALATE	30,064	14,524	15,540	86%	2,176	2.30E-02	50
CD	CADMIUM	5,561	2,977	2,584	91%	233	5.20E+00	1,209
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,207,948	80,989,976	82%	14,578,196	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,863	851	0%	851	2.90E-03	2
T23	CHLOROFORM	125,352	125,351	1	0%	1	2.10E-03	0
CR	CHROMIUM	14,533	8,989	5,544	91%	499	2.70E-02	13
CO	COBALT	5,264	3,539	1,725	4%	1,656	1.10E-01	182
CU	COPPER	122,556	60,664	61,892	84%	9,903	4.70E-01	4,654
T68	DI-N-BUTYL PHTHALATE	10,143	5,676	4,467	75%	1,117	1.20E-02	13
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.20E-01	306
T38	ETHYLBENZENE	44,621	20,292	24,329	0%	24,329	1.40E-03	34
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	5.60E-03	380
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	27,159	46,293	92%	3,703	1.80E+00	6,666
N95	M-XYLENE	21,366	19,692	1,674	0%	1,674	1.50E-03	3
MN	MANGANESE	23,929	10,719	13,210	41%	7,794	1.40E-02	109
HG	MERCURY	174	174	0	0%	0	5.00E+02	0
T44	METHYLENE CHLORIDE	35,480	11,824	23,656	0%	23,656	4.20E-04	10
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	346,103	340,821	0%	340,821	0.00E+00	0
N103	N-DOCOSANE	12,325	5,804	6,521	65%	2,282	0.00E+00	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	0.00E+00	0
N105	N-EICOSANE	163,512	12,358	151,154	0%	151,154	0.00E+00	0
N106	N-HEXACOSANE	17,892	4,347	13,545	65%	4,741	0.00E+00	0
N107	N-HEXADECANE	78,453	26,293	52,160	0%	52,160	0.00E+00	0
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	0.00E+00	0
N115	N-OCTADECANE	66,428	11,822	54,606	0%	54,606	0.00E+00	0
N116	N-TETRACOSANE	15,405	8,707	6,698	65%	2,344	0.00E+00	0
N117	N-TETRADECANE	112,217	23,201	89,016	0%	89,016	0.00E+00	0
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	0.00E+00	0
T55	NAPHTHALENE	38,713	18,835	19,878	0%	19,878	1.50E-02	298
NI	NICKEL	14,777	10,266	4,511	52%	2,165	3.60E-02	78
N119	O+P XYLENE	10,774	9,979	795	0%	795	8.50E-03	7
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,180,786	20,692,906	87%	2,690,078	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	57,874	0	99%	0	4.30E-02	0
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,649	0	95%	0	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,087	473	80%	95	4.70E+01	4,443
T85	TETRACHLOROETHENE	42,026	20,782	21,244	0%	21,244	7.40E-02	1,572
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	900	4,861	65%	1,701	3.00E-01	510
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	2.90E-02	42
T86	TOLUENE	72,921	59,128	13,792	0%	13,792	5.60E-03	77
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,086,442	6,410,230	71%	1,858,967	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,414,527	10,827,501	65%	3,789,625	1.00E-01	378,963
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9.30E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6.30E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	6.20E-01	5
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	58,577	135,593	77%	31,186	5.10E-02	1,591
	Totals	**575,722,778**	**417,851,812**	**157,870,966**		**27,308,247**		**407,358**

Source: Development Document (EPA, 1997a).

Table A-3
Industry Loads and Removals by Pollutant
COMBO Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	4.30E-03	107
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	1.80E-02	13
N42	2-PROPANONE	160,369	160,369	0	84%	0	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	4.30E-03	3
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	1.20E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1.00E-03	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	6.40E-02	1,498
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	1.90E-01	685
AS	ARSENIC	13,013	13,012	1	40%	0	4.00E+00	1
BA	BARIUM	71,391	57,034	14,356	35%	9,332	2.00E-03	19
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5.30E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	1.10E-01	2,124
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,935,931	6,324,628	91%	569,217	0.00E+00	0
B	BORON	34,470	33,931	539	14%	463	1.80E-01	83
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	2.30E-02	31
CD	CADMIUM	5,561	3,565	1,997	91%	180	5.20E+00	934
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,256,521	80,941,404	82%	14,569,453	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,874	839	0%	839	2.90E-03	2
T23	CHLOROFORM	125,352	125,352	0	0%	0	2.10E-03	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	2.70E-02	9
CO	COBALT	5,264	3,850	1,414	4%	1,358	1.10E-01	149
CU	COPPER	122,556	86,855	35,701	84%	5,712	4.70E-01	2,685
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	1.20E-02	6
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.20E-01	306
T38	ETHYLBENZENE	44,621	20,293	24,327	0%	24,327	1.40E-03	34
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	5.60E-03	380
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	1.80E+00	5,790
N95	M-XYLENE	21,366	19,868	1,498	0%	1,498	1.50E-03	2
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1.40E-02	93
HG	MERCURY	174	156	18	0%	18	5.00E+02	8,866
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	4.20E-04	2
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	0.00E+00	0
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	0.00E+00	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	0.00E+00	0
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	0.00E+00	0
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	0.00E+00	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	0.00E+00	0
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	0.00E+00	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	0.00E+00	0
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	0.00E+00	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	0.00E+00	0
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	0.00E+00	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	1.50E-02	279
NI	NICKEL	14,777	10,629	4,148	52%	1,991	3.60E-02	72
N119	O+P XYLENE	10,774	10,379	395	0%	395	8.50E-03	3
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	4.30E-02	15
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,637	12	95%	1	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,087	472	80%	94	4.70E+01	4,441
T85	TETRACHLOROETHENE	42,026	21,005	21,021	0%	21,021	7.40E-02	1,556
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	4,779	981	65%	343	3.00E-01	103
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	2.90E-02	42
T86	TOLUENE	72,921	59,200	13,721	0%	13,721	5.60E-03	77
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,088,883	6,407,789	71%	1,858,259	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	1.00E-01	370,850
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9.30E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6.30E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	6.20E-01	5
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	5.10E-02	989
	Totals	**575,722,778**	**419,052,398**	**156,670,380**		**27,028,386**		**402,253**

Source: Development Document (EPA, 1997a).

Table A-4
Industry Loads and Removals by Pollutant
DAF Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	3,489	52,970	0%	52,970	4E-03	228
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	2E-02	13
N42	2-PROPANONE	160,369	160,369	0	84%	0	8E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	4E-03	3
N54	4-METHYL-2-PENTANONE	19,278	19,076	202	0%	202	1E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1E-03	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	6E-02	1,498
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	2E-01	685
AS	ARSENIC	13,013	13,012	1	40%	0	4E+00	1
BA	BARIUM	71,391	43,646	27,745	35%	18,034	2E-03	36
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	3E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	6E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	1E-01	2,124
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,879,999	6,380,560	91%	574,250	0E+00	0
B	BORON	34,470	33,931	539	14%	463	2E-01	83
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	2E-02	31
CD	CADMIUM	5,561	3,565	1,997	91%	180	5E+00	934
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	178,964,957	86,232,967	82%	15,521,934	0E+00	0
T7	CHLOROBENZENE	2,714	1,740	974	0%	974	3E-03	3
T23	CHLOROFORM	125,352	125,352	0	0%	0	2E-03	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	3E-02	9
CO	COBALT	5,264	3,850	1,414	4%	1,358	1E-01	149
CU	COPPER	122,556	86,855	35,701	84%	5,712	5E-01	2,685
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	1E-02	6
T69	DI-N-OCTYL PHTHALATE	11,339	9,591	1,748	0%	1,748	2E-01	385
T38	ETHYLBENZENE	44,621	6,559	38,062	0%	38,062	1E-03	53
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3E-04	0
FE	IRON	1,111,476	621,491	489,985	83%	83,297	6E-03	466
T54	ISOPHORONE	4,504	4,504	0	62%	0	7E-04	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	2E+00	5,790
N95	M-XYLENE	21,366	19,497	1,869	0%	1,869	2E-03	3
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1E-02	93
HG	MERCURY	174	156	18	0%	18	5E+02	8,866
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	4E-04	2
MO	MOLYBDENUM	9,810	8,997	813	52%	390	2E-01	78
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	0E+00	0
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	0E+00	0
N104	N-DODECANE	172,443	59,948	112,495	0%	112,495	0E+00	0
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	0E+00	0
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	0E+00	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	0E+00	0
N114	N-OCTACOSANE	11,308	3,366	7,943	65%	2,780	0E+00	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	0E+00	0
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	0E+00	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	0E+00	0
N118	N-TRIACONTANE	14,897	7,273	7,625	65%	2,669	0E+00	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	2E-02	279
NI	NICKEL	14,777	10,629	4,148	52%	1,991	4E-02	72
N119	O+P XYLENE	10,774	10,379	395	0%	395	9E-03	3
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0E+00	0
N125	P-CRESOL	0	0	0	72%	0	2E-03	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	4E-02	15
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	3E-01	0
T65	PHENOL	13,649	13,637	12	95%	1	3E-02	0
SE	SELENIUM	99	99	0	34%	0	1E+00	0
AG	SILVER	4,560	4,069	490	80%	98	5E+01	4,610
T85	TETRACHLOROETHENE	42,026	20,463	21,563	0%	21,563	7E-02	1,596
TL	THALLIUM	0	0	0	28%	0	1E-01	0
SN	TIN	5,760	4,779	981	65%	343	3E-01	103
TI	TITANIUM	13,986	8,858	5,128	69%	1,590	3E-02	46
T86	TOLUENE	72,921	51,663	21,258	0%	21,258	6E-03	119
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	73,470,522	7,026,150	71%	2,037,584	0E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	1E-01	370,850
TS	TOTAL SUSPENDED SOLIDS	62,793,110	29,721,017	33,072,094	91%	2,976,488	0E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6E-02	0
V	VANADIUM	1,658	1,619	40	42%	23	6E-01	14
Y	YTTRIUM	648	643	5	58%	2	0E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	5E-02	989
	Totals	**575,722,778**	**410,439,304**	**165,283,474**		**28,552,783**		**402,921**

Source: Development Document (EPA, 1997a).

APPENDIX B

SUPPORTING DOCUMENTATION FOR COST-EFFECTIVENESS ANALYSIS: COST ANALYSIS

TABLE B-1

Computation of Annualized Costs in 1993 and 1981 Dollars

Costs	OC	CP	COMBO	DAF
Capital Cost ($1993)	$262,564,089	$425,080,134	$398,489,118	$329,375,031
Annual O&M Cost ($1993)	$31,637,263	$78,386,102	$89,086,664	$125,064,764
Total Annualized Capital Cost ($1993)	$27,794,417	$44,997,983	$42,183,121	$34,866,866
Total Annual Cost ($1993)	$59,431,680	$123,384,085	$131,269,784	$159,931,631
Deflator (c)	0.6785	0.6785	0.6785	0.6785
Total Cost ($1981)	$40,324,395	$83,716,102	$89,066,549	$108,513,611

Source: Capital and O&M Costs: Development Document (EPA, 1997a); Deflator: *Engineering News Record* Construction Cost Index, March 31, 1997.

APPENDIX C

COST-EFFECTIVENESS ANALYSIS RESULTS USING THE ALTERNATIVE PWF APPROACH

APPENDIX C

COST-EFFECTIVENESS ANALYSIS RESULTS USING THE ALTERNATIVE PWF APPROACH

The pollutant weighting factor (PWF) method is an alternative to the TWF method for assessing water-based effects. PWFs are derived from the more protective of either the chronic aquatic life criteria (or toxic effect levels) or the human health criteria (or toxic effect levels) established for the consumption of water and fish. For carcinogenic substances, the human health risk level is 10^{-6} (i.e., protective to a level allowing 1 in 1,000,000 excess lifetime cancer cases over background). In contrast to TWFs, PWFs are not related to a benchmark pollutant. PWFs are derived by taking the reciprocal of the more stringent (smallest value) of the aquatic life or human health criterion or toxic effect level, both expressed in concentration units of micrograms per liter (µg/L):

$$PWF = \frac{1}{AQ}, \text{ if } AQ < HHWO \text{ or } PWF = \frac{1}{HHWO}, \text{ if } HHWO < AQ$$

where:

PWF = pollutant weighting factor
AQ = chronic aquatic life value (µg/L)
HHWO = human health (ingesting water and organisms value (µg/L)

The results of using PWFs rather than TWFs in the cost-effectiveness analysis are shown in Tables C-1 and C-2. As Table C-2 shows, the proposed option, CP, has an incremental cost-effectiveness value of $512/lb. eq. and an average cost-effectiveness value of $868/lb. eq. using this approach. Tables C-3 through C-6 provide the detailed supporting data.

TABLE C-1

COST-EFFECTIVENESS RESULTS FOR POLLUTION CONTROL OPTIONS

Option	Total Annual		Incremental		Incremental Cost Effectiveness ($1981) ($/lb. equiv.)	Average Cost Effectiveness ($1981) ($/lb. equiv.)
	Pound Equivalents Removed (lbs.)	Cost ($1981)	Pound Equivalents Removed (lbs.)	Cost ($1981)		
OC	11,744	$40,324,395	11,744	$40,324,395	$3,433	$3,433
COMBO	87,394	$89,066,549	75,649	$48,742,154	$644	$1,019
DAF	87,652	$108,513,611	259	$19,447,063	$75,165	$1,238
CP	96,501	$83,716,102	8,848	($24,797,509)	($2,802)	$868

TABLE C-2

COST-EFFECTIVENESS RESULTS FOR POLLUTION CONTROL OPTIONS

Option	Total Annual		Incremental		Incremental Cost Effectiveness ($1981) ($/lb. equiv.)	Average Cost Effectiveness ($1981) ($/lb. equiv.)
	Pound Equivalents Removed (lbs.)	Cost ($1981)	Pound Equivalents Removed (lbs.)	Cost ($1981)		
OC	11,744	$40,324,395	11,744	$40,324,395	$3,433	$3,433
CP	96,501	$83,716,102	84,756	$43,391,707	$512	$868

Table C-3
Industry Loads and Removals by Pollutant
OC Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Pollutant Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	45,282	11,176	0%	11,176	7.70E-04	9
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	2.50E+01	0
N34	2-BUTANONE	28,645	16,645	12,000	0%	12,000	4.80E-05	1
N38	2-METHYLNAPHTHALENE	9,280	3,049	6,230	28%	4,486	3.20E-03	14
N42	2-PROPANONE	160,369	80,343	80,026	84%	12,804	2.90E-04	4
T22	4-CHLORO-3-METHYLPHENOL	12,774	12,774	0	63%	0	7.70E-04	0
N54	4-METHYL-2-PENTANONE	19,278	13,376	5,902	0%	5,902	5.80E-04	3
N58	ALPHA-TERPINEOL	12,512	6,820	5,691	0%	5,691	1.80E-04	1
AL	ALUMINUM	673,267	673,267	0	88%	0	1.10E-02	0
SB	ANTIMONY	32,101	32,101	0	72%	0	7.20E-02	0
AS	ARSENIC	13,013	13,013	0	40%	0	5.70E+01	0
BA	BARIUM	71,391	71,391	0	35%	0	1.00E-03	0
N64	BENZOIC ACID	78,273	78,273	0	81%	0	5.80E-05	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	1.00E-03	0
BE	BERYLLIUM	31	31	0	61%	0	1.30E+02	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	133,020	0	60%	0	5.70E-01	0
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	113,260,559	0	91%	0	0.00E+00	0
B	BORON	34,470	34,470	0	14%	0	3.20E-02	0
T67	BUTYL BENZYL PHTHALATE	30,064	17,432	12,632	86%	1,768	3.80E-03	7
CD	CADMIUM	5,561	5,561	0	91%	0	9.10E-01	0
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	265,197,924	0	82%	0	0.00E+00	0
T7	CHLOROBENZENE	2,714	897	1,816	0%	1,816	1.50E-03	3
T23	CHLOROFORM	125,352	129,011	(3,659)	0%	(3,659)	1.80E-01	(659)
CR	CHROMIUM	14,533	14,533	0	91%	0	4.80E-03	0
CO	COBALT	5,264	5,264	0	4%	0	2.00E-02	0
CU	COPPER	122,556	122,556	0	84%	0	8.30E-02	0
T68	DI-N-BUTYL PHTHALATE	10,143	10,143	0	75%	0	2.00E-03	0
T69	DI-N-OCTYL PHTHALATE	11,339	11,339	0	0%	0	2.70E-02	0
T38	ETHYLBENZENE	44,621	14,363	30,258	0%	30,258	3.20E-04	10
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	6.10E-05	0
FE	IRON	1,111,476	1,111,476	0	83%	0	1.00E-03	0
T54	ISOPHORONE	4,504	4,504	0	62%	0	2.80E-02	0
PB	LEAD	73,452	73,452	0	92%	0	3.10E-01	0
N95	M-XYLENE	21,366	14,595	6,770	0%	6,770	2.60E-04	2
MN	MANGANESE	23,929	23,929	0	41%	0	1.00E-02	0
HG	MERCURY	174	174	0	0%	0	8.30E+01	0
T44	METHYLENE CHLORIDE	35,480	16,778	18,701	0%	18,701	3.70E-01	6,920
MO	MOLYBDENUM	9,810	9,810	0	52%	0	3.60E-02	0
N102	N-DECANE	686,923	417,706	269,217	0%	269,217	7.70E-04	207
N103	N-DOCOSANE	12,325	12,325	0	65%	0	1.50E-05	0
N104	N-DODECANE	172,443	82,141	90,302	0%	90,302	7.70E-04	70
N105	N-EICOSANE	163,512	163,512	0	0%	0	7.70E-04	0
N106	N-HEXACOSANE	17,892	10,905	6,987	65%	2,445	1.50E-05	0
N107	N-HEXADECANE	78,453	78,453	0	0%	0	7.70E-04	0
N114	N-OCTACOSANE	11,308	8,100	3,209	65%	1,123	1.50E-05	0
N115	N-OCTADECANE	66,428	66,428	0	0%	0	7.70E-04	0
N116	N-TETRACOSANE	15,405	15,405	0	65%	0	1.50E-05	0
N117	N-TETRADECANE	112,217	112,217	0	0%	0	7.70E-04	0
N118	N-TRIACONTANE	14,897	10,494	4,403	65%	1,541	1.50E-05	0
T55	NAPHTHALENE	38,713	18,592	20,121	0%	20,121	2.70E-03	54
NI	NICKEL	14,777	14,777	0	52%	0	6.30E-03	0
N119	O+P XYLENE	10,774	7,906	2,868	0%	2,868	1.50E-03	4
HEM	OIL AND GREASE (AS HEM)	35,873,692	35,873,692	0	87%	0	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	6.00E-04	0
N126	P-CYMENE	57,874	19,102	38,772	99%	388	7.70E-03	3
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	5.30E-02	0
T65	PHENOL	13,649	13,649	0	95%	0	5.00E-03	0
SE	SELENIUM	99	99	0	34%	0	2.00E-01	0
AG	SILVER	4,560	4,560	0	80%	0	8.30E+00	0
T85	TETRACHLOROETHENE	42,026	3,817	38,209	0%	38,209	1.30E-01	4,967
TL	THALLIUM	0	0	0	28%	0	2.50E-02	0
SN	TIN	5,760	5,760	0	65%	0	5.40E-02	0
TI	TITANIUM	13,986	13,986	0	69%	0	5.20E-03	0
T86	TOLUENE	72,921	42,062	30,858	0%	30,858	1.00E-03	31
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	80,496,673	0	71%	0	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	13,242,028	0	65%	0	1.80E-02	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	62,793,110	0	91%	0	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	933	2,976	0%	2,976	1.40E-03	4
T87	TRICHLOROETHENE	3,334	892	2,443	0%	2,443	3.70E-02	90
V	VANADIUM	1,658	1,658	0	42%	0	1.10E-01	0
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	194,171	0	77%	0	9.10E-03	0
	Totals	**575,722,778**	**575,024,870**	**697,908**		**570,205**		**11,744**

Source: Development Document (EPA, 1997a).

Table C-4
Industry Loads and Removals by Pollutant
CP Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Pollutant Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	7.70E-04	19
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	2.50E+01	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	4.80E-05	0
N38	2-METHYLNAPHTHALENE	9,280	3,080	6,199	28%	4,463	3.20E-03	14
N42	2-PROPANONE	160,369	160,369	0	84%	0	2.90E-04	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	3,513	9,261	63%	3,427	7.70E-04	3
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	5.80E-04	0
N58	ALPHA-TERPINEOL	12,512	12,512	0	0%	0	1.80E-04	0
AL	ALUMINUM	673,267	413,096	260,172	88%	31,221	1.10E-02	343
SB	ANTIMONY	32,101	16,110	15,991	72%	4,477	7.20E-02	322
AS	ARSENIC	13,013	13,011	2	40%	1	5.70E+01	57
BA	BARIUM	71,391	57,034	14,356	35%	9,332	1.00E-03	9
N64	BENZOIC ACID	78,273	78,273	0	81%	0	5.80E-05	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	1.00E-03	0
BE	BERYLLIUM	31	30	0	61%	0	1.30E+02	19
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	82,027	50,993	60%	20,397	5.70E-01	11,626
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,929,464	6,331,095	91%	569,799	0.00E+00	0
B	BORON	34,470	29,154	5,316	14%	4,571	3.20E-02	146
T67	BUTYL BENZYL PHTHALATE	30,064	14,524	15,540	86%	2,176	3.80E-03	8
CD	CADMIUM	5,561	2,977	2,584	91%	233	9.10E-01	212
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,207,948	80,989,976	82%	14,578,196	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,863	851	0%	851	1.50E-03	1
T23	CHLOROFORM	125,352	125,351	1	0%	1	1.80E-01	0
CR	CHROMIUM	14,533	8,989	5,544	91%	499	4.80E-03	2
CO	COBALT	5,264	3,539	1,725	4%	1,656	2.00E-02	33
CU	COPPER	122,556	60,664	61,892	84%	9,903	8.30E-02	822
T68	DI-N-BUTYL PHTHALATE	10,143	5,676	4,467	75%	1,117	2.00E-03	2
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.70E-02	38
T38	ETHYLBENZENE	44,621	20,292	24,329	0%	24,329	3.20E-04	8
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	6.10E-05	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	1.00E-03	68
T54	ISOPHORONE	4,504	4,504	0	62%	0	2.80E-02	0
PB	LEAD	73,452	27,159	46,293	92%	3,703	3.10E-01	1,148
N95	M-XYLENE	21,366	19,692	1,674	0%	1,674	2.60E-04	0
MN	MANGANESE	23,929	10,719	13,210	41%	7,794	1.00E-02	78
HG	MERCURY	174	174	0	0%	0	8.30E+01	0
T44	METHYLENE CHLORIDE	35,480	11,824	23,656	0%	23,656	3.70E-01	8,753
MO	MOLYBDENUM	9,810	9,810	0	52%	0	3.60E-02	0
N102	N-DECANE	686,923	346,103	340,821	0%	340,821	7.70E-04	262
N103	N-DOCOSANE	12,325	5,804	6,521	65%	2,282	1.50E-05	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	7.70E-04	13
N105	N-EICOSANE	163,512	12,358	151,154	0%	151,154	7.70E-04	116
N106	N-HEXACOSANE	17,892	4,347	13,545	65%	4,741	1.50E-05	0
N107	N-HEXADECANE	78,453	26,293	52,160	0%	52,160	7.70E-04	40
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	1.50E-05	0
N115	N-OCTADECANE	66,428	11,822	54,606	0%	54,606	7.70E-04	42
N116	N-TETRACOSANE	15,405	8,707	6,698	65%	2,344	1.50E-05	0
N117	N-TETRADECANE	112,217	23,201	89,016	0%	89,016	7.70E-04	69
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	1.50E-05	0
T55	NAPHTHALENE	38,713	18,835	19,878	0%	19,878	2.70E-03	54
NI	NICKEL	14,777	10,266	4,511	52%	2,165	6.30E-03	14
N119	O+P XYLENE	10,774	9,979	795	0%	795	1.50E-03	1
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,180,786	20,692,906	87%	2,690,078	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	6.00E-04	0
N126	P-CYMENE	57,874	57,874	0	99%	0	7.70E-03	0
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	5.30E-02	0
T65	PHENOL	13,649	13,649	0	95%	0	5.00E-03	0
SE	SELENIUM	99	99	0	34%	0	2.00E-01	0
AG	SILVER	4,560	4,087	473	80%	95	8.30E+00	785
T85	TETRACHLOROETHENE	42,026	20,782	21,244	0%	21,244	1.30E-01	2,762
TL	THALLIUM	0	0	0	28%	0	2.50E-02	0
SN	TIN	5,760	900	4,861	65%	1,701	5.40E-02	92
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	5.20E-03	8
T86	TOLUENE	72,921	59,128	13,792	0%	13,792	1.00E-03	14
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,086,442	6,410,230	71%	1,858,967	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,414,527	10,827,501	65%	3,789,625	1.80E-02	68,213
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	1.40E-03	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	3.70E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	1.10E-01	1
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	58,577	135,593	77%	31,186	9.10E-03	284
	Totals	**575,722,778**	**417,851,812**	**157,870,966**		**27,308,247**		**96,501**

Source: Development Document (EPA, 1997a).

Table C-5
Industry Loads and Removals by Pollutant
COMBO Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Pollutant Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	7.70E-04	19
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	2.50E+01	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	4.80E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	3.20E-03	2
N42	2-PROPANONE	160,369	160,369	0	84%	0	2.90E-04	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	7.70E-04	1
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	5.80E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1.80E-04	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	1.10E-02	257
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	7.20E-02	259
AS	ARSENIC	13,013	13,012	1	40%	0	5.70E+01	20
BA	BARIUM	71,391	57,034	14,356	35%	9,332	1.00E-03	9
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	5.80E-05	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	1.00E-03	0
BE	BERYLLIUM	31	31	0	61%	0	1.30E+02	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	5.70E-01	11,007
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,935,931	6,324,628	91%	569,217	0.00E+00	0
B	BORON	34,470	33,931	539	14%	463	3.20E-02	15
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	3.80E-03	5
CD	CADMIUM	5,561	3,565	1,997	91%	180	9.10E-01	164
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,256,521	80,941,404	82%	14,569,453	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,874	839	0%	839	1.50E-03	1
T23	CHLOROFORM	125,352	125,352	0	0%	0	1.80E-01	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	4.80E-03	2
CO	COBALT	5,264	3,850	1,414	4%	1,358	2.00E-02	27
CU	COPPER	122,556	86,855	35,701	84%	5,712	8.30E-02	474
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	2.00E-03	1
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.70E-02	38
T38	ETHYLBENZENE	44,621	20,293	24,327	0%	24,327	3.20E-04	8
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	6.10E-05	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	1.00E-03	68
T54	ISOPHORONE	4,504	4,504	0	62%	0	2.80E-02	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	3.10E-01	997
N95	M-XYLENE	21,366	19,868	1,498	0%	1,498	2.60E-04	0
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1.00E-02	66
HG	MERCURY	174	156	18	0%	18	8.30E+01	1,472
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	3.70E-01	1,412
MO	MOLYBDENUM	9,810	9,810	0	52%	0	3.60E-02	0
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	7.70E-04	242
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	1.50E-05	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	7.70E-04	13
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	7.70E-04	115
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	1.50E-05	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	7.70E-04	39
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	1.50E-05	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	7.70E-04	40
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	1.50E-05	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	7.70E-04	68
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	1.50E-05	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	2.70E-03	50
NI	NICKEL	14,777	10,629	4,148	52%	1,991	6.30E-03	13
N119	O+P XYLENE	10,774	10,379	395	0%	395	1.50E-03	1
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	6.00E-04	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	7.70E-03	3
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	5.30E-02	0
T65	PHENOL	13,649	13,637	12	95%	1	5.00E-03	0
SE	SELENIUM	99	99	0	34%	0	2.00E-01	0
AG	SILVER	4,560	4,087	472	80%	94	8.30E+00	784
T85	TETRACHLOROETHENE	42,026	21,005	21,021	0%	21,021	1.30E-01	2,733
TL	THALLIUM	0	0	0	28%	0	2.50E-02	0
SN	TIN	5,760	4,779	981	65%	343	5.40E-02	19
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	5.20E-03	8
T86	TOLUENE	72,921	59,200	13,721	0%	13,721	1.00E-03	14
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,088,883	6,407,789	71%	1,858,259	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	1.80E-02	66,753
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	1.40E-03	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	3.70E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	1.10E-01	1
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	9.10E-03	176
	Totals	**575,722,778**	**419,052,398**	**156,670,380**		**27,028,386**		**87,394**

Source: Development Document (EPA, 1997a).

Table C-6
Industry Loads and Removals by Pollutant
DAF Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Pollutant Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	3,489	52,970	0%	52,970	7.70E-04	41
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	2.50E+01	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	4.80E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	3.20E-03	2
N42	2-PROPANONE	160,369	160,369	0	84%	0	2.90E-04	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	7.70E-04	1
N54	4-METHYL-2-PENTANONE	19,278	19,076	202	0%	202	5.80E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1.80E-04	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	1.10E-02	257
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	7.20E-02	259
AS	ARSENIC	13,013	13,012	1	40%	0	5.70E+01	20
BA	BARIUM	71,391	43,646	27,745	35%	18,034	1.00E-03	18
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	5.80E-05	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	1.00E-03	0
BE	BERYLLIUM	31	31	0	61%	0	1.30E+02	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	5.70E-01	11,007
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,879,999	6,380,560	91%	574,250	0.00E+00	0
B	BORON	34,470	33,931	539	14%	463	3.20E-02	15
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	3.80E-03	5
CD	CADMIUM	5,561	3,565	1,997	91%	180	9.10E-01	164
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	178,964,957	86,232,967	82%	15,521,934	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,740	974	0%	974	1.50E-03	1
T23	CHLOROFORM	125,352	125,352	0	0%	0	1.80E-01	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	4.80E-03	2
CO	COBALT	5,264	3,850	1,414	4%	1,358	2.00E-02	27
CU	COPPER	122,556	86,855	35,701	84%	5,712	8.30E-02	474
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	2.00E-03	1
T69	DI-N-OCTYL PHTHALATE	11,339	9,591	1,748	0%	1,748	2.70E-02	47
T38	ETHYLBENZENE	44,621	6,559	38,062	0%	38,062	3.20E-04	12
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	6.10E-05	0
FE	IRON	1,111,476	621,491	489,985	83%	83,297	1.00E-03	83
T54	ISOPHORONE	4,504	4,504	0	62%	0	2.80E-02	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	3.10E-01	997
N95	M-XYLENE	21,366	19,497	1,869	0%	1,869	2.60E-04	0
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1.00E-02	66
HG	MERCURY	174	156	18	0%	18	8.30E+01	1,472
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	3.70E-01	1,412
MO	MOLYBDENUM	9,810	8,997	813	52%	390	3.60E-02	14
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	7.70E-04	242
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	1.50E-05	0
N104	N-DODECANE	172,443	59,948	112,495	0%	112,495	7.70E-04	87
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	7.70E-04	115
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	1.50E-05	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	7.70E-04	39
N114	N-OCTACOSANE	11,308	3,366	7,943	65%	2,780	1.50E-05	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	7.70E-04	40
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	1.50E-05	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	7.70E-04	68
N118	N-TRIACONTANE	14,897	7,273	7,625	65%	2,669	1.50E-05	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	2.70E-03	50
NI	NICKEL	14,777	10,629	4,148	52%	1,991	6.30E-03	13
N119	O+P XYLENE	10,774	10,379	395	0%	395	1.50E-03	1
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	6.00E-04	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	7.70E-03	3
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	5.30E-02	0
T65	PHENOL	13,649	13,637	12	95%	1	5.00E-03	0
SE	SELENIUM	99	99	0	34%	0	2.00E-01	0
AG	SILVER	4,560	4,069	490	80%	98	8.30E+00	814
T85	TETRACHLOROETHENE	42,026	20,463	21,563	0%	21,563	1.30E-01	2,803
TL	THALLIUM	0	0	0	28%	0	2.50E-02	0
SN	TIN	5,760	4,779	981	65%	343	5.40E-02	19
TI	TITANIUM	13,986	8,858	5,128	69%	1,590	5.20E-03	8
T86	TOLUENE	72,921	51,663	21,258	0%	21,258	1.00E-03	21
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	73,470,522	7,026,150	71%	2,037,584	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	1.80E-02	66,753
TS	TOTAL SUSPENDED SOLIDS	62,793,110	29,721,017	33,072,094	91%	2,976,488	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	1.40E-03	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	3.70E-02	0
V	VANADIUM	1,658	1,619	40	42%	23	1.10E-01	3
Y	YTTRIUM	648	643	5	58%	2	0.00E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	9.10E-03	176
	Totals	**575,722,778**	**410,439,304**	**165,283,474**		**28,552,783**		**87,652**

Source: Development Document (EPA, 1997a).

APPENDIX D

COST-EFFECTIVENESS ANALYSIS RESULTS ASSUMING A TOXIC WEIGHTING FACTOR FOR TPH OF ZERO

APPENDIX D

COST-EFFECTIVENESS ANALYSIS RESULTS ASSUMING A TOXIC WEIGHTING FACTOR FOR TPH OF ZERO

Table D-1 presents the results of the cost-effectiveness analysis had EPA not developed a TWF for TPH. As the table shows, the incremental cost-effectiveness of the CP option is $1,660, and the average is $2,664. Tables D-2 through D-5 provide the detailed supporting data.

TABLE D-1

COST-EFFECTIVENESS RESULTS FOR POLLUTION CONTROL OPTIONS

Option	Total Annual		Incremental		Incremental Cost Effectiveness ($1981) ($/lb. equiv.)	Average Cost Effectiveness ($1981) ($/lb. equiv.)
	Pound Equivalents Removed (lbs.)	Cost ($1981)	Pound Equivalents Removed (lbs.)	Cost ($1981)		
OC	5,278	$40,324,395	5,278	40,324,395	$7,640	$7,640
CP	31,425	$83,716,102	26,147	43,391,707	$1,660	$2,664
COMBO	34,285	$89,066,549	2,860	5,350,447	$1,871	$2,598
DAF	35,366	$108,513,611	1,081	19,447,063	$17,996	$3,068

Table D-2
Industry Loads and Removals by Pollutant
OC Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	45,282	11,176	0%	11,176	4.30E-03	48
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	16,645	12,000	0%	12,000	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	3,049	6,230	28%	4,486	1.80E-02	81
N42	2-PROPANONE	160,369	80,343	80,026	84%	12,804	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	12,774	0	63%	0	4.30E-03	0
N54	4-METHYL-2-PENTANONE	19,278	13,376	5,902	0%	5,902	1.20E-04	1
N58	ALPHA-TERPINEOL	12,512	6,820	5,691	0%	5,691	1.00E-03	6
AL	ALUMINUM	673,267	673,267	0	88%	0	6.40E-02	0
SB	ANTIMONY	32,101	32,101	0	72%	0	1.90E-01	0
AS	ARSENIC	13,013	13,013	0	40%	0	4.00E+00	0
BA	BARIUM	71,391	71,391	0	35%	0	2.00E-03	0
N64	BENZOIC ACID	78,273	78,273	0	81%	0	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5.30E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	133,020	0	60%	0	1.10E-01	0
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	113,260,559	0	91%	0	0.00E+00	0
B	BORON	34,470	34,470	0	14%	0	1.80E-01	0
T67	BUTYL BENZYL PHTHALATE	30,064	17,432	12,632	86%	1,768	2.30E-02	41
CD	CADMIUM	5,561	5,561	0	91%	0	5.20E+00	0
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	265,197,924	0	82%	0	0.00E+00	0
T7	CHLOROBENZENE	2,714	897	1,816	0%	1,816	2.90E-03	5
T23	CHLOROFORM	125,352	129,011	(3,659)	0%	(3,659)	2.10E-03	(8)
CR	CHROMIUM	14,533	14,533	0	91%	0	2.70E-02	0
CO	COBALT	5,264	5,264	0	4%	0	1.10E-01	0
CU	COPPER	122,556	122,556	0	84%	0	4.70E-01	0
T68	DI-N-BUTYL PHTHALATE	10,143	10,143	0	75%	0	1.20E-02	0
T69	DI-N-OCTYL PHTHALATE	11,339	11,339	0	0%	0	2.20E-01	0
T38	ETHYLBENZENE	44,621	14,363	30,258	0%	30,258	1.40E-03	42
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	1,111,476	0	83%	0	5.60E-03	0
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	73,452	0	92%	0	1.80E+00	0
N95	M-XYLENE	21,366	14,595	6,770	0%	6,770	1.50E-03	10
MN	MANGANESE	23,929	23,929	0	41%	0	1.40E-02	0
HG	MERCURY	174	174	0	0%	0	5.00E+02	0
T44	METHYLENE CHLORIDE	35,480	16,778	18,701	0%	18,701	4.20E-04	8
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	417,706	269,217	0%	269,217	4.30E-03	1,158
N103	N-DOCOSANE	12,325	12,325	0	65%	0	8.20E-05	0
N104	N-DODECANE	172,443	82,141	90,302	0%	90,302	4.30E-03	388
N105	N-EICOSANE	163,512	163,512	0	0%	0	4.30E-03	0
N106	N-HEXACOSANE	17,892	10,905	6,987	65%	2,445	8.20E-05	0
N107	N-HEXADECANE	78,453	78,453	0	0%	0	4.30E-03	0
N114	N-OCTACOSANE	11,308	8,100	3,209	65%	1,123	8.20E-05	0
N115	N-OCTADECANE	66,428	66,428	0	0%	0	4.30E-03	0
N116	N-TETRACOSANE	15,405	15,405	0	65%	0	8.20E-05	0
N117	N-TETRADECANE	112,217	112,217	0	0%	0	4.30E-03	0
N118	N-TRIACONTANE	14,897	10,494	4,403	65%	1,541	8.20E-05	0
T55	NAPHTHALENE	38,713	18,592	20,121	0%	20,121	1.50E-02	302
NI	NICKEL	14,777	14,777	0	52%	0	3.60E-02	0
N119	O+P XYLENE	10,774	7,906	2,868	0%	2,868	8.50E-03	24
HEM	OIL AND GREASE (AS HEM)	35,873,692	35,873,692	0	87%	0	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	19,102	38,772	99%	388	4.30E-02	17
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,649	0	95%	0	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,560	0	80%	0	4.70E+01	0
T85	TETRACHLOROETHENE	42,026	3,817	38,209	0%	38,209	7.40E-02	2,827
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	5,760	0	65%	0	3.00E-01	0
TI	TITANIUM	13,986	13,986	0	69%	0	2.90E-02	0
T86	TOLUENE	72,921	42,062	30,858	0%	30,858	5.60E-03	173
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	80,496,673	0	71%	0	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	13,242,028	0	65%	0	0.00E+00	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	62,793,110	0	91%	0	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	933	2,976	0%	2,976	9.30E-05	0
T87	TRICHLOROETHENE	3,334	892	2,443	0%	2,443	6.30E-02	154
V	VANADIUM	1,658	1,658	0	42%	0	6.20E-01	0
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	194,171	0	77%	0	5.10E-02	0
	Totals	**575,722,778**	**575,024,870**	**697,908**		**570,205**		**5,278**

Source: Development Document.

Table D-3
Industry Loads and Removals by Pollutant
CP Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	4.30E-03	107
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	3,080	6,199	28%	4,463	1.80E-02	80
N42	2-PROPANONE	160,369	160,369	0	84%	0	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	3,513	9,261	63%	3,427	4.30E-03	15
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	1.20E-04	0
N58	ALPHA-TERPINEOL	12,512	12,512	0	0%	0	1.00E-03	0
AL	ALUMINUM	673,267	413,096	260,172	88%	31,221	6.40E-02	1,998
SB	ANTIMONY	32,101	16,110	15,991	72%	4,477	1.90E-01	851
AS	ARSENIC	13,013	13,011	2	40%	1	4.00E+00	4
BA	BARIUM	71,391	57,034	14,356	35%	9,332	2.00E-03	19
N64	BENZOIC ACID	78,273	78,273	0	81%	0	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	30	0	61%	0	5.30E+00	1
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	82,027	50,993	60%	20,397	1.10E-01	2,244
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,929,464	6,331,095	91%	569,799	0.00E+00	0
B	BORON	34,470	29,154	5,316	14%	4,571	1.80E-01	823
T67	BUTYL BENZYL PHTHALATE	30,064	14,524	15,540	86%	2,176	2.30E-02	50
CD	CADMIUM	5,561	2,977	2,584	91%	233	5.20E+00	1,209
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,207,948	80,989,976	82%	14,578,196	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,863	851	0%	851	2.90E-03	2
T23	CHLOROFORM	125,352	125,351	1	0%	1	2.10E-03	0
CR	CHROMIUM	14,533	8,989	5,544	91%	499	2.70E-02	13
CO	COBALT	5,264	3,539	1,725	4%	1,656	1.10E-01	182
CU	COPPER	122,556	60,664	61,892	84%	9,903	4.70E-01	4,654
T68	DI-N-BUTYL PHTHALATE	10,143	5,676	4,467	75%	1,117	1.20E-02	13
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.20E-01	306
T38	ETHYLBENZENE	44,621	20,292	24,329	0%	24,329	1.40E-03	34
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	5.60E-03	380
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	27,159	46,293	92%	3,703	1.80E+00	6,666
N95	M-XYLENE	21,366	19,692	1,674	0%	1,674	1.50E-03	3
MN	MANGANESE	23,929	10,719	13,210	41%	7,794	1.40E-02	109
HG	MERCURY	174	174	0	0%	0	5.00E+02	0
T44	METHYLENE CHLORIDE	35,480	11,824	23,656	0%	23,656	4.20E-04	10
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	346,103	340,821	0%	340,821	4.30E-03	1,466
N103	N-DOCOSANE	12,325	5,804	6,521	65%	2,282	8.20E-05	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	4.30E-03	71
N105	N-EICOSANE	163,512	12,358	151,154	0%	151,154	4.30E-03	650
N106	N-HEXACOSANE	17,892	4,347	13,545	65%	4,741	8.20E-05	0
N107	N-HEXADECANE	78,453	26,293	52,160	0%	52,160	4.30E-03	224
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	8.20E-05	0
N115	N-OCTADECANE	66,428	11,822	54,606	0%	54,606	4.30E-03	235
N116	N-TETRACOSANE	15,405	8,707	6,698	65%	2,344	8.20E-05	0
N117	N-TETRADECANE	112,217	23,201	89,016	0%	89,016	4.30E-03	383
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	8.20E-05	0
T55	NAPHTHALENE	38,713	18,835	19,878	0%	19,878	1.50E-02	298
NI	NICKEL	14,777	10,266	4,511	52%	2,165	3.60E-02	78
N119	O+P XYLENE	10,774	9,979	795	0%	795	8.50E-03	7
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,180,786	20,692,906	87%	2,690,078	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	57,874	0	99%	0	4.30E-02	0
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,649	0	95%	0	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,087	473	80%	95	4.70E+01	4,443
T85	TETRACHLOROETHENE	42,026	20,782	21,244	0%	21,244	7.40E-02	1,572
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	900	4,861	65%	1,701	3.00E-01	510
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	2.90E-02	42
T86	TOLUENE	72,921	59,128	13,792	0%	13,792	5.60E-03	77
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,086,442	6,410,230	71%	1,858,967	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,414,527	10,827,501	65%	3,789,625	0.00E+00	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9.30E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6.30E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	6.20E-01	5
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	58,577	135,593	77%	31,186	5.10E-02	1,591
	Totals	575,722,778	417,851,812	157,870,966		27,308,247		31,425

Source: Development Document.

Table D-4
Industry Loads and Removals by Pollutant
COMBO Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	31,647	24,811	0%	24,811	4.30E-03	107
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	1.80E-02	13
N42	2-PROPANONE	160,369	160,369	0	84%	0	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	4.30E-03	3
N54	4-METHYL-2-PENTANONE	19,278	19,278	0	0%	0	1.20E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1.00E-03	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	6.40E-02	1,498
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	1.90E-01	685
AS	ARSENIC	13,013	13,012	1	40%	0	4.00E+00	1
BA	BARIUM	71,391	57,034	14,356	35%	9,332	2.00E-03	19
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5.30E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	1.10E-01	2,124
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,935,931	6,324,628	91%	569,217	0.00E+00	0
B	BORON	34,470	33,931	539	14%	463	1.80E-01	83
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	2.30E-02	31
CD	CADMIUM	5,561	3,565	1,997	91%	180	5.20E+00	934
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	184,256,521	80,941,404	82%	14,569,453	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,874	839	0%	839	2.90E-03	2
T23	CHLOROFORM	125,352	125,352	0	0%	0	2.10E-03	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	2.70E-02	9
CO	COBALT	5,264	3,850	1,414	4%	1,358	1.10E-01	149
CU	COPPER	122,556	86,855	35,701	84%	5,712	4.70E-01	2,685
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	1.20E-02	6
T69	DI-N-OCTYL PHTHALATE	11,339	9,949	1,389	0%	1,389	2.20E-01	306
T38	ETHYLBENZENE	44,621	20,293	24,327	0%	24,327	1.40E-03	34
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	712,723	398,753	83%	67,788	5.60E-03	380
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	1.80E+00	5,790
N95	M-XYLENE	21,366	19,868	1,498	0%	1,498	1.50E-03	2
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1.40E-02	93
HG	MERCURY	174	156	18	0%	18	5.00E+02	8,866
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	4.20E-04	2
MO	MOLYBDENUM	9,810	9,810	0	52%	0	2.00E-01	0
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	4.30E-03	1,351
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	8.20E-05	0
N104	N-DODECANE	172,443	156,037	16,406	0%	16,406	4.30E-03	71
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	4.30E-03	640
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	8.20E-05	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	4.30E-03	219
N114	N-OCTACOSANE	11,308	3,816	7,493	65%	2,623	8.20E-05	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	4.30E-03	222
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	8.20E-05	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	4.30E-03	378
N118	N-TRIACONTANE	14,897	7,541	7,356	65%	2,574	8.20E-05	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	1.50E-02	279
NI	NICKEL	14,777	10,629	4,148	52%	1,991	3.60E-02	72
N119	O+P XYLENE	10,774	10,379	395	0%	395	8.50E-03	3
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	4.30E-02	15
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,637	12	95%	1	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,087	472	80%	94	4.70E+01	4,441
T85	TETRACHLOROETHENE	42,026	21,005	21,021	0%	21,021	7.40E-02	1,556
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	4,779	981	65%	343	3.00E-01	103
TI	TITANIUM	13,986	9,326	4,660	69%	1,445	2.90E-02	42
T86	TOLUENE	72,921	59,200	13,721	0%	13,721	5.60E-03	77
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	74,088,883	6,407,789	71%	1,858,259	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	0.00E+00	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	32,114,458	30,678,652	91%	2,761,079	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9.30E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6.30E-02	0
V	VANADIUM	1,658	1,644	14	42%	8	6.20E-01	5
Y	YTTRIUM	648	648	0	58%	0	0.00E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	5.10E-02	989
	Totals	**575,722,778**	**419,052,398**	**156,670,380**		**27,028,386**		**34,285**

Source: Development Document.

Table D-5
Industry Loads and Removals by Pollutant
DAF Option

Pollutant Code	Analyte	Industry Baseline Load (lb/yr)	Industry Treated Load (lb/yr)	Removals (lbs/yr)	POTW Removal Efficiency (%)	Removals After POTW (lbs/yr)	Toxic Weighting Factor	PE Removal
T11	1,1,1-TRICHLOROETHANE	56,458	3,489	52,970	0%	52,970	4.30E-03	228
T37	1,2-DIPHENYLHYDRAZINE	0	0	0	62%	0	1.20E+00	0
N34	2-BUTANONE	28,645	28,645	0	0%	0	2.20E-05	0
N38	2-METHYLNAPHTHALENE	9,280	8,274	1,006	28%	724	1.80E-02	13
N42	2-PROPANONE	160,369	160,369	0	84%	0	7.60E-06	0
T22	4-CHLORO-3-METHYLPHENOL	12,774	10,714	2,061	63%	762	4.30E-03	3
N54	4-METHYL-2-PENTANONE	19,278	19,076	202	0%	202	1.20E-04	0
N58	ALPHA-TERPINEOL	12,512	12,485	26	0%	26	1.00E-03	0
AL	ALUMINUM	673,267	478,212	195,056	88%	23,407	6.40E-02	1,498
SB	ANTIMONY	32,101	19,230	12,871	72%	3,604	1.90E-01	685
AS	ARSENIC	13,013	13,012	1	40%	0	4.00E+00	1
BA	BARIUM	71,391	43,646	27,745	35%	18,034	2.00E-03	36
N64	BENZOIC ACID	78,273	76,861	1,412	81%	268	3.30E-04	0
N66	BENZYL ALCOHOL	32,522	32,522	0	0%	0	5.60E-03	0
BE	BERYLLIUM	31	31	0	61%	0	5.30E+00	0
T66	BIS(2-ETHYLHEXYL) PHTHALATE	133,020	84,742	48,278	60%	19,311	1.10E-01	2,124
BOD	BOD 5-DAY (CARBONACEOUS)	113,260,559	106,879,999	6,380,560	91%	574,250	0.00E+00	0
B	BORON	34,470	33,931	539	14%	463	1.80E-01	83
T67	BUTYL BENZYL PHTHALATE	30,064	20,325	9,739	86%	1,363	2.30E-02	31
CD	CADMIUM	5,561	3,565	1,997	91%	180	5.20E+00	934
COD	CHEMICAL OXYGEN DEMAND (COD)	265,197,924	178,964,957	86,232,967	82%	15,521,934	0.00E+00	0
T7	CHLOROBENZENE	2,714	1,740	974	0%	974	2.90E-03	3
T23	CHLOROFORM	125,352	125,352	0	0%	0	2.10E-03	0
CR	CHROMIUM	14,533	10,906	3,627	91%	326	2.70E-02	9
CO	COBALT	5,264	3,850	1,414	4%	1,358	1.10E-01	149
CU	COPPER	122,556	86,855	35,701	84%	5,712	4.70E-01	2,685
T68	DI-N-BUTYL PHTHALATE	10,143	8,140	2,003	75%	501	1.20E-02	6
T69	DI-N-OCTYL PHTHALATE	11,339	9,591	1,748	0%	1,748	2.20E-01	385
T38	ETHYLBENZENE	44,621	6,559	38,062	0%	38,062	1.40E-03	53
N90	HEXANOIC ACID	8,389	8,389	0	0%	0	3.40E-04	0
FE	IRON	1,111,476	621,491	489,985	83%	83,297	5.60E-03	466
T54	ISOPHORONE	4,504	4,504	0	62%	0	7.30E-04	0
PB	LEAD	73,452	33,242	40,210	92%	3,217	1.80E+00	5,790
N95	M-XYLENE	21,366	19,497	1,869	0%	1,869	1.50E-03	3
MN	MANGANESE	23,929	12,683	11,245	41%	6,635	1.40E-02	93
HG	MERCURY	174	156	18	0%	18	5.00E+02	8,866
T44	METHYLENE CHLORIDE	35,480	31,665	3,815	0%	3,815	4.20E-04	2
MO	MOLYBDENUM	9,810	8,997	813	52%	390	2.00E-01	78
N102	N-DECANE	686,923	372,763	314,161	0%	314,161	4.30E-03	1,351
N103	N-DOCOSANE	12,325	6,740	5,585	65%	1,955	8.20E-05	0
N104	N-DODECANE	172,443	59,948	112,495	0%	112,495	4.30E-03	484
N105	N-EICOSANE	163,512	14,750	148,762	0%	148,762	4.30E-03	640
N106	N-HEXACOSANE	17,892	4,720	13,172	65%	4,610	8.20E-05	0
N107	N-HEXADECANE	78,453	27,414	51,039	0%	51,039	4.30E-03	219
N114	N-OCTACOSANE	11,308	3,366	7,943	65%	2,780	8.20E-05	0
N115	N-OCTADECANE	66,428	14,778	51,649	0%	51,649	4.30E-03	222
N116	N-TETRACOSANE	15,405	9,537	5,869	65%	2,054	8.20E-05	0
N117	N-TETRADECANE	112,217	24,343	87,873	0%	87,873	4.30E-03	378
N118	N-TRIACONTANE	14,897	7,273	7,625	65%	2,669	8.20E-05	0
T55	NAPHTHALENE	38,713	20,132	18,580	0%	18,580	1.50E-02	279
NI	NICKEL	14,777	10,629	4,148	52%	1,991	3.60E-02	72
N119	O+P XYLENE	10,774	10,379	395	0%	395	8.50E-03	3
HEM	OIL AND GREASE (AS HEM)	35,873,692	15,880,079	19,993,613	87%	2,599,170	0.00E+00	0
N125	P-CRESOL	0	0	0	72%	0	2.40E-03	0
N126	P-CYMENE	57,874	23,954	33,920	99%	339	4.30E-02	15
N130	PENTAMETHYLBENZENE	0	0	0	91%	0	2.90E-01	0
T65	PHENOL	13,649	13,637	12	95%	1	2.80E-02	0
SE	SELENIUM	99	99	0	34%	0	1.10E+00	0
AG	SILVER	4,560	4,069	490	80%	98	4.70E+01	4,610
T85	TETRACHLOROETHENE	42,026	20,463	21,563	0%	21,563	7.40E-02	1,596
TL	THALLIUM	0	0	0	28%	0	1.40E-01	0
SN	TIN	5,760	4,779	981	65%	343	3.00E-01	103
TI	TITANIUM	13,986	8,858	5,128	69%	1,590	2.90E-02	46
T86	TOLUENE	72,921	51,663	21,258	0%	21,258	5.60E-03	119
TOC	TOTAL ORGANIC CARBON (TOC)	80,496,673	73,470,522	7,026,150	71%	2,037,584	0.00E+00	0
SHEM	TOTAL PETROLEUM HYDROCARBON (AS SG	13,242,028	2,646,314	10,595,713	65%	3,708,500	0.00E+00	0
TS	TOTAL SUSPENDED SOLIDS	62,793,110	29,721,017	33,072,094	91%	2,976,488	0.00E+00	0
T30	TRANS-1,2-DICHLOROETHENE	3,909	3,909	0	0%	0	9.30E-05	0
T87	TRICHLOROETHENE	3,334	3,334	0	0%	0	6.30E-02	0
V	VANADIUM	1,658	1,619	40	42%	23	6.20E-01	14
Y	YTTRIUM	648	643	5	58%	2	0.00E+00	0
ZN	ZINC	194,171	109,873	84,297	77%	19,388	5.10E-02	989
	Totals	575,722,778	410,439,304	165,283,474		28,552,783		35,366

Source: Development Document.

APPENDIX E

COMPARISON OF AVERAGE COST-EFFECTIVENESS OF PROPOSED AND ALTERNATIVE EXCLUSION CUTOFFS UNDER THE CP OPTION

APPENDIX E

COMPARISON OF AVERAGE COST-EFFECTIVENESS OF PROPOSED AND ALTERNATIVE EXCLUSION CUTOFFS UNDER THE CP OPTION

As discussed in the Economic Assessment report (U.S. EPA, 1997b), EPA is proposing to exclude from coverage by the IL Standards small facilities that launder less than 1 million pounds of incoming laundry per calendar year and less than 255,000 pounds of shop towels and/or printer towels/rags per calendar year. EPA also looked at a number of additional alternative exclusion cutoffs (see Appendix E of the Economic Assessment report). This Appendix compares the average cost-effectiveness of the proposed cutoff, as described in Section Three of this report, to two of the alternative exclusion cutoffs: a cutoff at 3 million pounds of laundry per year and a cutoff at 5 million pounds of laundry per year (with neither alternative considering any cutoff of shop towels or printer towels/rags). The results of this comparison of average cost-effectiveness results can be seen in Table E-1. As the table shows, the average cost-effectiveness of the option with the cutoff as proposed is $206 per pound equivalent. In comparison, the 3 million pound cutoff would have an average cost-effectiveness of $164 per pound equivalent, and the 5 million pound cutoff would have an average cost-effectiveness of $128 per pound equivalent.

Table E-1

Comparison of Average Cost-Effectiveness of Proposed and Alternative Exclusion Cutoffs under the CP Option

Cutoff	Total Annual Cost ($1981)	Total Annual Pound Equivalent Removed (lbs.)	Average Cost Effectiveness ($1981) ($/lb.eq.)
Proposed	$83,716,102	407,358	$206
3 million pounds	$58,061,963	353,286	$164
5 million pounds	$33,579,859	262,943	$128