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# Environmental Assessment For The Proposed Effluent Limitations Guidelines, Pretreatment Standards, And New Source Performance Standards For The Centralized Waste Treatment Industry

# ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED EFFLUENT LIMITATIONS GUIDELINES, PRETREATMENT STANDARDS, AND NEW SOURCE PERFORMANCE STANDARDS FOR THE
# CENTRALIZED WASTE TREATMENT INDUSTRY

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## ACKNOWLEDGMENTS AND DISCLAIMER

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# Executive Summary

This report assesses the water quality related benefits that would be expected if the U.S. Environmental Protection Agency (EPA) adopts the proposed effluent limitations, guidelines and pretreatment standards for the Centralized Waste Treatment (CWT) Industry. EPA estimates that under baseline conditions 205 CWT facilities discharge approximately 5.22 million lbs/year of metal and organic pollutants. Under the proposed rule this pollutant loading would be reduced by 79% or to 1.08 million lbs/year (see Table ES-1).

### Summary of Non-Scaled Environmental Effects

#### (a) Ambient Water Quality Effects

EPA analyzed the environmental effects of 95 of the 205 CWT facilities. The analysis comparing modeled instream pollutant levels to Ambient Water Quality Criteria (AWQC) estimates that current discharge loadings result in 110 contraventions at 18 receiving water locations. The proposed rule would reduce pollutant loadings so that only 53 contraventions would occur at 13 receiving water locations.

#### (b) Human Health Effects

EPA estimates that CWT loadings from the 95 CWT facilities are responsible for 0.95 cancer cases per year. The proposed rule would reduce this to 0.3 cases per year. In addition, an estimated 91,000 persons would have reduced lead exposure and related health effects. EPA estimates the proposed rule would reduce lead uptake enough to prevent the IQ loss of 72 points in children of recreational and subsistent anglers. EPA also estimates that the IQs of 34 angler children would not drop below 70.

#### (c) POTW Effects

EPA estimates that six of the 64 Publically Owned Treatment Works (POTWs) analyzed experience inhibition problems due to CWT wastes. The proposed rule would decrease this number by two. The proposed rule will also improve biosolids quality of 4,100 metric tons.

#### (d) Basis of Conclusions

The report bases its conclusion about these benefits on site-specific analyses of current conditions and the conditions that would be achieved if EPA adopts the proposed Best Practicable Technology (BPT) currently available / Best Available Technology (BAT) economically achievable and Pretreatment Standards for Existing Sources (PSES) regulations. Under the proposed regulations, EPA would limit 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 95 CWT Facilities [a]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [b, c] | 5.22 | 1.08 | 79% reduction |
| AWQC Contraventions | 110 at 18 streams | 53 at 13 streams | 5 streams become "contaminant free" [e] |
| Additional Cancer Cases/yr [d] | 0.95 | 0.3 | 0.65 cases reduced each year |
| Population of 91,000 individuals exposed to lead health effects [d] | | | Annual benefits are:<br>• Reduction of 1.6 cases of hypertension<br>• Protection of 72 IQ points<br>• Prevention of lowering of 34 children's IQS below 70 |
| Population of 19,000 individuals exposed to other non-cancer effects [d] | | | Health effects to exposed population are reduced |
| POTWs experiencing inhibition | 6 of 64 | 4 of 64 | Potential inhibition eliminated at 2 POTWs |
| Biosolid Quality | | | 4,100 metric tons improved |

a. Modeled results which are not scaled represent ten direct and 85 indirect CWT waste water dischargers.
b. 105 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.
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.

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

**Proposed Treatment Options**

EPA selected the treatment technologies which form the basis of the proposed regulatory option from a larger set of technology options based on several criteria, including efficiency of pollutant removal + cost and impacts to CWT facilities. Chapter 9 of the technical development document discusses the technology basis of each of the selected options for each of the proposed subcategories. Table ES-2 provides a summary of the technology basis for the selected regulatory option.

**Table ES-2. Technology Basis for Selected Options**

| Metals Subcategory [a] | Oils Subcategory | | Organics Subcategory |
|---|---|---|---|
| BPT / BAT / PSES [b] | BPT / BAT | PSES | BPT / BAT / PSES |
| **Option 4**: Batch precipitation, liquid solid separation, secondary precipitation and sand filtration | **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 proposed limitations and standards. First, EPA estimated pollutant concentrations in receiving water bodies for priority and nonconventional pollutants under current (baseline) and proposed treatment levels. These estimates are detailed in Chapter 12 of the technical development document. Second, EPA estimated water quality effects from direct and indirect dischargers 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

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

sufficient data to analyze water quality impacts from 95 of the 205 CWT facilities. Third, EPA combined the impacts for each of the subcategories to estimate water quality impacts as a result of the rule.

EPA then analyzed benefits in terms of impacts to 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 proposed pretreatment levels. Inhibition of POTW operations is estimated by comparing modeled POTW influent concentrations to available inhibition levels. 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. The summary data are based 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. Impacts included seven cases of impairment to POTW operations due to cyanide, nitrate/nitrite, sodium, zinc, and ammonia, and one case of an impact on the quality of water due to organics. In addition, four direct CWT facilities and eight POTWs, which receive discharges from 13 facilities were identified by states as being point sources causing water quality problems.

# 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 selected treatment technologies (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 / BAT / PSES [b] | BPT / BAT | PSES | BPT / BAT / PSES |
| **Option 4**:<br><br>Batch precipitation, liquid solid separation, secondary precipitation and sand filtration | **Option 9**:<br><br>Emulsion breaking, gravity separation, secondary gravity separation and dissolved air flotation | **Option 8**:<br><br>Emulsion breaking, gravity separation, and dissolved air flotation | **Option 4**:<br><br>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 economic analysis of the proposed CWT effluent guidelines. This report first projects effects associated with current (baseline) conditions and then evaluates potential effects expected from adoption of the proposed limitations and standards. Evaluations of the environmental benefit of meeting the proposed limits and standards are then presented.

EPA believes that its estimation of benefits is incomplete. EPA cannot currently quantitatively evaluate all human health and ecosystem benefits associated with water quality improvements. For example, the analyses have considered the effects of 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 can produce significant adverse environmental effects. Additionally, EPA has identified 205 CWT facilities, but due to a lack of receiving stream flow information and 44 facilities at zero discharge, EPA only modelled aquatic life and human health effects of 95 facilities.

Within these limitations, EPA analyzes the effects of current water discharges and assesses the benefits of reductions in these discharges resulting from this proposal. 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 105 pollutants of concern 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 evaluates potential aquatic life and human health effects resulting from current and projected contaminant releases separately for the three proposed 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 assesses 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 assesses 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 proposed limitations and standards[2]. EPA compares these instream concentrations to health-based toxic

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

[2] EPA uses the long-term averages rather than the proposed limitations and standards for these analyses.

effect values[3] 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 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 each proposed regulatory option. Chapter 12 of the technical support document for the proposal 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 proposed BPT/BAT treatment levels using a simple stream dilution model that does not account for fate and transport processes (see Equation 1).[4]

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

where:

$C_{is}$ = in stream pollutant concentration ($\mu$g/L);

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

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

| | | |
|---|---|---|
| L | = | facility pollutant loading (lb/year); |
| OD | = | facility operation (days/year); |
| FF | = | facility flow (million gallons (MG)/day); |
| SF | = | receiving stream flow (MG / day); and |
| CF | = | conversion factor 120 ($\mu$g MG / L lbs) = 0.2642 (gal/L) x 0.4536 (kg/lbs) x $10^3$ ($\mu$g MG / kg gal). |

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 proposed 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).[5] EPA uses the HMF to estimate the potential for human health effects.[6] 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).

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

where:

| | | |
|---|---|---|
| $C_{es}$ | = | estuary pollutant concentration ($\mu$g/L); |

---

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

[6]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.

| | | |
|---|---|---|
| L | = | facility pollutant loadings (lb/year); |
| OD | = | facility operation (days/year); |
| FF | = | facility flow (MG / day); |
| CDF | = | critical dilution factor (unitless); and |
| CF | = | conversion factor = 120 ($\mu$g MG / L lbs). |

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.

$$CDF = CF \ x \ \frac{R}{FF}\frac{1}{DCP} \qquad \textbf{(3)}$$

where:

| | | |
|---|---|---|
| CDF | = | critical dilution factor (unitless); |
| R | = | pollutant loading after treatment (kg/site/day) |
| DCP | = | dissolved concentration potential (mg/L); |
| FF | = | facility flow (MG / day); and |
| CF | = | conversion factor = 0.2642 (mg MG/ kg L) = $10^6$ (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 regulatory option (combinations of the treatment technology basis for each of the proposed 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 proposed 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.

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

where:

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

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

where:

| | | |
|---|---|---|
| $C_{es}$ | = | estuary pollutant concentration ($\mu$g/L); |
| L | = | facility pollutant loading (lb/year); |
| OD | = | facility operation (days/year); |
| TMT | = | POTW treatment removal efficiency (unitless); |
| PF | = | POTW flow (MG /year); |
| CDF | = | critical dilution factor (unitless); and |
| CF | = | conversion factor = 120 ($\mu$g 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 regulatory option (combinations of the treatment technologies basis for each of the proposed 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 (mg/L); |
| $C_{dj}$ | = | average POTW influent concentration for chemical *j* due to other sources (mg/L); |
| L | = | facility pollutant loading (lb/year); |
| OD | = | number of operating days for each facility (260 days/year); |
| PF | = | POTW flow (million gallons/year); and |
| CF | = | conversion factor = 43.7 (mg MG d / lbs yr L) = 365 (d/yr) x 0.4536 (kg/lbs) x $10^{-6}$ (MG/gal) x 0.2642 (gal/L) x $10^{6}$ (mg/kg). |

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.[7]

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).

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[7] 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.

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

where:

| | | |
|---|---|---|
| $C_{sp}$ | = | biosolids pollutant concentration ($\mu$g/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 |

## 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 (95 of the 205 facilities). EPA scaled up loading values for the oils subcategory facilities (from 64 to 122 facilities) to better estimate the full impact of the proposed treatment levels on loading levels from the CWT industry. Aquatic life and human health effects were estimated based on 95 facilities for which facility -specific data are available.
- CWT facilities operate 260 days per year.
- CWT facilities 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).

- Only the potential for metal contamination of sewage biosolids to levels that would prohibit its land application as a fertilizer or soil conditioner is evaluated. 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 of actual contraventions of human health criteria or toxic effect levels.

- 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 4-25). 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 4-26 and 4-27). 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 proposed 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 quantifies contraventions of AWQCs by dividing the modeled in-stream concentrations for each flow condition by the respective AWQC for each chemical.

### 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 proposed limitations and standards. EPA compares these instream concentrations to health-based toxic effect values[8] 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

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

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 quantifies contraventions of health-based AWQCs by dividing the predicted in-stream concentration under HMF conditions by the health-based AWQC for each chemical discharged from each facility under each regulatory option and baseline conditions.

### (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:

(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.

- Identifying Exposure Pathways of Concern.  EPA identifies water-related exposure pathways and target populations.  Pathways quantitatively evaluated include only the ingestion of fish by recreational and subsistence anglers.
- Estimating Exposure Point Concentrations.  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.

- Estimating Chronic Daily Intakes. 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 proposed regulatory options.

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

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

where:

| | | |
|---|---|---|
| CDI | = | chronic daily intake (mg/kg/day); |
| EPC | = | exposure point concentration (in-stream concentration under HMF conditions, in $\mu$g/L); |
| CF | = | conversion facto r= $10^{-6}$ (kg mg / g $\mu$g) |
| BCF | = | bioconcentration factor (11,100 l/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 (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 quantifies carcinogenic risks using the equation below:

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

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:

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

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 quantify 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.

Noncarcinogenic Hazard Calculations

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 quantify the potential for an adverse noncarcinogenic effect to occur, using the following equation:

$$HQ_i = \frac{CDI_i}{RfD_i} \qquad \textbf{(11)}$$

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 quantifying 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[9]. 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:

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

- 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.

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

where:

$(\text{Total Lost IQ})_k$ = Total Reduction of IQ points in Affected Population

$\Delta GM_K$ = 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).[10]

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:

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

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

where:

$PbB_{adult'cental}$ = Central estimate of blood lead level concentration ($\mu$g/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 $\mu$g/dL) .

PbS = Soil lead concentration ($\mu$g/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 ($\mu$g/dL blood lead increase per $\mu$g/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:

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

where:

$PbB_{adult,central}$ = Central estimate of blood lead level concentration ($\mu$g/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 $\mu$g/dL)

$Is_c$ = In stream Concentration of lead ($\mu$g/L) (Affected receiving water bodies had in stream concentrations of lead ranging from 0.5 $\mu$g/L to approximately 7.7 $\mu$g/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).[11]

BKSF = Biokinetic Slope Factor relating (quasi-steady state) increase in typical adult blood lead concentrations to average daily uptake ($\mu$g/dL blood lead increase per $\mu$g/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)

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*

[11] $AF_s$ is the product of $Af_{soluable}$ * $RBF_{soilsoluable}$ where: $Af_{soluable}$ equals 0.1 and $RBF_{soilsoluable}$ equals 0.6. EPA uses an $Af_{soluable}$ =0.1 to account for the fact that under CWT scenarios lead is ingested in conjunction with a meal.

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.

**<u>Using the Equation to Estimate Benefits to the Affected Adult Population</u>**

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 proposed 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).

## 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

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[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. (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.

**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 | 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

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.

### 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

**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

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

### 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)**

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

where:

| | | |
|---|---|---|
| $HH_{oo}$ | = | human health value ($\mu$g/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 $\mu$g/mg). |

**For Carcinogenicity Protection (ingestion of organisms only)**

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

where:

| | | |
|---|---|---|
| $HH_{oo}$ | = | human health value ($\mu$g/L); |
| BW | = | body weight (70 kg); |
| RL | = | risk level ($10^{-6}$); |
| SF | = | cancer slope factor $(\text{mg/kg/day})^{-1}$; |

| | | |
|---|---|---|
| $IR_f$ | = | fish ingestion rate (0.0065 kg/day); |
| BCF | = | bioconcentration factor (L/kg); and |
| CF | = | conversion factor (1,000 $\mu$g/mg). |

**For Toxicity Protection (ingestion of water and organisms)**

$$HH_{wo} = \frac{RfD \ x \ CF}{IR_w + (IR_f \ x \ BCF)} \qquad \textbf{(Eq. 14)}$$

where:

| | | |
|---|---|---|
| $HH_{wo}$ | = | human health value ($\mu$g/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 $\mu$g/mg). |

**For Carcinogenic Protection (ingestion of water and organisms)**

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

where:

| | | |
|---|---|---|
| $HH_{wo}$ | = | human health value ($\mu$g/L); |
| BW | = | body weight (70 kg); |
| RL | = | risk level ($10^{-6}$); |
| SF | = | cancer slope factor $(mg/kg/day)^{-1}$; |
| $IR_w$ | = | 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 $\mu$g/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 proposed limits and standards. The first subsection, **Environmental Effects of 95 CWT facilities at Baseline and with Proposed Limits and standards**, presents the non-scaled environmental effects of 95 of the 205 CWT facilities that EPA has identified. Specifically, EPA analyzed 10 of 14 direct and 85 of 147 indirect wastewater dischargers discharging up to 105 pollutants (see Table 4-1). The 110 CWT facilities not evaluated either are zero dischargers (44) 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 (95). 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 proposed 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 proposed technologies on discharging conventional pollutants (e.g., BOD, COD, TSS). For example, although under baseline conditions, CWT facilities discharge 29.5 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 105 Pollutants of Concern 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 | | Biphenyl | | x | | Dibenzofuran | | x | |
| 4-Methyl-2-Pentanone | | x | x | Bis(2-ethylhexyl) phthalate | | x | | Dibenzothiophene | | x | |
| Acenaphthene | | x | | Boron | x | x | x | Dibromoethane, 1,2- | | | x |
| Acenaphthylene | | x | | Butanone, 2- | x | x | x | Dichloroaniline, 2,3- | | | x |
| Acetophenone | | | x | Butyl Benzyl Phthalate | | x | | Dichlorobenzene, 1,2- | | x | |
| Alpha-terpineol | | x | | Cadmium | x | x | | Dichlorobenzene, 1,4- | | x | |
| Aluminum | x | x | x | Carbazole | | x | | Dichloroethane, 1,2- | | x | x |
| Anthracene | | x | | Carbon disulfide | | x | | Dichloroethene, 1,1- | | x | x |
| Antimony | x | x | x | Chlorobenzene | | x | | Dichloromethane | | x | x |
| Arsenic | x | x | | Chloroform | | x | x | Diethyl phthalate | | x | |
| Barium | x | x | x | Chromium | x | x | x | Dimethyl phenanthrene, 3,6- | | x | |
| Benzene | | x | x | Chrysene | | x | | Dimethyl phenol, 2,4- | | x | |
| Benzo(a)anthracene | | x | | Cobalt | x | x | x | Diphenyl ether | | x | |
| Benzo(a)pyrene | | x | | Copper | x | x | x | Diphenylamine | | x | |
| Benzo(b)fluoranthene | | x | | Cresol, o- | | x | x | Ethylbenzene | | x | |
| Benzo(k)fluoranthene | | x | | Cresol, p- | | x | x | Fluoranthene | | x | |
| Benzofluorene, 2,3- | | x | | Cyanide | | | x | Fluorene | | x | |
| Benzoic acid | x | x | | Di-n-butyl phthalate | | x | | Hexanoic acid | | x | x |
| Benzyl alcohol | | x | | Di-n-octyl phthalate | | x | | Iron | x | x | x |

a. EPA details the pollutants of concern (POCs) in chapter six of the technical development document. This analysis only includes a portion of the POCs identified in Chapter 6.
b. Pollutant counts for each CWT industry subcategory are as follows: 23 metals; 89 oils; and 45 organics.
c. The POCs considered in this analysis are presented, by subcategory, in Appendix C.

(Continued onto next page)

**Table 4-1. The 105 Pollutants of Concern for the CWT Industry [a] (Continued)**

| Pollutants [b, c] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| POLLUTANT | METALS | OILS | ORGANICS | POLLUTANT | METALS | OILS | ORGANICS | POLLUTANT | METALS | OILS | ORGANICS |
| Lead | x | x | | P-Cymene | | x | | Titanium | x | x | |
| Lithium | | | x | Pentachlorophenol | | | x | Toluene | | x | x |
| Manganese | x | x | x | Pentamethylbenzene | | x | | Trans-1,2-dichloroethene | | | x |
| Mercury | x | x | | Phenol | | x | x | Trichlorobenzene, 1,2,4- | | x | |
| Methyl fluorene, 1- | | x | | Phenylnaphthalene, 2- | | x | | Trichloroethane, 1,1,1- | | x | x |
| Methylnaphthalene, 2- | | x | | Propanone, 2- | x | x | x | Trichloroethane, 1,1,2- | | | x |
| Methylphenanthrene, 1- | | x | | Pyrene | | x | | Trichloroethene | | x | x |
| Molybdenum | x | x | x | Pyridine | | | x | Trichlorophenol, 2,4,5- | | | x |
| N-Decane | | x | | Selenium | x | x | | Trichloropropane, 1,2,3- | | | x |
| N-Docosane | | x | | Silicon | x | x | | Tripropyleneglycol methylether | | x | |
| N-Dodecane | | x | | Strontium | | x | | Vinyl chloride | | | x |
| N-Eicosane | | x | | Styrene | | x | | Xylene, m- | | x | x |
| N-Hexadecane | | x | | Tetrachloroethene | | | x | Xylene, o-, p- | | x | |
| N-Octadecane | | x | | Tetrachloroethane, 1,1,1,2- | | | x | Zinc | x | x | x |
| N-Tetradecane | | x | | Tetrachloromethane | | | x | | | | |
| Naphthalene | | x | | Tetrachlorophenol, 2,3,4,6 - | | | x | | | | |
| Nickel | x | x | x | Tin | x | x | x | | | | |

a. EPA details the pollutants of concern (POCs) in chapter six of the technical development document. This analysis only includes a portion of the POCs identified in Chapter 6.
b. Pollutant counts for each CWT industry subcategory are as follows: 23 metals; 89 oils; and 45 organics.
c. The POCs considered in this analysis are presented, by subcategory, in Appendix C.

### 4.1.1 Combined Environmental Effects of 95 CWT Facilities at Baseline and with Proposed Limits

EPA estimates that under baseline, 205 CWT facilities discharge approximately 5.22 million lbs/year of metals and organic pollutants. Under the proposed rule pollutant loadings would be reduced by 79% or to 1.08 million lbs/year. The analysis comparing non-scaled (95 of the 205 facilities) modeled instream pollutant levels to Ambient Water Quality Criteria (AWQC) estimates that current discharge loadings result in 110 contraventions of criteria at 18 receiving water location. As seen in Table 4-2, the proposed rule would reduce the number of contraventions to 53 at 13 receiving water locations. EPA estimates that CWT discharges to surface waters are responsible for 0.95 cancer cases per year, but would be reduced to 0.3 cases per year under the proposed rule. In addition, an estimated 91,000 persons would have reduced lead exposure and related health effects. EPA also estimates the proposed rule would reduce lead uptake enough to prevent the IQ loss of 72 points in angler children (i.e., children living in a recreational angler's household), and that the IQs of 34 children would not drop below 70 (see Table 4-3). EPA estimates that six of the 64 POTWs analyzed experience inhibition problems due to CWT wastes. Under the proposed rule inhibition problems would be eliminated at two POTWs. The proposed rule would also improve the quality of 4,100 metric tons of biosolids.

**Table 4-2. Summary of Non-Scaled Environmental Effects of 95 CWT Facilities [a]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [b, c] | 5.22 | 1.08 | 79% reduction |
| AWQC Contraventions | 110 at 18 streams | 53 at 13 streams | 5 streams become "CWT industry contaminant free" |
| Additional Cancer Cases/yr [d] | 0.95 | 0.3 | 0.65 cases reduced each year |
| Population of 91,000 individuals exposed to lead health effects [d] | | | Annual benefits are:<br>• Reduction of 1.6 cases of hypertension<br>• Protection of 72 IQ points<br>• Prevention of lowering of 34 children's IQs below 70 |
| Population of 19,000 individuals exposed to other non-cancer effects [d] | | | Health effects to exposed population are reduced |
| POTWs experiencing inhibition | 6 of 64 | 4 of 64 | Potential inhibition eliminated at 2 POTWs |
| Biosolid Quality | | | 4,100 metric tons improved |

a. Modeled results represent 10 direct and 85 indirect waste water dischargers.
b. 105 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.
d. Through consumption of contaminated fish tissue.

**Table 4-3. Annual Reductions in Lead Related Health Effects From Reducing Lead Exposure of 91,000 People Potentially Affected by CWT Dischargers [a]**

| Lead Health Effect | Men | Female | Child | Neo-Natal | Total |
|---|---|---|---|---|---|
| Hypertension (Cases) | 1.6 | NA | NA | NA | 1.6 |
| Coronary Heart Disease (Cases) | 0.1 | < 0.01 | NA | NA | 0.1 |
| Cerebral Accidents (cases) | < 0.01 | < 0.01 | NA | NA | < 0.01 |
| Brain Infarction (cases) | < 0.01 | NA | NA | NA | NA |
| Premature Mortality (cases) | 0.06 | < 0.01 | NA | 0.05 | 0.11 |
| IQ point reduction (IQ points) | NA [b] | NA | 72 | NA | 72 |
| Children with IQ < 70 (cases) | NA | NA | 34 | NA | 34 |

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

### 4.1.2 Metals Subcategory

EPA estimates that 59 metal CWT facilities discharge at baseline approximately 1.74 million lbs/year of metals and organics to surface waters (see Table 4-4). Under the proposed rule, this pollutant loading would be reduced by 91% or to 0.15 million lbs/year.

EPA analyzed the environmental effects of 45 of the 59 metal CWT facilities. EPA estimates the proposed rule would reduce lead health related effects and prevent the IQ loss of approximately 36 points in angler children, and the IQs of about 18 children from dropping below 70 (see Table 4-5).

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

| Loadings (pounds/year) [a, b] | | | |
|---|---|---|---|
| | Direct Dischargers | Indirect Dischargers [c] | Total |
| Current | 1,460,000 | 280,000 | 1,740,000 |
| Proposed (Option 4) BPT/BAT/PSES | 100,000 | 50,000 | 150,000 |
| No. of Pollutants Evaluated | 23 | 23 | 23 |
| No. of Facilities Evaluated [d] | 8 | 37 | 45 |

a. Consists of 23 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 59 metal facilities.
c. For Indirect dischargers, loading estimates have been adjusted to account for POTW removals.
d. The total universe consists of 59 facilities (9 directs, 41 indirects and 9 zero dischargers).

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

| Lead Health Effect | Direct Dischargers (2) | Indirect Dischargers (1 ) | Total |
|---|---|---|---|
| Hypertension (Cases) | 0.5 | 0.3 | 0.8 |
| 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) | 15.5 | 20 | 35.5 |
| Children with IQ < 70 (cases) | 7 | 10.5 | 17.5 |

**(a) Metals Subcategory - Direct Dischargers**

EPA estimates that nine direct discharging CWT facilities discharge at baseline approximately 1.46 million lbs/year of metals and organics (see Table 4-6). The proposed BAT/BPT (Option 4) levels would reduce this pollutant loading by 93%, or to 0.1 million lbs/year.

EPA analyzed the modeled environmental effects of eight of the nine direct discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 11 contraventions in one stream would be reduced to six (see Table 4-7). Most of the contraventions are for chronic aquatic life criteria (see Table 4-8).

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 treatment levels. 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 32,000 individuals. The proposed discharge levels would prevent the IQ loss of 15.5 points in angler children, and the dropping of seven children's IQs below 70.

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

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [b] | 1.46 | 0.1 | 93% Reduction |
| AWQC Contraventions | 11 at one stream | 6 at one stream | |
| Additional Cancer Cases/yr [c] | < 0.1 | < 0.1 | |
| Population of 32,000 individuals exposed to lead health effects [c] | | | Annual benefits are:<br>• Reduction of 0.5 cases of hypertension<br>• Protection of 15.7 IQ points<br>• Prevention of lowering of 7 children's IQs below 70 |
| Population exposed to other non-cancer effects [c] | 0 | 0 | |

a. Modeled results represent eight of nine direct waste water dischargers. **Loadings** are scaled to represent all nine facilities.
b. 23 of 105 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 Contraventions for Eight Direct Dischargers**

| | Acute Aquatic Life | Chronic Aquatic Life | Human Health (Organisms Only) | Human Health (Water and Organisms) | Total [a] |
|---|---|---|---|---|---|
| Current | | | | | |
| Streams (No.) [b] | 1 | 1 | 1 | 1 | 1 |
| Pollutants(No)[c] | 1 | 10 | 1 | 1 | 11 |
| | | | | | |
| Proposed Option | | | | | |
| Streams (No.) | 0 | 1 | 0 | 0 | 1 |
| Pollutants (No.) | 0 | 6 | 0 | 0 | 6 |

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 eight.
c. Number of the 23 different pollutants analyzed that exceed ambient water quality and human heath-based criteria.

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

| Pollutants | Acute Aquatic Life [a, b] | | Chronic Aquatic Life [a, b] | | Human Health [a, b] | |
|---|---|---|---|---|---|---|
| | Current | Proposed Option | Current | Proposed Option | Current | Proposed Option |
| Arsenic | — | — | — | — | 1(0.95 )[c] | — |
| Aluminum | — | — | 1(590) | — | — | — |
| Boron | — | — | 1(690) | 1(180) | — | — |
| Cadmium | — | — | 1(1.3) | — | — | — |
| Copper | 1(20) | — | 1(18) | 1(12.5) | — | — |
| Lead | — | — | 1(7.67) | — | — | — |
| Mercury | — | — | 1(0.09) | — | — | — |
| Molybdenum | — | — | 1(58) | 1(37.5) | — | — |
| Selenium | — | — | 1(9.3) | 1(7.49) | — | — |
| Silver | — | — | 1(1.5) | 1(0.44) | — | — |
| Zirconium | — | — | 1(16.4) | 1(16.4) | — | — |
| **Total Pollutants** | **1** | **0** | **10** | **6** | **1** | **0** |

a. Number(s) in parentheses represent instream concentration ($\mu$g/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 are not the sum of the water bodies where contraventions occur.
c. Arsenic at 0.95$\mu$g/L is estimated to exceed human health criteria for both organisms only ($HH_{oo\ (As)}$ = 0.14 $\mu$g/L) and water and organisms ($HH_{wo\ (As)}$ = 0.017 $\mu$g/L)

### (b) Metals Subcategory - Indirect Dischargers

EPA estimates that 41 indirect discharging CWT facilities currently discharge 0.28 million lbs/year of metals and organics (see Table 4-9). The proposed PSES (Option 4) treatment level would reduce pollutant loadings by 82%, or to 0.05 million lbs/year.

EPA modeled the environmental effects of 37 of the 41 indirect discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 13 contraventions in two streams would be reduced to seven contraventions in two streams (see Tables 4-10). Most of the contraventions are for chronic aquatic life criteria (see Table 4-11).

EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year. However, EPA estimates that one facility discharges lead at levels which potentially could cause adverse health effects in recreational and subsistence angler populations totaling approximately 17,000 individuals (see Table 4-9). The proposed discharge levels would prevent the IQ loss of 20 points in angler children, and the lowering of ten children's IQs below 70. EPA also estimates a decreased risk of non-cancer effects to an additional

16,800 anglers.  The proposed PSES levels would reduce risks to these adult and child populations significantly.

EPA estimates that one of the 30 POTWs experience inhibition problems due to two pollutants in CWT wastes (see Tables 4-12).  The proposed rule would decrease the number of pollutants to one.  The proposed rule would also allow one POTW to switch its biosolids disposal from incineration to surface disposal.

**Table 4-9.  Metals Subcategory - Environmental Effects of 37 Indirect Dischargers [a, b]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [c] | 0.28 | 0.05 | 82% Reduction |
| AWQC Contraventions | 13 at 2 streams | 7 at 2 streams | |
| Additional Cancer Cases/yr [d] | < 0.1 | < 0.1 | |
| Population of 17,000 individuals exposed to lead health effects [d] | | | Annual benefits are:<br>• Reduction of 0.3 cases of hypertension<br>• Protection of 20 IQ points<br>• Prevention of lowering of 10.5 children's IQs below 70 |
| Population of 16,800 individuals exposed to other non-cancer effects [d] | | | Health effects are significantly reduced |
| POTWs experiencing inhibition [e] | 1 POTW with two pollutants | 1 POTW with one pollutant | Potential inhibition reduced by one pollutant |
| Biosolid Quality | | | 1 POTW able to switch from incineration to surface disposal |

a. Modeled non-scaled results represent 37 of 41 indirect waste water dischargers.  **Loadings** are scaled to represent all 41 indirect facilities.
b. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
c. 23 of 105 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 30.

**Table 4-10. Metals Subcategory - Projected Criteria Contraventions for 37 Indirect Dischargers**

| | Acute Aquatic Life | Chronic Aquatic Life | Human Health (Water and Organisms) | Human Health (Organisms Only) | Total [a] |
|---|---|---|---|---|---|
| Current | | | | | |
| Streams (No.) [b] | 1 | 1 | 2 | 1 | 2 |
| Pollutants (No.) [c] | 5 | 12 | 2 | 1 | 13 |
| | | | | | |
| Proposed Option | | | | | |
| Streams (No.) | 1 | 1 | 2 | 1 | 2 |
| Pollutants (No.) | 2 | 6 | 1 | 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 receiving streams is 30 (20 rivers and 10 estuaries).
c. Number of different pollutants that exceed ambient water quality and human heath based criteria.

**Table 4-11. Metals Subcategory - Pollutants Projected to Exceed Criteria for 37 Indirect Dischargers**

| Pollutants | Acute Aquatic Life [a, b] | | Chronic Aquatic Life [a,b] | | Human Health (Water & Orgs.) [a,b] | |
|---|---|---|---|---|---|---|
| | Current | Proposed Option | Current | Proposed Option | Current | Proposed Option |
| Aluminum | 1(131) | — | 1(951) | 1(146) | — | — |
| Antimony | 1(650) | — | 1(473) | — | — | — |
| Arsenic [c] | — | — | — | — | 2(0.16 -0.022) | 2(0.16 - 0.022) |
| Boron | — | — | 1(1930) | 1(512) | — | — |
| Cobalt | — | — | 1(50) | — | — | — |
| Copper | 1(20) | 1(20) | 1(16) | 1(15) | — | — |
| Lead | — | — | 1(6.6) | — | — | — |
| Mercury | — | — | 1(1.0) | 1(0.02) | — | — |
| Molybdenum | — | — | 1(334) | 1(170) | — | — |
| Nickel | — | — | 1(277) | — | — | — |
| Selenium | 1(95) | 1(64) | 1(69) | 1(47) | — | — |
| Tin | — | — | 1(73) | — | — | — |
| Zinc | 1(242) | — | 1(176) | — | — | — |
| **Total Pollutants** | **5** | **2** | **12** | **6** | **1** | **1** |

a. Number(s) in parentheses represent instream concentrations ($\mu$g/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 contraventions occur.
c. Exceeds human health-based criteria (organisms only) under current conditions: 1(0.163).

**Table 4-12. Metals Subcategory - Projected POTW Inhibition Problems from 37 Indirect Dischargers**

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

a. 37 CWT facilities discharge to 30 POTWs
b. 23 of 105 pollutants are analyzed
c. lead and boron
d. boron

### 4.1.2 Oils Subcategory

EPA estimates that 128 oil CWT facilities discharge at baseline approximately 1.92 million lbs/year of metals and organics to surface waters (see Table 4-13). Under the proposed rule, pollutant loadings would be reduced by 72% or to 0.53 million lbs/year.

EPA analyzed the environmental effects of 64 of the 128 oil CWT facilities. EPA estimates that the proposed limits would reduce additional annual cancer cases from 0.94 to 0.3 (see Table 4-16). EPA also estimates the proposed rule would reduce lead health related effects and prevent the IQ loss of approximately 36 points in angler children, and the IQs of 16 children from dropping below 70 (see Table 4-14).

#### (a) Oils Subcategory - Direct Dischargers

EPA estimates that under baseline conditions three direct discharging CWT oils subcategory facilities discharge approximately 43,000 lbs/year of metals and organics (see Table 4-15). Under the proposed BAT/BPT (Option 9) levels, pollutant loadings would be reduced by 53%, or to 20,000 lbs/year.

EPA modeled the environmental effects of one of three direct discharging CWT facilities. Under current conditions, the one facility does not discharge pollutants at levels that exceed AWQC or human health based criteria.  EPA estimates cancer risk from fish consumption to be much less than 0.1 cases per year.  EPA projects that no human populations are exposed to pollutants that could result in non-cancer effects under current treatment levels.

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

| Loadings (pounds/year) [a, b] | | | |
|---|---|---|---|
| | **Direct Dischargers** | **Indirect Dischargers [c]** | **Total** |
| Current | 43,000 | 1,872,000 | 1,915,000 |
| Proposed (BPT/BAT- Option 9)<br>(PSES - Option 8) | 20,000<br>--- | ---<br>511,000 | 531,000 |
| No. of Pollutants Evaluated | 89 | 89 | 89 |
| No. of Facilities Evaluated [d] | 1 | 63 | 64 |

a. Consists of 89 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 128 oil facilities.
c. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
d. The total universe consists of 128 facilities (3 directs, 92 indirects and 33 zero dischargers).

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

| Lead Health Effect | Indirect Dischargers (1 ) |
|---|---|
| Hypertension (Cases) | 0.6 |
| Coronary Heart Disease (Cases) | < 0.1 |
| Cerebral Accidents (cases) | < 0.1 |
| Brain Infarction | < 0.1 |
| Premature Mortality (cases) | < 0.1 |
| IQ Point Reduction in Children  (IQ points) | 35.6 |
| Children with IQ < 70 (cases) | 16 |

**Table 4-15. Oils Subcategory - Environmental Effects of One Direct Discharging CWT Facility [a]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (lbs/yr) [b] | 43,000 | 20,000 | 53% Reduction |
| AWQC Contraventions | 0 | 0 | |
| Additional Cancer Cases/yr [c] | < 0.1 | < 0.1 | |
| Population exposed to non-cancer effects [c] | | | |

a. Modeled results represent one of three direct waste water dischargers. **Loadings** are scaled to represent all three facilities.
b. 89 of 105 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.

### (b) Oils Subcategory - Indirect Dischargers

EPA estimates that 92 indirect discharging CWT facilities currently discharge 1.87 million lbs/year of metals and organics (see Table 4-16). Under the proposed PSES (Option 8) treatment level, pollutant loadings would be reduced by 73%, or to 0.51 million lbs/year.

EPA modeled the environmental effects of 63 of the 92 indirect discharging oil CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that 18 contraventions in 15 streams would be reduced to nine contraventions in nine streams (see Tables 4-17 and 4-18).

EPA estimates that under the proposed rule, annual cancer cases from consumption of contaminated fish from water bodies receiving oils indirect dischargers would be reduced from 0.94 cases per year to less than 0.3 cases per year. EPA also estimates that one facility discharges lead at levels which potentially could cause adverse health effects in recreational and subsistence angler populations totaling approximately 42,000 individuals. EPA estimates that the proposed rules would prevent the loss of 36 IQ points in children of anglers, and prevent the lowering of 16 children's IQs below 70. EPA also estimates the PSES limits would reduce the risk of non-cancer effects to an additional 2,100 anglers.

EPA estimates that four of the 48 POTWs experience inhibition problems due to two pollutants in CWT wastes (see Table 4-19). The proposed rule would decrease the number of POTWs to three. The proposed rule would also allow one POTW to switch its biosolids disposal from incineration to surface disposal.

**Table 4-16. Oils Subcategory - Environmental Effects of 63 Indirect Dischargers [a, b]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [c] | 1.87 | 0.51 | 73% Reduction |
| AWQC Contraventions | 11 at one stream | 6 at one stream | |
| Additional Cancer Cases/yr [d] | 0.94 | < 0.3 | A reduction of 0.64 cases / year |
| Population of 42,000 individuals exposed to lead health effects [d] | | | Annual benefits are:<br>• Reduction of 0.5 cases of hypertension<br>• Protection of 15.7 IQ points<br>• Prevention of lowering of 7 children's IQs below 70 |
| Population of 2,100 individuals exposed to other non-cancer effects [d] | | | Health effects are reduced |
| POTWs experiencing inhibition [e] | 4 POTWs with two pollutants | 3 POTWs with two pollutants | Potential inhibition reduced by one POTW |
| Biosolid Quality | 1 POTW | 0 POTWs | 1 POTW able to switch from incineration to surface disposal |

a. Modeled non-scaled results represent 63 of 92 indirect waste water dischargers. **Loadings** are scaled to represent all 92 indirect dischargers.
b. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
c. 89 of 105 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 Metal subcategory CWTs is 48.

**Table 4-17. Oils Subcategory - Projected Criteria Contraventions for 63 Indirect Dischargers**

| | **Acute Aquatic Life** | **Chronic Aquatic Life** | **Human Health (Water and Orgs.)** | **Human Health (Orgs. Only)** | **Total [a]** |
|---|---|---|---|---|---|
| Current | | | | | |
| Streams (No.) [b] | 1 | 2 | 15 | 15 | 15 |
| Pollutants (No.) [c] | 1 | 8 | 10 | 4 | 18 |
| | | | | | |
| Proposed Options (8) | | | | | |
| Streams (No.) | 0 | 2 | 9 | 9 | 9 |
| Pollutants (No.) | 0 | 2 | 7 | 3 | 9 |

a. Pollutants may exceed criteria on a number of streams, therefore the total does not equal the sum of pollutants exceeding criteria.
b. 48 POTWs discharge into 48 waterbodies (27 rivers and 21 estuaries).
c. 89 pollutants of 105 (see Table 4-1).

**Table 4-18. Oils Subcategory - Pollutants Projected to Exceed Criteria for 63 Indirect Dischargers**

| Pollutants | Acute Aquatic Life | | Chronic Aquatic Life | | Human Health (Water and Orgs.) | | Human Health (Orgs. Only) | |
|---|---|---|---|---|---|---|---|---|
| | Current | Proposed Option | Current | Proposed Option | Current | Proposed Option | Current | Proposed Option |
| benzo (a) anthracene | — | — | — | — | 5(0.0028 - 0.02) | 1(0.004) | — | — |
| benzo(b)fluoranthene | — | — | — | — | 1(0.04) | — | — | — |
| benzo (a) pyrene | — | — | 1(0.11) | — | 15(0.0004 - 0.04) | 9(0.0001 - 0.009) | 15(0.0006 - 0.04) | 9(0.0001 - 0.009) |
| bis(2-ethylhexyl phthalate | — | — | — | — | 1(9.6) | — | 1(9.6) | — |
| chrysene | — | — | — | — | 5(0.005 - 0.003) | 1(0.004) | — | — |
| 1,1-dichloroethene | — | — | — | — | 1(0.07) | 1(0.07) | — | — |
| 1,4-dichlorobenzene | — | — | — | — | 1(1.3) | — | — | — |
| fluoranthene | — | — | 1(9.1) | — | — | — | — | — |
| methylene chloride | — | — | — | — | 1(5.1) | 1(4.8) | — | — |
| phenanthrene | — | — | — | — | 12(0.0004 - 0.4) | 7(0.0003 - 0.08) | 5(0.03 - 0.4) | 1(0.08) |
| arsenic | — | — | — | — | 1(1.4) | 1(0.2) | 1(1.4) | 1(0.2) |
| aluminum | — | — | 1(600) | 1(312) | — | — | — | — |
| boron | — | — | 2(62 - 175) | 2(62 - 175) | — | — | — | — |
| iron | — | — | 1(1050) | — | — | — | — | — |
| lead | — | — | 1(3.2) | — | — | — | — | — |
| mercury | — | — | 1(0.02) | — | — | — | — | — |
| molybdenum | — | — | 1(28) | — | — | — | — | — |
| zinc | 1(152) | — | — | — | — | — | — | — |
| **Total Pollutants** | **1** | **0** | **8** | **2** | **10** | **7** | **4** | **3** |

a. Number(s) in parentheses represent instream concentrations ($\mu$g/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 contraventions occur.

**Table 4-19. Oils Subcategory - Projected POTW Inhibition Problems from 63 Indirect Dischargers**

| | Biological Inhibition |
|---|---|
| Current | |
| POTWs (No.) [b] | 4 |
| Pollutants (No.) [c] | 2 [a] |
| **Total Problems** | **4** |
| Proposed Option 8 | |
| POTWs (No.) | 3 |
| Pollutants (No.) | 2 |
| **Total Problems** | **3** |

a. arsenic, boron
b. 48 POTWs discharge into 48 waterbodies (27 rivers and 21 estuaries).
c. 89 pollutants of 105 (see Table 4-1).

### 4.1.3 Organics Subcategory

EPA estimates that 19 organic CWT facilities discharge at baseline approximately 1.57 million lbs/year of metals and organics to surface waters (see Table 4-20). Under the proposed rule, pollutant loadings would be reduced by 74% or to 0.4 million lbs/year. EPA analyzed the environmental effects of all 19 organic subcategory CWT facilities.

**Table 4-20. Organics Subcategory - Pollutant Loadings for 19 Dischargers**

| | Loadings (pounds/year) [a, b] | | |
|---|---|---|---|
| | **Direct Dischargers** | **Indirect Dischargers** | **Total** |
| Current | 390,000 | 1,180,000 | 1,570,000 |
| Proposed (Option 4) BPT/BAT/PSES | 390,000 | 10,000 | 400,000 |
| No. of Pollutants Evaluated | 45 | 45 | 45 |
| No. of Facilities Evaluated [b] | 4 | 15 | 19 |

a. Consists of 45 pollutants (see Table 4-1); Loadings are representative of metals and organic pollutants evaluated; only conventional pollutants are not included in this analysis.
b. The total universe consists of 19 facilities.

### (a) Organics Subcategory - Direct Dischargers

EPA estimates that under baseline conditions four direct discharging CWT facilities discharge approximately 0.39 million lbs/year of metals and organics facilities (see Table 4-21). Under the proposed BAT/BPT (Option 4) levels, pollutant loadings would remain at about 0.39 million lbs/year.

EPA modeled the environmental effects of all of the four organic direct discharging CWTs. The analysis comparing modeled instream pollutant levels to AWQC estimates that one contravention in one stream would still occur under the proposed 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 proposed treatment levels.

**Table 4-21. Organics Subcategory - Environmental Effects of Four Direct Dischargers [a]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [b] | 0.39 | 0.39 | No Reduction |
| AWQC Contraventions | one at one stream | one at one stream | |
| Additional Cancer Cases/yr [c] | < 0.1 | < 0.1 | |
| Population exposed to non-cancer effects [c] | 0 | 0 | |

a. Modeled results and loadings represent all of the four direct waste water dischargers.
b. 45 of 105 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.

### (b) Organics Subcategory - Indirect Dischargers

EPA estimates that 15 indirect discharging CWT facilities currently discharge 1.18 million lbs/year of metals and organics (see Table 4-22). Under the proposed PSES (Option 4) treatment level, pollutant loadings would be reduced by 99%, or to 0.01 million lbs/year.

EPA modeled the environmental effects of all of the 15 organic indirect discharging CWT facilities. The analysis comparing modeled instream pollutant levels to AWQC estimates that three contraventions in four streams would be reduced to zero contraventions in zero streams (see Tables 4-23 and 4-24).

EPA estimates cancer risk from fish consumption to be much less than 0.1 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 4-22. Organics Subcategory - Environmental Effects of 15 Indirect Dischargers [a, b]**

| | Current | Proposal | Summary |
|---|---|---|---|
| Loadings (million lbs/yr) [c] | 1.18 | 0.01 | 99% Reduction |
| AWQC Contraventions | three at four streams | zero at zero streams | |
| Additional Cancer Cases/yr [d] | < 0.1 | < 0.1 | |
| Population exposed to non-cancer effects [d] | 0 | 0 | |
| POTWs experiencing inhibition [e] | 0 | 0 | |
| Biosolid Quality | 0 | 0 | |

a. Modeled results represent all of the 15 indirect waste water dischargers.
b. For indirect dischargers, loading estimates have been adjusted to account for POTW removals.
c. Consists of 45 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 4-23. Organics Subcategory - Projected Criteria Contraventions for 15 Indirect Dischargers**

| | Acute Aquatic Life | Chronic Aquatic Life | Human Health (Water and Orgs.) | Human Health (Orgs. Only) | Total [a] |
|---|---|---|---|---|---|
| Current | | | | | |
| Streams (No.) | 0 | 1 | 4 | 0 | 4 |
| Pollutants (No.) [b] | 0 | 2 | 1 | 0 | 3 |
| | | | | | |
| Proposed Option | | | | | |
| Streams (No.) | 0 | 0 | 0 | 0 | 0 |
| Pollutants (No.) | 0 | 0 | 0 | 0 | 0 |

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 4-24. Organics Subcategory - Pollutants Projected to Exceed Criteria for Indirect Dischargers**

| 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 | Proposed Option | Current | Proposed Option | Current | Proposed Option | Current | Proposed Option |
| Aluminum | — | — | 1(125) | — | — | — | — | — |
| Boron | — | — | 1(38) | — | — | — | — | — |
| Methylene chloride | — | — | — | — | 4(5.5 - 310) | — | — | — |
| **Total Pollutants** | **0** | **0** | **2** | **0** | **1** | **0** | **0** | **0** |

a. Number(s) in parentheses represent instream concentrations ($\mu$g/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 contraventions 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 a permit exceedence, local limit exceedence, 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 4-25). 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 4-26 and 4-27).

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 4-25. Documented Environment 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 4-26. 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 4-27. 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.

# 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 |
| San Francisco Bay, CA | 1.371 |
| 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) | 0.2 |
| Green River, WA | 0.2 |
| Carney’s Point, NJ | 0.2 |
| Clear Creek, TX | 0.41 |
| Corpus Cristi Bay, TX | 0.467 |
| 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 |
| Deleware River, NJ | 0.014 |
| 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 | 0.083 |
| Mobile Bay, AL | 0.08 |

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

| Receiving Water Body | Dilution Concentration Potential |
|---|---|
| Mississippi River, LA | 0.01 |
| Atlantic Ocean (Pompano Beach, FL) | 1.0 |
| 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

B-1

## 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 |
|---|---|---|---|---|---|---|---|
| Xylene, o-, p- | 2 | | 208 | 2600 | 660 | 100000 | 42000 |
| 4-Chloro-3-methylphenol | | | 79 | 4050 | 1300 | | 3000 |
| 4-Methyl-2-pentanone | 0.05 | | 2.4 | 505000 | 56200 | 220000 | 1700 |
| Acenaphthene | 0.06 | | 242 | | 23 | 2670 | 1175 |
| Acenaphthylene | | | 286 | 1688 | 665 | | |
| Alpha-terpineol | | | | 14533 | 5503 | | |
| Aluminum | | | 231 | 748 | 87 | | |
| Ammonia | | | | | | | |
| Anthracene | 0.3 | | 478 | 2.78 | 2.2 | 6800 | 4100 |
| Antimony | 0 | | 1 | 88 | 30 | 4300 | 13.9 |
| Arsenic | 0 | 1.75 | 44 | 360 | 190 | 0.14 | 0.017 |
| Barium | 0.07 | | | 410000 | 2813 | | 1000 |
| Benzene | | 0.02 9 | 5.21 | 5300 | 530 | 71.3 | 1.2 |
| Benzo(a)anthracene | | 1.06 | 4620 | 10 | 1 | 0.031 | 0.0028 |
| Benzo(a)pyrene | | 7.3 | 11100 | 5 | 0.08 | 0.00013 | 0.00013 |
| Benzo(b)fluoranthene | | 1.02 | 30 | | | 0.35 | 0.03 |
| Benzo(k)fluoranthene | | 0.48 | 30 | | | 0.75 | 0.066 |
| Benzofluorene, 2,3- | | | 10100 | 576 | 26 | | |
| Benzoic acid | 4 | | 15 | 180000 | 17178 | 2871800 | 130000 |
| Benzyl alcohol | 0.3 | | 4 | 10000 | 1000 | 810000 | 10000 |
| Biphenyl | 0.05 | | 436 | 360 | 170 | 1235 | 724 |
| Bis(2-ethylhexyl) phthalate | 0.02 | 0.01 4 | 130 | 400 | 360 | 5.9 | 1.8 |
| Boron | 0.09 | | | | 31.6 | | |
| Butanone, 2- | 0.6 | | 1 | 3220000 | 263420 | 6500000 | 21000 |

| Chemical | RfD | SF | BCF | Acute AWQC | Chronic AWQC | Human Health Organism | Human Health Water and Organism |
|---|---|---|---|---|---|---|---|
| Butyl benzyl phthalate | 0.2 | | 414 | 2320 | 260 | 5200 | 3000 |
| Cadmium | 0 | | 64 | 3.9 | 1.1 | 84.1 | 14.5 |
| Carbazole | | 0.02 | 251 | 2180 | 875 | 2.2 | 0.96 |
| Carbon disulfide | 0.1 | | 11.5 | 2100 | 2 | 94000 | 3400 |
| Chlorobenzene | 0.02 | | 10.3 | 2370 | 2100 | 21000 | 680 |
| Chloroform | 0.01 | 0.006 | 3.75 | 13300 | 6300 | 470 | 5.7 |
| Chromium | 1 | | 16 | 1700 | 210 | 670000 | 33000 |
| Chrysene | | 0.032 | 4620 | 1020 | 102 | 0.03 | 0.0028 |
| Cobalt | | | | 1620 | 49 | | |
| Copper | | | 360 | 18 | 12 | | 1300 |
| Cresol, o- | 0.05 | | 18 | 8400 | 1809 | 29900 | 1700 |
| Cresol, p- | 0.05 | | 17.6 | 7500 | 2570 | 31000 | 1700 |
| Cyanide | | | | | | | |
| Di-n-butyl phthalate | 0.1 | | 89 | 850 | 500 | 12000 | 2700 |
| Di-n-octyl phthalate | 0.02 | | 5460 | 690 | 69 | 39.4 | 37.34 |
| Dibenzofuran | | | 1349 | 1700 | 280 | | |
| Dibenzothiophene | | | 1100 | 420 | 122 | | |
| Dichlorobenzene, 1,2- | 0.09 | | 55.6 | 1580 | 550 | 17000 | 2700 |
| Dichlorobenzene, 1,4- | | 0.024 | 55.6 | 1120 | 763 | 8.07 | 1.24 |
| Dichloroethane, 1,2- | | 0.091 | 1.2 | 116000 | 11000 | 98.6 | 0.38 |
| Dichloroethene, 1,1- | 0.009 | 0.6 | 5.6 | 108000 | 8614 | 3.2 | 0.057 |

| Chemical | RfD | SF | BCF | Acute AWQC | Chronic AWQC | Human Health Organism | Human Health Water and Organism |
|---|---|---|---|---|---|---|---|
| Dichloromethane | 0.06 | 0.008 | 0.91 | 330000 | 82500 | 1600 | 4.7 |
| Diethyl ether | | | | | | | |
| Diethyl phthalate | 0.8 | | 73 | 31800 | 10000 | 118019 | 22631 |
| Dimethylphenanthrene, 3,6- | | | | | | | |
| Dimethylphenol, 2,4- | 0.02 | | 94 | 2120 | 1970 | 2300 | 540 |
| Diphenyl ether | | | 930 | 4000 | 213 | | |
| Diphenylamine | 0.025 | | 269 | 4760 | 378 | 1000 | 480 |
| Ethylbenzene | 0.1 | | 37.5 | 9090 | 4600 | 29000 | 3100 |
| Fluoranthene | 0.04 | | 1150 | 3980 | 6.16 | 370 | 300 |
| Fluorene | 0.04 | | 30 | 212 | 8 | 14000 | 1300 |
| Hexanoic acid | | | 16 | 320000 | 16437 | | |
| Iron | 0.3 | | | | 1000 | | |
| Lead | | | 49 | 82 | 3.2 | | 50 |
| Lithium | | | | | | | |
| Lutetium | | | | | | | |
| Manganese | 0.005 | | | | 388 | | 100 |
| Mercury | 0 | | 5500 | 2.4 | 0.012 | 0.15 | 0.14 |
| Methylfluorene, 1- | | | 3300 | 541 | 63 | | |
| Methylnaphthalene, 2- | | | 2566 | 909 | 309 | | |
| Methylphenanthrene, 1- | | | | | | | |
| Molybdenum | 0.005 | | | | 27.8 | | |
| N-Decane | | | 8800 | 18000 | 1300 | | |
| N-Docosane | | | 100000 | 53000 | 68000 | | |
| N-Dodecane | | | 14500 | 18000 | 1300 | | |

| Chemical | RfD | SF | BCF | Acute AWQC | Chronic AWQC | Human Health Organism | Human Health Water and Organism |
|---|---|---|---|---|---|---|---|
| N-Eicosane | | | 100000 | | | | |
| N-Hexadecane | | | 32300 | 18000 | 1300 | | |
| N-Octadecane | | | 10100 | 18000 | 1300 | | |
| N-Tetradecane | | | 19500 | 18000 | 1300 | | |
| Naphthalene | 0.04 | | 10.5 | 1600 | 370 | 41026 | 1354 |
| Nickel | 0.02 | | 47 | 1400 | 160 | 4600 | 610 |
| P-Cynene | | | 770 | 6500 | 130 | | |
| Pentamethylbenzene | | | | | | | |
| Phenol | 0.6 | | 1.4 | 4200 | 200 | 4600000 | 21000 |
| Phenylnaphthalene, 2- | | | | | | | |
| Phosphorus | | | | | | | |
| Propanone, 2- | 0.1 | | 0.39 | 6210000 | 1000000 | 2800000 | 3500 |
| Pyrene | 0.03 | | 1110 | 1010 | 101 | 291 | 228 |
| Pyridine | 0.001 | | 2 | 93800 | 25000 | 5400 | 34.8 |
| Selenium | 0.005 | | 4.8 | 20 | 5 | 11000 | 170 |
| Silicon | | | | | | | |
| Strontium | 0.6 | | | | | | |
| Styrene | 0.2 | | 13.5 | 4020 | 402 | 160000 | 6700 |
| Sulfur | | | | | | | |
| Tin | 0.6 | | | | 18.6 | | |
| Titanium | | | | | 191 | | |
| Toluene | 0.2 | | 10.7 | 5500 | 1000 | 200000 | 6800 |
| Trichlorobenzene, 1,2,4- | 0.01 | | 1202 | 930 | 286 | 89.6 | 71.3 |
| Trichloroethane, 1,1,1- | 0.09 | | 5.6 | 42300 | 1300 | 170000 | 3100 |
| Trichloroethene | | | 10.6 | 40700 | 100 | 80.7 | 2.7 |

| Chemical | RfD | SF | BCF | Acute AWQC | Chronic AWQC | Human Health Organism | Human Health Water and Organism |
|---|---|---|---|---|---|---|---|
| Tripropyleneglycol-methylether | | | | 2484600 | 683870 | | |
| Xylene, m- | 2 | | 208 | 16000 | 3900 | 100000 | 42000 |
| Zinc | 0.3 | | 47 | 120 | 110 | 69000 | 9100 |

# APPENDIX C
# POLLUTANTS OF CONCERN CONSIDERED FOR THIS ANALYSIS

**Table C-1. Metals Subcategory - Pollutants of Concern [a]**

| Pollutants [b] | | | |
|---|---|---|---|
| Aluminum | Butanone, 2- | Lead | Selenium |
| Antimony | Cadmium | Manganese | Silicon |
| Arsenic | Chromium | Mercury | Tin |
| Barium | Cobalt | Molybdenum | Titanium |
| Benzoic acid | Copper | Nickel | Zinc |
| Boron | Iron | Propanone, 2- | |

a. Chapter six of the technical development document details the POCs for this subcategory; this list is a subset of those listed in Chapter six.

b. Although the total number of documented metals and organics pollutants is 28, only 23 pollutants were analyzed due to a lack of information on AWQC and toxicological information.

**Table C-2. Oils Subcategory - Pollutants of Concern [a]**

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

a. Chapter six of the technical development document details the POCs for this subcategory; this list is a subset of those listed in Chapter six.
b. Although the total number of documented metals and organics pollutants is 93, only 89 pollutants were analyzed due to a lack of information on AWQC and toxicological information.

**Table C-3. Organics Subcategory—Pollutants of Concern [a]**

| Pollutants [b] | |
|---|---|
| 4-methyl-2-pentanone | iron |
| aluminum | lithium |
| antimony | manganese |
| barium | molybdenum |
| benzene | phenol |
| boron | 2-propanone |
| 2-butanone | pyridine |
| chloroform | methylene chloride |
| chromium | nickel |
| cobalt | pentachlorophenol |
| copper | tin |
| o-cresol | toluene |
| p-cresol | 1,1,1-trichloroethane |
| cyanide | trichloroethene |
| 1,2-dichloroethane | m-xylene |
| 1,1-dichloroethene | zinc |
| hexanoic acid | 1,1,1,2-tetrachloroethane |
| tetrachloroethene | 1,1,2-trichloroethane |
| tetrachloromethane | 1,2,3-trichloropropane |
| trans-1,2-dichloroethene | 1,2-dibromoethane |
| vinyl chloride | 2,3-dichloroaniline |
| 2,3,4,6-tetrachlorophenol | acetophenone |
| 2,4,5-trichlorophenol | |

a. Chapter six of the technical development document details the POCs for this subcategory; this list is a subset of those listed in Chapter six.

b. Although the total number of documented metals and organics is 56, only 45 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***. Memo is in the CBI record)

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 | Violation data were not available; either this facility does not have violations or is a minor permittee. | | | |
| Facility 2 | 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.<br>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. | |

| 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 18 | High concentrations of oil and grease, phenols, and ammonia discharged to receiving water. | Potential impact on surface water quality. | | |
| 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 $\mu$g/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 $\mu$g/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. |

| 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 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. |
| 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. |

| 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 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. | |
| 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. |