Factor 1 Analysis: Human Health and Environmental Impacts

Status of Screening Level Review Phase

U.S. Environmental Protection Agency
Engineering and Analysis Division
Office of Water
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

REVISED DRAFT
December 16 2003

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

EXECUTIVE SUMMARY

In November 2002, the Environmental Protection Agency (EPA) announced the draft "Strategy for National Clean Water Industrial Regulations." The draft *Strategy* outlines a process that EPA proposes to use to develop Effluent Guidelines Plans. The process will allow EPA to identify existing effluent guidelines the Agency should consider revising or industry categories for which the Agency should consider developing new effluent guidelines. The draft *Strategy* describes four factors that the Agency would consider during its process.

This report discusses the status of the EPA Engineering and Analysis Division's (EAD's) initial screening level review phase for Factor 1, Human Health and Environmental Impacts. This factor considers the extent to which the pollutants discharged by industry categories pose adverse impacts, and more specifically, potential risk to human health or the environment.

The screening level review phase for this factor focuses on review of readily available information to assess both impacts and potential risk associated with pollutants discharged from categorical point sources. The data resources reviewed include databases, models, literature resources, and analyses currently underway on chemical contaminants in the environment. The resources present data on pollutant point source discharges, water quality, environmental impacts (e.g., sediment and fish contamination), pathogen impacts, and the Gulf Hypoxia Action Plan. EPA is also evaluating tools used to assess human health and environmental impacts; many of the tools identified focus on impacts to human health.

A few of the tools and resources discussed here include information that EAD can apply in the current cycle of planning. These are discussed in Section I of this report. Section II discusses the resources that were considered for the screening analysis. Others tools and resources require further analysis, such as the resources that identify chemicals of concern but do not identify potential sources, or modeling tools, such as those available from the Office of Research and Development, which may require data from EAD before generating results. These

tools and resources are discussed here in preliminary terms, and may not be available for the current planning cycle. These tools are discussed in Section III of this report. Table ES-1 lists all the tools and resources discussed in this report and based on preliminary reviews, whether EAD feels that the tool or resource will be applicable for the current planning cycle.

Table ES-1

Tools/Resources Assessed by EAD

Tool/Resource	Applicable to Current Planning Cycle?
EPA's Office of Pollution Prevention and Toxics (OPPT) - Section 2.0	
Toxics Release Inventory Data / Risk Screening Environmental Indicators Model	Yes
EPA's Office of Enforcement and Compliance Assurance (OECA) - Section 3.0	
Permit Compliance System Data	Yes
U.S. Geological Survey - Section 5.0	
National Water Quality Assessment Program; NAWQA National Report on Nutrients; National Water Information System; and Spatially Referenced Regressions on Watershed Attributes	No
EPA's Office of Science and Technology (OST) - Section 6.0	
National Sediment Contaminant Point Source Inventory	Yes
Better Assessment Science Integrating point and Nonpoint Sources (BASINS) Model	No
National Listing of Fish and Wildlife Consumption Advisories; National Fish Tissue Study; National Sediment Quality Survey; Beaches and Environmental Assessment and Coastal Health Act	No
EPA's Office of Ground Water and Drinking Water (OGWDW)- Section 7.0	
Safe Drinking Water Act Candidate Contaminant List; Source Water Assessment Program	No
EPA's Office of Research and Development (ORD) - Section 8.0	
Environmental Monitoring and Assessment Program; Regional Vulnerability Assessment; Frameworks/Multimedia, Multipathway and Multireceptor Risk Assessment; Total Human Exposure Risk Database and Advanced Simulation Environment; Total Exposure Model	No
Emerging Concerns and Other Data Considered - Section 9.0	
Pathogen Impacts; National Report on Human Exposure to Environmental Chemicals (NHANES)	No

Table ES-1 (continued)

Tool/Resource	Applicable to Current Planning Cycle?
Gulf Hypoxia Action Plan	No
Non-Federal Agency Resources - Section 10.0	
U.S. Public Interest Research Group (PIRG) Report (*Toxic Releases and Health: A Review of Pollution Data and Current Knowledge on the Health Effects of Toxic Chemicals*)	Yes

Based on the preliminary information and results currently available, the following is the list of potential point source categories/industries that warrant further investigation (see Section 11.0 for more details on the categories):

- Fertilizer manufacture;
- Inorganic chemical manufacturing;
- Nonferrous metals manufacturing;
- Ore mining and dressing
- Organic chemicals, plastics, and synthetic fibers;
- Petroleum bulk stations and terminals;
- Petroleum refining;
- Phosphate manufacturing;
- Pulp, paper, and paperboard;
- Steam electric power generation;
- Textile Mills
- Timber products processing.

EAD will continue to review these resources and will update the list of potential industry categories that warrant further examination until the beginning of the Final Agency Review process. Ultimately, EAD will create a ranked list of industries by comparing those identified through this factor analysis with similar lists generated by the Factor 2 (Technology Advances and Process Changes) and 4 (Implementation and Efficiency Considerations) analyses for further investigation.

EAD will announce the results of the screening level review phase in the 2004/2005 Effluent Guidelines Program Plan. These results may include a discrete list of industry categories which will be subjected to the second level screening review and eventually to the detailed investigation phase of the process.

1.0 INTRODUCTION

This report presents a status of the initial screening level review phase for Factor 1 of the draft *Strategy*. This report attempts to evaluate, at a screening level, the extent to which the pollutants remaining in an industry category's discharge pose a potential impact to human health and the environment. Risk assessments provide a qualitative or quantitative evaluation of the risk posed to human health and the environment by the actual or potential presence of pollutants; however, the level of analysis performed in this Factor 1 report will not approach the level of detail required by a formal risk assessment. A more in-depth analysis of Factor 1 will take place once a subset of candidate industries has been identified.

The screening level review phase for this factor focuses on review of readily available information to assess both hazard impacts and potential risk associated with pollutants discharged from categorical point sources. The data resources reviewed include databases, models, literature resources, and analyses currently underway on chemical contaminants in the environment. In some cases, these resources provide information on the source of the chemical contaminants, which can be used to identify categorical point sources associated with the contaminants. However, in most cases, these resources do not provide a link to the contaminant source.

This report describes EPA's data collection, review, and analysis to date on resources from EPA's Office of Pollution Prevention and Toxics (OPPT); EPA's Office of Enforcement and Compliance Assurance (OECA); EPA's Office of Wetlands, Oceans, and Watersheds (OWOW); the US Geological Survey (USGS); EPA's Office of Science and Technology/Standards and Health Protection Division (OST/SHPD); EPA's Office of Ground Water and Drinking Water (OGWDW); and EPA's Office of Research and Development (ORD). This report also includes information on the Center for Disease Control's National Report on Human Exposure to Environmental Chemicals (NHANES), pathogen impacts, the Gulf Hypoxia Action Plan, and non-federal agency data. Finally, this report discusses conclusions and recommendations for the analysis of Factor 1.

This report contains information readily available from government sources and industry and other publications. No new data (e.g., from effluent sampling or environmental monitoring) has been generated for this report. The documentation of all the data sources in the screening analysis is compliant with the Information Quality Guideline.

SECTION I

DISCUSSION OF RESOURCES USED IN THE SCREENING ANALYSIS

2.0 TOXICS RELEASE INVENTORY DATA AND ANALYSES

This section provides a brief summary of the Toxics Release Inventory (TRI), focusing on how the data can be used by EAD. Data reported under TRI include facility-specific discharge information that can be used to predict potential risk. For example, the Risk Screening Environmental Indicators (RSEI) model uses TRI data to compare potential risks associated with environmental releases. To interpret TRI data analyses in context, it is important for users to understand how TRI data are collected. This summary describes TRI data collection and quality as related to EAD's analyses, focusing on water discharges; it does not provide all the details about the TRI program (which covers all media).

The remainder of this section discusses the TRI program and how EAD analyzed TRI data using the RSEI model. Section I 2.1 presents an overview of TRI. Section I 2.2 discusses the RSEI model, how RSEI uses TRI data to calculate relative risk scores, and EAD's preliminary findings.

2.1 Overview of TRI Reporting and Relation to RSEI

TRI is the common name for Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA). Each year, facilities that meet certain thresholds (such as number of employees) must report their releases and other waste management activities (quantities recycled, collected, and combusted for energy recovery, treated for destruction, or disposed) for listed toxic chemicals. A separate report must be filed for each chemical that exceeds a threshold.

There are three criteria that a facility must meet to be required to submit a TRI report for that reporting year. The criteria are:

1) *SIC Code Determination*: Facilities in SIC Codes 20 through 39, seven additional SIC codes outside this range, and federal facilities must evaluate whether additional criteria are met and whether reporting is

required. EPA rarely checks or refutes facility claims regarding the SIC code identification. The primary SIC code, which is based on the facility's primary activity as reported by the submitter, determines TRI reporting and has been used as the basis for the RSEI analysis.

2) *Number of Employees*: Facilities must have 10 or more full-time employees or their equivalent. EPA defines a "full-time equivalent" as a person that works 2,000 hours in the reporting year (there are several exceptions and special circumstances that are well-defined in the TRI reporting instructions).

3) *Activity Thresholds:* If the facility is in a covered SIC code and has 10 or more full-time employee equivalents it must conduct an activity threshold analysis for every chemical and chemical category on the current TRI list. The facility must determine whether it manufactures, processes, OR otherwise uses each chemical at or above the appropriate activity threshold. Reporting thresholds are <u>not</u> based on the amount of release. All TRI thresholds are based on mass, not concentration. Different thresholds apply for persistent, bioaccumulative and toxic (PBT) chemicals than for non-PBT chemicals.

If a facility does not manufacture, process, or otherwise use any EPCRA Section 313 chemicals, it is not required to report to the TRI. This may account for the number of facilities known to be part of an SIC code in the 1997 U.S. Economic Census but not included in the RSEI analysis.

EAD recognizes that there are limitations associated with the release data reported to TRI when analyzing releases over time. First, the original TRI list included approximately 300 chemicals. This list was essentially doubled in 1995. Additionally, each year EPA receives petitions to add and remove specific chemicals (typically one or two per year). Second, the original industries covered in TRI only included those in the manufacturing sector (SIC codes 20 through 39) and thus the number of facilities is a small fraction of the number of facilities that generate wastewater. Federal facilities were included via an Executive Order in 1994 (regardless of associated SIC codes), and seven additional industries were added in 1997.

Third, prior to reporting year 2000, the three activity thresholds for all TRI chemicals were identical: 25,000 pounds for manufacturing; 25,000 pounds for processing; and 10,000 pounds for other use. However, as of reporting year 2000, EPA had designated 18 chemicals as PBTs. The thresholds for PBTs were lowered to either 10 pounds for "highly persistent" bioaccumulative toxic chemicals or 100 pounds for other PBTs (dioxins/furans are the exception where the threshold is 0.1 grams). Lead and lead compounds were not designated as PBTs until reporting year 2001. Despite these limitations, the Agency believes that this may be a useful and acceptable screening approach, especially if it is complemented by similar analyses performed on other Agency data.

Further information on TRI reporting, including discussions of how facilities report metals and metal compounds, how TRI data change over time, and TRI data quality, can be found in Attachment A to the *Evaluation of RSEI Model Runs* report. More detailed information on the TRI program is located on EPA's TRI homepage: http://www.epa.gov/tri/.

2.2 The RSEI Model

This subsection describes the RSEI model, which was created by EPA's Office of Pollution Prevention and Toxics (OPPT). RSEI allows users to complete screening-level analyses using TRI data. The RSEI model incorporates the following information into the model:

- Amount of the chemical released as reported from TRI;
- Location of the chemical release, assumed to be the actual facility location as reported from TRI;
- Proportional toxicity and toxicity weights based on sources such as the Integrated Risk Information System (IRIS);
- Estimated fate and transport of the chemical in the environment once released;

- Pathway of release based on the TRI-reported medium and extent of human exposure;
- Number of people exposed through fish ingestion based on 1990 U.S. Census data; and
- Number of people exposed based on drinking water populations from the Safe Drinking Water Information System (SDWIS) for assessment of drinking water exposures.

These components are combined and modeled to offer a quantitative screening-level, risk-related perspective for relative comparisons of chemical releases. The model also allows users to examine results from a hazard-based perspective (i.e., where TRI releases are weighted only by the toxicity of the chemical released, without considering the potential for exposure or number of people exposed), as well as to view results from a simple pounds perspective. This feature allows users to conduct analyses of releases and transfers of chemicals where exposure and modeling information is absent. For more details on how RSEI works, see the *Evaluation of RSEI Model Runs* report.

The remainder of this subsection describes the RSEI model structure and results. Section I 2.2.1 discusses how RSEI uses TRI to calculate relative risk, Section I 2.2.2 presents the preliminary RSEI results, and Section I 2.2.3 presents information on using RSEI for an environmental justice screening. See Section 4.0 for discussion of how the TRI reported discharges and transfers were further evaluated and used to create industry rankings.

2.2.1 Calculation of Risk-Related Results

Version 2.1 of the RSEI model calculates values that reflect, for modeled TRI releases and transfers, chronic human health risk-related impacts. The model does not address potential acute human health risks or risks to aquatic life. The analysis also does not account for multiple chemical exposures. The values output by the model can only be interpreted as relative measures and are only meaningful in relationship to one another. EPA's Engineering and Analysis Division (EAD) analyzed RSEI model output encompassing a subset of TRI releases

and transfers of chemicals by facilities to surface waters and POTWs for the year 2000. Although RSEI can model both air and water releases, this model cannot currently account for air deposition modeling that could result in chemical deposition into lakes, streams, and watersheds from stack air emissions.

Using RSEI model results generated by the Office of Pollution Prevention and Toxics (OPPT), EAD conducted analyses of total releases and transfers by facilities to surface waters and POTWs. EAD aggregated the results of the model for discharges to surface waters and transfers to POTWs and ranked the results by point source category and primary SIC code.

RSEI develops four rankings from the TRI data: 1) RSEI risk-related result, 2) modeled hazard, 3) hazard, and 4) total TRI pounds. EAD developed a fifth ranking: EAD toxic-weighting factor (TWF) hazard. These rankings are defined as follows:

- **Risk-Related Results** - The risk-related result is the product of the surrogate dose (estimated using exposure models), the chemical's RSEI toxic weighting factor, and the exposed population. This result requires all necessary modeling parameters to be present, and provides the most comprehensive ranking available by the model. The amount of chemical released is the modeled amount based on the fate and transport of the chemical pounds and physical/chemical properties of the chemical.

- **Modeled Hazard** - This value is computed by multiplying modeled TRI pounds by the RSEI toxic weighting factor of the chemical appropriate for the exposure pathway selected (i.e., inhalation toxicity weight or ingestion toxicity weight). Modeled TRI pounds are those in which all of the required input parameters required to calculate a risk-related result are present. Modeled TRI pounds do not necessarily include all reported discharges to surface waters or POTWs (e.g., pounds may be excluded because other required parameters are not available).

- **Hazard** - This value is calculated for TRI chemicals that have RSEI toxicity weights and provides a perspective regarding the chronic human health hazard of these releases. The hazard score is calculated by multiplying reported TRI pounds by the RSEI toxicity weight of the chemical associated with the release pathway selected (i.e., inhalation toxicity weight or oral toxicity weight). The model uses the inhalation toxicity weight when calculating the hazard score for air releases. For TRI

on-site direct water releases and off-site transfers to POTWs, the model uses the oral toxicity weight (risk-related calculations use toxicity weights for both exposure pathways when modeling the air and water releases from POTWs). For unmodeled releases, RSEI uses the highest toxicity weight for the hazard score. For this analysis, for indirect dischargers, the hazard score accounts for treatment that occurs at a POTW prior to discharge.

- **Total TRI Pounds** - This amount reflects the number of pounds released or transferred that are reported to the TRI. The model includes pounds discharged to surface water by both direct and indirect discharges. For indirect discharges, the reported pounds transferred off site to POTWs are adjusted to account for treatment that occurs at a POTW prior to discharge.

- **EAD Toxic-Weighting Factor (TWF) Hazard** - This value is calculated for TRI chemicals that have EAD TWFs, as developed by EAD's Economic & Environmental Assessment Branch. EAD TWF hazard scores are calculated by multiplying total TRI pounds (described above) by the EAD TWF of the chemical. For more details on how EAD TWFs were calculated, see Appendix A of this report.

The toxicity weights in RSEI are based upon the single, most sensitive chronic health endpoint (i.e., cancer or the most sensitive noncancer effect) for inhalation or ingestion exposure, and do not reflect severity of effects, multiple health effects, or dermal absorption. Neither acute human toxicity nor environmental toxicity are modeled. The analysis also does not account for multiple chemical exposures. The Agency recently published information on development of a screening methodology for cumulative risk assessment (http://cfpub1.epa.gov/ncea/cfm/recordisplay.cfm?deid=22478) . Once this methodology is finalized, EAD can consider applying it to the 304(m) planning process.

RSEI makes two significant assumptions regarding the toxicity of metals and metal compounds. The first assumption RSEI makes is that metal compounds have the same toxicity weight as that of the parent metal, even though the chronic human toxicity of some metal compounds may be higher or lower than the parent metal. The second, conservative assumption is that the entire release consists of the valence state associated with the highest chronic human toxicity (e.g., for chromium, Cr^{+6} versus Cr^{+3}). For more details on toxicity weight calculations,

see the *Evaluation of RSEI Model Runs* report. For more information on metals and their bioavailability, see the February 24, 2003 memorandum entitled "Evaluation of the Appropriateness of Representative Chemicals for Influential Chemical Groups" from Susan Keane and Kristina Watts, Abt Associates, to Lynn Zipf, EPA\OW.

EPA identified several factors associated with TRI reporting that could cause confusion when analyzing RSEI results:

- *Range Reporting:* TRI provides the option for facilities to report releases as specific numbers or as ranges, if appropriate. Specific estimates are encouraged if data are available to ensure the accuracy; however, EPA allows facilities to report releases in the following ranges: 1 to 10 pounds, 11 to 499 pounds, and 500 to 999 pounds. Range reporting is not permitted for PBT chemicals. The RSEI model uses the mid-point of each reported range.

- *Detection Limits:* Companies are required to use their judgement and report the most accurate information. The TRI program does not specify the use (or non-use) of detection limits. TRI guidance states that if a facility reasonably expects a chemical to be present in waste streams, the facility should assume half of the detection limit for estimates. If the facility does not reasonably expect the chemical to be present, they can assume a concentration of zero.

- *The De Minimis Exemption:* TRI includes an exemption such that, in general, chemicals in any process or waste stream below 1 percent (by mass) for non-carcinogens or below 0.1 percent for carcinogens (as defined by OSHA) should be excluded from both threshold and release estimates. The *de minimis* exemption is not applicable to the manufacture of any TRI chemical nor to PBT chemicals.

- *Alternate Certification Statement (Form A):* Starting in 1997, EPA instituted an optional second type of TRI Report, commonly called the Form A. With implementation of Form A, facilities may now certify that the total quantity of a specific chemical released and managed as waste is less than 500 pounds without quantifying estimates to any media. A significant number of Form A's are submitted by every industry each year; Form A's cannot be submitted for PBT chemicals. According to the 2000 Public Data Release 8, 456 Form A's were filed. Initial analysis of RSEI indicates that, because no release quantity can be assigned to any media, RSEI ignores all Form A submissions.

- *Test Data:* EPCRA mandates that facilities use the "best readily available information" to prepare threshold and release estimates for TRI reporting. It does not require the facility to conduct tests on the chemicals. However, if testing has been conducted for any other purpose, the facility is required to consider using the results if they are appropriate.

2.2.2 Preliminary Findings from Risk Screening Level Analysis

RSEI output shows 7,814 facilities reported discharges to surface waters and transfers to POTWs during the year 2000. Of these 7,814 facilities, 6,074 were assigned a risk-related result greater than zero, and 1,740 facilities were assigned a risk-related result of zero. In contrast, 7,625 of the 7,814 facilities were assigned an EAD TWF hazard score greater than zero, while 189 facilities were assigned an EAD TWF hazard score of zero. Analysis also shows that approximately 50 facilities represent 90 percent of both the total national RSEI risk-related result and the EAD TWF hazard score (the specific facilities comprising 90 percent of the two results differ). Therefore, less than one percent of the total number of facilities reporting releases and transfers account for 90 percent of the RSEI model results, either on a risk basis or a hazard basis.

To facilitate analysis of the RSEI model results to support the National Strategy, EAD summed SIC code-specific RSEI results for each of the point source categories with existing effluent limitation guidelines and standards. See Attachment C of the *Evaluation of RSEI Model Runs* report for tables relating SIC codes to point source categories. Some SIC codes fall in more than one point source category.

EAD evaluated the ranked list of point source categories based on the EAD TWF hazard score result. Table 2-1 presents the six point source categories that comprise 90 percent of the EAD TWF hazard score result for the U.S. and the corresponding result of all five rankings discussed in Section I 2.2.1. As part of the initial screening effort, EAD reviewed the top six point source categories to determine and comment on the underlying factors that drive the

EAD TWF hazard scores. See Sections 3.1 through 3.6 of the *Evaluation of RSEI Model Runs* for the summary of initial analysis for each of the six top point source categories.

Note that Table 2-1 also presents the number of facilities that comprise 90 percent of the EAD TWF hazard score for water discharges for each point source category (or SIC code). This information provides an indication of the extent to which the EAD TWF hazard score reasonably represents the hazard for the point source category as a whole rather than that of possibly atypical facility(s). For example, the Steam Electric Power Generation point source category is ranked first using the EAD TWF hazard score, yet greater than 90 percent of the EAD TWF hazard score for this point source category is attributed to only one facility. In contrast, the Pulp, Paper, and Paperboard point source category is ranked fourth using the EAD TWF hazard score; 90 percent of the EAD TWF hazard score for this point source category is attributed to 50 facilities.

To support the point source category analysis, EAD also analyzed the RSEI results for reported discharges to surface waters and POTWs by each primary 4-digit SIC code. EAD evaluated the ranked list of SIC codes based on the risk-related result, and focused on the 16 SIC codes that comprise 90 percent of the risk-related result for the U.S. Table 2-2 presents the results of all five rankings discussed in Section I 2.2.1 by 4-digit SIC code, and it presents the number of facilities that comprise 90 percent of the risk-related result for water discharges for each SIC code.

To customize RSEI output for analyses supporting the *Strategy*, the TRI pounds reported transferred to POTWs from indirect dischargers were adjusted to account for removals that occur at the POTW. EAD used the POTW removal efficiencies included in the RSEI model to adjust the pounds reported transferred to a POTW to reflect the pounds discharged to the receiving stream.

See Section 4.0 for discussion of how the TRI reported discharges and transfers were further evaluated and used to create industry rankings. In addition to the facility-specific

activities discussed the *Evaluation of RSEI Model Runs* report, EAD recommends conducting the following model validation activities:

- Validate the risk-related results assigned to the 52 facilities that contribute 90 percent of the RSEI risk-related results.
- Validate differences in risk-related results for sites with similar pounds of discharge within an SIC code.
- Further investigate the basis for the chemical removal efficiencies used in RSEI for discharges to publicly owned treatment works (POTWs).
- Further investigate risk-related results of zero to determine if they are valid or due to missing or incomplete data.
- Further investigate and list the exposed population for facilities with relatively high or low risk scores.
- Further investigate chemicals with zero risk-related results, including determination of how many facilities reported release of those chemicals.

Table 2-1

Ranking of Point Source Categories That Comprise 90% of EAD TWF Hazard

40 CFR Part	Point Source Category/SIC Code	EAD TWF Hazard Ranking [a]	Risk-Related Results Ranking [b]	TRI Pounds Ranking [c]	Hazard Ranking [d]	Modeled Hazard Ranking [e]	Number of Facilities Contributing 90% of EAD TWF Hazard[f]
423	Steam Electric Power Generation	1	1	13	1	2	1
414	Organic Chemicals, Plastics and Synthetic Fibers	2	6	2	2	1	4
429	Timber Products Processing	3	36	57	35	42	10
430	Pulp, Paper, and Paperboard	4	12	4	8	10	50
N/A	SIC 5171: Petroleum Bulk Stations and Terminals	5	19	74	28	39	2
419	Petroleum Refining	6	10	6	7	4	16

[a]**EAD TWF Hazard Ranking** - EAD TWF hazard scores are calculated by multiplying total TRI pounds (described below) by the EAD TWF of the chemical.
[b]**Risk-Related Results** - The risk-related result is the product of the surrogate dose (estimated using exposure models), the chemical's toxic weighting factor, and the exposed population.
[c]**Total TRI Pounds** - This amount reflects the number of pounds released or transferred that are reported to the TRI.
[d]**Hazard** - The hazard score is calculated by multiplying reported TRI pounds by the toxicity weight of the chemical associated with the release pathway selected (i.e., inhalation toxicity weight or oral toxicity weight).
[e]**Modeled Hazard** - This value is computed by multiplying modeled TRI pounds by the toxic weighting factor of the chemical appropriate for the exposure pathway selected (i.e., inhalation toxicity weight or ingestion toxicity weight).
[f]This value represents the number of facilities whose EAD TWF hazard scores, when summed, account for 90% of the hazard for that point source category.

Table 2-2

Summary Statistics for Point Source Categories That Comprise 90% of EAD TWF Hazard

EAD TWF Hazard Rank	Point Source Category [b]	Number of Facilities Reporting to 1997 U.S. Economic Census	Facilities Reporting to TRI (2000)		Facilities Reporting Water Release or Transfer in TRI (2000)[a]		Number of Water-Discharging Sites Assigned EAD TWF Hazard
			Number of Facilities	Percentage of Facilities	Number of Facilities	Percentage of Facilities	
1	Steam Electric Power Generation	6,212	638	10.3	342	53.6	342
2	Organic Chemicals, Plastics and Synthetic Fibers	1,570	996	63.4	576	57.8	574
3	Timber Products Processing	8,940	373	4.2	102	27.3	87
4	Pulp, Paper, and Paperboard	512	328	64.1	232	70.7	230
5	SIC 5171: Petroleum Bulk Stations and Terminals	9,104	502	5.5	167	33.3	167
6	Petroleum Refining	242	183	75.6	136	74.3	136

[a]The number of facilities reporting a direct or indirect water discharge to TRI. This number excludes facilities with no releases, facilities with only air and/or solids releases, or facilities that are not required to report due to small size or not exceeding reporting thresholds.

[b]Some SIC codes were included in multiple point source categories. See Section 3.0 and Attachment C for further information regarding EPA's methodology to relate SIC codes to point source categories. None of the SIC codes included in the RSEI analyses for these top 6 point source categories overlap with any other point source categories.

2.2.3 Preliminary Findings from Environmental Justice Analysis

This subsection evaluates the possibility of using the RSEI model to evaluate environmental justice (EJ). RSEI is currently able to calculate impacts by age group and gender, and could be enhanced to aggregate results by race, income, or behavior factors that affect exposure. As discussed in Section I 2.2, part of the RSEI determination of potential chronic human health risk evaluates likelihood of exposure based on the pathway of release and the number of people exposed. EPA examined the RSEI data sources to see if the RSEI output defined impacts on groups by race and socioeconomic status.

RSEI evaluates the exposure pathway by assuming that facilities discharge chemicals into the nearest stream reach, unless the actual receiving body is known (in which case RSEI uses the reported reach). For each stream, RSEI assumes chemicals will be present up to 200 kilometers downstream from the discharge location. For each discharge, RSEI estimates the chemical concentration in fish in these reaches and determines if the reach is used for drinking water. For more details on how RSEI calculates exposure, see the memorandum entitled "Procedure to Modify RSEI Model for Environmental Justice Indicators," dated January 13, 2003, from Susan Keane, Abt Associates, to Lynn Zipf, EPA.

RSEI evaluates fish ingestion based on a county-level data set created from fishing or hunting/fishing licenses from state fish and wildlife data for 1996 (or 1997 if 1996 data were not available). RSEI matches the county-level data in conjunction with U.S. Census data to estimate the number of people who would likely ingest fish by age and by gender. RSEI estimates the chemical concentration in each fish based on fate and transport in streams to which chemicals are released. Matching all these data together, RSEI estimates the human exposure resulting from fish ingestion.

RSEI evaluates drinking water intake based on Safe Drinking Water Information System (SDWIS) data, which lists intake location and the number of people served by each water system. In cases where one water system uses multiple intakes, RSEI assumes that the

population of the water system is exposed to the full chemical concentration at each water intake. SDWIS contains only the number of people served by each drinking water system and does not provide demographic or location information for those served. RSEI determines age-sex categories for locations based on the U.S. Census, and applies the ratios to the populations reported in SDWIS.

To support an EJ analysis, data are preferably reported by geographic area of concern. Currently, RSEI calculates the likelihood of exposure at the "Indicator Element" level, which is defined as the relative impact of a given release of a particular chemical from a particular reporting facility. Indicator elements are then aggregated to represent the impact resulting from an industry or a chemical or a geographic area. Although RSEI provides aggregate results by geographic area, the aggregation does not represent the impacts on that area from nearby indicator elements (e.g., a chemical flowing downstream from a different state). For air releases, RSEI can calculate impacts of all releases regardless of origin; however, RSEI cannot perform this level of analysis for water discharges.

Because the fish exposure analysis is based on county-level data, RSEI could be modified to support an EJ analysis from the fish consumption data. However, the SDWIS data used do not provide demographics related to age, sex, or geographic location. Drinking water intake estimates also do not factor in drinking water wells.

For RSEI to support an EJ analysis for just the fish consumption exposure, EPA recommends some modifications to the model. First, EPA would need modify the RSEI model to produce a data set for environmental justice analysis of potential disparate impacts that may result from consumption of non-commercial fresh-water fish caught for recreational or subsistence purposes. The data set created will allow EPA to evaluate impacts of contaminated fish consumption on different racial, income, and age groups in specific geographic areas. To modify the drinking water exposure estimates to support an EJ analysis would require data sources outside of SDWIS and restructuring the drinking water analysis portion of RSEI.

2.2.4 Potential Susceptible Populations Analysis

Another potential application of the RSEI model is the evaluation of disproportionate impacts on the health of susceptible populations, such as children and the elderly. The previous section (Section I 2.2.3) discusses EPA's efforts to utilize RSEI to aggregate results by race, income, or behavior factors that affect exposure. This effort could be extended to aggregate results by age, allowing an analysis of impacts of TRI discharges on the health of children and the elderly. This application will be considered for potential development once the EJ analysis has been completed and reviewed.

3.0 PERMIT COMPLIANCE SYSTEM DATA AND ANALYSES

The Office of Enforcement and Compliance Assurance (OECA) maintains EPA's Permit Compliance System (PCS). EAD used PCS, along with data from several other sources, including the Effluent Data Statistics System (EDSS) program, Standard Industrial Classification (SIC)/Point Source Category (PSC) Crosswalk, Chemical Abstract Service (CAS) registry numbers, and EAD's Toxic Weighting Factors (TWFs), to develop the PCSLoads2000 database tool for Factor 1 analyses. PCSLoads2000 is a Microsoft Access™ database that estimates the pollutant loadings discharged by facilities, industries, and point source categories. The purpose of this database is to compile the loadings (both mass-based and toxic-equivalent) to identify facilities, industries, and point source categories that are significant dischargers of pollutants and that may impact human health and the environment. EAD intends to use the results of this database to:

- Develop the proposed 2004/2005 Biennial 304(m) Plan;
- Develop a process to establish priorities for the Effluent Guidelines Program;
- Provide an initial screening review of readily-available data to determine the quantity of pollutants discharged from facilities, industries, and point source categories; and
- Create an initial list of potential industries and categories that warrant further examination.

In addition, PCSLoads2000 can be used to evaluate the pollutant loadings in reported discharges from facilities, industries, and point source categories.

3.1 Description of PCS

PCS, operated by OECA, was developed in 1974. PCS automates entry, updating, and retrieval of NPDES data and tracks permit issuance, permit limits and monitoring data, and

other data pertaining to facilities regulated under NPDES. Major dischargers are required to submit effluent monitoring data to the permitting authority on the DMR forms. These data are then entered into PCS by the permitting agency and evaluated for compliance with the NPDES permit requirements.

PCS contains information that is required by the NPDES permit program. For example, PCS records information for monitored parameters required in the NPDES permit. Parameters in PCS include water quality parameters (e.g., dissolved oxygen and temperature); specific chemicals (e.g., phenol); bulk parameters (e.g., biological oxygen demand); and wastewater flow. PCS only contains data for parameters limited in the facility's NPDES permit, although other pollutants may be discharged. PCS contains information for facilities with any SIC code. The SIC code numbering system identifies establishments by the type of activity in which they are engaged.

PCS provides comprehensive data for major direct discharging facilities. However, EAD identified the following constraints and limitations to using PCS for the analysis described in this document:

- Data entered into PCS undergo limited QA/QC screening prior to their addition. In addition, data are entered into PCS manually and therefore errors in the data entry can occur.
- In general, only pollutant discharges from major facilities that directly discharge to navigable water and have a NPDES permit are captured by PCS. Thus, because some facilities that discharge are not included in PCS, it does not provide a comprehensive view of all pollutant discharges to the Nation's waters. However, the majority of the major discharges are included in PCS.
- PCS reports the primary SIC code that represents the principal activity causing the facility's discharge. Other activities may be ongoing at the facility that would not be reflected in PCS.
- PCS is designed as a permit tracking system and therefore does not contain production information.

- PCS only contains data for parameters a facility is required by permit to monitor. Therefore, the facility is not required to monitor or report all pollutants actually discharged.

- PCS may have incomplete data for a facility.

Missing data elements in PCS have an impact on the analysis in this report, when one of the following is true:

- There are no corresponding units for the pollutant concentration and/or quantity data;

- There is no reported wastewater flow rate to associate with a pollutant concentration (or vice-versa), and the pollutant quantity is not reported; and

- There is no pollutant parameter associated with the pollutant concentration and/or quantity data. Pollutant parameter refers to the code for the name of the parameter.

Despite the limitations and constraints of data in PCS, EAD has determined that the data are appropriate for an initial screening level review and prioritization of the pollutant loadings discharged by industrial categories. Further evaluation of the prioritized categories will occur in a second level of review. The second level of review may include additional data collection and additional verification of data reported in PCS. See Section 4.0 for discussion of how the TRI reported discharges and transfers were further evaluated and used to create industry rankings.

3.2 Description of EDSS

Because units of measure vary widely in PCS, OECA developed EDSS to estimate mass loadings based on data stored in PCS. EDSS uses existing PCS reported mass loading values or multiplies reported discharge flows and effluent concentrations to estimate loadings for each outfall (discharge pipe), taking into account the various units of concentration

and flow rates. For the analysis in this report, EDSS was used to provide annual pollutant mass discharges.

For more information on how the EDSS program works, see "Guidance and Standards for Calculating Point Source Loads Using the Permit Compliance System (PCS), Point Source Load Reductions as an Indicator of Water Quality Improvements" (US EPA 1997). See Chapter 7 of the "Permit Compliance System Generalized Retrieval Training Manual" (US EPA 2001d) for more information regarding accessing EDSS.

3.3 PCSLoads2000 Use for Human Health and Environmental Impacts Analysis

The PCSLoads2000 database was created using the data sources described in Section 2.0 of the *Development of PCSLoads2000* report. The following steps were used to develop the database:

(1) EAD downloaded the selected facility information from PCS;

(2) EAD executed the EDSS program, using PCS Year 2000 data, to calculate the annual mass-based pollutant loadings for all major facilities;

(3) The primary SIC codes reported in PCS were associated with the appropriate point source categories using the table identified as "SIC/PSC Crosswalk"; and

(4) The EAD TWFs were associated with each parameter reported in PCS using the tables identified as "SUPERCAS" and "EAD TWF Requests".

As discussed in Section 2.2 of the *Development of PCSLoads2000* report, EDSS provides outputs that use different assumptions for concentrations reported as below detection limit (BDL): BDL is set equal to zero, BDL is set to the detection limit, or BDL is set equal to half the detection limit. For PCSLoads2000, EAD developed a hybrid approach where BDL was set equal to zero for parameters never detected by the facility in 2000. For parameters sometimes detected and sometimes not, BDL was set equal to half of the detection limit.

EAD chose this approach after examining EDSS results calculated with BDL set equal to half the detection limit. This approach resulted in relatively high calculated mass loads for some parameters reported with a wide range in detection limits (e.g., PCBs and dioxins). The high mass loads reflected high reported detection limits for discharges in which the parameters were never detected possibly as a result of relatively insensitive laboratory analyses. By assuming a value of zero, the pollutant discharges are likely to be underestimates because facilities generally monitor for only those pollutants likely to be generated by their industrial processes.

For parameters sometimes detected and sometimes not, BDL was set equal to half of the detection limit. EAD considered half the detection limit a reasonable estimate of the unknown concentration for an initial screening level review and prioritization of the toxic-weighted pollutant loadings discharged by industrial categories.

3.4 Quality Review

EAD reviewed the output from PCSLoads2000 for accuracy, completeness, and correctness. This review was conducted in stages as the database was developed.

Completeness checks: EAD verified that the number of facility records in the PCS Facility Data table equaled the number of facility records in the PCS 2000 table (EDSS Output). As reported in Table 2-2, EAD also checked the completeness of facility information from PCS. EAD considered the information available for major dischargers to be sufficiently complete for this screening level review.

Database queries. Database queries were used to analyze PCSLoads2000 data and to generate output tables. Programming code used to develop each query was reviewed by a second team member, verifying the logic. During the development of these queries, EAD completed record counts verifying the number of records in the output table equaled the number

of records in intermediate queries, to ensure that no data were missing and that there were no duplicate data.

Reasonableness checks - pollutant loads. EAD reviewed the EDSS output (i.e., the calculated kg/year for each discharge pipe) for those discharges with the highest toxic-weighted loads (i.e., dioxins). EAD identified some calculated discharges that were higher than expected, compared them to PCS reported concentrations and flows and TRI-reported releases, and identified some likely errors in recording units of measure. In PCS, EAD discovered that one facility reported dioxin in units of kg/L which is extremely unlikely. This unit was corrected to pg/L and EAD was able to use the data in the PCSLoads2000 database. If the EDSS output and TRI-reported releases were similar, EAD considered the EDSS output to be acceptable.

Reasonableness checks - facility loads. EAD checked the toxic-weighted loadings of facilities to ensure that they comprise a reasonable percent of the total national discharge. For some facilities which comprised a very high percent of the national discharge, EAD reviewed monthly information reported in PCS and identified non-continuous, intermittent discharges. In one case a facility was only permitted to discharge six months per year. In another case, the facility discharged occasionally (i.e., in batches). As applied by EAD, EDSS had extrapolated the intermittent discharge over the entire year, which overestimated the discharge. EAD recalculated these discharges from raw PCS data and corrected the mass loads in the PCS2000 table.

EAD also sought other available information (such as the NPDES permit fact sheet) to correct unrealistic flow rates. In one case, where no data were available, the facility with questionable loads was deleted from this screening level analysis.

Reasonableness checks - pollutant identity. EAD ranked the pollutants discharged from each point source category and verified that the pollutants comprising the majority of the load could be reasonably related to operations in the industry. As a result of this review, EAD corrected the SIC/PSC crosswalk.

Conclusion. EAD has determined that PCSLoads2000 data are usable for an initial screening level review and prioritization of the toxic-weighted pollutant loadings discharged by industrial categories. EAD checked for and corrected apparent errors in PCSLoads2000; further evaluation of the prioritized categories will occur in a second level of review. The second level of review may include additional data collection and additional verification of data used by PCSLoads2000. See Section 4.0 for discussion of how the TRI reported discharges and transfers were further evaluated and used to create industry rankings.

Table 3-1 presents the point source categories that account for the top 90 percent of the total toxic-weighted loads, and the loads associated with these point source categories. Table 3-2 presents the industrial categories that are not part of a point source category that are included in the top 90 percent of the total toxic-weighted loads from these industrial categories.

Table 3-1

Top 90 Percent Regulated Point Source Categories as Reported in 2000 in PCS

40 CFR Part	Point Source Category	Toxic Equivalents (tox lbs/yr)	Percent of Total Toxic Equivalents	Cumulative Percent of Total Toxic Equivalents
430	Pulp, paper, and paperboard	9,406,245	31%	31%
423	Steam electric power generation	8,734,590	29%	60%
414	Organic chemicals, plastics, and synthetic fibers	2,251,012	7%	68%
420	Iron and steel manufacturing	2,051,270	7%	75%
422	Phosphate manufacturing	1,970,639	7%	81%
421	Nonferrous metals manufacturing	1,306,014	4%	85%
415	Inorganic chemicals	1,121,542	4%	89%
418	Fertilizer manufacturing	1,114,181	4%	93%

Table 3-2

Top 90 Percent Industrial Categories* as Reported in 2000 in PCS

SIC Category Code	SIC Category Name	Toxic Equivalents (tox lbs/yr)	Percent of Total Equivalents	Cumulative Percent of Total Toxic Equivalents
4941	Water Supply	611,324	64%	64%
97	National Security & International Affairs	109,122	11%	76%
49	Electric, Gas, & Sanitary Services	91,622	10%	85%
28	Chemical & Allied Products	35,444	4%	89%
99	Non classifiable Establishments	29,591	3%	92%

*Does not include SIC code 4952, Sewerage Systems. Sewage systems are not subject to the CWA §304(m) effluent guidelines planning process. Rather, they are regulated under CWA Section §301(b)(1)(B).

4.0 TRI AND PCS INDUSTRY RANKINGS

Following the initial screening-level review of TRI and PCS data, as described in Sections I 2.0 and I 3.0, EAD conducted additional data quality reviews of reported pollutant discharges for certain top ranking industries and facilities. These reviews identified both misreported and miscalculated data, as described in addenda to the *Development of PCSLoads2000* report and the *Evaluation of RSEI Model Runs* report. EAD made changes to the databases used to calculate the industry loads based on PCS data (PCSLoads2000) and TRI data (TRIReleases2000), including:

- Adjustments to SIC codes associated with reported discharges (affecting the point source category or industry to which the pollutant loads are attributed);
- Revisions to TWFs used for certain TRI chemical categories (e.g., dioxin, PACs) to better reflect the specific chemicals discharged by a specific industry;
- Adjustments to the point source category/SIC crosswalk to eliminate or minimize double counting of pollutant loads between industry categories; and
- Facility- and pollutant-specific adjustments to reflect misreported or miscalculated pollutant loadings.

EAD then reestimated the reported pollutant discharges by industry category and reranked the industries.

4.1 Description of Ranking Methodology

EPA estimated pollutant loads discharged from facilities in 2000 using both PCS and TRI data, as described in Sections I 2.0 and I 3.0. Discharge data reported to PCS may be reported as either a concentration (e.g., mg/L) or a mass discharge (e.g., pounds/day). Facilities are also required to report flow (gallons/day). In addition, discharge data are reported on a

varying frequency (e.g., monthly, biannually), depending on the specific permit requirements. Finally, facilities may report discharges from multiple discharge points.

With PCS data, EPA calculated annual mass-based pollutant loads (in pounds) discharged by reporting facilities by first calculating individual pollutant loads for each reported pollutant at each discharge location, and then summing the loads by pollutant for the entire facility. Values that were below the detection limit were estimated to be half the detection limit if any values during the year were reported above the detection limit. If all values were reported below the detection limit, the value was assumed to be zero. To estimate the discharge of toxic weighted pound equivalents (TWPE), EPA weighted each pollutant's discharge load with the EAD toxic weighting factor (TWF). The following equation presents this calculation for pollutants reported in PCS by concentration:

$$TWPE_{PCS,facility} = \sum_{pollutant} \left(\sum_{pipes} (concentration \times flow) \right) \times TWF_{pollutant}$$

In TRI, facilities report an annual load (in pounds or grams) of pollutant released either directly to a receiving stream or transferred to a POTW. For facilities discharging directly to a stream, the loads were taken directly from the reported TRI data. To estimate the discharge of TWPE, EPA weighted each pollutant's discharge load with the EAD TWF:

$$TWPE_{TRI,facility} = \sum_{pollutant} (Mass\ Discharged_{stream} \times TWF_{pollutant})$$

For TRI facilities that transfer their discharge to POTWs, EPA first adjusted the pollutant loads transferred to POTWs to account for pollutant removal that occurs at the POTW prior to discharge to the POTW's receiving stream. This adjustment was made using POTW removal efficiencies from the RSEI model. EPA then summed the annual loads discharged by

pollutant for the entire facility. EPA estimated the discharge of TWPE by weighting each pollutant's discharge load with the EAD TWF.

$$TWPE_{TRI,facility} = \sum_{pollutant} \left\{ \left[\text{Mass Transferred}_{POTW} \times (1 - \text{POTW removal}) \right] \times TWF_{pollutant} \right\}$$

To analyze the pollutant loads at the point source category level for PCS and TRI, EAD related SIC codes to point source categories. Facilities are required to report a primary SIC code that best characterizes the activities occurring at the facility. As mentioned above, in some cases EPA identified and corrected instances where the SIC code was incorrectly reported or where the SIC code did not reflect the activities resulting in the wastewater discharge. EPA then aggregated the TWPE results by point source category to create final industry rankings. See Appendix B for the final industry ranking tables.

4.2 Differences Between PCS and TRI Industry Rankings

Due to the differences in the TRI and PCS data, the industry rankings differ based on whether PCS or TRI are used. In general, the primary differences in these two sets of data, which impact the overall rankings, are:

- The pollutants included in TRI and PCS databases are different, although some pollutants are reported to both;
- Annual pollutant loads are reported to TRI, but are calculated from PCS measurement data; and
- The primary SIC code reported in TRI for a facility may differ from the SIC code reported in PCS for that same facility.

Table 4-1 presents a more specific comparison of the data included in PCS versus TRI. Please note that the same EAD TWFs are used in both the TRI and PCS industry rankings.

Table 4-1

Comparison Table Between TRI and PCS Data Parameters

Parameter	TRI	PCS
Pollutants Reported	Pollutants listed on the TRI toxic chemical list are reported to TRI. • There are 582 individual chemicals, and 30 chemical groups on the TRI toxic chemical list. • TRI includes only chemical pollutants, not wastewater parameters such as BOD_5. • TRI pollutants include chemical groups that may contain multiple individual compounds (such as "Polycyclic Aromatic Compounds"). • Certain pollutants (PBT chemicals) were required to be reported for the first time in 2000.	Parameters monitored under NPDES permits are reported to PCS. • Approximately 3,100 parameters are reported to PCS, but an individual facility typically reports only those required in their permit. • PCS includes chemical and biological pollutant parameters. • PCS chemical pollutants are generally listed as individual compounds (such as "benzo(a)pyrene"). • PCS includes bulk parameters (e.g., BOD_5, COD, TSS)
Facilities Included in the Database	Facilities are required to report to TRI if they meet three criteria: 1. Are in a covered SIC Code (10, 12 , 20-39, 4911, 4931, 4939, 4953, 7398, 5169, or 5171); and 2. Employ 10 or more full-time employees; and 3. Manufacture, process, or otherwise use TRI-listed chemicals above threshold quantities • TRI includes facilities that discharge directly to waterbodies and facilities that discharge to POTWs.	Facilities with NPDES permits report to state agencies. Most state agencies report the facility information to PCS, some states may only include monitoring and compliance data for major facilities. • Only facilities discharging directly to waterbodies are represented in PCS. • Only major facilities were used in the PCS analysis.
SIC Code	Facilities are instructed to report the primary SIC code which represents the major portion of their business.	Facilities may report SIC codes associated with their wastewater discharge, which is not necessarily their primary SIC code.

Parameter	TRI	PCS
Pollutant Loads	Loads are reported to TRI on a pounds per year basis. • TRI reported values may be based on monitoring data, use of emission factors, mass balance calculations, or engineering calculations. • The loads from POTW discharges are calculated from TRI data and RSEI POTW removal efficiencies. • TRI guidance instructs facilities to use a concentration equivalent to half the detection limit when estimating releases based on monitoring data for a TRI chemical known to be present in a sample.	Loads are calculated from PCS data. • PCS reported values are based on measurements. • Measurement values are reported to PCS as concentrations (e.g., mg/L) or loads (e.g., pounds/day), usually on a monthly basis. • The PCS measurement data and an assumption on discharging days per year are used to calculate loads on a pounds per year basis. • In this analysis, measurement values that were below the detection limit were estimated to be half the detection limit if any values during the year were reported above the detection limit. If all values were reported below the detection limit, the value was assumed to be zero.
Toxic Weighting Factors	Toxic weighting factors used were obtained from EPA's Office of Water, Engineering and Analysis Division. • The toxicity of a certain pollutant was measured relative to the toxicity of copper. • Toxicity was assessed based on chronic freshwater aquatic criteria and on human health criteria for the consumption of fish.	
Toxic Weighting Factor Assignment	TRI chemical groups are assigned the TWF of one representative chemical. For example, the "Polycyclic Aromatic Compounds" are assigned the TWF for benzo(a)pyrene.	• In general, PCS parameters are assigned individual TWFs. • There are no TWFs for bulk parameters that impact water quality.

5.0 U.S. GEOLOGICAL SURVEY (USGS) DATA

EAD is in the process of reviewing several data resources from the U.S. Geological Survey (USGS), including the National Water Quality Assessment Program (NAWQA), the NAWQA National Report on Nutrients, National Water Information System (NWIS), and Spatially Referenced Regressions On Watershed Attributes (SPARROW). These resources provide data and information on the water quality of waterbodies using different sources and types of data. The NAWQA Program can be used to determine a national assessment of water quality. The NAWQA Nutrient Report describes the findings of the NAWQA Program on water quality issues caused by nutrients. NWIS provides access to real-time surface water and ground water data. SPARROW can be used to estimate contaminant transport, concentrations in stream reaches, and regional characterization of water quality conditions. Using these data resources, EAD can identify chemical contaminants of concern and the corresponding geographical location. EAD's review of these resources will not occur in the screening phase of this current planning cycle. For more information regarding these tools see Section III 14.0.

6.0 OFFICE OF SCIENCE AND TECHNOLOGY DATA AND RESOURCES

EAD reviewed six resources from EPA's Office of Science and Technology (OST), Standards and Health Protection Division (SHPD). Two of the resources, The National Sediment Contaminant Point Source Inventory (1997) and the BASINS Model, provide direct links between pollutants and point source dischargers (e.g., industrial dischargers). Although BASINS allows modeling of impacts of point source discharges for specific water bodies, EAD does not anticipate its use during this planning cycle. The National Sediment Contaminant Point Source Inventory (1997) is discussed in Section I 6.1; BASINS is discussed in Section III 15.1.1. The remaining four resources (the National Listing of Fish and Wildlife Consumption Advisories, the National Fish Tissue Study, the draft National Sediment Quality Survey, and the Beaches Environmental Assessment and Coastal Health Act) provide chemical-specific data, but do not link the data to point source dischargers. All the resources provide links between pollutant contamination and geographic area. Therefore, these resources will not be used in the screening phase of this current planning cycle because pollutant specific information needs to be bridged to discharging sources. Section III 15.0 discusses these four resources.

6.1 Resources Providing Chemical-Specific and Point Source Discharge Data

Both The National Sediment Contaminant Point Source Inventory (1997) and the BASINS Model may identify industry categories that discharge pollutants included in their scope. Section I 6.1.1 presents information on The National Sediment Contaminant Point Source Inventory (1997), Section III 15.1.1 presents information on the BASINS Model, and Section I 6.1.2 presents conclusions and recommendations for these resources and using them to evaluate human health and environmental impacts.

6.1.1 The National Sediment Contaminant Point Source Inventory (1997)

The National Sediment Contaminant Point Source Inventory (1997) identifies probable point source contributors to sediment pollutants using information from the Permit Compliance

System (PCS) and the Toxic Release Inventory (TRI). These data are linked to specific dischargers and therefore, can be linked to a specific industry category.

6.1.1.1 Description of Resource

In 1997, OST conducted a screening analysis identifying probable point source contributors of sediment pollutants and reported its results in The National Sediment Contaminant Point Source Inventory: Analysis of Facility Release Data (EPA-823-D-96-001). This analysis was based on1994 discharge data compiled in the PCS and 1993 data reported to the TRI for discharges occurring in 1993. PCS includes discharges reported by direct-discharging facilities. OST evaluated both the direct and indirect releases reported in TRI, and developed a sediment hazard scoring system. They calculated the annual chemical load from each facility represented in PCS and TRI, then multiplied this load by the sediment hazard score to calculate a hazard-weighted release. The hazard-weighted releases for each industry category were summed and the categories were ranked. TRI data and PCS data were analyzed separately. See the February 6, 2003 EPA brief The National Sediment Contaminant Point Source Inventory (1997) for more details.

As discussed in the Analysis of Facility Release Data, the The National Sediment Contaminant Point Source Inventory (1997) contains various limitations to consider when using the information. OST identified the following three major limitations of the inventory for purposes of EAD's analyses: 1) inability to predict whether a point source release contributes to a sediment contamination problem; 2) inability to predict where point source releases might contribute to sediment contamination (i.e., the geographic analyses are limited to identifying areas or watersheds where point source releases occur); 3) inability to access contributions from nonpoint sources (e.g., pesticides and household chemicals) and from point sources not represented in the PCS or TRI databases; and 4) the age of the data used is at least one permit cycle ago.

In its report, OST also notes that the certainty with which sediment toxicity can be predicted for each chemical varies based on the quality of available data and the appropriateness of exposure assumptions. OST identified the following limitations of estimated sediment chemistry screening values:

- Values may be overprotective or underprotective of actual site-specific sediment due to varying methodological and exposure conditions;
- Values are general approximations of concentrations that may potentially lead to adverse effects since data and assessment methods are continuously updated; and
- Values are composites of several different sediment assessment approaches and multiple data sources.

Therefore, OST recommends using the values for screening-level analyses only.

6.1.1.2 Resource Use for Human Health and Environmental Impacts Analysis

The National Sediment Contaminant Point Source Inventory: Analysis of Facility Release Data provides information on the specific chemical contaminants and their industrial source of discharge (i.e., specific facility and industry category). Three categories were identified in both the analysis of the 1993 TRI data and the 1994 PCS data as major dischargers of sediment contaminants:

- Metal Products and Finishing (covered under multiple effluent guidelines including Battery Manufacturing, Coil Coating, Copper Forming, Electrical and Electronic Components, Electroplating, Porcelain Enameling, Iron and Steel Manufacturing, Metal Finishing, Metal Products and Machinery, and Nonferrous Metals Forming and Metal Powders);
- Primary Metals (covered under multiple effluent guidelines including Aluminum Forming, Copper Forming, Ferroalloy Manufacturing, Iron and Steel Manufacturing, Metal Molding and Casting (Foundries), Metal Products and Machinery, Nonferrous Metals Forming and Metal Powders, and Nonferrous Metals Manufacturing); and

- Industrial Organic Chemicals (covered under multiple effluent guidelines including Gum and Wood Chemicals and Organic Chemicals, Plastics and Synthetic Fibers).

Several factors were used to weight chemical releases for sediment contamination potential. There is limited discussion of these factors in the brief. The TRI and PCS do not provide a complete picture of wastewater discharges, and the data used for the report are almost ten years old. In addition, TRI reporting requirements have changed since reporting year 1993, including the addition of certain industry categories and the lowering of reporting thresholds for PBT chemicals. Also, based on review of recent data, EAD may need to perform a comprehensive analysis of inputs to and outputs from sewerage systems and public utilities. Data in the 1994 PCS show that the majority of sediment contaminants (especially divalent metals) were from these point sources.

EAD used data from the National Sediment Contaminant Point Source Inventory (1997) to conduct an initial screening of industries for Factor 2 (see the Factor 2 status report). In addition, the methodology used to analyze PCS data for the *Inventory* could be used in EAD's ongoing analysis of PCS loads and trends. For future planning cycles, EAD is considering using the methodology of the inventory analysis to review more recent PCS and TRI data. See also Section I 3.0 for a discussion on EAD's PCS analysis for use in the current planning cycle.

EAD plans to compare The *National Sediment Contaminant Point Source Inventory* (1997) and draft National Sediment Quality Survey (2001) (see Section III 15.2.3) factors used to weight chemical releases for sediment contamination potential to the "toxic weighting factors" it has used to analyze the cost-effectiveness of effluent limitations guidelines and standards and the environmental indicators included in RSEI. EAD plans to also compare these factors to the chemical ranking factors used by OPPT. EAD may consider incorporating sediment hazard weighting factors into other risk screening tools (EAD's TWFs, RSEI) if they are not yet included.

For chemicals with high sediment contamination weights, EAD plans to use OPPT tools to obtain information about the relative amounts of these chemicals in commerce in the U.S. (and to identify chemicals no longer in commerce). EAD will also use the OPPT tools to identify all industries from which the identified sediment contaminants may be discharged. However, this review will not occur during this planning cycle because pollutant specific information needs to be bridged to discharging sources.

6.1.2 Conclusions/Recommendations for Resources Providing Chemical-Specific and Point Source Discharge Data

As discussed above, EAD plans to review the pollutants in the resources, eliminate those no longer in commerce using data from OPPT, and identify current sources for the rest. This includes persistent bioaccumulative toxics (PBTs), which are included in the *National Sediment Contaminant Point Source Inventory* (1997), and may be currently discharged. Further information will be included before Final Agency Review.

EAD believes these resources can be used as tools in subsequent screening analyses, and plans to review resource data in future years, focusing on contaminants that may be discharged from point sources.

7.0 OFFICE OF GROUND WATER AND DRINKING WATER DATA

The Office of Ground Water and Drinking Water (OGWDW), along with EPA's ten regional drinking water programs, oversees the implementation of the Safe Drinking Water Act (SDWA). EAD is currently reviewing two data resources established by the SDWA: 1) the Candidate Contaminant List (CCL) and 2) the Source Water Assessment Program (SWAP). The review of these two resources will not occur in the screening phase of this current planning cycle. For more information, see Section III 16.0.

8.0 OFFICE OF RESEARCH AND DEVELOPMENT TOOLS

EAD reviewed six resources from EPA's Office of Research and Development. Two of the resources, the Environmental Monitoring and Assessment Program (EMAP) and Regional Vulnerability Assessment (ReVA) provide regional, chemical-specific data. The remaining four resources, the Frames/Multimedia, Multipathway and Multireceptor Risk Assessment (3MRA) Model, the Total Human Exposure Risk Database and Advanced Simulation Environment (THERdbASE), and the Total Exposure Model (TEM), provide chemical exposure data. None of these six resources will be used in the screening phase of this current planning cycle. For more information regarding these tools see Section III. 17.0.

9.0 EMERGING CONCERNS AND OTHER DATA CONSIDERED

EAD also reviewed the following additional data and resources:

- Children's Health
- Endocrine Disruption
- Pathogen Impacts;
- Regional Resources, such as the Gulf Hypoxia Action Plan; and
- National Report on Human Exposure to Environmental Chemicals.

As discussed in Section III 18.0, none of these five resources will be used in the screening phase of this current planning cycle.

10.0 NON-FEDERAL AGENCY RESOURCES

EAD identified and reviewed one non-federal agency resource for its screening level review phase: the January 2003 report entitled *Toxic Releases and Health: A Review of Pollution Data and Current Knowledge on the Health Effects of Toxic Chemicals* prepared by the U.S. Public Interest Research Group (PIRG). Section I 10.1 discusses the resource and how it can be used for human health and environmental impacts analysis.

10.1 Toxic Releases and Health: A Review of Pollution Data and Current Knowledge on the Health Effects of Toxic Chemicals

The *Toxic Releases and Health: A Review of Pollution Data and Current Knowledge on the Health Effects of Toxic Chemicals* report was prepared by U.S. PIRG (Public Interest Research Group). It summarizes the amounts of the most hazardous chemicals released by the major sources for TRI reporting year 2000. Although the report is not a risk assessment - it does not draw conclusions potential health effects of TRI releases - it does refer to health assessments that have been conducted for certain communities in proximity to major sources. And although it does not focus exclusively on discharges to water, it is included here to assist the user in understanding the results in comparison with the RSEI results discussed in Section I 2.0. EAD is considering utilizing the approach presented in this report consistent with that approach to make a more appropriate comparison of results.

10.1.1 Description of Resource

The report summarizes combined TRI air and direct water releases (transfers to POTWs are not included) into five chemical groups: 1) Cancer-Causing Chemicals; 2) Developmental and Reproductive Toxicants; 3) Suspected Neurological Toxicants; 4) Suspected Respiratory Toxicants; and 5) Dioxins. Each section summarizes total releases to air and water, and identifies the top ten chemicals released, the top 20 zip codes where releases occur, and the top

10 industrial sectors reporting releases. Each section also includes a "community profile" for the zip code with the highest total amount released.

Although rankings are based on total releases to air and water combined, direct surface water release amounts are presented in most tables. The top 10 chemicals released directly to surface water are:

- Formaldehyde (408,143 pounds);
- Acetaldehyde (195,014 pounds);
- Chloroform (56,341 pounds);
- Naphthalene (48,855 pounds);
- Benzene (22,660);
- Dichloromethane (10,292 pounds);
- 1,3-Butadiene (1,163 pounds);
- Tetrachloroethylene (1,159 pounds);
- Chloroethane (693 pounds); and
- Trichloroethylene (593 pounds).

Table 10-1 lists the top ten industries, ranked by total releases to air and water, and the corresponding direct surface water releases.

Table 10-1

Top 10 Industries Reporting Air and Water Releases to the TRI for Reporting Year 2000

Industry	Direct Releases to Surface Water (pounds/year)
Electric Services	481611
Pulp Mills	343878
Paper Mills	198116
Plastic Materials	108735
Industrial Organic Chemicals	156469
Paperboard Mills	45556
Petroleum Refining	42103
Pharmaceutical Preparations	1950
Reconstituted Wood Products	1101

Table 10-1 (Continued)

Industry	Direct Releases to Surface Water (pounds/year)
Plastic Foam Products	5

Additional details on the result of the analysis, including top geographic locations and parent companies with the most releases is included in the March 19, 2003 EPA brief, *U.S. PIRG Report: Toxic Releases and Health: A Review of Pollution Data and Current Knowledge on the Health Effects of Toxic Chemicals (January 2003).*

10.1.2 Resource Use for Human Health and Environmental Impacts Analysis

The report only examines air releases and direct surface water releases. Transfers to POTWs are not included. Moreover, the report discusses total releases to air and water combined. Amounts of direct surface water releases are presented in selected tables.

This resource summarizes the results of the TRI data from reporting year 2000. The RSEI model (discussed in Section I 2.2) also uses the 2000 TRI data. In addition, RSEI uses only water discharge information and includes indirect discharges (transfers to POTW). EAD does not plan on any further review of the PIRG report for screening phase of this planning cycle.

11.0 CONCLUSIONS AND RECOMMENDATIONS

EAD has identified the following tools and resources for use in the current planning cycle:

- RSEI Model (discussed in Section I 2.2);
- PCSLoads2000 database (discussed in Section I 3.0);
- National Sediment Contaminant Point Source Inventory (discussed in Section I 6.1.1);
- U.S. PIRG report (discussed in Section I 10.1).

Based on the preliminary results available from these resources, EAD has identified a preliminary list of industry categories for possible consideration. Table 11-1 below summarizes these findings. These industries were identified by two or more of the tools and resources discussed in this report.

Table 11-1

Point Source Categories Identified by Factor 1 Resources

Point Source Category	SIC Codes	Identified by Tool/Resource (Report Section I)
Fertilizer manufacture	2873, 2875, 2879, 5191	PCSLoads2000 (3.0)
Inorganic chemicals	2812, 2813, 2816, 2819	PCSLoads2000 (3.0);
Nonferrous metals manufacturing	2819, 3331, 3334, 3339, 3341	PCSLoads2000 (3.0); OST Sediment Inventory (6.1.1)
Ore mining and dressing	10	PCSLoads2000 (3.0)
Organic chemicals, plastics, and synthetic fibers	2821, 2823, 2824, 2865, 2869	RSEI (2.2); PCSLoads2000 (3.0); OST Sediment Inventory (6.1.1); PIRG Report (10.1)[b]
Petroleum Bulk Stations and Terminals	5171	RSEI (2.2);
Petroleum refining	2911	RSEI (2.2); PIRG Report (10.1)[b]
Phosphate manufacturing	2819, 2874	PCSLoads2000 (3.0);

Point Source Category	SIC Codes	Identified by Tool/Resource (Report Section I)
Pulp, paper, and paperboard	2611, 2621, 2631	RSEI (2.2); PCSLoads2000 (3.0); PIRG Report (10.1)[b]
Steam electric power generation	4911	RSEI (2.2); PCSLoads2000 (3.0); PIRG Report (10.1)[b]
Textile Mills	22	PCSLoads2000 (3.0)
Timber Products Processing	2421	RSEI (2.2)

[a] Many four-digit SIC codes are included in this point source category; two-digit SIC codes are listed for simplicity.
[b] The PIRG report uses data from TRI for reporting year 2000; these same data were used for the RSEI analysis. However, PIRG identifies the top industries (point source categories) by using combined air and water release information and no POTW transfer information. The table includes the industries ranked in the top ten for both air and water releases that also discharged more than 40,000 pounds to surface water.

EAD will continue to review these resources and will update the list of potential industry categories that warrant further examination until the beginning of the Final Agency Review process. EAD is specifically working on the following:

- Analyzing data from the RSEI model to evaluate hazard rankings including POTW removals;
- Analyzing PCS data for 2000 to identify top dischargers by SIC code and point source category;
- Analyzing ambient water chemistry near industrial facilities using STORET data;
- Evaluating data quality and uncertainties in the dischargers to impaired waters data;
- Comparing *National Sediment Contaminant Point Source Inventory* factors used to weight chemical releases for sediment contamination with toxic weighting factors used by EAD and chemical ranking factors used by OPPT;
- Working with OPPT to obtain more information on chemicals identified as having high sediment contamination weights for the National Sediment Contaminant Point Source Inventory;
- Identifying chemicals of concern, point source discharges, and industry categories using the *National Sediment Contaminant Point Source Inventory*; and

- Contacting the EPA Task Force for the Gulf Hypoxia Action Plan (and other regional resources) to discuss status of their efforts to better characterize and reduce nutrient loadings.

Ultimately, EAD will create a ranked list of industries by comparing those identified through this factor analysis with similar lists generated by the Factor 2 (Technology Advances and Process Changes) and 4 (Implementation and Efficiency Considerations) analyses for further investigation.

11.1 Integration Discussion

EPA identified several criteria to help establish priorities among the categories to determine which were possible candidates for further study and which should be removed from consideration at the current time. The first criterion was whether rule making is already underway for an industry category identified by the screening level process. The second criterion to be applied to the screening level lists was whether an effluent guideline has recently been promulgated, but not yet fully implemented. However, in cases where EPA is aware of the growth of a new segment within a source category, or in cases where new concerns are identified for previously unevaluated pollutants (such as endocrine disruptors) or pollutants whose toxicity determination has been recently revised, EPA would continue to list the subcategory for further consideration. A third criterion EPA would consider during the ranking process is whether the source category has demonstrated continual improvement through voluntary effluent reductions.

Once the initial screening, which relied primarily on information gathered under Factor 1: Human Health and the Environment (addressing discharge amounts, toxicity and effects) and Factor 4: Efficiency and Implementation (addressing efficiency of the guidelines and NPDES permitting programs, multi-media issues, etc.) was completed a second level screening was employed. This screening in addition to excluding categories with guideline development underway or recently completed also excluded categories addressed by other Clean Water Act provisions (e.g., urban stormwater, POTWs, vessels) and began to look at categories where voluntary reductions or other measures (such as guidance development) were already underway.

During this screen, the Agency also determined if the industry was dominated by indirect dischargers (>99%) in which case they are covered by another part of the statute; if the estimated risks were limited to only one or a few facilities, in which case permit writing support might be a more appropriate approach; and identified industries for which the risk picture was unclear and more data would be needed to make an initial determination of the likely magnitude and extent of the risk. By using all of these criteria in the second-level screen, the Agency was able to reduce the number of categories that would receive a third-level screen described below. Thus, the Agency was able to concentrate its resources and further effort on those categories that appeared to pose the most risk concern while eliminating from consideration only those industries which ultimately would not be good candidates for guideline development or revision in any case or for which a determination could not be made at this time.

Additional screening-level steps (a third-level screen) which were not discussed in the *Strategy* were also used. The purpose of these additional screens was to analyze the data for pollutants driving the risk estimates, the geographic distribution of facilities in the industry, the efficiency of treatment already in place, and discharge trends within the industry. For categories not regulated under an existing guideline, these further screens focused on determining if there is a substantial risk and if effluent guideline development is the right tool to address that risk. As more analysis was done it also became clear that it was important to perform at least limited quality assurance checks on the data. For example, as different industries became more important in the analysis their data was scrutinized, to the extent possible, to determine if any of the risk estimates were due to incorrect or suspect data.

SECTION II

DISCUSSION OF RESOURCES CONSIDERED FOR SCREENING ANALYSIS

12.0 WATER QUALITY IMPAIRMENT DATA

EAD reviewed several resources from EPA's Office of Wetlands, Oceans, and Watersheds (OWOW), including the National Water Quality Inventory and a dischargers to impaired waters report. EAD may review information from the STOrage and RETrieval (STORET) database in another round. These resources supply information on the quality of U.S. waters and attempt to determine the potential sources of impaired water quality. These resources can be used to identify potential categories responsible for water quality impairment because they can match facilities to 303 (d) impaired waters if at least on PCS pollutant limit matched at least one of the reasons for impairment. Additional review is needed to make these resources more useful for achieving EPA's goal of identifying potential categories responsible for water quality impairment.

12.1 National Water Quality Inventory: 2000 305(b) Report - Assessed Waters that are Impaired

The National Water Quality Inventory is prepared under Section 305(b) of the Clean Water Act, which requires that all 50 states, the District of Columbia, 5 territories, 4 interstate commissions, and 5 Indian tribes assess their water quality biennially and report those findings to EPA. EPA then summarizes the findings into a national water quality inventory report.

The majority of U.S. waters remain unassessed. Moreover, the causes and sources of impairment for many of the waterbodies that have been assessed are listed as unknown. For the 2000 report, states assessed 19 percent of the nation's total river and stream miles, 43 percent of its lake, pond, and reservoir acres, 36 percent of its estuarine square miles, and 92 percent of the Great Lakes shoreline miles.

States and other jurisdictions compare their monitoring results to their water quality standards to produce an assessment of water quality. The assessments are based on both monitored data and on qualitative information. The 305(b) inventory lists the major pollutants

and other causes of water quality problems, such as pathogens, nutrients, metals, siltation, oxygen-depleting substances, total dissolved solids, habitat alterations, pesticides, flow alterations, filling and draining, turbidity, oil and grease, priority toxic organic chemicals, PCBs, thermal modifications, and excess algal growth.

Runoff from agricultural lands, municipal point sources (sewage treatment plants), and hydrologic modifications (such as channelization, flow regulation, and dredging) are the primary sources of impairment to assessed surface waters. For ground water, sources of pollution most commonly reported are leaking underground storage tanks, septic systems, landfills, industrial facilities, and fertilizer applications. Tables 12-1 and 12-2 present the major pollutants/stressors causing impaired waters and the potential sources of these pollutants/stressors, respectively. Please see the EPA *National Water Quality Inventory: 2000 Report*, dated February 28, 2003, for additional information.

Table 12-1

Pollutants/Stressors that are Reasons for 305(b) Impairments

Pollutant/Stressor	Rivers/Streams Rank Impaired (% Impaired)[a]	Lakes/Ponds Rank Impaired (% Impaired)[a]	Estuaries Rank Impaired (% Impaired)[a]	Ocean Shoreline Waters Rank Impaired (% Impaired)[a]	Wetlands Rank Impaired (# of States)
Metals	7 (15%)	2 (42%)	1 (52%)	6 (11%)	6 (3 States)
Nutrients	5 (20%)	1 (50%)		7 (10%)	3 (4 States)
Oxygen-Depleting Substances	4 (21%)	5 (15%)	3 (34%)	2 (24%)	
Pathogens	1 (35%)		4 (30%)	1 (88%)	
Siltation	2 (31%)	3 (21%)			1 (6 States)
Total Dissolved Solids		4 (19%)	7 (16%)	4 (12%)	
Pesticides		7 (8%)	2 (38%)		

Table 12-1 (Continued)

Pollutant/Stressor	Rivers/Streams Rank Impaired (% Impaired)[a]	Lakes/Ponds Rank Impaired (% Impaired)[a]	Estuaries Rank Impaired (% Impaired)[a]	Ocean Shoreline Waters Rank Impaired (% Impaired)[a]	Wetlands Rank Impaired (# of States)
Flow Alterations	8 (9%)				2 (5 States)
Habitat Alterations	3 (22%)				5 (3 States)
Priority Toxic Organic Chemicals			5 (23%)		
Polychlorinated Biphenyls (PCBs)			6 (17%)		
Thermal Modifications	6 (17%)				
Turbidity				3 (12%)	
Excess Algal Growth		6 (12%)			
Oil and Grease				5 (11%)	
Filling and Draining					4 (3 States)

[a]These percentages reflect only the waters that have been assessed and are not percentages of the total resource.

Table 12-2

Sources of 305(b) Impairments

Potential Sources	Rivers/Streams Rank Impaired (% Impaired)[a]	Lakes/Ponds Rank Impaired (% Impaired)[a]	Estuaries Rank Impaired (% Impaired)[a]	Ocean Shoreline Waters Rank Impaired (% Impaired)[a]	Wetlands Rank Impaired (# of States)
Urban Runoff/ Storm Sewers	4 (13%)	3 (18%)	2 (32%)	1 (56%)	4 (2 States)
Agriculture	1 (48%)	1 (41%)	5 (18%)		1 (4 States)
Municipal Point Source	6 (10%)	6 (12%)	1 (37%)	5 (20%)	
Hydrologic Modification	2 (20%)	2 (18%)	6 (14%)		3 (2 States)
Nonpoint Sources		4		2	

Table 12-2 (Continued)

Potential Sources	Rivers/Streams Rank Impaired (% Impaired)[a]	Lakes/Ponds Rank Impaired (% Impaired)[a]	Estuaries Rank Impaired (% Impaired)[a]	Ocean Shoreline Waters Rank Impaired (% Impaired)[a]	Wetlands Rank Impaired (# of States)
		(14%)		(33%)	
Industrial Discharges			3 (26%)	6 (18%)	
Land Disposal		7 (11%)		3 (28%)	
Atmospheric Deposition		5 (13%)	4 (24%)		
Resource Extraction	7 (10%)		7 (12%)		
Habitat Modification	3 (14%)				6 (2 States)
Construction				7 (7%)	2 (3 States)
Septic Tanks				4 (24%)	
Forestry	5 (10%)				
Silviculture					5 (2 States)

[a]These percentages reflect only the waters that have been assessed and are not percentages of the total resource.

12.2 PCS Facilities Discharging to 303(d) Impaired Waters

Which industrial sectors are discharging to waterbodies that have been classified as impaired by state agencies? And to what extent are industrial sectors discharging contaminants that have been identified as the causes of impairments? To answer these questions, EAD analyzed the spatial correlation between the discharge outfalls of regulated facilities that report to EPA's Permit Compliance System (PCS) database with impaired waterbodies listed under Section 303(d) of the Clean Water Act.

The technical documents, *Effluent Guidelines Ambient Analysis, Indus, March 2003,* and *Effluent Guidelines Ambient Analysis, Indus, July 2003,* summarize EAD's activities to assess

the geographic relationship between PCS dischargers and impaired waters. Additional supporting information is contained in *Identifying Sources of Water Quality Impairments, Indus, June 2002.*

12.2.1 Data Used in the Analysis

EPA explored the spatial correlations between PCS discharge outfalls retrieved from the PCS Envirofacts database together with waterbody information from the Clean Water Act Section 303(d) impaired waters data base. The EnviroFacts database was utilized to extract PCS facility, current pipe schedule, and current effluent parameter data. The data from EnviroFacts were extracted on February 23, 2003 from the National PCS ADABAS system and contained 168,617 unique facility NPDES (National Pollution Discharge Elimination System) IDs representing the active PCS facilities.

Based on their 305(b) water quality assessments, states biennially report to EPA a list of 303(d) waters for which pollution control efforts are not sufficient to meet water quality standards. The 303(d) list is used to determine which waterbodies require the establishment of a Total Maximum Daily Load (TMDL) program to achieve water quality standards. The TMDL process identifies the sources and causes of pollution or stress (e.g., point sources, nonpoint sources, or a combination of both) and establishes allocations for each source of pollution or stress as needed to attain water quality standards.

The PCS facility and 303(d) data are integrated into an information management system known as Watershed Assessment, Tracking, and Environmental Results System (WATERS). The WATERS 303(d) database contains a combination of information from the 1998 and 2000 state reporting cycles. Most information, however, is from 1998. The PCS and 303(d) data are indexed within WATERS to a digital map of waterbodies throughout the conterminous United States known as the National Hydrography Dataset (NHD).

The NHD, at a map scale of 1:100,000, is undergoing continuous development and refinement by EPA and the U.S. Geological Survey. It is a comprehensive set of digital spatial data about surface water features such as lakes, ponds, streams, rivers, springs, and wells. Within the NHD, surface water features are combined to form reaches, which provide the framework for linking water-related data to the NHD surface water drainage network. These linkages, when complete, will enable the analysis and display of water-related data in upstream and downstream order. Upon completion of the reach linkages, EPA will conduct analysis of PCS facilities upstream of impaired waters. Moreover, stream reach flow data is being added to the NHD to support downstream contaminant modeling. WATERS can be found online at http://www.epa.gov/waters/.

12.2.2 Approach

Allowable pollutant discharge concentration limits, known as PCS permit limits, or simply limits, were matched with the reasons for waterbody impairments. PCS facilities were matched to 303(d) impaired waters if at least one PCS pollutant limit matched at least one of the reasons for impairment. For example, if a PCS has a discharge limit for mercury and it is located on a waterbody that is impaired for mercury, then they were matched.

Only impaired waters that have been reach indexed were used for this analysis. Of the 22,041 current impaired waters in the WATERS 303(d) database, 19,674 have been reach indexed. The reach indexing of these impaired waters was performed either directly by the states using a reach-indexing tool provided by EPA or they were performed by an EPA contractor through a map interpolation of the impaired water from a marked map provided by the state.

PCS discharge concentration limit information, however, is generally only available for major facilities in PCS. So the actual pollutants discharged by facilities with minor and general permits is unknown. Accordingly, facilities with minor or general permits were matched with impaired waterbodies using the Typical Pollutant Concentration (TPC) data set compiled by

EPA's Office of Enforcement and Compliance Assurance. TPCs are an estimate of the average pollutant discharge concentrations by SIC code.

12.2.3 Results from July 2003 Analysis

As discussed in other sections of this report, EAD identified six industrial categories that may merit detailed analysis based on their total and toxicity-weighted discharges. Table 12-1 shows these six industrial categories ranked in relation to the top 50 industrial categories matched to impaired waters. As explained earlier, facilities are matched to impaired waters if at least one pollutant discharged is the same as a least one the reasons for the impairment. It is important to note that this analysis shows spatial correlations, not necessarily cause-effect relationships. Even though a facility discharges to an impaired waterbody it may not be reason that the waterbody is impaired. Facilities upstream of the impaired stream reach may be the cause. Or non-point sources may be the reason for the impairment. Or a combination of sources may be the cause. Also note that the impaired waters analysis does not fully examine potential impacts from Coal Bed Methane production because the industry is contained within SIC code (1311) which does not differentiate it from traditional O&G extraction.

Table 12-3

The Six Industrial Categories that May Merit Detailed Analysis Compared to the Top 50 Industrial Categories Matched to Impaired Waters

Rank	Point Source Category or SIC	Type of Group	2-Digit or 4-Digit SIC Group	40 CFR Part	Total Number of Facilities	Total Number of Indexed Facilities	Total Number of Indexed Facilities on Impaired Waters	Percent of Indexed Facilities on Impaired Waters
1	Sewerage Systems	SIC4	4952		30176	19458	4341	22%
2	Metal Finishing	PSC		433	4353	2920	629	22%
3	Metal Products and Machinery	PSC		438	3965	2663	573	22%
4	Real Estate	SIC	65		4198	3281	451	14%
5	Steam electric power generation	PSC		423	1537	1249	445	36%
6	Stone, Clay, & Glass Products	SIC	32		3337	2017	422	21%
7	Water Supply	SIC4	4941		2845	2029	412	20%
8	Mineral Mining and Processing	PSC		436	5413	3432	392	11%
9	Automative Dealers & Service Stations	SIC	55		2378	1545	333	22%
10	Petroleum Bulk Stations & Term	SIC4	5171		1840	1147	331	29%
11	Wholesale Trade- Durable Goods	SIC	50		2670	1494	282	19%
12	Trucking & Warehousing	SIC	42		2624	1606	279	17%
13	Coal mining	PSC		434	4610	1649	263	16%
14	Heavy Construction, Except Building	SIC	16		6218	2769	260	9%
15	Organic chemicals, plastics and synthetic fibers	PSC		414	752	578	205	35%
16	Pulp, paper and paperboard	PSC		430	398	367	158	43%
17	Water Transportation	SIC	44		733	423	153	36%
18	Inorganic chemicals	PSC		415	506	406	146	36%
19	Educational Services	SIC	82		1863	1274	141	11%
20	Timber products processing	PSC		429	1661	1205	134	11%
21	Non classifiable Establishments	SIC	99		1111	557	133	24%
22	Iron and steel manufacturing	PSC		420	348	295	131	44%
23	Landfills	PSC		445	1294	764	129	17%
24	Hazardous Waste combustors				1294	764	129	17%
25	Nonferrous metals manufacturing	PSC		421	431	357	124	35%
26	Electric, Gas, & Sanitary Services	SIC	49		740	473	119	25%
27	Hotels & Other Lodging Places	SIC	70		1150	834	105	13%
28	Food & Kindred Products	SIC	20		710	519	104	20%
29	Engineering & Management Services	SIC	87		1101	428	101	24%
30	Plastic Molding and Forming	PSC		463	682	480	101	21%

Table 12-3 (Continued)

Rank	Point Source Category or SIC	Type of Group	2-Digit or 4-Digit SIC Group	40 CFR Part	Total Number of Facilities	Total Number of Indexed Facilities	Total Number of Indexed Facilities on Impaired Waters	Percent of Indexed Facilities on Impaired Waters
31	Phosphate manufacturing	PSC		422	309	263	93	35%
32	Meat Products Processing	PSC		432	643	443	91	21%
33	Wholesale Trade- Nondurable Goods	SIC	51		948	588	87	15%
34	Textile mills	PSC		410	758	511	86	17%
35	Paving and roofing materials	PSC		443	828	498	82	16%
36	Petroleum refining	PSC		419	252	195	77	39%
37	Transportation by Air	SIC	45		888	528	74	14%
38	Railroad Transportation	SIC	40		299	199	70	35%
39	Metal molding and casting (foundries)	PSC		464	337	221	68	31%
40	Chemical & Allied Products	SIC	28		371	262	67	26%
41	Canned and preserved seafood	PSC		408	431	175	66	38%
42	General Building Contractors	SIC	15		1996	828	66	8%
43	Amusement & Recreation Services	SIC	79		778	400	63	16%
44	National Security & International Affairs	SIC	97		293	211	60	28%
45	Paper & Allied Products	SIC	26		243	176	53	30%
46	Fruits and vegetable processing	PSC		407	278	230	53	23%
47	Rubber Manufacturing	PSC		428	337	260	53	20%
48	Oil & Gas Extraction	PSC		435	7446	262	53	20%
49	Auto Repair, Services, & Parking	SIC	75		762	299	53	18%
50	CAFO	PSC		412	7317	925	51	6%
70	Coal Bed Methane	SIC4	1311		7,784	141	25	18%

Table 12-4 presents the reasons for 303(d) impairment. Please note that the total number of waterbodies impaired for each impairment cannot be summed in this table to arrive at the total number of impaired waterbodies. This is because many waterbodies have more than one reason for impairment.

Table 12-4

Reasons for 303(d) Impairment

Impairment	Number of Waterbodies Impaired
ACCUMULATED SEDIMENT	4
ALDRIN	1
ALGAE	17
ALGAL BLOOMS	2
ALGAL GRWTH/CHLOROPHYLL A	4
ALUMINUM	23
AMMONIA	172
AMMONIA (UN-IONIZED)	39
AMMONIA-NITROGEN	1
ANTIMONY	1
AQUATIC LIFE	2
AQUATIC WEEDS OR ALGAE	5
ARSENIC	41
ATRAZINE	2
BACTERIA	56
BACTERIAL SLIMES	1
BERYLLIUM	10
BIOCHEMICAL OXYGEN DEMAND	28
BIOLOGICAL OXYGEN DEMAND	2
BLOOMS	2
BOD	11
BORON	2
CADMIUM	74
CARBON DISULFIDE	1
CAUSE UNKNOWN (FISH KILL)	1
CBOD	1
CHEMA	7
CHEMICAL OXYGEN DEMAND	2
CHLORDANE	14
CHLORIDE	22
CHLORIDES	2
CHLORIDES/SULFATES/TDS	2
CHLORINATED BENZENES	1
CHLORINE	34
CHLORINE RESIDUAL	1
CHLOROPHYLL A	7
CHLORPYRIFOS	3
CHROMIUM	33
COLIFORMS	31
COMMERCIAL FISHING BAN	1
CONDUCTIVITY	3
CONTAMINATED SEDIMENTS	2
CONTAMINATED SEDIMENTS (CADMIUM)	1
CONTAMINATED SEDIMENTS (CHLORDANE)	1

Table 12-3 (Continued)

Impairment	Number of Waterbodies Impaired
CONTAMINATED SEDIMENTS (CHROMIUM)	1
CONTAMINATED SEDIMENTS (COPPER)	1
CONTAMINATED SEDIMENTS (PAHS)	1
CONTAMINATED SEDIMENTS (PCBS)	1
CONTAMINATED SEDIMENTS (ZINC)	1
COPPER	114
CREOSOTE	1
CYANIDE	16
DDT	9
DDT METABOLITES	1
DEBRIS	1
DI-2-ETHYLHEXYL PHTHALATE	1
DIAZINON	7
DICHLOROETHANE	1
DIELDRIN	6
DIOXIN	4
DIOXIN AND CHLORDANE IN FISH TISSUE	1
DISSOLVED OXYGEN	283
E. COLI	21
EROSION	1
EUTROPHICATION	3
EXCESS ALGAL GROWTH	2
FCA	6
FCA (DDT)	1
FCA (DIOXIN)	1
FCA (MERCURY)	38
FCA (PBB)	1
FCA (PCBS)	53
FECAL	14
FECAL COLIFORM	140
FISH ADVISORIES-DIOXIN	1
FISH ADVISORIES-SELENIUM	1
FISH CONSUMPTION GUIDANCE	1
FLOATABLES	1
FLOW ALTERATION(S)	19
FLOW MODIFICATION	1
FLOW REGULATION	1
FLUORIDE	1
GAS SUPERSATURATION	1
GROUP A PESTICIDES	2
HABITAT ALTERATIONS	1
HABITAT DEGRADATION	1
HABITAT LOSS	2
HEAVY METALS	2
HIGH COLIFORM COUNT	9
HYDROGEN SULFIDE	1
HYPOXIA	10

Table 12-3 (Continued)

Impairment	Number of Waterbodies Impaired
INADEQUATE FISH PASSAGE	1
IRON	58
LEAD	145
LOW DISSOLVED OXYGEN	11
LOW OXYGEN	11
LOW PH	5
MACROPHYTES	3
MANGANESE	19
MERCURY	137
METALS	604
NFR	9
NH3	7
NH3-N	14
NICKEL	15
NITRATE	4
NITRATE/NITRITE	5
NITRATES	1
NITRITE	1
NITROGEN	14
NONPRIORITY ORGANICS	5
NOX	1
NUTRIENTS	1136
NUTRIENTS (ALGAE)	5
NUTRIENTS OXYGEN DEMAND	7
ODORS	2
OIL	2
OIL AND GREASE	89
OIL FIELD WASTES	1
OIL/GASOLINE	2
ORGANIC ENRICHMENT	4
ORGANIC ENRICHMENT/LOW DISSOLVED OXYGEN	706
ORGANIC ENRICHMENT/LOW DO	98
ORGANICS	3
OTHER	6
OTHER HABITAT ALTERATION(S)	23
OTHER INORGANICS	4
PAHS	3
PATHOGENS	407
PCBS	16
PCBS & CHLORDANE IN FISH TISSUE	2
PCBS & CHLORDANE IN SEDIMENT	1
PCBS (DIOXIN-LIKE)	3
PENTACHLOROPHENOL	3
PESTICIDES	22
PESTICIDES (CHLORDANE)	5
PH	164
PHENOL	1

Table 12-3 (Continued)

Impairment	Number of Waterbodies Impaired
PHOSPHORUS	15
PRIORITY ORGANICS	170
PRIORITY ORGANICS (PCBS)	4
RADIATION	2
SALINITY	15
SALINITY/TDS/CHLORIDE	10
SALINITY/TDS/CHLORIDES	91
SCUM/FOAM-UNNATURAL	6
SEDIMENT	133
SEDIMENT OXYGEN DEMAND	3
SEDIMENT TOXICITY	2
SEDIMENTATION	8
SEDIMENTATION/SILTATION	19
SELENIUM	21
SHALLOW LAKE BASIN	1
SILTATION	833
SILTATION/TURBIDITY	10
SILVER	19
SODIUM	1
SULFATE	5
SULFATES	3
SUSPENDED SEDIMENT	49
SUSPENDED SOLIDS	287
TASTE AND ODOR	1
TDS	3
TEMPERATURE	27
TETRACHLOROETHYLENE	2
THALLIUM	3
THERMAL MODIFICATIONS	14
TKN	1
TOC	1
TOTAL DISSOLVED GAS	14
TOTAL DISSOLVED SOLIDS	16
TOTAL PHOSPHORUS	11
TOTAL SUSPENDED SOLIDS	35
TOTAL TOXICS	2
TOXAPHENE	1
TOXICITY	2
TOXICS	1
TRASH	9
TREND	4
TRIBUTYLTIN	4
TRICHLOROETHANE	1
TRICHLOROETHYLENE	1
TSI	7
TSS	9
TURBIDITY	174

Table 12-3 (Continued)

Impairment	Number of Waterbodies Impaired
UNIONIZED AMMONIA	1
UNKNOWN TOXICITY	25
USES	2
VDH HEALTH ADVISORY - MERCURY	7
VDH HEALTH ADVISORY - PCBS	1
VDH SHELLFISH RESTRICTION	3
VOLATILE ORGANICS/VOCS	1
ZINC	73

12.2.4 Data Limitations and Uncertainties in the Analysis

The actual number of PCS facilities discharging to impaired waters is unknown. Moreover, upstream facilities (and non-point sources) are not included in this analysis. Other limitations to the data presented in Table 12-1 include:

- **Under Counting of Facilities Because of Missing SICs:** 26 percent of PCS facilities (45,000 of 168,517) are excluded from the impaired waters analysis because they do not have SICs in PCS.

- **Under Estimating of Facility Loads:** A potential next step in the impaired waters analysis would be to determine discharge loads for PCS facilities matched to impaired waters. However, both concentration and discharge flow information are required to calculate load estimates for PCS facilities. Consequently, load estimates have been calculated primarily for majors because most minors do not have flow information in PCS.

- **Under Counting of Facilities Because They are not Indexed to Reaches:** 77 percent of PCS facilities are excluded from impaired waters analysis because they have not been indexed to reaches, including 5 percent of majors (340 of 6,833) and 80 percent of minors (129,350 of 161,684). 74, 480 PCS facilities have been indexed to the NHD reaches. There are a total of 22,347 impaired waters. 19,674 have been indexed to the NHD which consists of some 3 million reaches.

- Nationally, 9,741 indexed PCS facilities (1,928 majors and 7,813 minors) have been matched to 3,493 impaired waters. PCS limits were used to match major facilities to impaired waters. Typical Pollutant Concentrations (TPCs) - average pollutant discharge concentrations by SIC were used to match minors to impaired waters, because minors have little or no limit information in PCS.

- **Over Counting may Occur when Matches are based are based on TPCs:** Facilities might discharge pollutants for which there are no limits in their permits.

- **Under Counting may Occur when Matches are based on PCS Limits:** Facilities might discharge pollutants for which there are no limits in their permits.

- **Limitations in the Locational Data Quality:** 69 percent of the pipes in the PCS database had location data considered to be of low quality. For many facilities, particularly minors, facility locations as a surrogate for the outfall location.

- NHD data are not available for Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands.

- States only report 303(d) impairments for assessed waterbodies and most waterbodies are unassessed.

- SIC codes are not precise, facilities self-identify their SIC codes, and a single facility may have multiple industrial operations at a single site.

The current impairment analyses only identify spatial relationships between point source dischargers and impaired waterbodies. The current analyses do not suggest the actual correlations/causal relationships between point source dischargers and impaired waterbodies. EPA will need to conduct more analyses before determining whether there is any actual causal relationship between industrial point sources and impaired waters. EPA will examine the possibility of using the STORET (data STOrage and RETrieval system) database in impairment analyses for future effluent guidelines program plans. STORET is EPA's main repository of water quality monitoring data. It contains water quality information from a variety of organizations across the country, from small volunteer watershed groups to State and Federal environmental agencies.

12.2.5 Additional Analysis

Options for additional analysis might include matching upstream facilities to impaired waters through downstream pollutant modeling. Assessment of the amount of pollutants discharged to impaired waters through the use of PCS load estimates for major facilities might also be performed. Ideally, future analysis would focus on the correlation of 303(d) impaired

waters, PCS load estimates, fish consumption advisories, and STORET ambient monitoring data to form a more complete portrait of potential sources and their impacts on impaired waterbodies. EPA is investigating the number of TMDLs that have been written for the impaired waters. See Memo to Record from Tom Born.

12.3 Ambient Water Quality Near Industrial Facilities (STORET)

EPA maintains two data management systems containing water quality information for the nation's waters: the Legacy Data Center (LDC) and STORET. STORET is a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. The LDC contains historical water quality data dating back to the early part of the 20th century and collected up to the end of 1998. STORET contains data collected beginning in 1999, along with older data that have been properly documented and migrated from the LDC. EAD's review of these resources will not occur in the screening phase of this current planning cycle. For more information regarding these tools see Section III. 13.0.

SECTION III

DISCUSSION OF RESOURCES EXPLORED FOR SCREENING ANALYSIS

13.0 WATER QUALITY IMPAIRMENT DATA

13.1 Ambient Water Quality Near Industrial Facilities (STORET)

EPA maintains two data management systems containing water quality information for the nation's waters: the Legacy Data Center (LDC) and STORET. STORET is a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. The LDC contains historical water quality data dating back to the early part of the 20th century and collected up to the end of 1998. STORET contains data collected beginning in 1999, along with older data that have been properly documented and migrated from the LDC.

13.1.1 Description of Resource

STORET contains raw biological, chemical, and physical data on surface and ground water collected by federal, state, and local agencies, Indian Tribes, volunteer groups, academics, and others. Each sampling result in STORET is accompanied by information on where the sample was taken (latitude, longitude, state, county, Hydrologic Unit Code, and a brief site identification), when the sample was gathered, the medium sampled (e.g., water, sediment, fish tissue), and the name of the organization that sponsored the monitoring. In addition, STORET contains information on why the data were gathered; sampling and analytical methods used; the laboratory used to analyze the samples; the quality control checks used when sampling; handling the samples and analyzing the data; and the personnel responsible for the data.

13.1.2 Resource Use for Human Health and Environmental Impacts Analysis

EPA is currently using STORET to determine if high chemical concentrations can be associated with certain industrial dischargers. The goal of this analysis is to identify industry categories with results from downstream monitoring stations exceeding water quality criteria. The analysis will sort the industry categories based upon the percent of samples exceeding and

the distance from the discharger. The analysis will account for stations that are located downstream but have no results for a particular compound and for states where no water quality data are available. The analysis will be flexible enough to use national water quality criteria, or state specific criteria if available, as stored in the Water Quality Standards Database. If enough data exist, the analysis will be run using water chemistry data, sediment chemistry data, and fish tissue data. The analysis will also identify which of the stations with results above ambient criteria are located on impaired waters and if that water was listed for the parameter identified.

14.0 U.S. GEOLOGICAL SURVEY (USGS) DATA

14.1 National Water Quality Assessment Program (NAWQA)

The purpose of the NAWQA program is to develop long-term, consistent, and comparable information on streams, ground water, and aquatic ecosystems to support sound management and policy decisions. USGS scientists collect and interpret data about water chemistry, hydrology, land use, stream habitat, and aquatic life.

14.1.1 Description of Resource

The USGS's NAWQA program, which began in 1991, is designed to describe the status and trends in the quality of the nation's ground water and surface water resources. There are 59 areas ("study units") being studied and sampled, which represent more than two-thirds of people served by public water systems. Data collected from all study units are combined and, in addition to information from other programs, agencies, and researchers, are used to produce a national assessment or "national synthesis." The NAWQA program includes 500 chemical compounds. NAWQA data are available for 76 pesticides, 7 pesticide degradation products, and 7 fumigants (ground water only) analyzed in 8,500 ground water and surface water samples collected during 1992 through 1996.

Using data from the NAWQA program, water-quality conditions can be compared on a regional and national basis and trends in water quality can be analyzed to determine whether conditions are getting better or worse. Studies relate human activities (contaminant sources, land and chemical use) and natural factors (soils, geology, hydrology, climate) to water quality, aquatic life, and stream habitat, which help with decisions about managing water resources and protecting drinking water and aquatic ecosystems.

For more information, refer to the January 21, 2003 EPA brief National Water Quality Assessment Program.

14.1.2 Resource Use for Human Health and Environmental Impacts Analysis

The similar design of each investigation and use of standard methods allows for comparisons among the results measured at the various study units. Currently data are available for only 20 of the 59 study units. Data for most of the remaining study units are expected to occur in the near future. The 20 study units in which samples were collected are located throughout the country in 36 states covering all ten EPA regions. USGS emphasizes that the studies conducted at the various study units are not designed to produce a statistically representative analysis of national water quality conditions.

EAD intends to investigate the utility of this data resource for use in identifying categories for establishment of effluent limitations guidelines. As USGS continues to compile data for more study units, this data resource can be used to identify national water quality conditions and trends. However, this review will not occur in the screening phase of this current planning cycle because data collection is incomplete and pollutant specific information needs to be bridged to discharging sources.

14.2 NAWQA National Report on Nutrients

National summary reports, published under the signature title “The Quality of Our Nation's Waters,” describe water quality from a national perspective. The first report in this series covers nutrients and pesticides. It is contained in “The Quality of Our Nation's Waters - Nutrients and Pesticides”. Subsequent reports may present such topics as radon and arsenic in ground water, industrial chemicals in streams and ground water, and stream ecology. Each report in this interpretive series focuses on major findings of the NAWQA Program, based on data collected between 1991-2001.

14.2.1 Description of Resource

The NAWQA National Report on Nutrients is the first report that describes major findings of the NAWQA Program on water-quality issues of regional and national concern. The report on nutrients uses the information from the first 20 study units of the NAWQA Program. This first report presents insights on nutrients and pesticides in water and on pesticides in bed sediment and fish tissue. Streams and shallow ground water in agricultural, urban, and some undeveloped (mostly forested) settings were studied in the first 20 study units. The agricultural areas are diverse in climate and geography, and they span coastal, desert, and temperate environmental settings.

Nutrient levels are summarized on U.S. maps to facilitate analysis and comparison of regional and national patterns. Concentrations or detection frequencies are ranked according to three categories related to the concentrations or detection frequencies among all stream sites or ground water studies. The maps of national results also show patterns of nonpoint inputs of nitrogen and phosphorus. Based on county agriculture statistics for 1987 and 1992, average annual nitrogen and phosphorus inputs to agricultural and urban land were estimated from commercial fertilizer sales (1991-94) and manure from animals (1992). Average annual input of nitrogen from the atmosphere was estimated from 1991-94 data. See the report at http://water.usgs.gov/pubs/circ/circ1225/ and the March 3, 2003 EPA brief National Water Quality Assessment Program (NAWQA) Analysis of Nutrients for more information about the report.

14.2.2 Resource Use for Human Health and Environmental Impacts Analysis

EAD plans to use data in the NAWQA Nutrients report if more information on nutrients is needed or to determine where elevated concentrations of nutrients are located. However, this review will not occur in the screening phase of this current planning cycle because pollutant specific information needs to be bridged to discharging sources.

14.3 National Water Information System (NWIS)

NWIS is the national system for historic streamflow data, collected and maintained by USGS. Data includes current-conditions data for selected surface water, ground water, and water quality sites, and descriptive site information for all sites with links to all available water data for individual sites.

14.3.1 Description of Resource

The USGS has collected water-resources data at approximately 1.5 million sites across the United States, Puerto Rico, and Guam. The types of data collected are varied, but generally fit into the broad categories of surface water and ground water. Surface-water data, such as gage height (stage) and streamflow (discharge), are collected at major rivers, lakes, and reservoirs. Ground-water data, such as water level, are collected at wells and springs. Water-quality data are available for both surface water and ground water. Examples of water-quality data collected are temperature, specific conductance, pH, nutrients, pesticides, and volatile organic compounds.

This is a vast database of water resources data. NWISWeb is a Web site that contains current and historical data. Data are retrieved by category of data, such as surface water, ground water, or water quality, and by geographic area. Further refinement is possible by selecting specific information and by defining the output desired. Not all water-resources data collected by the USGS are provided on this Web page.

For more details, refer to the February 21, 2002 EPA brief NWIS Data.

14.3.2 Resource Use for Human Health and Environmental Impacts Analysis

EAD can use this data source to access surface water and ground water data. Specifically, EAD can access current-conditions data transmitted from selected surface-water, ground-water, and water-quality sites and descriptive site information for all sites with links to all available

water data for individual sites. EAD intends to investigate the usefulness of this data source in future modeling efforts. EAD hopes to develop a partnership with USGS to use the data in their national models as input to second phase of the planning process (thumbnail environmental assessment).

14.4 Applications of SPARROW

SPARROW stands for Spatially Referenced Regressions On Watershed Attributes. SPARROW relates in-stream water-quality measurements to spatially referenced characteristics of watersheds, including contaminant sources and factors influencing terrestrial and stream transport. The model empirically estimates the origin and fate of contaminants in streams, and quantifies uncertainties in these estimates based on model coefficient error and unexplained variability in the observed data.

14.4.1 Description of Resource

The SPARROW method uses spatially referenced regressions of contaminant transport on watershed attributes to support regional water-quality assessment goals, including descriptions of spatial and temporal patterns in water quality and identification of the factors and processes that influence those conditions. The method is designed to reduce the problems of data interpretation caused by sparse sampling, network bias, and basin heterogeneity. The regression equation relates measured transport rates in streams to spatially referenced descriptors of pollution sources and land-surface and stream-channel characteristics. Spatial referencing of land-based and water-based variables is accomplished via superposition of a set of contiguous land-surface polygons on a digitized network of stream reaches that define surface-water flow paths for the region of interest.

Water-quality measurements are obtained from monitoring stations located in a subset of the stream reaches. Water-quality predictors in the model are developed as a function of both reach and land-surface attributes and include quantities describing contaminant sources (point

and nonpoint) as well as factors associated with rates of material transport through the watershed (such as soil permeability and stream velocity). Predictor formulae describe the transport of contaminant mass from specific sources to the downstream end of a specific reach. Loss of contaminant mass occurs during both overland and in-stream transport.

In calibrating the model, measured rates of contaminant transport are regressed on predicted transport rates at the locations of the monitoring stations, giving rise to a set of estimated linear and nonlinear coefficients from the predictor formulae. Once calibrated, the model can be used to estimate contaminant transport and concentration in all stream reaches. A variety of regional characterizations of water-quality conditions are then possible based on statistical summarization of reach-level estimates. The application of bootstrap techniques allows estimation of the uncertainty of model coefficients and predictions. See the February 21, 2002 EPA brief SPARROW - Spatially Referenced Regressions on Watershed Attributes for more information and for a list of watershed data used in applications.

14.4.2 Resource Use for Human Health and Environmental Impacts Analysis

EAD intends to contact appropriate USGS staff to discuss potential uses of SPARROW for use in thumb-nail environmental assessments for industry categories where further investigation is warranted. EAD also plans to investigate the potential development of applications that are tailored to the planning process; however, this review will not occur in the screening phase of this current planning cycle because model requires tailoring to be useful to 304(m) process.

15.0 OFFICE OF SCIENCE AND TECHNOLOGY DATA AND RESOURCES

15.1 Resources Providing Chemical-Specific and Point Source Discharge Data

15.1.1 Better Assessment Science Integrating point and Nonpoint Sources (BASINS) Model

SHPD developed BASINS 3.0 (most recent version) as a multipurpose environmental analysis system used to perform watershed and water-quality-based studies.

15.1.1.1 Description of Resource

BASINS allows users to select specific stream sites or entire watersheds to obtain information on point and nonpoint discharge sources. BASINS integrates geographic information system (GIS), national watershed and meteorological data, and environmental assessment and modeling tools.

BASINS supports the development of total maximum daily loads (TMDLs), which require a watershed-based approach that integrates both point and nonpoint sources. It can support the analysis of a variety of pollutants at multiple scales. BASINS delivers four types of data: (1) base cartographic data, (2) environmental background data, (3) environmental monitoring data, and (4) point sources/loading data. BASINS uses the following tools for point source/loading data: Industrial Facilities Discharge (IFD) Sites, PCS Sites and Computed Annual Loadings, TRI Sites and Pollutant Release Data, CERCLIS-Superfund National Priority (NPL) Sites, Resource Conservation and Recovery Information System (RCRIS) Sites, and Minerals Availability System/Mineral Industry Location System (MAS/MILS).

15.1.1.2 Resource Use for Human Health and Environmental Impacts Analysis

BASINS provides water quality monitoring and pollutant loading data for chemical contaminants that may pose a risk to human health and the environment. The Web site links the data to the geographic area (e.g., stream or watershed) where the contaminants are present and to

specific point sources. EAD plans to review data sources for BASINS; this model may incorporate data from other sources EAD has on its list of resources (e.g., the listing of fish and wildlife advisories, see Section III 15.2.1).

15.2 Resources Providing Chemical-Specific Data Only

Using the resources discussed in this section , EAD can identify chemical contaminants of concern and the corresponding geographical location. These resources do not provide a direct link to the point source discharge (e.g., facility discharge) or industry category. This section describes each resource and how EAD may use the resource to perform screening level analyses. The following subsections are included:

- Section 15.2.1 presents information on the National Listing of Fish and Wildlife Consumption Advisories;
- Section 15.2.2 presents information on the National Fish Tissue Study;
- Section 15.2.3 presents information on the draft National Sediment Quality Survey (2001);
- Section15.2.4 presents information on the Beaches Environmental Assessment and Coastal Health Act; and
- Section15.2.5 presents conclusions and recommendations for these resources and using them to evaluate human health and environmental impacts.

A detailed review of these four resources will not occur in the screening phase of this current planning cycle.

15.2.1 National Listing of Fish and Wildlife Consumption Advisories

The National Listing of Fish and Wildlife Consumption Advisories database includes all available information describing fish consumption advisories issued by states, territories, Native

American tribes, and the federal government and identifies areas where fish contain high levels of chemical pollutants.

15.2.1.1 Description of Resource

The states, territories, and Native American tribes have primary responsibility for protecting residents from the potential health risks of eating contaminated fish and wildlife. If high concentrations of chemicals, such as mercury or polychlorinated biphenyls (PCBs), are found in local fish and wildlife, then a state, territory, or tribe may issue a consumption advisory for the general population, including recreational and subsistence fishers, as well as for sensitive subpopulations (e.g., pregnant women, nursing mothers, and children). A consumption advisory may include recommendations to limit or avoid eating certain fish and wildlife species caught from specific water bodies or, in some cases, from specific water body types (e.g., all lakes). Similarly, in Canada, the provinces and territories have primary responsibility for issuing fish consumption advisories for their residents.

In 2001, there were a total of 2,618 fish consumption advisories for a total of 39 chemical contaminants. Ninety-six percent of all advisories were issued due to high levels of one of the following five pollutants: mercury, PCBs, chlordane, dioxins, and DDT (and its degradation products, DDE and DDD). See the 2003 EPA brief National Listing of Fish and Wildlife Advisories for more details.

15.2.1.2 Use for Human Health and Environmental Impacts Analysis

The NLFWA Web site (http://www.epa.gov/waterscience/fish/) provides information on the specific chemical contaminants that may pose a potential risk to human health (through fish consumption) and the environment (through fish contamination). The Web site includes:

- Information on species and size of fish or wildlife under advisory;
- Chemical contaminants identified in the advisory;

- Geographic location of the water body;
- Lake acreage or river miles under advisory;
- Population for whom the advisory was issued;
- Fish tissue residue data for 45 states; and
- State and tribal contact information.

The Web site can generate national, regional, and state maps that summarize advisory information and provides on-going fish consumption advisory data. One way EAD could utilize this resource in future planning cycles would be to identify which of the main chemical contaminants identified in advisories are still being discharged to surface waters and attempt to determine which industries are currently discharging them. These industries would then be considered along with the other results of this analysis. However, this review will not occur in the current planning cycle because pollutant specific information needs to be bridged to discharging sources.

15.2.2 National Fish Tissue Study

The National Study of Chemical Residues in Lake Fish Tissue (or the National Fish Tissue Study) is a four-year national screening-level freshwater fish contamination study. OST is conducting this study as a priority activity under the Agency's Persistent, Bioaccumulative, and Toxic Chemicals (PBT) Initiative.

15.2.2.1 Description of Resource

The National Fish Tissue Study is the first national fish tissue survey to be based on a probabilistic (random) sampling design, and it will generate data on the largest set of PBT chemicals ever studied in fish. The statistical design of the study will allow EPA to develop national estimates of the mean concentrations of 265 chemicals in fish tissue from lakes and reservoirs of the continental United States, including dioxins/furans, PCBs, mercury, arsenic, organochlorine pesticides, organophosphate pesticides, polycyclic aromatic hydrocarbons (PAHs), and other semi-volatile organic compounds. EPA can use the study results to:

- Define national background levels for the 265 PBT chemicals in fish;
- Establish a baseline to track progress of pollution control activities; and
- Identify areas where contaminant levels are high enough to warrant further investigation.

Of the fish composites tested in the first year of the study, all showed concentrations of dioxin/furans and PCBs. More than 90 percent showed concentrations of mercury and total DDT. The only non-pesticide other than mercury found during the first year of the study was octachlorostyrene, detected in eight fish tissue samples. Octachlorostyrene is a by-product of wastes from the electrolytic production of chlorine prior to 1970 when graphite anodes and coal tar pitch binder were used. See the 2003 EPA brief National Fish Tissue Study for more details.

15.2.2.2 Resource Use for Human Health and Environmental Impacts Analysis

One way EAD could utilize this resource in future planning cycles would be to identify which of the major contributors to fish tissue contamination are still being discharged to surface waters and attempt to determine which industries are currently discharging them. These industries would then be considered along with the other results of this analysis.

The National Fish Tissue Study provides information on the PBT chemical contaminants that may pose a potential risk to human health (through fish consumption) and the environment (through fish contamination). The study links the data to geographic location. This could also be useful in identifying national patterns of discharge.

Any immediate use of this tool would be preliminary, however, since the four year study began in 1998, with sampling scheduled for 1999 to 2003, and only the first year's results are available at this time. Therefore, review of this resource will not occur in the screening phase of this current planning cycle because pollutant specific information needs to be bridged to discharging sources.

15.2.3 Draft National Sediment Quality Survey (2001)

The draft National Sediment Quality Survey (2001) describes the accumulation of chemical contaminants in river, lake, ocean, and estuary bottoms and includes a screening-level assessment of the potential for adverse effects on human and/or environmental health.. Using sediment chemistry and sediment toxicity information along with the sediment and tissue concentration measurements, OST classified each sampling station by the probability of adverse effects on aquatic life or human health. To support this report, OST initiated the National Sediment Inventory (NSI) database which provides concentrations of contaminants in sediments and tissue residue from 1980 through 1999.

15.2.3.1 Description of Resource

The draft report reflects samples collected from 1990 through 1999, representing about 9 percent of river reaches. Monitoring data that was evaluated in the report are available for 169 chemicals from more than 19,000 sampling stations. The study evaluated data on pollutants found in sediments and fish tissue although the report did not assign causality. The types of pollutants evaluated included:

- Bulk organics - a class of hydrocarbons including oil and grease;
- Halogenated hydrocarbons, or persistent organics - includes DDT and PCBs;
- Polycyclic aromatic hydrocarbons (PAHs) - group of organic chemicals that includes several petroleum products and by-products; and
- Metals - includes iron, manganese, lead, cadmium, zinc, mercury, and metalloids such as arsenic and selenium.

An appendix to the report discusses these pollutants and how often each was detected. See the 2003 EPA brief National Sediment Quality Survey (12/2001) for more details.

15.2.3.2 Resource Use for Human Health and Environmental Impacts Analysis

The draft report provides information on several specific chemical contaminants that may pose a potential risk to human health and the environment. The report also identified geographical areas of concern. OST has begun to develop ArcView files of all the data used in the report. It would then be possible to do an overlay of NPDES outfalls and see any potential contributors. EPA may be able to identify which of these chemicals are found nation-wide and investigate the types of industries that are likely sources of discharges of these chemicals.

To do this, EAD plans to review the complete report and contact authors to determine if "chemicals of concern" were identified. If so, EAD will review whether these chemicals are currently discharged by point sources. EAD will also determine if the analyses in this report have been used in the OPPT programs (e.g., PBT chemicals) to target chemical-specific work. The review of this resource will not occur in the current planning cycle because pollutant specific information needs to be bridged to discharging sources.

15.2.4 Beaches Environmental Assessment and Coastal Health Act (BEACH Act)

The Beaches Environmental Assessment and Coastal Health Act (BEACH Act), signed in October 2002, is intended to reduce the risk of disease to users of coastal recreation waters. The BEACH Act authorizes EPA to award grants to eligible coastal and Great Lake States and tribes for the development and implementation of programs to monitor coastal recreational waters for disease-causing microorganisms and to notify the public when monitoring indicates a public health hazard. To be eligible for the implementation grants, states must establish and operate monitoring and notification programs that are consistent with performance criteria provided by EPA. This information is reported to EPA and maintained in a database.

15.2.4.1 Description of Resource

The Beaches Web site provides 2001 monitoring data on concentrations of contaminants in coastal recreation waters and a summary, as of September 1997, of the Bacterial Water Quality Standards being used by each state (http://www.epa.gov/waterscience/beaches/local/sum2.html). The program is ongoing and data will be collected each year. Monitoring is conducted only during the use (i.e., swimming) season. See the 2003 EPA brief Beach Act for more details.

15.2.4.2 Resource Use for Human Health and Environmental Impacts Analysis

The Beaches Web site provides 2001 water quality monitoring data (and applicable standards) for chemical contaminants that may pose a potential risk to human health and the environment. One way the EAD could utilize this resource in the planning process would be to identify the major contributors to public health hazards or to identify compounds exceeding water quality criteria as identified by BEACH monitoring data. EAD could then attempt to determine which industries are currently discharging these pollutants. The Web site links the data to the geographic (coastal) area where the contaminants are present. This could also be useful in identifying national patterns of discharge. The review of this resource will not occur in the current planning cycle because pollutant specific information needs to be bridged to discharging sources.

15.2.5 Conclusions/Recommendations for Resources Providing Chemical-Specific Data Only

Some of the chemical contaminants in the National Listing of Fish and Wildlife Consumption Advisories, the National Fish Tissue Study, the National Sediment Quality Survey, and the Beaches Web site include pollutants no longer discharged (e.g., PCBs and certain pesticides), and pollutants believed to currently enter waters predominantly through atmospheric deposition, not discharge (e.g., dioxins and mercury, though there may be sediment accumulations from past discharges).

As discussed above, EAD plans to review these resources in future planning cycles. EAD will review the pollutants in the resources and eliminate those no longer in commerce using data from OPPT, and identify current sources for the rest. This includes polycyclic aromatic hydrocarbons (PAHs), which are included in the National Fish Tissue Study and the National Sediment Quality Survey and may be currently discharged. One source includes the TRI guidance document for polycyclic aromatic compounds).

16.0 DRINKING WATER DATA

16.1 Safe Drinking Water Act Candidate Contaminant List

In the 1996 amendments to the SDWA, EPA was required to publish a candidate contaminant list (CCL), which contains contaminants that are known or anticipated to be present in public water systems. The unregulated contaminants considered for the CCL must include, but not be limited to, substances referred to in Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and substances registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This list is published after consultation with the scientific community, notice and opportunity for public comment, and consideration of the occurrence database established under Section 1445(g). The current CCL, published in March 1998, contains 50 chemical and 10 microbial contaminants. To meet the required revision schedule, the next CCL is due in 2003.

16.1.1 Description of Resource

The CCL is a summary of data from eight source lists of possible contaminants including the Drinking Water Priority List (DWPL), Health Advisories (HAs), Integrated Risk Information System (IRIS), Public Water System (PWS), CERCLA, stakeholder summary list, Toxic Release Inventory (TRI), Office of Pollution Prevention (OPP) ranking, and endocrine disruptors. Criteria were developed by the National Drinking Water Advisory Committee (NDWAC) Working Group for use in screening and evaluating chemical contaminants for the draft CCL. The general premises of the criteria were: (1) The contaminants included for initial consideration are on EPA's initial list and are without National Primary Drinking Water Regulations (NPDWRs), and (2) occurrence of the contaminant is evaluated first, before evaluating its health effects information. Data used to evaluate and screen contaminants were obtained from STORET (discussed in Section I 12.3), the Hazardous Substances Database (HSDB), IRIS, published literature, and various EPA reports and documents. See the March 1, 2003 EPA brief Safe Drinking Water Act Contaminant Candidate List for more details.

16.1.2 Resource Use for Human Health and Environmental Impacts Analysis

EAD intends to use the CCL to identify contaminants that are known or anticipated to be present in public water sources and that are known to be detrimental to human health and the environment. This list of contaminants does not provide information on the source of contamination; however, EAD plans to cross reference the list with potential industry categories. This data resource could be used to establish a list of contaminants of concern that are causing impairments to drinking water sources. Then, the source (e.g., industry) of these contaminants could be determined using other available data resources.

EAD will also contact OGWDW for progress of the 2003 CCL and fulfillment of data gap research priorities. The CCL criteria, as well as the conceptual approach to the Contaminant Identification Method (CIM) presented in the December 2-3, 1996 Stakeholders meeting, will serve as the basis for developing a more robust contaminant identification method for future CCL development. The review of this resource will not occur in the current planning cycle because pollutant specific information needs to be bridged to discharging sources.

16.2 Source Water Assessment Program

The SDWA Amendments of 1996 require states to develop and implement Source Water Assessment Programs (SWAP) to analyze existing and potential threats to the quality of the public drinking water throughout the state. SWAP looks at the area directly around public drinking water intakes. Assessment areas are not that large; between 1/4 mile up to 10 miles around a public drinking water intake. State programs were due to EPA by February of 1999. States may use EPA's Source Water Assessment and Protection Programs Guidance to develop their programs.

16.2.1 Description of Resource

The statutorily defined goals for SWAPs are to provide for the "protection and benefit of public water systems and for the support of monitoring flexibility." Each source water assessment for a public water supply(s) must include three elements: a delineation of the source water protection area; an inventory of significant potential sources of contamination within that area; and a determination of the susceptibility of the public water supply(s) to the sources inventoried. The inventory of significant potential sources of contamination varies among States, with some States conducting actual inventories, others listing all businesses or potential sources or activities of concern within the SWAP. The inventory may not even list specifics, such as business names or types.

States have several resources for use in developing these three elements, including data from the Total Maximum Daily Load (TMDL) Program and modeling and monitoring activities. A TMDL quantifies the pollution to be controlled from permitted point source discharges as well as nonpoint sources such as storm water runoff. Existing monitoring and modeling efforts or results can be used for SWAPs. Whatever approach the state chooses, EPA recommends that the state's first steps are to review relevant available sources of existing data at the federal, state, and local levels. This review would include gathering and analyzing the data to determine what additional information may be collected and analyzed to complete individual assessments and the state's assessment program. Such information could include delineation and assessments done under a wellhead protection program or watershed approach; vulnerability assessments; sanitary surveys; monitoring programs; delineations and assessments done under a state management plan for pesticides; and any other delineations and assessments done under the Clean Water Act or under state or local statutes. See the EPA brief Source Water Assessment Program for more details.

States were required to have their program plans in to EPA by 1999, with final reports due three years after plan approval. Most states have requested extensions on implementation, and none have submitted the final report. To date EPA has approved 52 SWAP plans, and all

have begun implementation. The majority of programs are expected to be complete by May 2003. Funding may limit program implementation after 2003.

16.2.2 Resource Use for Human Health and Environmental Impacts Analysis

Following submittal of final reports to EPA, EAD plans to use data from SWAPs to identify contaminants causing impairments to drinking water sources and the sources of the contaminants. These SWAPs can be used to link contaminants to categorical point source discharges to better assess which industries should be evaluated for ELGs. The EPA brief titled Source Water Assessment Program includes an initial table that presents drinking water contaminants and the sources of these contaminants. However, because so few reports have been received to date, this resource will not be used in the current planning cycle.

17.0 OFFICE OF RESEARCH AND DEVELOPMENT TOOLS

17.1 Resources Providing Regional Data on Chemical Contaminants

EAD can use the EMAP and ReVA models to identify potential environmental risks and pollutants/stressors on the national level. This section describes each resource and how EAD plans to use the resource to perform screening level analyses in future planning cycles. Section III 17.1.1 presents information on EMAP, Section III 17.1.2 presents information on ReVA, and Section III 17.1.3 presents conclusions and recommendations for these resources and using them to evaluate human health and environmental impacts.

17.1.1 Environmental Monitoring and Assessment Program (EMAP)

The Environmental Monitoring and Assessment Program (EMAP) conducts trends in the Nation's aquatic ecosystems. The data can be aggregated to the national level; however it does not target areas with point source discharges. The analysis of chemical contaminants in surface water and sediments is limited.

EMAP is a research program to build the scientific basis, and the local, state, and tribal capacity, to monitor for status and trends in the condition of the Nation's aquatic ecosystems. To date it is the only statistically-valid approach to determine aquatic ecosystem conditions that are representative of conditions at a state or national level. It uses biological indicators (e.g., fish and benthic community structure) to assess aquatic ecosystems; establish measurable baselines for health of aquatic ecosystems and assess trends in condition; identify important areas and pollutants/stressors (e.g., chemical contaminants present); and provide monitoring designs for consistent aggregation of data from local to national levels. See the March 3, 2003 EPA brief EMAP for more details.

The EMAP approach can be used to establish the condition of aquatic ecosystems, and the potential chemical contaminants affecting them. There are uncertainties associated with the

use of the EMAP approach in identifying industrial sectors contributing to impacts on these ecosystems. In part, because of cost considerations, analyses of chemical contaminants in sediments or surface waters have been limited in most EMAP or Regional EMAP (R-EMAP) studies. Also, because of the scale of the studies (e.g., an eight state area) and the random site-selection process, the sampling does not readily target point source discharges contributing to stress of the aquatic ecosystems. EMAP data are being incorporated into STORET.

17.1.2 Regional Vulnerability Assessment (ReVA)

ORD is developing the Regional Vulnerability Assessment (ReVA) program to evaluate environmental conditions and known pollutants/stressors within a geographic region. ReVA's goal is to identify those ecosystems most vulnerable to being lost or permanently harmed in the next 5 to 25 years and to determine which pollutants/stressors are likely to cause the greatest risk.

The ReVA program will be responsible for the collection, management, and analysis of multiple data sources to evaluate the environmental condition and pollutants/stressors within a geographical region. The program begins with a pilot assessment of the Mid-Atlantic region. See the March 3, 2003 EPA brief Regional Vulnerability Assessment (ReVA) Program for more details.

The use of ReVA for environmental risk evaluation is possibly feasible. However, ORD is continuing to quantify uncertainties and has not done any analyses, to date, at a national scale. Therefore, ultimate effectiveness and predictive capabilities for EAD in the near term are not likely. To apply this resource to the national scale will depend on the quality of data inputs.

The program currently focuses on a single geographic region, the Mid-Atlantic Region; therefore, application to the national level has not been performed.

17.1.3 Conclusions/Recommendations for Resources Providing Regional Data on Chemical Contaminants

EMAP and ReVA can provide the different chemical contaminants associated with impaired aquatic conditions, but these are not cause-effect relationships. The cause of the impairments must still be diagnosed. While ORD is currently working on an approach to help deal with this issue for EMAP (through developing an improved 303(d) listing process for use with TMDLs), that approach is not ready for use in the current EAD planning process. ReVAs work on predicting the distribution of current stressors, along with mapping of ecological sensitivities, will also contribute to the process of diagnosis. Additionally, new statistical methods under development within the ReVA program show great promise for partitioning out the variability attributable to individual stressors with regard to current condition..

Some of the chemical contaminants in the resources may no longer be discharged. For future planning cycles, EAD intends to review the pollutants in the resources and eliminate those no longer in commerce using data from OPPT. These resources do not provide information on the sources for the chemical contaminants (e.g., industrial dischargers, local pesticide use); however, EAD plans to cross reference the remaining chemicals with potential industry categories.

EAD will continue to explore ways to utilize information already collected or generated using EMAP and ReVA to identify pollutants and to establish links between pollutants and point source category discharges. This analysis may also be targeted to specific watersheds or regions. EAD believes that with the assistance of EMAP and ReVA staff, these resources could eventually be used as a screening level tool for identifying national-level concerns or trends in the environment. EAD will also work with ReVA staff to determine the progress in identifying ecosystems most vulnerable to being lost or permanently harmed in the next 5 to 25 years.

In addition, EAD will discuss with EMAP and ReVA staff the possibility of using this approach for in-depth evaluation of the pollutants/stressors identified in the short-term (and their

possible sources) to support the more detailed investigation phase of the 304(m) planning process.

17.2 Resources for Estimating Potential Exposure and Risk

Using the resources discussed in this section , EAD can identify chemical contaminants that may pose human exposure risks. This section describes each resource and how EAD plans to use the resource to perform screening level analyses in future planning cycles. The following subsections are included:

- Section 17.2.1 presents information on the Frameworks/Multimedia, Multipathway and Multireceptor Risk Assessment (3MRA) Model;
- Section 17.2.2 presents information on the Total Human Exposure Risk Database and Advanced Simulation Environment (THERdbASE); and
- Section 17.2.3 presents information on the Total Exposure Model (TEM).

Each resource section presents conclusions and recommendations on whether and how EAD plans to use them to evaluate human health and environmental impacts.

17.2.1 Frameworks/Multimedia, Multipathway and Multireceptor Risk Assessment (3MRA)

In support of the Office of Solid Waste programs for establishing national exemption levels for the disposal waste streams in land-based waste management units, EPA developed the Multimedia, Multipathway, and Multireceptor Risk Assessment (3MRA) Model to perform site-based national risk assessment of the potential impacts to humans and the environment posed by disposal of industrial waste in land-based units (surface impoundments). The 3MRA model is contained within a software infrastructure (FRAMES - Framework for Risk Analysis in Multimedia Environmental Systems) designed to facilitate the application of the 3MRA model to regulatory problems (e.g., a national assessment of exemption levels of waste streams).

3MRA is an exposure and risk assessment modeling system. Beginning with a chemical concentration in a waste management unit, 3MRA estimates the release and transport of the chemical in various environmental media (e.g., soil, sediment, ground water, surface water, air) and predicts the exposure and potential risk based on that chemical concentration. See the March 3, 2003 EPA brief Frames/3MRA for more details.

EPA developed the 3MRA Model with the intention of broad application beyond the Office of Solid Waste. This is a potentially valuable risk analysis tool for future EAD planning cycles.

EAD will evaluate whether this model can be used as a future screening level tool for identifying national-level concerns or trends in human health and the environment. EAD will meet with 3MRA staff to answer questions including defining the multireceptors (environmental, human), needed data inputs, and how to validate the results. EAD will also discuss with 3MRA staff the possibility of using this model for industry-specific exposure and risk assessment to support the more detailed investigation phase of the 304(m) planning process.

17.2.2 Total Human Exposure Risk Database and Advanced Simulation Environment (THERdbASE)

Total Human Exposure Risk Database and Advanced Simulation Environment (THERdbASE) supports indoor air exposure assessments. The funding for the tool was discontinued in 1998, therefore it is not fully developed. ORD no longer supports this product.

THERdbASE, developed in a Cooperative Agreement between EPA and the University of Nevada-Las Vegas, integrates databases, analytical tools, and models to assist exposure and risk assessors, as well as students in the exposure assessment field of study. Models are linked to databases, or subsets of data, on human activity patterns, U.S. Census data, and related human exposure databases. This tool supports assessments of inhalation exposures, and is particularly

well suited for indoor air exposure assessments. See the March 3, 2003 EPA brief THERdbASE for more details.

Data that had been included before development ceased includes the 1990 Census data and data generated by the air monitoring studies performed under the Total Exposure Assessment Methodology (TEAM). This includes human activity patterns. Additional data resources would be needed to expand this tool's capabilities to include exposure assessments to exposures through the oral route (drinking water and fish ingestion). For example, there are currently no data in Category 3 (Food Consumption Patterns) and Category 4 (Food Contamination) databases.

The five models primarily support inhalation exposure assessments. Additional programming would be needed to expand this tool's capabilities to include exposure assessments to exposures through the oral route (drinking water and fish ingestion).

EAD's review of these databases and models show that they are mostly designed to support indoor air assessments, have not been updated since 1998, and may be inappropriate and outdated for current conditions. EAD does not plan to explore use of this resource further.

17.2.3 Total Exposure Model (TEM)

The Total Exposure Model (TEM) models the transport of chemicals from tap water to indoor air environments and estimates potential human exposure.

The Total Exposure Model (TEM) models physical and chemical processes that govern the transport of chemicals from tap water into indoor air environments (e.g., showering, clothes washing, dish washing) and predicts human exposure. See the March 5, 2003 EPA brief TEM for more details.

This model is predominantly designed to support indoor exposure assessments and likely to require more data than typically available during an environmental assessment. EAD does not plan to explore use of this resource further.

18.0 EMERGING CONCERNS AND OTHER DATA CONSIDERED

18.1 Children's Health

There is no systematic presentation of how well the various indicators (EAD's TWFs, sediment hazard scores, AWQCs) reflect children's health considerations. As a general resource, we have suggested methods currently under development by HECD for evaluation of CCL chemicals.

EAD is working closely with ORD through the workgroup to ensure that any preliminary/additional information is addressed during the Strategy process as soon as it is feasible.

18.2 Endocrine Disruption

The 304(m) planning process will use any information that becomes available as the Agency implements its Endocrine Disruptor Screening Program (EDSP). The Agency has issued a Federal Register Notice (http://www.epa.gov/fedrgstr/EPA-PEST/2002/December/Day-30/p32853.htm) describing its proposed chemical selection approach for the initial round of screening and requesting comment on this approach. Following consideration of comments on this draft approach, EPA will issue a second Federal Register Notice setting forth its approach for selecting the first group of chemicals and the chemicals it proposes for this initial list. Following comment of the draft list of specific chemicals, EPA will issue the final list. EPA also anticipates that it will modify its chemical selection approach for subsequent Tier 1 screening lists based on experience gained from the results of testing of chemicals on the initial list, the feasibility of incorporating different categories of chemicals (e.g., non-pesticide substances) and additional pathways of exposure, and the availability of new priority-setting tools (e.g., High Throughput Pre-screening (HTPS) or Quantitative Structure Activity Relationship (QSAR) models).

EPA developed its EDSP in response to a Congressional mandate in section 408(p) of FFDCA "to determine whether certain substances may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or such other effects as [EPA] may designate". When carrying out the program, the statute requires EPA to "provide for the testing of all pesticide chemicals." In addition, section 1457 of SDWA provides EPA with discretionary authority to provide for testing, under the FFDCA section 408(p) screening program, "of any other substances that may be found in sources of drinking water if the Administrator determines that a substantial population may be exposed to such substance."

EPA is following a tiered approach in implementing the requirements of section 408(p) of FFDCA. The core elements of the tiered approach are priority setting, Tier 1 screening, and Tier 2 testing. Tier 1 will be comprised of a battery of screening assays to identify substances that have potential to interact with the estrogen, androgen, or thyroid hormone systems. The purpose of Tier 2 is to determine whether the substance may cause endocrine-mediated effects via or involving estrogen, androgen, or thyroid hormone systems, determine the consequences to the organism of the activities observed in Tier 1, and establish the relationship between doses of an endocrine-active substance and the effects observed.

At the request of EPA, a joint subcommittee of the EPA Science Advisory Board (SAB) and the FIFRA Scientific Advisory Panel (SAP) reviewed a set of scientific issues related to the development of the Agency's EDSP. One of the recommendations of the SAB/SAP Subcommittee was that EPA should initiate the Tier 1 screening program with a set of 50 to 100 chemicals and then convene a panel of independent scientists to review the screening data for the purpose of evaluating and optimizing the Tier 1 screening battery. EPA is proposing to adopt this recommendation to initially select and screen approximately 50 to 100 chemicals to help the Agency further refine the EDSP. The Agency intends to submit the data received from the screening to an independent external panel of experts and request an evaluation of whether the program could be improved or optimized, and if so, how.

EPA has stated its intention to consider a broad universe of chemicals as potential candidates for testing under the EDSP including pesticide chemicals, non-pesticide commercial chemicals, mixtures, and environmental contaminants (63 FR 71542). However, for the first group of chemicals to be tested, EPA is intending to focus only on pesticide active ingredients and high production volume (HPV) chemicals with some pesticidal inert uses (i.e., the chemicals that are specifically mandated for testing under section 408(p) of FFDCA). The pesticide inerts to be considered are those with relatively large overall production volumes considering both pesticide and non-pesticide uses. This approach will allow EPA to focus its initial screening efforts on a smaller and more manageable universe of chemicals that emphasizes early attention to the pesticide chemicals that Congress specifically mandated EPA to test for possible endocrine effects.

In the future, EAD will remain in touch with the progress being made in the EDSP and use any information that becomes available through this program as testing methods and the scope of chemicals tested continues to develop.

18.3 Pathogen Impacts

The Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA) address microbial (pathogenic) contamination of the nation's waters. Pathogens include protozoa (e.g., Cryptosporidium parvum and Giardia lamblia), viruses (e.g., enteroviruses and hepatitis A), and bacteria (e.g., Legionella and Mycobacteria). Indicators of fecal contamination (and thus gastroenteritis causing organisms) under these two Acts differ based on likelihood of occurrence in the water source. A strategy that addresses issues such as non-enteric contamination (e.g., skin rashes, respiratory illness), emerging pathogens, and unification of indicators under the two Acts would be useful and has been called for by stakeholders for the protection of human health.

18.3.1 Description of Resource

Criteria documents (and corresponding short health advisories and fact sheets) for drinking water contaminants provide information to determine whether the contaminant is a significant health threat via drinking water exposure and whether sufficient data exist to perform quantitative risk assessments. Children's Risk documents may provide further information that addresses children's health issues. Criteria documents, health advisories, and fact sheets include:

- Protozoa: Cryptosporidium*, Giardia*;
- Bacteria: Legionella*, Mycobacteria*, Escherichia coli O157:H7; and
- Viruses: Enteroviruses and Hepatitis A.

* Children Risk Documents

See the 2003 EPA brief Waterborne Pathogens for more details.

18.3.2 Resource Use for Human Health and Environmental Impacts Analysis

EAD identified multiple tools to be used in the evaluation of pathogen impacts including the New Microbial Strategy (March 2003), criteria and other health related documents mentioned above, and efforts/results from other entities (e.g., ORD) for pathogen impact assessments. EAD may also explore the best indicators associated with health as a follow up to the completion of a National Research Council (NRC) report. Combinations of water quality indicators may provide more powerful ways to assess overall health impacts. Although this resource may be useful in the future, it is not included in the current planning cycle.

18.4 Regional Resource: Gulf Hypoxia Action Plan

The analysis of point source nutrient loadings in the Mississippi River system was prepared to support the White House Committee on Environment and Natural Resources' (CENR) Gulf of Mexico Hypoxia Work Group. This work group assessed the causes and consequences of hypoxia in the Gulf of Mexico.

18.4.1 Description of Resource

The analysis results provide estimated annual nutrient discharges for total nitrogen and phosphorus for approximately 11,500 point source facilities within the Mississippi River Basin system. The total annual nutrient loads from all point sources for total nitrogen and phosphorus were estimated to be 643 million pounds and 133 million pounds, respectively. Tables included in EPA's March 5, 2003 brief, Point Source Nutrient Loadings in the Mississippi River System, present the chief contributors of nutrients to the Mississippi River system by industry, from a total of 390 evaluated industries. Of the point sources, municipal discharges accounted for 70 percent of the total nitrogen and 51 percent of the total phosphorus. Tables 1 and 2 in the brief present the top contributors (by facility type) of total nitrogen and total phosphorus, respectively. These facility types contribute 95 percent of the total point source load. Table 18-1 below presents the top contributors of total nutrients. Nineteen of the top 21 nitrogen contributors are also in the top 31 phosphorus contributors. See the March 5, 2003 EPA brief Point Source Nutrient Loadings in the Mississippi River System for more details.

18.4.2 Resource Use for Human Health and Environmental Impacts Analysis

Data from this report provides nutrient loading information for a wide range of industry categories. EAD can use the data (and corresponding industry ranking) to identify major sources of nutrient discharges.

EAD will contact the EPA Task Force responsible for the Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico to determine the status of their short-term goals. These goals include monitoring efforts, studies, and strategies for nutrient loading reduction, additional efforts to identify significant point source dischargers of nutrients and reducing their loads, and potential voluntary actions.

EAD anticipates that this resource will be a major tool for identifying nutrient impacts from point source discharges to the Mississippi River system, but because no other regional

resources were considered in the screening analysis of this planning cycle, the data will not be used during the screening analysis.

Table 18-1

Top Point Source Contributors of Total Nutrients to the Mississippi River System

Facility Type	SIC Code	Total Nitrogen			Total Phosphorous		
		Annual Load (lbs/yr)[a]	Contribution Percent[b]	Rank	Annual Load (lbs/yr)[a]	Contribution Percent[b]	Rank
Municipal (sewerage systems)	4952	449,854,637	70%	1	67,457,250	51%	1
Plastics materials & resins	2821	28,648,686	4%	2	3,362,204	3%	7
Refuse systems	4953	14,801,664	2%	3	1,681,738	1%	11
Nitrogenous fertilizers	2873	14,146,203	2%	4	917,180	1%	18
Primary aluminum	3334	13,494,456	2%	5	1,401,960	1%	13
Wet corn milling	2046	11,611,176	2%	6	5,877,623	4%	3
Blast furnaces & steel mills	3312	8,834,989	1%	7	3,859,608	3%	5
Cyclic crudes & intermediates	2865	8,423,954	1%	8	431,858	0.3%	31
Industrial inorganic chemicals, NEC	2819	6,995,119	1%	9	2,734,463	2%	8
Meat packing plants	2011	6,766,578	1%	10	581,886	0.4%	26
Petroleum refining	2911	6,625,177	1%	11	3,910,332	3%	4
Beef cattle feedlots	211	5,914,201	1%	12	8,508,149	6%	2
Paper mills	2621	5,747,612	1%	13	3,821,188	3%	6
Pulp mills	2611	5,625,299	1%	14	2,396,654	2%	9
Cellulosic manmade fibers	2823	4,143,917	1%	15	640,734	0.5%	25
National security	9711	3,484,848	1%	16	2,118,710	2%	10
Paints and allied products	2851	3,051,224	0.5%	17	310,493	0.2%	40
Cold finishing of steel shapes	3316	2,617,604	0.4%	18			
Primary nonferrous metals, NEC	3339	2,207,537	0.3%	19			
Poultry slaughtering & processing	2015	1,997,804	0.3%	20	1,081,226	1%	17
Petroleum bulk stations & terminals	5171	1,874,870	0.3%	21	1,172,099	1%	15
Total		**641938881**	**95%**		**132921302**	**84%**	

[a] Sum of BEST ESTIMATE ANNUAL LOAD
[b] Percentage out of 390 facility types
NEC - Not elsewhere classified

18.5 National Report on Human Exposure to Environmental Chemicals

The National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention (CDC), conducted the National Health and Nutrition Examination Survey (NHANES) survey to collect information about the health and diet of people in the United States. Data from this survey were used to prepare the *National Report on Human Exposure to Environmental Chemicals*, which provides an ongoing assessment of the U.S. population's exposure to environmental chemicals using biomonitoring. The report can be viewed online at http://www.cdc.gov/exposurereport/pdf/SecondNER.pdf.

18.5.1 Description of Resource

The overall purpose of the report is to provide unique exposure information. Some of the specific public health uses of the exposure information are:

- To determine which chemicals enter the human body in the U.S. and at what concentrations;
- To determine the prevalence of people with levels above known chemical toxicity levels (e.g., lead);
- To establish reference ranges that can be used by physicians and scientists to determine whether a person or group has an unusually high exposure;

- To assess the effectiveness of public health efforts to reduce exposure of Americans to specific chemicals;
- To determine whether exposure levels are higher among minorities, children, women of childbearing age, or other potentially vulnerable groups;
- To track, over time, trends in levels of exposure of the population; and
- To set priorities for research on human health.

The first report, issued March 2001, presents exposure data based on the 1999 NHANES survey for 27 chemicals, including metals (e.g., lead, mercury, and cadmium), dialkyl phosphate metabolites of organophosphate pesticides, cotinine, and phthalates. The second report, issued January 2003, presents biomonitoring exposure data for 116 environmental chemicals, including the 27 in the first report and the following chemicals:

- Polycyclic aromatic hydrocarbons (PAHs);
- Dioxins, furans, and coplanar polychlorinated biphenyls (PCBs);
- Non-coplanar PCBs;
- Phytoestrogens;
- Selected organophosphate pesticides;
- Organochlorine pesticides;
- Carbamate pesticides;
- Herbicides; and
- Pest repellents and disinfectants.

The report presents exposure data for the U.S. population divided into age, gender, and race/ethnicity groups.

18.5.2 Resource Use for Human Health and Environmental Impacts Analysis

Any pollutants EAD identifies as being of concern will be checked to see if they are included in the NHANES survey data and the results in the *National Report on Human Exposure to Environmental Chemicals*. However, this review will not occur in the current planning cycle because pollutant specific information needs to be bridged to discharging sources.

SECTION IV

APPENDIX A

EAD TOXIC WEIGHTING FACTOR METHODOLOGY

The U.S. Environmental Protection Agency (EPA) uses EAD's TWFs to calculate copper-based pound-equivalents of pollutants. EAD's TWFs are derived from chronic aquatic life criteria (or toxic effect levels) and human health criteria (or toxic effect levels) established for the consumption of fish. For carcinogenic substances, EPA sets the human health risk level at 10^{-5} (i.e., protective to a level allowing 1 in 100,000 excess lifetime cancer cases over background). In the EAD's TWF method for assessing water-based effects, these toxicity levels of pollutants of concern are compared to a benchmark value that represents the toxicity level of a specified pollutant. EPA selected copper, a toxic metal commonly detected and removed from industrial effluent, as the benchmark pollutant. EPA used copper in previous EAD TWF calculations for the cost-effectiveness analysis of effluent guidelines. Although EPA revised the water quality criterion for copper in 1998 (to 9.0 micrograms per liter [µg/L]), the EAD TWF method uses the former criterion (5.6 µg/L) to facilitate comparisons with cost-effectiveness values calculated for other regulations. The former criterion for copper (5.6 µg/L) was reported in the 1980 *Ambient Water Quality Criteria for Copper* document (U.S. EPA, 1980).

To calculate EAD TWF values, EPA adds TWFs for aquatic life effects and for human health effects for each pollutant of concern. EPA uses chronic effects on aquatic life and human health effects from ingesting contaminated organisms (HHOO) as the basis for EAD 's TWFs. The calculation is performed by dividing aquatic life and human health criteria (or toxic effect levels) for each pollutant, expressed as a concentration in micrograms per liter (µg/L), into the former copper criterion of 5.6 µg/L:

$$\mathrm{TWF} = \frac{5.6}{\mathrm{AQ}} + \frac{5.6}{\mathrm{HHOO}}$$

where:

TWF = toxic weighting factor
AQ = chronic aquatic life value (µg/L)
HHOO = human health (ingesting organisms only) value (µg/L)

Chronic Aquatic Life Values

When selecting chronic aquatic toxicity values, EPA uses national water quality criteria, when available. When these criteria are not available, other values representative of the chemical's chronic toxicity are used. EPA uses the following hierarchy to select the appropriate chronic values:

1. National chronic freshwater quality criteria

2. Lowest reported measured maximum allowable toxicant concentration (MATC), lowest-observed-effect concentration (LOEC), or no-observed-effect concentration (NOEC)

3. Lowest reported measured chronic growth or reproductive toxicity test concentration

4. Estimated chronic toxicity concentration from a measured acute:chronic ratio for a less sensitive species, quantitative structure-activity relationship (QSAR) model, or default acute:chronic ratio of 10:1

National Chronic Freshwater Quality Criteria

National chronic water quality criteria are the first choice for values because they represent a consideration of a chemical's toxicity to a diverse genera of aquatic life and have been published by EPA. The derivation of EPA criteria values is described in EPA Office of Water's criteria documents for specific pollutants (U.S. EPA, 1980). "Criteria" is defined as the 4-day average concentration of toxicants 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.

Lowest Reported MATC, LOEC, or NOEC Concentration

The term "chronic" involves a stimulus that continues for a long time, often for periods of several weeks to years, depending on the organism's reproductive life cycle. Chronic aquatic tests measure the effects of long-term exposure to a chemical. The biological response to the exposure is typically of relatively slow progress and long continuance. Citing rapid developments in test methodology, EPA recommends several 7-day, short-term period exposure duration test methods (U.S. EPA, 1989a). Test endpoints include such variables as survival percentage, hatchability, and normal larvae weight and length. Chronic tests of longer exposure duration measure endpoints such as growth and reproduction.

EPA uses chronic aquatic test data to identify three concentration levels of potential significance: the no-observed-effect concentration (NOEC), the lowest-observed-effect concentration (LOEC), and the maximum allowable toxicant concentration (MATC). The NOEC is the highest toxicant concentration to which test organisms have been exposed with results of no-observed adverse effect. The NOEC may be statistically determined using hypothesis testing, or it may be derived from the inhibition concentration, which is an estimate of the toxicant concentration that will result in a given percentage reduction in biological measurement of the test organisms. The LOEC is the lowest toxicant concentration at which a chronic effect on a test organism has been observed. The MATC is the geometric mean of the NOEC and LOEC and is meant to represent the threshold level where chronic effects will begin to occur. MATC values are selected first, followed by LOEC values, and lastly by NOEC values.

Lowest Chronic or Reproductive Test Concentration

For chemicals that do not have chronic aquatic life criteria, MATCs, LOECs, or NOECs, EPA obtains chronic effect concentrations from readily available sources of chronic toxicity test data. The preferred information source is the EPA's Assessment Tools for the Evaluation of Risk (ASTER) (U.S. EPA, 1998/1999a), which combines the Aquatic Toxicity Information

Retrieval database (AQUIRE) (U.S. EPA, 1998/1999b), the EPA Environmental Research Laboratory-Duluth (ERL-Duluth) fathead minnow database (U.S. EPA, 1998/1999c), and tables of toxicity test results from water quality criteria documents. The ASTER system differentiates between AQUIRE test data that are likely to be of good quality and AQUIRE test data that are of unknown quality, according to the following criteria:

- Test pH within range of 6.5 - 8.5.
- Review code 1 (methodology section cites published or well-documented procedures; satisfactory control; measured concentration; temperature, pH, dissolved oxygen, and hardness are reported) or 2 (one or more of the following may occur: control mortality not reported; no solvent control when a solvent is used in the test; unmeasured concentration; water chemistry variables not reported or incomplete).
- No use of formulations or carriers.
- Measured values and flow-through exposure only for tests on fish (no static exposure).
- Measured values only for invertebrates or plants (exposure may be static or flow-through).

Test results from the ERL-Duluth fathead minnow database are assumed to be of good quality. However, test results reported in water quality criteria documents are assumed to be of unknown quality.

EPA selects the lowest reported concentration—from a chronic growth or reproductive test on a North American native fish or invertebrate or from a biologically significant (i.e., chlorophyll production) EC_{50} test for an algal species—from the pool of test data likely to be of good quality or, alternatively, from the pool of data of unknown quality. If appropriate test data are not available from ASTER, other primary or secondary information sources are consulted.

Estimated Chronic Toxicity Concentration

EPA uses estimated chronic toxicity concentrations when measured values are unavailable. The first option for estimating a chronic toxicity concentration is to use acute toxicity concentrations and a measured acute:chronic ratio (ACR). ACRs are based on measured acute and chronic pollutant concentration values for the same species. The calculated ACR is applied to the acute aquatic toxicity criterion or toxic effect level selected for the pollutant of concern. EPA uses this method in instances where an ACR is available for a species that has a measured chronic toxicity concentration that is greater than the acute criterion or the representative acute toxic effect level for the selected pollutant. These instances arise when chronic toxicity test data are available for less sensitive species only. The acute aquatic toxic effect level (used if national acute water quality criteria are not available) is typically the lowest reported acute aquatic bioassay test concentration (24- to 96-hour median lethal concentration (LC_{50})) for a North American resident species of fish or invertebrate. As with chronic toxic effect levels, a test result of good quality is selected ahead of a test result of unknown quality.

The second option for estimating a chronic toxicity test concentration is to use ERL-Duluth's QSAR model (U.S. EPA, 1998/1999d). QSAR derives statistically based relationships between physical-chemical properties and biological activity. The QSAR model uses measured toxicity test results for compounds with similar chemical structures and properties to estimate MATC values for compounds whose chemical structure and properties are known or may be estimated.

The final option for estimating a chronic toxicity concentration is to apply an assumed ACR of 10:1 to the acute aquatic toxic effect concentration. The ACR of 10:1 is based on a recommendation in EPA Office of Water's *Technical Support Document for Water Quality-based Toxics Control* (U.S. EPA, 1991) for estimating chronic toxicity when no data are available. The recommendation assumes that the chronic toxicity value is 10 times lower than the acute value.

Human Health Values

EPA addresses potential human health toxicity for EAD 's TWFs using the HHOO, human health (ingesting organisms only) criterion or toxic effect level. For PWFs, the HHWO, human health (ingesting water and organisms) criterion or toxic effect level is used. EPA uses the following hierarchy to determine human health values, in order of priority:

1. Calculated human health criteria using EPA's Integrated Risk Information System (IRIS) (U.S. EPA, 1998/1999e) oral reference doses (RfDs) or oral cancer potency slope factors (SFs) in conjunction with adjusted 3 percent lipid bioaccumulation factor (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 grams per day (g/day) was derived (U.S. EPA, 1991).

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

3. Calculated human health values using RfDs or SFs from EPA's Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1997) or EPA's Region III Risk-Based Concentration (RBC) Table (U.S. EPA, 1998) used in conjunction with adjusted 3 percent lipid BCF values derived from *Ambient Water Quality Criteria Documents*.

4. Calculated human health criteria using current RfDs or SFs from HEAST or EPA's Region III RBC table and representative BCF values for common North American species of fish or invertebrates or estimated BCF values.

5. Criteria from the *Ambient Water Quality Criteria Documents*.

6. Calculated human health values using RfDs or SFs from data sources other than IRIS, HEAST, or the Region III RBC Table.

This hierarchy is based on Section 2.4.6 of the *Technical Support Document for Water Quality-based Toxics Control* (U.S. EPA, 1991), which recommends that the most current risk information from IRIS be used when estimating human health risks. This document also recommends using an average daily fish consumption rate of 6.5 grams, an average daily water

intake of 2 liters, and an average adult body weight of 70 kilograms. In cases where a chemical has both an RfD and SF from sources at the same level of the hierarchy, the human health values are calculated using the SF, which always results in the more stringent value of the two. When a chemical has both an RfD and SF but these values are from different levels of the hierarchy, the value that is from the source higher on the hierarchy is used. The carcinogenic risk level is 10^{-5} for EAD 's TWFs, whereas a risk level of 10^{-6} is used for PWFs. The following equations are used to calculate human health values:

For Toxicity Protection (ingestion of organisms only)

$$\text{HHOO } (\mu g/L) = \frac{\text{RfD (mg/kg/d) x 70 kg x 1,000 } \mu g/mg}{\text{0.0065 kg/d x BCF (L/kg)}}$$

For Carcinogenicity Protection (ingestion of organisms only)

$$\text{HHOO } (\mu g/L) = \frac{\text{70 kg x Risk Level (dimensionless) x 1,000 } \mu g/mg}{\text{SF } (mg/kg/d)^{-1} \text{ x 0.0065 kg/d x BCF (L/kg)}}$$

For Toxicity Protection (ingestion of water and organisms)

$$\text{HHWO } (\mu g/L) = \frac{\text{RfD (mg/kg/d) x 70 kg x 1,000 } \mu g/mg}{\text{2 L/d + [0.0065 kg/d x BCF (L/kg)]}}$$

For Carcinogenicity Protection (ingestion of water and organisms)

$$\text{HHWO } (\mu g/L) = \frac{\text{70 kg x Risk Level (dimensionless) x 1,000 } \mu g/mg}{\text{SF } (mg/kg/d)^{-1} \text{ x [2 L/d + [0.0065 kg/d x BCF (L/kg)]]}}$$

Seven of the pollutants addressed in this report are chlorinated dibenzofuran (CDF) congeners. For these chemicals, EPA recommends using toxicity equivalency factors (U.S. EPA, 1989c). The toxicity equivalency factor (TEF) approach assumes the structure-activity relationship is sufficiently strong that estimates of long-term toxicity of minimally tested chlorinated dibenzo-p-dioxin (CDD) and CDF congeners can be reasonably inferred on the basis of available information. The TEFs for tetra (T), penta (Pe), hexa (Hx), hepta (Hp), and octa (O) CDDs/CDFs are as follows:

Compound	TEF
2,3,7,8-TCDD	1
2,3,7,8-PeCDD	0.5
2,3,7,8-HxCDDs	0.1
2,3,7,8-HpCDD	0.01
OCDD	0.001
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
2,3,7,8-HxCDFs	0.1
2,3,7,8-HpCDFs	0.01
OCDF	0.001

SECTION IV

APPENDIX B

TRI AND PCS INDUSTRY RANKINGS

Table B-1: Toxic Weighted Pound Equivalents Discharges by Industries Regulated by Existing Effluent Guidelines

40 CFR Part	Point Source Category	PCS Reported Toxic-Weighted Pound Equivalents	TRI Reported Toxic-Weighted Pound Equivalents	PCS Reported		TRI Reported	
				Step 1 Rankings	Step 6B Rankings	Step 1 Rankings	Step 6B Rankings
405	Dairy products processing	4	5,829	47	33	37	27
406	Grain mills manufacturing	471	8,610	42	31	35	25
407	Canned and preserved fruits and vegetable processing	2,905	17,649	38	28	29	20
408	Canned and preserved seafood	18,961	20	26	17	49	37
409	Sugar processing	15,501	284	28	18	43	32
410	Textile mills	296,601	84,754	11	7	19	12
411	Cement manufacturing	15,113	10,827	29	19	33	23
412	Concentrated animal feeding operations (CAFO)	N/A	N/A	N/C	N/C	N/C	N/C
413	Electroplating	15,967	41,380	27	N/C	23	N/C
414	Organic chemicals, plastics and synthetic fibers	2,251,114	31,598,863	4	2	1	1
415	Inorganic chemicals manufacturing	853,568	630,218	7	4	12	7
417	Soaps and detergents manufacturing	164	362	44	32	42	31
418	Fertilizer manufacturing	113,776	61,273	17	10	20	13
419	Petroleum refining	197,490	2,394,632	14	8	4	3
420	Iron and steel manufacturing	2,051,270	1,685,493	5	N/C	6	N/C
421	Nonferrous metals manufacturing	434,925	978,450	9	5	8	6
422	Phosphate manufacturing	1,098,008	255	6	3	44	33
423	Steam electric power generation	8,734,590	1,854,204	1	1	5	4
424	Ferroalloy manufacturing	8,830	22,131	31	21	27	18
425	Leather tanning and finishing	5,486	28,670	36	26	24	16
426	Glass manufacturing	0	1,875	48	34	38	28
427	Asbestos manufacturing	N/A	6	N/C	N/C	51	38
428	Rubber manufacturing	8,748	166,343	32	22	14	8
429	Timber products processing	960	5,546,567	40	29	2	2
430	Pulp, paper and paperboard (Phase III)	5,120,869	319,244	2	N/C	13	N/C
430	Pulp, paper and paperboard (Phase I)	4,217,679	3,575,766	3	N/C	3	N/C
430	Pulp, paper and paperboard (Phase II)	67,796	1,336,418	19	12	7	5
432	Meat products processing	19,404	16,783	25	N/C	30	N/C
433	Metal finishing	445,785	842,890	8	N/C	11	N/C
434	Coal mining	1,385	22,472	39	N/C	26	N/C
436	Mineral mining and processing	29,402	0	22	15	52	39
437	Centralized waste treatment	N/A	N/A	N/C	N/C	N/C	N/C
438	Metal products and machinery	197,082	45	15	N/C	47	N/C
439	Pharmaceutical manufacturing	19,825	105,119	24	N/C	17	N/C
440	Ore mining and dressing	383,560	52,627	10	6	21	14
40 CFR Part	Point Source Category	PCS Reported Toxic-Weighted	TRI Reported Toxic-Weighted	PCS Reported		TRI Reported	

		Pound Equivalents	Pound Equivalents				
				Step 1 Rankings	Step 6B Rankings	Step 1 Rankings	Step 6B Rankings
446	Paint formulating	N/A	916	N/C	N/C	39	29
447	Ink formulating	N/A	51	N/C	N/C	45	34
450	Construction and development	N/A	N/A	N/C	N/C	N/C	N/C
451	Aquatic animal production industry	16	N/A	45	N/C	N/C	N/C
454	Gum and wood chemicals	42,455	50	21	14	46	35
455	Pesticide chemicals	178,977	13,281	16	9	31	21
457	Explosives	5,550	381	35	25	41	30
458	Carbon black manufacturing	N/A	N/A	N/C	N/C	N/C	N/C
459	Photographic	0	N/A	48	35	N/C	N/C
460	Hospital	5	724	46	N/C	40	N/C
461	Battery manufacturing	0	8,047	48	35	36	26
463	Plastic molding and forming	3,698	106,189	37	27	15	9
464	Metal molding and casting	5,833	45,182	33	23	22	15
465	Coil coating	N/A	11,764	N/C	N/C	32	22
466	Porcelain enameling	54,077	92,174	20	13	18	11
467	Aluminum forming	103,624	25,035	18	11	25	17
468	Copper forming	5,556	22,071	34	24	28	19
469	Electrical and electronic components	23,714	9,800	23	16	34	24
471	Nonferrous metals forming and metal powders	15,095	105,540	30	20	16	10

Note: "N/A"means not available and "N/C" means not calculated. EPA maynot have calculated a rank due to lack of PCS or TRI data (e.g., coil coating). EPA may also have been unable to identifythe pollutant loadings for the various subcategories within a point source category. This is important when trying to identify subcategories or wastewater discharges from industrial operations not subject to any exclusions identified in Step 2.

Note: The TWPE estimates for both Waste Combustors (Part 444) and Landfills (Part 445) are the same as EPA used the same SIC code (Refuse systems (4953)) to estimate loadings for both categories. EPA will refine theses TWPE estimates for the final record by using the facilities identified in these rulemaking records.

Table B-2: Toxic-Weighted Pound Equivalents Discharges by Industries Not Regulated by Existing Effluent Guidelines

SIC Code	Industrial Sector	PCS Reported Toxic-Weighted Pound Equivalents	TRI Reported Toxic-Weighted Pound Equivalents	PCS Reported		TRI Reported	
				Step 1 Rankings	Step 6B Rankings	Step 1 Rankings	Step 6B Rankings
Two-Digit SIC Code Data							
9	Fishing, Hunting, & Trapping	266	N/A	N/C	N/C	N/C	N/C
16	Heavy Construction, Except Building	0	N/A	N/C	N/C	N/C	N/C
20	Food & Kindred Products	25,890	24,500	N/C	N/C	N/C	N/C
21	Tobacco Products	N/A	6,131	N/C	N/C	N/C	N/C
23	Apparel & Other Textile Products	N/A	53	N/C	N/C	N/C	N/C
24	Lumber & Wood Products	2,885	14,656	N/C	N/C	N/C	N/C
25	Furniture & Fixtures	N/A	2	N/C	N/C	N/C	N/C
26	Paper & Allied Products	990	1,622	N/C	N/C	N/C	N/C
27	Printing & Publishing	2,247	280	N/C	N/C	N/C	N/C
28	Chemical & Allied Products	35,444	164,662	N/C	N/C	N/C	N/C
29	Petroleum & Coal Products	29	5,698	N/C	N/C	N/C	N/C
30	Rubber and miscellaneous plastics products	N/A	0	N/C	N/C	N/C	N/C
32	Stone, Clay, & Glass Products	5,683	5,561	N/C	N/C	N/C	N/C
34	Fabricated metal products	N/A	0	N/C	N/C	N/C	N/C
39	Misc. Manuf. Industries	N/A	0	N/C	N/C	N/C	N/C
40	Railroad Transportation	11,701	N/A	N/C	N/C	N/C	N/C
42	Trucking & Warehousing	5,212	N/A	N/C	N/C	N/C	N/C
44	Water Transportation	N/A	N/A	N/C	N/C	N/C	N/C
46	Pipelines, Except Natural Gas	347	N/A	N/C	N/C	N/C	N/C
47	Transportation Services	7	N/A	N/C	N/C	N/C	N/C
49	Electric, Gas, & Sanitary Services	91,622	17,957	N/C	N/C	N/C	N/C
50	Wholesale Trade- Durable Goods	0	287	N/C	N/C	N/C	N/C
51	Wholesale Trade- Nondurable Goods	945	275	N/C	N/C	N/C	N/C
65	Real Estate	109	N/A	N/C	N/C	N/C	N/C
67	Holding & Other Investment Offices	N/A	0	N/C	N/C	N/C	N/C
73	Business Services	N/A	88,810	N/C	N/C	N/C	N/C
82	Educational Services	6,892	N/A	N/C	N/C	N/C	N/C
87	Engineering & Management Services	1,265	124,717	N/C	N/C	N/C	N/C
89	Services, Not Elsewhere Classified	N/A	566	N/C	N/C	N/C	N/C
91	Executive, Legislative, & General	3	36,734	N/C	N/C	N/C	N/C

SIC Code	Industrial SectorPCS Reported Toxic-Weighted Pound Equivalents	TRI Reported Toxic-Weighted Pound Equivalents	PCS Reported	TRI Reported			
				Step 1 Rankings	Step 6B Rankings	Step 1 Rankings	Step 6B Rankings
92	Justice, Public Order, & Safety	546	N/A	N/C	N/C	N/C	N/C
95	Environmental Quality & Housing	1,307	18,458	N/C	N/C	N/C	N/C
96	Administration of Economic Programs	4,163	N/A	N/C	N/C	N/C	N/C
97	National Security & International Affairs	109,122	3,647	N/C	N/C	N/C	N/C
99	Non classifiable Establishments	29,591	1	N/C	N/C	N/C	N/C
Industry Sectors Identified by Stakeholders							
45	Airport Industrial Discharges	466	N/A	3	2	N/C	N/C
0273	Aquatic Animal Production	16	N/A	4	N/C	N/C	N/C
15	Storm Water Discharges from Construction and Development	N/A	N/A	N/C	N/C	N/C	N/C
8021	Dental Facilities	N/A	N/A	N/C	N/C	N/C	N/C
4941	Drinking Water Supply and Treatment	611,324	7	1	1	2	1
581	Food Service Establishments	N/A	N/A	N/C	N/C	N/C	N/C
4959	Groundwater Remediation	N/A	N/A	N/C	N/C	N/C	N/C
8071	Independent & Stand Alone Laboratories	N/A	N/A	N/C	N/C	N/C	N/C
7218	Industrial Laundries	N/A	N/A	N/C	N/C	N/C	N/C
4481	Ocean Going Vessels	N/A	N/A	N/C	N/C	N/C	N/C
27	Printing & Publishing	2,247	280	2	N/C	1	N/C
9223	Prisons	N/A	N/A	N/C	N/C	N/C	N/C
N/A	Municipal Storm Water Runoff	N/A	N/A	N/C	N/C	N/C	N/C
4952	Wastewater Treatment and Sewerage Systems	N/A	N/A	N/C	N/C	N/C	N/C

Note: "N/A" means not available and "N/C" means not calculated. EPA may not have calculated a rank due to lack of PCS or TRI data (e.g., tobacco products).