Environmental Assessment
for the
Final Effluent Limitations Guidelines,
Pretreatment Standards for New and Existing Sources and
New Source Performance Standards
for the Centralized Waste Treatment Point Source Category

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Executive Summary

This report assesses the water quality related benefits that would be expected from adoption by the U.S. Environmental Protection Agency (EPA) of final effluent limitations, guidelines and pretreatment standards for the Centralized Waste Treatment (CWT) Point Source Category. EPA estimates that under baseline conditions 205 CWT facilities discharge approximately 8.6 million lbs/year of metal and organic pollutants. The final rule, in EPA's assessment, will reduce this pollutant loading by 50%, to 4.3 million lbs/year (see Table ES-1).

Summary of Non-Scaled Environmental Effects

(a) Ambient Water Quality Effects

EPA analyzed the environmental effects associated with discharges from 113 of the 205 CWT facilities. The analysis compared modeled instream pollutant levels to Ambient Water Quality Criteria (AWQC). This review found estimates that current discharge loadings contribute to in-stream concentrations in excess of AWQCs in 252 cases at 43 receiving water locations. The final rule would reduce the number of in-stream concentrations exceeding AWQCs to 156 at 38 receiving water locations.

(b) Human Health Effects

EPA estimates that CWT loadings from the 113 CWT facilities are responsible for 0.18 cancer cases per year. The final rule would reduce this to 0.14 cases per year. In addition, the rule reduces lead exposure and related health effects for an estimated 101,000 persons. EPA estimates the final rule will reduce lead uptake enough to prevent the IQ loss of 60 points in children of recreational and subsistent anglers. EPA also estimates that the IQs of 0.2 angler children would not drop below 70.

(c) POTW Effects

EPA estimates that six of the 69 Publically Owned Treatment Works (POTWs) considered for this assessment experience inhibition problems due to CWT wastes. The final rule would decrease this number by two. The final rule will also improve biosolids quality of 3,900 metric tons.

(d) Basis of Conclusions

The report bases its conclusion about these benefits on site-specific analyses of current conditions and the expected changes from compliance with the final CWT Best Available Technology (BAT) economically achievable effluent limitations and Pretreatment Standards for Existing Sources (PSES). The final regulations limits the discharges of pollutants into navigable waters of the United States and the introduction of pollutants into POTWs from existing sources and from new sources in three CWT subcategories. These categories are Metal-Bearing Waste Treatment and Recovery Operations (metals), Used/Waste Oil Treatment and Recovery Operations (oils), and Organic Waste Treatment (organics). Many CWT facilities treat or recover wastes in more than one category.[1]

Table ES-1. Summary of Non-Scaled Environmental Effects of 113 CWT Facilities [a]

	Current	Final Rule	Summary of Benefits of Final Rule
Loadings (million lbs/yr) [b, c]	8.6	4.3	50% reduction
Number of In-Stream Concentrations for Pollutants that Exceed AWQC	252 at 43 streams	156 at 38 streams	5 streams become "contaminant free" [e]
Additional Cancer Cases/yr [d]	0.18	0.14	0.04 cases reduced each year
Population potentially at risk to lead exposure [d]	101,000	101,000	Annual benefits are: • Reduction of 1.5 cases of hypertension • Protection of 60 IQ points • Prevention of lowering of 0.2 children's IQs below 70
Population potentially exposed to other non-cancer health risks [d]	1,880	none	Health effects to exposed population are completely reduced
POTWs experiencing inhibition	6 of 69	4 of 69	Potential inhibition eliminated at 2 POTWs
Improved Biosolid Quality	0 metric tons	3,900 metric tons	3,900 metric tons improved

a. Modeled results which are not scaled represent 12 direct and 101 indirect CWT waste water dischargers.
b. 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; conventional pollutants are not included in the analysis.
c. Loadings are scaled to represent all 205 facilities. Loadings account for POTW removals.
d. Through consumption of contaminated fish tissue.
e. "Contaminant free" from CWT discharges; however potential contamination from other point source discharges and non-point sources is still possible.

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[1] Many CWT facilities treat wastes from multiple subcategories. Therefore, EPA aggregated loadings from each subcategory to estimate the combined environmental effects of the final rule.

Final Treatment Options

EPA selected the treatment technologies which form the basis for the final rule from a larger set of technology options based on several criteria, including efficiency of pollutant removal and the economic achievability of these removals. Chapter 9 of the technical development document discusses the technology basis of each of the selected technologies for each of the final subcategories. Table ES-2 provides a summary of the technology basis for the final rule.

Table ES-2. Technology Basis for Selected Options

Metals Subcategory [a]		Oils Subcategory		Organics Subcategory
BPT / BCT /BAT / PSES / PSNS [b]	NSPS	BPT / BCT/BAT/ PSNS / NSPS	PSES	BPT / BCT / BAT / PSES /PSNS / NSPS
Option 4: Precipitation, liquid solid separation, secondary precipitation and sand filtration (sand filters for directs only).	**Option 3:** Selective metals precipitation, liquid-solid separation, secondary (sulfide) precipitation, liquid-solid tertiary precipitation, clarification.	**Option 9**: Emulsion breaking, gravity separation, secondary gravity separation and dissolved air flotation	**Option 8:** Emulsion breaking, gravity separation, and dissolved air flotation	**Option 4**: Equalization, and biological treatment

a. For facilities in the cyanide subset of the metals subcategory, the technology basis is alkaline chlorination at specific operating conditions.
b. Direct dischargers are covered by BPT / BAT. Indirect dischargers are covered by PSES

Modeling Techniques

EPA employed modeling techniques to assess the potential benefits of the final limitations and standards. First, EPA estimated pollutant concentrations in receiving water bodies for priority and nonconventional pollutants under current (baseline) and final treatment levels. Chapter 12 of the Technical Development Document explains more about these estimates. Second, EPA estimated water quality effects associated with direct and indirect discharges for the three subcategories of CWT facilities using stream dilution modeling.[2] EPA analyzed the effects from direct and indirect discharge operations separately. EPA had sufficient data to analyze water quality impacts for 113 of the 205 CWT facilities. Third, EPA combined the impacts for each of the subcategories to estimate water quality effects as a result of the rule.

EPA then analyzed benefits in terms of effects on aquatic life, human health, and POTW operations. EPA projected the benefits to aquatic life by comparing the modeled instream pollutant concentrations to EPA aquatic life criteria and toxicity values (acute and chronic ambient water quality criteria). EPA projected human health benefits by comparing estimated instream pollutant concentrations to health-based toxic effect values derived using standard EPA methodology (referred to as human health ambient water quality criteria). In addition, EPA projected potential carcinogenic and noncarcinogenic hazards to the recreational and subsistence angler populations due to the consumption of fish.

The environmental assessment also assesses the potential inhibition of POTW operations and potential sewage biosolids contamination (thereby, limiting its use for land application) based on current and final pretreatment levels. EPA estimated inhibition of POTW operations by comparing modeled POTW influent concentrations to available inhibition levels. EPA assessed the potential contamination of sewage biosolids is estimated by comparing projected pollutant concentrations in sewage biosolids to available EPA sewage biosolids regulatory standards.

Documented Impacts

The Environmental Assessment also summarizes documented environmental impacts on water quality and POTW operations from centralized waste treatment facilities. EPA based the summary data on information obtained from State 304(l) Short Lists and EPA Regional and State Pretreatment Coordinators on the quality of receiving waters and impacts on POTW facilities. Effects included seven cases of impairment to POTW operations due to cyanide, nitrate/nitrite, sodium, zinc, and ammonia, and one case of an effect on the quality of water due to organics. In addition, several states have identified four direct CWT facilities and eight POTWs, which receive discharges from 13 facilities as point sources causing water quality problems.

[2] The model employed was a simple dilution model that does not account for fate processes.

1. Introduction

This report presents the result of the water quality assessment performed by the U.S. Environmental Protection Agency (EPA) as part of its effort to develop effluent limitations guidelines and pretreatment standards for centralized waste treatment (CWT) facilities. EPA based effluent limitations guidelines and pretreatment standards upon the treatment technologies described below (see Table 1-1). The report also explains how EPA prepared its assessment.

Table. 1-1. Technology Basis for Selected Options

Metals Subcategory [a]		Oils Subcategory		Organics Subcategory
BPT / BCT /BAT / PSES / PSNS [b]	NSPS	BPT / BCT/BAT/ PSNS / NSPS	PSES	BPT / BCT / BAT / PSES /PSNS / NSPS
Option 4: Precipitation, liquid solid separation, secondary precipitation and sand filtration (sand filters for directs only).	**Option 3:** Selective metals precipitation, liquid-solid separation, secondary (sulfide) precipitation, liquid-solid tertiary precipitation, clarification.	**Option 9**: Emulsion breaking, gravity separation, secondary gravity separation and dissolved air flotation	**Option 8:** Emulsion breaking, gravity separation, and dissolved air flotation	**Option 4**: Equalization, and biological treatment

a. For facilities in the cyanide subset of the metals subcategory, the technology basis is alkaline chlorination at specific operating conditions.

b. Direct dischargers are covered by BPT / BAT. Indirect dischargers are covered by PSES.

EPA estimated the potential effects on aquatic life and human health resulting from exposure to effluent discharges from centralized waste treatment (CWT) facilities and from publicly owned treatment works (POTWs) which receive and treat waste from CWT facilities and then discharge to surface waters. EPA has also used the results of this assessment in the final economic analysis of the final CWT effluent guidelines. This report first projects effects associated with current (baseline) conditions and then evaluates potential effects expected from adoption of the final limitations and standards. Evaluations of the environmental benefit of meeting the final limits and standards are then presented.

EPA recognizes that its estimation of benefits is probably incomplete. At the present time, EPA cannot evaluate in a quantitative manner all human health and ecosystem benefits associated with water quality improvements. For example, the analyses have considered the effects of certain toxic pollutants but do not evaluate the effects of other pollutants (such as five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), and total suspended solids (TSS)), all of which may produce significant adverse environmental effects. Additionally, EPA has identified 205 CWT facilities, but because it lacks receiving stream flow information, EPA only modeled aquatic life and human health effects for 113 facilities.

With these limitations, EPA has analyzed the effects of current water discharges and assessed the benefits of reductions in these discharges resulting from this final rule. EPA evaluated water quality benefits of controlling the discharge from CWT facilities to surface waters and POTWs for direct and indirect dischargers located throughout the United States. CWT industry waste effluents contain pollutants that when discharged into freshwater and estuarine ecosystems may alter aquatic habitats, affect aquatic life, and adversely affect human health. In fact, all 104 pollutants included in this analysis (see Table 4-1) have at least one toxic effect. Each is a human health carcinogen and/or human health systemic toxicant or aquatic toxicant. Many of these pollutants are persistent and bioaccumulate in aquatic organisms. In addition, many of these pollutants may also adversely affect POTW operations and/or cause POTW sludge contamination. These effects are widely documented. For example, State 304(l) lists detail adverse effects on aquatic life, human health, and POTW operations.

EPA has organized this report into five sections. Section 2 describes the methodology EPA used to evaluate water quality effects from direct and indirect discharging facilities and effects on POTW operations from indirect discharging facilities. Section 3 describes the data sources used for evaluating water quality effects such as facility-specific data, POTW operational data, water quality criteria, and documented environmental impact data. Section 4 presents a summary of the results of this analysis. Section 5 provides a complete list of references cited. Appendices A through C provide additional detail on the specific information addressed in the main report.

2. Methodology

EPA evaluates potential water quality effects of direct discharges on receiving streams and of indirect discharges on POTW operations and their receiving streams using stream modeling techniques, as described in Sections 2.1.1 and 2.1.2. Direct discharge facilities are those which discharge directly into water bodies usually following on-site wastewater treatment. Indirect discharge facilities are those which discharge facility effluent into a publicly owned treatment works (POTWs), which provides subsequent treatment of the facility effluent.

EPA evaluated potential aquatic life and human health effects resulting from current and projected contaminant releases separately for the three final subcategories of CWT operations. The categories are as follows: Metal-Bearing Waste Treatment and Recovery Operations (metals), Used/Waste Oil Treatment and Recovery Operations (oils), and Organic Waste Treatment (organics). Many facilities fall into multiple subcategory combinations.[1] EPA also assessed the effects on POTWs that treat effluent from CWT facilities (Section 2.2). These effects may include biological upset of treatment processes and sewage biosolids toxicity.

EPA assessed potential effects on aquatic life by comparing modeled in-stream concentrations to EPA's aquatic life ambient water quality criteria (AWQCs). Where EPA has not developed water quality criteria, EPA uses other values representative of that chemical's aquatic toxicity. The Agency compares modeled in-stream concentrations to both acute and chronic AWQCs when available.

EPA estimates potential effects on human health in the following manner. EPA first compares modeled in-stream contaminant concentrations for each facility by subcategory under baseline conditions and for the final limitations and standards. EPA compares these instream concentrations to health-based toxic effect values derived using standard EPA methodology. Next, EPA estimates potential carcinogenic risks and noncarcinogenic hazards to the recreational and subsistence angler populations and their households due to the consumption of contaminated fish. EPA also estimates exposure to contaminants through the water

[1] Many CWT facilities treat wastes from multiple subcategories. Therefore, EPA aggregated loadings from each subcategory to estimate the combined environmental effects of the final rule.

pathway by comparing modeled in-stream contaminant concentrations to health-based AWQCs for the ingestion of water and organisms.

2.1 Estimating In-Stream Concentrations

EPA estimates in-stream contaminant concentrations for various flow conditions as the first step in evaluating effects on aquatic life and human health. EPA uses treatment data collected from industry and EPA sampling data to estimate contaminant loadings discharged at each facility under baseline conditions and under the final rule. Chapter 12 of the final technical development document (EPA 821-R-00-023) for the final rule explains the methodology EPA used to estimate current and post-compliance pollutant loadings. The following subsections describe the methodology and assumptions EPA uses to evaluate effects of direct and indirect discharging facilities on human health and aquatic life.

2.1.1 Direct Discharge Facilities

EPA projects in-stream concentrations for current and final rule BPT/BAT treatment levels using a simple stream dilution model that does not account for fate and transport processes (see Equation 1).[2]

$$C_{is} = \frac{L/OD}{FF+SF} \times CF \qquad \textbf{(1)}$$

where:

C_{is}	=	in stream pollutant concentration (µg/L);
L	=	facility pollutant loading (lb/year);
OD	=	facility operation (days/year);
FF	=	facility flow (million gallons per day (MGD));
SF	=	receiving stream flow (MGD); and
CF	=	conversion factor 120 (µg MG / L lbs) = 0.2642 (gal/L) x 0.4536 (kg/lbs) x 10^3 (µg MG / kg gal).

[2] Equations used to estimate instream concentrations are adapted from methodology presented in "*Technical Support Document for Water Quality-Based Toxics Control*, EPA, March 1991.

EPA obtains the facility-specific data (i.e., pollutant loading, operating days, and facility flow) used in Equation 1 from the sources described in Section 3.1 of this report. In all, EPA uses three different values for receiving stream flow rate (1Q10 low flow, 7Q10 low flow, and harmonic mean flow (HMF)) for the current and final regulatory options. The 1Q10 and 7Q10 low flows are used to evaluate the potential for acute and chronic aquatic toxicity, respectively, in receiving streams, as recommended in the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a).[3] EPA uses the HMF to estimate the potential for human health effects.[4] Neither the 1Q10 nor 7Q10 flow is appropriate for assessing potential human health effects because neither has a consistent relationship with the long-term mean dilution.

Because EPA is not able to obtain stream flows for hydrologically complex waters such as bays, estuaries and oceans, EPA uses site-specific critical dilution factors (CDFs) with Equation 2 to predict pollutant concentrations for facilities discharging to these complex water bodies. EPA uses site-specific CDFs developed from a 1992 survey of states and EPA Regions conducted by EPA's Office of Pollution Prevention and Toxics (OPPT).

$$C_{es} = \left[\left(\frac{L/OD}{FF} \right) \times CF \right] / CDF \qquad \textbf{(2)}$$

where:

C_{es}	=	estuary pollutant concentration (µg/L);
L	=	facility pollutant loadings (lb/year);
OD	=	facility operation (days/year);
FF	=	facility flow (MGD);
CDF	=	critical dilution factor (unitless); and
CF	=	conversion factor = 120 (µg MG / L lbs).

[3] The 1Q10 and 7Q10 flows, respectively, are the lowest 1-day and lowest consecutive 7-day average flow during any 10-year period.

[4] The harmonic means are determined by taking the reciprocal of the mean value of the reciprocal of individual values. EPA recommends that the long-term harmonic mean flow be used for assessing potential human health effects because it provides a more conservative estimate than the arithmetic mean flow.

When EPA cannot obtain CDFs directly, EPA uses dissolved concentration potentials (DCPs) with Equation 3 to calculate the CDF. EPA obtains DCPs from the Strategic Assessment Branch of the National Oceanic and Atmospheric Administration's (NOAA) Ocean Assessments Division. NOAA developed DCPs based on freshwater inflow and salinity gradients to predict pollutant concentrations in each estuary in the National Estuarine Inventory (NEI) Data Atlas. These DCPs are applied to predict concentrations of nonreactive dissolved substances. In addition, the DCPs reflect the predicted estuary-wide response and might not be indicative of site-specific locations. If neither DCPs nor CDFs are available for an estuary receiving discharges from CWT facilities, EPA estimates a CDF based on best professional judgement of the size, depth, and location of the receiving water body. Appendix A provides DCP values used for specific water bodies.

$$CDF = \frac{BL \times CF}{DCP \times OD \times FF} \qquad \textbf{(3)}$$

where:

CDF	=	critical dilution factor (unitless);
BL	=	benchmark load = 10,000 (tons/yr);
DCP	=	dissolved concentration potential (mg/L);
OD	=	facility operation (days/year);
FF	=	facility flow (MG / day); and
CF	=	conversion factor = 239.68 (mg MG/ ton L) = 907.2 (kg/ton) 10^6 (mg/kg) x 10^{-6} (MG/gal) x 0.2642 (gal/L).

In summary, EPA estimates in-stream (Equation 1) or estuary (Equation 2 or 3) pollutant concentrations for direct discharge facilities to evaluate whether either human health criteria or ambient water quality criteria are exceeded. EPA sums pollutant loadings for individual subcategories before calculating concentrations from multiple subcategory CWTs. When evaluating the combined effects, (combinations of the treatment technology that form the basis for each of the final subcategories), EPA determines water body concentrations by first summing pollutant loadings from all CWT facilities.

2.1.2 Indirect Discharge Facilities

EPA estimates in-stream concentrations for current and final PSES requirements using a simple stream dilution model that does not account for fate processes but does account for POTW influences (see Equation 4). Note that Equation 4 and Equation 1 differ to account for the additional dilution provided by the POTW flow and the removal of pollutants by POTW treatment processes. Sections 3.1 and 3.2 of this report describes the sources the facility-specific data used in Equation 4.

$$C_{is} = (L/OD) \times \frac{(1 - TMT) \times CF}{PF + SF} \qquad \textbf{(4)}$$

where:

C_{is}	=	in stream pollutant concentration (µg/L);
L	=	facility pollutant loading (lb/year);
OD	=	facility operation (days/year);
TMT	=	POTW treatment removal efficiency (unitless);
PF	=	POTW flow (MGD);
SF	=	receiving stream flow (MGD); and
CF	=	conversion factor = 120 (µg MG / L lbs).

EPA predicts pollutant concentrations of hydrologically complex water bodies, such as bays, estuaries, and oceans, that received POTW discharges using Equation 5 and site-specific CDFs.

$$C_{es} = \left[\left(\frac{L/OD \times (1 - TMT)}{PF} \right) \times CF \right] / \; CDF \qquad \textbf{(5)}$$

Where:

C_{es}	=	estuary pollutant concentration (µg/L);
L	=	facility pollutant loading (lb/year);
OD	=	facility operation (days/year);

TMT = POTW treatment removal efficiency (unitless);

PF = POTW flow (MGD);

CDF = critical dilution factor (unitless); and

CF = conversion factor = 120 (µg MG / L lbs).

When EPA cannot obtain a CDF directly, EPA uses estuarine DCPs with Equation 4 to calculate that CDF. If neither DCPs nor CDFs are available for estuaries receiving discharges from CWT facilities, EPA estimates a CDF based on best professional judgment of the size, depth, and location of the receiving water body. Appendix A provides the DCP values used for specific water bodies.

EPA sums pollutant loadings for individual subcategories before calculating concentrations for POTWs receiving effluent from multiple subcategory CWT facilities. When evaluating the combined effects (combinations of the treatment technologies basis for each of the final subcategories), EPA determines water body concentrations by first summing contaminant loadings from all CWT facilities discharging to each POTW.

2.2 Estimating POTW Effects

EPA calculates effects on POTW operations based either on inhibition of POTW processes (i.e., inhibition of activated sludge or biological treatment), or contamination of POTW sewage biosolids (thereby limiting a POTW's ability to use the biosolids for land application). EPA determines inhibition of POTW operations by comparing calculated POTW influent levels (Equation 6) with available inhibition levels (see Table 3-1).

$$C_p = C_{dj} + \frac{L/OD}{PF} \times CF \qquad \textbf{(6)}$$

where:

C_p = average POTW influent concentration with load contribution of facility (µ/L);

C_{dj} = average POTW influent concentration for chemical *j* due to other sources (µ/L);

L = facility pollutant loading (lb/year);

OD = number of operating days for each facility (days/year);

PF = POTW flow (MGD); and

CF = conversion factor = 120 (μg MG / lbs L).

The term C_{dj} in Equation 6 represents the contribution of other sources (non-CWT pollutant loads) to the average POTW concentration—a contribution that varies among POTWs. In the absence of specific knowledge of each POTW, EPA conservatively estimates C_{dj} by multiplying the reported chemical-specific upset criterion by 0.75.[5]

EPA evaluates potential contamination of sewage biosolids by comparing projected pollutant concentrations in the biosolids (Equation 7) with regulatory values for land application of sewage biosolids. EPA uses two sets of regulatory criteria to characterize projected POTW biosolids concentrations (see Table 3-2).

$$C_{sp} = C_{dp} + \left(\frac{L}{OD_{POTW}} \times \frac{TMT}{PF \times SG} \times CF\right) \quad \textbf{(7)}$$

where:

C_{sp} = biosolids pollutant concentration (μg/L);
C_{dp} = average POTW biosolids pollutant concentration in typical domestic biosolids (mg/kg dry);
L = facility pollutant loading (lb/year);
TMT = POTW treatment removal efficiency (unitless);
PF = POTW flow (million gallons/year);
SG = biosolids generation factor (lb dry/million gallons treated); and
CF = conversion factor = 10^6 (mg/kg) = (0.4536 kg/lb)/(0.4536 kg_{dry}/lb_{dry}) x 10^6 (mg/kg)2.3

[5] Seventy-five percent of the biological inhibition threshold for a given pollutant activated sludge treatment processes is assumed to be comprised of non-CWT sources. The remaining 25 percent limit is available for CWT sources. Threshold levels used were obtained from *CERCLA Site Discharges to POTW's: Guidance Manual,* EPA 1990.

2.3 Assumptions and Caveats

EPA makes the following assumptions in this analysis:

- EPA models CWT facilities if the receiving streams or the POTWs to which they discharge could be identified (113 of the 205 facilities).
- Aquatic life and human health effects were estimated based on 113 facilities for which facility - specific data are available.
- CWT facilities operate 260 days per year.
- Discharges from CWT contribute produce only a small portion of the total POTW (domestic) biosolids.
- The process water at each facility and the water discharged to a POTW are obtained from a source other than the receiving stream.
- The pollutant load to the receiving stream is continuous and representative of long-term facility operations. This assumption might overestimate risks to human health and aquatic life.
- Complete mixing of discharge flow and stream flow occurs across the stream at the discharge point. This mixing results in the calculation of an “average stream” concentration even though the actual concentration might vary across the width and depth of the stream.
- EPA did not consider pollutant fate processes such as sediment adsorption, volatilization, and hydrolysis. This approach might result in estimated in-stream concentrations that are environmentally conservative (higher).
- The study only evaluates the potential for metal contamination of sewage biosolids to levels that would prohibit its land application as a fertilizer or soil conditioner. Biosolids criteria levels are only available for 7 pollutants: arsenic, cadmium, copper, lead, mercury, selenium & zinc.
- The analysis dilutes pollutant loadings in 1,400 pounds of primary sludge per million gallons treated.

- The 1Q10 and 7Q10 receiving stream flow rates are used to estimate aquatic life effects, and harmonic mean flow rates to estimate human health effects. The analysis estimates 1Q10 low flows using the results of a regression analysis of 1Q10 and 7Q10 flows from representative U.S. rivers and streams conducted by Versar Inc. for EPA's OPPT (Versar, 1992). The analysis estimates harmonic mean flows from the mean and 7Q10 flows as recommended in the *Technical Support Document for Water-Quality-based Toxics Control* (USEPA, 1991a). These flows might not be the same as those used by specific states to assess effects.

- The analysis uses an exposure duration of 365 days to determine the likelihood that human health criteria or toxic effect levels will be exceeded.

- The analysis uses water quality criteria or toxic effect levels developed for freshwater organisms to analyze facilities discharging to estuaries or bays.

2.4 Compiling Documented Environmental Effects

During the months of June through September 1997, EPA contacted EPA Regional and State Pretreatment Coordinators regarding effects of CWT discharges on POTWs and surface waters (see Table 4-27). EPA reviewed State 304(l) Short Lists (USEPA, 1991b) for evidence of documented environmental effects on aquatic life, human health, POTW operations, and the quality of receiving water due to discharges of pollutants from CWT facilities (see Tables 4-28 and 4-29). EPA also reviewed the Permit Compliance System (PCS) data.

2.5 Estimating Toxic Effects

2.5.1 Estimating Effects on Aquatic Life

EPA evaluates potential effects on aquatic life on a site-specific basis by comparing modeled in-stream contaminant concentrations under baseline conditions and following adoption of the final rule using aquatic life criteria and toxicity values (acute and chronic AWQCs). EPA compares the in-stream concentrations for each chemical discharged from each facility under 1Q10 and 7Q10 flow conditions to acute and chronic AWQCs, respectively. EPA first determines whether the discharge of any of the 104 pollutants will exceed the AWQC for that pollutant in a given stream. Next, EPA totals these to obtain the number of in-stream concentrations that exceed one or more AWQC for the 41 water bodies examined.

2.5.2 Estimating Effects on Human Health

EPA estimates potential effects on human health in the following manner. EPA first compares modeled in-stream contaminant concentrations for each subcategory under baseline conditions and following adoption of the final limitations and standards. EPA compares these instream concentrations to health-based toxic effect values[6] derived using standard EPA methodology. Next EPA estimates potential carcinogenic risks and noncarcinogenic hazards to the recreational and subsistence angler population due to the consumption of contaminated fish. Finally, EPA estimates both the annual incidence of cancer and potential lead related health effects in the potentially exposed angler population. Each of these techniques is discussed in more detail below.

(a) Human Health AWQCs

EPA uses the modeled in-stream HMF concentration for estimation of human health AWQ. It is more reflective of average water body conditions then 1Q10 or 7Q10 flow conditions, because health-based AWQCs are derived for lifetime exposure conditions rather than for subchronic or acute conditions. EPA first determines whether the discharge of any of the 104 pollutants will exceed the health based AWQC for that pollutant in a given stream. Next, EPA totals these to obtain the number of in-stream concentrations that exceed one or more of the health based AWQC for the 87 water bodies examined. EPA divides the predicted in-stream concentration under HMF conditions by the health-based AWQC for each chemical discharged from each facility under the final rule and baseline conditions. The sum of these represents in-stream concentrations of specific pollutants that exceed AWQCs as a result of CWT discharges to 87 water bodies from the 113 facilities examined.

(b) Carcinogenic Risks and Noncarcinogenic Hazards

Next, EPA evaluates potential effects on human health by estimating potential carcinogenic risks and noncarcinogenic hazards. EPA performs this assessment in accordance with available EPA guidance including *Risk Assessment Guidance for Superfund* (USEPA, 1989a) and *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual* (USEPA, 1989b). As outlined in EPA guidance, the technical approach for conducting a risk assessment involves a three-step process:

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[6] The report refers to these either as human health ambient water quality criteria, or health-based AWQCs.

(1) **Toxicity Assessment**. EPA uses available human health toxic effect values for the contaminants of potential concern derived from data sources such as IRIS (USEPA, 1997a), and HEAST (USEPA, 1996). The list of chemicals of potential concern, with their available reference dose values (RfD) and cancer slope factors (SF) are in Appendix B.

(2) **Exposure Assessment.** The exposure assessment involves identifying exposure pathways of concern, estimating exposure point concentrations, and estimating chronic daily intakes.

- <u>Identifying Exposure Pathways of Concern</u>. EPA identifies water-related exposure pathways and target populations. Pathways quantitatively evaluated include only the ingestion of fish by recreational and subsistence anglers.
- <u>Estimating Exposure Point Concentrations</u>. The exposure point concentration (EPC) is the average concentration contacted over the duration of the exposure period. For the fish ingestion pathway, EPA calculates fish tissue EPCs by multiplying the contaminant-specific BCF by the estimated in-stream concentration under HMF conditions using the simple dilution model.
- <u>Estimating Chronic Daily Intakes</u>. EPA estimates chronic daily intakes (CDIs) using exposure models from EPA guidance for each chemical discharged from a facility under each regulatory option and baseline conditions. EPA expresses CDIs in terms of milligrams of contaminant contacted per kilogram of body weight per day (mg/kg/day). EPA calculates a CDI by combining the EPC and exposure parameter estimates (e.g., ingestion rate, exposure frequency, exposure duration, body weight, averaging time) using a chemical intake equation. EPA estimates CDIs for evaluating both carcinogenic risks (based on a lifetime average daily dose) and noncarcinogenic hazards (based on an average daily dose during the exposure period). EPA estimates CDIs for both baseline conditions and final regulatory options.

The equation and exposure parameter values used to estimate CDIs for ingestion of fish is presented below:

$$CDI = \frac{EPC \times BCF \times CF \times IR \times EF \times ED}{BW \times AT} \quad \textbf{(8)}$$

where:

CDI	=	chronic daily intake (mg/kg/day);
EPC	=	exposure point concentration (in-stream concentration under HMF conditions, in µg/L);
CF	=	conversion facto r= 10^{-6} (kg mg / g µg)
BCF	=	bioconcentration factor (liters/kg)
IR	=	ingestion rate (for the recreational and subsistence anglers, EPA assumes fish consumption rates of at 16.6 grams/day and 140 grams/day, respectively);
EF	=	exposure frequency (365 days/year);
ED	=	exposure duration (70 years);
BW	=	body weight (70 kg); and
AT	=	averaging time = 25,500 (days) = (70 years x 365 days/year).

(3) **Risk Characterization**. EPA assesses carcinogenic risks and noncarcinogenic hazards for chemicals using available toxicity criteria for the pathways quantitatively evaluated in this study.

Carcinogenic Risk Calculations

EPA expresses the potential carcinogenic risks associated with the discharges as an increased probability of developing cancer over a lifetime (e.g., excess individual lifetime cancer risk)(USEPA, 1989a). EPA estimates carcinogenic risks using the equation below:

$$Cancer\ risk_i = CDI_i \times SF_i \qquad \textbf{(9)}$$

where:

Cancer $risk_i$=		potential carcinogenic risk associated with exposure to chemical *I* (unitless);
CDI_i	=	chronic daily intake for chemical *I* (mg/kg/day); and

Sf_i = slope factor for chemical *I* ((mg/kg/day)$^{-1}$).

If the carcinogenic risk exceeds 10^{-2}, EPA guidance (USEPA, 1989a) recommends using the following equation to estimate carcinogenic risk:

$$Cancer\ risk_i = 1 - e^{(-CDI_i \times SF_i)} \tag{10}$$

where:

Cancer $risk_i$ = potential carcinogenic risk associated with exposure to chemical *I* (unitless);

CDI_i = chronic daily intake for chemical *I* (mg/kg/day); and

Sf_i = slope factor for chemical *I* ((mg/kg/day)$^{-1}$)

EPA sums chemical-specific cancer risks in accordance with EPA guidance (USEPA, 1989a) to estimate the combined cancer risks associated with exposure to a chemical mixture. EPA estimates the total potential carcinogenic risk for each exposure pathway, for each facility, and for each regulatory option and baseline conditions.

<u>Noncarcinogenic Hazard Calculations</u>

EPA evaluates noncarcinogenic hazards by comparing the estimated dose (e.g., CDI) with a reference dose (RfD). EPA calculates the hazard quotient, which is used to estimate the potential for an adverse noncarcinogenic effect to occur, using the following equation:

$$HQ_i = \frac{CDI_i}{RfD_i} \tag{11}$$

where:

Hq_i = hazard quotient for chemical *I* (unitless);

CDI_i = chronic daily intake for chemical *I* (mg/kg/day); and

RfD_i = reference dose for chemical *I* (mg/kg/day).

If the hazard quotient exceeds unity (1), an adverse effect might occur. The higher the hazard quotient, the more likely that an adverse noncarcinogenic effect will occur as a result of exposure to the chemical. If the estimated hazard quotient is less than unity, an adverse noncarcinogenic effect is highly unlikely to occur.

EPA recommends summing chemical-specific hazard quotients for contaminants with similar endpoints to evaluate the combined noncarcinogenic hazard from exposure to a chemical mixture (USEPA, 1989a). The sum of the chemical-specific hazard quotients is called the hazard index. Using this approach assumes that chemical-specific noncarcinogenic hazards are additive. Limited data are available for actually estimating the potential synergistic and/or antagonistic relationships between chemicals in a chemical mixture. This assessment sums, only the hazard quotients that have similar target organs and toxicological mechanisms.

2.6 Estimating Human Health Risks Associated with Consumption of Lead-Contaminated Fish

Because discharges from several CWT metals and oils facilities contain significant quantities of lead, EPA separately analyzes potential human health risks associated with the consumption of lead-contaminated fish by recreational and subsistence anglers. Ingestion of lead has been shown to cause adverse health effects in both child and adult populations. Elevated blood lead levels in children may impair intellectual development as measured by reduced IQ levels. Adult ingestion of lead may cause numerous cardiovascular problems, including hypertension, coronary heart disease, and strokes. These ailments may cause premature death, particularly in adults aged 40-75 years old. In addition, elevated blood lead levels in pregnant women may increase of the risk of neonatal mortality. EPA estimates the potential for such effects by adapting methodologies developed for assessing human health risks from lead at CERCLA/RCRA sites and for estimating the benefits of the Clean Air Act.

EPA estimates blood lead levels in children using EPA's "Integrated Exposure Uptake Biokinetic Model for Lead in Children" (IEUBK-USEPA,1994a). This PC-based model allows the user to estimate the geometric mean blood lead concentration for a hypothetical child or population of children. Using information on children's exposure to lead, the model estimates a plausible distribution of blood lead concentrations centered on the geometric mean blood lead concentration.

To use the IEUBK model, EPA must first estimate the in-stream lead concentration (based on the methodology described in section 2.1). EPA then projects the daily ingestion of lead based upon the instream concentration, bioconcentration factor for lead, and fish consumptions rates for children.[7] The IEUBK model then estimates the geometric mean blood lead level. Although, the model can estimate blood lead concentrations from multi-pathway exposure (air, soil, diet, water), all other pathway exposures other than diet were "zeroed out" in order to isolate blood lead levels solely attributable to consumption of lead-contaminated fish.

As noted above, children are primarily adversely affected through intellectual impairment as measured by changes in IQ. EPA estimates the health and monetary benefits from decreasing risks for reduced IQ potential in at-risk populations using the equations used in Lead Benefits Analysis performed for the Retrospective Study of the Clean Air Act (EPA, 1997c). The specific steps used to estimate the health effects benefits based on estimated changes in blood levels is described below:

- EPA uses the "1997 Statistical Abstract of the US" to estimate the percentage of the total US population between 0 and 72 months equal to 0.1031 percent. For each reach, EPA estimates *exposed* child population by multiplying the total exposed population for each reach (recreation and subsistence) by the corresponding percentage of children.

- EPA estimates the change in children's IQ using equation (5) from Appendix G of the Retrospective Study of the Clean Air Act.

$$(Total\ Lost\ IQ)_k = \Delta GM_k \times 1.117 \times 0.25 \times Pop_k/7 \qquad (12)$$

[7] Volume II- Food Ingestion Factors, Exposure Factors Handbook, EPA, August 1997 (USEPA, 1997b).

where:

(Total Lost IQ)$_k$	=	Total Reduction of IQ points in Affected Population
a GM_K	=	Change in the Geometric Mean of Affected Population's Blood Lead Level

For adult populations, EPA estimates health effects using methodology contained in its interim approach for assessing risks associated with adult exposure to lead in soil (*Interim Guidance,* USEPA 1996a).[8]

The approach described in the *Interim Guidance* estimates the effects of ingestion of lead contaminated soil on blood lead levels of women of child-bearing age. The analysis looks at this subpopulation group in order to derive risk-based remediation goals (RBRG) that would be protective of the developing fetus of adult women having site exposure. Although the *Interim Guidance* equation is based on a scenario quite different from that analyzed in the CWT environmental assessment (i.e.; consumption of contaminated fish by recreational and subsistence anglers), the exposure pathways are essentially the same. The main difference being the matrices which contain the lead contaminant (i.e., soil versus fish). The applicable equation (*Interim Guidance*, pg.2. Equation 1) is as follows:

$$(PbB)_{adult'central} = PbB_{adult0} \times PbS \times BKSF \times IR_s \times AF_s \times EF_s / AT \qquad \textbf{(13)}$$

where:

$PbB_{adult'central}$	=	Central estimate of blood lead level concentration (µg/dL) in adults (i.e. women of child-bearing age) that have site exposure to soil lead at concentration, PbS.
$PbB_{adult,0}$	=	Typical blood lead concentration in adults in absence of exposures to the site that is being assessed (The TRW *Interim Guidance* uses a background blood lead level of 2 µg/dL).

[8] Recommendations of the Technical Workgroup for Lead for Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, USEPA, December 1996.

PbS	=	Soil lead concentration (µg/g) (appropriate average concentration for individual).
BKSF	=	Biokinetic Slope Factor relating (quasi-steady state) increase in typical adult blood lead concentrations to average daily uptake (µg/dL blood lead increase per µg/day lead uptake).(The TRW *Interim Guidance* uses a BKSF of 0.4)
Ir_s	=	Intake rate of soil, including both outdoor soil and indoor soil-derived dust (g/day).
Af_s	=	Absolute gastrointestinal absorption factor for ingested lead in soil and lead in dust derived from soil (dimension less).
Ef_s	=	Exposure frequency for contact with assessed soils and/or dust derived in part from these soils (days of exposure during the averaging period); may be taken as days per year for continuing, long-term exposure.
AT	=	Averaging time; the total period during which soil contact may occur; 365 day/year for continuing exposures.

EPA has modified the above equation to estimate adult blood lead levels from consuming lead-contaminated fish consumption by modifying the equation as follows:

$$(PbB)_{adult,central} = PbB_{adult0} + IS_c \times BCF \times ING_f \times AF_s \times BKSF \times EF_s \times CF/AT \qquad \textbf{(14)}$$

where:

$PbB_{adult,central}$	=	Central estimate of blood lead level concentration (µg/dL) in adults (i.e., adults consuming fish contaminated with lead attributable to CWT discharges.

$PbB_{adult,0}$ = Typical blood lead concentration in adults in absence of exposures to contaminated fish. (2 µg/dL).

Is_c = In stream Concentration of lead (µg/L) (Affected receiving water bodies had in stream concentrations of lead ranging from 0.5 µg/L to approximately 7.7 µg/L).

BCF = Bioconcentration Factor for lead (49 L/kg).

ING_f = Average daily consumption of fish (16.5g/day for recreational anglers and 140 g/day for subsistence anglers).

Af_s = Absolute gastrointestinal absorption factor for ingested lead in fish (.06 dimensionless).[9]

BKSF = Biokinetic Slope Factor relating (quasi-steady state) increase in typical adult blood lead concentrations to average daily uptake (µg/dL blood lead increase per µg/day lead uptake). (EPA uses the 0.4 slope factor as presented in the *Interim Guidance*).

Ef_s = Exposure frequency for ingestion of contaminated fish; (days of exposure during the averaging period); may be taken as days per year for continuing, long-term exposure (365 days).

CF = Conversion Factor 10^{-3} (kg/g).

[9] For both the proposed and final CWT rules EPA used 0.06. However based upon a review of *Measurement of Soil-Borne Lead Bioavailability in Human Adults, and its Application to Biokinetic Modeling* (Maddaloni, 1998) and consultation with the author, EPA now believes that a value of 0.03 may be more appropriate. EPA notes that this lower value would reduce the estimated lead health effect in adults for the CWT final rule making (monetized at $258,000 to $1,358,000 based on the value of 0.06). This reduction of lead health effects in adults may reduce the total estimated monetized benefits of this rule by up to 17 percent.

AT = Averaging time; the total period during which food is consumed; 365 day/year for continuing exposures.

EPA modifies the equation presented in *the Interim Guidance* to account for ingestion of lead contained in fish tissue rather than ingestion of lead contained in a soil matrix. The primary source of uncertainty in applying the *Interim Guidance* equation to the affected CWT population is:

- Using soil lead bioavailability factor to estimate fish lead bioavailability.

The bioavailability of lead ingested in a soil matrix is likely to be different from the ingestion of lead contained in fish tissue. Studies conducted by *Maddaloni* and others that are cited in the *Interim Guidance* indicate that lead ingested with food is absorbed at a significantly lower rate than when lead is ingested without food in a soil matrix. It has been suggested that these lower absorption rates may be due to the presence of chelating substances in food products as well as the fact that readily absorbed food may serve as a physical barrier to absorption of less soluble substances such as lead. To account for the these differences, EPA has modified the absorption rate presented in the *Interim Guidance* (12 percent), which used a "meal weighted average" rate. For purposes of this analysis, EPA uses an absorption factor of six percent. In all other aspects, the equation for soil and for fish ingestion are consistent and require no modification.

Using the Equation to Estimate Benefits to the Affected Adult Population

By using the results of the CWT Modeling efforts and adapting methodology from the *Interim Guidance* EPA conservatively estimates changes in adult blood lead levels for the affected population. The procedure involves a four- step process which estimates:

1. In stream concentration of lead using CWT models described in Section 2.1
2. Lead uptake in affected adult population using the established bioconcentration factor for lead and fish consumption rates for recreational and subsistence anglers.
3. Changes in blood lead levels using *Interim Guidance* methodology described above
4. Changes in health status from final regulations using methodology cited in the *CAA Study*.

3. Data Sources

EPA uses readily available Agency and other databases, models, and reports to evaluate water quality effects. The following sections describe the various data sources that EPA used in this analysis.

3.1 Facility-Specific Data

EPA uses various sources for collecting data on CWT facilities. EPA obtains data through EPA site visits and sampling, responses to CWT questionnaires, comments to the 1995 proposal and 1996 Notice of Data Availability, and contacts with industry sources, regions and states. EPA uses this information to estimate many of the facility-specific parameters required for this analysis such as annual discharge volume, current pollutant loadings, and loadings associated with each regulatory option. EPA's data collection procedure is described in detail in Chapter 2 of the technical development document.

For the CWT facilities which were identified through the WTI Questionnaire, EPA has discharge location information. For the others, EPA had to make some assumptions about their discharge locations. For direct dischargers, EPA assumes the adjacent water body is the receiving water. For indirect dischargers, EPA conducts an analysis to identify the appropriate publicly owned treatment works (POTW) that may receive the facility discharge. For others, EPA identifies the locations of CWT facilities or POTWs on receiving water bodies using USGS cataloging units and EPA stream segment (reach) numbers contained in either EPA's Permit Compliance System (PCS) or Industrial Facilities Discharge (IFD) database. If a reach number is not available in the EPA databases, EPA uses facility latitude/longitude coordinates to locate facility discharge points using EPA's Reach File 1 (RF1). For any indirect discharge facilities (those discharging to a POTW, not directly to a water body), EPA obtains the name, location, and design flow data for each affected POTW from a variety of sources including EPA's 1996 Clean Water Needs Survey database, IFD, and PCS.

EPA obtains the raw receiving water flow data from the USGS Daily Flow File. In all cases, EPA uses the closest flow gauge to estimate the flow rate at the point of facility discharge. EPA determines the average and low-flow statistics (e.g., the 7Q10 low flow) using the Water Quality Analysis System residing on the

Agency's NCC mainframe computer. EPA obtains Dissolved Concentration Potentials (DCPs) for estuaries and bays from the Strategic Assessment Branch of NOAA's Ocean Assessments Division (see Appendix A). EPA uses Critical dilution factors (CDFs) from the *Mixing Zone Dilution Factors for New Chemical Exposure Assessments* (USEPA, 1992b). If neither DCPs nor CDFs are available for a particular facility, EPA estimates a CDF based on best professional judgment and the dimensions, depth, and general flushing characteristics of the bay or estuary.

3.2 Information Used to Evaluate POTW Operations

As detailed in the Chapter 7 of technical development document, EPA estimates the average percent removal for each pollutant of concern at well-operated POTWs (those meeting secondary treatment requirements) using data from a study of 50 well-operated POTWs and data from the Risk Reduction Engineering Laboratory (RREL). EPA uses inhibition values obtained from the *Guidance Manual for Preventing Interference at POTWs* (USEPA, 1987a) and from *CERCLA Site Discharges to POTWs: Guidance Manual* (USEPA, 1990) (see Table 3-1).

Whenever a range of values are obtained, EPA uses the most conservative value reported for activated sludge-based POTWs. For pollutants with no specific inhibition value, EPA uses a value based on compound type (e.g., aromatics).

EPA uses sewage biosolids regulatory levels[1], if available for the pollutants of concern (see Table 3-2). EPA uses pollutant limits established for the final use or disposal of sewage biosolids applied to agricultural and nonagricultural land (see Table 3-2). For predicting biosolids generation, EPA assumes that 1,400 pounds of biosolids are generated for each million gallons of wastewater processed (Metcalf & Eddy, 1972).

[1] 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge, Final Rule (February 19, 1993).

Table 3-1. POTW Removals and Biological Inhibition Concentrations

Pollutant	% POTW Removal [a]	Biological Inhibition Concentration (mg/L)[b]	Pollutant	% POTW Removal [a]	Biological Inhibition Concentration (mg/L)[b]
aluminum	17	N/A	acetophenone	95	N/A
antimony	71	N/A	alpha-terpinol	94	1000
arsenic	91	0.04	anthracene	96	5
barium	90	N/A	benzene	95	5
boron	70	10	benzo(a)anthracene	98	500
cadmium	90	0.5	benzo(a)pyrene	95	500
calcium	52	N/A	benzo(b)fluoranthene	95	500
chromium	93	0.1	benzo(k)fluoranthene	95	500
cobalt	4.8	N/A	benzoic acid	81	5
copper	88	0.1	benzyl alcohol	78	1000
iodine	39	N/A	biphenyl	96	N/A
iron	83	5	bis(2-ethylhexyl) phthalate	60	10
lead	92	0.1	bromodichloromethane	92	N/A
lithium	26	N/A	butanone	97	150
magnesium	32	N/A	butyl benzyl phthalate	94	10
manganese	41	10	carbazole	85	1
mercury	92	0.1	carbon disulfide	84	N/A
molybdenum	52	N/A	chlorobenzene	97	5
nickel	58	1	chloroform	77	150
phosphorus	69	N/A	chrysene	97	500
potassium	20	N/A	di-n-butyl phthalate	79	10
selenium	34	N/A	dibenzofuran	85	500
silicon	27	N/A	dibenzothiopene	85	500
sodium	52	N/A	diethyl ether	7	N/A
strontium	15	N/A	diethyl phthalate	60	10
sulfur	14	N/A	diphenyl ether	98	1
tin	65	N/A	diphenylamine	79	1
titanium	69	N/A	ether	52	1000
zinc	79	0.3	ethyl benzene	94	5
1,1,1,2-tetrachloroethane	23	N/A	fluoranthene	42	500
1,1,1-trichloroethane	92	150	fluorene	70	5
1,1,2-trichloroethane	75	N/A	hexanoic acid	84	N/A
1,1-dichloroethane	81	N/A	isophorone	62	N/A

Table 3-1. POTW Removals and Biological Inhibition Concentrations (Continued)

Pollutant	% POTW Removal [a]	Biological Inhibition Concentration (mg/L)[b]	Pollutant	% POTW Removal[a]	Biological Inhibition Concentration (mg/L)[b]
1,1-dichloroethene	89	150	m-xylene	99	5
1,2,3-trichloropropane	5	N/A	methylene chloride	55	150
1,2,4-trichlorobenzene	92	0.1	n-decane	9	150
1,2-dibromoethane	17	N/A	n-dodecane	95	150
1,2-dichlorobenzene	89	0.1	n-eicosane	92	150
1,2-dichloroethane	89	150	n-hexadecane	71	150
1,3-dichlorobenzene	89	0.1	n-octadecane	71	150
1,4-dichlorobenzene	52	0.1	n-tetradecane	71	150
1-methyl fluorene	88	5	N.N-dimethylformamide	85	150
1-methylphenanthrene	88	5	naphthalene	96	5
2,3,4,6-tetra chlorophenol	33	N/A	o+p xylene	95	5
2,3-benzofluorene	88	500	o-cresol	53	N/A
2,3-dichloroaniline	41	N/A	p-cresol	72	N/A
2,4,5-trichlorophenol	28	N/A	p-cymene	99	5
2,4,6-trichlorophenol	65	N/A	pentachlorophenol	14	N/A
2,4-dimethylphenol	99	N/A	pentamethylbenzene	92	5
2-butanone	92	150	phenanthrene	95	5
2-chlorophenol	85	N/A	phenol	97	90
2-hexanone	88	N/A	pyrene	84	500
2-methylnaphthalene	28	5	pyridine	95	1
2-phenylnaphthalene	88	5	tetrachloroethene	83	150
2-picoline	85	N/A	tetra chloromethane	92	N/A
2-propanone	84	150	toluene	97	5
3,6-dimethyl phenanthrene	88	5	trans-1,2-dichloroethene	79	N/A
4-chloro-3-methylphenol	63	N/A	trichloroethene	93	150
4-methyl-2-pentanone	88	150	trichlorofluoromethane	98	N/A
acenaphthylene	99	5	tripropyleneglycolmethyl	52	1,000
acenapthene	98	5	vinyl chloride	93	N/A

a. Calculation is detailed in Chapter 7 of the technical development document.

b. The lowest reported concentration at which the activated sludge process is inhibited. EPA evaluated POTW operations using facility-specific data and information derived from the sources described in Sections 3.1 and 3.2. The individual loadings from CWT facilities that discharge to the same POTW were summed before the POTW influent and biosolids concentrations are calculated.

3.3 Water Quality Criteria (WQC)

EPA obtains the ambient criteria (or toxic effect levels) for the protection of aquatic life and human health from a variety of sources including EPA criteria documents, EPA's Assessment Tools for the Evaluation of Risk (ASTER), and EPA's Integrated Risk Information System (IRIS, USEPA 1997a) uses ecological toxicity estimations when there are no available published values. The following subsections describe the hierarchies used to select the appropriate aquatic life and human health values.

Table 3-2. POTW Biosolids Pollutant Concentration Criteria[d]

Pollutant	Pollutant Ceiling Values [a] (mg/kg)	Pollutant Concentration Limit Values [b] (mg/kg)
Arsenic	75	41
Cadmium	85	39
Copper	4,300	1,500
Lead	840	300
Mercury	57	17
Molybdenum[c]	75	35[c]
Nickel	420	420
Selenium	100	36
Zinc	7,500	2,800

a. Maximum concentration permitted for land application of biosolids.
b. Concentration limit for continuous unlimited land application of biosolids.
c. The standard used for molybdenum is 35 mg/kg (59 *Federal Register* 9095, February 18, 1994). EPA notes that the PCL value for molybdenum was deleted from Part 503 effective February 19,1994. EPA will consider establishing a limit at a later date.
d. Referenced from 40 CFR Part 503 3-3.

3.3.1 Aquatic Life

EPA has established water quality criteria for many pollutants for the protection of freshwater aquatic life (acute and chronic criteria). The acute value represents a maximum allowable 1-hour average concentration of a pollutant at any time and can be related to acute toxic effects on aquatic life. The chronic value represents the average allowable concentration of a toxic pollutant over a 4-day period at which a diverse group of aquatic organisms and their uses should not be unacceptably affected, provided that these levels are not exceeded more than once every 3 years.

EPA uses specific toxicity values[2] for pollutants for which no water quality criteria have been developed. In selecting values from the literature, EPA prefers measured concentrations from flow-through studies under typical pH and temperature conditions. The test organism must be a North American resident species of fish or invertebrate. The hierarchies used to select the appropriate acute and chronic values are listed below in descending order of priority.

Acute Aquatic Life Values:

- National acute freshwater quality criteria
- Lowest reported acute test values (96-hour LC_{50} for fish and 48-hour EC_{50}/LC_{50} for daphnids)
- Lowest reported LC_{50} test value of longer duration, adjusted to estimate a 96-hour exposure period
- Lowest reported LC_{50} test value of longer duration, up to a maximum of 2 weeks exposure
- Estimated 96-hour LC_{50} from the ASTER QSAR model

[2] Acute and chronic effect concentrations reported in published literature or estimated using various application techniques.

Chronic Aquatic Life Values:

- National chronic freshwater quality criteria
- Lowest reported maximum allowable toxic concentration (MATC), lowest observable effect concentration (LOEC), or no observable effect concentration (NOEC)
- Lowest reported chronic growth or reproductive toxicity test concentration
- Estimated chronic toxicity concentration from a measured acute chronic ratio for a less sensitive species, quantitative structure activity relationship (QSAR) model, or default acute: chronic ratio of 10:1

3.3.2 Human Health

EPA has established water quality criteria for the protection of human health based on a pollutant's toxic effects, including carcinogenic potential. EPA has developed these human health criteria values for two exposure routes: (1) ingesting the pollutant via contaminated aquatic organisms only, and (2) ingesting the pollutant via both contaminated water and aquatic organisms. These equations are as follows:

For Toxicity Protection (ingestion of organisms only)

$$HH_{oo} = \frac{RfD \ x \ CF}{IR_f \ x \ BCF} \qquad \textbf{(12)}$$

Where:

HH_{oo}	=	human health value (µg/L);
RfD	=	reference dose (mg/day);
IR_f	=	fish ingestion rate (0.0065 kg/day);
BCF	=	bioconcentration factor (L/kg); and
CF	=	conversion factor (1,000 µg/mg).

For Carcinogenicity Protection (ingestion of organisms only)

$$HH_{oo} = \frac{BW \times RL \times CF}{SF \times IR_f \times BCF} \qquad (13)$$

Where:

HH_{oo}	=	human health value (µg/L);
BW	=	body weight (70 kg);
RL	=	risk level (10^{-6});
SF	=	cancer slope factor $(mg/kg/day)^{-1}$;
IR_f	=	fish ingestion rate (0.0065 kg/day);
BCF	=	bioconcentration factor (L/kg); and
CF	=	conversion factor (1,000 µg/mg).

For Toxicity Protection (ingestion of water and organisms)

$$HH_{wo} = \frac{RfD \times CF}{IR_w + (IR_f \times BCF)} \qquad (14)$$

where:

HH_{wo}	=	human health value (µg/L);
RfD	=	reference dose (mg/day);
IR_w	=	water ingestion rate (2 liters/day);
IR_f	=	fish ingestion rate (0.0065 kg/day);
BCF	=	bioconcentration factor (L/kg); and
CF	=	conversion factor (1,000 µg/mg).

For Carcinogenic Protection (ingestion of water and organisms)

$$HH_{wo} = \frac{BW \times RL \times CF}{SF \times [\, IR_w + (IR_f \times BCF) \,]} \qquad \textbf{(15)}$$

where:

HH_{wo}	=	human health value (µg/L);
BW	=	body weight (70 kg);
RL	=	risk level (10^{-6});
SF	=	cancer slope factor $(mg/kg/day)^{-1}$;
R_w	=	water ingestion rate (2 L/day);
IR_f	=	fish ingestion rate (0.0065 kg/day);
BCF	=	bioconcentration factor (L/kg); and
CF	=	conversion factor (1,000 µg/mg).

EPA derives the values for ingesting specific pollutants by drinking contaminated water and/or eating contaminated aquatic organisms by assuming an average daily ingestion of 2 liters of water, an average daily fish consumption rate (16.6 and 140 grams per day of fish products for recreational and subsistence anglers, respectively), and an average adult body weight of 70 kilograms (USEPA, 1989 a).

If a pollutant of concern has a cancer slope factor, then EPA uses values protective of carcinogenicity to assess the pollutant's potential effects on human health. EPA develops protective concentration levels for carcinogens in terms of non-threshold lifetime risk level. This analysis relies on criteria at a risk level of 10^{-6}. This risk level indicates a probability of one additional case of cancer for every 1,000,000 persons exposed. Toxic effects criteria for non-carcinogens include systemic effects (e.g., reproductive, immunological, neurological, circulatory, or respiratory toxicity), organ-specific toxicity, developmental toxicity, mutagenesis, and lethality.

The hierarchy used to select the most appropriate human health criteria values is presented below in descending order of priority:

- Calculated human health criteria values using EPA's IRIS RfDs or SFs used in conjunction with adjusted 3 percent lipid BCF values derived from *Ambient Water Quality Criteria Documents* (USEPA, 1987b); 3 percent is the mean lipid content of fish tissue reported in the study from which the average daily fish consumption rates are derived.

- Calculated human health criteria values using current IRIS RfDs or SFs and representative BCF values for common North American species of fish or invertebrates or estimated BCF values.

- Calculated human health criteria values using RfDs or SFs from EPA's Health Effects Assessment Summary Tables (HEAST) used in conjunction with adjusted 3 percent lipid BCF values derived from *Ambient Water Quality Criteria Documents* (USEPA, 1987b).

- Calculated human health criteria values using current RfDs or SFs from HEAST and representative BCF values for common North American species of fish or invertebrates or estimated BCF values.

- Criteria from the *Ambient Water Quality Criteria Documents* (USEPA, 1987b).

- Calculated human health values using RfDs or SFs from data sources other than IRIS or HEAST.

This hierarchy is based on Section 2.4.6 of the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a). This document recommends using the most current risk information from IRIS when estimating human health risks. In cases where chemicals have both RfDs and cancer SFs from the same level of the hierarchy, EPA calculates human health values using the formulas for carcinogenicity, which always results in the more stringent value of the two given the risk levels employed.

4. Results

4.1 Projected Water Quality Effects

This section presents the results of the analysis of the environmental effects of the CWT discharges at both baseline and following the adoption of final limits and standards. The first subsection, **Environmental Effects of 113 CWT facilities at Baseline and with Final Limits and standards**, presents the non-scaled environmental effects of 113 of the 205 CWT facilities that EPA has identified. Specifically, EPA analyzed 12 direct and 101 indirect wastewater dischargers discharging up to 104 pollutants (see Table 4-1). The 92 CWT facilities not evaluated either are zero dischargers (42) or have insufficient data to conduct the water quality analysis.

The following subsections present analysis results for each CWT subcategory (metals, oils, and organics). Each subsection begins with a general overview and then presents results for both the direct and indirect wastewater discharges analyzed. Many facilities have operations in multiple subcategories, and therefore the sum of the number of facilities presented in the metals, oils, and organics subcategories is greater than the total (113). To prevent double counting of loadings at multiple subcategory facilities, EPA only includes wastes from metals, oils, and organic waste treatment trains in the metals, oils, and organics subcategories, respectively.

As previously explained, EPA estimates the potential benefits of controlling discharges from CWT facilities by using modeling techniques to quantify impacts on water quality in receiving water bodies (i.e., potential impacts on human health and aquatic life), and POTW operations (i.e., biological inhibition and biosolid contamination). Specifically, EPA compares under current and final requirements estimated pollutant concentrations to water quality criteria or toxic effect levels for both aquatic life and human health. EPA analyzes direct and indirect dischargers separately. The study did not evaluate the effects of the final technologies on discharging conventional pollutants (e.g., BOD, COD, TSS). For example, although under baseline conditions, CWT facilities discharge 21.5 million pounds per year of conventional pollutants, the benefits analysis focuses entirely on reductions in metals and organic pollutants. Finally, EPA assesses the effects of indirect discharges on POTW operations and biosolids contamination.

Table 4-1. The 104 Pollutants Evaluated for the CWT Industry[a]

Pollutants[b, c]											
POLLUTANT	METALS	OILS	ORGANICS	POLLUTANT	METALS	OILS	ORGANICS	POLLUTANT	METALS	OILS	ORGANICS
4-Chloro-3-Methylphenol		x		Butyl Benzyl Phthalate		x		Dichloroethane, 1,2-		x	x
4-Methyl-2-Pentanone		x	x	Cadmium	x	x		Dichloroethene, 1,1-	x	x	x
Acenaphthene		x		Carbazole		x		Dichloroethene, trans 1, 2-			x
Acetophenone			x	Carbon disulfide	x	x		Diethyl ether			x
Alpha-terpineol		x		Chlorobenzene		x		Diethyl phthalate		x	
Aluminum	x	x	x	Chloroform		x	x	Dimethylformamide, N, N–	x	x	x
Anthracene		x		Chromium	x	x	x	Dimethyl phenanthrene, 3,6-		x	
Antimony	x	x	x	Chrysene		x		Dimethyl phenol, 2,4-		x	
Arsenic	x	x		Cobalt	x	x	x	Diphenyl ether		x	
Barium		x	x	Copper	x	x	x	Ethylbenzene		x	
Benzene		x	x	Cresol, o-		x	x	Fluoranthene		x	
Benzo(a)anthracene		x		Cresol, p-		x	x	Fluorene		x	
Benzofluorene, 2,3-		x		Di-n-butyl phthalate		x		Hexanoic acid		x	x
Benzoic acid	x	x	x	Dibenzofuran		x		Iron	x	x	x
Benzyl alcohol		x		Dibenzothiophene		x		Lead	x	x	
Biphenyl		x		Dibromochloromethane	x			Lithium	x		x
Bis(2-ethylhexyl) phthalate		x		Dibromoethane, 1,2-			x	Manganese	x	x	x
Boron	x	x	x	Dichloroaniline			x	Mercury	x	x	
Butanone, 2-	x		x	Dichlorobenzene, 1,4-		x		Methylene Chloride	x		x

Table 4-1. The 104 Pollutants Evaluated for the CWT Industry[a] (Continued)

Pollutants[b, c]											
POLLUTANT	METALS	OILS	ORGANICS	POLLUTANT	METALS	OILS	ORGANICS	POLLUTANT	METALS	OILS	ORGANICS
Methylfluorene, 1-		x		Phenanthrene		x		Tin	x	x	x
Methylnaphthalene, 2-		x		Phenol		x	x	Titanium	x	x	
Methylphenanthrene, 1-		x		Phenylnaphthalene, 2-		x		Toluene	x	x	x
Molybdenum	x	x	x	Phosphorus	x	x	x	Trichlorobenzene, 1,2,4-		x	
N-Decane		x		Propanone, 2-	x	x	x	Trichloroethane, 1,1,1-	x	x	x
N-Docosane		x		Pyrene		x		Trichloroethane, 1,1,2-			x
N-Dodecane		x		Pyridine	x	x	x	Trichloroethene		x	x
N-Eicosane		x		Selenium	x	x		Trichlorophenol, 2,4,5-			x
N-Hexadecane		x		Silicon	x	x	x	Trichloropropane, 1,2,3-			x
N-Octadecane		x		Silver	x	x		Tripropyleneglycol methylether	x	x	
N-Tetradecane		x		Strontium	x	x	x	Vanadium	x		
Naphthalene		x		Styrene		x		Vinyl chloride			x
Nickel	x	x	x	Sulfur	x	x	x	Xylene, m-		x	x
P-Cymene		x		Tetrachloroethene		x	x	Zinc	x	x	x
Pentachlorophenol			x	Tetrachloroethane, 1,1,1,2-			x	Zirconium	x		
Pentamethylbenzene		x		Tetrachloromethane			x				

a. EPA details the pollutants evaluated in chapter six of the technical development document. This analysis only includes a portion of the pollutants identified in Chapter 6.

b. Pollutant counts for each CWT industry subcategory are as follows: 38 metals; 86 oils; and 50 organics.

c. The POCs considered in this analysis are presented, by subcategory, in Appendix C.

4.1.1 Combined Environmental Effects of 113 CWT Facilities at Baseline and with Final Limits

EPA estimates that under baseline, 205 CWT facilities discharge approximately 8.6 million lbs/year of metals and organic pollutants. Under the final rule, pollutant loadings would be reduced by 50 percent or to 4.3 million lbs/year. The analysis comparing non-scaled (113 of the 205 facilities) modeled instream pollutant levels to Ambient Water Quality Criteria (AWQC) estimates that current discharge loadings will result in 252 concentrations in excess of criteria at 43 receiving water locations. As seen in Table 4-2, the final rule would reduce this number of concentrations in excess of AWQC to 156 at 38 receiving water locations. EPA estimates that CWT discharges to surface waters are responsible for approximately 0.18 cancer cases per year, but this would be reduced to 0.14 cases per year under the final rule. In addition, an estimated 101,000 persons would have reduced lead exposure and related health effects. EPA also estimates the final rule would reduce lead uptake enough to prevent the IQ loss of 60 points in angler children (i.e., children living in a recreational angler's household), and that the IQs of 0.2 fewer children would drop below 70 (see Table 4-3). EPA estimates that six of the 69 POTWs analyzed

Table 4-2. Summary of Non-Scaled Environmental Effects of 113 CWT Facilities[a]

	Current	Final	Summary
Loadings (million lbs/yr)[b, c]	8.6	4.3	50% reduction
AWQC Excedences	252 at 43 streams	156 at 38 streams	5 streams become "CWT industry contaminant free"
Additional Cancer Cases/yr [d]	0.18	0.14	0.04 cases reduced each year
Population potentially at risk to lead exposure [d]	101,000	101,000	Annual benefits are: C Reduction of 1.5 cases of hypertension C Protection of 60 IQ points C Prevention of lowering of 0.2 children's IQs below 70
Population exposed to other non-cancer effects[c]	1,880	None	Health effects to exposed population are reduced
POTWs experiencing inhibition	6 of 69	4 of 69	Potential inhibition eliminated at 2 POTWs
Biosolid Quality			3,900 metric tons improved

a. Modeled results represent 12 direct and 101 indirect waste water dischargers.
b. 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in the analysis.
c. Loadings are scaled to represent all 205 facilities. Loadings for indirects are adjusted to account for POTW removals.
d. Through consumption of contaminated fish tissue.

Table 4-3. Annual Reductions in Lead Related Health Effects From Reducing Lead Exposure of 101,000 People Potentially Affected by CWT Dischargers at 10 Reaches[a]

Lead Health Effect	Men	Female	Child	Neo-Natal	Total
Hypertension (Cases)	1.5	NA	NA	NA	1.5
Coronary Heart Disease (Cases)	0.09	< 0.01	NA	NA	0.1
Cerebral Accidents (cases)	< 0.01	< 0.01	NA	NA	< 0.01
Brain Infarction (cases)	< 0.01	<0.01	NA	NA	<0.01
Premature Mortality (cases)	0.09	< 0.01	NA	0.01	0.1
IQ point reduction (IQ points)	NA[b]	NA	60	NA	60
Children with IQ < 70 (cases)	NA	NA	0.2	NA	0.2

a. Oil and metal dischargers are included. Organic dischargers do not have lead in waste stream.
b. Not Applicable (NA).

experience inhibition problems due to CWT wastes. Under the final rule inhibition problems would be eliminated at two POTWs. The final rule would also improve the quality of 3,900 metric tons of biosolids and allow two facilities to switch to less expensive land disposal practices.

4.1.2 Metals Subcategory

EPA estimates that 69 metal CWT facilities discharge at baseline approximately 2.56 million lbs/year of metals and organics to surface waters (see Table 4-4). Under the final rule, this pollutant loading would be reduced by 85 percent or to approximately 0.39 million lbs/year.

EPA analyzed the environmental effects of 49 of the 69 metal CWT facilities (17 facilities are zero dischargers, and three facilities had missing data). EPA estimates that the final rule would reduce lead health-related effects and prevent the IQ loss of approximately 49 points in angler children (see Table 4-5).

Table 4-4. Metals Subcategory - Summary of Pollutant Loadings

	Direct Dischargers	Indirect Dischargers [c]	Total
Current (million lbs/yr)	2.18	0.38	2.56
Final (Option 4) BPT/BAT/PSES	0.30	0.09	0.39
No. of Pollutants Evaluated	38	38	38
No. of Facilities Evaluated[d]	9	40	49

a. Consists of 38 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
b. Loadings are scaled to represent all 69 metal facilities.
c. For Indirect dischargers, loading estimates have been adjusted to account for POTW removals.
d. The total universe consists of 69 facilities (9 directs, 40 indirects, 17 zero dischargers, and 3 with missing information).

Table 4-5. Metals Subcategory - Estimated Annual Reduction of Lead Related Health Effects

Lead Health Effect	Direct Dischargers (4)	Indirect Dischargers (2)	Total
Hypertension (Cases)	0.13	0.72	0.85
Coronary Heart Disease (Cases)	< 0.1	< 0.1	< 0.1
Cerebral Accidents (cases)	< 0.1	< 0.1	< 0.1
Brain Infarction	< 0.1	< 0.1	< 0.1
Premature Mortality (cases)	< 0.1	< 0.1	< 0.1
IQ Point Reduction in Children (IQ points)	11	38	49
Children with IQ < 70 (cases)	0.03	0.12	0.15

(a) Metals Subcategory - Direct Dischargers

EPA estimates that 12 direct discharging CWT facilities discharge at baseline approximately 2.18 million lbs/year of metals and organics (see Table 4-6). The final BAT/BPT (Option 4) levels would reduce this pollutant loading by 86 percent, or to 0.30 million lbs/year.

EPA analyzed the modeled environmental effects of nine of the 12 direct discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 42 excedences in eight streams would be reduced to 18 in five streams (see Table 4-6). Most of the concentrations in excess of AWQC are for chronic aquatic life criteria (see Table 4-7 and Table 4-8).

Table 4-6. Metals Subcategory - Environmental Effects of Nine Direct Dischargers[a]

	Current	Final	Summary
Loadings (million lbs/yr) [b]	2.18	0.30	86% Reduction
AWQC Excedences	42 at 8 streams	18 at 5 streams	All excedences eliminated at 3 streams
Additional Cancer Cases/y [c]	< 0.1	< 0.1	Reduction of <0.1
Population of 44,000 individuals exposed to lead health effects[c]			Annual benefits are: C Reduction of 0.13 cases of hypertension C Protection of 11 IQ points C Prevention of lowering of 0.03 children's IQs below 70
Population exposed to other non-cancer effects[c]	1,040	None	Reduction of exposed population by 1,040

a. Modeled results represent nine of twelve direct waste water dischargers. Loadings are scaled to represent all 12 facilities.
b. 38 of 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
c. Through consumption of contaminated fish tissue.

Table 4-7. Metals Subcategory - Projected Criteria Excedences for Nine Direct Dischargers

	Acute Aquatic Life	Chronic Aquatic Life	Human Health (Organisms Only)	Human Health (Water and Organisms)	Total[a]
Current					
Streams (No.)[b]	5	8	2	4	8
Pollutants(No)[c]	5	14	1	2	15
Final Option					
Streams (No.)	3	5	1	2	5
Pollutants (No.)	2	7	1	1	8

a. Pollutants may exceed criteria on a number of streams, therefore, total does not equal sum of pollutants exceeding criteria.
b. Number of receiving streams is nine.
c. Number of the 38 different pollutants analyzed that exceed ambient water quality and human heath-based criteria.

EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year. EPA also projects that 1,040 persons are exposed to pollutants that could result in non-cancer effects under current treatment levels. However, EPA estimates that six facilities discharge lead at levels which potentially could cause adverse health effects in recreational and subsistence angler populations totaling approximately 44,000 individuals. The final discharge levels would prevent the IQ loss of 11 points in angler children.

Table 4-8. Metals Subcategory - Pollutants Projected to Exceed Criteria for Nine Direct Dischargers

Pollutants	Acute Aquatic Life [a, b]		Chronic Aquatic Life [a, b]		Human Health [a, b] (water and organisms)		Human Health [a, b] (organisms only)	
	Current	Final Option	Current	Final Option	Current	Final Option	Current	Final Option
Arsenic	—	—	—	—	4(0-0.84)[c]	2(0-0.48)	2(0-0.84)[c]	1(0.48)
Aluminum	—	—	1(93.7)	—	—	—	—	—
Boron	—	—	2(4.5-81)	1(28.5)	—	—	—	—
Cadmium	2(4-23)	—	2(4-23)	—	1(23)	—	—	—
Chromium	—	—	2(23-65)	—	—	—	—	—
Copper	1(38)	—	1(38)	—	—	—	—	—
Lead	—	—	2(1-2.4)	1(0.58)	—	—	—	—
Molybdenum	—	—	1(10.4)	1(5.9)	—	—	—	—
Nickel	—	—	1(8.1)	—	—	—	—	—
Phosphorus	5(4.2-3911)	3(0.6-84)	8(0.1-3911)	5(0.6-84)	—	—	—	—
Selenium	1(2.0)	1(1.8)	1(2.0)	1(1.8)	—	—	—	—
Silver	—	—	1(0.3)	1(0.09)	—	—	—	—
Tin	—	—	1(24.8)	—	—	—	—	—
Zinc	1(27.8)	—	1(27.8)	—	—	—	—	—
Zirconium	—	—	1(4.5)	1(4.4)	—	—	—	—
Total Pollutants	**5**	**2**	**14**	**7**	**2**	**1**	**1**	**1**

a. Number(s) in parentheses represent instream concentration (µg/L).

b. Numbers outside of parentheses represent the number of occurrence(s) of a pollutant; however different pollutants may be discharged from the same water body so the total number of occurrences is not the sum of the water bodies where excedences occur.

c. Arsenic at 0.84µg/L is estimated to exceed human health criteria for both organisms only ($HH_{oo\,(As)}$ = 0.16 µg/L) and water and organisms ($HH_{wo\,(As)}$ = 0.02 µg/L)

(b) Metals Subcategory - Indirect Dischargers

EPA estimates that 42 indirect discharging CWT facilities currently discharge 0.38 million lbs/year of metals and organics (see Table 4-9). The final PSES (Option 4) treatment level would reduce pollutant loadings by 77 percent, or to 0.09 million lbs/year.

EPA modeled the environmental effects of 40 of the 42 indirect discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 82 excedences in 19 streams would be reduced to 50 excedences in 16 streams (see Table 4-9). Most of the concentrations in excess of AWQC are for chronic aquatic life criteria (see Table 4-10 and Table 4-11).

Table 4-9. Metals Subcategory - Environmental Effects of 40 Indirect Dischargers[a, b]

	Current	Final	Summary
Loadings (million lbs/yr) [c]	0.38	0.09	77% Reduction
AWQC Excedences	82 at 19 streams	50 at 16 streams	3 streams became "contaminant-free"
Additional Cancer Cases/yr[d]	< 0.1	< 0.1	Reduction of <0.1
Population of 21,000 individuals exposed to lead health effects[d]			Annual benefits are: C Reduction of 0.72 cases of hypertension C Protection of 38 IQ points C Prevention of lowering of 0.12 children's IQs below 70
Population exposed to other non-cancer effects[d]	840	None	Affected population reduced by 840
POTWs experiencing inhibition[e]	2 POTWs with three pollutants	1 POTW with one pollutant	Potential inhibition reduced at one POTW
Biosolid Quality	1 POTW	0 POTWs	1 POTW able to switch from incineration to surface disposal

a. Modeled results represent 40 of 42 indirect waste water dischargers. Loadings are scaled to represent all 42 indirects
b. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
c. 38 of 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; conventional pollutants such as Chemical Oxygen Demand (COD), BOD_5 and Total Suspended Solids (TSS); Total Phenols, hexanoic acid and Hexane Extractable Material are not representative of the loadings.
d. Through consumption of contaminated fish tissue.
e. Total number of POTWs receiving discharges from Metal subcategory CWTs is 41.

Table 4-10. Metals Subcategory - Projected Criteria Excedences for 40 Indirect Dischargers

	Acute Aquatic Life	Chronic Aquatic Life	Human Health (Water and Organisms)	Human Health (Organisms Only)	Total[a]
Current					
Streams (No.)[b]	12	19	8	1	19
Pollutants (No.)[c]	9	14	4	1	19
Final Option					
Streams (No.)	10	16	7	1	16
Pollutants (No.)	3	9	1	1	10

a. Pollutants may exceed criteria on a number of streams, therefore, the total does not equal the sum of pollutants exceeding criteria.
b. Number of receiving streams is 33 (19 rivers and 14 estuaries).
c. Number of different pollutants that exceed ambient water quality and human heath based criteria.

EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year. However, EPA estimates that two facilities discharge lead at levels which potentially could cause adverse health effects in recreational and subsistence angler populations totaling approximately 21,000 individuals (see Table 4-9). The final discharge levels would prevent the IQ loss of 38 points in angler children. EPA also estimates a decreased risk of non-cancer effects to an additional 840 anglers.

Table 4-11. Metals Subcategory - Pollutants Projected to Exceed Criteria for 40 Indirect Dischargers

Pollutants	Acute Aquatic Life[a, b]		Chronic Aquatic Life[a,b]		Human Health[a,b] (water and orgs.)		Human Health[a,b] (orgs. only)	
	Current	Final Option	Current	Final Option	Current	Final Option	Current	Final Option
Aluminum	—	—	1(47.7)	—	—	—	—	—
Antimony	—	—	—	—	1(26.9)	—	—	—
Arsenic[c]	—	—	—	—	8(0-1)	7(0-1)	1(1.2)	1(0.95)
Boron	—	—	10(7.3-522)	2(4.4-125)	—	—	—	—
Cadmium	2(0.5-0.5)	—	2(0.5-0.5)	—	—	—	—	—
Chromium	1(2.6)	—	2(2.6-15.3)	—	—	—	—	—
Cobalt	—	—	—	—	—	—	—	—
Copper	2(0.1-5.5)	2(0.1-2.3)	1(5.54)	1(2.3)	—	—	—	—
dibromo-chloromethane	—	—	—	—	1(0.4)	—	—	—
dichloro-ethene, 1, 1-	—	—	—	—	1(0.8)	—	—	—
Lead	1(8.4)	—	1(8.4)	1(0.8)	—	—	—	—
Lithium	—	—	1(516.7)	—	—	—	—	—
Molybdenum	—	—	2(1.7-92.3)	2(1-27.6)	—	—	—	—
Nickel	1(190.4)	—	1(190.4)	1(10.6)	—	—	—	—
Phosphorus	12(0.8-297)	10(2-148)	19(0.03-297)	16(0.1-148)	—	—	—	—
Selenium	2(0.3-3.6)	2(0.2-3.6)	2(0.3-3.6)	2(0.2-3.6)	—	—	—	—
Silver	1(0.51)	—	1(0.51)	1(0.06)	—	—	—	—
Tin	—	—	1(26.9)	—	—	—	—	—
Zinc	2(0.3-9.9)	—	—	—	—	—	—	—
Zirconium	—	—	2(0.4-16.3)	2(0.4-11.3)	—	—	—	—
Total Pollutants	**9**	**3**	**14**	**9**	**4**	**1**	**1**	**1**

a. Number(s) in parentheses represent instream concentrations (µg/L).
b. Numbers outside of parentheses represent the number of occurrence(s) of a pollutant, however different pollutants may be discharged from the same water body. Therefore the total number of occurrences are not the sum of the waterbodies where excedences occur.

EPA estimates that two of the 39 POTWs (39 of 41 POTWs analyzed) receiving CWT waste waters experience inhibition problems due to three pollutants in CWT wastes (see Table 4-12). The final rule would decrease the number of adversely affected facilities to one. The final rule would also allow one POTW to switch its biosolids disposal from incineration to surface disposal.

Table 4-12. Metals Subcategory - Projected POTW Inhibition Problems from 40 Indirect Dischargers

	Biological Inhibition
Current	
POTWs (No.) [a]	2
Pollutants (No.) [b]	3[c]
Total Problems	**2**
Final Option	
POTWs (No.)	1
Pollutants (No.)	1[d]
Total Problems	**1**

a. 42 CWT facilities discharge to 41 POTWs
b. 23 of 104 pollutants are analyzed
c. chromium, boron, nickel
d. boron

4.13. Oils Subcategory

EPA estimates that 125 oil CWT facilities discharge at baseline approximately 1.83 million lbs/year of metals and organics to surface waters (see Table 4-13). Under the final rule, pollutant loadings would be reduced by 42 percent or to 1.05 million lbs/year.

Table 4-13. Oils Subcategory - Summary of Pollutant Loadings

Loadings (million pounds/year)[a, b]			
	Direct Dischargers	**Indirect Dischargers[b]**	**Total**
Current	0.03	1.80	1.83
Final (BPT/BAT- Option 9) (PSES - Option 8)	0.02 ---	--- 1.03	1.05
No. of Pollutants Evaluated	86	86	86
No. of Facilities Evaluated[c]	3	72	75

a. Consists of 86 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
b. Loadings are scaled to represent all 125 oil facilities.
c. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
d. The total universe consists of 125 facilities (3 directs, 72 indirects, 10 with missing information, and 40 zero dischargers).

EPA analyzed the environmental effects of 75 of the 125 oil CWT facilities (3 directs, 72 indirects, 10 with missing information, and 40 zero dischargers). EPA estimates that the final limits would reduce additional annual cancer cases from approximately 0.07 under baseline conditions to 0.06. EPA also estimates the final rule would reduce lead health related effects and prevent the IQ loss of approximately 11 points in angler children, and the IQs of 4 children from dropping below 70 (see Table 4-14).

Table 4-14. Oils Subcategory - Estimated Annual Reduction of Lead Related Health Effects

Lead Health Effect	Total	Direct (2)	Indirect Dischargers (3)
Hypertension (Cases)	0.62	0.20	0.42
Coronary Heart Disease (Cases)	<0.1	<0.1	< 0.1
Cerebral Accidents (cases)	<0.1	<0.1	< 0.1
Brain Infarction	<0.1	<0.1	< 0.1
Premature Mortality (cases)	<0.1	<0.1	< 0.1
IQ Point Reduction in Children (IQ points)	11	11	0
Children with IQ < 70 (cases)	0.03	0.03	0

(a) Oils Subcategory - Direct Dischargers

EPA estimates that under baseline conditions three direct discharging CWT oils subcategory facilities discharge approximately 30,900 lbs/year of metals and organics (see Table 4-15). Under the final BAT/BPT (Option 9) levels, pollutant loadings would be reduced by 31 percent, or to 21,400 lbs/year.

EPA modeled the environmental effects of the three direct discharging oil CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 36 concentrations in excess of AWQC in two streams would be reduced to 28 excedences in two streams (see Tables 4-15, 4-16, and 4-17). None of the facilities discharge at levels that could cause adverse health effects from noncarcinogens.

Table 4-15. Oils Subcategory - Environmental Effects of 3 Direct Discharging CWT Facilities

	Current	Final	Summary
Loadings (lbs/yr)[a,b]	30,900	21400	31% Reduction
AWQC Excedences	36 at 2	28 at 2	22% Reduction
Additional Cancer Cases/yr[c]	< 0.1	< 0.1	Reduction of <0.1
Population exposed to non-cancer effects[c]	None	None	

a. Modeled results represent three direct waste water dischargers.
b. 86 of 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants only.
c. Through consumption of contaminated fish tissue.

Table 4-16. Oils Subcategory - Projected Criteria Excedences for 3 Direct Dischargers

	Acute Aquatic Life	Chronic Aquatic Life	Human Health (Water and Orgs.)	Human Health (Orgs. Only)	Total [a]
Current					
Streams (No.)	2	2	2	2	2
Pollutants (No.) [b]	7	15	3	3	16
Final Options (9)					
Streams (No.)	2	2	2	2	2
Pollutants (No.)	5	13	2	2	14

a. Pollutants may exceed criteria on a number of streams, therefore the total does not equal the sum of pollutants exceeding criteria.
b. 86 pollutants of 104 (see Table 4-1).

EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year. EPA also estimates that the final limits would reduce lead health related effects and prevent the IQ loss of approximately 11 points in angler children.

Table 4-17. Oils Subcategory - Pollutants Projected to Exceed Criteria for 3 Direct Dischargers[a, b]

Pollutants	Acute Aquatic Life		Chronic Aquatic Life		Human Health (Water and Orgs.)		Human Health (Orgs. Only)	
	Current	Final Option	Current	Final Option	Current	Final Option	Current	Final Option
anthracene	1(0.1)	1(0.1)	1(0.1)	1(0.1)	—	—	—	—
benzo (a) anthracene	—	—	1(0.1)	1(0.1)	2(0.02-0.1)	2(0.02-0.1)	2(0.02-0.1)	2(0.02-0.1)
arsenic	—	—	—	—	2(0.07-0.3)	2(0.07-0.3)	1(0.3)	1(0.3)
aluminum	1(186)	1(62)	2(41-186)	1(62)	—	—	—	—
boron	—	—	2(101-461)	2(80-363)	—	—	—	—
cadmium	—	—	1(0.1)	—	—	—	—	—
carbon disulfide	—	—	1(0.1)	1(0.1)	—	—	—	—
cobalt	—	—	1(7.8)	1(7.8)	—	—	—	—
copper	1(3.2)	1(0.5)	1(3.2)	1(0.5)	—	—	—	—
iron	—	—	1(212)	1(103)	—	—	—	—
lead	1(3.7)	—	2(0.8-3.7)	1(0.4)	—	—	—	—
mercury	1(0.1)	—	1(0.1)	—	1(0.1)	—	1(0.1)	—
molybdenum	—	—	1(17.4)	1(6.8)	—	—	—	—
nickel	—	—	1(4.4)	1(4.4)	—	—	—	—
phosphorus	2(19-86)	2(19-86)	2(19-86)	2(19-86)	—	—	—	—
zinc	1(54)	1(9)	1(54)	1(9)	—	—	—	—
Total Pollutants	**7**	**5**	**15**	**13**	**3**	**2**	**3**	**2**

a. Number(s) in parentheses represent instream concentrations (µg/L).
b. Numbers outside of parentheses represent the number of occurrence(s) of a pollutant, however different pollutants may be discharged from the same water body. Therefore the total number of occurrences are not the sum of the waterbodies where exceedences occur.

(b) Oils Subcategory - Indirect Dischargers

EPA estimates that 86 indirect discharging CWT facilities currently discharge 1.80 million lbs/year of metals and organics (see Table 4-18). Under the final PSES (Option 8) treatment level, pollutant loadings would be reduced by 43 percent or to 1.03 million lbs/year.

EPA modeled the environmental effects of 72 of the 86 indirect discharging oil CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 66 concentrations in excess of AWQC in 19 streams would be reduced to 50 excedences in 19 streams (see Tables 4-18, 4-19, and 4-20).

Table 4-18. Oils Subcategory - Environmental Effects of 72 Indirect Dischargers[a]

	Current	Final	Summary
Loadings (million lbs/yr)[b]	1.80	1.03	43% Reduction
AWQC Excedences	66 at 19 streams	50 at 19 streams	24% Reduction
Additional Cancer Cases/yr[c]	<0.1	<0.1	Reduction of <0.1
Population of 42,000 individuals exposed to lead health effects [c]		Health effects are reduced	Annual benefits are: C Reduction of 0.42 cases of hypertension C Protection of 0 IQ points C Prevention of lowering of 0 children's IQs below 70
Population of individuals exposed to other non-cancer effects[c]	None	None	None
POTWs experiencing inhibition[d]	5 POTWs with one pollutant. Potential inhibition reduced by one POTW	3 POTWs with one pollutant	Potential inhibition reduced by 2 POTWs
Biosolid Quality	1 POTW	0 POTWs	1 POTW able to switch from incineration to surface disposal

a. Modeled non-scaled results represent 72 indirect waste water dischargers.

b. 86 of 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; conventional pollutants such as Chemical Oxygen. Demand (COD), BOD_5 and Total Suspended Solids (TSS); Total Phenols, hexanoic acid and Hexane Extractable Material are not representative of the loadings. Loadings are scaled to represent all 86 facilities. Loadings are adjusted for POTW removals.

c. Through consumption of contaminated fish tissue.

d. Total number of POTWs receiving discharges from Oil subcategory CWTs is 56.

Table 4-19. Oils Subcategory - Projected Criteria Excedences for 72 Indirect Dischargers

	Acute Aquatic Life	Chronic Aquatic Life	Human Health (Water and Orgs.)	Human Health (Orgs. Only)	Total[a]
Current					
Streams (No.)[b]	10	19	5	4	19
Pollutants (No.)[c]	4	9	3	3	13
Final Options (8)					
Streams (No.)	10	19	4	3	19
Pollutants (No.)	2	5	2	2	8

a. Pollutants may exceed criteria on a number of streams, therefore the total does not equal the sum of pollutants exceeding criteria.
b. 56 POTWs discharge into 56 waterbodies (32 rivers and 24 estuaries).
c. 86 pollutants of 104 (see Table 4-1).

EPA estimates that under the final rule, annual cancer cases from consumption of contaminated fish from water bodies receiving oils indirect dischargers would be less than 0.1 cases per year. EPA estimates that under the final rules, there would be no effect on the IQ of the children of anglers, although there would be a small reduction in adult cases of hypertension.

EPA estimates that five of the 54 POTWs analyzed experience inhibition problems due to one pollutant in CWT wastes (see Table 4-21). The final rule would decrease the number of affected POTWs to three. The final rule would also allow one POTW to switch its biosolids disposal from incineration to surface disposal.

Table 4-20. Oils Subcategory - Pollutants Projected to Exceed Criteria for 72 Indirect Dischargers[a, b]

Pollutants	Acute Aquatic Life		Chronic Aquatic Life		Human Health (Water and Orgs.)		Human Health (Orgs. Only)	
	Current	Final Option	Current	Final Option	Current	Final Option	Current	Final Option
benzo (a) anthracene	—	—	—	—	4(0.003-0.007)	3(0.003-0.005)	4(0.003-0.007)	3(0.003-0.005)
bis(2-ethylhexyl phthalate	—	—	—	—	2(5.2-8.5)	—	1(8.5)	—
arsenic	—	—	—	—	5(0.02-0.2)	4(0.02-0.2)	1(0.2)	1(0.2)
aluminum	1(3.6)	—	1(3.6)	1(2.0)	—	—	—	—
boron	—	—	7(2.5-179)	6(5.1-120)	—	—	—	—
lead	—	—	3(0.2-0.6)	—	—	—	—	—
molybdenum	—	—	2(3.1-7.2)	1(2.1)	—	—	—	—
zinc	1(2.5)	1(1.1)	1(2.5)	—	—	—	—	—
copper	1(0.1)	—	—	—	—	—	—	—
phosphorus	10(0.2-13.4)	10(0.2-13.4)	19(0.02-13.4)	19(0.02-13.4)	—	—	—	—
carbon disulfide	—	—	1(0.044)	—	—	—	—	—
cobalt	—	—	1(1.6)	1(1.6)	—	—	—	—
N-hexadecane	—	—	1(25)	—	—	—	—	—
Total Pollutants	**4**	**2**	**9**	**5**	**3**	**2**	**3**	**2**

a. Number(s) in parentheses represent instream concentrations (μg/L).
b. Numbers outside of parentheses represent the number of occurrence(s) of a pollutant, however different pollutants may be discharged from the same water body. Therefore the total number of occurrences are not the sum of the waterbodies where excedences occur.

Table 4-21. Oils Subcategory - Projected POTW Inhibition Problems from 72 Indirect Dischargers

	Biological Inhibition
Current	
POTWs (No.)[b]	5
Pollutants (No.)[c]	1[a]
Total Problems	**4**
Final Option 9	
POTWs (No.)	3
Pollutants (No.)	1
Total Problems	**3**

a. boron
b. 56 POTWs discharge into 56 waterbodies (32 rivers and 24 estuaries).
c. 86 pollutants of 104 (see Table 4-1).

4.1.4 Organics Subcategory

EPA estimates that 43 organic CWT facilities discharge at baseline approximately 4.18 million lbs/year of metals and organics to surface waters (see Table 4-22). Under the final rule, pollutant loadings would be reduced by 33 percent or to 28.2 million lbs/year. EPA analyzed the environmental effects of 19 of 43 (24 zero dischargers) organic subcategory CWT facilities.

Table 4-22. Organics Subcategory - Pollutant Loadings for 19 Dischargers

Loadings (millions pounds/year)[a, b]			
	Direct Dischargers	Indirect Dischargers	Total
Current	0.95	3.23	4.18
Final (Option 4) BPT/BAT/PSES	0.95	1.87	2.82
No. of Pollutants Evaluated	49	49	49
No. of Facilities Evaluated[b]	4	15	19

a. Consists of 49 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis. Loadings are scaled to represent 43 facilities.
b. The total universe consists of 43 facilities (24 are zero dischargers).

(a) Organics Subcategory - Direct Dischargers

EPA estimates that under baseline conditions four direct discharging CWT facilities discharge approximately 0.95 million lbs/year of metals and organics facilities (see Table 4-23). Under the final BAT/BPT (Option 4) levels, pollutant loadings would remain at about 0.95 million lbs/year.

Table 4-23. Organics Subcategory - Environmental Effects of Four Direct Dischargers[a]

	Current	Final	Summary
Loadings (million lbs/yr) [b]	0.95	0.95	No Reduction
AWQC Excedences	two at one stream	two at one stream	No Reduction
Additional Cancer Cases/yr[c]	< 0.1	< 0.1	Reduction of <0.1
Population exposed to non-cancer effects[c]	None	None	No Reduction

a. Modeled results and loadings represent all of the four direct waste water dischargers.
b. 49 of 104 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
c. Through consumption of contaminated fish tissue.

EPA modeled the environmental effects of four organic direct discharging CWTs. The analysis comparing modeled instream pollutant levels to AWQC estimates that two excedences in one stream would still occur under the final rule. EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year. EPA also projects that no human populations are exposed to pollutants that could result in non-cancer effects under current or final treatment levels.

(b) Organics Subcategory - Indirect Dischargers

EPA estimates that 15 indirect discharging CWT facilities currently discharge 3.23 million lbs/year of metals and organics (see Table 4-24). Under the final PSES (Option 4) treatment level, pollutant loadings would be reduced by 42 percent, or to 1.87 million lbs/year.

EPA modeled the environmental effects of 15 organic indirect discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 46 concentrations in excess of AWQC in 11 streams would be reduced to 29 concentrations in excess of AWQC in eight streams (see Tables 4-24, 4-25, and 4-26).

EPA estimates cancer risk from fish consumption would be reduced from approximately 0.09 cases per year to 0.08 cases per year. EPA also estimates that organic indirect discharges do not substantially increase risk of non-cancer effects to local anglers. No POTWs are estimated to be affected by CWT organic discharges.

Table 4-24. Organics Subcategory - Environmental Effects of 15 Indirect Dischargers[a, b]

	Current	Final	Summary
Loadings (million lbs/yr)[c]	3.23	1.87	42% Reduction
AWQC Excedences	46 at 11 streams	29 at 8 streams	3 streams become "CWT contaminant-free"
Additional Cancer Cases/yr[d]	0.09	0.08	Reduction of 0.01
Population exposed to non-cancer effects [d]	None	None	No Reduction
POTWs experiencing inhibition[e]	None	None	No Reduction
Biosolid Quality	None	None	No Reduction

a. Modeled results represent 15 indirect waste water dischargers (five facilities are zero dischargers).
b. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
c. Consists of 49 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
d. Through consumption of contaminated fish tissue.
e. Total number of POTWs receiving discharges from organic subcategory CWTs is 15.

Table 4-25. Organics Subcategory - Projected Criteria Excedences for 15 Indirect Dischargers

	Acute Aquatic Life	Chronic Aquatic Life	Human Health (Water and Orgs.)	Human Health (Orgs. Only)	Total[a]
Current					
Streams (No.)	3	5	11	5	11
Pollutants (No.)[b]	2	3	5	1	7
Final Option					
Streams (No.)	2	3	8	3	8
Pollutants (No.)	2	3	5	1	7

a. Pollutants may exceed criteria on a number of streams, therefore, the total does not equal the sum of pollutants exceeding criteria.
b. Number of different pollutants that exceed ambient water quality and human heath based criteria.

Table 4-26. Organics Subcategory - Pollutants Projected to Exceed Criteria for Indirect Discharger

Pollutants	Acute Aquatic Life[a, b]		Chronic Aquatic Life[a, b]		Human Health (Water and Orgs.)[a, b]		Human Health (Orgs. Only)[a, b]	
	Current	Final Option	Current	Final Option	Current	Final Option	Current	Final Option
Boron	—	—	2(9.3-14.3)	1(9.3)	—	—	—	—
Methylene chloride	—	—	—	—	5(34.4-350)	3(34.4-284)	—	—
Vinyl chloride	—	—	—	—	5(0.03-0.3)	3(0.03-0.2)	—	—
Tetrachloro-methane	—	—	—	—	2(0.5-0.7)	1(0.5)	—	—
Phosphorus	3(0.3-0.8)	2(0.3-0.5)	5(0.1-0.8)	3(0.1-0.5)	—	—	—	—
Pentachloro-phenol	2(2.2-2.7)	1(2.2)	2(2.2-2.7)	1(2.2)	4(0.43-2.7)	3(0.3-2.2)	—	—
Dibromo-ethane, 1, 2-	—	—	—	—	11(0-1.1)	8(0-0.9)	5(0.1-1)	3(0.1-1)
Total Pollutants	**2**	**2**	**3**	**3**	**5**	**5**	**1**	**1**

a. Number(s) in parentheses represent instream concentrations (µg/l).
b. Numbers outside of parentheses represent the number of occurrence(s) of a pollutant, however different pollutants may be discharged from the same water body. Therefore the total number of occurrences are not the sum of the water bodies where excedences occur.

4.2 Documented Environmental Effects

4.2.1 Permit Violations of CWT Facilities

EPA Regional personnel and the corresponding State Pretreatment Coordinators identified a total of 35 facilities which have had various permit violations (see Appendix D, Table D-1). Of the 35 facilities that have reported violations, only five continue to have discharge violations or continue to present problems for the receiving POTW. Violations may take the form of exceeding permit limits or other, local limit pass through problem for receiving POTW, negative effect on surface water quality, or negative effect on water odor. The most commonly cited violations involve metal discharges.

4.2.2 Effects of CWT Wastes on POTW Operations and Water Quality

EPA identified environmental effects on POTW operations and water quality due to discharges of pollutants from nine indirect CWT facilities. Effects include seven cases of impairment to POTW operations due to cyanide, nitrate/nitrite, sodium, zinc and ammonia, and one case of an effect on the quality of receiving water due to organics (Table 4-27). In addition, the states identified four direct centralized waste treatment facilities and eight POTWs, which receive the discharge from 13 facilities, as point sources causing water quality problems included on state 304(1) Short Lists (see Tables 4-28 and 4-29).

Pollutants of concern include cadmium, copper, cyanide, lead, mercury, nickel, selenium, silver, zinc, and organics. Section 304(1) of the Water Quality Act of 1987 requires States to identify water bodies impaired by the presence of toxic substances, to identify point source discharges of these toxics, and to develop Individual Control Strategies (ICSs) for these discharges. The Short List is a list of waters for which a State does not expect achievement of the applicable water quality standards (numeric or narrative) to be achieved after technology-based requirements have been met due entirely or substantially to point source discharges of Section 307(a) toxics.

Table 4-27. Documented Environmental Effects of CWT Wastes on POTW Operations and Water Quality

POTW	Identified Impacts
Case #1	High concentrations of nitrate, nitrate and sodium in CWT's batch discharges responsible for interference of POTW operations (1993/1994). High chlorine demand of discharges caused loss of chlorine residual and resulted in POTW fecal coliform violations; $5000 fine is pending.
Case #2	Permit violations for phosphorus and total cyanide (1992/1993). Discharge of high levels of cyanide caused interference of POTW operations and results in $10,000 fine.
Case #3	Municipality below POTW developed drinking water taste and odor problems. Organics discharged by CWT identified as source.
Case #4	Permit violations of Total Toxic Organics(TTO), cyanide, nickel, fats, oils and grease (FOG), lead, zinc and mercury (1989-1990). Resulted in $60,000 fine.
Case #5	Zinc and Ammonia pass-through events from CWT discharges caused POTW NPDES violations in 1991 and 1996, respectively.
Case #6	Ammonia-nitrate pass-through from CWT discharge caused POTW NPDES violations due to nitrification inhibition (1991/1992). POTW fined CWT facility $3,450 for violation.
Case #7	Zinc pass-through from CWT discharge caused POTW NPDES violations on 3 occasions (1993). Since CWT receives both wastewater and hazardous wastes, under CFR section 261.4, they claim they do not need a RCRA permit. In 1997 a law suit between the CWT and both the POTW and Citizens was settled. The CWT paid $650,000 and $300,000 to the POTW and citizens, respectively.
Case #8	High strength ammonia discharge from CWT caused inhibitions problems resulting in low pH POTW NPDES violations on 3 occasions (1991).
Case #9	POTW permit violations of copper and cyanide resulted in a pass-through event. CWT fined cost of all analytic and administrative work needed to be performed subsequent to the violations. This order expired in 1998, and now the POTW is collecting new compliance data.

Source: EPA Regions and State Pretreatment Coordinators.

Table 4-28. CWT Facilities Included on State 304(L) Short Lists

NPDES	Facility Name	City	Waterbody	Reach Number	Listed Pollutants
AL0003247	Sloss Industries	Birmingham	Five Mile Creek	03160111006	Cadmium, Copper, Cyanide, Lead, Zinc
CT0001376	Pratt & Whitney	East Hartford	Willow Brook (Connecticut River)	01080205024	Copper, Nickel, Zinc
NJ0003867	CP Chemicals	Sewaren	Woodbridge Creek (Arthur Kill)	02030104003	Copper, Lead, Nickel, Zinc
PA0027715	Mill Service	Yukon	Sewickley Creek	05020006045	Copper, Lead, Silver

Source: Compiled from OW files dated April/May 1991.

Table 4-29. POTWs Which Receive Discharge From CWT Facilities and are Included on State 304(L) Short Lists

Facility Name	City	Receiving POTW	POTW NPDES	Waterbody	Reach Number	Pollutants
Clean Harbors	Baltimore	Back River WWTP	MD0021555	Back River to Curtis Bay	18050004002	Lead, Mercury, Selenium
Environmental Waste Control	Inkster	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
Edwards Oil	Detroit	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
DYNECOL	Detroit	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
American Tank Service	Ferndale	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
American Waste Oil	Belleville	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
CYANOKEM	Detroit	Detroit WWTP	MI0022802	Detroit River	04090004009	Cadmium, Copper, Lead, Mercury, PCBs
Chemical Waste Management	Newark	Passaic Valley Sewage Comm.	NJ0021016	Upper New York Bay	02030104001	Cadmium, Lead, Mercury
Waste Conversion	Hatfield	Hatfield TWP Mun. Authority	PA0026247	W.B. Neshaminy Creek to Neshaminy River	02040201011	27 Organics
Envirite	York	Springettsbury TWP	PA0026808	Codorus Creek	02050306066	–
ETICAM	Warwick	Warwick WWTP	RI0100234	Pawtuxet River	0109004029	Lead, Silver
Belpar Environmental	Prince George	Hopewell POTW	VA0066630	Gravelly Run to James River	02080206041	Copper, Lead, Zinc
Crosby and Overton	Kent	Metro (Renton STP)	WA0029581	Green River	17110013004	–

Source: Compiled From OW Files Dated April/May 1991.

5.0 References

Code of Federal Regulations, Title 40 part 131 section 36. 1993. *Criteria for Priority Toxic Pollutants*.

Karnovitz, Alan, Donahoe, Sean, Collins, Jim 1998a. *Assessing Potential Risks to Exposed Adult Populations from Consuming Lead-Contaminated Fish*. Memo to Tony Donigian. August.

Karnovitz, Alan, Donahoe, Sean, Collins, Jim 1998b. *Assessing Potential Risks to Exposed Populations from Consuming Lead-Contaminated Fish*. Memo to Tony Donigian. July.

Leggeir, Richard W. 1993. *An Age-specific Kinetic Model of Lead Metabolism in Humans in Research Advances*. Volume 101 Number 7, December.

Maddaloni, M. A. 1998. Measurement of Soil-Born Lead Bioavailability in Human Adults, and its Application in Biokinetic Modeling. Ph.D. Dissertation. School of Public Health, Columbian University, New York.

Metcalf & Eddy, Inc. 1972. *Wastewater Engineering*. McGraw-Hill Book Company, New York

Sherlock, J., Smart, G., Forbes, G.I., Moore, M.R., Patterson, W.J., Richards, W.N., Wilson, T.S. 1982. *Assessment Of Lead Intakes And Dose-response for a Population in Ayr Exposed to a Plumbosolvent Water Supply*. The Macmillan Press Ltd.

Society of Toxicology. 1998. *Toxicological Sciences, Formerly Fundamental and Applied Toxicology*. An Official Journal of the Society of Toxicology Supplement. Volume 42, Number 1-S, March 1998.

Tetra Tech Inc. 1998a. A*ppendix 1, Cancer Risk & Non-Cancer Systemic Hazard Calculations & Assumptions*.

Tetra Tech Inc. 1998b. *CWT Raw Data and Modeling Outputs.* On one diskette.

USEPA. 1982. *Fate of Priority Pollutants in Publicly Owned Treatment Works*. Final Report, Volume I. EPA 440/1-82/303. U.S. Environmental Protection Agency, Effluent Guidelines Division, Washington, DC.

USEPA. 1987a. *Guidance Manual for Preventing Interference at POTWs*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

USEPA. 1987b. Quality Criteria for Water. U.S. Environmental Protection Agency, Office of Water. EPA 440/5-86-001. [Also refers series EPA 440/5-80 and to any updated criteria documents (EPA 440/5-85 and EPA 440/5-87 Series)].

USEPA. 1989a. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part A)*. Interim final. OSWER Directive 9285.7-01a. U.S. Environmental Protection Agency, Offce of Solid Waste and Emergency Response, Washington, DC. December.

USEPA. 1989b. *Assessing Human Health Risks for Chemically Contaminated Fish and Shellfish: A Guidance Manual*. EPA-503/8-89-002. U.S. Environmental Protection Agency, Office of Water Regulations and Standarda, Washington, DC. September.

USEPA. 1989c. Supplemental Risk Assessment Guidance for the Superfund Program. Draft Final. U.S. Environmental Protection Agency Region 1 Risk Assessment Work Group. June.

USEPA. 1989d. *Risk Assessment Guidance For Superfund – Environmental Evaluation Manual*. Interim Final. EPA/540/1-89/001A. OSWER Directive 9285.7-01. U.S. Environmental Protection Agency Office of Emergency And Remedial Response. Washington, DC. March.

USEPA. 1990. *CERCLA Site Discharges to POTWs: Guidance Manuals.* EPA-540/G-90-005. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 1991a. *Technical Support Document for Water Quality-based Toxics Control*. EPA/505/2-90-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1991b. *Documented Environmental Effects*. Compiled from Office of Water files dated April/May 1991. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 1991c. *Technical Support Document for Water Quality-based Toxics Control.* United States Environmental Protection Agency, Office of Water. EPA/505/2-90-001, March 1991.

USEPA. 1994a. *Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 0.99D (for microcomputers).* Computer Product Information Sheet.

USEPA. 1994b. *Land Application of Sewage Sludge*. EPA/831-B-93-002b. U.S. Environmental Protection Agency Office of Enforcement and Compliance Assurance. December.

USEPA. 1995. *User's guide for the Industrial Source Complex (ISC3) Dispersion Models Volume I – User Instructions.* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards Emissions, Monitoring, and Analysis Division. EPA 454/B-95-003a. September 1995.

USEPA. 1996a. *Health Effects Assessment Summary Tables (HEAST).* FY-1996. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

USEPA. 1996b. *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*. Technical Review Workgroup for Lead. December

USEPA. 1996c. *Toxic and Pollutant Weighting Factors for Pesticide Formulating, Packaging, and Repackaging Industry Final Effluent Guidelines*. Final Report. U.S. Environmental Protection Agency Office of Science and Technology Standards and Applied Science Division. March.

USEPA. 1997a. Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency, Health Criteria and Assessment Office, Washington, DC.

USEPA. 1997b. *Volume II – Food Ingestion Factors. Exposure Factors Handbook. Update to Exposure Factors Handbook*. EPA/600/P-95/002Fb. U.S. Environmental Protection Agency Office of Research & Development National Center for Env. Assessment.August 1997.

USEPA. 1997c. Appendix G: Lead Benefits Analysis. The Benefits and Costs of the Clean Air Act, 1970 to 1990. U.S. Environmental Protection agency.

USEPA. 1998a. Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments). Interim. U.S. Environmental Protection Agency Solid Waste and Emergency Response. EPA 540-R-97-033. OSWER 9285.7-01D. January.

USEPA. 1998. *Environmental Assessment for the Proposed Effluent Guidelines, Pretreatment Standards, and New Source for the Centralized Waste Treatment Industry*. EPA 821-R-98-017. December.

USEPA. 2000. *Toxic and Pollutant Weighting Factors For Final Effluent Guidelines For The Centralized Waste Treater's Industry*. August

Versar, Inc. 1992. *Upgrade of Flow Statistics Used to Estimate Surface Water Chemical Concentrations for Aquatic and Human Exposure Assessment*. Report prepared by Versar, Inc., for U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Washington, DC.

Versar, Inc. 1992. *Mixing Zone Dilution Factors for New Chemical Exposure Assessments*. Draft Report. Contract No. 68-D9-0166. Task No. 3-35

Versar, Inc. 1994. *Toxic and Pollutant Weighting Factors for the Centralized Waste Treatment Industry Proposed Effluent Guidelines*. Final Report. Prepared for U.S. Environmental Protection Agency Office of Science and Technology Standards and Applied Science Division. December.

Versar, Inc. 1997. *Development of Mixing Zone Dilution Factors*. EPA/68-D3-0013. Prepared for U.S. Environmental Protection Agency, Economics, Exposure and Technology Division. Washington, DC.

Versar, Inc., Memo to Charles Tamulonis, USEPA. 1998. *PCS Analysis – Enforcement Violations – CWT Industry*. May 18

APPENDIX A
DILUTION CONCENTRATION POTENTIAL (DCP) VALUES

Appendix A. Dilution Concentration Potential (DCP) Values for Specific Water Bodies

Receiving Water Body	Dilution Concentration Potential
Detroit River, MI	0.2
Pacific Ocean (Vernon, CA)	0.685
James River, VA (Chesapeake Bay)	0.072
Puget Sound, WA	0.039
Niagra River, NY	0.2
Lake Michigan, IL	0.0042
South Oyster Bay, NY	0.054
Upper New York Bay, NJ	0.233
Curtis Bay, MD (Chesapeake Bay)	0.072
Alameda Creek, CA	0.048
Arthur Kill, NJ	0.223
Pacific Ocean (Long Beach, CA)	0.685
Green River, WA	0.2
Carney's Point, NJ	0.2
Clear Creek, TX	0.41
Corpus Cristi Bay, TX	4.67
San Francisco Bay, CA	0.048
Tucker Bayou, TX	0.41
Neches River, TX	0.38
Pacific Ocean (Los Angeles, CA)	0.685
Pacific Ocean (Honolulu, HI)	1.5
Calcasieu, LA	1.18
Delaware River, NJ	0.14
San Francisco Bay (E. Palo Alto), CA	0.104
Pacific Ocean (Santa Fe Springs, CA)	0.685
Tallaboa Bay, PR	1.371
Bayou Sara, AL	0.08
Lake Erie, OH	0.2
Casco Bay, ME	0.061
Atlantic Ocean (Miami, FL)	0.4
Pacific Ocean (Compton, CA)	0.685
Holmes Run/Cameron Run, VA (Chesapeake Bay)	0.072
Charles River, MA	0.27
St. Johns River, FL	0.83
Mobile Bay, AL	0.08
Mississippi River, LA	0.01
Atlantic Ocean (Pompano Beach, FL)	1.0

Appendix A. Dilution Concentration Potential (DCP) Values for Specific Water Bodies

Receiving Water Body	Dilution Concentration Potential
Elizabeth River, VA	0.14
Cedar Bayou, TX	0.41
Pensacola Bay, FL	0.46
Lake Michigan, WI	0.3
Alamitos Creek, CA	0.192
Pascagoula River, MS	0.17
Boston Bay, MA	0.27

APPENDIX B
TOXICOLOGICAL INFORMATION

Appendix B. Toxicity Values for the Contaminants Analyzed in the Centralized Waste Treatment Industry

Chemical	RfD	SF	BCF	Acute AWQC	Chronic AWQC	Human Health Organism	Human Health Water and Organism
4-Chloro-3-methylphenol	2		79	4050	1300	270000	56000
4-Methyl-2-pentanone	0.08		2.4	505000	50445	360000	2800
Acenaphthene	0.06		242	580	208	2700	1200
Acetophenone	0.1		11	162000	31094	98000	3400
Alpha-terpineol			48	12742	4879		
Aluminum	1		231	750	87	47000	20000
Anthracene	0.3		478	2.78	2.2	6800	4100
Antimony	0.000 4		1	3500	1600	4300	14
Arsenic	0.000 3	1.5	44	340	150	0.16	0.02
Barium	0.07			410000	2813		1000
Benzene	0.003	0.029	5.21	5300	530	71	1.2
Benzo(a)anthracene		0.73	4620	10	1	0.0032	0.003
Benzofluorene, 2,3-			10100	588	36		
Benzoic acid	4		15	180000	17178	2900000	130000
Benzyl alcohol	0.3		4	10000	1000	810000	10000
Biphenyl	0.05		436	360	230	1200	720
Bis(2-ethylhexyl) phthalate	0.02	0.014	130			5.9	1.8
Boron	0.09				31.6		
Butanone, 2-	0.6		1	3220000	233550	6500000	21000
Butyl benzyl phthalate	0.2		414	820	260	5200	3000
Cadmium	0.000 5		64	4.3	2.2	84	14
Carbazole		0.02	251	930	893	2.1	0.96
Carbon disulfide	0.1		11.5	2100	2	94000	3400

Chemical	RfD	SF	BCF	Acute AWQC	Chronic AWQC	Human Health Organism	Human Health Water and Organism
Chlorobenzene	0.02		10.3	2370	2100	21000	680
Chloroform	0.01	0.0061	3.75	13300	6300	470	5.7
Chromium	1.5		16	570	74	1000000	50000
Chrysene		0.0073	4620	592	16	0.32	0.3
Cobalt	0.06			1620	49		
Copper	0.04		360	13	9	1200	650
Cresol, o-	0.05		18	14000	2251	30000	1700
Cresol, p-	0.005		17.6	7500	2570	3100	170
Di-n-butyl phthalate	0.1		89	850	500	12000	2700
Dibenzofuran	0.0004		1349	1050	280	32	26
Dibenzothiophene			1100	420	122		
Dibromochloromethane	0.02	0.084	29	34000	14607	4.4	0.38
Dibromoethane, 1,2-		85	10	106050	35485	0.013	0.0004
Dichloraniline			29	7170	717		
Dichlorobenzene, 1,4-	0.03	0.024	55.6	1120	763	8.1	1.2
Dichloroethane, 1,2-	0.03	0.091	1.2	116000	11000	99	0.38
Dichloroethene, 1,1-	0.009	0.6	5.6	11600	5114	3.2	0.057
Dichloroethene, trans, 1,2-	0.02		1.6	20000	110000	130000	70
Diethyl ether	0.2		2.8	2560000	79833	770000	6900
Diethyl phthalate	0.8		73	31800	10000	120000	23000
Dimethylformamide, N,N-	0.1		0.005	7100000	710000	220000000	3500
Dimethylphenanthrene, 3,6-			33000	543	21		
Dimethylphenol, 2,4-	0.02		94	2120	1970	2300	540

Chemical	RfD	SF	BCF	Acute AWQC	Chronic AWQC	Human Health Organism	Human Health Water and Organism
Diphenyl ether			930	4000	213		
Ethylbenzene	0.1		37.5	9090	4600	29000	3100
Fluoranthene	0.04		1150	45	7.1	370	300
Fluorene	0.04		30	212	8	14000	1300
Hexanoic acid			16	320000	15170		
Iron	0.3				1000		300
Lead			49	65	2.5		
Lithium	0.02				464		
Manganese	0.14				388	100	50
Mercury			5500	1.4	0.77	0.051	0.05
Methylene Chloride	0.06	0.0075	0.91	330000	82500	1600	4.7
Methylfluorene, 1-			3300	627	115		
Methylnaphthalene, 2-		0.02	2566	1133	417	84	75
Methylphenanthrene, 1-			4790	555	54		
Molybdenum	0.005				27.8		
N-Decane			8800	18000	1300		
N-Docosane			100000	530000	68000		
N-Dodecane			14500	18000	1300		
N-Eicosane			100000	18000	1300		
N-Hexadecane			32300	18000	1300		
N-Octadecane			10100	18000	1300		
N-Tetradecane			19500	18000	1300		
Naphthalene	0.02		10.5	1600	370	21000	680
Nickel	0.02		47	470	52	4600	610
P-Cymene			770	6500	237		

Chemical	RfD	SF	BCF	Acute AWQC	Chronic AWQC	Human Health Organism	Human Health Water and Organism
Pentachlorophenol	0.03	0.12	11	19	15	8.2	0.28
Pentamethylbenzene			2600	528	102		
Phenanthrene			486	180	19		
Phenol	0.6		1.4	4200	200	4600000	21000
Phenylnaphthalene, 2-			4470	560	37		
Phosphorus				2.4	0.1		
Propanone, 2-	0.1		0.39	6210000	1866000	2800000	3500
Pyrene	0.03		1110	591	61	290	230
Pyridine	0.001		2	93800	25000	5400	34.7739692
Selenium	0.005		4.8	12.83	5	11000	170
Silicon							
Silver	0.005		0.5	3.4	0.34	110000	170
Strontium	0.6		9.5			680000	20000
Styrene	0.2		13.5	4020	402	160000	6700
Sulfur				10000000	1000000		
Tetrachloroethane, 1,1,1, 2-	0.03	0.026	17	20000	10000	24	1.3
Tetrachloroethene	0.01	0.052	30.6	4990	510	3500	320
Tetrachloromethane	0.0007	0.13	18.75	41400	3400	4.4	0.25
Tin	0.6				18.6		
Titanium	4				191		
Toluene	0.2		10.7	5500	1000	200000	6800
Trichlorobenzene, 1,2,4-	0.01		1202	930	286	90	71
Trichloroethane, 1,1,1-	0.02		5.6	42300	1300	38000	690

Chemical	RfD	SF	BCF	Acute AWQC	Chronic AWQC	Human Health Organism	Human Health Water and Organism
Trichloroethane, 1,1,2-	0.004	0.057	4.5	18000	13000	42	0.61
Trichloroethene	0.006	0.011	10.6	40700	14850	92	3.1
Trichlorophenol, 2,4,5-	0.1		1905	1549	344	570	490
Trichloropropane, 1,2,3-	0.006	7	18.8	33800	17140	3400	200
Tripropyleneglycol-methylether			0.2	2484600	683870		
Vanadium	0.007			11200	9		
Vinyl Chloride		1.9	1.17	56329	18242	4.8	0.018
Xylene, m-	2		208	16000	3900	100000	42000
Zinc	0.3		47	120	120	69000	9100
Zirconium					10.3		

APPENDIX C
POLLUTANTS EVALUATED

Table C-1. Metals Subcategory - Pollutants Evaluated

Pollutants [a]			
Aluminum	Copper	Molybdenum	Tin
Antimony	Dibromochloromethane	Nickel	Titanium
Arsenic	Dichloroethene, 1, 1-	Phosphorus	Toluene
Benzoic acid	Dimethylformamide, N, N-	Propanone, 2-	Trichloroethane, 1, 1, 1-
Boron	Iron	Pyridine	Tripropyleneglycolmethylether
Butanone, 2-	Lead	Selenium	Vanadium
Cadmium	Lithium	Silicon	Zinc
Carbon disulfide	Manganese	Silver	Zirconium
Chromium	Mercury	Strontium	
Cobalt	Methylene Chloride	Sulfur	

a. Although the total number of documented metals and organics pollutants is 49, only 38 pollutants were analyzed due to a lack of information on AWQC and toxicological information.

Table C-2. Oils Subcategory - Pollutants Evaluated

Pollutants [a]			
4-Chloro-3-Methylphenol	Chloroform	Iron	Phosphorus
4-Methyl-2-Pentanone	Chromium	Lead	Propanone, 2-
Acenaphthene	Chrysene	Manganese	Pyrene
Alpha-terpineol	Cobalt	Mercury	Pyridine
Aluminum	Copper	Methylfluorene, 1-	Selenium
Anthracene	Cresol, o-	Methylnaphthalene, 2-	Silicon
Antimony	Cresol, p-	Methylphenanthrene, 1-	Silver
Arsenic	Di-n-butyl phthalate	Molybdenum	Strontium
Barium	Dibenzofuran	N-Decane	Styrene
Benzene	Dibenzothiophene	N-Docosane	Sulfur
Benzo(a)anthracene	Dichlorobenzene, 1,4-	N-Dodecane	Tetrachloroethene
Benzofluorene, 2,3-	Dichloroethane, 1,2-	N-Eicosane	Tin
Benzoic acid	Dichloroethene, 1,1-	N-Hexadecane	Titanium
Benzyl alcohol	Diethyl phthalate	N-Octadecane	Toluene
Biphenyl	Dimethylformamide, N, N-	N-Tetradecane	Trichlorobenzene, 1,2,4-
Bis(2-ethylhexyl) phthalate	Dimethylphenanthrene, 3,6-	Naphthalene	Trichloroethane, 1,1,1-
Boron	Dimethylphenol, 2,4-	Nickel	Trichloroethene
Butyl Benzyl Phthalate	Diphenyl ether	P-Cymene	Tripropyleneglycolmethylether
Cadmium	Ethylbenzene	Pentamethylbenzene	Xylene, m-
Carbazole	Fluoranthene	Phenanthrene	Zinc
Carbon disulfide	Fluorene	Phenol	
Chlorobenzene	Hexanoic acid	Phenylnaphthalene, 2-	

a. Although the total number of documented metals and organics pollutants is 93, only 86 pollutants were analyzed due to a lack of information on AWQC and toxicological information.

Table C-3. Organics Subcategory—Pollutants Evaluated

Pollutants [a]		
4-methyl-2-pentanone	Dichloroethane, 1, 2-	Silicon
Acetophenone	Dichloroethene, 1, 1-	Strontium
Aluminum	Dichloroethene, trans 1, 2-	Sulfur
Antimony	Diethyl ether	Tetrachloroethane, 1,1,1,2-
Barium	Dimethylformamide, N, N-	Tetrachloroethene
Benzene	Hexanoic acid	Tetrachloromethane
Benzoic acid	Iron	Tin
Boron	Lithium	Toluene
Butanone, 2-	Manganese	Trichloroethane, 1,1,1-
Chloroform	Methylene chloride	Trichloroethane, 1,1,2-
Chromium	Molybdenum	Trichloroethene
Cobalt	Nickel	Trichlorophenol, 2,4,5-
Copper	Pentachlorophenol	Trichloropropane, 1,2,3-
Cresol, o-	Phenol	Vinyl chloride
Cresol, p-	Phosphorus	Xylene, m-
Dibromoethane, 1, 2-	Propanone, 2-	Zinc
Dichloraniline	Pyridine	

a. Although the total number of documented metals and organics is 63, only 50 pollutants were analyzed due to a lack of information on AWQC and toxicological information.

APPENDIX D
DOCUMENTED ENVIRONMENTAL EFFECTS

DOCUMENTED ENVIRONMENTAL EFFECTS

(Excerpts taken from the May 5, 1998 memo prepared by ABT Associates, for Charles Tamulonis, titled ***Summary of Documented POTW Problems from Centralized Waste Treatment Facilities and Potential Monetization of Case Studies***).

Problems with CWT facilities were identified through a series of phone conversations made during the months of June through September 1997 with EPA regional coordinators regarding 156 CWT facilities nationwide.

A total of 35 facilities were reported as having problems with their discharge. These problems may take the form of a permit exceedence, local limit exceedence, pass through problem for receiving POTW, negative impact on surface water quality, or negative impact on water odor.

The most commonly cited violations involve metals discharge. Permit violations for lead, silver, arsenic, zinc copper, nickel, mercury, and aluminum were reported by POTWs as originating from CWT facilities. Other commonly cited violations involved ammonia and oil and grease. Table 1 below presents the reported violations at 35 facilities in eight different EPA regions[1]. Table 1 also lists the impacts of the violations on POTWs, the actions taken by the facility in response to the violation, and the current violation status of the facility.

As Table 1 demonstrates, violations at CWT facilities have not been insignificant. However, of the 35 facilities that have reported violations, only five continue to have discharge violations or continue to present problems for the receiving POTW. Three facilities have ceased discharging processed wastewater to the POTW, 16 have remedied the problem through more stringent quality assurance and quality control (QA/QC) procedures, and the current status of the remaining 11 facilities is not known.

1 Regions 8 and 9 reported no violations.

Table D.1. Reported Permit Violations and Other Discharge Effects From CWT Facilities				
Site	Reported Violation	Impacts on Receiving Waterbody or POTW	Actions Taken	Current Status
Facility 1 Direct	Violation data were not available; either this facility does not have violations or is a minor permittee.			
Facility 2 Indirect	High chlorine demand and high concentrations of nitrate, nitrite, sodium, lead, silver, and arsenic in influent to the POTW.	POTW had fecal coliform violations due to high chlorine demand. Also potential pass-through of lead and silver and arsenic.	Facility was fined $5,000. POTW was placed on the RI State 304 list.	Facility improved its QA/QC and screens every batch of pollutants. Recent violations are minor and sporadic.
Facility 3	High cyanide and metal concentrations in influent flow to the POTW in the past. Facility has no non-compliance issues now.			Facility adopted more stringent QA/QC procedures.
Facility 4	Unacceptably high levels of copper, lead, nickel and zinc in receiving water.			
Facility 5	Permit violations (specific violation data were not available.)		Information on steps taken to remediate the problem is not available.	
Facility 6	Permit violations (specific violation data were not available.)		Information on steps taken to remediate the problem is not available.	
Facility 7	High concentration of phosphorus and cyanide in influent flow to the POTW.	Interference with POTW operations.	Facility was fined $10,000. Facility was required to upgrade its waste characterization system.	Facility has not had any significant violations over the past 3 years.
Facility 8	High concentrations of cadmium, lead and mercury in influent flow to the POTW.	Potential impact on surface water quality (potential pass-through of cadmium, lead and mercury).	POTW was placed on the State 304(L) Short list.	Facility no longer treats waste at this site.

Table D.1. Reported Permit Violations and Other Discharge Effects From CWT Facilities				
Site	Reported Violation	Impacts on Receiving Waterbody or POTW	Actions Taken	Current Status
Facility 9	High concentrations of copper, lead and silver discharged to the receiving water.	Potential impact on surface water quality.	POTW was placed on the State 304(L) Short list.	Facility has not had any significant violations since 1991.
Facility 10	High concentrations of copper (0.06 mg/l) and aluminum (1.41 mg/l) discharged to receiving water.	Potential impact on surface water quality.		
Facility 11	High concentrations of organics in influent flow to the POTW.	Customers complained about the taste and odor of the local drinking water supply.	POTW was placed on the State 304(L) Short list.	Low level concentrations are still a concern.
Facility 12	High concentrations of TTO, cyanide, nickel, fats, oils and grease, lead, zinc, and mercury.	Potential impact on surface water quality.	Facility was fined $60,000 for permit violations. POTW was placed on the State 304(L) Short list.	Facility has had an excellent compliance record for the past few years.
Facility 13	High concentrations of lead and zinc in influent flow to the POTW.	Potential impact on surface water quality.	POTW was placed on the State 304(L) Short list.	The site has not engaged in non-compliance practices with the exception of occasional reporting violations since Waste Management took over.
Facility 14	A couple of minor, one-time exceedances in the past.		POTW was placed on the State 304(L) Short list	The last violation was in 1994.
Facility 15	Monitoring the temperature and chlorine content of their discharge.			
Facility 16	Monitoring of gas extraction condensate.			
Facility 17	High concentrations of cadmium, copper, cyanide, lead, and zinc discharged to receiving water.	Potential impact on surface water quality.	POTW was placed on the State 304(L) Short list.	
Facility 18	High concentrations of oil and grease, phenols, and ammonia discharged to receiving water.	Potential impact on surface water quality.		

Table D.1. Reported Permit Violations and Other Discharge Effects From CWT Facilities				
Site	Reported Violation	Impacts on Receiving Waterbody or POTW	Actions Taken	Current Status
Facility 19	High concentrations of lead, cyanide, oil and grease dicharged to receiving water. They also had temperature and pH problems.	Potential impact on surface water quality.		Thay are currently involved in a lawsuit due to which further information on violations and remediation processes was not available.
Facility 20	High concentrations of BOD (50.0 mg/L), TSS (238.0 mg/L), oil and grease (13.2 mg/L), zinc (320 µg/L) as well as CBOD, copper, pH and fecal coliform discharged to receiving water. The facility also had problems with boiler blowdown, softener regeneration backwash, and sanitary wastes.	Potential impact on surface water quality.		The facility tied all of its non-contacting cooling water processes together and now discharges to the POTW. They are only directly discharging groundwater and storm water.
Facility 21	High concentrations of zinc (2410 µg/L), fats, oils, and grease (348 mg/L), nickel (1,700 mg/L), and ammonia (8.92 mg/L) in influent flow to the POTW.	POTW had NPDES violations due to zinc pass-through. There was also an incident with ammonia pass-through for which the facility was fined.	For the ammonia there was a prohibited discharge surcharge of $175 and one to two thousand dollars to reimburse the POTW.	Facility adopted more stringent QA/QC procedures.
Facility 22	High concentrations of organics (including benzene) and metals in influent flow to the POTW.	Discharged organic waste has produced health and environmental hazards and foul odors.	A civil lawsuit was settled and the POTW received $650,000 and the Citizen's suit received $300,000.	The facility is now bound by local limits developed by the POTW for organics. The facility has not improved.
Facility 23	High concentrations of ammonia, cyanide, and oil and grease in influent flow to the POTW.	POTW had NPDES violations due to discharge containing ammonia-nitrate which caused nitrification inhibition.	The POTW fined the facility $3,450 for these violations.	Facility adopted more stringent QA/QC procedures.
Facility 24	High concentrations of ammonia in influent flow to the POTW.	POTW had NPDES violations for low pH causing inhibition problems.		Facility adopted more stringent QA/QC procedures and screens every batch of pollutants.

Table D.1. Reported Permit Violations and Other Discharge Effects From CWT Facilities				
Site	Reported Violation	Impacts on Receiving Waterbody or POTW	Actions Taken	Current Status
Facility 25	High concentrations of dissolved oxygen levels and a sewer overflow event.		POTW was placed on the State 304(L) Short list.	The facility has ceased operation.
Facility 26	Slug loading was caused at the POTW due to the discharge of malodorous solids into the sewer system, reducing air flow in the plant's oxidation dishes.	Interference with POTW operations.		Facility adopted more stringent QA/QC procedures.
Facility 27	High concentrations of copper, cyanide, zinc and lead in influent flow to the POTW.	Potential impact on surface water quality.	POTW has fined the facility for administrative and analytic work.	Facility adopted more stringent QA/QC procedures.
Faciliity 28	High concentrations of zinc, copper and lead in influent flow to the POTW.	Potential impact on surface water quality.		Facility adopted more stringent QA/QC procedures.
Facility 29	High concentrations of zinc and copper in influent flow to the POTW.			The facility could not comply with POTW limits and now they haul waste by truck to Indianapolis.
Facility 30	High concentrations of total recoverable phenolics, TSS, BOD, pH, single phenol compound, COD, free cyanide amenable to chlorination and bis(2-ethylhexyl)phthalate discharged to receiving water.	Potential impact on surface water quality.	The facility has been subject to administrative and penalty orders. A violator may have to pay $2,000 per violation per day up to $10,000 for administrative orders.	The facility has had no significant violations recently.
Facility 31	High concentrations of organics and benzene discharged to receiving water.	Potential impact on surface water quality.		The facility has not committed any violations for a number of years.
Facility 32	Facility had a reporting problem but it was not a situation of non-compliance.		The issue was resolved without any major problems to the POTW.	

Table D.1. Reported Permit Violations and Other Discharge Effects From CWT Facilities				
Site	Reported Violation	Impacts on Receiving Waterbody or POTW	Actions Taken	Current Status
Facility 33	High concentrations of chromium (7.42 mg/L), nickel (2.97 mg/L), zinc (5.17 mg/L), and nonpolar fats, oil and grease (407.3 mg/L) discharged to receiving water.	Potential impact on surface water quality. POTW placed on 304 (L) short list.	The facility was fined $4,840 which covered all post-violation charges, including follow-up inspections, sampling and analytic tests.	The facility and POTW have been unable to reach a negotiated settlement.
Facility 34	High concentrations of copper, zinc, chromium, lead, nickel and fluoride.	Potential impact on surface water quality.	A telephone conversation and a notice of violation.	
Facility 35	High concentrations of sulfate, phenols and pH.	Potential impact on surface water quality.	Compliance Telephone Memorandums.	The facility has some equipment upgrades to improve the efficiency of the facility, not to address compliance issues.