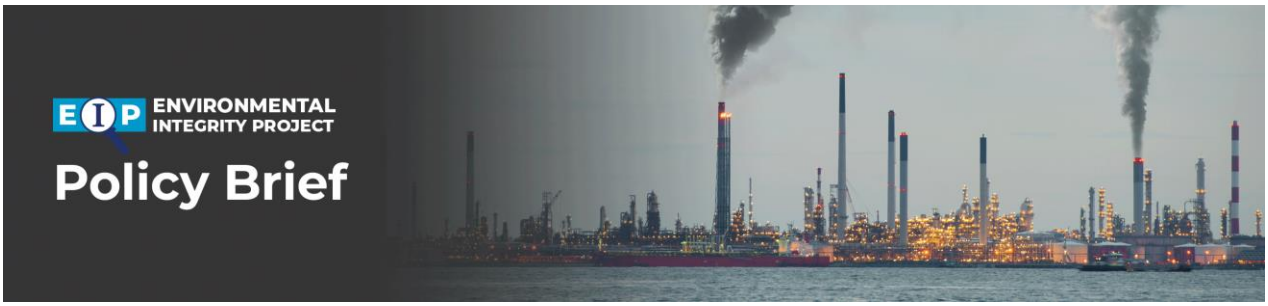

Outdated Regulations Allow Chemical and Plastics Manufacturers to Release Significant Pollution to Waterways

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The effluent guidelines for petrochemical and plastics plants were last updated in 1993, 31 years ago.[1] Though the existing federal regulations set limits for some pollutants, many remain unregulated, resulting in millions of pounds of unnecessary water pollution. The Environmental Integrity Project (EIP) analyzed industry-reported data about the wastewater discharged by 31 chemical and plastics plants, just a small subset of the hundreds of chemical plants spread across the U.S., and found that the industry releases significant amounts of nutrients. Nutrients are compounds like nitrogen and phosphorus that fuel algal blooms that cause oxygen-depleted dead zones that suffocate fish and other aquatic life downstream.

EIP's analysis of discharge monitoring data and public permit documents found that 31 petrochemical and plastics plants discharged 14.2 million pounds of nitrogen and 3.7 million pounds of phosphorus, based on the two-year average of annual discharges in 2022 and 2023 (See appendix). While EPA has previously determined that modern wastewater treatment methods could reduce total nitrogen concentrations in wastewater to 8 milligrams per liter (or less), at least 21 of the 31 facilities reported exceeding that threshold. Concentrations ranged from 1.5 mg/L to 208.4 mg/L – though the four facilities where nitrogen concentrations were below 2 mg/L achieved this level by diluting their wastewater instead of through treatment.

The pollution load from just this subset of 31 large petrochemical plants suggests that a previous EPA study significantly underestimated the amount of pollution this industry releases. That 2018 study said that 757 chemical plants released no more than 14.1 million pounds of nitrogen and 5.4 million pounds of phosphorus.[2] In addition to these nutrients, these 31 petrochemical plants released, on average, 19.7 million pounds of total organic carbon and nearly 245 million pounds of chemical oxygen demand. Significant discharges of these parameters can deplete oxygen levels in waterways, leading to dead-zones and fish kills. The facilities also discharged over 4.1 billion pounds of total dissolved solids (a proxy for salts, which can arm fish and impact drinking water systems) and over 268 million pounds of total suspended solids (a measure of solid materials in the water).[3] (See facility-level data in spreadsheet here).

EPA needs to review and revise the effluent limitation guidelines for petrochemical and plastics plants, along with those for oil refineries, fertilizer plants, and other industries with outdated technology-based limits. Publicly available data indicates that requiring modern and widely available treatment technologies could significantly reduce nutrient pollution from some of the nation's biggest polluters.

Table 1. Total Nitrogen Discharged to Waterways by Industrial Sector, in Pounds.

Industrial Sector	No. of Facilities	Total Nitrogen	Data Year
Petrochemical and Plastics Facilities	31	14,199,496	2022-2023 Avg.
Petroleum Refineries	81	15,740,912	2021
Nitrogen Fertilizer Manufacturers	21	7,734,551	2021
Steam Electric Power Generators	195	16,900,000	2010

***Source**: For petrochemical and plastics facilities, petroleum refineries, and nitrogen fertilizer manufacturers, EIP analyzed data from EPA ECHO Discharge Monitoring Reports (DMRs), Wastewater Permit (NPDES) Applications and Fact Sheets. For some facilities, data were only available to estimate partial nitrogen and may be higher. See methodology for details. Steam Electric Power Generator data from EPA's 2015 Environmental Assessment for the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category (EPA-821-R-15-006).*

See the appendix of this report for facility-level nutrient pollution data and a detailed spreadsheet on nutrients and additional pollutants, including Chemical Oxygen Demand (a measure of oxygen-depletion), organic carbon, and dissolved and suspended solids.

Methodology: EIP conducted a wastewater analysis of 31 large petrochemical and plastics facilities, just a sampling of the hundreds of facilities in the sector. There is significant variability across facilities within the sector, and many facilities not included in this preliminary analysis may discharge less pollution. Though this analysis has focused on facilities regulated by the Organic Chemicals, Plastics, and Synthetic Fibers effluent guidelines, many of these facilities may also discharge process wastewater from other industrial categories, such as pesticide manufacturing and inorganic chemicals manufacturing.

EIP used a combination of data reported in EPA's Enforcement and Compliance History Online (ECHO) database and publicly-available permit applications, fact sheets, and permits issued to industrial dischargers. Loads and concentrations are limited to outfalls where process wastewater is discharged. Some outfalls include additional types of wastestreams, such as stormwater and cooling water, that increase flow volume and can dilute pollutant concentrations of treated process wastewater.

In quantifying pollution loads, EIP prioritized data reported in discharge monitoring reports, where available, over data reported in permit applications. Some permit applications only contain a single sampling result for each pollutant. Though average concentrations based on a larger number of samples would provide a more accurate estimate, the values included in permit applications are supposed to be representative of a plant's typical discharge. Where "Total Nitrogen" data were unavailable, EIP calculated total nitrogen using reported nitrogen species, combining ammonia as N, nitrate as N, nitrite as N, and organic N.

For a detailed spreadsheet, click here.

Summary of Select Pollutants Found in Chemical and Plastic Plant Wastewater

The summaries below describe the impact that some of the specific pollutants found in wastewater discharges from chemical plants and other industrial sources have on water quality.

Nutrients:

Nutrients are substances like nitrogen and phosphorus that enhance the growth of plants or animals. In water, these nutrients can fuel algal blooms, and when the algae die, they consume oxygen in the water. This results in oxygen-depleted dead zones that suffocate fish and other aquatic life downstream. In addition to dead zones, nutrients also fuel harmful algal blooms that are toxic to humans and animals alike. They have local and distant impacts depending on where, when, and how they are released. Upstream discharges have been connected to dead zones in places far downstream, like the Gulf of Mexico and the Chesapeake Bay.

Total Nitrogen: Total nitrogen is a combination of the nitrogen from organic nitrogen, nitrate, nitrite, and ammonia that is available or potentially available to support algae growth. Ammonia and nitrate are toxic to aquatic life and humans.

Total Phosphorus: Total phosphorus is a measure of all the dissolved phosphorus, phosphorus attached to soil particles, phosphorus in organic waste, and phosphorus in microbes like algae in a water sample.

General Measures of Pollution Potential or "Wastewater Strength"

Chemical Oxygen Demand: Chemical oxygen demand (COD) is a measure of the oxygen needed to chemically oxidize organic and oxidizable inorganic nutrients like ammonia or nitrate, in wastewater. It does not account for oxidization caused by bacteria or other microbes. High COD levels in water indicate the presence of organic and oxidizable inorganic pollutants. When wastewater with high COD levels is discharged into natural bodies of water, it can deplete dissolved oxygen levels through microbial decomposition. This in turn results in hypoxic or anoxic conditions and can cause fish kills. Depending on how, when, and where it is discharged, among other factors, the release of wastewater containing high COD can have local and downstream impacts.

Total Organic Carbon: Total organic carbon (TOC) is a measure of the total amount of carbon present in organic compounds within a water sample. It does not specifically identify individual carbon-containing compounds but rather indicates the overall presence of organic matter in the water. While naturally occurring sources, such as decomposing plant matter, contribute to organic carbon levels, high levels of TOC indicate a greater presence of organic pollutants, such as insecticides, herbicides, and fertilizers entering the waterway through direct discharge or rainfall runoff. These organic compounds are broken down by microorganisms through decomposition, a process that consumes oxygen. The more organic matter in the water, the less dissolved oxygen is available for aquatic life, which can lead to dead zones. Depending on the source of pollution, some of the organic compounds themselves could be toxic, posing direct threats to aquatic life.

Total Dissolved Solids: Total Dissolved Solids (TDS) refers to the concentration of dissolved minerals, like salts, in a water sample (see below re: impact of salts on water quality).

Total Suspended Solids: Total Suspended Solids (TSS) refers to the concentration of suspended particles in a water sample. They can include soil and other solid materials that are picked up through stormwater

runoff or industrial processes. In wastewater, the types of solids depend on the products manufactured, how they are made, and how small particles are managed on-site. Sometimes suspended solids can increase if treatment is inefficient. High levels of suspended solids can impact aquatic systems by clogging gills, reducing visibility, blocking sunlight needed by aquatic life, and altering early-development in aquatic animals.

Salts: Releasing high levels of salts like chlorides and sulfates into freshwater can wreak havoc on ecosystems. Wastewater with high levels of chlorides and sulfates can corrode metal surfaces and impede plant growth in receiving waterways. They are considered part of total dissolved solids.

Chlorides: Chlorides are corrosive ions that can damage metal, impede plant growth, and increase the electrical conductivity of water. They can form salts with other minerals. Some oil and gas feedstocks contain trace amounts of chlorides that need to be removed before making other products. They can also be introduced during wastewater treatment, as some chemical agents used to remove or reduce other contaminants may contain chlorides.

Sulfur Compounds: Sulfur compounds include sulfate, sulfite, and sulfide. In high enough concentrations, sulfate and sulfide can cause people to develop diarrhea or dehydration in people who typically drink water with lower concentrations. They can also feed sulfate-reducing bacteria that can produce hydrogen sulfide gas, causing a rotten egg smell and toxic fumes. When present with chloride, sulfates can accelerate the corrosion of metal surfaces. Oil and gas extracted from "sour" formations contain high amounts of sulfur compounds that need to be removed before other components of the oil or gas can be refined or processed. Sulfates can form salts with other minerals like sodium, potassium, and magnesium.

Sources:

EPA Water Quality Parameter Fact Sheets: https://www.epa.gov/awma/factsheets-water-quality-parameters

EPA's NPDES Permit Writer Training Manual Glossary of Terms: https://www3.epa.gov/npdes/pubs/glossary.pdf

EPA National Recommended Water Quality Criteria for Chloride: https://www.epa.gov/sites/default/files/2018-08/documents/chloride-aquatic-life-criteria-1988.pdf

EPA Secondary Drinking Water Standards: Guidance for Nuisance Chemicals: https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals

Appendix: 2022-2023 Average Total Nitrogen and Total Phosphorus Discharges (pounds) and Concentration (mg/L) at Petrochemical and Plastics Facilities

Facility (NPDES ID)	Location	Receiving Waterway	Nitrogen Load*	Nitrogen Concentration	Phosphorus Load	Phosphorus Concentration
Dow Chemical Plant (TX0006483)	Freeport, TX	Brazos River Tidal	3,102,804	1.5	612,171	0.26
Union Carbide Corporation (LA0000191)	Taft, LA	Mississippi River	2,721,161	1.8	312,264	0.21
Dow Chemical - Plaquemine (LA0003301)	Plaquemine, LA	Mississippi River	1,957,544	1.7	801,334	0.70
Oxychem Ingleside Plant (TX0104876)	Ingleside, TX	Corpus Christi Bay	703,892	105.2	15,651	2.34
Westlake Lake Charles South (LA0000761)	Westlake, LA	Calcasieu River	550,363	1.8	1,955	0.12
Kraton Polymers US LLC (OH0007030)	Belpre, OH	Ohio River	*506,871*	*208.4*	No Data	No Data
Cornerstone Chemical Company (LA0004367)	Westwego, LA	Mississippi River	408,712	41.0	673	0.08
Chemours Washington Works (WV0001279)	Washington, WV	Ohio River	362,330	2.7	43,895	0.32
Syngenta Crop Protection LLC - St. Gabriel Plant (LA0005487)	Saint Gabriel, LA	Mississippi River	347,388	53.5	5,140	0.84
Ascend Performance Materials Operations, LLC (AL0000116)	Decatur, AL	Tennessee River	289,017	53.0	1,021,956	187.83
Altivia Services, LLC (WV0000086)	Institute, WV	Kanawha River	275,008	46.7	-	-
Tennessee Operations of Eastman Chemical Company (TN0002640)	Kingsport, TN	South Fork Holston River	270,307	3.0	47,937	0.54
Bayer Cropscience Kansas City (MO0002526)	Kansas City, MO	Missouri River	217,407	54.6	34,396	8.94
INV Camden Plant (SC0002585)	Lugoff, SC	Wateree River	215,311	55.0	627	0.16
Indorama Ventures Oxides Port Neches (TX0005070)	Port Neches, TX	Neches River Tidal	214,918	8.2	65,514	2.48
Dupont Specialty Products USA LLC - Spruance Plant (VA0004669)	North Chesterfield, VA	James River	214,194	3.2	16,933	0.24
BASF Corp-Geismar (LA0002950)	Geismar, LA	Mississippi River	204,681	7.1	37,477	1.30

BASF Freeport Site (TX0008788)	Freeport, TX	Brazos River Tidal	204,093	16.4	17,872	1.45
Taminco Higher Amines, Inc. - St. Gabriel Plant (LA0046361)	Saint Gabriel, LA	Mississippi River	185,875	159.9	7,226	6.35
Indorama Ventures Xylenes & PTA, LLC (AL0000108)	Decatur, AL	Tennessee River	137,988	10.3	8,186	0.61
Shintech Louisiana, LLC-Plaquemine Plant (LA0120529)	Plaquemine, LA	Mississippi River	*133,267*	*4.2*	254,389	9.46
3M - Cottage Grove (MN0001449)	Cottage Grove, MN	Mississippi River	*128,057*	*16.4*	1,249	0.16
Occidental Chemical Corporation (LA0002933)	Geismar, LA	Mississippi River	124,404	26.1	40,688	8.52
Chemours Chambers Works (NJ0005100)	Pennsville Twp, NJ	Delaware River	123,720	7.9	1,200	0.08
Sabic Innovative Plastics, US, LLC (AL0054704)	Burkville, AL	Alabama River	122,475	13.1	875	0.09
BASF Mcintosh Site (AL0003093)	Mcintosh, AL	Tombigbee River	105,469	11.4	11,131	1.20
Arkema Inc. - Mobile Facility (AL0042447)	Axis, AL	Mobile River	100,336	145.3	422	0.61
Goodyear Tire & Rubber Beaumont Chemical Plant (TX0005061)	Beaumont, TX	Hillebrandt Bayou	84,224	8.5	14,359	1.45
Bayer CropScience LP (LA0005266)	Luling, LA	Mississippi River	78,068	8.1	291,545	30.10
Angus Chemical Company (LA0007854)	Sterlington, LA	Ouachita River	59,550	22.6	9,500	3.62
Westlake Chemical Opco LP (LA0082511)	Lake Charles, LA	Calcasieu River	50,062	10.1	17,925	3.62
		Total Load (pounds)	**14,199,496**		**3,694,488**	

Source: EPA ECHO Discharge Monitoring Reports (DMRs), Wastewater Permit (NPDES) Applications and Fact Sheets.

* Data from EPA's Toxics Releases Inventory indicate some facilities may discharge additional nitrogen from nitrate compounds but are not included in this analysis. *Italicized values* reflect partial data and may underestimate total nitrogen. Total nitrogen is comprised of different nitrogen-based compounds, but data were unavailable for at least one component.

[1] Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) point source category.
[2] "EPA's Review of Nutrients in Industrial Wastewater Discharge," December 2020. Link: https://www.regulations.gov/document/EPA-HQ-OW-2018-0618-0659.
[3] EIP excluded total dissolved solids from the Dow Chemical Plant in Freeport, TX (TX0006483) as an outlier. The facility uses saltwater as cooling water, heavily skewing the total dissolved solids load.