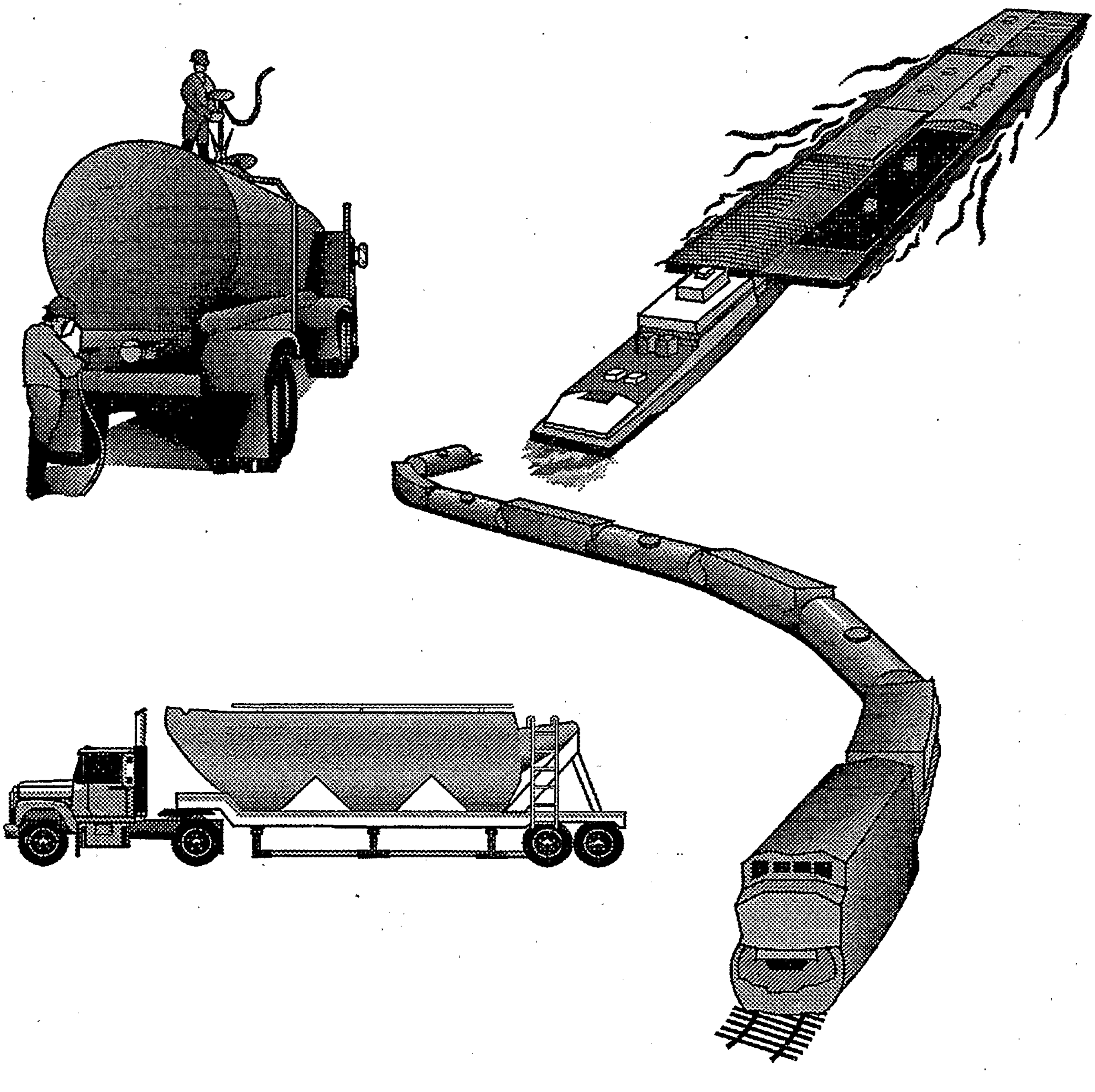
United States
Environmental Protection
Agency

Office of Water
(4303)

EPA-821-B-98-015
May 1998

EPA

Environmental Assessment Of Proposed Effluent Limitations Guidelines And Standards For The Transportation Equipment Cleaning Category



ENVIRONMENTAL ASSESSMENT OF THE PROPOSED EFFLUENT GUIDELINES FOR THE TRANSPORTATION EQUIPMENT CLEANING (TEC) INDUSTRY

Volume I

Final Report

Prepared for:

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ACKNOWLEDGMENTS AND DISCLAIMER

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EXECUTIVE SUMMARY

This environmental assessment quantifies the water quality-related benefits for Transportation Equipment Cleaning (TEC) facilities based on site-specific analyses of current conditions and the conditions that would be achieved by process changes under proposed BAT (Best Available Technology) and PSES (Pretreatment Standards for Existing Sources) controls. The U.S. Environmental Protection Agency (EPA) estimated instream pollutant concentrations for 157 priority and nonconventional pollutants from three subcategories (barge-chemical and petroleum, rail-chemical, and truck-chemical) of direct and indirect discharges using stream dilution modeling. The potential impacts and benefits to aquatic life are projected by comparing the modeled instream pollutant concentrations to published EPA aquatic life criteria guidance or to toxic effect levels. Potential adverse human health effects and benefits are projected by: (1) comparing estimated instream concentrations to health-based water quality toxic effect levels or criteria; and (2) estimating the potential reduction of carcinogenic risk and noncarcinogenic hazard (systemic) from consuming contaminated fish or drinking water. Upper-bound individual cancer risks, population risks, and systemic hazards are estimated using modeled instream pollutant concentrations and standard EPA assumptions. Modeled pollutant concentrations in fish and drinking water are used to estimate cancer risk and systemic hazards among the general population, sport anglers and their families, and subsistence anglers and their families. EPA used the findings from the analyses of reduced occurrence of instream pollutant concentrations in excess of both aquatic life and human health criteria or toxic effect levels to assess improvements in recreational fishing habitats that are impacted by TEC wastewater discharges (ecological benefits). These improvements in aquatic habitats are then expected to improve the quality and value of recreational fishing opportunities and nonuse (intrinsic) values of the receiving streams.

Potential inhibition of operations at publicly owned treatment works (POTW) and sewage sludge contamination (thereby limiting its use for land application) are also evaluated based on current and proposed pretreatment levels. Inhibition of POTW operations is estimated by comparing modeled POTW influent concentrations to available inhibition levels; contamination of sewage sludge is estimated by comparing projected pollutant concentrations in sewage sludge to available EPA regulatory standards. Economic productivity benefits are estimated on the basis of the incremental quantity of sludge that, as a result of reduced pollutant discharges to POTWs, meets criteria for the generally less expensive disposal method, namely land application and surface disposal.

In addition, the potential fate and toxicity of pollutants of concern associated with TEC wastewater are evaluated based on known characteristics of each chemical. Recent literature and studies are also reviewed and State and Regional environmental agencies are contacted for evidence of documented environmental impacts on aquatic life, human health, POTW operations, and on the quality of receiving water.

These analyses are performed for discharges from representative sample sets of 6 direct barge-chemical and petroleum facilities, 1 indirect barge-chemical and petroleum facility, 12 indirect rail-chemical facilities, and 40 indirect truck-chemical facilities. Results are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. This report provides the results of these analyses, organized by the type of discharge (direct and indirect) and type of facility (barge-chemical and petroleum, rail-chemical, and truck-chemical).

Comparison of Instream Concentrations with Ambient Water Quality Criteria (AWQC)/Impacts at POTWs

Direct Discharges

(a) Barge-Chemical and Petroleum (Sample Set)

The water quality modeling results for 6 direct barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams indicate that at **current** and **proposed BAT** discharge levels, instream concentrations are not projected to exceed **aquatic life criteria** (acute or chronic) or toxic effect levels. Additionally, at **current** discharge levels, instream concentrations of 2 pollutants (using a target risk of 10^{-6} (1E-6) for carcinogens) are projected to exceed **human health criteria** or toxic effect levels (developed for consumption of water and organisms) in 33 percent (2 of the total 6) of the receiving streams. Excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) are projected in 1 of the 6 receiving streams due to the discharge of the 2 pollutants. The **proposed BAT** regulatory option will reduce **human health criteria** or toxic effect levels (developed for consumption of water and organisms) excursions to 1 receiving stream and eliminate excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only). Under the **proposed BAT** regulatory option, pollutant loadings are reduced 95 percent.

(b) Barge-Chemical and Petroleum Facilities (National Extrapolation)

Modeling results of the sample set are extrapolated to 14 barge-chemical and petroleum facilities discharging 60 pollutants to 14 receiving streams. Extrapolated instream concentrations of 2 pollutants are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 43 percent (6 of the total 14) of the receiving streams at **current** discharge levels. The proposed regulation will reduce excursions of **human health criteria** or toxic effect levels (developed for water and organisms consumption) to 2 pollutants in 3 receiving streams. A total of 9 excursions in 6 receiving streams at **current** conditions will be reduced to 6 excursions in 3 receiving streams at **proposed BAT** discharge levels. The 6 excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) in 3 receiving streams will be eliminated at **proposed BAT** discharge levels.

Indirect Dischargers

(a) Barge-Chemical and Petroleum Facilities (Sample Set)

The 1 indirect barge-chemical and petroleum facility is not being proposed for pretreatment standards. EPA did, however, evaluate the effects of the facility's discharge on a POTW and its receiving stream.

Water quality modeling results for the 1 indirect barge-chemical and petroleum facility that discharges 60 pollutants to 1 POTW with an outfall on 1 receiving stream indicate that at both **current** and **proposed pretreatment** discharge levels no instream pollutant concentrations are expected to exceed **aquatic life criteria** (acute or chronic) or toxic effect levels. Additionally, at

current and **proposed pretreatment** discharge levels, the instream concentrations (using a target risk of 10^{-6} (1E-6) for carcinogens) are not projected to exceed **human health criteria** or toxic effect levels (developed for consumption of water and organisms/organisms consumption only). Pollutant loadings are reduced 54 percent.

In addition, the potential impact of the 1 barge-chemical and petroleum facility is evaluated in terms of inhibition of POTW operation and contamination of sludge. No inhibition or sludge contamination problems are projected at the 1 POTW receiving wastewater.

Since no excursions of ambient water quality criteria (AWQC) or impacts at POTWs are projected, results are not extrapolated to the national level.

(b) Rail-Chemical Facilities (Sample Set)

The potential effects of POTW wastewater discharges on receiving stream water quality are also evaluated at **current** and **proposed pretreatment** discharge levels for a representative sample set of 12 indirect rail-chemical facilities that discharge 103 pollutants to 11 POTWs with outfalls on 11 receiving streams. Modeling results indicate that at both **current** and **proposed pretreatment** discharge levels instream concentrations of 3 pollutants and 1 pollutant, respectively, (using a target risk of 10^{-6} (1E-6) for carcinogens) are projected to exceed **human health criteria** or toxic effect levels (developed for organisms consumption only) in 45 percent (5 of the total 11) of the receiving streams for 1 pollutant. Excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) are projected in 18 percent (2 of the total 11) of the receiving streams for 1 pollutant. The **proposed pretreatment** regulatory option will eliminate these excursions. Instream concentrations of 4 pollutants are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 18 percent (2 of the total 11) of the receiving streams at **current** discharge levels. **Proposed pretreatment** discharge levels reduce projected excursions to 3 pollutants in 1 of the 11 receiving streams. The 1 excursion of **acute aquatic life criteria** or toxic effect levels is eliminated by the **proposed pretreatment** regulatory option. Pollutant loadings are reduced 42 percent.

In addition, the potential impact of the 12 rail-chemical facilities, which discharge to 11 POTWs, are evaluated in terms of inhibition of POTW operation and contamination of sludge. At **current** discharge levels, inhibition from 4 pollutants are projected at 55 percent (6 of the total 11) of the POTWs receiving wastewater discharges. The **proposed pretreatment** regulatory option reduces inhibition problems to 4 POTWs. No sludge problems are projected at the 11 POTWs receiving wastewater discharges.

(c) Rail-Chemical Facilities (National Extrapolation)

Modeling results of the sample set are extrapolated to 38 rail-chemical facilities discharging 103 pollutants to 37 POTWs with outfalls on 37 receiving streams. Extrapolated instream pollutant concentrations are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 43 percent (16 of the total 37) of the receiving streams at both **current** and **proposed pretreatment** discharge levels. A total of 32 excursions due to the discharge of 3 pollutants will be reduced to 16 excursions due to the discharge of 1 pollutant. Additionally, the 8 excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) projected in 8 receiving streams will be eliminated by the **proposed pretreatment** regulatory option.

Extrapolated instream pollutant concentrations are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 22 percent (8 of the total 37) of the receiving streams at **current** discharge levels. A total of 4 pollutants at **current** discharge levels are projected to exceed instream criteria or toxic effect levels. **Proposed pretreatment** discharge levels will reduce projected excursions to 3 pollutants in 16 percent (6 of the total 37) of the receiving streams. A total of 26 excursions at **current** conditions will be reduced to 17 excursions as a result of the **proposed pretreatment** regulatory option. The 6 excursions of **acute aquatic life criteria** or toxic effect levels projected in 6 receiving streams will be eliminated by the **proposed pretreatment** regulatory option.

In addition, extrapolated inhibition problems are projected at 57 percent (21 of the 37) of the POTWs receiving wastewater discharges at **current** discharge levels. **Proposed pretreatment** discharge levels will reduce projected problems to 35 percent (13 of the 37) of the POTWs. A total of 42 inhibition problems at **current** conditions will be reduced to 34 inhibition problems as a result of the **proposed pretreatment**.

(d) **Truck-Chemical Facilities (Sample Set)**

Additionally, the potential effects of POTW wastewater discharges of 80 pollutants on receiving stream water quality are evaluated at **current** and **proposed pretreatment** discharge levels for a representative sample set of 40 truck-chemical facilities which discharge to 35 POTWs with outfalls on 35 receiving streams.

Instream concentrations of 1 pollutant (using a target risk of 10^{-6} (1E-6) for carcinogens) are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption/organisms consumption only) in 6 percent (2 of the total 35) of the receiving streams at **current** discharge levels. The **proposed pretreatment** regulatory option eliminates excursions of **human health criteria**.

Instream pollutant concentrations are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 23 percent (8 of the total 35) of the receiving streams at **current** discharge levels. A total of 1 pollutant at **current** discharge levels is projected to exceed instream criteria or toxic effect levels. **Proposed pretreatment** discharge levels reduce projected excursions to 1 pollutant in 17 percent (6 of the total 35) of the receiving streams. No excursions of **acute aquatic life criteria** or toxic effect levels are projected. Under the **proposed pretreatment** regulatory option, pollutant loadings are reduced 80 percent.

In addition, the potential impact of the 40 truck-chemical facilities are evaluated in terms of inhibition of POTW operation and contamination of sludge. No inhibition or sludge contamination problems are projected at the 35 POTWs receiving wastewater discharges. Since no impacts at POTWs are projected, results are not extrapolated to the national level.

(e) **Truck-Chemical Facilities (National Extrapolation)**

Modeling results of the sample set are extrapolated to 288 truck-chemical facilities discharging 80 pollutants to 264 POTWs located on 264 receiving streams. Extrapolated instream pollutant concentrations of 1 pollutant are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption/organisms consumption only) in 5 percent (14 of the total 264) of the receiving streams at **current** discharge levels. Excursions of **human health criteria** are eliminated at the **proposed pretreatment** regulatory option.

Extrapolated instream concentrations of 1 pollutant are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 19 percent (49 of the total 264) of the receiving streams at **current** discharge levels. **Proposed pretreatment** discharge levels reduce excursions to 1 pollutant in 14 percent (37 of the total 264) of the receiving streams. A total of 49 excursions in 49 receiving streams at **current** conditions will be reduced to 37 excursions in 37 receiving streams at the **proposed pretreatment** regulatory option.

Human Health Risks and Benefits

The excess annual cancer cases at **current** discharge levels and, therefore, at **proposed BAT** and **proposed pretreatment** discharge levels are projected to be far less than 0.5 for all populations evaluated from the ingestion of contaminated fish and drinking water for both direct and indirect TEC (barge-chemical and petroleum, rail-chemical, and truck-chemical) wastewater discharges. A monetary value of this benefit to society is, therefore, not projected. The risk to develop systemic toxicant effects are projected from fish consumption for only indirect truck-chemical discharges. For truck-chemical discharges (sample set), the risk to develop systemic effects are projected to result from the discharge of 1 pollutant to 7 receiving streams at **current** discharge levels and from the discharge of 1 pollutant to 3 receiving streams at **proposed pretreatment** discharge levels. An estimated population of 4,284 subsistence anglers and their families are projected to be affected at **current** discharge levels. The affected population is reduced to 687 at **proposed pretreatment** levels. Results are extrapolated to the national level; an estimated population of 14,173 subsistence anglers and their families are projected to be affected from the discharge of 1 pollutant to 39 receiving streams at **current** discharge levels. The affected population is reduced to 3,492 (16 receiving streams) as a result of the **proposed pretreatment** regulatory option. Monetary values for the reduction of systemic toxic effects cannot currently be estimated.

Ecological Benefits

Potential ecological benefits of the proposed regulation, based on improvements in recreational fishing habitats, are projected for only direct barge-chemical and petroleum wastewater discharges and indirect truck-chemical wastewater discharges, because the proposed regulation is not projected to completely eliminate instream concentrations in excess of aquatic life and human health ambient water quality criteria (AWQC) in any stream receiving wastewater discharges from indirect barge-chemical and petroleum, and indirect rail-chemical facilities. For the direct barge-chemical and petroleum sample set, concentrations in excess of AWQC are projected to be eliminated at 1 receiving stream as a result of the **proposed BAT** regulatory option. The monetary value of improved recreational fishing opportunity is estimated by first calculating the baseline value of the receiving stream using a value per person day of recreational fishing, and the number of person-days fished on the receiving stream. The value of improving water quality in this fishery, based on the increase in value to anglers of achieving contaminant-free fishing, is then calculated. The resulting estimate of the increase in value of recreational fishing to anglers on the improved receiving stream is $54,400 to $194,000 (1994 dollars). Based on extrapolated data to the national level, the proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 3 receiving streams. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $157,000 to $562,000 (1994 dollars). In addition, EPA conservatively estimates that the nonuse (intrinsic) benefits compose one-half of the recreational fishing benefits. The resulting estimate of the nonuse value on the improved receiving stream is $27,200 to $97,000 (1994 dollars). Based on extrapolated data to the national level, the resulting increase in nonuse value ranges from $78,500 to $281,000 (1994 dollars).

For the indirect truck-chemical sample set, concentrations in excess of AWQC are projected to be eliminated at 2 receiving streams as a result of the **proposed pretreatment** regulatory option.

The monetary value of improved recreational fishing opportunity is estimated by first calculating the baseline value of the receiving stream using a value per person day of recreational fishing, and the number of person-days fished on the receiving stream. The value of improving water quality in this fishery, based on the increase in value to anglers of achieving contaminant-free fishing, is then calculated. The resulting estimate of the increase in value of recreational fishing to anglers on the improved receiving streams is $248,000 to $886,000 (1994 dollars). Based on extrapolated data to the national level, the proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 12 receiving streams. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $1,494,000 to $5,334,000 (1994 dollars). In addition, the estimate of the nonuse value (intrinsic) on the improved receiving streams is $124,000 to $443,000 (1994 dollars). Based on extrapolated data to the national level, the resulting increase in nonuse value ranges from $747,000 to $2,667,000 (1994 dollars).

There are a number of additional use and nonuse benefits associated with the proposed standards that could not be monetized. The monetized recreational benefits were estimated only for fishing by recreational anglers, although there are other categories of recreational and other use benefits that could not be monetized. An example of these additional benefits includes enhanced water-dependent recreation other than fishing. There are also nonmonetized benefits that are nonuse values, such as benefits to wildlife, threatened or endangered species, and biodiversity benefits. Rather than attempt the difficult task of enumerating, quantifying, and monetizing these nonuse benefits, EPA calculated nonuse benefits as 50 percent of the use value for recreational fishing. This value of 50 percent is a reasonable approximation of the total nonuse value for a population compared to the total use value for that population. This approximation should be applied to the total use value for the affected population; in this case, all of the direct uses of the affected reaches (including fishing, hiking, and boating). However, since this approximation was only applied to recreational fishing benefits for recreational anglers, it does not take into account nonuse values for non-anglers or for the uses other than fishing by anglers. Therefore, EPA has estimated only a portion of the nonuse benefits for the proposed standards.

Economic Productivity Benefits

Potential economic productivity benefits, based on reduced sewage sludge contamination and sewage sludge disposal costs, are evaluated at POTWs receiving the wastewater discharges from indirect TEC facilities. Because no sludge contamination problems are projected at the 1 POTW receiving wastewater from 1 barge-chemical and petroleum facility, at the 11 POTWs receiving wastewater from 12 rail-chemical facilities, or at the 35 POTWs receiving wastewater from 40 truck-chemical facilities, no economic productivity benefits are projected as a result of the proposed regulation.

Pollutant Fate and Toxicity

Barge-Chemical and Petroleum Facilities

EPA identified 67 pollutants of concern (priority, nonconventional, and conventional) in wastestreams from barge-chemical and petroleum facilities. These pollutants are evaluated to assess their potential fate and toxicity based on known characteristics of each chemical.

Most of the 67 pollutants have at least one known toxic effect. Based on available physical-chemical properties and aquatic life and human health toxicity data for these pollutants, 20 exhibit moderate to high toxicity to aquatic life; 10 are classified as known or probable human carcinogens; 33 are human systemic toxicants; 23 have drinking water values; and 25 are designated by EPA as priority pollutants. In terms of projected partitioning, 27 of the evaluated pollutants are moderately to highly volatile (potentially causing risk to exposed populations via inhalation); 29 have a moderate to high potential to bioaccumulate in aquatic biota (potentially accumulating in the food chain and causing increased risk to higher trophic level organisms and to exposed human populations via consumption of fish and shellfish); 24 are moderately to highly adsorptive to solids; and 8 are resistant to or slowly biodegraded.

Rail-Chemical Facilities

In addition, EPA identified 106 pollutants of concern (priority, nonconventional, and conventional) in wastestreams from rail-chemical facilities. These pollutants are also evaluated to assess their potential fate and toxicity, based on known characteristics of each chemical.

Most of the 106 pollutants have at least one known toxic effect. Based on available physical-chemical properties and aquatic life and human health toxicity data for these pollutants, 55 exhibit moderate to high toxicity to aquatic life; 62 are human systemic toxicants; 28 are classified as known or probable carcinogens; 22 have drinking water values; and 23 have been designated by EPA as priority pollutants. In terms of projected environmental partitioning among media, 22 of the evaluated pollutants are moderately to highly volatile; 64 have a moderate to high potential to bioaccumulate in aquatic biota; 48 are moderately to highly adsorptive to solids; and 43 are resistant to or slowly biodegraded.

Truck-Chemical Facilities

EPA also identified 86 pollutants of concern (priority, nonconventional, and conventional) in wastestreams from truck-chemical facilities. These pollutants are also evaluated to assess their potential fate and toxicity, based on known characteristics of each chemical.

Most of the 86 pollutants have at least one known toxic effect. Based on available physical-chemical properties and aquatic life and human health toxicity data for these pollutants, 32 exhibit moderate to high toxicity to aquatic life; 52 are human systemic toxicants; 19 are classified as known or probable carcinogens; 29 have drinking water values; and 25 have been designated by EPA as priority pollutants. In terms of projected environmental partitioning among media, 28 of the evaluated pollutants are moderately to highly volatile; 46 have a moderate to high potential to bioaccumulate in aquatic biota; 29 are moderately to highly adsorptive to solids; and 21 are resistant to or slowly biodegraded.

The impacts of 3 conventional and 4 nonconventional pollutants are not evaluated when modeling the effect of the proposed regulation on receiving stream water quality and POTW operations or when evaluating the potential fate and toxicity of discharged pollutants. These pollutants are total suspended solids (TSS), 5-day biological oxygen demand (BOD_5), total recoverable oil and grease, chemical oxygen demand (COD), total dissolved solids (TDS), total organic carbon (TOC), and total petroleum hydrocarbons. The discharge of these pollutants can have adverse effects on human health and the environment. For example, habitat degradation can result from increased suspended particulate matter that reduces light penetration, and thus primary productivity, or from accumulation of sludge particles that alter benthic spawning grounds and feeding habitats. Oil and grease can have lethal effects on fish, by coating surface of gills causing asphyxia, by depleting oxygen levels due to excessive biological oxygen demand, or by reducing stream reaeration because of surface film. Oil and grease can also have detrimental effects on water fowl by destroying the buoyancy and insulation of their feathers. Bioaccumulation of oil substances can cause human health problems including tainting of fish and bioaccumulation of carcinogenic polycyclic aromatic compounds. High COD and BOD_5 levels can deplete oxygen concentrations, which can result in mortality or other adverse effects on fish. High TOC levels may interfere with water quality by causing taste and odor problems and mortality in fish.

Documented Environmental Impacts

Documented environmental impacts on aquatic life, human health, POTW operations, and receiving stream water quality are also summarized in this assessment. The summaries are based on a review of published literature abstracts, State 304(l) Short Lists, State Fishing Advisories, and contact with State and Regional environmental agencies. Five (5) POTWs receiving the discharge from 1 rail-chemical and 4 truck-chemical facilities are identified by States as being point sources causing water quality problems and are included on their 304(l) Short List. All POTWs listed currently report no problems with TEC wastewater discharges. Past and potential problems are reported by the POTWs for oil and grease, pH, TSS, surfactants, glycol ethers, pesticides and mercury. Several POTW contacts stated the need for a national effluent guidelines for the TEC industry. Current and past problems (violation of effluent limits, POTW pass-through and interference problems, POTW sludge contamination, etc.) caused by direct and indirect discharges from all three subcategories of TEC facilities (barge-chemical and petroleum, rail-chemical and truck-chemical) are also reported by State and Regional contacts in 7 regions. Pollutants causing the problems include BOD, cyanide, hydrocarbons, metals (copper, chromium, silver, zinc), oil and grease, pesticides, pH, phosphorus, styrene, surfactants, and TSS. In addition, 1 barge-chemical and petroleum facility and 19 POTWs receiving wastewater discharges of 2 rail-chemical and 20 truck-chemical facilities are located on waterbodies with State-issued fish consumption advisories. However, the vast majority of advisories are based on chemicals that are not pollutants of concern for the TEC industry.

1. INTRODUCTION

The purpose of this report is to present an assessment of the water quality benefits of controlling the discharge of wastewater from transportation equipment cleaning (TEC) facilities (barge-chemical and petroleum , rail-chemical, and truck-chemical subcategories) to surface waters and publicly-owned treatment works (POTWs). Potential aquatic life and human health impacts of direct barge-chemical and petroleum discharges on receiving stream water quality and of indirect barge-chemical and petroleum, rail-chemical, and truck-chemical discharges on POTWs and their receiving streams are projected at current, proposed BAT (Best Available Technology), and proposed PSES (Pretreatment Standards for Existing Sources) levels by quantifying pollutant releases and by using stream modeling techniques. The potential benefits to human health are evaluated by: (1) comparing estimated instream concentrations to health-based water quality toxic effect levels or U.S. Environmental Protection Agency (EPA) published water quality criteria; and (2) estimating the potential reduction of carcinogenic risk and noncarcinogenic hazard (systemic) from consuming contaminated fish or drinking water. Reduction in carcinogenic risks is monetized, if applicable, using estimated willingness-to-pay values for avoiding premature mortality. Potential ecological benefits are projected by estimating improvements in recreational fishing habitats and, in turn, by projecting, if applicable, a monetary value for enhanced recreational fishing opportunities. Economic productivity benefits are estimated based on reduced POTW sewage sludge contamination (thereby increasing the number of allowable sludge uses or disposal options). In addition, the potential fate and toxicity of pollutants of concern associated with TEC wastewater are evaluated based on known characteristics of each chemical. Recent literature and studies are also reviewed for evidence of documented environmental impacts (e.g., case studies) on aquatic life, human health, and POTW operations and for impacts on the quality of receiving water.

While this report does not evaluate impacts associated with reduced releases of three conventional pollutants (total suspended solids [TSS], 5-day biological oxygen demand [BOD_5] and total recoverable oil and grease) and four classical pollutant parameters (chemical oxygen demand [COD], total dissolved solids [TDS], total organic carbon [TOC], and total petroleum hydrocarbons), the discharge of these pollutants can have adverse effects on human health and the environment. For example, habitat degradation can result from increased suspended particulate matter that reduces light penetration and primary productivity, or from accumulation of sludge particles that alter benthic spawning grounds and feeding habitats. Oil and grease can have lethal effects on fish, by coating surface of gills causing asphyxia, by depleting oxygen levels due to excessive biological oxygen demand, or by reducing stream reaeration because of surface film. Oil and grease can also have detrimental effects on waterfowl by destroying the buoyancy and insulation of their feathers. Bioaccumulation of oil substances can cause human health problems including tainting of fish and bioaccumulation of carcinogenic polycyclic aromatic compounds. High COD and BOD_5 levels can deplete oxygen levels, which can result in mortality or other adverse effects in fish. High TOC levels may interfere with water quality by causing taste and odor problems and mortality in fish.

The following sections of this report describe: (1) the methodology used in the evaluation of projected water quality impacts and projected impacts on POTW operations for direct and indirect discharging TEC facilities (including potential human health risks and benefits, ecological benefits, and economic productivity benefits) in the evaluation of the potential fate and toxicity of pollutants of concern, and in the evaluation of documented environmental impacts; (2) data sources used to evaluate water quality impacts such as plant-specific data, information used to evaluate POTW operations, water quality criteria, and information used to evaluate human health risks and benefits, ecological benefits, economic productivity benefits, pollutant fate and toxicity, and documented environmental impacts; (3) a summary of the results of this analysis; and (4) a complete list of references cited in this report. The various appendices presented in Volume II provide additional detail on the specific information addressed in the main report. These appendices are available in the administrative record.

2. METHODOLOGY

2.1 Projected Water Quality Impacts

The water quality impacts and associated risks/benefits of TEC discharges at various treatment levels are evaluated by: (1) comparing projected instream concentrations with ambient water quality criteria,[1] (2) estimating the human health risks and benefits associated with the consumption of fish and drinking water from waterbodies impacted by the TEC industry, (3) estimating the ecological benefits associated with improved recreational fishing habitats on impacted waterbodies, and (4) estimating the economic productivity benefits based on reduced sewage sludge contamination at POTWs receiving the wastewater of TEC facilities. These analyses are performed for a representative sample set of 6 direct barge-chemical and petroleum facilities, 1 indirect barge-chemical and petroleum facility, 12 indirect rail-chemical facilities, and 40 indirect truck-chemical facilities. Results are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. The methodologies used in this evaluation are described in detail below.

2.1.1 Comparison of Instream Concentrations with Ambient Water Quality Criteria

Current and proposed pollutant releases are quantified and compared, and potential aquatic life and human health impacts resulting from current and proposed pollutant releases are evaluated using stream modeling techniques. Projected instream concentrations for each pollutant are compared to EPA water quality criteria or, for pollutants for which no water quality criteria have been developed, to toxic effect levels (i.e., lowest reported or estimated toxic concentration). Inhibition of POTW operation and sludge contamination are also evaluated. The following three

[1] In performing this analysis, EPA used guidance documents published by EPA that recommend numeric human health and aquatic life water quality criteria for numerous pollutants. States often consult these guidance documents when adopting water quality criteria as part of their water-quality standards. However, because those State-adopted criteria may vary, EPA used the nationwide criteria guidance as the most representative values. EPA also recognizes that currently there is no scientific consensus on the most appropriate approach for extrapolating the dose-response relationship to the low-dose associated with drinking water exposure for arsenic. EPA's National Center for Environmental Assessment and EPA's Office of Water sponsored an Expert Panel Workshop, May 21-22, 1997, to review and discuss the relevant scientific literature for evaluating the possible modes of action underlying the carcinogenic action of arsenic.

sections (i.e., Section 2.1.1.1 through Section 2.1.1.3) describe the methodology and assumptions used for evaluating the impact of direct and indirect discharging facilities.

2.1.1.1 *Direct Discharging Facilities*

Using a stream dilution model that does not account for fate processes other than complete immediate mixing, projected instream concentrations are calculated at current and proposed BAT treatment levels for stream segments with direct discharging facilities. For stream segments with multiple facilities, pollutant loadings are summed, if applicable, before concentrations are calculated. The dilution model used for estimating instream concentrations is as follows.

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

where:

C_{is}	=	instream pollutant concentration (micrograms per liter [μg/L])
L	=	facility pollutant loading (pounds/year [lbs/year])
OD	=	facility operation (days/year)
FF	=	facility flow (million gallons/day [gal/day])
SF	=	receiving stream flow (million gal/day)
CF	=	conversion factors for units

The facility-specific data (i.e., pollutant loading, operating days, facility flow, and stream flow) used in Eq. 1 are derived from various sources as described in Section 3.1.1 of this report. One of three receiving stream flow conditions (1Q10 low flow, 7Q10 low flow, and harmonic mean flow) is used for the two treatment levels; use depends on the type of criterion or toxic effect level intended for comparison. The 1Q10 and 7Q10 flows are the lowest 1-day and the lowest consecutive 7-day average flow during any 10-year period, respectively, and are used to estimate potential acute and chronic aquatic life impacts, respectively, as recommended in the *Technical Support Document for Water Quality-based Toxics Control* (U.S. EPA, 1991a). The harmonic mean flow is defined as the inverse mean of reciprocal daily arithmetic mean flow values and is used to estimate potential human health impacts. EPA recommends the long-term harmonic mean flow as the design flow for assessing potential human health impacts, because it provides a more conservative estimate than the arithmetic mean flow. 7Q10 flows are not appropriate for assessing potential human health impacts, because they have no consistent relationship with the long-term mean dilution.

For assessing impacts on aquatic life, the facility operating days are used to represent the exposure duration; the calculated instream concentration is thus the average concentration *on days the facility is discharging wastewater*. For assuming long-term human health impacts, the operating days (exposure duration) are set at 365 days; the calculated instream concentration is thus the average concentration *on all days of the year*. Although this calculation for human health impacts leads to a lower calculated concentration because of the additional dilution from days when the facility is not in operation, it is consistent with the conservative assumption that the target population is present to consume drinking water and contaminated fish every day for an entire lifetime.

Because stream flows are not available for hydrologically complex waters such as bays, estuaries, and oceans, site-specific critical dilution factors (CDFs) or estuarine dissolved concentration potentials (DCPs) are used to predict pollutant concentrations for facilities discharging to estuaries and bays, if applicable, as follows:

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

where:

C_{es}	=	estuary pollutant concentration (μg/L)
L	=	facility pollutant loading (lbs/year)
OD	=	facility operation (days/year)
FF	=	facility flow (million gal/day)
CDF	=	critical dilution factor
CF	=	conversion factors for units

$$C_{es} = L \times DCP \times CF \qquad \text{(Eq. 3)}$$

where:

C_{es}	=	estuary pollutant concentration (μg/L)
L	=	facility pollutant loading (lbs/year)
DCP	=	dissolved concentration potential (milligrams per liter [mg/L])
CF	=	conversion factor for units

Site-specific critical dilution factors are obtained from a survey of States and Regions conducted by EPA's Office of Pollution Prevention and Toxics (OPPT) *Mixing Zone Dilution Factors for New Chemical Exposure Assessments*, Draft Report, (U.S. EPA, 1992a). Acute CDFs are used to evaluate acute aquatic life effects; whereas, chronic CDFs are used to evaluate chronic aquatic life or adverse human health effects. It is assumed that the drinking water intake and fishing location are at the edge of the chronic mixing zone.

The Strategic Assessment Branch of the National Oceanic and Atmospheric Administration's (NOAA) Ocean Assessments Division has 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. They also do not consider pollutant fate and are designed strictly to simulate concentrations of nonreactive dissolved substances. In addition, the DCPs reflect the predicted estuary-wide response and may not be indicative of site-specific locations.

Water quality excursions are determined by dividing the projected instream (Eq. 1) or estuary (Eq. 2 and Eq. 3) pollutant concentrations by EPA ambient water quality criteria or toxic effect levels. A value greater than 1.0 indicates an excursion.

2.1.1.2 *Indirect Discharging Facilities*

Assessing the impacts of indirect discharging facilities is a two-stage process. First, water quality impacts are evaluated as described in Section (a) below. Next, impacts on POTWs are considered as described in Section (b) that follows.

(a) Water Quality Impacts

A stream dilution model is used to project receiving stream impacts resulting from releases by indirect discharging facilities as shown in Eq. 4. For stream segments with multiple facilities, pollutant loadings are summed, if applicable, before concentrations are calculated. The facility-specific data used in Eq. 4 are derived from various sources as described in Section 3.1.1 of this report. Three receiving stream flow conditions (1Q10 low flow, 7Q10 low flow, and harmonic mean flow) are used for the current and proposed pretreatment options. Pollutant concentrations are predicted for POTWs located on bays and estuaries using site-specific CDFs or NOAA's DCP calculations (Eq. 5 and Eq. 6).

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

where:

C_{is}	=	instream pollutant concentration (μg/L)
L	=	facility pollutant loading (lbs/year)
OD	=	facility operation (days/year)
TMT	=	POTW treatment removal efficiency
PF	=	POTW flow (million gal/day)
SF	=	receiving stream flow (million gal/day)
CF	=	conversion factors for units

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

where:

C_{es} = estuary pollutant concentration (μg/L)
L = facility pollutant loading (lbs/year)
OD = facility operation (days/year)
TMT = POTW treatment removal efficiency
PF = POTW flow (million gal/day)
CDF = critical dilution factor
CF = conversion factors for units

$$C_{es} = L \ x \ (1-TMT) \ x \ DCP \ x \ CF \qquad \text{(Eq. 6)}$$

where:

C_{es} = estuary pollutant concentration (μg/L)
L = facility pollutant loading (lbs/year)
TMT = POTW treatment removal efficiency
DCP = dissolved concentration potential (mg/L)
CF = conversion factors for units

Potential impacts on freshwater quality are determined by comparing projected instream pollutant concentrations (Eq. 4) at reported POTW flows and at 1Q10 low, 7Q10 low, and harmonic mean receiving stream flows with EPA water quality criteria or toxic effect levels for the protection of aquatic life and human health; projected estuary pollutant concentrations (Eq. 5 and Eq. 6), based on CDFs or DCPs, are compared to EPA water quality criteria or toxic effect levels to determine impacts. Water quality criteria excursions are determined by dividing the projected instream or estuary pollutant concentration by the EPA water quality criteria or toxic effect levels. (See Section 2.1.1.1 for discussion of streamflow conditions, application of CDFs or DCPs, assignment of exposure duration, and comparison with criteria or toxic effect levels. A value greater than 1.0 indicates an excursion.

(b) Impacts on POTWs

Impacts on POTW operations are calculated in terms of inhibition of POTW processes (i.e., inhibition of microbial degradation) and contamination of POTW sludges. Inhibition of POTW operations is determined by dividing calculated POTW influent levels (Eq. 7) with chemical-specific inhibition threshold levels. Excursions are indicated by a value greater than 1.0.

$$C_{pi} = \frac{L/OD}{PF} \; x \; CF \qquad \text{(Eq. 7)}$$

where:

C_{pi}	=	POTW influent concentration (μg/L)
L	=	facility pollutant loading (lbs/year)
OD	=	facility operation (days)
PF	=	POTW flow (million gal/day)
CF	=	conversion factors for units

Contamination of sludge (thereby limiting its use for land application, etc.) is evaluated by dividing projected pollutant concentrations in sludge (Eq. 8) by available EPA-developed criteria values for sludge. A value greater than 1.0 indicates an excursion.

$$C_{SP} = C_{pi} \; x \; TMT \; x \; PART \; x \; SGF \qquad \text{(Eq. 8)}$$

where:

C_{sp}	=	sludge pollutant concentration (milligrams per kilogram [mg/kg])
C_{pi}	=	POTW influent concentration (μg/L)
TMT	=	POTW treatment removal efficiency
PART	=	chemical-specific sludge partition factor
SGF	=	sludge generation factor (5.96 parts per million [ppm])

Facility-specific data and information used to evaluate POTWs are derived from the sources described in Sections 3.1.1 and 3.1.2. For facilities that discharge to the same POTW, their individual loadings are summed, if applicable, before the POTW influent and sludge concentrations are calculated.

The partition factor is a measure of the tendency for the pollutant to partition in sludge when it is removed from wastewater. For predicting sludge generation, the model assumes that 1,400 pounds of sludge are generated for each million gallons of wastewater processed (Metcalf & Eddy, 1972). This results in a sludge generation factor of 5.96 mg/kg per μg/L (that is, for every 1 μg/L of pollutant removed from wastewater and partitioned to sludge, the concentration in sludge is 5.96 mg/kg dry weight).

2.1.1.3 *Assumptions and Caveats*

The following major assumptions are used in this analysis:

- Background concentrations of each pollutant, both in the receiving stream and in the POTW influent, are equal to zero; therefore, only the impacts of discharging facilities are evaluated.

- An exposure duration of 365 days is used to determine the likelihood of actual excursions of human health criteria or toxic effect levels.

- 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 may vary across the width and depth of the stream.

- 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 assumed to be continuous and is assumed to be representative of long-term facility operations. These assumptions may overestimate risks to human health and aquatic life, but may underestimate potential short-term effects.

- 1Q10 and 7Q10 receiving stream flow rates are used to estimate aquatic life impacts, and harmonic mean flow rates are used to estimate human health impacts. 1Q10 low flows are estimated using the results of a regression analysis conducted by Versar, Inc. for EPA's Office of Pollution Prevention and Toxics (OPPT) of 1Q10 and 7Q10 flows from representative U.S. rivers and streams taken from *Upgrade of Flow Statistics Used to Estimate Surface Water Chemical Concentrations for Aquatic and Human Exposure Assessment* (Versar, 1992). Harmonic mean flows are estimated from the mean and 7Q10 flows as recommended in the *Technical Support Document for Water-Quality-based Toxics Control* (U.S. EPA, 1991a). These flows may not be the same as those used by specific States to assess impacts.

- Pollutant fate processes, such as sediment adsorption, volatilization, and hydrolysis, are not considered. This may result in estimated instream concentrations that are environmentally conservative (higher).

- Pollutants without a specific POTW treatment removal efficiency provided by EPA or found in the literature are assigned a removal efficiency of zero; pollutants without a specific partition factor are assigned a value of zero.

- Sludge criteria levels are only available for seven pollutants--arsenic, cadmium, copper, lead, mercury, selenium, and zinc.

- Water quality criteria or toxic effect levels developed for freshwater organisms are used in the analysis of facilities discharging to estuaries or bays.

2.1.2 Estimation of Human Health Risks and Benefits

The potential benefits to human health are evaluated by estimating the risks (carcinogenic and noncarcinogenic hazard [systemic]) associated with reducing pollutant levels in fish tissue and drinking water from current to proposed treatment levels. Reduction in carcinogenic risks is monetized, if applicable, using estimated willingness-to-pay values for avoiding premature mortality. The following three sections (i.e., Section 2.1.2.1 through Section 2.1.2.3) describe the methodology and assumptions used to evaluate the human health risks and benefits from the consumption of fish tissue and drinking water derived from waterbodies impacted by direct and indirect discharging facilities.

2.1.2.1 *Fish Tissue*

To determine the potential benefits, in terms of reduced cancer cases, associated with reducing pollutant levels in fish tissue, lifetime average daily doses (LADDs) and individual risk levels are estimated for each pollutant discharged from a facility based on the instream pollutant concentrations calculated at current and proposed treatment levels in the site-specific stream dilution analysis. (See Section 2.1.1.) Estimates are presented for sport anglers, subsistence anglers, and the general population. LADDs are calculated as follows:

$$LADD = (C \times IR \times BCF \times F \times D) / (BW \times LT) \quad \text{(Eq. 9)}$$

where:

LADD	=	potential lifetime average daily dose (milligrams per kilogram per day [mg/kg/day])
C	=	exposure concentration (mg/L)
IR	=	ingestion rate (See Section 2.1.2.3 - Assumptions)
BCF	=	bioconcentration factor, (liters per kilogram [L/kg] (whole body x 0.5)
F	=	frequency duration (365 days/year)
D	=	exposure duration (70 years)
BW	=	body weight (70 kg)
LT	=	lifetime (70 years x 365 days/year)

Individual risks are calculated as follows:

$$R = LADD \times SF \quad \text{(Eq. 10)}$$

where:

R	=	individual risk level
LADD	=	potential lifetime average daily dose (mg/kg/day)
SF	=	potency slope factor $(mg/kg\text{-}day)^{-1}$

The estimated individual pollutant risk levels are then applied to the potentially exposed populations of sport anglers, subsistence anglers, and the general population to estimate the potential number of excess annual cancer cases occurring over the life of the population. The number of excess cancer cases is then summed on a pollutant, facility, and overall industry basis. The number of reduced cancer cases is assumed to be the difference between the estimated risks at current and proposed treatment levels.

A monetary value of benefits to society from avoided cancer cases is estimated if current wastewater discharges result in excess annual cancer cases greater than 0.5. The valuation of benefits is based on estimates of society's willingness-to-pay to avoid the risk of cancer-related premature mortality. Although it is not certain that all cancer cases will result in death, to develop a worst case estimate for this analysis, avoided cancer cases are valued on the basis of avoided *mortality*. To value mortality, a range of values recommended by an EPA, Office of Policy Analysis (OPA) review of studies quantifying individuals' willingness-to-pay to avoid risks to life is used (Fisher, Chestnut, and Violette, 1989; and Violette and Chestnut, 1986). The reviewed studies used hedonic wage and contingent valuation analyses in labor markets to estimate the amounts that individuals are willing to pay to avoid slight increases in risk of mortality or will need to be compensated to accept a slight increase in risk of mortality. The willingness-to-pay values estimated in these studies are associated with small changes in the probability of mortality. To estimate a willingness-to-pay for avoiding certain or high probability mortality events, they are extrapolated to the value for a 100 percent probability event.[2] The resulting estimates of the value of a "statistical life saved" are used to value regulatory effects that are expected to reduce the incidence of mortality.

From this review of willingness-to-pay studies, OPA recommends a range of $1.6 to $8.5 million (1986 dollars) for valuing an avoided event of premature mortality or a statistical life saved. A more recent survey of value of life studies by Viscusi (1992) also supports this range with the finding that value of life estimates are clustered in the range of $3 to $7 million (1990 dollars). For this analysis, the figures recommended in the OPA study are adjusted to 1992 using the relative change in the Employment Cost Index of Total Compensation for All Civilian Workers from 1986 to 1994 (38 percent). Basing the adjustment in the willingness-to-pay values on change in nominal Gross Domestic Product (GDP) instead of change in inflation, accounts for the expectation that willingness-to-pay to avoid risk is a normal economic good, and, accordingly, society's

[2] These estimates, however, do not represent the willingness-to-pay to avoid the certainty of death.

willingness-to-pay to avoid risk will increase as national income increases. Updating to 1994 yields a range of $2.2 to $11.7 million.

Potential reductions in risks due to reproductive, developmental, or other chronic and subchronic toxic effects are estimated by comparing the estimated lifetime average daily dose and the oral reference dose (RfD) for a given chemical pollutant as follows:

$$HQ = ORI/RfD \qquad \text{(Eq. 11)}$$

where:

HQ	=	hazard quotient
ORI	=	oral intake (LADD x BW, mg/day)
RfD	=	reference dose (mg/day assuming a body weight of 70 kg)

A hazard index (i.e., sum of individual pollutant hazard quotients) is then calculated for each facility or receiving stream. A hazard index greater than 1.0 indicates that toxic effects may occur in exposed populations. The size of the subpopulations affected are summed and compared at the various treatment levels to assess benefits in terms of reduced systemic toxicity. While a monetary value of benefits to society associated with a reduction in the number of individuals exposed to pollutant levels likely to result in systemic health effects could not be estimated, any reduction in risk is expected to yield human health related benefits.

2.1.2.2 *Drinking Water*

Potential benefits associated with reducing pollutant levels in drinking water are determined in a similar manner. LADDs for drinking water consumption are calculated as follows:

$$LADD = (C \times IR \times F \times D) / (BW \times LT) \qquad \text{(Eq. 12)}$$

where:

LADD	=	potential lifetime average daily dose (mg/kg/day)
C	=	exposure concentration (mg/L)
IR	=	ingestion rate (2L/day)
F	=	frequency duration (365 days/year)
D	=	exposure duration (70 years)
BW	=	body weight (70 kg)
LT	=	lifetime (70 years x 365 days/year)

Estimated individual pollutant risk levels greater than 10^{-6} (1E-6) are applied to the population served downstream by any drinking water utilities within 50 miles from each discharge site to determine the number of excess annual cancer cases that may occur during the life of the population. Systemic toxicant effects are evaluated by estimating the sizes of populations exposed to pollutants from a given facility, the sum of whose individual hazard quotients yields a hazard index (HI) greater than 1.0. A monetary value of benefits to society from avoided cancer cases is estimated, if applicable, as described in Section 2.1.2.1.

2.1.2.3 *Assumptions and Caveats*

The following assumptions are used in the human health risks and benefits analyses:

- A linear relationship is assumed between pollutant loading reductions and benefits attributed to the cleanup of surface waters.
- Synergistic effects of multiple chemicals on aquatic ecosystems are not assessed; therefore, the total benefit of reducing toxics may be underestimated.
- The total number of persons who might consume recreationally caught fish and the number who rely upon fish on a subsistence basis in each State are estimated, in part, by assuming that these anglers regularly share their catch with family members. Therefore, the number of anglers in each State are multiplied by the average household size in each State. The remainder of the population of these States is assumed to be the "general population" consuming commercially caught fish.

- Five percent of the resident anglers in a given State are assumed to be subsistence anglers; the other 95 percent are assumed to be sport anglers.

- Commercially or recreationally valuable species are assumed to occur or to be taken in the vicinity of the discharges included in the evaluation.

- Ingestion rates of 6.5 grams per day for the general population, 30 grams per day (30 years) + 6.5 grams per day (40 years) for sport anglers, and 140 grams per day for subsistence anglers are used in the analysis of fish tissue (*Exposure Factors Handbook*, U.S. EPA, 1989a)

- All rivers or estuaries within a State are equally fished by any of that State's resident anglers, and the fish are consumed only by the population within that State.

- Populations potentially exposed to discharges to rivers or estuaries that border more than one State are estimated based only on populations within the State in which the facility is located.

- The size of the population potentially exposed to fish caught in an impacted water body in a given State is estimated based on the ratio of impacted river miles to total river miles in that State or impacted estuary square miles to total estuary square miles in that State. The number of miles potentially impacted by a facility's discharge is assumed to be 50 miles for rivers and the total surface area of the various estuarine zones for estuaries.

- Pollutant fate processes (e.g., sediment adsorption, volatilization, hydrolysis) are not considered in estimating the concentration in drinking water or fish; consequently, estimated concentrations are environmentally conservative (higher).

2.1.3 Estimation of Ecological Benefits

The potential ecological benefits of the proposed regulation are evaluated by estimating improvements in the recreational fishing habitats that are impacted by TEC wastewater discharges. Stream segments are first identified for which the proposed regulation is expected to eliminate all occurrences of pollutant concentrations in excess of both aquatic life and human health ambient water quality criteria (AWQC) or toxic effect levels. (See Section 2.1.1.) The elimination of pollutant concentrations in excess of AWQC is expected to result in significant improvements in aquatic habitats. These improvements in aquatic habitats are then expected to improve the quality and value of recreational fishing opportunities and nonuse (intrinsic) value of the receiving streams. The estimation of the monetary value to society of improved recreational fishing opportunities is based on the concept of a "contaminant-free fishery" as presented by Lyke (1993).

Research by Lyke (1993) shows that anglers may place a significantly higher value on a contaminant-free fishery than a fishery with some level of contamination. Specifically, Lyke estimates the consumer surplus[3] associated with Wisconsin's recreational Lake Michigan trout and salmon fishery, and the additional value of the fishery if it was completely free of contaminants affecting aquatic life and human health. Lyke's results are based on two analyses:

1. A multiple site, trip generation, travel cost model was used to estimate net benefits associated with the fishery under baseline (i.e., contaminated) conditions.
2. A contingent valuation model was used to estimate willingness-to-pay values for the fishery if it was free of contaminants.

Both analyses used data collected from licensed anglers before the 1990 season. The estimated incremental benefit values associated with freeing the fishery of contaminants range from 11.1 percent to 31.3 percent of the value of the fishery under current conditions.

To estimate the gain in value of stream segments identified as showing improvements in aquatic habitats as a result of the proposed regulation, the baseline recreational fishery value of the stream segments are estimated on the basis of estimated annual person-days of fishing per segment and estimated values per person-day of fishing. Annual person-days of fishing per segment are calculated using estimates of the affected (exposed) recreational fishing populations. (See Section 2.1.2.) The number of anglers are multiplied by estimates of the average number of fishing days per angler in each State to estimate the total number of fishing days for each segment. The baseline value for each fishery is then calculated by multiplying the estimated total number of fishing days by an

[3]Consumer surplus is generally recognized as the best measure from a theoretical basis for valuing the net economic welfare or benefit to consumers from consuming a particular good or service. An increase or decrease in consumer surplus for particular goods or services as the result of regulation is a primary measure of the gain or loss in consumer welfare resulting from the regulation.

estimate of the net benefit that anglers receive from a day of fishing where net benefit represents the total value of the fishing day exclusive of any fishing-related costs (license fee, travel costs, bait, etc.) incurred by the angler. In this analysis, a range of median net benefit values for warm water and cold water fishing days, $29.47 and $37.32, respectively, in 1994 dollars is used. Summing over all benefiting stream segments provides a total baseline recreational fishing value of TEC facility stream segments that are expected to benefit by elimination of pollutant concentrations in excess of AWQC.

To estimate the increase in value resulting from elimination of pollutant concentrations in excess of AWQC, the baseline value for benefiting stream segments are multiplied by the incremental gain in value associated with achievement of the "contaminant-free" condition. As noted above, Lyke's estimate of the increase in value ranged from 11.1 percent to 31.3 percent. Multiplying by these values yields a range of expected increase in value for the TEC facility stream segments expected to benefit by elimination of pollutant concentrations in excess of AWQC.

In addition, nonuse (intrinsic) benefits to the general public, as a result of the same improvements in water quality, as described above, are expected. These nonuse benefits (option values, aesthetics, existence values, and request values) are based on the premise that individuals who never visit or otherwise use a natural resource might nevertheless be affected by changes in its status or quality. Nonuse benefits are not associated with current use of the affected ecosystem or habitat, but arise rather from 1) the *realization* of the improvement in the affected ecosystem or habitat resulting from reduced effluent discharges, and 2) the value that individuals place on the *potential for use* sometime in the future. Nonuse benefits can be substantial for some resources and are conservatively estimated as one-half of the recreational benefits. Since this approximation was only applied to recreational fishing benefits for recreational anglers, it does not take into account nonuse values for non-anglers or for the uses other than fishing by anglers. Therefore, EPA estimated only a portion of the nonuse benefits.

2.1.3.1 *Assumptions and Caveats*

The following major assumptions are used in the ecological benefits analysis:

- Background concentrations of the TEC pollutants of concern in the receiving stream are not considered.

- The estimated benefit of improved recreational fishing opportunities is only a limited measure of the value to society of the improvements in aquatic habitats expected to result from the proposed regulation; increased assimilation capacity of the receiving stream, improvements in taste and odor, or improvements to other recreational activities, such as swimming and wildlife observation, are not addressed.

- Significant simplifications and uncertainties are included in the assessment. This may overestimate or underestimate the monetary value to society of improved recreational fishing opportunities. (See Sections 2.1.1.3 and 2.1.2.3.)

- Potential overlap in valuation of improved recreational fishing opportunities and avoided cancer cases from fish consumption may exist. This potential is considered to be minor in terms of numerical significance.

2.1.4 Estimation of Economic Productivity Benefits

Potential economic productivity benefits are estimated based on reduced sewage sludge contamination due to the proposed regulation. The treatment of wastewaters generated by TEC facilities produces a sludge that contains pollutants removed from the wastewaters. As required by law, POTWs must use environmentally sound practices in managing and disposing of this sludge. The proposed pretreatment levels are expected to generate sewage sludges with reduced pollutant concentrations. As a result, the POTWs may be able to use or dispose of the sewage sludges with reduced pollutant concentrations at lower costs.

To determine the potential benefits, in terms of reduced sewage sludge disposal costs, sewage sludge pollutant concentrations are calculated at current and proposed pretreatment levels. (See Section 2.1.1.2.) Pollutant concentrations are then compared to sewage sludge pollutant limits for surface disposal and land application (minimum ceiling limits and pollutant concentration limits). If, as a result of the proposed pretreatment, a POTW meets all pollutant limits for a sewage sludge use or disposal practice, that POTW is assumed to benefit from the increase in sewage sludge use or disposal options. The amount of the benefit deriving from changes in sewage sludge use or disposal practices depends on the sewage sludge use or disposal practices employed under current levels. This analysis assumes that POTWs choose the least expensive sewage sludge use or disposal practice for which their sewage sludge meets pollutant limits. POTWs with sewage sludge that qualifies for land application in the baseline are assumed to dispose of their sewage sludge by land application; likewise, POTWs with sewage sludge that meets surface disposal limits (but not land application ceiling or pollutant limits) are assumed to dispose of their sewage sludge at surface disposal sites.

The economic benefit for POTWs receiving wastewater from a TEC facility is calculated by multiplying the cost differential between baseline and post-compliance sludge use or disposal practices by the quantity of sewage sludge that shifts into meeting land application (minimum ceiling limits and pollutant concentration limits) or surface disposal limits. Using these cost differentials, reductions in sewage sludge use or disposal costs are calculated for each POTW (Eq. 14):

$$SCR = PF \times S \times CD \times PD \times CF \qquad \text{(Eq. 13)}$$

where:

SCR	=	estimated POTW sewage sludge use or disposal cost reductions resulting from the proposed regulation (1994 dollars)
PF	=	POTW flow (million gal/year)
S	=	sewage sludge to wastewater ratio (1,400 lbs (dry weight) per million gallons of water)
CD	=	estimated cost differential between least costly composite baseline use or disposal method for which POTW qualifies and least costly use or disposal method for which POTW qualifies post-compliance ($1994/dry metric ton)
PD	=	percent of sewage sludge disposed
CF	=	conversion factor for units

2.1.4.1 *Assumptions and Caveats*

The following major assumptions are used in the economic productivity benefits analysis:

- 13.4 percent of the POTW sewage sludge generated in the United States is generated at POTWs that are located too far from agricultural land and surface disposal sites for these use or disposal practices to be economical.

This percentage of sewage sludge is not associated with benefits from shifts to surface disposal or land application.

- Benefits expected from reduced record-keeping requirements and exemption from certain sewage sludge management practices are not estimated.
- No definitive source of cost-saving differential exists. Analysis may overestimate or underestimate the cost differentials.
- Sewage sludge use or disposal costs vary by POTW. Actual costs incurred by POTWs affected by the TEC regulation may differ from those estimates.
- Due to the unavailability of such data, baseline pollutant loadings from all industrial sources are not included in the analysis.

2.2 Pollutant Fate and Toxicity

Human and ecological exposure and risk from environmental releases of toxic chemicals depend largely on toxic potency, inter-media partitioning, and chemical persistence. These factors are dependant on chemical-specific properties relating to toxicological effects on living organisms, physical state, hydrophobicity/lipophilicity, and reactivity, as well as the mechanism and media of release and site-specific environmental conditions.

The methodology used in assessing the fate and toxicity of pollutants associated with TEC wastewaters is comprised of three steps: (1) identification of pollutants of concern; (2) compilation of physical-chemical and toxicity data; and (3) categorization assessment. These steps are described in detail below. A summary of the major assumptions and limitations associated with this methodology is also presented.

2.2.1 Pollutants of Concern Identification

From 1994 through 1996, EPA conducted 20 sampling episodes to determine the presence or absence of priority, conventional, and nonconventional pollutants at TEC facilities located nationwide. EPA visited 7 truck facilities, 5 rail facilities, 7 barge facilities, and 1 closed-top hopper barge facility. There, EPA collected grab and composite samples of untreated process wastewater and treated final effluent. Most of these samples were analyzed for 478 analytes to identify pollutants at these facilities. Using these data, EPA applied three criteria to identify non-pesticide/herbicide pollutants effectively removed (i.e., pollutants of concern) by technology options: (1) detected at least two times in the subcategory influent, (2) average concentration of the pollutant in the influent greater than five times the detection limit, and (3) effectively treated with a removal rate of 50 percent or more. EPA applied two criteria to identify pesticide/herbicide pollutants effectively removed by technology options: (1) detected at least one time in subcategory wastewater, and (2) treated with a removal rate greater than 0 percent.

In the barge-chemical and petroleum subcategory, EPA detected 67 pollutants (25 priority pollutants, 3 conventional pollutant parameters, and 39 nonconventional pollutants) in waste streams that met the selection criteria. These pollutants are identified as pollutants of concern and are evaluated to assess their potential fate and toxicity based on known characteristics of each chemical.

In the rail-chemical subcategory, EPA detected 106 pollutants (23 priority pollutants, 2 conventional pollutant parameters, and 81 nonconventional pollutants) in waste streams that met the selection criteria. These pollutants are identified as pollutants of concern and are evaluated to assess their potential fate and toxicity based on known characteristics of each chemical.

In the truck-chemical subcategory, EPA detected 86 pollutants (25 priority pollutants, 3 conventional pollutant parameters, and 58 nonconventional pollutants) in waste streams that met the selection criteria. These pollutants are identified as pollutants of concern and are evaluated to assess their potential fate and toxicity based on known characteristics of each chemical.

2.2.2 Compilation of Physical-Chemical and Toxicity Data

The chemical specific data needed to conduct the fate and toxicity evaluation for this study include aquatic life criteria or toxic effect data for native aquatic species, human health reference doses (RfDs) and cancer potency slope factors (SFs), EPA maximum contaminant levels (MCLs) for drinking water protection, Henry's Law constants, soil/sediment adsorption coefficients (K_{oc}), bioconcentration factors (BCFs) for native aquatic species, and aqueous aerobic biodegradation half-lives (BD).

Sources of the above data include EPA ambient water quality criteria documents and updates, EPA's Assessment Tools for the Evaluation of Risk (ASTER) and the associated AQUatic Information REtrieval System (AQUIRE) and Environmental Research Laboratory-Duluth fathead minnow data base, EPA's Integrated Risk Information System (IRIS), EPA's 1993-1995 Health Effects Assessment Summary Tables (HEAST), EPA's 1991-1996 Superfund Chemical Data Matrix (SCDM), EPA's 1989 Toxic Chemical Release Inventory Screening Guide, Syracuse Research Corporation's CHEMFATE data base, EPA and other government reports, scientific literature, and other primary and secondary data sources. To ensure that the examination is as comprehensive as possible, alternative measures are taken to compile data for chemicals for which physical-chemical property and/or toxicity data are not presented in the sources listed above. To the extent possible, values are estimated for the chemicals using the quantitative structure-activity relationship (QSAR) model incorporated in ASTER, or for some physical-chemical properties, utilizing published linear regression correlation equations.

(a) Aquatic Life Data

Ambient criteria or toxic effect concentration levels for the protection of aquatic life are obtained primarily from EPA ambient water quality criteria documents and EPA's ASTER. For several pollutants, EPA has published ambient water quality criteria for the protection of freshwater aquatic life from acute effects. The acute value represents a maximum allowable 1-hour average concentration of a pollutant at any time that protects aquatic life from lethality. For pollutants for which no acute water quality criteria have been developed by EPA, an acute value from published aquatic toxicity test data or an estimated acute value from the ASTER QSAR model is used. In selecting values from the literature, measured concentrations from flow-through studies under typical pH and temperature conditions are preferred. In addition, the test organism must be a North American resident species of fish or invertebrate. The hierarchy used to select the appropriate acute value is listed below in descending order of priority.

- 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 shorter 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; and
- Estimated 96-hour LC_{50} from the ASTER QSAR model.

BCF data are available from numerous data sources, including EPA ambient water quality criteria documents and EPA's ASTER. Because measured BCF values are not available for several chemicals, methods are used to estimate this parameter based on the octanol/water partition coefficient or solubility of the chemical. Such methods are detailed in Lyman et al. (1982). Multiple values are reviewed, and a representative value is selected according to the following guidelines:

- Resident U.S. fish species are preferred over invertebrates or estimated values.
- Edible tissue or whole fish values are preferred over nonedible or viscera values.
- Estimates derived from octanol/water partition coefficients are preferred over estimates based on solubility or other estimates, unless the estimate comes from EPA Criteria Documents.

The most conservative value (i.e., the highest BCF) is selected among comparable candidate values.

(b) Human Health Data

Human health toxicity data include chemical-specific RfD for noncarcinogenic effects and potency SF for carcinogenic effects. RfDs and SFs are obtained first from EPA's IRIS, and secondarily from EPA's HEAST. The RfD is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious noncarcinogenic health effects over a lifetime (U.S. EPA, 1989b). A chemical with a low RfD is more toxic than a chemical with a high RfD. Noncarcinogenic effects include systemic effects (e.g., reproductive, immunological, neurological, circulatory, or respiratory toxicity), organ-specific toxicity, developmental toxicity, mutagenesis, and lethality. EPA recommends a threshold level assessment approach for these systemic and other effects, because several protective mechanisms must be overcome prior to the appearance of an adverse noncarcinogenic effect. In contrast, EPA assumes that cancer growth can be initiated from a single cellular event and, therefore, should not be subject to a threshold level assessment approach. The SF is an upper bound estimate of the probability of cancer per unit intake of a chemical over a lifetime (U.S. EPA, 1989b). A chemical with a large SF has greater potential to cause cancer than a chemical with a small SF.

Other chemical designations related to potential adverse human health effects include EPA assignment of a concentration limit for protection of drinking water, and EPA designation as a priority pollutant. EPA establishes drinking water criteria and standards, such as the MCL, under authority of the Safe Drinking Water Act (SDWA). Current MCLs are available from IRIS. EPA has designated 126 chemicals and compounds as priority pollutants under the authority of the Clean Water Act (CWA).

(c) Physical-Chemical Property Data

Three measures of physical-chemical properties are used to evaluate environmental fate: Henry's Law constant (HLC), an organic carbon-water partition coefficient (K_{oc}), and aqueous aerobic biodegradation half-life (BD).

HLC is the ratio of vapor pressure to solubility and is indicative of the propensity of a chemical to volatilize from surface water (Lyman et al., 1982). The larger the HLC, the more likely the chemical will volatilize. Most HLCs are obtained from EPA's Office of Toxic Substances' (OTS) 1989 Toxic Chemical Release Inventory Screening Guide (U.S. EPA, 1989c), the Office of Solid Waste's (OSW) Superfund Chemical Data Matrix (U.S. EPA, 1994a), or the quantitative structure-activity relationship (QSAR) system (U.S. EPA, 1993a), maintained by EPA's Environmental Research Laboratory (ERL) in Duluth, Minnesota.

K_{oc} is indicative of the propensity of an organic compound to adsorb to soil or sediment particles and, therefore, partition to such media. The larger the K_{oc}, the more likely the chemical will adsorb to solid material. Most K_{oc}s are obtained from Syracuse Research Corporation's CHEMFATE data base and EPA's 1989 Toxic Chemical Release Inventory Screening Guide.

BD is an empirically-derived time period when half of the chemical amount in water is degraded by microbial action in the presence of oxygen. BD is indicative of the environmental persistence of a chemical released into the water column. Most BDs are obtained from Howard et al. (1991) and ERL-Duluth's QSAR.

2.2.3 Categorization Assessment

The objective of this generalized evaluation of fate and toxicity potential is to place chemicals into groups with qualitative descriptors of potential environmental behavior and impact. These groups are based on categorization schemes derived for:

- Acute aquatic toxicity (high, moderate, or slight);
- Volatility from water (high, moderate, slight, or nonvolatile);
- Adsorption to soil/sediment (high, moderate, slight, or nonadsorptive);
- Bioaccumulation potential (high, moderate, slight, or nonbioaccumulative); and
- Biodegradation potential (fast, moderate, slow or resistant).

Using appropriate key parameters, and where sufficient data exist, these categorization schemes identify the relative aquatic and human toxicity and bioaccumulation potential for each chemical associated with TEC wastewater. In addition, the potential to partition to various media (air, sediment/sludge, or water) and to persist in the environment is identified for each chemical.

These schemes are intended for screening purposes only and do not take the place of detailed pollutant assessments analyzing all fate and transport mechanisms.

This evaluation also identifies chemicals that: (1) are known, probable, or possible human carcinogens; (2) are systemic human health toxicants; (3) have EPA human health drinking water standards; and (4) are designated as priority pollutants by EPA. The results of this analysis can provide a qualitative indication of potential risk posed by the release of these chemicals. Actual risk depends on the magnitude, frequency, and duration of pollutant loading; site-specific environmental conditions; proximity and number of human and ecological receptors; and relevant exposure pathways. The following discussion outlines the categorization schemes. Ranges of parameter values defining the categories are also presented.

(a) Acute Aquatic Toxicity

Key Parameter: Acute aquatic life criteria/LC_{50} or other benchmark (AT) ($\mu g/L$)

Using acute criteria or lowest reported acute test results (generally 96-hour and 48-hour durations for fish and invertebrates, respectively), chemicals are grouped according to their relative short-term effects on aquatic life.

Categorization Scheme:

$AT < 100$	Highly toxic
$1,000 \geq AT \geq 100$	Moderately toxic
$AT > 1,000$	Slightly toxic

This scheme, used as a rule-of-thumb guidance by EPA's OPPT for Premanufacture Notice (PMN) evaluations, is used to indicate chemicals that could potentially cause lethality to aquatic life downstream of discharges.

(b) Volatility from Water

Key Parameter: Henry's Law constant (HLC) (atm-m^3/mol)

$$HLC = \frac{\text{Vapor Pressure (atm)}}{\text{Solubility (mol/m}^3\text{)}} \quad \text{(Eq. 14)}$$

HLC is the measured or calculated ratio between vapor pressure and solubility at ambient conditions. This parameter is used to indicate the potential for organic substances to partition to air in a two-phase (air and water) system. A chemical's potential to volatilize from surface water can be inferred from HLC.

Categorization Scheme:

$HLC > 10^{-3}$	Highly volatile
$10^{-3} \geq HLC \geq 10^{-5}$	Moderately volatile
$10^{-5} > HLC \geq 3 \times 10^{-7}$	Slightly volatile
$HLC < 3 \times 10^{-7}$	Essentially nonvolatile

This scheme, adopted from Lyman et al. (1982), gives an indication of chemical potential to volatilize from process wastewater and surface water, thereby reducing the threat to aquatic life and human health via contaminated fish consumption and drinking water, yet potentially causing risk to exposed populations via inhalation.

(c) Adsorption to Soil/Sediments

Key Parameter: Soil/sediment adsorption coefficient (K_{oc})

K_{oc} is a chemical-specific adsorption parameter for organic substances that is largely independent of the properties of soil or sediment and can be used as a relative indicator of adsorption to such media. K_{oc} is highly inversely correlated with solubility, well correlated with octanol-water partition coefficient, and fairly well correlated with BCF.

Categorization Scheme:

$K_{oc} > 10,000$	Highly adsorptive
$10,000 \geq K_{oc} \geq 1,000$	Moderately adsorptive
$1,000 > K_{oc} \geq 10$	Slightly adsorptive
$K_{oc} < 10$	Essentially nonadsorptive

This scheme is devised to evaluate substances that may partition to solids and potentially contaminate sediment underlying surface water or land receiving sewage sludge applications. Although a high K_{oc} value indicates that a chemical is more likely to partition to sediment, it also indicates that a chemical may be less bioavailable.

(d) Bioaccumulation Potential

Key Parameter: Bioconcentration Factor (BCF)

$$BCF = \frac{\text{Equilibrium chemical concentration in organism (wet weight)}}{\text{Mean chemical concentration in water}} \qquad \text{(Eq. 15)}$$

BCF is a good indicator of potential to accumulate in aquatic biota through uptake across an external surface membrane.

Categorization Scheme:

$BCF > 500$	High potential
$500 \geq BCF \geq 50$	Moderate potential

50 > BCF ≥ 5	Slight potential
BCF < 5	Nonbioaccumulative

This scheme is used to identify chemicals that may be present in fish or shellfish tissues at higher levels than in surrounding water. These chemicals may accumulate in the food chain and increase exposure to higher trophic level populations, including people consuming their sport catch or commercial seafood.

(e) Biodegradation Potential

Key Parameter: Aqueous Aerobic Biodegradation Half-life (BD) (days)

Biodegradation, photolysis, and hydrolysis are three potential mechanisms of organic chemical transformation in the environment. A BD is selected to represent chemical persistence because of its importance and the abundance of measured or estimated data relative to other transformation mechanisms.

Categorization Scheme:

BD ≤ 7	Fast
7 < BD ≤ 28	Moderate
28 < BD ≤ 180	Slow
180 < BD	Resistant

This scheme is based on classification ranges given in a recent compilation of environmental fate data (Howard et al., 1991). This scheme gives an indication of chemicals that are likely to biodegrade in surface water, and therefore, not persist in the environment. However, biodegradation products can be less toxic, equally as toxic, or even more toxic than the parent compound.

2.2.4 Assumptions and Limitations

The major assumptions and limitations associated with the data compilation and categorization schemes are summarized in the following two sections.

(a) Data Compilation

- If data are readily available from electronic data bases, other primary and secondary sources are not searched.
- Much of the data are estimated and, therefore, can have a high degree of associated uncertainty.
- For some chemicals, neither measured nor estimated data are available for key categorization parameters. In addition, chemicals identified for this study do not represent a complete set of wastewater constituents. As a result, this study does not completely assess TEC wastewater.

(b) Categorization Schemes

- Receiving waterbody characteristics, pollutant loading amounts, exposed populations, and potential exposure routes are not considered.
- Placement into groups is based on arbitrary order of magnitude data breaks for several categorization schemes. Combined with data uncertainty, this may lead to an overstatement or understatement of the characteristics of a chemical.
- Data derived from laboratory tests may not accurately reflect conditions in the field.
- Available aquatic toxicity and bioconcentration test data may not represent the most sensitive species.
- The biodegradation potential may not be a good indicator of persistence for organic chemicals that rapidly photoxidize or hydrolyze, since these degradation mechanisms are not considered.

2.3 Documented Environmental Impacts

State and Regional environmental agencies are contacted, and State 304(l) Short Lists, State Fishing Advisories, and published literature are reviewed for evidence of documented environmental impacts on aquatic life, human health, POTW operations, and the quality of receiving water due to discharges of pollutants from TEC facilities. Reported impacts are compiled and summarized by study site and facility.

3. DATA SOURCES

3.1 Water Quality Impacts

Readily available EPA and other agency data bases, models, and reports are used in the evaluation of water quality impacts. The following six sections describe the various data sources used in the analysis.

3.1.1 Facility-Specific Data

EPA's Engineering and Analysis Division (EAD) provided projected facility effluent process flows, facility operating days, and pollutant loadings (Appendix A) in February-May 1997 (U.S. EPA, 1997). For each option, the long-term averages (LTAs) were calculated for each pollutant of concern based on sampling data. Facilities reported in the *1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry* the annual quantity discharged to surface water and POTWs (U.S. EPA, 1994b). The annual quantity discharged (facility flow) was multiplied by the LTA for each pollutant and converted to the proper units to calculate the loading (in pounds per year) for each pollutant.

The locations of facilities on receiving streams are identified using the U.S. Geological Survey (USGS) cataloging and stream segment (reach) numbers contained in EPA's Industrial Facilities Discharge (IFD) data base (U.S. EPA, 1994-1996a). Latitude/longitude coordinates, if available, are used to locate those facilities and POTWs that have not been assigned a reach number in IFD. The names, locations, and the flow data for the POTWs to which the indirect facilities discharge are obtained from the 1994 TEC Questionnaire (U.S. EPA, 1994b), EPA's 1992 NEEDS Survey (U.S. EPA, 1992b), IFD, and EPA's Permit Compliance System (PCS) (U.S. EPA, 1993-1996). If these sources did not yield information for a facility, alternative measures are taken to obtain a complete set of receiving streams and POTWs.

The receiving stream flow data are obtained from either the W.E. Gates study data or from measured streamflow data, both of which are contained in EPA's GAGE file (U.S. EPA, 1994-1996b). The W.E. Gates study contains calculated average and low flow statistics based on the best available flow data and on drainage areas for reaches throughout the United States. The GAGE file also includes average and low flow statistics based on measured data from USGS gaging stations. "Dissolved Concentration Potentials (DCPs)" for estuaries and bays are obtained from the Strategic Assessment Branch of NOAA's Ocean Assessments Division (NOAA/U.S. EPA, 1989-1991) (Appendix B). Critical Dilution Factors are obtained from the *Mixing Zone Dilution Factors for New Chemical Exposure Assessments* (U.S. EPA, 1992a).

3.1.2 Information Used to Evaluate POTW Operations

POTW treatment efficiency removal rates are obtained from a variety of sources including a study of 50 well-operated POTWs, referred to as the "50 POTW Study" (U.S. EPA, 1982), the Risk Reduction Engineering Laboratory (RREL) data base (now renamed the National Risk Management Reserch Laboratory data base U.S. EPA, 1995a); the *Environmental Assessment of the Pesticide Manufacturing Industry* (U.S. EPA, 1993b); the *Environmental Assessment of the Proposed Effluent Guidelines for the Metal Products and Machinery Industry (Phase I)* (U.S. EPA, 1995b); and the *Environmental Assessment of Proposed Effluent Guidelines for the Centralized Waste Treatment Industry* (U.S. EPA, 1995c). When data are not available, the removal rate is based on the removal rate of a similar pollutant (Appendix C).

Inhibition values are obtained from *Guidance Manual for Preventing Interference at POTWs* (U.S. EPA, 1987) and from *CERCLA Site Discharges to POTWs: Guidance Manual* (U.S. EPA, 1990a). The most conservative values for activated sludge are used. For pollutants with no specific inhibition value, a value based on compound type (e.g., aromatics) is used (Appendix C).

Sewage sludge regulatory levels, if available for the pollutants of concern, are obtained from the Federal Register 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge, Final Rule (October 25, 1995) (U.S. EPA, 1995d). Pollutant limits established for the final use or disposal of sewage sludge when the sewage sludge is applied to agricultural and non-agricultural land are used (Appendix C). Sludge partition factors are obtained from the *Report to Congress on the Discharge of Hazardous Wastes to Publicly-Owned Treatment Works (Domestic Sewage Study)* (U.S. EPA, 1986) (Appendix C).

3.1.3 Water Quality Criteria (WQC)

The ambient criteria (or toxic effect levels) for the protection of aquatic life and human health are obtained from a variety of sources including EPA criteria documents, EPA's ASTER, and EPA's IRIS (Appendix C). Ecological toxicity estimations are used when published values are not available. The hierarchies used to select the appropriate aquatic life and human health values are described in the following sections.

3.1.3.1 *Aquatic Life*

Water quality criteria for many pollutants are established by EPA 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 genera of aquatic organisms and their uses should not be unacceptably affected, provided that these levels are not exceeded more than once every 3 years.

For pollutants for which no water quality criteria are developed, specific toxicity values (acute and chronic effect concentrations reported in published literature or estimated using various application techniques) are used. In selecting values from the literature, measured concentrations from flow-through studies under typical pH and temperature conditions are preferred. 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 shorter 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; and
- 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; and
- Estimated chronic toxicity concentration from a measured acute chronic ratio for a less sensitive species, QSAR model, or default acute:chronic ratio of 10:1.

3.1.3.2 *Human Health*

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

For Toxicity Protection (ingestion of organisms only)

$$HH_{oo} = \frac{RfD \times CF}{IR_f \times BCF} \qquad \text{(Eq. 16)}$$

where:

HH_{oo} = human health value (μg/L)
RfD = reference dose for a 70-kg individual (mg/day)
IR_f = fish ingestion rate (0.0065 kg/day)
BCF = bioconcentration factor (liters/kg)
CF = conversion factor for units (1,000 μg/mg)

For Carcinogenic Protection (ingestion of organisms only)

$$HH_{oo} = \frac{BW \times RL \times CF}{SF \times IR_f \times BCF} \qquad \text{(Eq. 17)}$$

where:

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

For Toxicity Protection (ingestion of water and organisms)

$$HH_{wo} = \frac{RfD \times CF}{IR_w + (IR_f \times BCF)} \qquad \text{(Eq. 18)}$$

where:

HH_{wo} = human health value (μg/L)
RfD = reference dose for a 70-kg individual (mg/day)
IR_w = water ingestion rate (2 liters/day)

IR_f = fish ingestion rate (0.0065 kg/day)
BCF = bioconcentration factor (liters/kg)
CF = conversion factor for units (1000 μg/mg)

For Carcinogenic Protection (ingestion of water and organisms)

$$HH_{wo} = \frac{BW \times RL \times CF}{SF \times (IR_w + (IR_f \times BCF))} \quad \text{(Eq. 19)}$$

where:

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

The values for ingesting water and organisms are derived by assuming an average daily ingestion of 2 liters of water, an average daily fish consumption rate of 6.5 grams of potentially contaminated fish products, and an average adult body weight of 70 kilograms (U.S. EPA, 1991a). Values protective of carcinogenicity are used to assess the potential effects on human health, if EPA has established a slope factor.

Protective concentration levels for carcinogens are developed in terms of non-threshold lifetime risk level. Criteria at a risk level of 10^{-6} (1E-6) are chosen for this analysis. This risk level indicates a probability of one additional case of cancer for every 1-million persons exposed. Toxic effects criteria for noncarcinogens 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 listed 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* (U.S. EPA, 1980); three percent is the mean lipid content of fish tissue reported in the study from which the average daily fish consumption rate of 6.5 g/day is 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 HEAST used in conjunction with adjusted 3 percent lipid BCF values derived from *Ambient Water Quality Criteria Documents* (U.S. EPA, 1980);

- 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* (U.S. EPA, 1980); and

- 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* (U.S. EPA, 1991a), which recommends using the most current risk information from IRIS when estimating human health risks. In cases where chemicals have both RfDs and SFs from the same level of the hierarchy, human health values are calculated using the formulas for carcinogenicity, which always result in the more stringent value of the two given the risk levels employed.

3.1.4 Information Used to Evaluate Human Health Risks and Benefits

Fish ingestion rates for sport anglers, subsistence anglers, and the general population are obtained from the *Exposure Factors Handbook* (U.S. EPA, 1989a). State population data and average household size are obtained from the 1995 *Statistical Abstract of the United States* (U.S. Bureau of the Census, 1995). Data concerning the number of anglers in each State (i.e., resident fishermen) are obtained from the 1991 *National Survey of Fishing, Hunting, and Wildlife Associated Recreation* (U.S. FWS, 1991). The total number of river miles or estuary square miles within a State are obtained from the 1990 *National Water Quality Inventory - Report to Congress* (U.S. EPA, 1990b). Drinking water utilities located within 50 miles downstream from each discharge site are identified using EPA's PATHSCAN (U.S. EPA, 1996a). The population served by a drinking water utility is obtained from EPA's Drinking Water Supply Files (U.S. EPA, 1996b) or Federal Reporting Data System (U.S. EPA, 1996c). Willingness-to-pay values are obtained from OPA's review of a 1989 and a 1986 study *The Value of Reducing Risks of Death: A Note on New Evidence* (Fisher, Chestnut, and Violette, 1989) and *Valuing Risks: New Information on the Willingness to Pay for Changes in Fatal Risks* (Violette and Chestnut, 1986). Values are adjusted to 1994, based on the relative change in the Employment Cost Index of Total Compensation for all Civilian Workers. Information used in the evaluation is presented in Appendix D.

3.1.5 Information Used to Evaluate Ecological Benefits

The concept of a "contaminant-free fishery" and the estimate of an increase in the consumer surplus associated with a contaminant-free fishery are obtained from *Discrete Choice Models to Value Changes in Environmental Quality: A Great Lakes Case Study*, a thesis submitted at the University of Wisconsin-Madison by Audrey Lyke in 1993. Data concerning the number of resident anglers in each State and average number of fishing days per angler in each State are obtained from the 1991 *National Survey of Fishing, Hunting, and Wildlife Associated Recreation* (U.S. FWS, 1991) (Appendix D). Median net benefit values for warm water and cold water fishing days are obtained from *Nonmarket Values from Two Decades of Research on Recreational Demand* (Walsh et al., 1990). Values are adjusted to 1994, based on the change in the Consumer Price Index for all urban consumers, as published by the Bureau of Labor Statistics. The concept and methodology of estimating nonuse (intrinsic) benefits, based on improved water quality, are obtained from *Intrinsic Benefits of Improved Water Quality: Conceptual and Empirical Perspectives* (Fisher and Raucher, 1984).

3.1.6 Information Used to Evaluate Economic Productivity Benefits

Sewage sludge pollutant limits for surface disposal and land application (ceiling limits and pollutant concentration limits) are obtained from the Federal Register 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge, Final Rule (October 25, 1995) (U.S. EPA, 1995b). Cost savings from shifts in sludge use or disposal practices from composite baseline disposal practices are obtained from the *Regulatory Impact Analysis of Proposed Effluent Limitations Guidelines and Standards for the Metal Products and Machinery Industry (Phase I)* (U.S. EPA, 1995e). Savings are adjusted to 1994 using the Construction Cost Index published in the Engineering News Record. In this report, EPA consulted a wide variety of sources, including:

- 1988 National Sewage Sludge Survey;
- 1985 EPA *Handbook for Estimating Sludge Management Costs*;
- 1989 EPA *Regulatory Impact Analysis of the Proposed Regulations for Sewage Sludge Use and Disposal*;
- Interviews with POTW operators;
- Interviews with State government solid waste and waste pollution control experts;
- Review of trade and technical literature on sewage sludge use or disposal practices and costs; and
- Research organizations with expertise in waste management.

Information used in the evaluation is presented in Appendix D.

3.2 Pollutant Fate and Toxicity

The chemical-specific data needed to conduct the fate and toxicity evaluation are obtained from various sources as discussed in Section 2.2.2 of this report. Aquatic life and human health values are presented in Appendix C. Physical/chemical property data are also presented in Appendix C.

3.3 Documented Environmental Impacts

Data are obtained from State and Regional environmental agencies in Regions III, V, VI, VII, VIII, IX, X. Data are also obtained from the 1990 State 304(l) Short Lists (U.S. EPA, 1991b) and the 1995 *National Listing of Fish Consumption Advisories* (U.S. EPA, 1995f). Literature abstracts are obtained through the computerized information system DIALOG (Knight-Ridder Information, 1996), which provides access to Enviroline, Pollution Abstracts, Aquatic Science Abstracts, and Water Resources Abstracts.

4. SUMMARY OF RESULTS

4.1 Projected Water Quality Impacts

4.1.1 Comparison of Instream Concentrations with Ambient Water Quality Criteria

The results of this analysis indicate the water quality benefits of controlling discharges from TEC facilities (barge-chemical and petroleum, rail-chemical, and truck-chemical) to surface waters and POTWs. The following two sections summarize potential aquatic life and human health impacts on receiving stream water quality and on POTW operations and their receiving streams for direct and indirect discharges. All tables referred to in these sections are presented at the end of Section 4. Appendices E, F, and G present the results of the stream modeling for each type of discharge and TEC facility, respectively.

4.1.1.1 *Direct Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The effects of direct wastewater discharges on receiving stream water quality are evaluated at **current** and **proposed BAT** treatment levels for 6 barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams (rivers) (Table 1). At **current** discharge levels, these 6 facilities discharge 84,653 pounds-per-year of priority and nonconventional pollutants (Table 2). These loadings are reduced to 3,931 pounds-per-year at **proposed BAT** discharge levels; a 95 percent reduction.

Modeled instream pollutant concentrations are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 33 percent (2 of the total 6) of the receiving streams at **current** discharge levels and in 17 percent (1 of the total 6) of the receiving streams at **proposed BAT** discharge levels (Table 3). Two (2) pollutants at both **current** and **proposed BAT** discharge levels are projected to exceed instream criteria or toxic effect levels using a target risk of 10^{-6} (1E-6) for carcinogens (Table 4).

Instream pollutant concentrations are not projected to exceed **aquatic life criteria** (acute or chronic) or toxic effect levels at **current** or **proposed BAT** discharge levels (Table 3). Excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) are also presented in Table 3. Instream concentrations of 2 pollutants are projected to exceed **human health criteria** or toxic effect levels in 1 of the 6 receiving streams at **current** discharge levels. The two excursions projected at **current** discharge levels are eliminated at **proposed BAT** discharge levels.

(b) Barge-Chemical and Petroleum Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 6 barge-chemical facilities discharging 60 pollutants to 6 receiving streams (Table 1). These values are extrapolated to 14 barge-chemical and petroleum facilities discharging 60 pollutants to 14 receiving streams (Table 5).

Extrapolated instream pollutant concentrations of 2 pollutants are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 43 percent (6 of the total 14) receiving streams at **current** discharge levels and in 21 percent (3 of the total 14) of the receiving streams at **proposed BAT** discharge levels (Tables 5 and 6). A total of 9 excursions in 6 receiving streams at **current** conditions will be reduced to 6 excursions in 3 receiving streams at **proposed BAT** discharge levels (Table 5). Additionally, the 6 excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) in 3 receiving streams will be eliminated at **proposed BAT** discharge levels (Table 5).

4.1.1.2 *Indirect Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The 1 indirect barge-chemical and petroleum facility is not being proposed for pretreatment standards. EPA did, however, evaluate the effects of the facility's discharge on a POTW and its receiving stream. At **current** discharge levels, this 1 facility discharges 14,565 pounds-per-year of priority and nonconventional pollutants (Table 2). These loadings are reduced to 6,665 pounds-per-year at **proposed pretreatment** discharge levels; a 54 percent reduction.

Water quality modeling results for the 1 indirect barge-chemical and petroleum facility that discharges 60 pollutants to 1 POTW with an outfall on 1 receiving stream indicate that at both **current** and **proposed pretreatment** discharge levels no instream pollutant concentrations are expected to exceed **aquatic life criteria** (acute or chronic) or toxic effect levels (Table 7). Additionally, at **current** and **proposed pretreatment** discharge levels, the instream concentrations (using a target risk of 10^{-6} for carcinogens) are not projected to exceed **human health criteria** or toxic effect levels (developed for consumption of water and organisms/organisms consumption only) (Table 7).

In addition, the potential impact of the 1 barge-chemical and petroleum facility is evaluated in terms of inhibition of POTW operation and contamination of sludge. No inhibition or sludge contamination problems are projected at the 1 POTW receiving wastewater (Table 8).

Since no excursions of ambient water quality criteria (AWQC) or impacts at POTWs are projected, results are not extrapolated to the national level.

(b) Rail-Chemical Facilities - Sample Set

The effects of POTW wastewater discharges of 103 pollutants on receiving stream water quality are evaluated at **current** and **proposed pretreatment** discharge levels, for 12 indirect rail-chemical facilities that discharge to 11 POTWs located on 11 receiving streams (rivers) (Table 9). Pollutant loadings for the 12 facilities at **current** discharge levels are 13,580 pounds-per-year (Table 2). The loadings are reduced to 7,852 pounds-per-year after **proposed pretreatment**; a 42 percent reduction.

Instream pollutant concentrations are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 45 percent (5 of the total 11) of the receiving streams at **current** and **proposed pretreatment** discharge levels (Table 10). Three (3) pollutants at **current** and 1 pollutant at **proposed pretreatment** discharge levels are projected to exceed instream criteria or toxic effect levels using a target risk of 10^{-6} (1E-6) for the carcinogens (Table 11). Excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) are projected in 18 percent (2 of the total 11) of the receiving streams (Tables 10 and 11). The **proposed pretreatment** regulatory option will eliminate these excursions (Tables 10 and 11).

Instream pollutant concentrations are projected to exceed **chronic aquatic life criteria** or toxic effect levels in 18 percent (2 of the total 11) of the receiving streams at **current** discharge levels (Table 10). A total of 4 pollutants at **current** discharge levels are projected to exceed instream criteria or toxic effect levels (Table 11). **Proposed pretreatment** discharge levels reduce projected excursions to 3 pollutants in 1 of the 11 receiving streams (Tables 10 and 11). The 1 excursion of **acute aquatic life criteria** or toxic effect levels is eliminated by the **proposed pretreatment** regulatory option (Tables 10 and 11).

In addition, the potential impact of the 12 rail-chemical facilities, which discharge to 11 POTWs, are evaluated in terms of inhibition of POTW operation and contamination of sludge. Inhibition problems from 4 pollutants are projected at 55 percent (6 of the 11) of the POTWs receiving wastewater discharges at **current** discharge levels (Tables 12 and 13). Inhibition problems are reduced to 4 POTWs by the **proposed pretreatment** regulatory option. No sludge contamination problems are projected at the 11 POTWs receiving wastewater discharges (Table 12).

(c) Rail-Chemical Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 12 rail-chemical facilities discharging 103 pollutants to 11 POTWs located on 11 receiving streams (Table 9). These values are extrapolated to 38 rail-chemical facilities discharging 103 pollutants to 37 POTWs with outfalls on 37 streams (Table 14).

Extrapolated instream concentrations are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption) in 43 percent (16 of the total 37) receiving streams at both **current** and **proposed pretreatment** discharge levels (Tables 14 and 15). A total of 32 excursions due to the discharge of 3 pollutants at **current** conditions will be reduced to 16 excursions due to the discharge of 1 pollutant (Table 14). Additionally, the 8 excursions of **human health criteria** or toxic effect levels (developed for organisms consumption only) in 8 receiving streams will be eliminated by the **proposed pretreatment** regulatory option (Table 14).

Extrapolated instream pollutant concentrations are projected to exceed **chronic aquatic life criteria** or toxic effect levels in 22 percent (8 of the total 37) receiving streams at **current** discharge levels (Table 14). A total of 4 pollutants at **current** discharge levels are projected to exceed instream criteria or toxic effect levels (Table 15). **Proposed pretreatment** discharge levels reduce projected excursions to 3 pollutants in 16 percent (6 of the total 37) receiving streams (Tables 14 and 15). A total of 26 excursions at **current** conditions are reduced to 17 excursions at **proposed pretreatment** discharge levels (Table 14). Additionally, the 6 excursions of **acute aquatic life criteria** or toxic effect levels in 6 receiving streams will be eliminated by the **proposed pretreatment** regulatory option (Table 14).

The extrapolated potential impact of the 38 rail-chemical facilities which discharge to 37 POTWs are also evaluated in terms of inhibition of POTW operation and contamination of sludge. Inhibition problems at 57 percent (21 of the 37) of the POTWs at **current** discharge levels are reduced to 35 percent (13 of 37) of the POTWs by the **proposed pretreatment** regulatory option (tables 16 and 17). No sludge contamination problems are projected at the 37 POTWs (Table 16).

(d) Truck-Chemical Facilities - Sample Set

The effects of POTW wastewater discharges of 80 pollutants on receiving stream water quality are evaluated at **current** and **proposed pretreatment** discharge levels for 40 truck-chemical facilities which discharge to 35 POTWs with outfalls on 35 receiving streams (29 rivers and 6 estuaries) (Table 18). Pollutant loadings for the 40 facilities at **current** discharge levels are 128,932 pounds-per-year (Table 2). The loadings are reduced to 26,083 pounds-per-year after the **proposed pretreatment**; an 80 percent reduction.

Instream concentrations of 1 pollutant (using a target risk of 10^{-6} (1E-6) for carcinogens) are projected to exceed **human health criteria** or toxic effect levels (developed for water and organism consumption/organism consumption only) in 6 percent (2 of the total 35) of the receiving streams at **current** discharge levels (Tables 19 and 20). The **proposed pretreatment** regulatory option eliminates excursions of **human health criteria** or toxic effect levels.

Instream pollutant concentrations are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 23 percent (8 of the total 35) of the receiving streams at **current** discharge levels (Table 19). A total of 1 pollutant at **current** discharge levels is projected to exceed instream criteria or toxic effect levels (Table 20). **Proposed pretreatment** discharge levels reduce projected excursions to 1 pollutant in 17 percent (6 of the total 35) of the receiving streams (Tables 19 and 20). No excursions of **acute aquatic life criteria** or toxic effect levels are projected.

In addition, the potential impact of the 40 truck-chemical facilities, which discharge to 35 POTWs, are evaluated in terms of inhibition of POTW operation and contamination of sludge. No inhibition or sludge contamination problems are projected at the 35 POTWs receiving wastewater discharges (Table 21).

Since no impacts at POTWs are projected, results are not extrapolated to the national level.

(e) Truck-Chemical Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 40 truck-chemical facilities discharging 80 pollutants to 35 POTWs with outfalls on 35 receiving streams (Table 18). The values are extrapolated to 288 truck-chemical facilities discharging 80 pollutants to 264 POTWs located on 264 receiving streams (Table 22).

Extrapolated instream pollutant concentrations of 1 pollutant are projected to exceed **human health criteria** or toxic effect levels (developed for water and organisms consumption/organisms consumption only) in 5 percent (14 of the total 264) of the receiving streams at **current** discharge levels (Tables 22 and 23). Excursions of **human health criteria** or toxic effect levels are eliminated by the **proposed pretreatment** regulatory option (Table 22).

Extrapolated instream pollutant concentrations of 1 pollutant are also projected to exceed **chronic aquatic life criteria** or toxic effect levels in 19 percent (49 of the total 264) of the receiving streams at **current** discharge levels (Tables 22 and 23). **Proposed pretreatment** discharge levels reduce excursions to 1 pollutant in 14 percent (37 of the total 264) of the receiving streams (Tables 22 and 23). A total of 49 excursions in 49 receiving streams at **current** conditions will be reduced to 37 excursions in 37 receiving streams at **proposed pretreatment** discharge levels (Table 22).

4.1.2 Estimation of Human Health Risks and Benefits

The results of this analysis indicate the potential benefits to human health by estimating the risks (carcinogenic and systemic effects) associated with current and reduced pollutant levels in fish tissue and drinking water. The following two sections summarize potential human health impacts from the consumption of fish tissue and drinking water derived from waterbodies impacted by direct and indirect discharges. Risks are estimated for recreational (sport) and subsistence anglers and their families, as well as the general population. Appendices H and I present the results of the modeling for each type of discharge and facility, respectively.

4.1.2.1 *Direct Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The effects of direct wastewater discharges on human health from the consumption of fish tissue and drinking water are evaluated at **current** and **proposed BAT** treatment levels for 6 barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams (rivers) (Table 1).

Fish Tissue -- At **current** discharge levels, 1 receiving stream has total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 1 barge-chemical and petroleum facility (Table 24). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. At **current** discharge levels, total excess annual cancer cases are estimated to be 3.9E-4 (Table 24). At **proposed BAT** discharge levels, 1 receiving stream has total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 1 barge-chemical and petroleum facility. Total estimated risks greater than 10^{-6} (1E-6) are projected for only **subsistence anglers**. Total excess annual cancer cases are reduced to 5.6E-6 at **proposed BAT** discharge levels (Table 24). Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not estimated. In addition, systemic toxicant effects (hazard index greater than 1.0) are not projected at **current** or **proposed BAT** discharge levels (Table 25).

Drinking Water -- At **current** and **proposed BAT** discharge levels, 1 receiving stream has total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 1 facility (Table 26). Estimated risks are 1.4E-5 and 1.1E-6 at **current** and at **proposed BAT** discharge levels, respectively. However, no drinking water utility is located within 50 miles downstream of the discharge site. Total excess annual cancer cases are, therefore, not projected. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed BAT** discharge levels (Table 25).

(b) Barge-Chemical and Petroleum Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 6 barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams (Table 1). These values are extrapolated to 14 barge-chemical and petroleum facilities discharging 60 pollutants to 14 receiving streams.

Fish Tissue -- At **current** discharge levels, 3 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 3 barge-chemical and petroleum facilities POTWs (Table 27). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. At **current** discharge levels, total excess annual cancer cases are estimated to be 1.1E-3 (Table 27). At **proposed BAT** discharge levels, 3 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 3 facilities. Total estimated risks greater than 10^{-6} (1E-6) are projected for only **subsistence anglers**. Total excess annual cancer cases are reduced to 1.6E-5 at **proposed BAT** discharge levels (Table 27). Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not estimated. In addition, systemic toxicant effects (hazard index greater than 1.0) are not projected at **current** or **proposed BAT** discharge levels (Table 28).

Drinking Water -- At **current** and **proposed BAT** discharge levels, 3 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 1 carcinogen from 3 facilities (Table 29). However, no drinking water utilities are located within 50 miles downstream of the discharge sites. Total excess annual cancer cases are, therefore, not projected. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed BAT** discharge levels (Table 28).

4.1.2.2 *Indirect Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The 1 indirect barge-chemical and petroleum facility that discharges 60 pollutants to 1 POTW is not being proposed for pretreatment standards (Table 1). EPA did, however, evaluate the effects of the POTW wastewater discharges on human health from the consumption of fish tissue and drinking water at current and proposed pretreatment discharge levels.

Fish Tissue -- At current and proposed pretreatment discharge levels, the 1 stream receiving the discharge from 1 barge-chemical and petroleum facility/POTW is not projected to have a total estimated individual pollutant cancer risk greater than 10^{-6} (1E-6) (Table 30). In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at current or proposed pretreatment discharge levels (Table 31).

Drinking Water -- At current and proposed pretreatment discharge levels, the 1 stream is not projected to have a total estimated individual pollutant cancer risk greater than 10^{-6} (1E-6) (Table 32).In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at current or proposed pretreatment discharge levels (Table 31).

(b) Rail-Chemical Facilities - Sample Set

The effects of POTW wastewater discharges on human health from the consumption of fish tissue and drinking water are evaluated at current and proposed pretreatment discharge levels for 12 rail-chemical facilities that discharge 103 pollutants to 11 POTWs with outfalls on 11 receiving streams (rivers) (Table 9).

Fish Tissue -- At current discharge levels, 7 streams receiving the discharge from 8 facilities/POTWs, have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) from 13 carcinogens (Tables 33 and 34). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. Total excess annual cancer cases are estimated at 6.5E-3. At **proposed pretreatment** discharge levels, 5 streams, receiving the discharge from 6 facilities /POTWs, have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 12 carcinogens (Tables 33 and 34). Total estimated risks greater than 10^{-6} (1E-6) are still projected for the **general population**, **sport anglers**, and **subsistence anglers**. Total excess annual cancer cases are reduced to an estimated 1.1E-3. Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not projected. Additionally, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed pretreatment** discharge levels (Table 35).

Drinking Water -- At **current** and **proposed pretreatment** discharge levels, 5 receiving streams are projected to have a total estimated individual pollutant cancer risk greater than 10^{-6} (1E-6) due to the discharge of 2 carcinogens (Table 36). However, no drinking water utilities are located within 50 miles downstream of the discharge sites. Total excess cancer cases are, therefore, not projected. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed pretreatment** discharge levels (Table 35).

(c) Rail-Chemical Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on sample set of 12 rail-chemical facilities discharging 103 pollutants to 11 POTWs with outfalls on 11 receiving streams (Table 9). These values are extrapolated to 38 rail-chemical facilities discharging 103 pollutants to 37 POTWs located on 37 receiving streams.

Fish Tissue — At **current** discharge levels, 24 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 13 carcinogens from 25 rail-chemical facilities/POTWs (Table 37). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. At **current** discharge levels, total excess annual cancer cases are estimated to be 2.7E-2 (Table 37). At **proposed pretreatment** discharge levels, 16 receiving steams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 12 carcinogens from 17 rail-chemical facilities/POTWs. Total estimated risks greater than 10^{-6} (1E-6) are still projected for the **general population**, **sport anglers**, and **subsistence anglers**. Total excess annual cancer cases are reduced to 4.5E-3 at **proposed pretreatment** levels (Table 37). Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not estimated. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed pretreatment** discharge levels (Table 38).

Drinking Water -- At **current** and **proposed pretreatment** discharge levels, 16 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 2 carcinogens (Table 39). However, no drinking water utilities are located within 50 miles downstream of the discharge sites. Total excess cancer cases are, therefore, not projected.

(d) Truck-Chemical Facilities - Sample Set

The effects of POTW wastewater discharges on human health from the consumption of fish tissue and drinking water are evaluated at **current** and **proposed pretreatment** discharge levels for 40 truck-chemical facilities discharging 80 pollutants to 35 POTWs with outfalls on 35 receiving streams (29 rivers and 6 estuaries) (Table 18).

Fish Tissue — At **current** discharge levels, 12 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 5 carcinogens from 13 truck-chemical facilities/POTWs (Tables 40 and 41). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. At **current** discharge levels, total excess annual cancer cases are estimated to be 1.8E-3 (Table 40). At **proposed pretreatment** discharge levels, 5 receiving steams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 4 carcinogens from 5 truck-chemical facilities/POTWs. Total estimated risks greater than 10^{-6} (1E-6) are still projected for only

subsistence anglers. Total excess annual cancer cases are reduced to 5.5E-5 at **proposed pretreatment** levels (Table 40). Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not estimated.

The risk to develop systemic toxicant effects (hazard index greater than 1.0) are projected from 1 pollutant for only subsistence anglers in 7 receiving streams at **current** discharge levels and in 3 receiving streams at **proposed pretreatment** discharge levels (Table 42). An estimated population of 4,284 subsistence anglers and their families are projected to be affected at **current** discharge levels. The affected population is reduced to 687 at **proposed pretreatment** levels.

Drinking Water -- At **current** discharge levels, 2 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 6 carcinogens (Table 43). Estimated risks range from 3.2E-8 to 6.4E-7. A drinking water utility is located within 50 miles downstream of 1 discharge site. However, EPA has published a drinking water criterion for 5 of the 6 pollutants, and it is assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds. The cancer risk for the remaining pollutant is less than 10^{-6} (1E-6). Total excess annual cancer cases are, therefore, not projected. Total estimated individual cancer risks greater than 10^{-6} (1E-6) are eliminated at **proposed pretreatment** discharge levels. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed pretreatment** levels (Table 42).

(e) Truck-Chemical Facilities -- National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on sample set of 40 truck-chemical facilities discharging 80 pollutants to 35 POTWs with outfalls on 35 receiving streams (Table 18). These values are extrapolated to 288 truck-chemical facilities discharging 80 pollutants to 264 POTWs located on 264 receiving streams.

Fish Tissue -- At **current** discharge levels, 90 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 5 carcinogens from 99 barge-chemical facilities/POTWs (Table 44). Total estimated risks greater than 10^{-6} (1E-6) are projected for the **general population**, **sport anglers**, and **subsistence anglers**. At **current** discharge levels, total excess annual cancer cases are estimated to be 1.2E-2 (Table 44). At **proposed pretreatment** discharge levels, 30 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 4 carcinogens from 30 truck-chemical facilities/POTWs. Total estimated risks greater than 10^{-6} (1E-6) are projected for only **subsistence anglers**. Total excess annual cancer cases are reduced to 3.1E-4 at **proposed pretreatment** levels (Table 44). Because the number of excess annual cancer cases at current discharge levels is less than 0.5, a monetary value of benefits to society from avoided cancer cases is not estimated.

The risk to develop systemic toxicant effects (hazard index greater than 1.0) are projected for only **subsistence anglers** in 39 receiving streams from 1 pollutant at **current** discharge levels and in 16 receiving streams at **proposed pretreatment** discharge levels (Table 45). An estimated affected population of 14,173 subsistence anglers and their families is reduced to a population of 3,492 as a result of the **proposed pretreatment**. A monetary value of benefits to society could not be estimated.

Drinking Water -- At **current** and **proposed pretreatment** discharge levels, 14 receiving streams have total estimated individual pollutant cancer risks greater than 10^{-6} (1E-6) due to the discharge of 6 carcinogens (Table 46). Drinking water utilities are located within 50 miles of 7 discharge sites. However, EPA has published a drinking water criterion for 5 of the 6 pollutants, and it is assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds. The cancer risk for the remaining pollutant is less than 10^{-6} (1E-6). Total excess annual cancer cases are, therefore, not projected. In addition, no systemic toxicant effects (hazard index greater than 1.0) are projected at **current** or **proposed pretreatment** levels (Table 45).

4.1.3 Estimation of Ecological Benefits

The results of this analysis indicate the potential ecological benefits of the proposed regulation by estimating improvements in the recreational fishing habitats that are impacted by direct and indirect TEC wastewater discharges. Such impacts include acute and chronic toxicity, sublethal effects on metabolic and reproductive functions, physical destruction of spawning and feeding habitats, and loss of prey organisms. These impacts will vary due to the diversity of species with differing sensitivities to impacts. For example, lead exposure can cause spinal deformities in rainbow trout. Copper exposure can affect the growth activity of algae. In addition, copper and cadmium can be acutely toxic to aquatic life, including finfish. The following sections summarize the potential monetary use and nonuse benefits for direct and indirect discharges as well as additional benefits that are not monetized. Appendices H and I present the results of the analyses for each type of discharge and facility, respectively.

4.1.3.1 *Direct Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The effects of direct wastewater discharges on aquatic habitats are evaluated at **current** and **proposed BAT** treatment levels for 6 barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams (Tables 1 and 3). The proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 1 receiving stream (Table 3). Benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. The monetary value of improved recreational fishing opportunity is estimated by first calculating the baseline value of the benefiting stream segment. From the estimated total of 16,616 person-days fished on the stream segment, and the value per person-day of recreational fishing ($29.47 and $37.32, 1994 dollars), a baseline value of $490,000 to $620,000 is estimated for the 1 stream segment (Table 47). The value of improving water quality in this fishery, based on the increase in value (11.1 percent to 31.3 percent) to anglers of achieving a contaminant-free fishing (Lyke, 1993), is then calculated. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $54,400 to $194,000. In addition, the estimate of the nonuse (intrinsic) benefits to the general public, as a result of the same improvements in water quality, ranges from at least $27,200 to $97,000 (1994 dollars) (Table 47). These nonuse benefits are estimated as one-half of the recreational benefits and may be significantly underestimated.

(b) Barge-Chemical and Petroleum Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 6 barge-chemical and petroleum facilities discharging 60 pollutants to 6 receiving streams (Table 1). These values are extrapolated to 14 barge-chemical and petroleum facilities discharging 60 pollutants to 14 receiving streams (Table 5).

The proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 3 receiving streams (Table 5). Benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $157,000 to $562,000 (Table 47). In addition, the resulting increase in nonuse value to the general public ranges from $78,500 to $281,000 (1994 dollars) (Table 47).

4.1.3.2 *Indirect Discharges*

(a) Barge-Chemical and Petroleum Facilities - Sample Set

The effects of indirect wastewater discharges on aquatic habitats are evaluated at **current** and **proposed pretreatment** discharge levels for 1 barge-chemical and petroleum facility that discharges 60 pollutants to 1 POTW, with an outfall located on 1 receiving stream (Tables 1 and 7). Because the proposed regulation is not estimated to eliminate instream concentrations in excess of AWQC (i.e., excursions of AWQC are not projected), no benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. In addition, nonuse benefits are not estimated.

(b) Rail-Chemical Facilities - Sample Set

The effects of indirect wastewater discharges on aquatic habitats are evaluated at **current** and **proposed pretreatment** discharge levels for 12 rail-chemical facilities that discharge 103 pollutants to 11 POTWs with outfalls on 11 receiving streams (Tables 9 and 10). Because the proposed regulation is not estimated to completely eliminate instream concentrations in excess of AWQC, no benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. In addition, nonuse benefits are not estimated.

(c) Rail-Chemical Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 12 rail-chemical facilities discharging 103 pollutants to 11 POTWs located on 11 receiving streams (Table 9). These values are extrapolated to 38 rail-chemical facilities discharging 103 pollutants to 37 POTWs located on 37 receiving streams (Tables 9 and 14). Because the proposed regulation is not estimated to completely eliminate instream concentrations in excess of AWQC, no benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. In addition, nonuse benefits are not estimated.

(d) Truck-Chemical Facilities - Sample Set

The effects of indirect wastewater discharges on aquatic habitats are evaluated at **current** and **proposed pretreatment** levels for 40 truck-chemical facilities that discharge 80 pollutants to 35 POTWs with outfalls located on 35 receiving streams (Tables 18 and 19). The proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 2 receiving streams (Table 19). Benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. The monetary value of improved recreational fishing opportunity is estimated by first calculating the baseline value of the benefiting stream segment. From the estimated total 75,815 person-days fished on the 2 stream segments, and the value per person-day of recreational fishing ($29.47 and $37.32, 1994 dollars), a baseline value of $2,234,261 to

$2,829,407 is estimated for the 2 stream segments (Table 48). The value of improving water quality in this fishery, based on the increase in value (11.1 percent to 31.3 percent) to anglers of achieving a contaminant-free fishing (Lyke, 1993), is then calculated. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $248,000 to $886,000. In addition, the estimate of the nonuse (intrinsic) benefits to the general public, as a result of the same improvements in water quality, ranges from $124,000 to $443,000 (1994 dollars) (Table 48). These nonuse benefits are estimated as one-half of the recreational benefits and may be significantly underestimated.

(e) Truck-Chemical Facilities - National Extrapolation

Sample set data are extrapolated to the national level based on the statistical methodology used for estimated costs, loads, and economic impacts. Extrapolated values are based on the sample set of 40 truck-chemical facilities discharging 80 pollutants to 35 POTWs located on 35 receiving streams (Table 18). These values are extrapolated to 288 truck-chemical facilities discharging 80 pollutants to 264 POTWs on 264 receiving streams (Table 22).

The proposed regulation is projected to completely eliminate instream concentrations in excess of AWQC at 12 receiving streams (Table 22). Benefits to recreational (sport) anglers, based on improved quality and improved value of fishing opportunities, are estimated. The resulting estimate of the increase in value of recreational fishing to anglers ranges from $1,494,000 to $5,334,000 (Table 48). In addition, the resulting increase in nonuse value to the general public ranges from $747,000 to $2,667,000 (1994 dollars) (Table 48).

4.1.2.3 *Additional Ecological Benefits*

There are a number of additional use and nonuse benefits associated with the proposed standards that could not be monetized. The monetized recreational benefits were estimated only for fishing by recreational anglers, although there are other categories of recreational and other use benefits that could not be monetized. An example of these additional benefits includes enhanced water-dependent recreation other than fishing. There are also nonmonetized benefits that are nonuse values, such as benefits to wildlife, threatened or endangered species, and biodiversity benefits.

Rather than attempt the difficult task of enumerating, quantifying, and monetizing these nonuse benefits, EPA calculated nonuse benefits as 50 percent of the use value for recreational fishing. This value of 50 percent is a reasonable approximation of the total nonuse value for a population compared to the total use value for that population. This approximation should be applied to the total use value for the affected population; in this case, all of the direct uses of the affected reaches (including fishing, hiking, and boating). However, since this approximation was only applied to recreational fishing benefits for recreational anglers, it does not take into account nonuse values for non-anglers or for the uses other than fishing by anglers. Therefore, EPA has estimated only a portion of the nonuse benefits for the proposed standards.

4.1.4 Estimation of Economic Productivity Benefits

The results of this analysis indicate the potential productivity benefits of the proposed regulation based on reduced sewage sludge contamination at POTWs receiving the discharges from indirect TEC facilities. Because no sludge contamination problems are projected at the 1 POTW receiving wastewater from 1 barge-chemical and petroleum facility, at the 11 POTWs receiving wastewater from 12 rail-chemical facilities, or at the 35 POTWs receiving wastewater from 40 truck-chemical facilities, no economic productivity benefits are projected.

4.2 <u>Pollutant Fate and Toxicity</u>

Human exposure, ecological exposure, and risk from environmental releases of toxic chemicals depend largely on toxic potency, inter-media partitioning, and chemical persistence. These factors are dependent on chemical-specific properties relating to toxicological effects on living organisms, physical state, hydrophobicity/lipophilicity, and reactivity, as well as the mechanism and media of release and site-specific environmental conditions. Based on available physical-chemical properties, and aquatic life and human health toxicity data for the 67 barge-chemical and petroleum pollutants of concern, 20 exhibit moderate to high toxicity to aquatic life; 33 are human systemic toxicants; 10 are classified as known or probable human carcinogens; 23 have drinking water values (21 with enforceable health-based MCLs, 1 with a secondary MCL for aesthetics or taste, and 1 with an action level for treatment); and 25 are designated by EPA as priority pollutants (Tables 49, 50, and

51). In terms of projected environmental partitioning among media, 27 of the pollutants are moderately to highly volatile (potentially causing risk to exposed populations via inhalation); 29 have a moderate to high potential to bioaccumulate in aquatic biota (potentially accumulating in the food chain and causing increased risk to higher trophic level organisms and to exposed human populations via fish and shellfish consumption); 24 are moderately to highly adsorptive to solids; and 18 are resistant to or slowly biodegraded.

Based on available physical-chemical properties, and aquatic life and human health toxicity data for the 106 rail-chemical pollutants of concern, 55 exhibit moderate to high toxicity to aquatic life; 62 are human systemic toxicants; 28 are classified as known or probable carcinogens; 22 have drinking water values (20 with enforceable health-based MCLs, 1 with a secondary MCL and 1 with an action level for treatment); and 23 are designated by EPA as priority pollutants (Tables 52, 53, and 54). In terms of projected environmental partitioning among media, 22 of the evaluated pollutants are moderately to highly volatile; 64 have a moderate to high potential to bioaccumulate in aquatic biota; 48 are moderately to highly adsorptive to solids; and 43 are resistant to or slowly biodegraded.

In addition, based on available physical-chemical properties, and aquatic life and human health toxicity data for the 86 truck-chemical pollutants of concern, 32 exhibit moderate to high toxicity to aquatic life; 52 are human systemic toxicants; 19 are classified as known or probable carcinogens; 29 have drinking water values (27 with enforceable health-based MCLs, 1 with a secondary MCL and 1 with an action level for treatment); and 25 are designated by EPA as priority pollutants (Tables 55, 56, and 57). In terms of projected environmental partitioning among media, 28 of the pollutants are moderately to highly volatile; 46 have a moderate to high potential to bioaccumulate in aquatic biota; 29 are moderately to highly adsorptive to solids; and 21 are resistant to or slowly biodegraded.

4.3 Documented Environmental Impacts

Literature abstracts, State 304(l) Short Lists, and State fishing advisories are reviewed and State and Regional environmental agencies are contacted for documented impacts due to discharges from TEC facilities. Five (5) POTWs receiving wastewater discharges from 1 rail-chemical and 4 truck-chemical facilities are identified by States as being point sources causing water quality problems and are included on their 304(l) Short List (Table 58). Section 304(l) of the Water Quality Act of 1987, which requires States to identify waterbodies 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 applicable water quality standards (numeric or narrative) to be achieved after technology-based requirements are met due entirely or substantially to point source discharges of Section 307(a) toxics. All POTWs listed currently report no problems with TEC wastewater discharges. Past and potential problems are reported by the POTWs for oil and grease, pH, TSS, surfactants, glycol ethers, pesticides and mercury. Several POTW contacts stated the need for a national effluent guidelines for the TEC industry. Current and past problems (violation of effluent limits, POTW pass-through interference problems, POTW sludge contamination, etc.) caused by direct and indirect discharges from all three subcategories of TEC facilities (barge-chemical and petroleum, rail-chemical, and truck-chemical) are also reported by State and Regional contacts in 7 regions. Pollutants causing the problems include BOD, cyanides, hydrocarbons, metals (copper, chromium, silver, zinc), oil and grease, pesticides, pH, phosphorus, styrene, surfactants, and TSS (See Appendix J for summary of information received from State and Regional environmental agencies). In addition, 1 barge-chemical and petroleum facility and 19 POTWs receiving wastewater discharges of 2 rail-chemical and 20 truck-chemical facilities are located on waterbodies with State-issued fish consumption advisories (Table 59). However, the vast majority of advisories are based on chemicals which are not pollutants of concern for the TEC industry.

Table 1. Evaluated Pollutants of Concern (60) Discharged from 6 Direct and 1 Indirect TEC Barge-Chemical and Petroleum Facilities

CAS Number	Pollutant
83329	ACENAPHTHENE
208968	ACENAPHTHYLENE
67641	ACETONE
107131	ACRYLONITRILE
7429905	ALUMINUM
7664417	AMMONIA AS NITROGEN
120127	ANTHRACENE
71432	BENZENE
243174	BENZOFLUORENE, 2,3-
65850	BENZOIC ACID
7440417	BERYLLIUM
92524	BIPHENYL
117817	BIS(2-ETHYLHEXYL) PHTHALATE
7440439	CADMIUM
67663	CHLOROFORM
7440473	CHROMIUM
7440508	COPPER
99876	CYMENE, P-
75990	DALAPON
124185	DECANE, N-
1576676	DIMETHYLPHENANTHRENE, 3,6-
117840	DI-N-OCTYL PHTHALATE
629970	DOCOSANE, N-
112403	DODECANE, N-
112958	EICOSANE, N-
100414	ETHYLBENZENE
86737	FLUORENE
16984488	FLUORIDE
630013	HEXACOSANE, N-
544763	HEXADECANE, N-
18540299	HEXAVALENT CHROMIUM
7439896	IRON
7439921	LEAD
7439965	MANGANESE
7439976	MERCURY
78933	METHYL ETHYL KETONE
108101	METHYL ISOBUTYL KETONE
75092	METHYLENE CHLORIDE
1730376	METHYLFLUORENE, 1-
91576	METHYLNAPHTHALENE, 2-
832699	METHYLPHENANTHRENE, 1-
7439987	MOLYBDENUM
91203	NAPHTHALENE
7440020	NICKEL
630024	OCTACOSANE, N-
593453	OCTADECANE, N-

Table 1. Evaluated Pollutants of Concern (60) Discharged from 6 Direct and 1 Indirect TEC Barge-Chemical and Petroleum Facilities

CAS Number	Pollutant
700129	PENTAMETHYLBENZENE
85018	PHENANTHRENE
108952	PHENOL
129000	PYRENE
100425	STYRENE
7440257	TANTALUM
646311	TETRACOSANE, N-
629594	TETRADECANE, N-
7440326	TITANIUM
108883	TOLUENE
108383	XYLENE, M-
136777612	XYLENE, O+P-
7440666	ZINC
7440677	ZIRCONIUM

Source: Engineering and Analysis Division (EAD), April/May 1997
Version 5.0/5.1 Loading File

Table 2. Summary of Pollutant Loadings for Evaluated Direct and Indirect TEC Facilities

	Loadings (Pounds-per-Year)*				Total
	Barge-Chemical and Petroleum		Rail-Chemical	Truck-Chemical	
	Direct Dischargers	Indirect Dischargers	Indirect Dischargers	Indirect Dischargers	
Current	84,653	14,565	13,580	128,932	241,730
Proposed BAT/Pretreatment	3,931	6,665	7,852	26,083	44,531
No. of Pollutants Evaluated	60	60	103	80	157
No. of Facilities Evaluated	6	1	12	40	59

* Loadings are representative of pollutants evaluated; conventional and nonconventional pollutants such as TSS, BOD_5, COD, TDS, TOC, oil and grease, and total petroleum hydrocarbons are not evaluated.

** The same pollutant may be discharged from a number of direct and indirect facilities; therefore, the total does not equal the sum of pollutants.

Table 3. Summary of Projected Criteria Excursions for TEC Direct Barge-Chemical and Petroleum Dischargers
(Sample Set)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	0	0	2	1	2
Pollutants (No.)	0	0	2 (2.1-53.7)	2 (1.4-4.8)	2
Total Excursions	**0**	**0**	**3**	**2**	
Proposed BAT					
Stream (No.)	0	0	1	0	1
Pollutants (No.)	0	0	2 (1.2-1.6)	0	2
Total Excursions	**0**	**0**	**2**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Number of streams evaluated = 6 (rivers), number of facilities = 6, and number of pollutants = 60.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 5.1 Loading File

Table 4. Summary of Pollutants Projected to Exceed Criteria for TEC Direct Barge-Chemical and Petroleum Dischargers
(Sample Set)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed BAT	Current	Proposed Bat	Current	Proposed Bat	Current	Proposed BAT
Acrylonitrile	0	0	0	0	1 (15.6)	1 (1.2)	1 (1.4)	0
Phenanthrene*	0	0	0	0	2 (2.1-53.7)	1 (1.6)	1 (4.8)	0

NOTE: Number of pollutants = 60.

* Evaluated for human health based on criteria for polynuclear aromatic hydrocarbons (PAHs) as a class.

Version 5.1 Loading File

Table 5. Summary of Projected Criteria Excursions for TEC Direct Barge-Chemical and Petroleum Dischargers (National Level)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	0	0	6	3	6
Pollutants (No.)	0	0	2 (2.1-53.7)	2 (1.4-4.8)	2
Total Excursions	**0**	**0**	**9**	**6**	
Proposed BAT					
Stream (No.)	0	0	3	0	3
Pollutants (No.)	0	0	2 (1.2-1.6)	0	2
Total Excursions	**0**	**0**	**6**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Total number of streams = 14 (rivers), total number of facilities = 14, and total number of pollutants = 60.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 5.1 Loading File

Table 6. Summary of Pollutants Projected to Exceed Criteria for TEC Direct Barge-Chemical and Petroleum Dischargers (National Level)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed BAT	Current	Proposed BAT	Current	Proposed BAT	Current	Proposed BAT
Acrylonitrile	0	0	0	0	3 (15.6)	3 (1.2)	3 (1.4)	0
Phenanthrene*	0	0	0	0	6 (2.1-53.7)	3 (1.6)	3 (4.8)	0

NOTE: Total number of pollutants = 60.

* Evaluated for human health based on criteria for polynuclear aromatic hydrocarbons (PAHs) as a class.

Version 5.1 Loading File

Table 7. Summary of Projected Criteria Excursions for TEC Indirect Barge-Chemical and Petroleum Dischargers
(Sample Set)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	0	0	0	0	0
Pollutants (No.)	0	0	0	0	0
Total Excursions	**0**	**0**	**0**	**0**	
Proposed Pretreatment					
Stream (No.)	0	0	0	0	0
Pollutants (No.)	0	0	0	0	0
Total Excursions	**0**	**0**	**0**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Number of streams evaluated = 1 (river), number of POTWs = 1, number of facilities = 1, and number of pollutants = 60.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 5.0 Loading File

Table 8. Summary of Projected POTW Inhibition and Sludge Contamination Problems from TEC Indirect Barge-Chemical and Petroleum Dischargers
(Sample Set)

	Biological Inhibition	Sludge Contamination	Total
Current			
POTWs (No.)	0	0	0
Pollutants (No.)	0	0	0
Total Problems	0	0	
Proposed Pretreatment			
POTWs (No.)	0	0	0
Pollutants (No.)	0	0	0
Total Problems	0	0	

NOTE: Number of POTWs = 1 and number of facilities = 1.

Version 5.0 Loading File

Table 9. Evaluated Pollutants of Concern (103) Discharged from 12 Indirect TEC Rail-Chemical Facilities.

CAS Number	Pollutant
94757	2,4-D
94826	2,4-DB (BUTOXON)
93765	2,4,5-T
93721	2,4,5-TP
72548	4,4'-DDD
72559	4,4'-DDE
50293	4,4'-DDT
30560191	ACEPHATE
15972608	ALACHLOR
319846	ALPHA-BHC
5103719	ALPHA-CHLORDANE
7429905	ALUMINUM
120127	ANTHRACENE
1912249	ATRAZINE
7440393	BARIUM
1861401	BENEFLURALIN
65850	BENZOIC ACID
319857	BETA-BHC
314409	BROMACIL
1689992	BROMOXYNIL OCTANOATE
23184669	BUTACHLOR
78933	BUTANONE, 2-
2425061	CAPTAFOL
133062	CAPTAN
86748	CARBAZOLE
786196	CARBOPHENOTHION
510156	CHLOROBENZILATE
2675776	CHLORONEB
7440473	CHROMIUM
61949766	CIS-PERMETHRIN
7440508	COPPER
106445	CRESOL, P-
1861321	DACTHAL (DCPA)
75990	DALAPON
319868	DELTA-BHC
2303164	DIALLATE
1918009	DICAMBA
117806	DICHLONE
120365	DICHLOROPROP
115322	DICOFOL
60571	DIELDRIN
88857	DINOSEB
78342	DIOXATHION
629970	DOCOSANE, N-
112403	DODECANE, N-
112958	N-EICOSANE

Table 9. Evaluated Pollutants of Concern (103) Discharged from 12 Indirect TEC Rail-Chemical Facilities

CAS Number	Pollutant
959988	ENDOSULFAN I
1031078	ENDOSULFAN SULFATE
72208	ENDRIN
7421934	ENDRIN ALDEHYDE
53494705	ENDRIN KETONE
55283686	ETHALFLURALIN
100414	ETHYLBENZENE
2593159	ETRADIAZOLE
60168889	FENARIMOL
206440	FLUORANTHENE
16984488	FLUORIDE
58899	GAMMA-BHC
5103742	GAMMA-CHLORDANE
1024573	HEPTACHLOR EPOXIDE
630013	HEXACOSANE, N-
544763	HEXADECANE, N-
465736	ISODRIN
33820530	ISOPROPALIN
94746	MCPA
7085190	MCPP
72435	METHOXYCHLOR
832699	METHYLPHENANTHRENE, 1-
21087649	METRIBUZIN
2385855	MIREX
91203	NAPHTHALENE
1836755	NITROFEN
630024	OCTACOSANE, N-
593453	OCTADECANE, N-
40487421	PENDAMETHALIN
82688	PENTACHLORONITROBENZENE (PCNB)
72560	PERTHANE
85018	PHENANTHRENE
108952	PHENOL
1918021	PICLORAM
1918167	PROPACHLOR
139402	PROPAZINE
129000	PYRENE
122349	SIMAZINE
8001501	STROBANE
100425	STYRENE
5902512	TERBACIL
5915413	TERBUTHYLAZINE
22248799	TETRACHLORVINPHOS
646311	TETRACOSANE, N-
629594	TETRADECANE, N-
7440326	TITANIUM

Table 9. Evaluated Pollutants of Concern (103) Discharged from 12 Indirect TEC Rail-Chemical Facilities

CAS Number	Pollutant
34643464	TOKUTHION
95807	TOLUENE, 2,4-DIAMINO-
638686	TRIACONTANE, N-
43121433	TRIADIMEFON
52686	TRICHLORFON
327980	TRICHLORONATE
1582098	TRIFLURALIN
512561	TRIMETHYLPHOSPHATE
108383	XYLENE, M-
136777612	XYLENE, O+P
7440666	ZINC

Source: Engineering and Analysis Division (EAD), February/May 1997
Version 4.0/5.0 Loading File

Table 10. Summary of Projected Criteria Excursions for TEC Indirect Rail-Chemical Dischargers
(Sample Set)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	1	2	5	2	5
Pollutants (No.)	1 (1.0)	4 (1.4-8.5)	3 (1.2 - 88.8)	1 (6.6-9.5)	7
Total Excursions	**1**	**5**	**9**	**2**	
Proposed Pretreatment					
Stream (No.)	0	1	5	0	5
Pollutants (No.)	0	3 (1.3-2.7)	1 (2.1-88.1)	0	4
Total Excursions	**0**	**3**	**5**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Number of streams evaluated = 11 (rivers), number of POTWs = 11, number of facilities = 12, and number of pollutants = 103.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 4.0/5.0 Loads

Table 11. Summary of Pollutants Projected to Exceed Criteria for TEC Indirect Rail-Chemical Dischargers (Sample Set)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment
Dieldrin	0	0	0	0	2 (6.6-9.5)	0	2 (6.6-9.5)	0
Mirex	0	0	1 (2.7)	1 (2.7)	0	0	0	0
Phenanthrene	0	0	0	0	2 (1.2-2.5)	0	0	0
Simazine	1 (1.0)	0	2 (1.4-8.5)	1 (1.3)	0	0	0	0
Strobane	0	0	1 (3.8)	0	0	0	0	0
Toluene, 2,4-Diamino	0	0	0	0	5 (2.1-88.8)	5 (2.1-88.1)	0	0
Trichlorfon	0	0	1 (3.4)	1 (1.8)	0		0	0

NOTE: Number of pollutants evaluated = 103

Version 4.0/5.0 Loading File

Table 12. Summary of Projected POTW Inhibition and Sludge Contamination Problems from TEC Indirect Rail-Chemical Dischargers
(Sample Set)

	Biological Inhibition	Sludge Contamination	Total
Current			
POTWs (No.)	6	0	6
Pollutants (No.)	4	0	4
Total Problems	**10**	**0**	
Proposed Pretreatment			
POTWs (No.)	4	0	4
Pollutants (No.)	4	0	4
Total Problems	**8**	0	

NOTE: Number of POTWs evaluated = 11, number of facilities = 12, and number of pollutants = 103.

Version 4.0/5.0 Loading File

Table 13. Summary of Pollutants Projected to Exceed Inhibition/Sludge Contamination Values for TEC Indirect Rail-Chemical Dischargers
(Sample Set)

	Biological Inhibition		Sludge Contamination	
	Current	Proposed Pretreatmnt	Current	Proposed Pretreatment
MCPA	1	1	0	0
MCPP	4	4	0	0
Simazine	4	2	0	0
Terbuthylazine	1	1	0	0

Note: Number of pollutants evaluated = 103.

Version 4.0/5.0 Loading File

Table 14. Summary of Projected Criteria Excursions for TEC Indirect Rail-Chemical Dischargers (National Level)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	6	8	16	8	16
Pollutants (No.)	1 (1.0)	4 (1.4-8.5)	3 (1.2 - 88.8)	1 (6.6-9.5)	7
Total Excursions	**6**	**26**	**32**	**8**	
Proposed Pretreatment					
Stream (No.)	0	6	16	0	16
Pollutants (No.)	0	3 (1.3-2.7)	1 (2.1-88.1)	0	4
Total Excursions	**0**	**17**	**16**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Total number of streams =37 (rivers), total number of POTWs =37, total number of facilities =38, and total number of pollutants = 103.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 4.0/5.0 Loading File

Table 15. Summary of Pollutants Projected to Exceed Criteria for TEC Indirect
Rail-Chemical Dischargers
(National Level)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment
Dieldrin	0	0	0	0	8 (6.6-9.5)	0	8 (6.6-9.5)	0
Mirex	0	0	6 (2.7)	6 (2.7)	0	0	0	0
Phenanthrene	0	0	0	0	8 (1.2-2.5)	0	0	0
Simazine	6 (1.0)	0	8 (1.4-8.5)	6 (1.3)	0	0	0	0
Strobane	0	0	6 (3.8)	0	0	0	0	0
Toluene, 2,4-Diamino	0	0	0	0	16 (2.1-88.8)	16 (2.1-88.1)	0	0
Trichlorfon	0	0	6 (3.4)	6 (1.8)	0	0	0	0

NOTE: Total number of pollutants = 103

* Due to rounding, total of proposed pretreatment pollutant excursions does not equal total excursions as presented in Table 14.

Version 4.0/5.0 Loading File

Table 16. Summary of Projected POTW Inhibition and Sludge Contamination Problems from TEC Indirect Rail-Chemical Dischargers (National Level)

	Biological Inhibition	Sludge Contamination	Total
<u>Current</u>			
POTWs (No.)	21	0	21
Pollutants (No.)	4	0	4
Total Problems	**42**	**0**	
<u>Proposed Pretreatment</u>			
POTWs (No.)	13	0	13
Pollutants (No.)	4	0	4
Total Problems	**34**	**0**	

NOTE: Total number of POTWs = 37, total number of facilities = 38, and total number of pollutants = 103.

Version 4.0/5.0 Loading File

Table 17. Summary of Pollutants Projected to Exceed Inhibition/Sludge Contamination Values for TEC Indirect Rail-Chemical Discharges (National Level)

	Biological Inhibition		Sludge Contamination	
	Current	Proposed Pretreatment	Current	Proposed Pretreatment
MCPA	6	6	0	0
MCPP	13	13	0	0
Simazine	17	9	0	0
Terbuthylazine	6	6	0	0

Note: Total number of pollutants = 103.

Version 4.0/5.0 Loading File

Table 18. Evaluated Pollutants of Concern (80) Discharged from 40 Indirect TEC Truck-Chemical Facilities

CAS Number	Pollutant
94757	2,4-D
94826	2,4-DB (BUTOXON)
93765	2,4,5-T
93721	2,4,5-TP
50293	4,4'-DDT
98555	ALPHA-TERPINEOL
7429905	ALUMINUM
2642719	AZINPHOS ETHYL
86500	AZINPHOS METHYL
71432	BENZENE
65850	BENZOIC ACID
100516	BENZYL ALCOHOL
319857	BETA-BHC
117817	BIS(2-ETHYLHEXYL) PHTHALATE
7440428	BORON
78933	BUTANONE, 2- (METHYL ETHYL KETONE)
510156	CHLOROBENZILATE
67663	CHLOROFORM
95578	CHLOROPHENOL, 2-
7440473	CHROMIUM
7440508	COPPER
56724	COUMAPHOS
95487	CRESOL, O-
106445	CRESOL, P-
57125	CYANIDE (TOTAL)
99876	CYMENE, P-
75990	DALAPON
124185	DECANE, N-
2303164	DIALLATE
97176	DICHLOFENTHION
95501	DICHLOROBENZENE, 1,2-
107062	DICHLOROETHANE, 1,2-
60571	DIELDRIN
117840	DI-N-OCTYL PHTHALATE
88857	DINOSEB
298044	DISULFOTON
629970	DOCOSANE, N-
112403	DODECANE, N-
112958	EICOSANE, N-
33213659	ENDOSULFAN II
1031078	ENDOSULFAN SULFATE
2104645	EPN
100414	ETHYLBENZENE
16984488	FLUORIDE
58899	GAMMA-BHC

Table 18. Evaluated Pollutants of Concern (80) Discharged from 40 Indirect TEC Truck-Chemical Facilities

CAS Number	Pollutant
5103742	GAMMA-CHLORDANE
630013	HEXACOSANE, N-
544763	HEXADECANE, N-
2027170	ISOPROPYLNAPHTHALENE, 2-
21609905	LEPTOPHOS
7439965	MANGANESE
94746	MCPA
7085190	MCPP
7439976	MERCURY
150505	MERPHOS
108101	METHYL-2-PENTANONE, 4- (METHYL ISOBUTYL KETONE
75092	METHYLENE CHLORIDE
91576	METHYLNAPHTHALENE, 2-
91203	NAPHTHALENE
1836755	NITROFEN
593453	OCTADECANE, N-
82688	PENTACHLORONITROBENZENE (PCNB)
1918021	PICLORAM
67641	PROPANONE, 2- (ACETONE)
122349	SIMAZINE
100425	STYRENE
5915413	TERBUTHYLAZINE
127184	TETRACHLOROETHENE
22248799	TETRACHLORVINPHOS
646311	TETRACOSANE, N-
629594	TETRADECANE, N-
7440315	TIN
7440326	TITANIUM
108883	TOLUENE
638686	TRIACONTANE, N-
71556	TRICHLOROETHANE, 1,1,1-
79016	TRICHLOROETHENE
108383	XYLENE, M-
136777612	XYLENE, O+P-
7440666	ZINC

Source: Engineering and Analysis Division (EAD), March 1997
Version 5.1 Loading File

Table 19. Summary of Projected Criteria Excursions for TEC Indirect Truck-Chemical Dischargers
(Sample Set)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	0	8	2	2	8
Pollutants (No.)	0	1 (1.0 - 14.4)	1 (1.2 - 1.3)	1 (1.2 - 1.3)	2
Total Excursions	**0**	**8**	**2**	**2**	
Proposed Pretreatment					
Stream (No.)	0	6	0	0	6
Pollutants (No.)	0	1 (1.0 - 3.0)	0	0	1
Total Excursions	**0**	**6**	**0**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Number of streams evaluated = 35 (29 rivers, 6 estuaries), number of POTWs = 35, number of facilities = 40, and number of pollutants = 80.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 5.1 Loading File

Table 20. Summary of Pollutants Projected to Exceed Criteria for TEC Indirect Truck-Chemical Dischargers (Sample Set)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment
Coumaphos	0	0	8 (1.0-14.4)	6 (1.0-3.0)	0	0	0	0
Dieldrin	0	0	0	0	2 (1.2-1.3)	0	2 (1.2-1.3)	0

NOTE: Number of pollutants = 80.

Version 5.1 Loading File

Table 21. Summary of Projected POTW Inhibition and Sludge Contamination Problems from TEC Indirect Truck-Chemical Dischargers (Sample Set)

	Biological Inhibition	Sludge Contamination	Total
Current			
POTWs (No.)	0	0	0
Pollutants (No.)	0	0	0
Total Problems	**0**	**0**	
Proposed Pretreatment			
POTWs (No.)	0	0	0
Pollutants (No.)	0	0	0
Total Problems	**0**	**0**	

NOTE: Number of POTWs evaluated = 35 and number of facilities = 40.

Version 5.1 Loading File

Table 22. Summary of Projected Criteria Excursions for TEC Indirect Truck-Chemical Dischargers
(National level)

	Acute Aquatic Life	Chronic Aquatic Life	Human Health Water and Orgs.	Human Health Orgs. Only	Total*
Current					
Stream (No.)	0	49	14	14	49
Pollutants (No.)	0	1 (1.0 - 14.4)	1 (1.2 - 1.3)	1 (1.2 - 1.3)	2
Total Excursions	**0**	**49**	**14**	**14**	
Proposed Pretreatment					
Stream (No.)	0	37	0	0	37
Pollutants (No.)	0	1 (1.0 - 3.0)	0	0	1
Total Excursions	**0**	**37**	**0**	**0**	

NOTE: Number in parentheses represents magnitude of excursions.
Total number of streams = 264, total number of POTWs = 264, total number of facilities = 288, and total number of pollutants = 80.

* Pollutants may exceed criteria on a number of streams; therefore, total does not equal sum of pollutants exceeding criteria.

Version 5.1 Loading File

Table 23. Summary of Pollutants Projected to Exceed Criteria for TEC Indirect Truck-Chemical Dischargers (National Level)

	Number of Excursions							
	Acute Aquatic Life		Chronic Aquatic Life		Human Health Water and Orgs.		Human Health Orgs. Only	
	Current	Proposed Pretreatment	Current*	Proposed Pretreatment	Current	Proposed Pretreatment	Current	Proposed Pretreatment
Coumaphos	0	0	49 (1.0-14.4)	37 (1.0-3.0)	0	0	0	0
Dieldrin	0	0	0	0	14 (1.2-1.3)	0	14 (1.2-1.3)	0

NOTE: Total number of pollutants = 80.

* Due to rounding, total of current pollutant excursions does not equal total excursions as presented in Table 22.

Version 5.1 Loading File

Table 24. Summary of Potential Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers (Fish Tissue Consumption) (Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	1/1	NA/NA
Carcinogens (No.)*	1	NA
General Population	1 (1.4E-6)	1.6E-4
Sport Anglers	1 (3.5E-6)	1.6E-4
Subsistence Anglers	1 (3.0E-5)	7.1E-5
TOTAL		**3.9E-4**
Proposed BAT		
Stream (No.)/Facilities (No.)	1/1	NA/NA
Carcinogens (No.)*	1	NA
General Population	0	NA
Sport Anglers	0	NA
Subsistence Anglers	1 (2.3E-6)	5.6E-6
TOTAL		**5.6E-6**

NOTE: Number of streams evaluated = 6, number of facilities = 6, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
NA = Not Applicable
*Acrylonitrile

Version 5.1 Loading File

Table 25. Summary of Potential Systemic Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers
(Fish Tissue and Drinking Water Consumption)
(Sample Set)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0
Proposed BAT		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0

NOTE: Number of streams evaluated = 6, number of facilities = 6, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

Version 5.1 Loading File

Table 26. Summary of Potential Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers
(Drinking Water Consumption)
(Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
<u>Current</u>		
Stream (No.)	1	NA
Carcinogens (No.)*	1 (1.4E-5)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		NA
<u>Proposed BAT</u>		
Stream (No.)	1	NA
Carcinogens (No.)*	1 (1.1E-6)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		NA

NOTE: Number of streams evaluated = 6, number of facilities = 6, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
NA = Not Applicable
* Acrylonitrile

Version 5.1 Loading File

Table 27. Summary of Potential Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers (Fish Tissue Consumption) (National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	3/3	NA/NA
Carcinogens (No.)*	1	NA
General Population	3 (1.4E-6)	4.6E-4
Sport Anglers	3 (3.5E-6)	4.6E-4
Subsistence Anglers	3 (3.0E-5)	2.1E-4
TOTAL		**1.1E-3**
Proposed BAT		
Stream (No.)/Facilities (No.)	3/3	NA/NA
Carcinogens (No.)*	1	NA
General Population	0	NA
Sport Anglers	0	NA
Subsistence Anglers	3 (2.3E-6)	1.6E-5
TOTAL		**1.6E-5**

NOTE: Total number of streams = 14, total number of facililites = 14, and total number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
NA = Not Applicable

*Acrylonitrile

Version 5.1 Loading File

Table 28. Summary of Potential Systemic Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers
(Fish Tissue and Drinking Water Consumption)
(National Level)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0
Proposed BAT		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0

NOTE: Total number of streams = 14, total number of facilities = 14, and total number of pollutants = 60. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

Version 5.1 Loading File

Table 29. Summary of Potential Human Health Impacts for TEC Direct Barge-Chemical and Petroleum Dischargers
(Drinking Water Consumption)
(National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)	3	NA
Carcinogens (No.)*	1 (1.4E-5)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		NA
Proposed BAT		
Stream (No.)	3	NA
Carcinogens (No.)*	1 (1.1E-6)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		NA

NOTE: Total number of streams = 14, total number of facilities = 14, and total number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
NA = Not Applicable

* Acrylonitrile

Version 5.1 Loading File

Table 30. Summary of Potential Human Health Impacts for TEC Indirect Barge-Chemical and Petroleum Dischargers
(Fish Tissue Consumption)
(Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	0/0	NA/NA
Carcinogens (No.)	0	NA
General Population	0	NA
Sport Fishermen	0	NA
Subsistence Fishermen	0	NA
TOTAL		NA
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	0/0	NA/NA
Carcinogens (No.)	0	NA
General Population	0	NA
Sport Fishermen	0	NA
Subsistence Fishermen	0	NA
TOTAL		NA

NOTE: Number of streams evaluated = 1, number of POTWs = 1, number of facilities = 1, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6).
NA = Not Applicable

Version 5.0 Loading File

Table 31. Summary of Potential Systemic Human Health Impacts for TEC Indirect Barge-Chemical and Petroleum Dischargers
(Fish Tissue and Drinking Water Consumption)
(Sample Set)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Fishermen	0	0
Subsistence Fishermen	0	0
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Fishermen	0	0
Subsistence Fishermen	0	0

NOTE: Number of streams evaluated = 1, number of POTWs = 1, number of facilities = 1, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

Version 5.0 Loading File

Table 32. Summary of Potential Human Health Impacts for TEC Indirect Barge-Chemical and Petroleum Dischargers
(Drinking Water Consumption)
(Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)	0	NA
Carcinogens (No.)	0	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		**NA**
Proposed Pretreatment		
Stream (No.)	0	NA
Carcinogens (No.)	0	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
TOTAL		**NA**

NOTE: Number of streams evaluated = 1, number of POTWs = 1, number of facilities = 1, and number of pollutants = 60. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6).
NA = Not Applicable

Version 5.0 Loading File

Table 33. Summary of Potential Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (Fish Tissue Consumption) (Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	7/8	NA/NA
Carcinogens (No.)	13*	NA
General Population	2 (8.1E-6 to 1.2E-5)	2.5E-3
Sport Anglers	2 (2.1E-5 to 3.1E-5)	2.7E-3
Subsistence Anglers	7 (1.0E-6 to 2.6E-4)	1.3E-3
TOTAL		**6.5E-3**
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	5/6	NA/NA
Carcinogens (No.)	12	NA
General Population	2 (1.4E-6 to 1.9E-6)	4.1E-4
Sport Anglers	2 (3.4E-6 to 4.9E-6)	4.5E-4
Subsistence Anglers	5 (1.4E-6 to 4.1E-5)	2.3E-4
TOTAL		**1.1E-3**

NOTE: Number of streams evaluated = 11, number of POTWs = 11, number of facilities = 12, and number of pollutants = 103.
Table resents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
Primary contributors included in summary even if cancer risk did not exceed 10^{-6} (1E-6).
NA = Not Applicable

Version 4.0/5.0 Loading File

Table 34. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Rail-Chemical Dischargers
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current:			
Stream No. 1			
Beta-BHC	0/NA	0/NA	1.2E-8/2.5E-8
Dicofol	0/NA	0/NA	4.9E-8/1.1E-7
Dieldrin	0/NA	0/NA	8.2E-7/1.8E-6
Heptachlor Epoxide	0/NA	0/NA	4.5E-8/9.9E-8
Simazine	0/NA	0/NA	4.7E-8/1.0E-7
Toluene, 2,4-Diamino	0/NA	0/NA	1.8E-8/4.0E-8
Stream No. 2			
Atrazine	0/NA	0/NA	7.9E-8/3.4E-7
Chlorobenzilate	0/NA	0/NA	5.6E-8/2.4E-7
Dicofol	0/NA	0/NA	1.5E-6/6.4E-6
Dieldrin	0/NA	0/NA	1.0E-6/4.4E-6
Gamma-Chlordane	0/NA	0/NA	7.2E-8/3.1E-7
Heptachlor Epoxide	0/NA	0/NA	1.4E-6/5.9E-6
Mirex	0/NA	0/NA	2.6E-7/1.1E-6
Simazine	0/NA	0/NA	5.2E-8/2.2E-7
Toluene, 2,4-Diamino	0/NA	0/NA	5.6E-7/2.4E-6
4,4'-DDD	0/NA	0/NA	1.2E-8/4.9E-8
4,4'-DDE	0/NA	0/NA	1.2E-7/5.3E-7
4,4'-DDT	0/NA	0/NA	1.9E-8/8.0E-8

Table 34. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current: (continued)			
Stream No. 3			
Beta-BHC	9.3E-8/1.2E-5	2.4E-7/1.6E-5	2.0E-6/7.1E-6
Dicofol	4.0E-7/5.3E-5	1.0E-6/6.9E-5	8.6E-6/3.0E-5
Dieldrin	6.6E-6/8.9E-4	1.7E-5/1.1E-3	1.4E-4/5.1E-4
Heptachlor Epoxide	3.7E-7/4.9E-5	9.4E-7/6.3E-5	7.9E-6/2.8E-5
Mirex	7.0E-8/9.3E-6	1.8E-7/1.2E-5	1.5E-6/5.3E-6
Simazine	3.8E-7/5.1E-5	9.7E-7/6.6E-5	8.2E-6/2.9E-5
Toluene, 2,4-Diamino	1.5E-7/2.0E-5	3.8E-7/2.6E-5	3.2E-6/1.1E-5
Stream No. 4			
Beta-BHC	0/NA	0/NA	1.4E-8/4.2E-9
Dicofol	0/NA	0/NA	6.2E-8/1.8E-8
Dieldrin	0/NA	0/NA	1.0E-6/3.0E-7
Haptachlor Epoxide	0/NA	0/NA	5.7E-8/1.7E-8
Mirex	0/NA	0/NA	1.1E-8/3.2E-9
Simazine	0/NA	0/NA	5.9E-8/1.7E-8
Toluene 2,4-Diamino	0/NA	0/NA	2.3E-8/6.8E-9
Stream No. 5			
Dicofol	0/NA	0/NA	4.2E-7/1.2E-6
Dieldrin	0/NA	0/NA	4.9E-7/1.4E-6
Heptachlor Epoxide	0/NA	0/NA	3.9E-7/1.1E-6
Toluene, 2,4-Diamino	0/NA	0/NA	1.6E-7/4.5E-7

Table 34. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current: (continued)			
Stream No. 6			
Beta-BHC	0/NA	0/NA	1.5E-7/3.6E-7
Dicofol	0/NA	0/NA	5.8E-7/1.4E-6
Dieldrin	0/NA	0/NA	4.1E-6/9.6E-6
Heptachlor Epoxide	0/NA	0/NA	4.9E-7/1.2E-6
Mirex	0/NA	0/NA	1.1E-7/2.7E-7
Simazine	0/NA	0/NA	4.3E-7/1.0E-6
Toluene, 2,4-Diamino	0/NA	0/NA	2.4E-7/5.7E-7
Stream No. 7			
Beta-BHC	1.9E-7/2.2E-5	4.9E-7/2.2E-5	4.1E-6/9.8E-6
Dicofol	6.3E-7/7.4E-5	1.6E-6/7.3E-5	1.4E-5/3.2E-5
Dieldrin	9.5E-6/1.1E-3	2.4E-5/1.1E-3	2.0E-4/4.8E-4
Heptachlor Epoxide	4.1E-7/4.8E-5	1.1E-6/4.8E-5	8.9E-6/2.1E-5
Mirex	1.4E-7/1.7E-5	3.7E-7/1.7E-5	3.1E-6/7.4E-6
Simazine	6.9E-7/8.0E-5	1.8E-6/7.9E-5	1.5E-5/3.5E-5
Toluene, 2,4-Diamino	3.1E-7/3.6E-5	7.8E-7/3.5E-5	6.6E-6/1.6E-5
4,4'-DDD	6.7E-8/7.9E-6	1.7E-7/7.8E-6	1.5E-6/3.4E-6
4,4'-DDE	6.8E-8/8.0E-6	1.7E-7/7.8E-6	1.5E-6/3.5E-6

Table 34. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Proposed Pretreatment:			
Stream No. 2			
Atrazine	0/NA	0/NA	7.9E-8/3.4E-7
Chlorobenzilate	0/NA	0/NA	5.6E-8/2.4E-7
Dicofol	0/NA	0/NA	1.5E-6/6.4E-6
Dieldrin	0/NA	0/NA	1.0E-6/4.4E-6
Gamma-Chlordane	0/NA	0/NA	7.2E-8/3.1E-7
Heptachlor Epoxide	0/NA	0/NA	1.4E-6/5.9E-6
Mirex	0/NA	0/NA	2.6E-7/1.1E-6
Simazine	0/NA	0/NA	5.2E-8/2.2E-7
Toluene, 2,4-Diamino	0/NA	0/NA	5.6E-7/2.4E-6
4,4'-DDD	0/NA	0/NA	1.1E-8/4.9E-8
4,4'-DDE	0/NA	0/NA	1.2E-7/5.3E-7
4,4'-DDT	0/NA	0/NA	1.9E-8/8.0E-8
Stream No. 3			
Dicofol	3.9E-7/5.3E-5	1.0E-6/6.8E-5	8.5E-6/3.0E-5
Dieldrin	3.7E-7/4.9E-5	9.4E-7/6.3E-5	7.9E-6/2.8E-5
Heptachlor Epoxide	3.7E-7/4.9E-5	9.3E-7/6.3E-5	7.9E-6/2.8E-5
Mirex	6.9E-8/9.3E-6	1.8E-7/1.2E-5	1.5E-6/5.3E-6
Toluene, 2,4-Diamino	1.5E-7/2.0E-5	3.8E-7/2.5E-5	3.2E-6/1.1E-5
Stream No. 5			
Dicofol	0/NA	0/NA	4.2E-7/1.2E-6
Dieldrin	0/NA	0/NA	4.9E-7/1.4E-6
Heptachlor Epoxide	0/NA	0/NA	3.9E-7/1.1E-6
Toluene, 2,4-Diamino	0/NA	0/NA	1.6E-7/4.5E-7

Table 34. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks > 10^{-6}/ Excess Annual Cancer Cases General Population	Cancer Risks > 10^{-6}/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks > 10^{-6}/ Excess Annual Cancer Cases Subsistence Fishermen
Proposed Pretreatment: (continued)			
Stream No. 6			
Dicofol	0/NA	0/NA	3.5E-7/8.4E-7
Dieldrin	0/NA	0/NA	4.5E-7/1.1E-6
Heptachlor Epoxide	0/NA	0/NA	2.3E-7/5.5E-7
Mirex	0/NA	0/NA	1.1E-7/2.7E-7
Toluene, 2,4-Diamino	0/NA	0/NA	2.4E-7/5.7E-7
Stream No. 7			
Dicofol	4.5E-7/5.2E-5	1.1E-6/5.2E-5	9.7E-6/2.3E-5
Dieldrin	5.7E-7/6.6E-5	1.5E-6/6.6E-5	1.2E-5/2.9E-5
Heptachlor Epoxide	2.9E-7/3.4E-5	7.5E-7/3.4E-5	6.3E-6/1.5E-5
Mirex	1.4E-7/1.7E-5	3.6E-7/1.6E-5	3.1E-6/7.3E-6
Simazine	1.0E-7/1.2E-5	2.6E-7/1.2E-5	2.2E-6/5.3E-6
Toluene, 2,4-Diamino	3.1E-7/3.6E-5	7.8E-7/3.5E-5	6.6E-6/1.6E-5
4,4'-DDE	6.8E-8/7.9E-6	1.7E-7/7.8E-6	1.5E-6/3.5E-6

NOTE: Number of streams evaluated = 11, number of POTWs = 11, number of facilities = 12, and number of pollutants = 103. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6). Primary contributors included in summary even if cancer risk did not exceed 10^{-6} (1E-6).
NA = Not Applicable

Version 4.0/5.0 Loading File

Table 35. Summary of Potential Systemic Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (Fish Tissue and Drinking Water Consumption) (Sample Set)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0

NOTE: Number of streams evaluated = 11, number of POTWs = 11, number of facilities = 12, and number of pollutants = 103. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

Version 4.0/5.0 Loading File

Table 36. Summary of Potential Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (Drinking Water Consumption) (Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)	5	NA
Carcinogens (No.)*	2 (2.1E-6 to 1.3E-4)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
Proposed Pretreatment		
Stream (No.)	5	NA
Carcinogens (No.)*	2 (2.1E-6 to 9.4E-5)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA

NOTE: Number of streams evaluated = 11, number of POTWs = 11, number of facilities = 12, and number of pollutants = 103. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).

NA = Not Applicable

* 2,4-Diaminotoluene, simazine; EPA has published a drinking water criterion for simazine and its assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds.

Version 4.0/5.0 Loading File

Table 37. Summary of Potential Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (Fish Tissue Consumption) (National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	24/25	NA/NA
Carcinogens (No.)	13	NA
General Population	8 (8.1E-6 to 1.2E-5)	1.1E-2
Sport Anglers	8 (2.1E-5 to 3.1E-5)	1.1E-2
Subsistence Anglers	24 (1.0E-6 to 2.6E-4)	5.2E-3
TOTAL		**2.7E-2**
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	16/17	NA/NA
Carcinogens (No.)	12	NA
General Population	8 (1.4E-6 to 1.9E-6)	1.7E-3
Sport Anglers	8 (3.4E-6 to 4.9E-6)	1.9E-3
Subsistence Anglers	16 (1.4E-6 to 4.1E-5)	9.0E-4
TOTAL		**4.5E-3**

NOTE: Total number of streams = 37, total number of POTWs = 37, total number of facilities = 38, and total number of pollutants = 103. Table resents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6). Primary contributors included in summary even if cancer risk did not exceed 10^{-6} (1E-6).
NA = Not Applicable

Version 4.0/5.0 Loading File

Table 38. Summary of Potential Systemic Human Health Impacts for TEC Indirect Rail-Chemical Dischargers
(Fish Tissue and Drinking Water Consumption)
(National Level)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	0/0	0/0
Pollutants (No.)	0	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	0	0

NOTE: Total number of streams = 37, total number of POTWs = 37, total number of facilities = 38, and total number of pollutants = 103. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

Version 4.0/5.0 Loading File

Table 39. Summary of Potential Human Health Impacts for TEC Indirect Rail-Chemical Dischargers (Drinking Water Consumption) (National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)	16	NA
Carcinogens (No.)*	2 (2.1E-6 to 1.3E-4)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA
Proposed Pretreatment		
Stream (No.)	16	NA
Carcinogens (No.)*	2 (2.1E-6 to 9.4E-5)	NA
With Drinking Water Utility ≤ 50 miles	0	NA
Carcinogens (No.)	0	NA

NOTE: Total number of streams = 37, total number of POTWs = 37, total number of facilities = 38, and total number of pollutants = 103. Table presents results for those streams/facilities for which the projected excess cancer risk for any pollutant exceeds 10^{-6} (1E-6).
NA = Not Applicable

* 2,4-Diaminotoluene, simazine; EPA has published a drinking water criterion for simazine and its assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds.

Version 4.0/5.0 Loading File

Table 40. Summary of Potential Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (Fish Tissue Consumption) (Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	12/13	NA/NA
Carcinogens (No.)	5	NA
General Population	2 (1.7E-6 to 1.8E-6)	4.2E-4
Sport Anglers	2 (4.3E-6 to 4.4E-6)	7.3E-4
Subsistence Anglers	12 (1.2E-6 to 3.7E-5)	6.7E-4
TOTAL		**1.8E-3**
Proposed BAT		
Stream (No.)/Facilities (No.)	5/5	NA/NA
Carcinogens (No.)	4	NA
General Population	0	NA
Sport Anglers	0	NA
Subsistence Anglers	5 (1.9E-6 to 6.1E-6)	5.5E-5
TOTAL		**5.5E-5**

NOTE: Number of streams evaluated = 35, number of POTWs = 35, number of facilities = 40, and number of pollutants = 80. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6). Primary contributors included in summary even if cancer risk for a pollutant did not exceed 10^{-6} (1E-6).
NA = Not Applicable

Version 5.1 Loading File

Table 41. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Truck-Chemical Dischargers
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current:			
Stream No 1			
Chlorobenzilate	0/NA	0/NA	2.0E-7/9.7E-7
Dieldrin	0/NA	0/NA	2.0E-6/9.6E-6
Gamma-Chlordane	0/NA	0/NA	1.5E-7/7.5E-7
PCNB	0/NA	0/NA	1.7E-7/8.6E-7
4,4'-DDT	0/NA	0/NA	2.2E-7/1.1E-6
Stream No 2			
Chlorobenzilate	1.3E-7/2.1E-5	3.2E-7/3.0E-5	2.7E-6/1.3E-5
Dieldrin	1.3E-6/2.1E-4	3.2E-6/3.0E-4	2.7E-5/1.3E-4
Gamma-Chlordane	9.7E-8/1.6E-5	2.5E-7/2.3E-5	2.1E-6/1.0E-5
PCNB	1.1E-7/1.9E-5	2.8E-7/2.7E-5	2.4E-6/1.2E-5
4,4'-DDT	1.4E-7/2.3E-5	3.5E-7/3.3E-5	3.0E-6/1.5E-5
Stream No 3			
Chlorobenzilate	0/NA	0/NA	3.8E-7/1.3E-6
Dieldrin	0/NA	0/NA	3.7E-6/1.3E-5
Gamma-Chlordane	0/NA	0/NA	2.8E-7/9.9E-7
4,4'-DDT	0/NA	0/NA	4.4E-7/1.6E-6
Stream No 4			
Chlorobenzilate	0/NA	0/NA	8.5E-8/3.0E-7
Dieldrin	0/NA	0/NA	8.5E-7/3.0E-6
Gamma-Chlordane	0/NA	0/NA	6.6E-8/2.3E-7
PCNB	0/NA	0/NA	7.5E-8/2.7E-7
4,4'-DDT	0/NA	0/NA	9.3E-8/3.3E-7

Table 41. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $> 10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current: (continued)			
Stream No 5			
Chlorobenzilate	0/NA	0/NA	4.7E-7/6.5E-7
Dieldrin	0/NA	0/NA	4.6E-6/6.4E-6
Gamma-Chlordane	0/NA	0/NA	3.6E-7/4.9E-7
PCNB	0/NA	0/NA	3.0E-7/4.2E-7
4,4'-DDT	0/NA	0/NA	5.2E-7/7.2E-7
Stream No 6			
Chlorobenzilate	0/NA	0/NA	3.9E-7/3.0E-6
Dieldrin	0/NA	0/NA	3.9E-6/3.0E-5
Gamma-Chlordane	0/NA	0/NA	3.1E-7/2.3E-6
PCNB	0/NA	0/NA	3.5E-7/2.7E-6
4,4'-DDT	0/NA	0/NA	4.3E-7/3.3E-6
Stream No. 7			
Chlorobenzilate	0/NA	0/NA	1.8E-7/8.4E-7
Dieldrin	0/NA	0/NA	1.8E-6/8.4E-6
Gamma-Chlordane	0/NA	0/NA	1.4E-7/6.5E-7
PCNB	0/NA	0/NA	1.6E-7/7.5E-7
4,4'-DDT	0/NA	0/NA	2.0E-7/9.2E-7
Stream No. 8			
Chlorobenzilate	0/NA	0/NA	1.1E-7/4.5E-7
Dieldrin	0/NA	0/NA	1.1E-6/4.5E-6
Gamma-Chlordane	0/NA	0/NA	8.4E-8/3.5E-7
PCNB	0/NA	0/NA	9.6E-8/4.0E-7
4,4'-DDT	0/NA	0/NA	1.2E-7/5.0E-7

Table 41. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Current: (Continued)			
Stream No. 9			
Chlorobenzilate	1.2E-7/9.3E-6	3.1E-7/2.3E-5	2.6E-6/1.0E-5
Dieldrin	1.2E-6/9.3E-5	3.1E-6/2.3E-4	2.6E-5/1.0E-4
Gamma-Chlordane	9.4E-8/7.2E-6	2.4E-7/1.8E-5	2.0E-6/7.8E-6
PCNB	1.1E-7/8.3E-6	2.7E-7/2.0E-5	2.3E-6/9.0E-6
4,4'-DDT	1.3E-7/1.0E-5	3.4E-7/2.5E-5	2.8E-6/1.1E-5
Stream No. 10			
Chlorobenzilate	0/NA	0/NA	5.0E-7/1.2E-6
Dieldrin	0/NA	0/NA	4.9E-6/1.2E-5
Gamma-Chlordane	0/NA	0/NA	3.7E-7/8.7E-7
4,4'-DDT	0/NA	0/NA	5.8E-7/1.4E-6
Stream No. 11			
Chlorobenzilate	0/NA	0/NA	1.6E-7/3.1E-7
Dieldrin	0/NA	0/NA	1.6E-6/3.1E-6
Gamma-Chlordane	0/NA	0/NA	1.3E-7/2.5E-7
PCNB	0/NA	0/NA	1.5E-7/2.9E-7
4,4'-DDT	0/NA	0/NA	1.8E-7/3.5E-7
Stream No. 12			
Chlorobenzilate	0/NA	0/NA	4.5E-7/1.7E-5
Dieldrin	0/NA	0/NA	4.5E-6/1.7E-4
Gamma-Chlordane	0/NA	0/NA	3.5E-7/1.3E-5
PCNB	0/NA	/NA	4.0E-7/1.5E-5
4,4'-DDT	0/NA	0/NA	4.9E-7/1.8E-5

Table 41. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Proposed Pretreatment:			
Stream No 2			
Chlorobenzilate	0/NA	0/NA	1.4E-7/6.6E-7
Dieldrin	0/NA	0/NA	1.5E-6/7.2E-6
Gamma-Chlordane	0/NA	0/NA	1.1E-7/5.4E-7
4,4'-DDT	0/NA	0/NA	1.7E-7/8.6E-7
Stream No. 3			
Chlorobenzilate	0/NA	0/NA	3.2E-7/1.1E-6
Dieldrin	0/NA	0/NA	3.5E-6/1.2E-5
Gamma-Chlordane	0/NA	0/NA	2.6E-7/9.3E-7
4,4'-DDT	0/NA	0/NA	4.1E-7/1.5E-6
Stream No. 5			
Chlorobenzilate	0/NA	0/NA	1.7E-7/2.3E-7
Dieldrin	0/NA	0/NA	1.8E-6/2.5E-6
Gamma-Chlordane	0/NA	0/NA	1.4E-7/1.9E-7
4,4'-DDT	0/NA	0/NA	2.2E-7/3.0E-7
Stream No. 9			
Chlorobenzilate	0/NA	0/NA	2.5E-7/9.6E-7
Dieldrin	0/NA	0/NA	2.7E-6/1.0E-5
Gamma-Chlordane	0/NA	0/NA	2.0E-7/7.8E-7
4,4'-DDT	0/NA	0/NA	3.2E-7/1.2E-6

Table 41. Summary of Pollutants Projected to Cause Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (continued)
(Fish Tissue Consumption)
(Sample Set)

	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases General Population	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Sport Fishermen	Cancer Risks $>10^{-6}$/ Excess Annual Cancer Cases Subsistence Fishermen
Proposed Pretreatment: (Continued)			
<u>Stream No. 10</u>			
Chlorobenzilate	0/NA	0/NA	4.4E-7/1.0E-6
Dieldrin	0/NA	0/NA	4.7E-6/1.1E-5
Gamma-Chlordane	0/NA	0/NA	3.6E-7/8.5E-7
4,4'-DDT	0/NA	0/NA	5.7E-7/1.3E-6

NOTE: Number of streams evaluated = 35, number of POTWs = 35, number of faciities = 40, and number of pollutants = 80.
Table presents results for those streams/facilities for which the projected excess cancer risks is greater than 10^{-6} (1E-6). Primary contributers included in summary even if cancer risk did not exceed 10^{-6} (1E-6).
NA = Not Applicable.

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Table 42. Summary of Potential Systemic Human Health Impacts for TEC Indirect Truck-Chemical Dischargers
(Fish Tissue and Drinking Water Consumption)
(Sample Set)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	7/8	0/0
Pollutants (No.)	1*	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	7 (1.0-6.5)	0
Affected Population	4,284	
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	3/3	0/0
Pollutants (No.)	1*	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	3 (1.1-2.0)	0
Affected Population	687	

NOTE: Number of streams evaluated = 35, number of POTWs = 35, number of facilities = 40, and number of pollutants = 80. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

* EPN/Santox

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Table 43. Summary of Potential Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (Drinking Water Consumption) (Sample Set)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
<u>Current</u>		
Stream (No.)	2	N/A
Carcinogens (No.)	6* (3.2E-8 to 6.4E-7)	N/A
With Drinking Water Utility ≤ 50 miles	1	N/A
Carcinogens (No.)	6** (3.3E-8 to 6.4E-7)	N/A
TOTAL		N/A
<u>Proposed Pretreatment</u>		
Stream (No.)	0	N/A
Carcinogens (No.)	0	N/A
With Drinking Water Utility ≤ 50 miles	0	N/A
Carcinogens (No.)	0	N/A
TOTAL		N/A

NOTE: Number of streams evaluated = 35, number of POTWs = 35, number of facilities = 40, and number of pollutants = 80. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6). Primary contributors included in summary even if risk for a pollutant did not exceed 10^{-6} (1E-6).

NA = Not Applicable

* Bis(2-ethylhexyl) phthalate, methylene chloride, PCNB, simazine, tetrachloroethene, 1,2-dichloroethane

** EPA has published a drinking water criterion for 5 of the 6 carcinogens and it is assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds. The cancer risk for the remaining carcinogen (PCNB) is less than 10^{-6}.

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Table 44. Summary of Potential Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (Fish Tissue Consumption) (National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)/Facilities (No.)	76/77	NA/NA
Carcinogens (No.)	5	NA
General Population	14 (1.7E-6 to 1.8E-6)	3.0E-3
Sport Anglers	14 (4.3E-6 to 4.4E-6)	5.2E-3
Subsistence Anglers	76 (1.2E-6 to 3.7E-5)	3.4E-3
TOTAL		**1.2E-2**
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	30/30	NA/NA
Carcinogens (No.)	4	NA
General Population	0	NA
Sport Anglers	0	NA
Subsistence Anglers	30 (1.9E-6 to 6.1E-6)	3.1E-4
TOTAL		**3.1E-4**

NOTE: Total number of streams = 264, total number of POTWs = 264, total number of facilities = 288, and total number of pollutants = 80. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6). Primary contributors included in summary even if cancer risk for a pollutant did not exceed 10^{-6} (1E-6).
NA = Not Applicable

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Table 45. Summary of Potential Systemic Human Health Impacts for TEC Indirect Truck-Chemical Dischargers
(Fish Tissue and Drinking Water Consumption)
(National Level)

	Fish Tissue Hazard Indices > 1	Drinking Water Hazard Indices > 1
Current		
Stream (No.)/Facilities (No.)	39/40	0/0
Pollutants (No.)	1*	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	39 (1.0-6.5)	0
Affected Population	14,173	
Proposed Pretreatment		
Stream (No.)/Facilities (No.)	16/16	0/0
Pollutants (No.)	1*	0
General Population	0	0
Sport Anglers	0	0
Subsistence Anglers	16 (1.1-2.0)	0
Affected Population	3,492	

NOTE: Total number of streams = 264, total number of POTWs = 264, total number of facilities = 288, and total number of pollutants = 80. Table presents results for those streams/facilities for which the projected hazard index for any pollutant exceeds 1.0.

* EPN/Santox

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Table 46: Summary of Potential Human Health Impacts for TEC Indirect Truck-Chemical Dischargers (Drinking Water Consumption) (National Level)

	Total Individual Cancer Risks > 10^{-6}	Total Excess Annual Cancer Cases
Current		
Stream (No.)	14	N/A
Carcinogens (No.)	6* (3.2E-8 to 6.4E-7)	N/A
With Drinking Water Utility ≤ 50 miles	7	N/A
Carcinogens (No.)	6** (3.3E-8 to 6.4E-7)	N/A
TOTAL		N/A
Proposed Pretreatment		
Stream (No.)	0	N/A
Carcinogens (No.)	0	N/A
With Drinking Water Utility ≤ 50 miles	0	N/A
Carcinogens (No.)	0	N/A
TOTAL		**N/A**

NOTE: Total number of streams = 264, total number of POTWs = 264, total number of facilities = 288, and total number of pollutants = 80. Table presents results for those streams/facilities for which the projected excess cancer risk exceeds 10^{-6} (1E-6). Primary contributors included in summary even if risk for a pollutant did not exceed 10^{-6} (1E-6).
NA = Not Applicable

* Bis(2-ethylhexyl) phthalate, methylene chloride, PCNB, simazine, tetrachloroethene, 1,2-dichloroethane

** EPA has published a drinking water criterion for 5 of the 6 carcinogens and it is assumed that drinking water treatment systems will reduce concentrations to below adverse effect thresholds. The cancer risk for the remaining carcinogen (PCNB) is less than 10^{-6}.

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Table 47. Summary of Ecological (Recreational and Nonuse) Benefits for TEC Direct Barge-Chemical and Petroleum Dischargers (Sample Set and National Level)

Data	Number of Stream Segments with Concentrations Exceeding AWQC Eliminated	Total Fishing Days	Baseline Value of Fisheries ($ 1994)	Increased Value of Fisheries ($ 1994)
Sample Set	1	16,616	$490,000 - $620,000	$54,400 - $194,000
National Level	3	48,137	$1,419,000 - 1,796,473	$157,000 - $562,000

NOTE: Value per person day of recreational fishing = $29.47 (warm water) and $37.32 (cold water).

Increase value of contaminant-free fishing = 11.1 to 31.3 percent.

Data	Number of Stream Segments with Concentrations Exceeding AWQC Eliminated	Increased Nonuse Value ($ 1994)
Sample Set	1	$27,200 - $97,000
National Level	3	$78,500 - $281,000

NOTE: Nonuse value estimated as one-half of the recreational benefits.

Table 48. Summary of Ecological (Recreational and Nonuse) Benefits for TEC Indirect Truck-Chemical Dischargers (Sample Set and National Level)

Data	Number of Stream Segments with Concentrations Exceeding AWQC Eliminated	Total Fishing Days	Baseline Value of Fisheries ($ 1994)	Increased Value of Fisheries ($ 1994)
Sample Set	2	75,815	$2,234,261 - $2,829,407	$248,000 - $886,000
National Level	12	456,656	$13,458,000 - 17,042,000	$1,494,000 - $5,334,000

NOTE: Value per person day of recreational fishing = $29.47 (warm water) and $37.32 (cold water).

Increase value of contaminant-free fishing = 11.1 to 31.3 percent.

Data	Number of Stream Segments with Concentrations Exceeding AWQC Eliminated	Increased Nonuse Value ($ 1994)
Sample Set	2	$124,000 - $443,000
National Level	12	$747,000 - $2,667,000

NOTE: Nonuse value estimated as one-half of the recreational benefits.

Table 49. Potential Fate and Toxicity of Pollutants of Concern (Barge-Chemical and Petroleum)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
1	1-Methylfluorene	1730376	Moderate	Moderate	High	High	Unknown				
2	1-Methylphenanthrene	832699	Moderate	Slight	High	High	Unknown				
3	2-Methylnaphthalene	91576	Moderate	Moderate	Moderate	High	Slow				
4	2,3-Benzofluorene	243174	Moderate	Moderate	High	High	Unknown				
5	3,6-Dimethylphenanthrene	1576676	Moderate	Slight	High	High	Unknown				
6	Acenaphthene	83329	Unknown	Moderate	Moderate	Moderate	Slow		X		X
7	Acenaphthylene	208968	Slight	High	Moderate	Moderate	Slow				X
8	Acetone	67641	Slight	Moderate	Slight	Nonbioaccumulative	Fast		X		
9	Acrylonitrile	107131	Slight	Moderate	Nonadsorptive	Slight	Moderate	X	X		X
10	Aluminum	7429905	Moderate	Unknown	Unknown	Moderate	Unknown			M	
11	Ammonia as Nitrogen	7664417	Slight	Moderate	Nonadsorptive	Unknown	Moderate				
12	Anthracene	120127	High	Moderate	High	Moderate	Resistant		X		X
13	Benzene	71432	Slight	High	Slight	Slight	Moderate	X		M	X
14	Benzoic Acid	65850	Slight	Slight	Slight	Slight	Moderate		X		
15	Beryllium	7440417	Moderate	Unknown	Unknown	Slight	Unknown	X	X	M	X
16	Biphenyl	92524	Moderate	Moderate	Moderate	Moderate	Fast		X		
17	Bis(2-ethylhexyl) Phthalate	117817	Moderate	Moderate	High	Moderate	Moderate	X	X	M	X
18	BOD 5-Day (Carbonaceous)	C001	Unknown	Unknown	Unknown	Unknown	Unknown				
19	Cadmium	7440439	High	Unknown	Unknown	Moderate	Unknown	X	X	M	X
20	Chemical Oxygen Demand (COD)	C002	Unknown	Unknown	Unknown	Unknown	Unknown				
21	Chloroform	67663	Slight	High	Slight	Nonbioaccumulative	Slow	X	X	M	X
22	Chromium	7440473	Slight	Unknown	Unknown	Slight	Unknown		X	M	X
23	Copper	7440508	High	Unknown	Unknown	Moderate	Unknown			TT	X
24	Dalapon	75990	Slight	Slight	Slight	Nonbioaccumulative	Unknown		X	M	
25	Di-N-Octyl Phthalate	117840	Moderate	Slight	Moderate	High	Moderate		X		X
26	Ethylbenzene	100414	Slight	High	Slight	Slight	Moderate		X	M	X
27	Fluorene	86737	Moderate	Moderate	Moderate	Slight	Slow		X		X
28	Fluoride	16984488	Slight	Unknown	Unknown	Unknown	Unknown		X	M	
29	Hexavalent Chromium	18540299	High	Unknown	Unknown	Slight	Unknown	X	X	M	X
30	Iron	7439896	Unknown	Unknown	Unknown	Unknown	Unknown			M	
31	Lead	7439921	High	Unknown	Unknown	Slight	Unknown	X	X	M	X
32	Manganese	7439965	Unknown	Unknown	Unknown	Unknown	Unknown		X	M	
33	Mercury	7439976	High	High	High	High	Unknown		X	M	X
34	Methyl Ethyl Ketone	78933	Slight	Moderate	Nonadsorptive	Nonbioaccumulative	Fast		X		
35	Methyl Isobutyl Ketone	108101	Slight	Moderate	Slight	Nonbioaccumulative	Fast		X		
36	Methylene Chloride	75092	Slight	High	Slight	Nonbioaccumulative	Moderate	X	X	M	X
37	Molybdenum	7439987	Unknown	Unknown	Unknown	Unknown	Unknown		X		
38	m-Xylene	108383	Slight	High	Slight	Moderate	Moderate		X	M	
39	Naphthalene	91203	Slight	Moderate	Slight	Slight	Moderate		X		X
40	n-Decane	124185	Slight	Unknown	High	High	Unknown				
41	n-Docosane	629970	Slight	Unknown	Nonadsorptive	High	Unknown				
42	n-Dodecane	112403	Slight	Unknown	High	High	Unknown				

Table 49. Potential Fate and Toxicity of Pollutants of Concern (Barge-Chemical and Petroleum)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
43	n-Eicosane	112958	Slight	Unknown	High	High	Unknown				
44	n-Hexacosane	630013	Slight	Unknown	Unknown	Unknown	Unknown				
45	n-Hexadecane	544763	Slight	Unknown	High	High	Unknown				
46	Nickel	7440020	Slight	Unknown	Slight	Slight	Unknown				
47	n-Octacosane	630024	Slight	Unknown	Unknown	Unknown	Unknown		X	M	X
48	n-Octadecane	593453	Slight	Unknown	High	High	Unknown				
49	n-Tetracosane	646311	Slight	Unknown	High	High	Unknown				
50	n-Tetradecane	629594	Slight	Unknown	High	High	Unknown				
51	o+p Xylene*	136777612	Slight	High	Slight	Moderate	Moderate				
52	p-Cymene	99876	Slight	High	Moderate	High	Unknown		X	M	
53	Pentamethylbenzene	700129	Moderate	Moderate	Moderate	High	Unknown				
54	Phenanthrene	85018	High	Moderate	High	Moderate	Unknown				
55	Phenol	108952	Slight	Slight	Slight	Nonbioaccumulative	Resistant	X			X
56	Pyrene	129000	Slight	Slight	High	High	Fast		X		X
57	Styrene	100425	Slight	High	Slight	Slight	Resistant		X		X
58	Tantalum	7440257	Unknown	Unknown	Unknown	Unknown	Moderate		X	M	
59	Titanium	7440326	Unknown	Unknown	Unknown	Unknown	Unknown				
60	Toluene	108883	Slight	High	Slight	Slight	Unknown				
61	Total Dissolved Solids	C003	Unknown	Unknown	Unknown	Unknown	Moderate		X	M	X
62	Total Organic Carbon (TOC)	C004	Unknown	Unknown	Unknown	Unknown	Unknown				
63	Total Petroleum Hydrocarbons (TPH)	C005	Unknown	Unknown	Unknown	Unknown	Unknown				
64	Total Recoverable Oil and Grease	C006	Unknown	Unknown	Unknown	Unknown	Unknown				
65	Total Suspended Solids	C007	Unknown	Unknown	Unknown	Unknown	Unknown				
66	Zinc	7440666	Moderate	Unknown	Unknown	Slight	Unknown				
67	Zirconium	7440677	Unknown	Unknown	Unknown	Unknown	Unknown		X	SM	X

* - Values assumed for p-Xylene.

Note: M = Maximum Contaminant Level established for health-based effect.
SM = Secondary Maximum Contaminant Level (SMCL) established for taste or aesthetic effect.
TT = Treatment technology action level established.

Table 50. Toxicants Exhibiting Systemic and Other Adverse Effects* (Barge-Chemical and Petroleum)

	Cas Number	Toxicant	Reference Dose Target Organ and Effects
1	83329	Acenaphthene	Hepatotoxicity (Liver)
2	67641	Acetone	Increased liver and kidney weights and nephrotoxicity
3	107131	Acrylonitrile	Decreased sperm counts (Under review)
4	120127	Anthracene	No adverse effects observed**
5	65850	Benzoic Acid	No adverse effects observed**
6	7440417	Beryllium	No adverse effects observed**
7	92524	Biphenyl	Kidney damage
8	117817	Bis(2-ethylhexyl) Phthalate	Increased relative liver weight
9	7440439	Cadmium	Significant proteinuria
10	67663	Chloroform	Fatty cyst formation in liver
11	7440473	Chromium	No adverse effects observed**
12	75990	Dalapon	Increased kidney body weight ratio
13	117840	Di-N-Octyl Phthalate	Increased liver and kidney weight (Under review)
14	100414	Ethylbenzene	Liver and kidney toxicity
15	86737	Fluorene	Decreased erythrocyte counts
16	16984488	Fluoride	Objectionable dental fluorosis
17	18540299	Hexavalent Chromium	No adverse effects observed**
18	7439921	Lead	Cardiovascular and CNS effects
19	7439965	Manganese	CNS effects
20	7439976	Mercury	CNS effects
21	78933	Methyl Ethyl Ketone	Decreased fetal birth weight
22	108101	Methyl Isobutyl Ketone	Increased liver and kidney weight, lethargy (Under review)
23	75092	Methylene Chloride	Liver toxicity
24	7439987	Molybdenum	Increased uric acid
25	108383	m-Xylene	Hyperactivity, decreased weight
26	91203	Naphthalene	Eye damage, decreased body weight
27	7440020	Nickel	Decreased body and organ weights
28	136777612	o+p Xylene*	Hyperactivity, decreased body weight, increased mortality
29	108952	Phenol	Reduced fetal body weight in rats
30	129000	Pyrene	Kidney effects (renal tubular pathology, decreased kidney weights)
31	100425	Styrene	Red blood cell and liver effects
32	108883	Toluene	Changes in liver and kidney weights
33	7440666	Zinc	Anemia

* Chemicals with EPA verified or provisional human health-based reference doses, referred to as "systemic toxicants."

** Reference dose based on no observed adverse effect level (NOAEL).

Table 51. Human Carcinogens Evaluated, Weight-of-Evidence Classifications, and Target *Organs* (Barge-Chemical and Petroleum)

	Cas Number	Carcinogen	Weight-of-Evidence Classification	Target Organs
1	107131	Acrylonitrile	B1	Lung
2	71432	Benzene	A	Blood
3	7440417	Beryllium	B2	Lung, bone
4	117817	Bis(2-ethylhexyl) Phthalate	B2	Liver
5	7440439	Cadmium	B1	Lung, trachea, bronchus
6	67663	Chloroform	B2	Kidney, liver
7	18540299	Hexavalent Chromium	A	Lung
8	7439921	Lead	B2	Kidney, stomach, lung
9	75092	Methylene Chloride	B2	Liver, lung
10	85018	Phenanthrene*	D	Skin, lungs, and epithelial tissue

A- Human Carcinogen
B1- Probable Human Carcinogen (limited human data)
B2- Probable Human Carcinogen (animal data only)
C- Possible Human Carcinogen
D- Not Classifiable as to Human Carcinogenicity
* Evaluated as a carcinogen based on EPA ambient water quality criteria for human health cancer risk for polynuclear aromatic hydrocarbons (PAHs) as a class

Table 52. Potential Fate and Toxicity of Pollutants of Concern (Rail-Chemical)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
1	1-Methylphenanthrene	832699	Moderate	Slight	High	High	Unknown				
2	2,4,5-T	93765	Moderate	Nonvolatile	Slight	Moderate	Moderate		X		
3	2,4,5-TP	93721	Moderate	Nonvolatile	Slight	Moderate	Slow		X	M	
4	2,4-D	94757	Slight	Nonvolatile	Slight	Moderate	Slow		X	M	
5	2,4-DB (Butoxon)	94826	Slight	Unknown	Slight	Moderate	Fast		X		
6	2-Butanone	78933	Slight	Moderate	Nonadsorptive	Nonbioaccumulative	Fast		X		
7	4,4'-DDD	72548	High	Slight	High	High	Resistant	X			X
8	4,4'-DDE	72559	Slight	Moderate	High	High	Resistant	X			X
9	4,4'-DDT	50293	High	Moderate	High	High	Resistant	X	X		X
10	Acephate	30560191	Slight	Nonvolatile	Nonadsorptive	Slight	Unknown	X	X		
11	Alachlor	15972608	Unknown	Nonvolatile	Moderate	Moderate	Slow	X	X	M	
12	alpha-BHC	319846	Moderate	Slight	Moderate	Moderate	Slow	X			X
13	alpha-Chlordane	5103719	High	Unknown	Unknown	High	Unknown	X	X		
14	Aluminum	7429905	Moderate	Unknown	Unknown	Moderate	Unknown			M	
15	Anthracene	120127	High	Moderate	High	Moderate	Resistant		X		X
16	Atrazine	1912249	Moderate	Nonvolatile	Slight	Moderate	Resistant	X	X	M	
17	Barium	7440393	Slight	Unknown	Unknown	Unknown	Unknown		X	M	
18	Benefluralin	1861401	Moderate	High	High	High	Unknown		X		
19	Benzoic Acid	65850	Slight	Slight	Slight	Slight	Moderate		X		
20	beta-BHC	319857	Moderate	Slight	Moderate	Moderate	Slow	X			X
21	Bromacil	314409	Slight	Nonvolatile	Slight	Slight	Unknown				
22	Bromoxynil Octanoate	1689992	High	Unknown	Unknown	Unknown	Unknown		X		
23	Butachlor	23184669	Slight	Nonvolatile	Moderate	High	Slow				
24	Captafol	2425061	High	Unknown	Moderate	Nonbioaccumulative	Unknown	X	X		
25	Captan	133062	High	Slight	Slight	Slight	Unknown	X	X		
26	Carbazole	86748	Slight	Nonvolatile	Moderate	Moderate	Unknown	X			
27	Carbophenothion	786196	Moderate	Unknown	High	High	Slow				
28	Chlorobenzilate	510156	Moderate	Nonvolatile	Moderate	High	Slow	X	X		
29	Chloroneb	2675776	Slight	Moderate	Moderate	Slight	Unknown				
30	Chromium	7440473	Slight	Unknown	Unknown	Slight	Unknown		X	M	X
31	cis-Permethrin	61949766	High	Unknown	Unknown	Unknown	Unknown				
32	Copper	7440508	High	Unknown	Unknown	Moderate	Unknown			TT	X
33	Dacthal (DCPA)	1861321	Slight	Slight	Moderate	Moderate	Slow		X		
34	Dalapon	75990	Slight	Slight	Slight	Nonbioaccumulative	Unknown		X	M	
35	delta-BHC	319868	Moderate	Nonvolatile	Moderate	Moderate	Slow				X
36	Diallate	2303164	Slight	Slight	Slight	Moderate	Unknown	X			
37	Dicamba	1918009	Slight	Nonvolatile	Slight	Slight	Slow		X		
38	Dichlone	117806	High	Unknown	High	High	Unknown				
39	Dichloroprop	120365	Moderate	Nonvolatile	Slight	Slight	Slow				
40	Dicofol	115322	Moderate	Nonvolatile	High	High	Slow	X			
41	Dieldrin	60571	High	Slight	Moderate	High	Resistant	X	X		X
42	Dinoseb	88857	High	Slight	Slight	Moderate	Slow		X	M	
43	Dioxathion	78342	High	Unknown	Moderate	Moderate	Resistant		X		
44	Endosulfan I	959988	High	Moderate	Nonadsorptive	Moderate	Slow		X		X
45	Endosulfan Sulfate	1031078	High	High	Moderate	Moderate	Slow		X		X

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Table 52. Potential Fate and Toxicity of Pollutants of Concern (Rail-Chemical)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
46	Endrin	72208	High	Slight	High	High	Moderate		X	M	X
47	Endrin Aldehyde	7421934	High	Nonvolatile	Slight	High	Resistant		X		X
48	Endrin Ketone	53494705	High	Unknown	Unknown	High	Unknown		X		
49	Ethalfluralin	55283686	High	Slight	High	High	Unknown				
50	Ethylbenzene	100414	Slight	High	Slight	Slight	Moderate		X	M	X
51	Etradiazole	2593159	Slight	Slight	Moderate	Moderate	Unknown				
52	Fenarimol	60168889	Moderate	Nonvolatile	Moderate	Moderate	Unknown				
53	Fluoranthene	206440	Slight	Slight	High	High	Resistant		X		X
54	Fluoride	16984488	Slight	Unknown	Unknown	Unknown	Unknown		X	M	
55	gamma-BHC	58899	High	Moderate	Moderate	Moderate	Resistant	X	X	M	X
56	gamma-Chlordane	5103742	High	Unknown	Unknown	High	Unknown	X	X		
57	Heptachlor Epoxide	1024573	High	Moderate	Slight	High	Resistant	X	X	M	X
58	Isodrin	465736	High	Unknown	Unknown	Slight	Unknown				
59	Isopropalin	33820530	Moderate	Moderate	High	High	Slow		X		
60	m-Xylene	108383	Slight	High	Slight	Moderate	Moderate		X	M	
61	MCPA	94746	Slight	Nonvolatile	Slight	Slight	Fast		X		
62	MCPP	7085190	Slight	Nonvolatile	Nonadsorptive	Nonbioaccumulative	Unknown		X		
63	Methoxychlor	72435	High	Moderate	High	High	Resistant		X	M	
64	Metribuzin	21087649	Slight	Nonvolatile	Slight	Nonbioaccumulative	Moderate		X		
65	Mirex	2385855	Moderate	Moderate	Moderate	High	Resistant	X	X		
66	n-Docosane	629970	Slight	Unknown	Nonadsorptive	High	Unknown				
67	n-Dodecane	112403	Slight	Unknown	High	High	Unknown				
68	n-Eicosane	112958	Slight	Unknown	High	High	Unknown				
69	n-Hexacosane	630013	Slight	Unknown	Unknown	Unknown	Unknown				
70	n-Hexadecane	544763	Slight	Unknown	High	High	Unknown				
71	n-Octacosane	630024	Slight	Unknown	Unknown	Unknown	Unknown				
72	n-Octadecane	593453	Slight	Unknown	High	High	Unknown				
73	n-Tetracosane	646311	Slight	Unknown	High	High	Unknown				
74	n-Tetradecane	629594	Slight	Unknown	High	High	Unknown				
75	n-Triacontane	638686	Slight	Unknown	Unknown	Unknown	Unknown				
76	Naphthalene	91203	Slight	Moderate	Slight	Slight	Moderate		X		X
77	Nitrofen	1836755	Moderate	Slight	Moderate	High	Slow				
78	o+p Xylene*	136777612	Slight	High	Slight	Moderate	Moderate		X	M	
79	p-Cresol	106445	Slight	Slight	Slight	Slight	Fast	X	X		
80	Pendamethalin	40487421	Moderate	Moderate	Moderate	High	Slow		X		
81	Pentachloronitrobenzene (PCNB)	82688	Moderate	Moderate	High	High	Resistant	X	X		
82	Perthane	72560	High	Unknown	High	High	Slow				
83	Phenanthrene	85018	High	Moderate	High	Moderate	Resistant	X			X
84	Phenol	108952	Slight	Slight	Slight	Nonbioaccumulative	Fast		X		X
85	Picloram	1918021	High	Nonvolatile	Slight	Nonbioaccumulative	Unknown		X	M	
86	Propachlor	1918167	Moderate	Nonvolatile	Slight	Slight	Slow		X		
87	Propazine	139402	Slight	Nonvolatile	Slight	Moderate	Slow		X		
88	Pyrene	129000	Slight	Slight	High	High	Resistant		X		X
89	Simazine	122349	High	Nonvolatile	Slight	Nonbioaccumulative	Slow	X	X	M	
90	Strobane	8001501	High	Unknown	Unknown	Unknown	Unknown				

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Table 52. Potential Fate and Toxicity of Pollutants of Concern (Rail-Chemical)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
91	Styrene	100425	Slight	High	Slight	Slight	Moderate		X	M	
92	Terbacil	5902512	High	Nonvolatile	Slight	Nonbioaccumulative	Unknown		X		
93	Terbuthylazine	5915413	Slight	Nonvolatile	Moderate	Moderate	Unknown				
94	Tetrachlorvinphos	22248799	Moderate	Nonvolatile	Moderate	Moderate	Slow	X	X		
95	Titanium	7440326	Unknown	Unknown	Unknown	Unknown	Unknown				
96	Tokuthion	34643464	Slight	Unknown	Unknown	Unknown	Unknown				
97	Toluene, 2,4-Diamino-	95807	Slight	Nonvolatile	Slight	Nonbioaccumulative	Slow	X	X		
98	Total Petroleum Hydrocarbons (TPH)	C001	Unknown	Unknown	Unknown	Unknown	Unknown				
99	Total Recoverable Oil and Grease	C002	Unknown	Unknown	Unknown	Unknown	Unknown				
100	Total Suspended Solids	C003	Unknown	Unknown	Unknown	Unknown	Unknown				
101	Triadimefon	43121433	Slight	Nonvolatile	Moderate	Slight	Unknown		X		
102	Trichlorfon	52686	High	Nonvolatile	Slight	Nonbioaccumulative	Slow		X		
103	Trichloronate	327980	High	Unknown	Moderate	High	Unknown				
104	Trifluralin	1582098	Moderate	Moderate	High	High	Slow	X	X		
105	Trimethylphosphate	512561	Slight	Nonvolatile	Slight	Nonbioaccumulative	Unknown	X			
106	Zinc	7440666	Moderate	Unknown	Unknown	Slight	Unknown		X	SM	X

* - Values assumed for p-Xylene.

Note: M = Maximum Contaminant Level established for health-based effect.

SM = Secondary Maximum Contaminant Level (SMCL) established for taste or aesthetic effect.

TT = Treatment technology action level established.

Table 53. Toxicants Exhibiting Systemic and Other Adverse Effects (Rail-Chemical)*

	Cas Number	Toxicant	Reference Dose Target Organ and Effects
1	78933	2-Butanone	Decreased fetal birth weight
2	94757	2,4-D	Hematologic, hepatic, and renal toxicity
3	94826	2,4-DB (Butoxon)	Internal hemorrhage, mortality
4	93765	2,4,5-T	Increased urinary caproporphyrins, reduced neonatal survival
5	93721	2,4,5-TP	Histopathological changes in liver
6	50293	4,4'-DDT	Liver lesions
7	30560191	Acephate	Inhibition of brain ChE
8	15972608	Alachlor	Hemosiderosis, hemolytic anemia
9	5103719	alpha-Chlordane	Hypertrophy of liver
10	120127	Anthracene	No adverse effects observed**
11	1912249	Atrazine	Decreased weight gain, cardiac toxicity, and moderate to severe dilation of right atrium
12	7440393	Barium	Increased blood pressure
13	1861401	Benefluralin	Depressed erythrocyte counts
14	65850	Benzoic Acid	No adverse effects observed**
15	1689992	Bromoxynil Octanoate	No adverse effects observed**
16	2425061	Captafol	Kidney and bladder toxicity
17	133062	Captan	Decreased mean body weights
18	510156	Chlorobenzilate	Decreased stool quantity, food consumption and body weight
19	7440473	Chromium	No adverse effects observed**
20	1861321	Dacthal (DCPA)	Effects on lungs, liver, kidney, and thyroid
21	75990	Dalapon	Increased kidney body weight ratio
22	1918009	Dicamba	Maternal and fetal toxicity
23	60571	Dieldrin	Liver lesions
24	88857	Dinoseb	Decreased fetal weight
25	78342	Dioxathion	Inhibition of cholinesterase
26	959988	Endosulfan I	Glomerulonephrosis (kidney) aneurysms (blood vessel)
27	1031078	Endosulfan Sulfate	Glomerulonephrosis (kidney) aneurysms (blood vessel)
28	72208	Endrin	Mild histological lesions in liver, occasional convulsions
29	7421934	Endrin Aldehyde	Mild histological lesions in liver, occasional convulsions (Endrin)
30	53494705	Endrin Ketone	Mild histological lesions in liver, occasional convulsions (Endrin)
31	100414	Ethylbenzene	Liver and kidney toxicity
32	206440	Fluoranthene	Nephropathy, increased liver weights, hematological alterations, and clinical effects
33	16984488	Fluoride	Objectionable dental fluorosis
34	58899	gamma-BHC	Liver and kidney toxicity
35	5103742	gamma-Chlordane	Hypertrophy of liver
36	1024573	Heptachlor Epoxide	Increased liver-to-body weight ratio in both males and females
37	33820530	Isopropalin	Reduced hemoglobin concentration, lowered hematocrits, and altered organ weights
38	94746	MCPA	Kidney and liver toxicity
39	7085190	MCPP	Increased absolute and relative kidney weights
40	72435	Methoxychlor	Excessive loss of litters
41	21087649	Metribuzin	Liver and kidney effects, decreased body weight, mortality
42	2385855	Mirex	Liver cytomegaly, fatty metamorphosis, angiectasis; thyroid cystic follicles
43	108383	m-Xylene	Hyperactivity, decreased weight
44	91203	Naphthalene	Eye damage, decreased body weight
45	136777612	o+p Xylene*	Hyperactivity, decreased body weight, increased mortality
46	106445	p-Cresol	Hypoactivity, distress, maternal death
47	40487421	Pendamethalin	Increase in serum alkaline phosphatase and liver weight, and hepatic lesions
48	82688	Pentachloronitrobenzene (PCNB)	Liver toxicity
49	108952	Phenol	Reduced fetal body weight in rats
50	1918021	Picloram	Increased liver weights
51	1918167	Propachlor	Decreased weight gain, food consumption; increased relative liver weights
52	139402	Propazine	Decrease in body weight
53	129000	Pyrene	Kidney effects (renal tubular pathology, decreased kidney weights)
54	122349	Simazine	Reduction in weight gains, hematological changes in females
55	100425	Styrene	Red blood cell and liver effects
56	5902512	Terbacil	Increase in thyroid/body weight ratio; slight increase in liver weights; elevated alkaline phosphatase
57	22248799	Tetrachlorvinphos	Increased liver and kidney weights
58	95807	Toluene, 2,4-Diamino-	No adverse effects observed**
59	43121433	Triadimefon	Decreased body weight gain, erythrocyte count, and hemoglobin level
60	52686	Trichlorofon	Inhibition of cholinesterase
61	1582098	Trifluralin	Increased liver weights; increase in methemoglobin
62	7440666	Zinc	Anemia

* Chemicals with EPA verified or provisional human health-based reference doses, referred to as "systemic toxicants."
** Reference dose based on no observed adverse effect level (NOAEL).

Table 54. Human Carcinogens Evaluated, Weight-of-Evidence Classifications, and Target Organs (Rail-Chemical)

	Cas Number	Carcinogen	Weight-of-Evidence Classification	Target Organs
1	72548	4,4'-DDD	B2	Lung, liver, thyroid
2	72559	4,4'-DDE	B2	Liver, thyroid
3	50293	4,4'-DDT	B2	Liver
4	30560191	Acephate	C	Liver
5	15972608	Alachlor	B2**	Lung, thorax
6	319846	alpha-BHC	B2	Liver
7	5103719	alpha-Chlordane	B2	Liver
8	1912249	Atrazine	C	Mammary
9	319857	beta-BHC	C	Liver
10	2425061	Captafol	C**	Lymphatic System
11	133062	Captan	B2**	Gastrointestinal
12	86748	Carbazole	B2	Liver
13	510156	Chlorobenzilate	B2	Liver
14	2303164	Diallate	B2	Liver
15	115322	Dicofol	C**	Liver
16	60571	Dieldrin	B2	Liver
17	58899	gamma-BHC	B2-C	Liver
18	5103742	gamma-Chlordane	B2	Liver
19	1024573	Heptachlor Epoxide	B2	Liver
20	2385855	Mirex	B2**	Liver
21	106445	p-Cresol	C	Bladder
22	82688	Pentachloronitrobenzene (PCNB)	C**	Liver
23	85018	Phenanthrene*	D	Skin, lungs, and epithelial tissue
24	122349	Simazine	C	Mammary
25	22248799	Tetrachlorvinphos	C	Liver
26	95807	Toluene, 2,4-Diamino-	B2	Mammary
27	1582098	Trifluralin	C	Urinary tract, thyroid
28	512561	Trimethylphosphate	B2	Uterus

A- Human Carcinogen
B1- Probable Human Carcinogen (limited human data)
B2- Probable Human Carcinogen (animal data only)
C- Possible Human Carcinogen
D- Not Classifiable as to Human Carcinogenicity
* Evaluated as a carcinogen based on EPA ambient water quality criteria for human health cancer risk for polynuclear aromatic hydrocarbons (PAHs) as a class
** Under review

Table 55. Potential Fate and Toxicity of Pollutants of Concern (Truck-Chemical)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
1	1,1,1-Trichloroethane	71556	Slight	High	Slight	Slight	Resistant		X	M	X
2	1,2-Dichlorobenzene	95501	Slight	High	Slight	Moderate	Slow		X	M	X
3	1,2-Dichloroethane	107062	Slight	Moderate	Slight	Nonbioaccumulative	Slow	X		M	X
4	2-Butanone (Methyl Ethyl Ketone)	78933	Slight	Moderate	Nonadsorptive	Nonbioaccumulative	Fast		X		
5	2-Chlorophenol	95578	Slight	Moderate	Moderate	Moderate	Moderate		X		X
6	2-Isopropylnaphthalene	2027170	Moderate	Moderate	High	High	Unknown				
7	2-Methylnaphthalene	91576	Moderate	Moderate	Moderate	High	Slow				
8	2-Propanone (Acetone)	67641	Slight	Moderate	Slight	Nonbioaccumulative	Fast		X		
9	2,4-D	94757	Slight	Nonvolatile	Slight	Moderate	Slow		X	M	
10	2,4-DB (Butoxon)	94826	Slight	Unknown	Slight	Moderate	Fast		X		
11	2,4,5-T	93765	Moderate	Nonvolatile	Slight	Moderate	Moderate		X		
12	2,4,5-TP	93721	Moderate	Nonvolatile	Slight	Moderate	Slow		X	M	
13	4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	108101	Slight	Moderate	Slight	Nonbioaccumulative	Fast		X		
14	4,4'-DDT	50293	High	Moderate	High	High	Resistant	X	X		X
15	Alpha-Terpineol	98555	Slight	Unknown	Unknown	Unknown	Unknown				
16	Aluminum	7429905	Moderate	Unknown	Unknown	Moderate	Unknown			M	
17	Azinphos Ethyl	2642719	High	Unknown	Unknown	Moderate	Unknown				
18	Azinphos Methyl	86500	High	Nonvolatile	Slight	Moderate	Unknown		X		
19	Benzene	71432	Slight	High	Slight	Slight	Moderate	X		M	X
20	Benzoic Acid	65850	Slight	Slight	Slight	Slight	Moderate		X		
21	Benzyl Alcohol	100516	Slight	Slight	Nonadsorptive	Nonbioaccumulative	Moderate		X		
22	beta-BHC	319857	Moderate	Slight	Moderate	Moderate	Slow	X			X
23	Bis(2-ethylhexyl) Phthalate	117817	Moderate	Moderate	High	Moderate	Moderate	X	X	M	X
24	BOD 5-Day (Carbonaceous)	C001	Unknown	Unknown	Unknown	Unknown	Unknown				
25	Boron	7440428	Unknown	Unknown	Unknown	Unknown	Unknown		X		
26	Chemical Oxygen Demand (COD)	C002	Unknown	Unknown	Unknown	Unknown	Unknown				
27	Chlorobenzilate	510156	Moderate	Nonvolatile	Moderate	High	Slow	X	X		
28	Chloroform	67663	Slight	High	Slight	Nonbioaccumulative	Slow	X	X	M	X
29	Chromium	7440473	Slight	Unknown	Unknown	Slight	Unknown		X	M	X
30	Copper	7440508	High	Unknown	Unknown	Moderate	Unknown			TT	X
31	Coumaphos	56724	High	Nonvolatile	High	Moderate	Unknown				
32	Dalapon	75990	Slight	Slight	Slight	Nonbioaccumulative	Unknown		X	M	
33	Diallate	2303164	Slight	Slight	Slight	Moderate	Unknown	X			
34	Dichlofenthion	97176	High	Unknown	High	High	Unknown				
35	Dieldrin	60571	High	Slight	Moderate	High	Resistant	X	X		X
36	Di-n-octyl Phthalate	117840	Moderate	Slight	Moderate	High	Moderate		X		X
37	Dinoseb	88857	High	Slight	Slight	Moderate	Slow		X	M	
38	Disulfoton	298044	High	Slight	Moderate	Moderate	Moderate		X		
39	Endosulfan II	33213659	High	Moderate	Nonadsorptive	Moderate	Slow		X		
40	Endosulfan Sulfate	1031078	High	High	Moderate	Moderate	Slow		X		X
41	EPN	2104645	High	Nonvolatile	Unknown	High	Unknown		X		
42	Ethylbenzene	100414	Slight	High	Slight	Slight	Moderate		X	M	X
43	Fluoride	16984488	Slight	Unknown	Unknown	Unknown	Unknown		X	M	
44	gamma-BHC	58899	High	Moderate	Moderate	Moderate	Resistant	X	X	M	X
45	gamma-Chlordane	5103742	High	Unknown	Unknown	High	Unknown	X	X		
46	Leptophos	21609905	High	Unknown	High	High	Unknown				

Table 55. Potential Fate and Toxicity of Pollutants of Concern (Truck-Chemical)

	Chemical Name	CAS Number	Aquatic Toxicity Category	Volatility Category	Sediment Adsorption Category	Bioaccumulation Category	Biodegradation	Carcinogenic Effect	Systemic Health Effect	Drinking Water Value	Priority Pollutant
47	Manganese	7439965	Unknown	Unknown	Unknown	Unknown	Unknown		X	M	
48	MCPA	94746	Slight	Nonvolatile	Slight	Slight	Fast		X		
49	MCPP	7085190	Slight	Nonvolatile	Nonadsorptive	Nonbioaccumulative	Unknown		X		
50	Mercury	7439976	High	High	High	High	Unknown		X	M	X
51	Merphos	150505	Slight	Unknown	Moderate	High	Unknown		X		
52	Methylene Chloride	75092	Slight	High	Slight	Nonbioaccumulative	Moderate	X	X	M	X
53	m-Xylene	108383	Slight	High	Slight	Moderate	Moderate		X	M	
54	Naphthalene	91203	Slight	Moderate	Slight	Slight	Moderate		X		X
55	n-Decane	124185	Slight	Unknown	High	High	Unknown				
56	n-Docosane	629970	Slight	Unknown	Nonadsorptive	High	Unknown				
57	n-Dodecane	112403	Slight	Unknown	High	High	Unknown				
58	n-Eicosane	112958	Slight	Unknown	High	High	Unknown				
59	n-Hexacosane	630013	Slight	Unknown	Unknown	Unknown	Unknown				
60	n-Hexadecane	544763	Slight	Unknown	High	High	Unknown				
61	Nitrofen	1836755	Moderate	Slight	Moderate	High	Slow				
62	n-Octadecane	593453	Slight	Unknown	High	High	Unknown				
63	n-Tetracosane	646311	Slight	Unknown	High	High	Unknown				
64	n-Tetradecane	629594	Slight	Unknown	High	High	Unknown				
65	n-Triacontane	638686	Slight	Unknown	Unknown	Unknown	Unknown				
66	o-Cresol	95487	Slight	Slight	Slight	Slight	Fast	X	X		
67	o+p Xylene	136777612	Slight	High	Slight	Moderate	Moderate		X	M	
68	p-Cresol	106445	Slight	Slight	Slight	Slight	Fast	X	X		
69	p-Cymene	99876	Slight	High	Moderate	High	Unknown				
70	Pentachloronitrobenzene (PCNB)	82688	Moderate	Moderate	High	High	Resistant	X	X		
71	Picloram	1918021	High	Nonvolatile	Slight	Nonbioaccumulative	Unknown		X	M	
72	Simazine	122349	High	Nonvolatile	Slight	Nonbioaccumulative	Slow	X	X	M	
73	Styrene	100425	Slight	High	Slight	Slight	Moderate		X	M	
74	Terbuthylazine	5915413	Slight	Nonvolatile	Moderate	Moderate	Unknown				
75	Tetrachloroethene	127184	Slight	High	Slight	Slight	Resistant	X	X	M	X
76	Tetrachlorvinphos	22248799	Moderate	Nonvolatile	Moderate	Moderate	Slow	X	X		
77	Tin	7440315	Unknown	Unknown	Unknown	Unknown	Unknown		X		
78	Titanium	7440326	Unknown	Unknown	Unknown	Unknown	Unknown				
79	Toluene	108883	Slight	High	Slight	Slight	Moderate		X	M	X
80	Total Cyanide	57125	High	Unknown	Slight	Nonbioaccumulative	Moderate		X	M	X
81	Total Organic Carbon (TOC)	C003	Unknown	Unknown	Unknown	Unknown	Unknown				
82	Total Petroleum Hydrocarbons (TPH)	C004	Unknown	Unknown	Unknown	Unknown	Unknown				
83	Total Recoverable Oil and Grease	C005	Unknown	Unknown	Unknown	Unknown	Unknown				
84	Total Suspended Solids	C006	Unknown	Unknown	Unknown	Unknown	Unknown				
85	Trichloroethene	79016	Slight	High	Slight	Slight	Resistant	X		M	X
86	Zinc	7440666	Moderate	Unknown	Unknown	Slight	Unknown		X	SM	X

* - Values for p-Xylene assumed.

Note: M = Maximum Contaminant Level established for health-based effect.
SM = Secondary Maximum Contaminant Level (SMCL) established for taste or aesthetic effect.
TT = Treatment technology action level established.

Table 56. Toxicants Exhibiting Systemic and Other Adverse Effects (Truck-Chemical)*

	Cas Number	Pollutant	Reference Dose Target Organ and Effects
1	71556	1,1,1-Trichloroethane	Liver toxicity
2	95501	1,2-Dichlorobenzene	No adverse effects observed**
3	78933	2-Butanone (Methyl Ethyl Ketone)	Decreased fetal birth weight
4	95578	2-Chlorophenol	Reproductive effects
5	67641	2-Propanone (Acetone)	Increased liver and kidney weights and nephrotoxicity
6	94757	2,4-D	Hematologic, hapatic and renal toxicity
7	94826	2,4-DB (Butoxon)	Internal hemorrhage, mortality
8	93765	2,4,5-T	Increased urinary caproporphyrins, reduced neonatal survival
9	93721	2,4,5-TP	Histopathological changes in liver
10	108101	4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	Lethargy, increased relative and absolute weight in liver and kidneys
11	50293	4,4'-DDT	Liver lesions
12	86500	Azinphos Methyl	CNS effects, inhibition of cholinesterase, respiratory system
13	65850	Benzoic Acid	No adverse effects observed**
14	100516	Benzyl Alcohol	Epithelial hyperplasia, forestomach
15	117817	Bis(2-ethylhexyl) Phthalate	Increased relative liver weight
16	7440428	Boron	Testicular atrophy, spermatogenic arrest
17	510156	Chlorobenzilate	Decreased stool quantity, food consumption and body weight
18	67663	Chloroform	Fatty cyst formation in liver
19	7440473	Chromium	No adverse effects observed**
20	75990	Dalapon	Increased kidney body weight ratio
21	60571	Dieldrin	Liver lesions
22	117840	Di-n-octyl Phthalate	Increased liver and kidney weight (under review)
23	88857	Dinoseb	Decreased fetal weight
24	298044	Disulfoton	ChE inhibition, optic nerve degeneration
25	33213659	Endosulfan II	Glomerulonephrosis (kidney), aneurysms (blood vessel)
26	1031078	Endosulfan Sulfate	Glomerulonephrosis (kidney), aneurysms (blood vessel)
27	2104645	EPN	Neurotoxicity
28	100414	Ethylbenzene	Liver and kidney toxicity
29	16984488	Fluoride	Objectionable dental fluorosis
30	58899	gamma-BHC	Liver and kidney toxicity
31	5103742	gamma-Chlordane	Hypertrophy of liver
32	7439965	Manganese	CNS effects
33	94746	MCPA	Kidney and liver toxicity
34	7085190	MCPP	Increased absolute and relative kidney weights
35	7439976	Mercury	CNS effects
36	150505	Merphos	Ataxia, delayed neurotoxicity, and weight loss
37	75092	Methylene Chloride	Liver toxicity
38	108383	m-Xylene	Hyperactivity, decreased weight
39	91203	Naphthalene	Eye damage, decreased body weight
40	95487	o-Cresol	Decreased body weights and neurotoxicity
41	136777612	o+p Xylene	Hyperactivity, decreased body weight, increased mortality
42	106445	p-Cresol	Hypoactivity, distress, maternal death
43	82688	Pentachloronitrobenzene (PCNB)	Liver toxicity
44	1918021	Picloram	Increased liver weights
45	122349	Simazine	Reduction in weight gains, hematological changes in females
46	100425	Styrene	Red blood cell and liver effects
47	127184	Tetrachloroethene	Hepatotoxicity in mice, weight gain in rats
48	22248799	Tetrachlorvinphos	Increased liver and kidney weights
49	7440315	Tin	Kidney and liver lesions
50	108883	Toluene	Changes in liver and kidney weights
51	57125	Total Cyanide	Weight loss, thyroid effects, and myeline degeneration
52	7440666	Zinc	Anemia

* Chemicals with EPA verified or provisional human health-based reference doses, referred to as "systemic toxicants."
** Reference dose based on no observed adverse effect level (NOAEL).

Table 57. Human Carcinogens Evaluated, Weight-of-Evidence Classifications, and Target Organs (Truck-Chemical)

	Cas Number	Carcinogen	Weight-of-Evidence Classification	Target Organs
1	107062	1,2-Dichloroethane	B2	Circulatory system
2	50293	4,4'-DDT	B2	Liver
3	71432	Benzene	A	Blood
4	319857	beta-BHC	C	Liver
5	117817	Bis(2-ethylhexyl) Phthalate	B2	Liver
6	510156	Chlorobenzilate	B2	Liver
7	67663	Chloroform	B2	Kidney, liver
8	2303164	Diallate	B2	Liver
9	60571	Dieldrin	B2	Liver
10	58899	gamma-BHC	B2-C	Liver
11	5103742	gamma-Chlordane	B2	Liver
12	75092	Methylene Chloride	B2	Liver, lung
13	95487	o-Cresol	C	Skin
14	106445	p-Cresol	C	Bladder
15	82688	Pentachloronitrobenzene (PCNB)	C*	Liver
16	122349	Simazine	C	Mammary
17	127184	Tetrachloroethene	B2*	Liver
18	22248799	Tetrachlorvinphos	C	Liver
19	79016	Trichloroethene	B2*	Liver

A- Human Carcinogen
B1- Probable Human Carcinogen (limited human data)
B2- Probable Human Carcinogen (animal data only)
C- Possible Human Carcinogen
D- Not Classifiable as to Human Carcinogenicity
* Under Review

Table 58. POTWs Which Receive Discharge from Modeled TEC Facilities and Are Included on State 304(L) Short Lists

Facility Name	Subcategory	City	Receiving POTW	POTW NPDES	Waterbody	Reach Number	Pollutants
Quadrel Bros. Trucking	Truck-Chemical	Rahway	Rahway Valley Sewerage Authority	NJ0024643	Arthur Kill	02030104033	Copper, Lead, Nickel, Silver, Zinc
Rogers Cartage	Truck-Chemical	Sauget	Sauget ABRTF	IL0065145	Mississippi River	07140101006	Chlorobenzene, 4-nitrophenol
Total Cleaning Power	Truck-Chemical	Richmond	Richmond Municipal Wastewater Plant	VA0063177	James River	02080206046	Copper
United Rail Service	Truck-Chemical	East Chicago	East Chicago STP	IN0022829	Grand Calumet River	04040001010	Cyanide
Buncher Rail Car Service	Rail-Chemical	Lynchburg	Lynchburg POTW	VA0024970	James River	02080203047	Silver

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

Table 59. TEC Modeled Facilities/POTWS Located on Waterbodies With State-Issued Fish Consumption Advisories

TECI Facility Number	TECI Subcategory	Discharge Type	Advisory Date	Reach Number	State	Waterbody	Pollutant	Species	Population
1586	Barge-Chemical and Petroleum	Direct	September 1990	12020003001	TX	Neches River	Dioxins	Fish	NCSP, RGP
1130	Truck-Chemical	Indirect	--	05140101001	IN	Ohio River	PCBs	Channel Catfish < 19", Carp Channel Catfish >19"	NCSP, RGP NCGP
			June 1989	05140101001	KY	Ohio River	PCBs, Chlordane	Paddlefish, Paddlefish (eggs) Carp, White Bass, Channel Catfish	NCGP
1139	Truck-Chemical	Indirect	March 1992	05060001027	OH	Scioto River	PCBs, Chlordane	Carp, Catfish	NCGP
1142	Truck-Chemical	Indirect	January 1986	07120004004	IL	Des Plaines River	PCBs	Channel Catfish, Carp >15" Smallmouth Buffalo, Drum	NCGP NCSP, RGP
1308/3009	Truck-Chemical	Indirect	September 1990	12040204001	TX	Houston Ship Channel	Dioxins	Catfish, Shellfish	NCSP, RGP
1643	Truck-Chemical	Indirect	September 1991	18070104003	CA	Coastal Waters	DDT, PCBs DDT, PCBs	Surf perch, Croaker, Queenfish, Sculpin, Kelp-Bass, Rockfish, Corbina Croaker	RGP NCGP
1858, 2028	Truck-Chemical	Indirect	September 1990	12020003001	TX	Neches River	Dioxins	Fish	NCSP, RGP
2034	Truck-Chemical	Indirect	May 1993	11010002017	MO	Waters near Kansas City, St. Louis and Springfield	Multiple	Fish	RGP
2423, 3360	Truck-Chemical	Indirect	January 1991	06020001006	TN	Nickajack Reservoir	PCBs	Catfish	RSP
2424	Truck-Chemical	Indirect	April 1982, June 1985	06010201035	TN	Fort Loudoun Reservoir	PCBs	Catfish Largemouth Bass	CFB, NCGP NCGP
2971	Truck-Chemical	Indirect	March 1986	05050008007	WV	Kanawha River	Dioxins	Bottom-fish	NCGP
3344	Truck-Chemical	Indirect	---	02030104003	NJ	Arthur Kill/Raritan Bay	PCBs PCBs	Catfish, Perch, Bluefish >24" >6 lbs, Striped Bass Striped Bass, Shellfish, Catfish, Bluefish >24" > 6 lbs., Perch, American Eel	RGP NCSP
							PCBs	Striped Bass, Shellfish, American Eel	CFB
							Dioxins	Striped Bass, Shellfish	CFB, NCGP, NCSP
3356	Truck-Chemical	Indirect	---	04120104008	NY	Niagara River	PCBs	Carp	NCSP, RGP
3525	Truck-Chemical	Indirect	January 1988	07140101006	IL	Mississippi River	Chlordane	Shovelnose Sturgeon, Shovelnose Sturgeon (eggs)	NCGP
			May 1993	07140101006	MO	Mississippi River	Multiple	Fish	RGP

Table 59. TEC Modeled Facilities/POTWS Located on Waterbodies With State-Issued Fish Consumption Advisories (continued)

TECI Facility Number	TECI Subcategory	Discharge Type	Advisory Date	Reach Number	State	Waterbody	Pollutant	Species	Population
3930	Truck-Chemical	Indirect	July 1988	02080206046	VA	James River	Kepone	Fish	RGP
4106	Truck-Chemical	Indirect	January 1987, 1988	05080002005	OH	Great Miami River	PCBs	Carp, Catfish, Sucker	NCGP
			May 1988	05080002005	OH	Great Miami River	PCBs	Fish	NCGP
4208	Truck-Chemical	Indirect	May 1991	10230006004	NE	Missouri River	PCBs, Dieldrin	Channel Catfish	RGP
3964	Truck-Chemical	Indirect	January 1992	07130006004	IL	Sangamon River	Chlordane	Carp	NCGP
1032	Rail-Chemical	Indirect	May 1993	10300101030	MO	Waters near Kansas City, St. Louis and Springfield	Multiple	Fish	RGP
1128	Rail-Chemical	Indirect	January 1988	07140105001	IL	Mississippi River	Chlordane	Shovelnose Sturgeon, Shovelnose Sturgeon (eggs)	NCGP

Source: The National Listing of Fish Consumption Advisories (NLFCA) - December 1995

NCSP - Advises against consumption of fish and shellfish by subpopulations potentially at greater risk (e.g., pregnant or nursing women or small children).
RGP - Advises the general population to restrict size and frequency of meals of fish and shellfish.
NCGP - Advises against consumption of fish and shellfish by general population.
CFB - Bans commercial harvest and/or sale of fish and shellfish.
RSP - Advises subpopulations potentially at greater risk (e.g., pregnant or nursing women or small children) to restrict the size and/or frequency of meals of fish and shellfish.

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NOTE: Many of these references are available in the public docket for the Effluent Guidelines for Industrial Laundries. Reference EPA 1989b is available in the public docket for the Effluent Guidelines for Pulp, Paper, and Paperboard. For additional information, contact Pat Harrigan, EPA/SASD, at 202/260-8479.