THE NATIONAL COASTAL POLLUTANT DISCHARGE INVENTORY

Pollutant Discharge Concentrations for Industrial Point Sources

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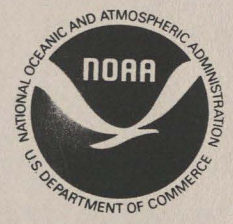

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The National Coastal Pollutant Discharge Inventory (NCPDI)

The National Coastal Pollutant Discharge Inventory is a data base and computational framework being developed within the National Oceanic and Atmospheric Administration by the Strategic Assessment Branch. The NCPDI contains pollutant loading estimates for all point, nonpoint, and riverine sources located in coastal counties or the 200 mile Exclusive Economic Zone (EEZ) that discharge into estuarine, coastal, and oceanic waters of the contiguous USA (excluding the Great Lakes).

The pollutant discharge estimates in the NCPDI are for the base year 1982, but can be considered to approximate pollutant discharge conditions during the period 1980-85. Estimates are made for 18 pollutants in nine major source categories: 1) wastewater; 2) oxygen-demanding materials; 3) particulate material; 4) nutrients; 5) heavy metals; 6) petroleum hydrocarbons; 7) chlorinated hydrocarbons; 8) pathogens; and 9) sludges; and can be aggregated by county or U.S. G.S. hydrologic cataloging unit.

An important aspect of the NCPDI is a computational framework that enables estimates to be aggregated in various ways, depending on the issue or problem of concern. For example, estimates can be aggregated by pollutant, source category, individual source, various spatial units, and various temporal dimensions. Spatial aggregations can be made for each region including: state coastal areas, individual coastal counties, U.S. Geological Survey cataloging units, estuarine drainage basins, or 30 x 30 minute offshore grid cells. Temporal aggregations can be made for each season (spring, summer, winter, and fall) as well as totals for the year.

The NCPDI has been developed as part of NOAA's program of strategic assessments of the nation's coastal and oceanic regions. Its primary application is as an assessment tool to identify and evaluate existing and future conflicts over the use of resources in the coastal zone. These types of assessments are characterized as "strategic" because they are carried out from a comprehensive perspective that focuses on the nation as a whole or on large coastal or oceanic regions. They are important because they provide synoptic pictures of resource use issues that allow decisionmakers to view the true scale of resource problems in the coastal zone. They bridge the gap between the mountains of very detailed data available for some areas (typically hard to reduce and compare from area to area) and the sparse data available for the rest of the nations's coastal zone.

The NCPDI contains pollutant loading estimates for approximately 2,800, 700, and 800 direct discharging industrial point sources, along the East, West, and Gulf of Mexico coasts, respectively. In many cases there was little monitored data available . The typical concentrations shown in Table 2 are relevant when monitored data was unavailable.

For additional information on these values or the National Coastal Pollutant Discharge Inventory, contact:

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Introduction

This paper presents a matrix of typical pollutant concentrations in wastewater streams discharged from industrial facilities, and discusses how these typical concentrations have been developed and used in NOAA's NCPDI. Typical effluent concentrations for 16 pollutants are provided for 83 industrial categories (Table 2). These concentration values or coefficients are used to approximate pollutant discharges when monitored or measured data are unavailable.[a/] Since comprehensive monitored data exists for relatively few pollutants, use of concentrations such as these have been, and will continue to be, a major means for estimating pollutant discharges.

The concentration values in this report have been compiled during development of NOAA's ***National Coastal Pollutant Discharge Inventory*** (NCPDI). They are presented because they will be useful to anyone attempting to estimate pollutant discharges when little or no measured data are available, particularly during the early or preliminary screening phase of a study. In addition, this paper provides users of the NCPDI with a ready reference.

Estimating Discharges When Measured Data Are Not Available

There are 5 basic ways to estimate pollutant discharges from an industrial facility when no measured data exist, and resources for conducting additional monitoring are inadequate. These methods include each of the following or combinations of each:

(1) Assume a facility is meeting regulated discharge limits.

Our review of available measured data and permit limits for both coastal and non coastal facilities indicates that actual discharge levels are not the same as their permit limits. In addition few of the pollutants of interest in the NCPDI (Table 1) are regulated at most facilities. A compendium of major NPDES permits compiled by EPA called the Abstracts of Industrial NPDES Permits indicates that there are different permit limits written for different industrial facilities within the same industrial category. If the regulated limits are used to estimate discharges, overall results are inconsistent, incomplete and difficult to assess.

(2) Assume that pollutant loads are equal to the plant flow times the typical concentrations obtained by secondary treatment or the treatment train commonly used by the industry.

Given highly variable raw waste inputs and treatment efficiencies which differ depending upon the quality of the waste stream, using engineering treatment design levels is not always the best representation of actual discharges. Due to in-plant water use changes, some plants may be doing better than design levels (this is often the case in newer petrochemical plants and petroleum refineries). On the other hand, if operation and maintenance of the wastewater treatment facility is poor, the plants may be doing worse.This method is difficult to implement comprehensively due to limited availability of data on influent quality and treatment trains in place at individual facilities.

[a/] The Clean Water Act (PL 92-500) mandates that every direct discharging industrial facility must have a permit that defines the levels of pollutants it is allowed to discharge. The permits are regulated under the National Pollutant Discharge Elimination System (NPDES) of the U.S. Environmental Protection Agency (EPA) and state water quality agencies. Under this system each facility must monitor its own waste stream and report its effluent characteristics to state water quality agencies on a regular basis. A number of the pollutants of interest contained in the NPCDI are not included in the NPDES system. They are included, however, because they are known to have potential adverse impacts on marine organisms.

Table 1. Pollutants included in the National Coastal Pollutant Discharge Inventory (NCPDI)

Pollutants	Definition	Effects
1. OXYGEN-DEMANDING MATERIALS		
Biochemical Oxygen Demand (BOD5)	Measure of organic material in a discharge that can be readily oxidized through microbial decomposition.	Can result in depletion of dissolved oxygen concentrations; low concentrations can result in death marine organisms.
2. PARTICULATE MATTER		
Total Suspended Solids (TSS)	Measure of suspended solid material.	Increases turbidity and bottom deposition; many toxic compounds are bound to, carried by, and deposited with TSS particles
3. NUTRIENTS		
a. Total Nitrogen (N)	Measure of all forms of nitrogen, i.e. nitrate, nitrite, ammonia-N, and organic forms.	N and P are major plant nutrients. Excessive amounts in water overstimulate plant growth; resultant oxygen depletion may have lethal effects on marine organisms.
b. Total Phosphorus (P)	Measure of all forms of phosphorus, i.e., ortho and para-compounds.	
4. HEAVY METALS		
a. Arsenic (As) b. Cadmium (Cd) c. Chromium (Cr) d. Copper (Cu) e. Iron (Fe) f. Lead (Pb) g. Mercury (Hg) h. Zinc (Zn)	A group of elements present in the environment from natural and anthropogenic sources that can produce toxic effects; determination based on EPA standard methods that measure environmentally available "metals."	Can be toxic to marine organisms, and potentially to humans, through consumption of contaminated water and organisms.
5. PETROLEUM HYDROCARBONS (Pet HC)	A mixture of hydrocarbons found in petroleum comprised of hundreds of chemical compounds.	Acute lethal and chronic sublethal toxicity to marine organisms; interference with cellular and physiological processes, e.g., feeding and reproduction.
6. CHLORINATED HYDROCARBONS		
a. Polychlorinated Biphenyls (PCBs)	A group of aromatic compounds composed of two fused benzene rings and two or more chlorine atoms; used in heat exchange and insulating fluids.	Toxic to marine organisms; highly persistent; potential human carcinogen through consumption of contaminated water and organisms.
b. Chlorinated Hydrocarbons other than PCBs (CHP)	Includes the chlorinated pesticides, aromatic, and nonaromatics.	Varying degree of acute and chronic aquatic toxicity, persistence, and human carcinogenicity.
7. PATHOGENS		
Fecal coliform bacterial (FCB)	Enteric bacteria which enter water in fecal material of human or animal origin; FCB are used as an indicator of the presence of pathogens.	Main effects are on public health quality and safety of seafood.
8. SLUDGES (Slu)	Solids or semi-solid materials generated as a result of potable or industrial water supply treatment, sanitary or industrial wastewater treatment or flue gas scrubbing using wet processes.	May contain concentrated levels of contaminants found in wastewater, especially pathogens, heavy metals, and toxic organics, and contaminants found in flue gases.
9. WASTEWATER (WW)	Water that has come in contact with pollutants as a result of human activities and is not used in a product, but discharged as a waste stream.	May contain concentrations of various pollutants or be contaminated by heat, or when discharged into marine waters the extra influx of fresh water may affect salinity gradients.

(3) Base discharge estimates on plant flow and the concentration associated with a unit of production using a given unit process (e.g. 400 pounds of BOD5 per ton of product produced using process X). This estimate derives a raw waste load, and then the final load is estimated by assuming a removal efficiency typical of the treatment train used by the industry (similar to method 2).

This approach suffers from some of the problems of the second method in that the treatment efficiency assumption overlooks operation and maintainance differences in the treatment plant, in -plant process water use differences and variability over time. The complexity of products and processes contributing to the waste stream is better captured, but actual end of pipe measurements may better represent discharges than a composite developed using this method for individual process waste streams. EPA has used this approach in developing regulations for certain industries. In complex industries such as Pulp and Paper, with multiple products and processes in an individual plant, it is often not possible to assign plants to process categories and develop a composite end of pipe load estimate.This approach is better developed for conventional pollutants than for other pollutants. In addition, this approach is labor intensive to implement for a large data base, and the information required for many pollutants is not available.

(4) Collect all self monitoring data available for an industrial category and take median concentration values for industrial categories

This method accurately represents end of pipe discharges from complex facilities.Unfortunately, information on many pollutants is limited or incomplete due to variable monitoring requirements on NPDES permits. Self monitoring data must be carefully verified as to pipe type and industry type. This is a resource intensive process. Many state and national data bases with Discharge Monitoring Report data (DMR) are of limited use due to poor quality control. It is also difficult to evaluate much of the DMR data because they have not been consistently verified by enforcement personnel. Based on our experience in using this approach for the coastal Gulf of Mexico region, there is insufficient data available to refine industrial categories beyond large categories, such as the two digit SIC code level. Inaccuracies are introduced when categories are lumped together, especially in complex industrial categories.

(5) Assume typical effluent concentrations based on industrial categories, where plant flow times a concentration typical for the industry equals the load

This approach is based upon studies of entire facilities and their end of pipe discharge concentrations and does not make simple assumptions based upon removal efficienceies or typical treatment plant performance. For screening purposes it represents average actual conditions and makes it easier to understand and assess bias. However, even within a given industrial category, discharges from plant to plant can be highly variable, depending upon processes and product housekeeping and water use practices, age, and production rate. In industrial categories that contain a complex mix of process/product subcategories such as the chemical industry, differences between plants in the same subcategory with different processes or product mixes are missed.

The results using the different methods can be expected to vary by industrial category and pollutant. For certain simple industries the methods may yield similar results, while for others the variability may be quite large. Given the limitations and biases introduced by each of these approaches, it is necessary to provide a clear audit trail identifying the source of the concentration values and the time frame in which they apply. An effort must always be made to assess the extent to which their use introduces variability and uncertainty.

How were the Discharge Concentrations Developed for the NCPDI ?

The National Coastal Pollutant Discharge Inventory uses method 4 for small categories that have not been well studied and method 5 for all others. In recognition of the problems with method 5 in complex major industries, DMR data has been collected at state offices and verified with permit engineers for major facilites.

Organizing available information on typical pollutant concentration values for industrial dischargers required four steps: 1) defining industrial categories for which reasonable information existed; 2) identifying which of the pollutants of interest were discharged from each category; 3) developing a procedure for selecting values; and 4) making assumptions about how to consider process water versus cooling water discharges.

Step 1: Defining Industrial Categories

Industrial operations can be defined by a series of four-digit Standard Industrial Classification (SIC) codes. These codes classify industrial facilities according to their types of products and activities. The four digit SIC code is the basic classification unit used in the NCPDI to define typical pollutant concentrations. Industrial categories such as organic chemical manufacturing encompass a number of wastewater discharging SIC code groups and can be further subdivided into subcategories based upon products . For example in the NCPDI different typical concentrations are assumed for the 21 SIC codes comprising the following subcategories: adhesives and sealants, gum and wood chemicals, pesticides, pharmaceuticals, general organic chemical manufacture and soaps and detergents.

The general assumption is that facilities producing the same or similar products have similiar production processes and hence pollutant discharge characteristics. Although the validity of this assumption varies by category and it is not always clear into which category a particular facility should be placed, the categorization still provides a reasonable means for organizing facilities according to their pollutant characteristics.Through years of study, regulation, and revision, EPA has defined categories for industrial facilities with similiar wastewater characteristics. These are the categories for which typical concentration values have been compiled. They cover 45 industrial categories and a total of 83 category/subcategory combinations for the 1,180 four digit SIC codes known to produce wastewater.The National Pollutant Discharge Elimination System assigns a four-digit SIC code to each direct discharging industrial facility in the nation, making it possible to quickly assign plants to categories/subcategories using the information in Table 2.

Step 2. Identifying Presence of NCPDI Pollutants of Interest

Determination of whether a pollutant of interest was likely to be present in the wastewaters discharged from facilities in an industrial category was primarily based on a detailed review of: 1) the 50 plus EPA Effluent Guideline Development Documents produced since 1973; and 2) proposed or final regulations for point sources published in the Federal Register. The individual references used for each industrial category are identified in Table 2.

Depending on the industrial category, available information indicated that a pollutant was either: 1) regulated and, therefore, in the effluent discharged from the category; 2) detected in treated effluent but not regulated; 3) detected in effluents but below quantifiable limits; or 4) not detected. If a pollutant was detected infrequently, it was generally not considered to be present. In cases where a pollutant was detected frequently but below the quantifiable limit, it was assumed to be present and the detection limit was assumed to be the typical concentration value for the category.

Step 3. Selecting Concentration Values

Depending on the pollutant and industrial category, the information available varied greatly. For well studied categories and pollutants, selecting typical concentration values was relatively straightforward. For example, the Pulp and Paper Industry has been well studied for conventional pollutants such as BOD_5 and TSS. For other industrial categories such as Electrical and Electronic Components, little research has been conducted on characterizing the pollutants discharged. However, in all cases a decision was made as to how best to use available information to select or estimate a "typical" concentration value for a category.

Available concentration information by industrial category falls into four general cases. The procedures briefly described below were used to select/estimate typical "net" concentration values (after treatment) for each case.

Case I. Studies had been done for facilities in **subcategories** within an EPA industrial category (such as the organic chemicals industry as previously discussed) and "net" concentrations estimates were made for the pollutant of interest.

- If the amount of effluent (wastewater) discharged from each subcategory was **known**, a flow-weighted average concentration was computed as the "typical value" for the overall category.
- If the amount of effluent discharged from each subcategory was **not known**, a weighted average of subcategory values was computed for the category based on subcategory concentrations and weighted by the number of plants in each subcategory.
- If neither the amount of effluent discharged or the number of plants in a subcategory were known, an average was computed for the category based on the available concentration values reported for each subcategory.

Case 2. Studies had been done for facilities in an industrial category but concentration values reported were "gross" concentrations. (Gross refers to concentration values before treatment.)

- A net typical concentration for the category was computed by applying industry typical treatment levels to each facility in the category and calculating an arithmetic average.

Case 3. No studies were available, or the industrial category had not been studied recently, but monitored data were available for selected plants .

- A typical concentration value was computed by averaging concentration data for plants operating at the regulated treatment level. [b/]

b/ For some industrial categories, median concentration values were selected as typical from plants with monitoring data and operating at regulated treatment levels (Gianessi and Arnold, 1982).

Case 4. No studies have been conducted and little or no monitored data were available.

- A typical concentration value was selected from the EPA Treatability Manual (reference 3).

Step 4. Defining Assumptions about Process versus Cooling Waters

It is important to distinguish between process and cooling water discharges from a facility, because normally there are significantly greater pollutant concentrations in process than in cooling water. Consequently, care has been taken in selecting concentrations that apply to process water discharges. In applying these concentrations it is equally important to distinguish between process and cooling water discharge pipes so that accurate pollutant loads are assigned to a facility with a mixture of pipe types.

Uses and Limitations

The typical concentation values shown can be used to approximate the amount of a given pollutant that generic classes of industrial facilities may discharge "on average" in a year. They can further be used to approximate the amount discharged within a season, e.g., by using them in conjunction with data on seasonal wastewater flows and operating cycles in an industry The typical concentrations contained in Table 2 have been reviewed for reasonableness by industrial pollution experts including permit writers at the EPA regional offices, contractors responsible for developing regulatory guidelines, regulatory and planning personnel at EPA headquarters and various industry and academic experts for specific industries.

However, it must be emphasized that they are not a substitute for monitored or plant specific data and must always be used with caution. Users of this information are encouraged to consult the references used and understand clearly the basis for arriving at these values and the biases they contain.

If used properly these values can help provide information for assessing the relative contributions of various sources of pollutant discharges, both under existing conditions and for a range of alternative policies that affect the amount and distribution of these discharges.

Table 2. Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

Industrial Category	SIC Codes	Pollutant Concentrations																References (No. and Page)
		BOD_5 (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	FCB (c/l)	As mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (ug/l)	Zn (mg/l)	Pet HCs (mg/l)	PCB (ug/l)	CHP (ug/l)	
1. ASBESTOS	3292	16.0	26.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(4) pp. 57-64 (5) pp. 82-97
2. BAKERY PRODUCTS	2051 2052,2065 2066,2067	8.0	12.0	2.4	-	-	-	-	-	-	-	-	-	-	1.6	-	-	(3) see Table 1
3. BATTERY MFG.	3691,92	-	125.4	-	-	-	1.0	0.001	9.00	0.400	0.08	1.5	160.2	44.5	7.2	-	-	(1) Appendix B
4. BEVERAGE PRODUCTS a. Beverages	2082-85,87 2095	219.6	34.2	16.8	-	-	-	-	-	-	-	-	-	-	4.5	-	-	(3) see Table 1
b. Soft Drinks	2086	70.0	40.0	8.6	4.0	-	-	-	-	-	-	-	-	-	-	-	-	(24) pp. 398-403 (2) pp 3.2.1-11
5. CANNED & PRESERVED FRUITS & VEG.	2032-37	116.0	246.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(2) pp. 3.2.2-6 (8) pp.172-173 (9) p.36
6. CANNED & PRESERV.[a] SEAFOOD PRODUCTS a. Seafood	2091-92	417.4	213.1	22.6	-	-	-	-	-	-	-	-	-	-	-	-	-	(6) pp. 43-62, 108-122, 213-278
b. Shellfish	2091-92	669.7	402.2	22.6	-	-	-	-	-	-	-	-	-	-	-	-	-	(7) pp. 100-114
c. Finfish	2091-92	380.7	180.7	22.6	-	-	-	-	-	-	-	-	-	-	-	-	-	(7) pp. 150-186
7. CAR WASHES	7542	35.1	68.6	-	8.2	-	-	-	-	0.005	-	-	-	-	21.0	-	-	(3) see Table 1
8. CIMENT	3241	-	27.7	-	-	-	-	-	0.002	-	0.2	0.08	-	-	-	-	-	(2) pp 3.1.18-7 (10) pp. 28-32
9. CHEMICAL PROD.[b] a. Inorganic Chemicals	2812,13,16 19,92,99 3274	-	46.0	1.9	-	-	0.04	0.03	0.07	0.07	0.02	0.2	1.8	0.2	-	-	-	(1) Appendix H (1) Appendix S
b. Nitrogenous Fertilizers	2873,75	-	8.7	4.4	-	-	-	-	0.01	-	-	-	-	-	-	-	-	(15) Section III
c. Phosphatic Fertilizers	2874	-	2.5	-	2.8	-	-	-	0.01	-	-	-	-	0.005	-	-	-	(16) Section III
d. Organic Chemicals[c]	2821,23,24 2851,65,93 3955,52,53 7535	23.6	47.7	33.4	-	-	0.03	0.003	0.7	0.1	-	0.03	3.6	0.3	15.5	-	-	(1) Appendix H (for metals) (26) pp. 145,153, 278-280 (others)

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Reports;
C/1, cells per 100 ml; mg/1, milligrams per liter; ug/1, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

Industrial Category	SIC Codes	Pollutant Concentrations																References (No. and Page)
		BOD_5 (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	FCB (C/l)	As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (ug/l)	Zn (mg/l)	Pet HCs (mg/l)	PCB (ug/l)	CHP (ug/l)	
e. Adhesives and Sealants d/	2891	3.1	4.2	-	0.2	-	-	-	0.50	1.00	-	-	-	1.0	-	-	-	Not regulated based upon NPDES Permit related DMR's for 10 East Coast plants
f. Gum and Wood Chemicals	2861	69.8	27.0	-	-	-	0.03	-	0.30	0.70	-	0.006	-	0.20	-	-	-	(21) pg. 49
g. Pesticides	2869,79	43.5	15.3	-	-	-	-	-	-	0.001	-	-	-	-	-	-	22.7	(28) pp. 69-74, 100-106 (others):(1)Sec. III (for Metals)
h. Pharmaceutical	2831,33,34	83.0	108.0	-	-	-	-	-	0.05	0.09	-	0.05	0.3	0.30	-	-	-	(1) Section III (43) Mean Values
i. Soaps and Detergents	2841-44	2.0	1.9	-	-	-	-	-	0.05	0.02	-	0.007	-	0.03	-	-	-	(40) pp. 12, 21
10. CONCRETE e/	3271-73	-	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not regulated-based upon DMR's for 7 plants
11. CLAY PRODUCTS a.Structural Clay Products	3251-59	14.0	25.0	-	-	-	-	0.02	-	-	1.7	-	-	-	-	-	-	(3) see Table 1
b. Pottery and Related Prod.	3261-69,75 3295-97,99	21.0	33.0	-	-	-	-	0.06	0.02	-	0.6	0.90	-	0.24	-	-	-	(3) see Table 1
12. DAIRY PRODUCTS	2021-24,26	38.6	49.0	36.5	33.3	-	-	-	-	-	-	-	-	-	-	-	-	(2) pg.5.1-16 (12) pp. 48-68
13. EDIBLE OILS	2079	45.3	47.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(24) pp. 315-331, 530-586
14. ELECTRICAL PROD. a. Electrical & Electronic Components	3624,41,71 3672,74,76 3679,99	21.4	10.9	7.3	1.0	-	0.03	0.05	0.09	0.20	0.3	0.10	0.7	0.2	4.2	-	-	(3) see Table 1
b. Power Transformers	3677,3612	15.5	11.0	-	-	-	-	0.03	0.03	0.10	-	0.04	-	0.1	3.5	10.0	-	(1) Section III
15. FEEDLOTS f/	0211-0291	90.0	178.6	28.5	41.0	400.0	-	-	-	-	-	-	-	-	-	-	-	(2) pg. 3.2.2-6 (14) pp. 54. 131

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Reports; C/l, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

Industrial Category	SIC Codes	Pollutant Concentrations																References (No. and Page)
		BOD_5 (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	FCB (C/l)	As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (ug/l)	Zn (mg/l)	Pet HCs (mg/l)	PCB (ug/l)	CHP (ug/l)	
16. FISH HATCHERIES g/	0921	4.8	6.0	0.7	0.1	-	-	-	-	-	-	-	-	-	-	-	-	(17) pp. 54-75
17. FOUNDRIES	3321-25,61 3362,69	-	34.0	6.3	-	-	0.003	0.004	0.001	0.05	1.2	0.7	-	1.9	6.0	-	-	(1) Section III
18. FOODS AND BEVERAGES (MISC.)	2038,47, 2074-76,87 97-99,5144	44.1	48.0	17.9	6.7	-	-	-	-	-	-	-	-	-	-	-	-	(3) see Table 1
19. GLASS MFG.	3211,21,29 3231	11.7	15.1	-	1.0	-	0.08	0.2	0.03	0.3	1.2	0.07	-	0.1	7.0	-	-	(18) pp. 90-92 (19) pg. 33 (20) pp. 45-60
20. GRAIN PROCESSING	2043-46,48 2041	17.1	21.6	39.9	19.5	-	-	-	-	-	-	-	-	-	-	-	-	(3) see Table 1
21. HOSPITALS	8062,63,69	15.0	20.0	33.4	11.7	-	-	-	0.04	0.4	2.0	-	5.3	-	27.2	-	-	(22) ppg. v-1-25, 26
22. IRON AND STEEL h/	3312,3315, 3316,3317	-	12.3	2.9	-	-	0.02	0.01	0.02	0.02	0.1	0.04	-	0.1	2.5	-	-	(1) Section III
23. LAUNDRIES	7211-7217 7218,7219	122.9	79.5	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	(3) see Table 1
24. LEATHER TANNING	3111,3131 3142-44,49 3151,61,71 3172,99	33.0	56.0	48.8	-	-	-	-	4.8	0.03	-	0.05	0.3	0.1	19.6	-	-	(1) Section III
25. METAL FINISHING a. Finishing	i/	-	11.2	-	-	-	-	0.1	0.6	0.8	-	0.2	-	0.5	11.8	-	-	(1) Section III
b. Coil Coating	3479,3497	-	48.4	-	2.5	-	-	0.05	1.2	0.007	2.6	0.04	-	5.7	18.1	-	-	(1) Section III (11) pp. 106-136, 187
c. Can making	3411	-	12.0	-	4.1	-	0.5	0.08	0.08	0.6	0.4	0.1	60.0	0.3	10.0	-	-	(1) Section III

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Reports; C/l, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

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		BOD_5 (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	FCB (c/l)	As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (ug/l)	Zn (mg/l)	Pet HCs (mg/l)	PCB (ug/l)	CHP (ug/l)	
26. MACHINERY																		
a. Instruments	3811-3873	6.9	11.2	5.9	1.3	-	0.1	0.03	0.2	0.3	0.5	0.1	10.0	0.4	5.9	-	-	(3) see Table 1
b. Machinery	3511-3599	10.1	10.0	3.0	0.9	-	0.0004	0.01	0.07	0.1	0.5	0.01	2.0	0.1	4.3	-	-	(3) see Table 1
c. Miscellaneous Manufacturing	3914,15,31 3944,49,51 3961,63,64 3993,95,99	8.9	7.0	25.8	0.6	-	0.2	0.02	0.1	1.5	0.3	0.07	3.0	0.3	3.5	-	-	(3) see Table 1
d. Shipbuilding	3731-32	-	26.7	-	-	-	0.06	0.07	0.1	0.2	3.4	0.09	1.7	0.3	2.2	-	-	(32) pp. 59, 62
e. Transportation Equipment	3711-28, 3743-3799	12.6	11.9	3.6	0.7	-	0.01	0.05	0.03	0.1	0.8	0.1	1.0	0.2	3.4	-	-	(3) see Table 1
27. MINERAL MINING	1411-99	-	9.0	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	(3) see Table 1
28. MISC. INDUSTRIAL COMMERCIAL [j]	5011-99	23.9	22.1	11.2	7.0	200.0	0.003	0.001	0.04	0.04	0.7	0.05	0.3	0.1	11.2	-	-	(42) pp. 36-87
29. NONFERROUS METALS																		
a. Primary [k] Nonferrous Metals	3331-39	-	26.7	8.5	-	-	0.04	0.02	0.05	0.1	-	0.07	-	0.05	7.0	-	-	(1) Appendix K,T
b. Primary [l] Zinc	3333	-	1.1	-	-	-	0.5	0.08	0.08	0.6	-	0.1	-	0.3	-	-	-	(1) Appendix K
c. Secondary Nonferrous Metals	3341	-	126.3	-	-	-	0.3	0.09	0.06	0.2	-	1.7	-	0.5	0.3	-	-	(1) Appendix K,T
d. Nonferrous Metal Forming	3356,57,63	-	15.5	52.1	-	-	-	0.1	0.1	0.7	0.5	0.1	-	0.5	10.0	-	-	(25) pp.649, 762-778
e. Aluminum Forming	3353-55	-	34.4	-	-	-	-	0.002	3.3	9.0	-	0.03	-	8.1	34.6	-	-	(1) Section III
f. Copper Forming	3351	-	12.0	-	2.1	-	-	0.08	0.08	0.6	0.4	0.1	-	0.3	10.0	-	-	(1) Appendix K, Section III

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Reports; C/l, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

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30. ORE MINING AND DRESSING	1011,21,31 1041,44,51 1061,81,92 1094	-	5.0	-	-	-	0.5	0.005	0.05	0.03	0.5	0.07	1.0	0.4	-	-	-	(3) see Table 1
31. PAVING AND ROOFING	2951,2952 3996	9.5	40.0	0.1	-	-	0.002	0.1	0.2	0.1	0.6	1.0	0.9	0.2	19.5	-	-	(27) pp. 4-10, 39
32. PETROLEUM REFINING	2911,92,99	13.5	26.1	6.8	-	-	-	-	0.1	0.01	-	0.005	0.9	0.1	17.1	-	-	(1) Section III
33. PHOTOGRAPHIC PROCESSING	7395	143.1	5.9	21.0	-	-	-	0.05	0.05	-	6.7	0.08	-	-	-	-	-	(1) Section III
34. PLASTICS MOLDING AND FORMING	3079,3652	11.7	86.4	0.2	1.1	-	-	0.006	0.02	0.006	0.3	0.09	-	0.08	7.5	-	1.6	(29) pp. 100, 123-128
35. PORCELAIN ENAMELING	3431,3469 3611,31-33 3639	-	12.0	-	4.1	-	0.2	0.08	0.08	0.6	0.4	0.1	-	0.3	10.0	-	-	(1) Appendix M
36. PRINTING AND PUBLISHING	2711-95	6.0	3.5	7.6	-	-	0.006	-	0.4	0.2	-	0.8	-	2.9	7.0	-	-	(41) pp. 69-93
37. PULP AND PAPER	2611-55	17.3	28.4	1.4	-	-	-	-	0.03	0.01	-	0.01	0.1	0.2	-	-	-	(1) Section III, Appendix N
38. RENDERING [m/]		44.1	58.8	10.8	2.9	400.0	-	-	-	-	-	-	-	-	-	-	-	(3) see Table 1
39. RUBBER PROCESSING	2822,3021 3031,41,69 3293,7534	33.0	40.0	-	-	-	-	-	-	-	-	0.01	-	0.4	15.0	-	-	(2) pp. 3.1.14-7, 3.1.5-8, 3.2.1-12 (30) pp. 52-63

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Reports; C/l, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

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40. TIRE AND INNER TUBE	3011	7.2	40.0	-	-	-	-	-	-	-	-	-	-	-	10.0	-	-	(31) pp. 78-87
41. STEAM ELECTRIC a. Non-cooling Flows	4911	-	30.0	-	-	-	0.07	0.009	0.06	0.09	0.8	0.01	1.2	0.7	15.0	-	-	(33) pp. 110-130, 176-238
b. Recycled Cooling	4911	-	30.0	-	-	-	0.002	0.01	0.05	0.05	0.5	0.06	0.4	0.08	-	-	-	(44) pp. 8-16
c. Once Through Cooling [n/]	4911	-	-	-	-	-	-	-	-	0.002	-	-	-	-	-	-	-	(45) pp. 278-282 (46) pp. 63-66 (47) pp. 244-247
42. SUGAR PRODUCTS a. Beet Sugar	2063	68.5	478.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(2) pp. 3.2.1-11, 2.3.2-6 (34) pp. 61
b. Cane Sugar	2061,2062	57.0	180.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(35) p. 86 (36) p. 80
43. TEXTILE MFG. a. General Textile Mfg.	2311-99, 2281-84, 2293,94	22.4	49.1	-	-	-	0.02	0.003	0.06	0.06	-	0.06	0.8	0.5	26.3	-	-	(1) Appendix O
b. Wool Scouring	2299	50.0	230.1	-	-	-	0.04	0.03	0.04	0.08	-	0.9	1.0	0.3	190.0	-	-	(1) Appendix O
c. Wool Finishing	2231	25.0	60.0	-	-	-	0.02	0.006	0.4	0.02	-	0.1	-	2.3	-	-	-	(1) Appendix O
d. Low Water Use Textile Processing	2211,21,41 2295,96,98	30.4	88.0	-	-	-	-	0.005	0.01	0.04	-	0.08	-	2.3	-	-	-	(37) pp. 132,195, 389
e. Woven Fabric Finishing	2261,62	22.0	48.7	-	-	-	0.02	0.002	0.02	0.06	-	0.04	0.8	0.4	14.0	-	-	(1) Appendix O

(continued)

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Report; C/l, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Table 2 (cont'd.). Typical Pollutant Concentrations in Industrial Process Wastewater Discharges

Industrial Category	SIC Codes	Pollutant Concentrations																References (No. and Page)
		BOD_5 (mg/l)	TSS (mg/l)	TN (mg/l)	TP (mg/l)	FCB (c/l)	As (mg/l)	Cd (mg/l)	Cr (mg/l)	Cu (mg/l)	Fe (mg/l)	Pb (mg/l)	Hg (ug/l)	Zn (mg/l)	Pet HCs (mg/l)	PCB (ug/l)	CHP (ug/l)	
f. Knit Fabric Finishing	2251-54 2257-59,92	23.6	41.0	-	-	-	0.02	0.005	0.05	0.06	-	0.04	1.4	0.3	21.0	-	-	(1) Appendix O
g. Carpet Finishing	2271,72,79	35.0	65.0	-	-	-	-	0.004	0.2	0.04	-	0.03	-	0.2	6.0	-	-	(1) Appendix O
h. Stock and Yarn	2269	10.0	25.0	-	-	-	0.006	0.005	0.07	0.09	-	0.08	1.0	0.3	90.0	-	-	(1) Appendix O
i. Nonwoven Mfg.	2297	35.0	65.0	-	-	-	-	0.004	0.2	0.04	-	0.03	-	0.2	4.8	-	-	(1) Appendix O
j. Felted Fabric	2291	25.0	60.0	-	-	-	-	-	0.04	-	-	0.05	-	-	2.4	-	-	(1) Appendix O
44. TIMBER PRODUCTS a. Sawmills	2411-29 2661	38.7	31.8	-	-	-	-	-	1.0	0.1	-	0.04	-	0.5	9.8	-	-	(3) see Table 1
b. Plywood	2431-99 2511,12,17 2521,31,41 2591,99	20.0	33.5	-	-	-	-	-	-	-	-	-	-	-	15.0	-	-	(3) see Table 1
45. TRANSPORTATION a. Railroads	4011,13	17.4	19.9	-	-	-	-	-	0.2	-	-	-	-	-	10.2	-	-	(38) p. 6
b. Trucking	4131,4171-4214,22,31	22.3	19.9	-	-	-	-	-	0.2	-	-	-	-	-	10.4	-	-	(39) p. II.4

Abbreviations: SIC, Standard Industrial Classification; DMR, Discharge Monitoring Report; C/1, cells per 100 ml; mg/l, milligrams per liter; ug/l, micrograms per liter

Footnotes

a/ Canned & Preserved Seafood. One outlying value was dropped in calculating mean values. Development document categories were consolidated into shellfish, finfish, and plants processing both, to better reflect actual plants.

b/ Inorganic Chemicals. Iron is only found in the waste stream of two subcategories and was dropped to prevent skewing of results. Explosives are covered under inorganic chemical values due to difficulties in deriving realistic values.

c/ Organic Chemicals. Paint and ink plants covered with organic chemical values due to difficulties in deriving realistic values from the limited numbers of plants sampled and reported in the source documents.

d/ Adhesives & Sealants. Not currently regulated but permitted in some states, values based on Discharge Monitoring Reports for 10 plants.

e/ Concrete. Not currently regulated but permitted in some states, values based on Discharge Monitoring Reports for 7 plants.

f/ Feedlots. FCB is assumed to be equal to the BPT regulated level. The only feedlots that are direct discharges are wet duck farming, and values represent this activity.

g/ Fish Hatcheries. Includes cleaning waste stream and normal daily operations.

h/ Iron & Steel. Ferroalloys covered under this category.

i/ Metal Finishing. This category is defined by EPA for 64 individual SIC categories: 2514, 2515, 2522, 2542, 3398, 3399, 3412, 3421, 3423, 3425, 3429, 3432, 3433, 3441, 3442, 3443, 3444, 3446, 3448, 3449, 3451, 3452, 3462, 3465, 3466, 3471, 3482, 3483, 3484, 3489, 3493, 3494, 3496, 3498, 3499, 3613, 3621, 3622, 3623, 3629, 3634-3636, 3643-48, 3651, 3661, 3662, 3673, 3675, 3678, 3693, 3694, 7531, 7692-7699.

j/ Miscellaneous Industrial Commercial. Assumed to represent small package treatment plants, with discharge characteristics similar to secondary treatment.

k/ Nonferrous Primary & Secondary. Note that subcategories are consolidated under primary and secondary category, based on flow weighted averages for current concentration levels from reference 1. A nitrogen value is not given for secondary nonferrous due to the wide range of concentration values given (3-3000 mg/1) in the source document.

l/ Primary Zinc. Not regulated until 1984, values represent pretreatment levels as currently regulated.

m/ Meat Processing & Rendering. FCB was derived from the EPA Development Document. Note that there is not a value for oil and grease because it is defined as petroleum hydrocarbons and not animal fats and oils.

n/ Steam Electric. Once through cooling concentrations represent values for saline waters and not freshwater.

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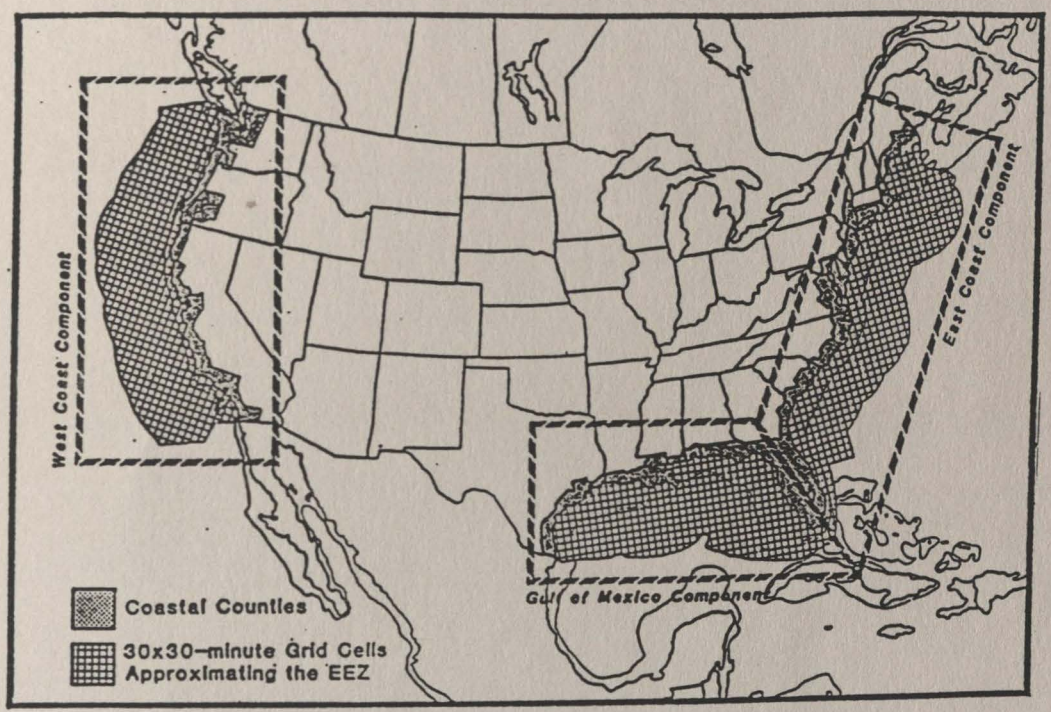

Regional Components of the National Coastal Pollutant Discharge Inventory (NCPDI)