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Environmental Protection
Agency

Preliminary Effluent Guidelines Program Plan 14

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1. EXECUTIVE SUMMARY

The EPA prepares Preliminary Effluent Guidelines Program Plans pursuant to Clean Water Act (CWA) section 304(m). Preliminary plans provide a summary of the EPA's annual review of effluent guidelines and pretreatment standards, consistent with CWA sections 301(d), 304(b), 304(g), 304(m), and 307(b). From these reviews, preliminary plans identify any new or existing industrial categories selected for effluent guidelines or pretreatment standards rulemakings and provide a schedule for such rulemakings. In addition, preliminary plans present any new or existing categories of industry selected for further review and analysis.

Preliminary Plan 14 discusses the one ongoing rulemaking (and the associated schedule), the rulemaking for the Steam Electric Power Generating Point Source Category. The EPA has concluded that no additional categories warrant new or revised effluent guidelines at this time. Preliminary Plan 14 provides updates on the Electrical and Electronic Components Category Detailed Study and the Oil and Gas Extraction Wastewater Management Study and proposes to conclude the Petroleum Refining Point Source Category Detailed Study. Additionally, Preliminary Plan 14 introduces new analyses and tools that the EPA is developing to improve its annual review and biennial planning process.

The EPA solicits comments on the reviews of industrial wastewater discharges and treatment technologies that were conducted for the development of Preliminary Plan 14 and described therein. The EPA solicits comments on new analyses and tools announced in Preliminary Plan 14, including analyses of industrial sources and discharges of nutrients and per- and polyfluoroalkyl substances (PFAS), a new methodology for proposed treatment technology reviews, and a proposed effluent limitations guidelines database. Preliminary Plan 14 presents tentative results for some new analyses (e.g. industrial discharges of nutrients). The EPA solicits comments on the utility and applicability of these results along with any comments or suggestions on the methodologies used to obtain them.

2. BACKGROUND

This section explains how the Effluent Guidelines Program fits into the EPA's National Water Program, describes the background of the Effluent Guidelines Program, and summarizes the EPA's procedures for revising and developing effluent limitations guidelines (ELGs) (i.e., the effluent guidelines planning process).

2.1 The Clean Water Act and the Effluent Guidelines Program

The CWA's goal is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. 33 U.S.C. 1251(a). To that end, the CWA is focused on two types of controls for point source discharges of pollutants to waters of the United States: (1) technology-based controls, based on effluent limitations guidelines and standards (ELGs) and, (2) water quality-based controls, based on state water quality standards.

The CWA directs the EPA to promulgate technology-based ELGs that reflect pollutant reductions achievable in categories or subcategories of industrial point sources through implementation of available treatment and pollution prevention technologies. 33 U.S.C. 1311(b) and 1314(b). ELGs apply to pollutants discharged from industrial facilities to surface water (direct discharges) and to publicly owned treatment works (POTWs) (indirect discharges). The EPA's goal in establishing national ELGs is to ensure that industrial facilities with similar characteristics will, at a minimum, meet similar effluent guidelines or pretreatment standards representing the performance of the "best" pollution control technologies or pollution prevention practices, regardless of their location or the nature of their receiving water or POTW into which they discharge.

ELGs are one tool among several tools and authorities in the CWA that Congress provided to the EPA and the states to restore and maintain the quality of the nation's waters. The CWA also gives states the primary responsibility for establishing, reviewing, and revising water quality standards. While technology-based ELGs in discharge permits may meet or exceed water quality standards, effluent guidelines are not specifically designed to ensure that regulated discharges meet the water quality standards of the receiving water body. For this reason, the CWA also requires the EPA and authorized states to establish water quality-based effluent limitations as stringent as necessary to meet water quality standards. 33 U.S.C. 1311(b)(1)(C). Water quality-based limits may require industrial facilities to meet requirements that are more stringent than those in the ELGs.

To date, the EPA has promulgated ELGs for 59 industrial categories. See the EPA's Industrial Effluent Guidelines webpage[1] for more information. These regulations apply to between 35,000 and 45,000 U.S. direct dischargers, as well as another 129,000 facilities that discharge to POTWs. Based on pollutant reduction estimates from each guideline, the EPA estimates that the regulations altogether prevent the discharge of over 700 billion pounds of pollutants annually.[2]

2.2 Effluent Limitations Guidelines and Pretreatment Standards Overview

The EPA promulgates technology-based limitations for conventional, toxic, and nonconventional pollutants in accordance with six statutorily prescribed levels of control (Table 2-1). The limitations are

[1] See https://www.epa.gov/eg/industrial-effluent-guidelines.

[2] Estimated from the difference between discharges in each point source category before ELG promulgation and expected decrease in discharge post promulgation, based on a review of ELG development documents.

based on performance of specific technologies, but the regulations do not require use of a specific control technology to achieve the limits. For more information, see the EPA's Learn about Effluent Guidelines webpage.[3]

In some cases, the CWA specifies different levels of control based on the type of pollutant at issue (i.e., conventional, toxic or nonconventional). CWA section 304(a)(4) designates the following as conventional pollutants: biochemical oxygen demand (BOD_5), total suspended solids, fecal coliform, pH, and any additional pollutants defined by the Administrator as conventional. The Administrator designated oil and grease as an additional conventional pollutant on July 30, 1979 (44 FR 44501). The EPA has identified 65 pollutants and classes of pollutants as toxic, among which 126 specific substances have been designated priority toxic pollutants (Appendix A to Part 423, reprinted after 40 CFR Part 423.17). All other pollutants are considered nonconventional.

Table 2-1. Statutorily Prescribed Levels of Control

Level of Control	CWA Statutory Reference	Description
Best Practicable Control Technology (BPT)	CWA sections 301(b)(1)(A) and 304(b)(1), 33 U.S.C. 1311(b)(1)(A) and 1314(b)(1)	The EPA develops effluent limitations based on BPT for conventional, toxic, and nonconventional pollutants. Traditionally, the EPA establishes BPT effluent limitations based on the average of the best performance of facilities within the industry of various ages, sizes, processes or other common characteristics. Where existing performance is uniformly inadequate, BPT may reflect higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.
Best Conventional Pollutant Control Technology (BCT)	CWA sections 301(b)(2)(E) and 304(b)(4), 33 U.S.C. 1311(b)(2)(E) and 1314(b)(4)	BCT addresses conventional pollutants from existing industrial point sources. The EPA establishes BCT limitations by considering the factors specified in Section 304(b)(4)(B), including a two part "cost-reasonableness" test. This methodology was published in a Federal Register notice on July 9, 1986 (51 FR 24974).
Best Available Technology Economically Achievable (BAT)	CWA sections 301(b)(2)(A) and 304(b)(2), 33 U.S.C. 1311(b)(2)(A) and 1314(b)(2)	The EPA develops effluent limitations based on BAT for toxic and nonconventional pollutants. BAT represents the best available economically achievable performance of plants in the industrial subcategory or category. Factors considered in establishing BAT include the age of equipment and facilities involved, the process employed, the engineering aspects of control techniques or process changes, the cost of achieving such effluent reduction, non-water quality environmental impacts (including energy requirements), and such other factors as the Administrator deems appropriate. 33 U.S.C. 1314(b)(2)(B). BAT limitations may be based on end-of-pipe wastewater treatment or effluent reductions attainable through changes in a facility's processes and operations.
Standards of Performance for New Sources (NSPS)	CWA section 306, 33 U.S.C. 1316	The EPA develops effluent limitations based on NSPS for conventional, toxic, and nonconventional pollutants. NSPS reflect effluent reductions based on the best available demonstrated control technology. 33 U.S.C. 1316(a)(1). New sources have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available demonstrated control technology for all pollutants (i.e., conventional, nonconventional, and priority pollutants).

[3] See https://www.epa.gov/eg/learn-about-effluent-guidelines.

Table 2-1. Statutorily Prescribed Levels of Control

Level of Control	CWA Statutory Reference	Description
Pretreatment Standards for Existing Sources (PSES)	CWA section 307(b), 33 U.S.C. 1317(b)	The EPA develops PSES for nonconventional and toxic pollutants. PSES are national, uniform, technology-based standards that apply to indirect dischargers. They are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs 33 U.S.C. 1317(b)(1). The Agency considers the same factors for PSES as it does for BAT limitations.
Pretreatment Standards for New Sources (PSNS)	CWA section 307(c), 33 U.S.C. 1317(c)	The EPA develops PSNS for nonconventional and toxic pollutants. PSNS are national, uniform, technology-based standards that apply to new indirect dischargers. Like PSES, they are designed to prevent the discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. PSNS are issued at the same time as NSPS. 33 U.S.C. 1317(c). The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS. New indirect dischargers have the opportunity to incorporate into their plants the best available demonstrated control technologies.

The EPA and states implement ELGs for point sources that discharge pollutants into surface waters through National Pollutant Discharge Elimination System (NPDES) permits.[4] POTWs, states, and the EPA enforce pretreatment standards for point sources that discharge to POTWs.[5]

2.3 Effluent Guidelines Review and Planning Process

The EPA reviews annually point source categories subject to existing effluent limitations guidelines and pretreatment standards (and the limitations contained therein) to identify potential candidates for revision.[6] As part of the annual review, the EPA also reviews industries not currently subject to ELGs in order to identify potential candidates for development of new ELGs.[7]

In the effluent guidelines planning process, the EPA's goals are to provide transparent decision making and to involve stakeholders early and often during the planning process. The EPA considers the following factors when prioritizing effluent guidelines and pretreatment standards for possible development or revision.

- *Environmental risk.* The EPA considers the combination of the amount and type of pollutants in an industrial category's discharge and the relative hazard (human or ecological health risks) posed by that discharge. This factor enables the EPA to prioritize rulemakings that could produce the greatest environmental and health benefits.
- *Technology availability.* The EPA considers the performance and cost of wastewater treatment technologies, process changes, and pollution prevention alternatives that could effectively reduce pollutant concentrations in the industrial category's wastewater.
- *Economic achievability.* The EPA considers the affordability of wastewater treatment technologies, process changes, or pollution prevention measures for a particular industry. The

[4] See CWA sections 301(a), 301(b), and 402; 33 U.S.C. 1311(a), 1311(b), and 1342.
[5] See CWA sections 307(b) and 307(c); 33 U.S.C. 1317(b) and 1317(c).
[6] See CWA sections 304(b), 301(d), 304(m)(1)(A) and 304(g), 33 U.S.C. 1314(b), 1311(d), 1314(m)(1)(A) and 1314(g).
[7] See CWA sections 304(m)(1)(B), 33 U.S.C. 1314(m)(1)(B), and CWA section 307(b), 33 U.S.C. 1317(b).

EPA evaluates whether or not more stringent regulations are economically achievable based on the costs of any potential regulations and the financial health of the industry.

- *Regulatory efficiency.* The EPA considers opportunities to eliminate inefficiencies and impediments to pollution prevention and technological innovation, as well as opportunities to promote innovative approaches. The EPA also considers whether pollutant sources are efficiently and effectively controlled by other regulatory or non-regulatory programs.

Sections 304(m)(1)(A) and (B) of the CWA, 33 U.S.C. 1314(m)(1)(A) and (B), require the EPA to publish a plan every two years that (1) identifies any existing industries for effluent guidelines revision; (2) identifies any new industries for development of effluent guidelines regulations; and (3) provides a schedule for such activities. Pursuant to this requirement, the EPA biennially publishes an Effluent Guidelines Program Plans (hereafter referred to as Plan or Plans). To increase transparency and stakeholder awareness of its planning process, the EPA also includes in the Plans information on its review of existing effluent guidelines and pretreatment standards and any industries reviewed for potential development of new effluent guidelines or pretreatment standards. Every two years the EPA solicits public comment on a preliminary version of the Plan and considers these comments when developing each final Plan. 33 U.S.C. 1314(m)(2).

In previous Plans, the EPA identified and ranked industrial categories whose reported pollutant discharges potentially posed a substantial hazard to human health and the environment. This process is called the toxicity rankings analysis (TRA). As part of the TRA, the EPA assesses the relative hazard of discharges by applying toxic weighting factors (TWFs) to the annual pollutant discharges reported on discharge monitoring reports (DMRs) and to the Toxics Release Inventory (TRI). TWFs are used to calculate the total discharge of toxic pollutants as toxic-weighted pound equivalents (TWPE) for each point source category. (Once calculated, TWPEs allow for more direct comparison of the severity of pollutant discharges across different industry categories and different pollutants.) The EPA then ranks the categories by total discharges. The EPA last conducted the TRA in 2015 (see the *Preliminary 2016 Effluent Guidelines Program Plan* for further details (U.S. EPA, 2016a)). While the TRA has provided a useful cross industry comparison of hazards, it has certain limitations.

- The majority of the available pollutant monitoring data are for pollutants already regulated by ELGs; therefore pollutant monitoring data are available only for a subset of pollutants that may have the potential to raise human or aquatic health concerns.
- No information is considered regarding changes to industrial production processes that may influence wastewater characteristics.
- No information is considered regarding improvements to wastewater treatment technology.
- No primary data are collected directly from facilities (pollutant data are only provided by DMRs and TRI).
- The resulting rankings are more or less the same from one analysis to the next.

Beginning in 2011, the EPA revised its annual review process to include an odd-and-even-year review cycle (U.S. EPA, 2013). In the odd-year reviews, the EPA would screen industrial dischargers through the TRA; in the even years, the EPA would review additional hazard data sources and conduct alternate analyses to ensure that industrial categories for which new or revised ELGs may be appropriate are not limited to those that traditionally rank high in the TRA. Because of the limitations of the TRA identified by the EPA, the agency plans to further reduce the frequency of the TRA (e.g., every five years) and instead focus resources on developing new tools and analyses that will address the data gaps and

limitations discussed above and broaden the dataset that it uses in the annual reviews. These new efforts will help ensure that all four factors – environmental risk, technology availability, economic achievability, and regulatory efficiency – are more fully considered. This Plan discusses several projects that the EPA is initiating to achieve this goal. This Plan also presents the findings of the EPA's ongoing effluent guidelines planning efforts, including point source category studies and ELG rulemaking.

The EPA is simplifying how the Plans are named. Previously, the Plans were named based on the year the final Plan was published. This caused confusion, partly because the preliminary versions of the Plans were named for the same year as the final Plans but were published the previous year. The new naming convention is simply to use numerical order. The next final Plan will be the EPA's 14th Plan, so this document is Preliminary ELG Program Plan 14 and the subsequent final Plan will be Final ELG Program Plan 14. Subsequent preliminary and final Plans will be numbered accordingly.

3. REVIEWS OF INDUSTRIAL WASTEWATER DISCHARGES AND TREATMENT TECHNOLOGIES

This section describes the EPA's ongoing ELG program planning activities and analyses to identify industrial categories for potential development of new or revised ELGs, as well as the data sources and limitations used to complete the reviews. It also presents the findings and next steps for the associated planning activities. This Plan discusses the following actions that the EPA has taken.

- Began compiling an ELG Database that will include information across all regulated point source categories in a consolidated, searchable database (see Section 3.2).
- Implemented a cross-industry review of nutrient discharges in industrial wastewater and developed a tool to estimate nutrient discharges from industrial sources that are underrepresented in readily available datasets (see Section 3.3).
- Continued its review of per- and polyfluoroalkyl substances (PFAS) in industrial wastewater (see Section 3.4).
- Continued to compile wastewater treatment technology information in the Industrial Wastewater Treatment Technology (IWTT) Database and populate the information in the IWTT web application for public use (see Section 3.5).
- Implemented a method to screen, prioritize, and further review specific industrial wastewater treatment technologies that may be more broadly evaluated as technology options for future studies and rulemakings (see Section 3.6).
- Began developing an economic analysis methodology to screen and help prioritize industrial point source categories for further review (see Section 3.7).
- Reviewed data collected on impaired watersheds to determine if specific industrial sources were contributing to impairments. (see Section 3.8).
- Concluded a study of engineered nanomaterials (see Section 3.9).
- Concluded a study of pesticide active ingredients (see Section 3.10).

3.1 Summary of Annual Review Activities

This section provides a summary of projects that were conducted during the 2016 and 2017 annual reviews and projects that are part of the 2018 annual review or expected to be part of the 2019 annual review This section will not discuss detailed studies or rulemakings for specific industrial categories that are mentioned in subsequent sections.

In the 2016 annual review, which was used in the development of the Final 2016 ELG Program Plan, the EPA completed preliminary reviews of categories that ranked high on the 2015 TRA: Iron and Steel Manufacturing (40 CFR Part 420); Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) (40 CFR Part 414); and Pulp, Paper, and Paperboard (Pulp and Paper) (40 CFR Part 430) and further reviewed the following categories: Battery Manufacturing (40 CFR Part 461), Electrical and Electronic Components (40 CFR Part 469), Metal Finishing (40 CFR Part 433), and Pesticide Chemicals Manufacturing (40 CFR Part 455). The EPA also conducted cross-industry reviews using the Canadian National Pollutant Release Inventory (CNPRI) and available data on Engineered Nanomaterials. See the Final 2016 Effluent Guidelines Program Plan (U.S. EPA, 2018) for further details.

For the 2017 annual review, which was used in the development of this Plan, the EPA conducted cross-industry reviews of nutrients in industrial discharges (Section 3.3,) based on 2015 DMR And TRI data,

PFAS in industrial discharges (Section 3.4) based on 2016 DMR data, discharges to impaired waters (Section 3.8), and economic indicators (Section 3.7). These efforts reviewed all existing ELGs, relevant data for industries with existing ELGs, and data for some industries that are not currently regulated by ELGs.

The EPA also proposed to use peer-reviewed information on industrial wastewater treatment technologies compiled in the IWTT Database since 2012 (Section 3.5), along with other information sources to review technologies that could prompt revision of ELGs (Section 3.6). The EPA also began constructing and populating the ELG Database (Section 3.1). The EPA plans to continue this effort with the goal of including all 59 ELGs.

For the 2018 annual review, the EPA expanded the dataset used to review PFAS in industrial discharges to include 2017 DMR data. The EPA also continued development of the other analyses and tools described in this Plan.

The 2019 annual review is not yet complete, but is expected to expand the dataset for review of nutrient discharges in industrial wastewater to include 2016, 2017 and 2018 DMR and to expand the dataset for review of PFAS in industrial discharges to include 2018 DMR data. Results of these and any additional reviews will be discussed in Final ELG Program Plan 14.

3.2 Effluent Limitations Guidelines Database

The EPA is compiling information on its ELGs for 59 different point source categories[8] into a consolidated ELG Database. The database will facilitate searching for information within and across ELGs. It will capture information from the Code of Federal Regulations (CFR) (40 CFR Parts 405 through 471),[9] as well as from the technical development documents supporting promulgated rules. The ELG Database will include the following information.

- Regulations promulgated (e.g., BPT, BAT, BCT, PSES and PSNS, NSPS).
- Applicability of the ELGs to specific industrial operations, including definitions of any regulated subcategories.
- Wastestreams or process operations associated with each regulation.
- Pollutant limitations.
- CFR references to best management practices, monitoring requirements, and narrative limitations.
- Rule history, including promulgation and revision dates.
- Technology bases and pollutant long-term average performance data, where available, underlying the regulations.

The database will provide the EPA with consolidated information about the requirements and development of current existing ELGs. The EPA will be able to search the regulations for a specific point source category or compare regulations across multiple point source categories more quickly, systematically, and comprehensively.

[8] See EPA's Industrial Effluent Guidelines webpage (https://www.epa.gov/eg/industrial-effluent-guidelines) for a list of the 59 point source categories.
[9] See https://www.ecfr.gov/cgi-bin/text-idx?SID=1e3d7a295bbc0feaae8ea6b4b85da954&mc=true&tpl=/ecfrbrowse/Title40/40tab_02.tpl.

The EPA plans to use this information to compare specific pollutant limitations, and the associated technology bases, across industries to identify limitations that may be based on outdated technologies, or limitations developed using less sensitive analytical methods than are now available.

3.3 Nutrient Discharges in Industrial Wastewater

Nutrient pollution is one of the most widespread, costly, and challenging environmental problems impacting water quality in the United States. Excessive nitrogen and phosphorus in surface water can lead to a variety of problems, including eutrophication and harmful algal blooms, with impacts on drinking water, recreation, and aquatic life. A wide range of human activities contribute to nutrient pollution from both point and nonpoint sources, including stormwater discharges, runoff, leaking septic systems, fertilizer, atmospheric deposition, and wastewater discharges.

To more comprehensively screen industrial wastewater as a source of nutrients, the EPA conducted a cross-industry review of publicly available DMR and TRI data on nutrient discharges from industrial point source categories. This review aimed to identify industries that may be candidates for ELG development or revision and prioritize them for further review, based on their discharges of nutrients in wastewater and the potential to reduce their nutrient discharges. The EPA then ranked industrial categories by the nutrient loads in their wastewater discharges.

Upon review of the industry rankings and the available data, the Agency began two concurrent activities.

- The EPA further reviewed sources of nutrients, nutrient wastewater discharges, and typical wastewater treatment technologies or best management practices used to control nutrient discharges from the top two ranking categories: Pulp, Paper, and Paperboard (40 CFR Part 430) and Meat and Poultry Products (40 CFR Part 432).
- To further understand potential nutrient discharges in the U.S., the EPA estimated discharges from industrial facilities likely to discharge nutrients but that are not captured in the DMR and TRI data.

The subsections below briefly summarize the methods and findings of the EPA's current review of nutrient discharges, as well as plans for continued review of nutrients. For additional details on the methodology and analyses completed for the nutrients review, see *EPA's Review of Nutrients in Industrial Wastewater Discharge* ("Nutrients Report") (U.S. EPA, 2019c).

3.3.1 Nutrient Discharge Rankings

The EPA conducted a nutrient discharge rankings analysis using publicly available data to screen industrial categories based on annual total nitrogen and total phosphorus loads discharged to receiving waters. The goal of this review was to identify industries with large nutrient loads relative to other industries and prioritize for further review those industries that may be candidates for controlling nutrient discharges through ELG development or revision.

For this analysis, the EPA evaluated 2015 DMR and TRI total nitrogen and DMR total phosphorus data, downloaded from the EPA's Water Pollutant Loading Tool (Loading Tool).[10]

The nitrogen and phosphorus parameters reported in DMRs vary by industry and NPDES permit and may include total nitrogen, ammonia, nitrate, phosphate, total phosphorus and/or other nitrogen or

[10] See https://echo.epa.gov/trends/loading-tool/water-pollution-search.

phosphorus species. To facilitate analyses of the data, the Loading Tool has a built-in function to calculate aggregated loads for total nitrogen and total phosphorus based on reported discharges from one or more individual nutrient parameters. The EPA used the aggregated total nitrogen and total phosphorus loads from the Loading Tool as the basis for the nutrient discharge rankings. The Loading Tool does not have a similar function to aggregate nutrient loads for the individual parameters reported to TRI (ammonia and nitrate are the only TRI-reported nutrient parameters); therefore, the EPA performed the total nitrogen aggregation separately. See the Nutrients Report (U.S. EPA, 2019c) for a detailed discussion of the DMR and TRI nutrient aggregation methodology.

The EPA downloaded the 2015 DMR and TRI nutrient data from the Loading Tool and summed the aggregated facility loads for all facilities in an industrial category, thereby ranking industrial categories by their nutrient loadings according to three criteria: DMR total nitrogen rankings, DMR total phosphorus rankings, and TRI total nitrogen rankings. Due to the potential for double counting between the reported nutrient parameters in DMR and TRI, the EPA developed total nitrogen rankings for DMR and TRI separately and then considered the findings together. In aggregate, 2015 DMRs reported that industrial facilities discharged more than 111,000,000 pounds of total nitrogen and 20,500,000 pounds of total phosphorus to surface waters in 2015. For comparison, POTWs discharged 1,600,000,000 pounds of total nitrogen and 246,000,000 pounds of total phosphorus in 2015, loadings that are significantly higher than any of the single industrial categories for both nitrogen and phosphorus.[11] Figure 3-1, Figure 3-2, and Figure 3-3 below present the percent allocation of DMR total nitrogen discharges, TRI total nitrogen discharges, and DMR total phosphorus discharges among the top-ranking point source categories, respectively.

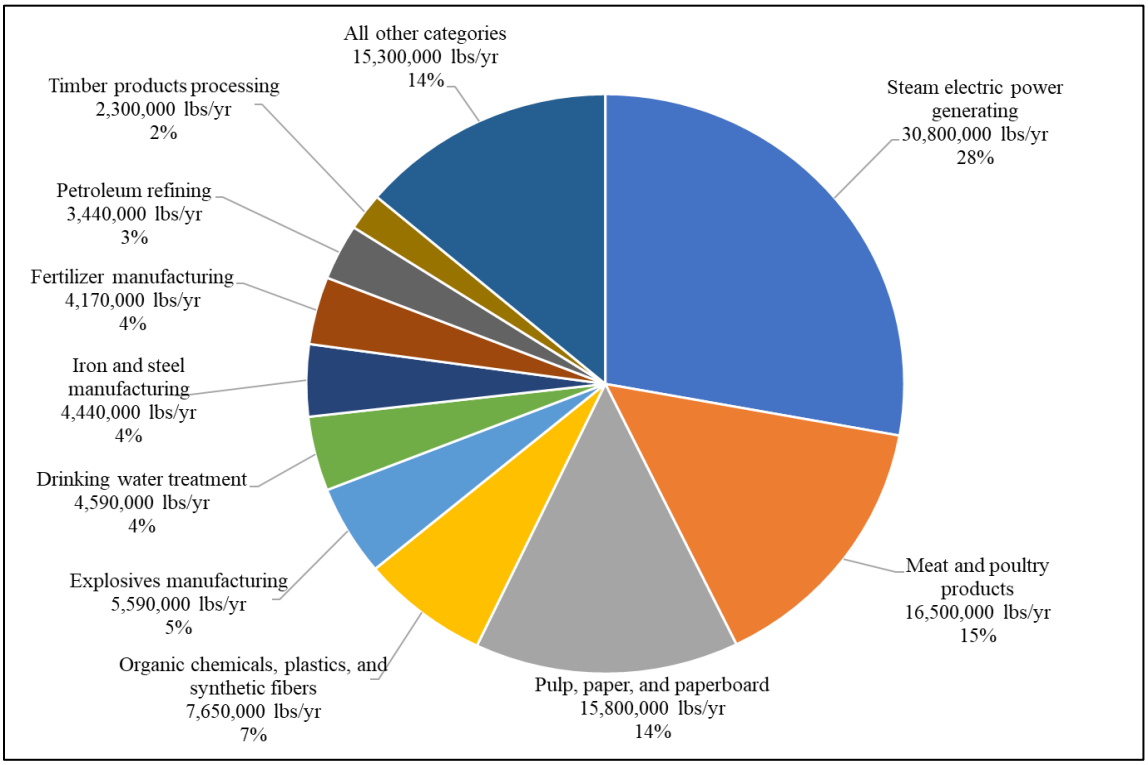

Figure 3-1. 2015 DMR Total Nitrogen Discharges for Top Ranking Categories in Pounds per Year and Percent of Total Annual Load

[11] EPA obtained total nitrogen and total phosphorus POTW loadings from a March 2019 search of the Loading Tool for DMRs submitted in 2015 (ERG, 2019a).

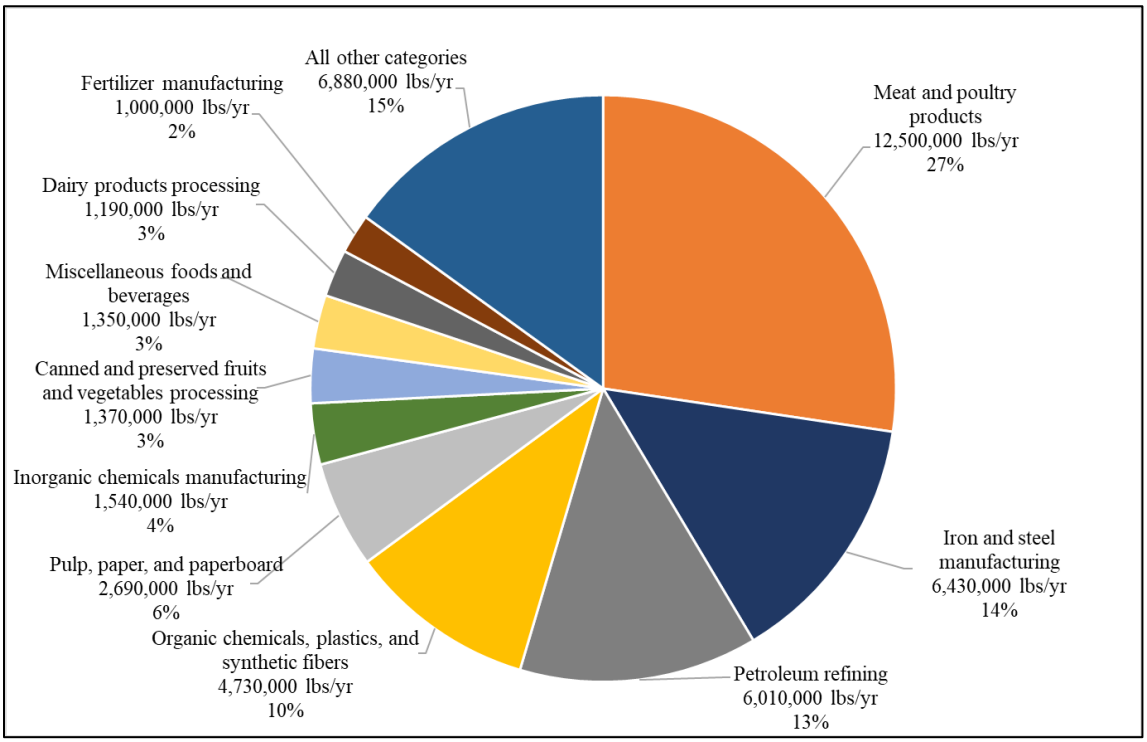

Figure 3-2. 2015 TRI Total Nitrogen Discharges for Top Ranking Categories in Pounds per Year and Percent of Total

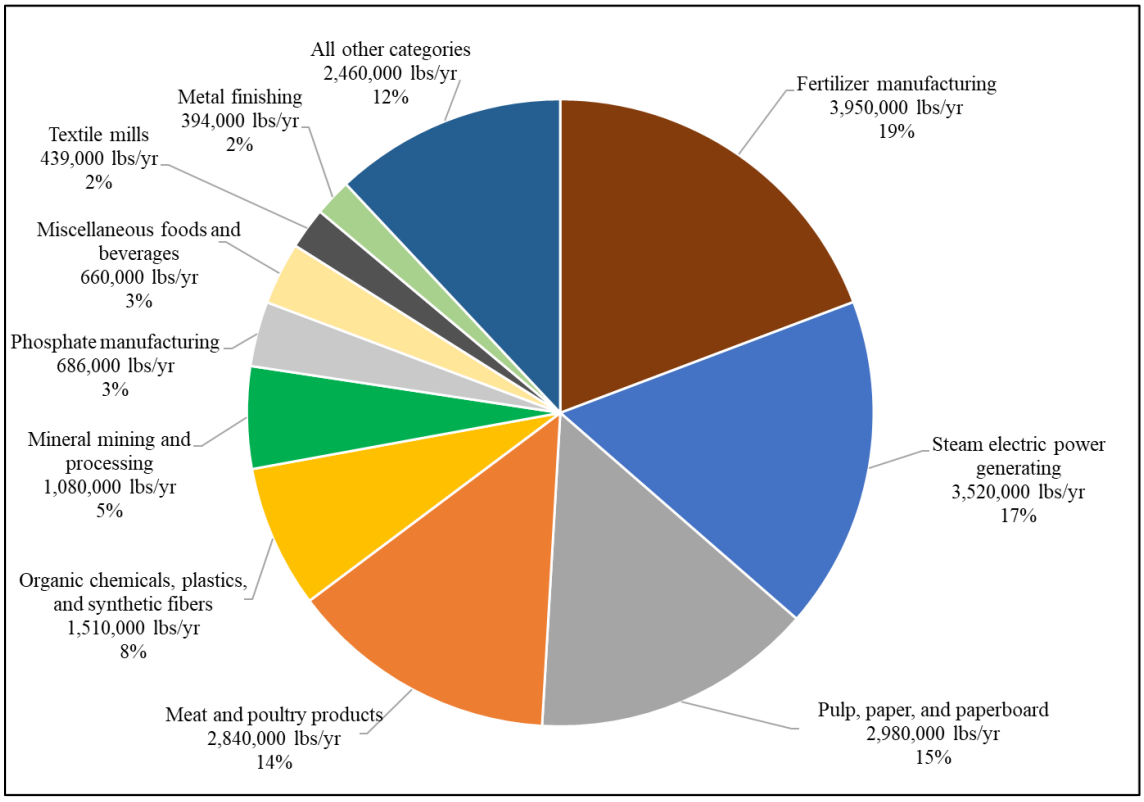

Figure 3-3. 2015 DMR Total Phosphorus Discharges for Top Ranking Categories in Pounds per Year and Percent of Total Load

From the rankings, the EPA prioritized specific industries to review further for their potential to reduce nutrient discharges through national ELGs. The EPA considered the annual total pounds of nutrients discharged, annual median pounds discharged, and the number of facilities reporting nutrient discharges. The EPA did not consider industrial categories for which ELGs have been established or revised since 2012 or categories whose ELGs are currently undergoing revision (these are Airport Deicing (40 CFR Part 449) promulgated in 2012, Construction and Development (40 CFR Part 450) last revised in 2014, Steam Electric Power Generating (40 CFR Part 423) last revised in 2015 and undergoing current revision (Section 5.1), and Dental Offices (40 CFR Part 441) promulgated in 2017). Additional details about this analysis are available in Appendix C of the Nutrients Report (U.S. EPA, 2019c).

After conducting this analysis, the EPA prioritized the Pulp, Paper, and Paperboard (Pulp and Paper) (40 CFR Part 430) and Meat and Poultry Products (Meat and Poultry) (40 CFR Part 432) categories for further review. These two categories contributed the highest nutrient loads across the nutrient discharge rankings analyses for both total nitrogen and total phosphorus, based on the median facility load and number of facilities reporting discharges. See the Nutrients Report (U.S. EPA, 2019c) for these data.

3.3.2 Nutrient Discharges From the Pulp and Paper Industry

The EPA first promulgated ELGs for the Pulp and Paper Category in 1974, further revising and refining these regulations several times, most recently in 2007. According to the technical development documents (TDDs) published in 1980 and 1982, pulp and paper mill wastewater was typically nutrient deficient, prompting mills to supplement their biological treatment systems with nutrients, such as urea or phosphoric acid, to ensure efficient operation (U.S. EPA, 1980, 1982). At the time, the EPA reviewed available ammonia data and identified two technologies capable of removing ammonia from pulp and paper wastewaters, but commenters voiced concern about the rule because of the absence of widespread problems with receiving water quality from routine industrial discharges. Ultimately, the EPA determined that the establishment of ELGs for ammonia was not warranted due to projected severe economic impacts to the industry (U.S. EPA, 1982). The EPA revised the regulations for the pulp and paper industry in 1998 (63 FR 18504), 1999 (64 FR 36580), 2002 (67 FR 58990), and 2007 (72 FR 11199), but none of these amendments focused on nutrients in wastewater discharges.

In 2006, the EPA conducted a detailed study of the Pulp and Paper Category. Although the associated report indicates that nutrients may be present in raw wastestreams such as lignin from wood, or in materials added in process operations, such as bleaching chemicals, the EPA identified the addition of nutrients prior to biological treatment as the major source of nutrients in mill wastewater effluent. The EPA concluded that end-of-pipe treatment technologies specifically for nutrient removal have not been historically common in pulp and paper mill treatment trains. Minimizing the discharge of nutrients from pulp and paper mill wastewater may require optimizing the addition of nutrients for biological treatment and effective removal of suspended solids. However, the EPA could not determine if these strategies were feasible for all mills (U.S. EPA, 2006).

To further understand nutrient sources, discharges, and treatment in the pulp and paper industry, the EPA consulted the following data sources: pulp and paper industry trade associations (the American Forest & Paper Association (AF&PA) and the National Council for Air and Stream Improvement (NCASI)), 2015 DMR and TRI data, and contacts at several pulp and paper mills that reported ammonia and nitrate releases to TRI.

From its review of the available information, the EPA confirmed that pulp and paper mill wastewater is typically nutrient deficient and that mills supplement their biological treatment systems with nutrients to facilitate biological treatment. This was consistent with its findings from the original rulemaking and the

2006 detailed study. Discussions with industry trade associations and contacts with facilities indicated that mills typically strive to optimize nutrient addition during biological treatment and that, due to cost, few mills operate tertiary treatment systems for removing residual nutrients from biologically treated effluents. (NCASI, 2016).

To understand the magnitude of the nutrient discharges from the industry, the EPA used the Loading Tool to compile annual average DMR discharge concentrations[12] and TRI annual releases for nutrients, including total nitrogen, ammonia (as N), nitrate, total Kjeldahl nitrogen (TKN), and total phosphorus. EPA identified 277 mills that submitted DMR data in 2015, including 83 mills that submitted discharges for one or more nitrogen parameters and 87 mills that submitted discharges for one or more phosphorus parameters.

EPA also identified 388 pulp and paper mills that reported releases of toxic pollutants in the 2015 TRI dataset, of which 140 reported releases of nitrogen. As the TRI dataset only contains annual releases, in order to obtain flow and concentration data for facilities with the highest nutrient discharges EPA worked with individual pulp and paper mills, as well as trade associations. EPA was able to obtain flow and concentration data for 12 individual facilities.

Table 3-1 summarizes the pulp and paper mill concentration data obtained from DMRs and TRI (TRI data supplemented with information supplied by paper mills and trade associations to enable the EPA to calculate concentration). The DMR data represent direct dischargers, and the TRI data are separated by direct and indirect dischargers. Of the DMR and TRI data presented in Table 3-1, most mills discharge to surface water, though the EPA notes both datasets are limited to facilities that are required to monitor and/or report for nutrients, as described in Section 2.1 of the Nutrients Report (U.S. EPA, 2019c).

As shown in Table 3-1, total phosphorus and ammonia are the most frequently reported nutrient parameters on DMRs. For most of the parameters, mills are reporting a wide range of discharge concentrations, differing by an order of magnitude or more. This range most likely reflects the variability in the permits, which range from monitoring requirements only, to very stringent site specific limits based on water quality requirements of the receiving water. The data also suggest that mills vary in their optimization of nutrient addition to supplement biological treatment. The EPA is not able to draw meaningful comparisons between direct and indirect discharges because the dataset for indirect discharges is so limited, though the EPA notes that the median indirect discharge concentrations for ammonia and nitrate are similar to the direct discharge concentrations reported on DMRs.

[12] The Loading Tool calculates annual average concentrations for DMR and TRI data. For additional information on the methodology for these calculations, see the Technical Users Background Document for the Water Pollutant Loading Tool (U.S. EPA, 2012).

Table 3-1. Concentration of Nutrients in Pulp and Paper Mill Discharges (mg/L)

Nutrient Parameter	Statistics	Annual Average Discharge Concentration		
		DMR Data (Direct Dischargers)	TRI Data (Direct Dischargers)	TRI Data (Indirect Dischargers)
Total Nitrogen[a,b]	Median	3.79 mg/L	-	-
	Range	0.022 – 126 mg/L	-	-
	Facility Count	28	-	-
Ammonia (as N)	Median	0.885 mg/L	0.53 mg/L	0.84 mg/L
	Range	0.010 – 114 mg/L	0.01 – 1.23 mg/L	0.10 – 2.50 mg/L
	Facility Count	77	7	4
TKN	Median	3.90 mg/L	-	-
	Range	0.405 – 33.5 mg/L	-	-
	Facility Count	34	-	-
Nitrate	Median	0.328 mg/L	2.48 mg/L	0.34 mg/L
	Range	0.178 – 0.929 mg/L	0.41 – 28.3 mg/L	0.21 – 0.47 mg/L
	Facility Count	7	8	2
Total Phosphorus[a,c]	Median	0.427 mg/L	-	-
	Range	0.008 – 4.65 mg/L	-	-
	Facility Count	101	-	-

Source: ERG, 2018a

Note: Data are rounded to three significant figures unless data are only available to a lesser precision.

[a] The EPA compiled speciated data for nitrogen and phosphorus. The data do not include total nitrogen or phosphorus as aggregated from other reported nutrient compounds.

[b] For the purposes of this review, the EPA removed one outlier facility from the dataset with a total nitrogen average concentration of 1,420 mg/L, one order of magnitude larger than the next largest concentration.

[c] For the purposes of this review, the EPA removed from the dataset one outlier facility with a total phosphorus concentration of 1,850 mg/L, three orders of magnitude larger than the next largest concentration.

For informational purposes only and to provide some context, the EPA compared the nutrient concentration data to benchmarks from a 2011 Water Environment Research Foundation (WERF) study. The 2011 WERF study aimed to determine sustainability impacts as municipal wastewater treatment plants implemented technologies to meet increasingly stringent nutrient limits (WERF, 2011). The 2011 WERF study considered five theoretical levels of treatment for reducing total nitrogen and total phosphorus in municipal wastewater. Each level was associated with a treatment train and target nutrient discharge concentration, or "treatment objective." Table 3-2 presents the study treatment level objectives that the EPA used for its comparison to pulp and paper industry discharges, along with the nutrient removal mechanisms associated with each level. Level 2 represents the least stringent level that includes nutrient removal; Level 5 represents the most stringent level from the WERF study.

Table 3-2. Treatment Objective Levels in WERF 2011 Study

WERF Treatment Level	Nutrient Removal Mechanisms	Treatment Level Objectives
Level 2	Nitrification/Denitrification Biological Phosphorus Removal	Total Nitrogen: 8 mg/L Total Phosphorus: 1 mg/L
Level 5	Nitrification/Denitrification, Biological Phosphorus Removal High Rate Clarification Denitrification, Filtration Microfiltration/Reverse Osmosis on about Half the Flow	Total Nitrogen: <2 mg/L Total Phosphorus: <0.02 mg/L

Source: WERF, 2011.

Pulp and paper mill median effluent concentrations for total nitrogen (3.79 mg/L) and total phosphorus (0.427 mg/L) fall within the range of WERF study treatment objectives shown in Table 3-2, indicating that the typical pulp and paper mill is achieving nutrient discharge concentrations that may be comparable to POTWs employing some level of nutrient removal mechanisms in their wastewater treatment. However, two mills exceed the Level 2 treatment objective for total nitrogen and 24 mills exceed the Level 2 treatment objective for total phosphorus.

To understand how nutrient permit limits for pulp and paper mills are developed, the EPA reviewed 44 pulp and paper mill permits from 14 states and NPDES permits gathered from EPA Regions 1, 4, and 5, and from an online search. For this review, the EPA did not intentionally target the 12 mills for which underlying TRI concentrations were obtained as the purpose was to assess a larger more representative portion of the industry; however, one of these mills was captured in the permits review. Across the permits reviewed, the range of average monthly concentration limits for each nutrient parameter is presented below. The review suggests that permit limits for nutrients, which most commonly include total phosphorus, ammonia, and total nitrogen, vary by one to two orders of magnitude.

- Total phosphorus: 0.1 milligrams per liter (mg/L) to 3 mg/L.
- Ammonia: 0.1 mg/L to 20 mg/L.
- Total nitrogen: 2 mg/L to 6 mg/L.

The EPA Regional contacts indicated that most permit limits are either Technology-Based Effluent Limitations (TBELs) based on best professional judgement or Water Quality-Based Effluent Limitations (WQBELs) that are protective of the water quality standard of the receiving water. In the absence of ELGs for a discharge or pollutant, permit writers are required to identify any needed TBELs on a case-by-case basis (U.S. EPA, 2010). The EPA was not able to gather sufficient information from the EPA Regions or permit reviews to compare the range of TBELs to WQBELs to understand limits achieved by available technologies. Further study would be required to understand this relationship.

Although the total pounds of nutrients discharged by the pulp and paper industry ranked high compared to other industrial categories, the EPA found that these loads are the result of nutrient addition during wastewater treatment and that, according to information from industry, mills are striving to optimize nutrient addition. The large range of average nutrient concentrations reflects the range of permit requirements for pulp and paper facilities and suggests that the level of nutrient addition optimization varies across the industry. However, the median nutrient concentrations in direct discharges from the industry are comparable to nutrient discharges achievable by POTWs that implement nutrient removal mechanisms in their wastewater treatment. Based on these findings, the EPA intends to continue to review this category as additional information becomes available.

3.3.3 Nutrient Discharges From the Meat and Poultry Industry

The EPA first promulgated ELGs for the Meat and Poultry Category in 1974 which covered direct discharges from meat processing facilities. Ammonia was the only nutrient regulated by these proposed ELGs. Although the EPA proposed ELGs for direct dischargers from poultry processing facilities, they were never finalized.

In 2002, the EPA proposed revisions to the meat processing ELGs and proposed new ELGs for poultry processing, including limitations on total nitrogen, total phosphorus, and ammonia. No pretreatment standards were proposed (U.S. EPA, 2002). The EPA proposed to establish effluent limitations based on biological treatment technology to reduce the nutrient forms of these compounds (e.g., convert ammonia to nitrate). Public comments submitted for the proposal and a Notice of Data Availability (NODA) expressed concerns regarding seasonal changes affecting biological nitrification and the disparity of influent nitrogen concentrations among meat and poultry facilities. The EPA also noted that the treatment technology basis for the final limitations do not remove phosphorus despite the presence of phosphorous in the wastewater (U.S. EPA, 2004). Following the proposal and NODA, the EPA promulgated limitations for ammonia and total nitrogen in 2004. The technology bases used to establish limitations for the 12 meat and poultry subcategories, while differing slightly, all consist of pretreatment followed by biological treatment, clarification, and disinfection. The EPA did not establish pretreatment standards for indirect dischargers because there was insufficient evidence of pass through or interference at POTWs from meat and poultry facilities to warrant establishing national pretreatment standards for these facilities (U.S. EPA, 2004).

To further understand nutrient sources, discharges, and treatment, the EPA consulted the following data sources: historical documentation supporting the development of the ELGs, 2015 DMR and TRI data, and contacts at several meat and poultry facilities.

According to the 2002 TDD for the proposed Meat and Poultry ELGs, organic nitrogen and ammonia, among other nutrients, were widespread in meat and poultry wastewater, originating from bone, soft tissue, blood, manure, and cleaning compounds (U.S. EPA, 2002). The facilities the EPA contacted for this review confirmed that the major source of nutrients, particularly nitrate and ammonia, in meat and poultry wastewater continues to be blood, manure, and other organic material.

The meat and poultry industry profile presented in the 2004 TDD for the final ELGs, indicated that 94 percent of the industry consists of indirect dischargers. At the time, EPA estimated that 288 meat and poultry facilities were direct dischargers (U.S. EPA, 2004). The overall number of direct dischargers from the 2015 DMR data comprised 367 facilities, an increase of 27.4 percent compared to the number of direct dischargers identified in 2004, indicating that the portion of this industry that is direct dischargers has increased. Due to the limitations of the TRI dataset, which excludes smaller or other facilities not required to report, the EPA is not able to determine the current number of indirect dischargers without further data collection. In 2015, only 104 meat and poultry facilities, out of 175 reporting nitrogen release in TRI, reported indirect discharges; a small fraction of the 4,430 facilities that the EPA identified in 2004 as discharging wastewater indirectly.

The EPA gathered information from EPA Regions 4 and 5 on the development of nutrient permit limits and current practices for managing wastewater containing these pollutants. The EPA chose these Regions based on the presence of meat and poultry facilities discharging the highest loads of nutrients according to the 2015 DMR dataset. Of the 157 meat and poultry facilities that reported nutrient discharges greater than zero on 2015 DMRs, the EPA reviewed 16 meat and poultry facility permits from nine states: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina,

Tennessee, and Illinois. Table 3-3 shows the current ELGs for the Meat and Poultry Category, as well as the range of permit limits for total nitrogen and ammonia identified from the EPA's permit review. About half the facilities have ammonia limits more stringent than the current ELGs; however, none of the facilities had total nitrogen limits more stringent than the ELGs. Over half of the permits reviewed also included limits for one or more nutrient parameters not regulated by the current ELGs, including TKN, nitrate/nitrite, and total phosphorus. Many of the permits reviewed also had seasonal limits, with more stringent limits in the summer months. According to discussions with the EPA Regional contacts, limits are either (1) technology-based effluent limits (TBELs) based on ELGs or best professional judgment or (2) water quality effluent-based limits (WQBELs) depending on which limit is more stringent. For meat and poultry facilities, WQBELs tend to be more stringent than TBELs.

The EPA's review of NPDES permits and discussions with facilities indicate that meat and poultry facilities commonly use basin-based biological treatment, lagoon-based biological treatment, chemical precipitation, nitrification/denitrification, dissolved air flotation (DAF), and disinfection. Technologies such as biological treatment, nitrification, and disinfection are consistent with the technology basis of the current ELGs. Table 3-3 summarizes BAT permit limits for total nitrogen and ammonia (as N) at the facilities that the EPA identified from review of permits for meat and poultry facilities. Based on the applicability of the ELGs, a "first" processor refers to a facility with process wastewater from animal holding areas, including slaughterhouses and packinghouses, and a "further" processor refers to a facility with operations that process whole carcasses or cut-up meat and poultry products for the production of fresh or frozen products.

Table 3-3. Meat and Poultry Nutrient BAT ELGs and Permit Review Results Summary

Subcategory	Total Nitrogen BAT ELGs		Ammonia (as N) BAT ELGs	
	Daily Max	Monthly Avg	Daily Max	Monthly Avg
A-D: Meat First Processors	194 mg/L	134 mg/L	8.0 mg/L	4.0 mg/L
E: Small Meat Processors	NA	NA	NA	NA
F-I: Meat Further Processors	194 mg/L	134 mg/L	8.0 mg/L	4.0 mg/L
J: Independent Renderers[a]	194 mg/L	134 mg/L	0.14 lb per 100 lb of raw material	0.07 lb per 100 lb of raw material
K: Poultry First Processors[b]	147 mg/L	103 mg/L	8.0 mg/L	4.0 mg/L
L: Poultry Further Processors[c]	147 mg/L	103 mg/L	8.0 mg/L	4.0 mg/L
Summary Statistics				
Descriptive Statistic	**Total Nitrogen Permit Limits**		**Ammonia (as N) Permit Limits**	
	Daily Max	**Monthly Avg**	**Daily Max**	**Monthly Avg**
Minimum Permit Limit Based on Permit Review	147 mg/L	103 mg/L	0.02 mg/L	1.0 mg/L
Median Permit Limit Based on Permit Review	147 mg/L	103 mg/L	8.0 mg/L	4.0 mg/L
Maximum Permit Limit Based on Permit Review	194 mg/L	134 mg/L	30.0[d] mg/L	20.0[d] mg/L

[a] Regulations apply to facilities producing > 10 million lb/yr.

[b] Regulations apply to facilities producing > 100 million lb/yr.

[c] Regulations apply to facilities producing > 7 million lb/yr.

[d] Permit limits above the concentration-based ELGs apply to facilities identified as subcategory J by EPA Region 4.

To understand the magnitude of the discharges, the EPA compiled annual average DMR discharge concentrations from meat and poultry facilities for the available nutrient parameters (i.e., total nitrogen, ammonia (as N), nitrate, inorganic nitrogen, TKN, and total phosphorus) from the Loading Tool.[13] The EPA also identified and contacted facilities with the highest nutrient loads in the TRI dataset that reported releases based on monitoring data and did not have corresponding DMR data. Using this approach, the EPA obtained underlying concentration data that formed the basis for the TRI-reported direct releases of ammonia and nitrate from 12 facilities.[14] This included six facilities that reported direct releases and six facilities that reported indirect releases of these nutrients.

Table 3-4 provides a summary of the median meat and poultry DMR and TRI annual average concentration data. The DMR data represent direct dischargers, and TRI data are separated by direct and indirect dischargers. The EPA notes DMR data may be limited as a facility is only required to monitor or report discharges for the nutrient parameters included within its permit. The EPA also notes that TRI data are limited to and representative of only the small subset of facilities it contacted. Further, because the EPA selected facilities to contact with the highest nutrient discharges, these 12 facilities are not likely to be representative of discharges from all facilities in the industry.

The EPA compared the meat and poultry nutrient concentration data to the following nutrient-specific benchmarks, also listed in Table 3-4.

1. *ELG BAT Monthly Average.* The EPA promulgated total nitrogen and ammonia ELGs for the Meat and Poultry Category in 2004.
2. *Long-term Average (LTA).* During the 2004 rulemaking, the EPA collected information about the concentrations of total nitrogen and ammonia and calculated LTAs reflecting various technology bases (U.S. EPA, 2004). These LTAs are the average performance level that a facility with well-designed and operated model pollution removal technologies can achieve based on the data collected during the 2004 rulemaking. ELG limitations are developed using the LTAs and a variability factor, which accounts for performance variability of the wastewater treatment system in practice.
3. *WERF Treatment Objective Levels.* In 2011, the Water Environment Research Foundation (WERF) conducted a study to determine the sustainability impacts as municipal wastewater treatment plants implemented technologies to meet increasingly stringent nutrient limits (WERF, 2011). See Table 3-2 for a discussion of the technology objectives. For the purpose of this analysis, the EPA compared the meat and poultry concentration data to the lowest treatment objective targeting nutrients (Level 2).
4. *Publicly Owned Treatment Works (POTW) Concentration Data*. The EPA compared the median 2015 DMR effluent concentration data achieved by POTWs to the effluent concentration achieved by meat and poultry facilities.

[13] The Loading Tool calculates annual average concentrations for DMR and TRI data. For additional information on the methodology for these calculations, see the Technical Users Background Document for the Water Pollutant Loading Tool (U.S. EPA, 2012).
[14] Ammonia and nitrate are the only nutrient parameters included in the TRI dataset.

Table 3-4. Summary of Meat and Poultry Facility Concentration Data and Comparison to Benchmarks

Concentration Data/ Comparison Benchmark	Subcategory	Concentration (mg/L)					
		Total Nitrogen	Ammonia (as N)	TKN	Nitrate	Inorganic Nitrogen	Total Phosphorus
Median 2015 DMR Annual Avg. Concentration (# of reporting facilities)	NA	32.8[a] (97 facilities)	0.504 (119 facilities)	3.18 (99 facilities)	3.66 (19 facilities)	2.14 (90 facilities)	1.96[a] (140 facilities)
Median 2015 TRI Direct Annual Avg. Concentration (# of reporting facilities)	NA	-	0.586 (2 facilities)	-	72.2 (6 facilities)	-	-
Median 2015 TRI Indirect Annual Avg. Concentration (# of reporting facilities)	NA	-	69.6 (6 facilities)	-	86.0 (1 facilities)	-	-
ELG BAT Monthly Average	Meat Processing (Subcategories A-D and F-I)	134[b]	4.0[c]	NA	NA	NA	NA
LTA	Meat Processing/ Rendering (Subcategories A-D, F-I, J)	34	0.895	NA	NA	NA	NA
	Poultry (Subcategories K and L)	34	1	NA	NA	NA	NA
WERF Treatment Objective Level 2	NA	8	NA	NA	NA	NA	1
POTW Annual Median	NA	9.21	0.673	2.34	5.03	6.65	1.31

Sources: U.S. EPA, 2004; ERG, 2018b; ERG, 2018h; WERF, 2011

NA: Not Applicable

Note: Data are rounded to three significant figures unless data are only available to a lesser precision.

[a] The EPA compiled speciated data for total nitrogen and total phosphorus. The data do not include total nitrogen or phosphorus that are aggregated from other reported nutrient compounds.

[b] This ELG total nitrogen concentration also applies to Renderers (Subcategory J).

[c] This ELG ammonia concentration also applies to Poultry First Further Processors (Subcategories K and L).

From this comparison, the EPA found the following.

- The median annual average total nitrogen concentration from the DMR data, for 97 direct discharging facilities, is 32.8 mg/L — well below the ELG monthly average and comparable to the LTA benchmark.
- Seventy-three of the 97 facilities that reported a total nitrogen discharge concentration for 2015 discharged a higher total nitrogen concentration compared to the POTW total nitrogen median effluent concentration, and 75 facilities discharged a higher total nitrogen concentration compared to the WERF Level 2 treatment objective for total nitrogen.
- The two estimates of the median annual average ammonia concentration directly discharged — 0.504 mg/L from DMRs and 0.586 mg/L from TRI — are both less than all the benchmarks, including the LTAs and POTW median effluent concentration.
- The median annual average TKN, nitrate, and inorganic nitrogen from DMRs are less than or comparable to the POTW median annual average concentration.
- The median annual average total phosphorus concentration from DMRs — 1.96 mg/L — is above the benchmarks, including the POTW median effluent concentration and WERF Level 2 treatment objective.
- Very little data are available on nutrient discharges from indirect discharging facilities, which in 2004 included approximately 94 percent of the facilities in the meat and poultry industry.

Based on these findings, the EPA intends to continue to study this category as additional information becomes available.

3.3.4 Estimation of National Nutrient Discharges from Industrial Point Sources

Available DMR data on nutrient discharges are limited because facilities are only required to submit discharge data for pollutants specified in their individual NPDES permits. Currently, only 14 of the 59 ELGs contain limitations for nitrogen or phosphorus (11 for nitrogen, one for phosphorus, and two for both nitrogen and phosphorus). This suggests that nutrient limits may be inconsistently applied to permits within and among industries, depending on whether and how the permitting authorities determine they are needed to protect receiving waters. In an effort to better compare nutrient discharges between industries with different nutrient reporting requirements, the EPA developed a Nutrient Estimation Tool (Nutrient Tool) that identifies and estimates nutrient discharges for facilities that do not report nutrient discharges in the DMR dataset.[15] The EPA intends to use the Nutrient Tool to facilitate identification of industry categories that may be candidates for ELG development or revision to control nutrient discharges. The EPA may also use the Nutrient Tool to further understand total nutrient discharges in the United States.

The Nutrient Tool is similar to the Hypoxia Task Force (HTF) Search,[16] jointly developed by the EPA Office of Wastewater Management (OWM) and Office of Wetlands, Ocean, and Watersheds (OWOW) to better identify facilities operating in industries likely to discharge nutrients and to estimate the amount of nutrients that these facilities discharge. The Nutrient Tool uses known nutrient discharge data within defined industrial sectors or subsectors, as reported on DMRs, to estimate nutrient discharges for

[15] The Nutrient Tool includes discharges of total nitrogen, ammonia (as N), nitrate (as N), total phosphorus, and phosphate (as P). The Tool does not use data from the TRI because TRI data do not include underlying pollutant concentrations or wastewater flows.

[16] See https://echo.epa.gov/trends/loading-tool/hypoxia-task-force-nutrient-model.

facilities within that sector or subsector that do not have reported nutrient discharges but are likely to discharge nutrients. The estimation considers, within each sector or subsector, elements such as the median nutrient concentration and flow, as well as the percent of facilities within the sector or subsector that have reported discharges. This section of the Plan provides an overview of the Nutrient Tool and presents the initial nutrient estimation results. See the Nutrients Report (U.S. EPA, 2019c) for a more detailed discussion of the Nutrient Tool, including the data sources, estimation methodology, data quality, and tool uses and limitations.

3.3.4.1 Methodology

The Nutrient Tool comprises five databases, one for each of the nutrient parameters: total nitrogen, ammonia (as N), nitrate (as N), total phosphorus, and phosphate (as P).

The EPA used the aggregated 2015 DMR data from the Loading Tool for total nitrogen and total phosphorus, which accounts for reported discharges from multiple individual nutrient parameters (e.g., nitrate, organic nitrogen, TKN, etc.). See the Nutrients Report (U.S. EPA, 2019c) for additional details on the EPA's nutrient aggregation method. For ammonia, nitrate, and phosphate, the Nutrient Tool uses the data reported for these individual nutrient parameters.

The Nutrient Tool first divides the dataset into three categories based on the available data in DMR in order to perform further analyses: (1) facilities with reported nutrient discharges, (2) facilities without reported nutrient discharges but with reported flow, and (3) facilities without reported discharges or flow. The nutrients tool does not estimate nutrient loads for facilities without reported flow.

The Nutrient Tool performs the following steps to estimate nutrient loads for facilities with flow that have not reported nutrient discharges.

1. For facilities with reported nutrient discharges, groups facilities by SIC code and calculates a median concentration for each SIC code. It further groups the facilities within each SIC code that have similar flow rates and calculates a median concentration for each SIC code/flow group.
2. Classifies each SIC code as "likely to discharge" nutrients or not based on whether (1) the median nutrient concentration is detectable and (2) a sufficient percentage of facilities within the SIC code are reporting nutrient discharges. The Nutrient Tool considers SIC codes that exceed specified concentration and percent reporting threshold benchmarks as "likely to discharge." See below for a discussion of the "likely to discharge" benchmarks.
3. For facilities without reported nutrient discharges (and with flow) that are within a SIC code that is "likely to discharge," calculates an estimated nutrient load using the facility's reported flow and the median nutrient concentration from the relevant SIC code/flow group.

Once the Nutrient Tool has estimated nutrient loads for facilities that do not have reported nutrient discharges, it sums the estimated and reported facility load data to estimate total loads by SIC code and also by industrial point source category. The EPA has also built functionality into the Nutrients Tool to sum estimated and reported facility loads by hydrologic unit code (HUC) of the receiving water.

The EPA used nutrient concentration benchmarks and percent reporting thresholds in Table 3-5 to classify a SIC code as "likely to discharge" or not for each nutrient parameter, as discussed above. Concentration benchmarks are based on parameter method detection limits (MDLs) or the minimum of the acceptable range for the detection method to ensure the median concentration for SIC codes with

estimated loads is a detectable quantity. The EPA selected five percent as the minimum percent of facilities reporting in a SIC code for the reporting data to be used in the Nutrient Tool estimates. The five percent threshold helps to ensure the reported discharges may be representative of discharges more broadly within the SIC code rather than representing a small number of outlier facilities. The EPA considered that the DMR data for nutrients may be underreported due to limitations in the dataset when selecting the default "likely to discharge" values. The tool allows the user to adjust these criteria; however, the EPA used these default values as the basis for the initial estimated results.

Table 3-5. Default Nutrient Concentration Criteria and Benchmarks to Designate SIC Codes as "Likely to Discharge"

Nutrient Parameter	Percent Reporting Criterion for "Likely to Discharge"	Median Concentration Criterion for "Likely to Discharge"	Basis for Concentration Benchmark	Reference
Total Nitrogen (aggregated)	5%	0.1 mg/L	NCASI Method TNTP-W10900 Minimum of Acceptable Range for TKN	(NCASI, 2011)
Ammonia (as N)	5%	0.01 mg/L	EPA Method 350.1 Method Detection Limit	(U.S. EPA, 1993a)
Nitrate (as N)	5%	0.01 mg/L	EPA Method 300.0 Method Detection Limit	(U.S. EPA, 1993b)
Total Phosphorus (aggregated)	5%	0.01 mg/L	EPA Method 365.1 Method Detection Limit for Total Orthophosphate	(U.S. EPA, 1993c)
Phosphate (as P)	5%	0.01 mg/L	EPA Method 365.1 Method Detection Limit for Total Orthophosphate	(U.S. EPA, 1993c)

3.3.4.2 Initial Results

Table 3-6 below presents a summary of the Nutrient Tool outputs, including the total reported and estimated nutrient loads in industrial wastewater from direct dischargers, as well as the counts of facilities estimated to discharge nutrients. The summary table suggests that the current DMR dataset may be underrepresenting, by a quarter to more than half, the quantity of nutrient discharges from industrial point source categories, depending on the nutrient parameter, for example 85.7% of the nitrate load is estimated. It also suggests that nutrient discharges may not be adequately monitored or controlled, as more than double the number of facilities apparently have nutrient discharges than are reporting them in DMR. Appendix E of the Nutrients Report (U.S. EPA, 2019c) presents the total nutrient loads (estimated plus reported) generated by the Nutrient Tool using the default "likely to discharge" benchmarks listed in Table 3-5 for all five nutrients in the tool: total nitrogen, ammonia, nitrate, total phosphorus, and phosphate. EPA would like feedback from the public on the methodology for estimating nutrient discharges presented in this table and in the Nutrients Report (U.S. EPA, 2019c).

Table 3-6. Nutrient Discharges in Industrial Wastewater, Reported and Estimated

Parameter	Reported Loads in 2015 DMR (lb/yr)	Estimated Loads Nutrient Tool (lb/yr)	Total Load (reported + estimated) (lb/yr)	Percent Estimated	No. of Facilities with Reported Loads in DMR	No. of Facilities with Estimated Loads
Total Nitrogen	111,000,000	42,000,000	153,000,000	27.5%	2,386	2,773
Ammonia	74,800,000	18,300,000	93,100,000	19.6%	1,965	3,486
Nitrate	8,140,000	48,900,000	57,100,000	85.7%	215	658
Total Phosphorus	20,500,000	61,800,000	82,300,000	75.1%	1,519	5,252
Phosphate	498,000	139,000	637,000	21.8%	38	20

Sources: ERG, 2018c, 2018d, 2018e, 2018f, 2018g

3.4 Per- and Polyfluoroalkyl Substances (PFAS) Industrial Sources and Discharges

This section briefly summarizes the methods and findings for the EPA's current review of per- and polyfluoroalkyl substances (PFAS), as well as plans for continued review of PFAS in industrial wastewater discharges. This review incorporates information that has become available since the EPA last reviewed PFAS industrial wastewater discharges in *The 2012 Annual Effluent Guidelines Review Report* (U.S. EPA, 2014a). Note that in that review, the EPA referred to fluorinated compounds as perfluorinated chemicals (PFCs) but now uses the term PFAS.

3.4.1 Background

PFAS are a group of man-made organic chemicals that contain carbon-fluorine bonds, one of the strongest bonds among organic chemicals. PFAS have been used in a variety of consumer and industrial products since their commercial development in the 1940s (ITRC, 2017). The global regulatory community has historically been interested in two broad groups of PFAS: (1) perfluoroalkyl sulfonic acids and their salts (PFSAs), a chemical family that includes perfluorooctane sulfonic acid (PFOS); and (2) perfluoroalkyl carboxylic acids (PFCAs), a chemical family that includes perfluorooctanoic acid (PFOA). PFOA and PFOS, in particular, are very persistent in the environment and in the human body; they do not easily degrade by natural processes and can accumulate over time. Research on the human health and ecological effects of PFAS is still evolving, but there is evidence that exposure to certain forms of PFAS, such as PFOS and PFOA, can lead to adverse human health effects. As discussed in *EPA's Review of Per- and Polyfluoroalkyl Substances (PFAS) in Industrial Wastewater Discharge* (U.S. EPA, 2019b), the EPA compiled a list of 40 PFAS compounds based on those identified in the EPA's Office of Pollution Prevention and Toxics (OPPT) 2006 Inventory Update Reporting (IUR) public database (now called the Chemical Data Reporting, or CDR, database), as well as those frequently mentioned in peer-reviewed literature.

3.4.2 Methodology and Data Sources for the EPA's Current Review of PFAS

The EPA examined readily-available information about PFAS surface water discharges and impacts to identify industrial sources that may warrant further study. This review incorporates information that has become available since the EPA last reviewed PFAS industrial wastewater discharges in *The 2012 Annual Effluent Guidelines Review Report*. Below are the specific activities that the EPA conducted for this review.

- Conducted a targeted literature search to: identify industries that may be manufacturing or using PFAS; better understand environmental fate, transport, and exposure pathways of PFAS; and identify information on human health impacts associated with environmental releases of PFAS.
- Reviewed 2016 DMR data to identify facilities that reported discharges of PFAS, the type and amount of PFAS discharged, and the point source category associated with the identified facilities. The EPA did not evaluate TRI data for this review because facilities are not currently required to report PFAS discharges to the TRI. The EPA, however, as noted in the *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, is considering whether to add PFAS compounds to the TRI (U.S. EPA, 2019a).[17]
- Identified seven states with 18 facilities, including one drinking water treatment plant and five POTWs, that submitted DMRs in 2016 with discharges of PFAS and contacted permitting authorities in those states. The EPA reviewed permits for all 18 facilities to understand how the states develop permit monitoring requirements for PFAS and to further understand the analytical sampling methods, processes, and treatment technologies at discharging facilities.
- Evaluated non-Confidential Business Information (CBI) 2016 CDR data, collected under Toxic Substance Control Act Authority, to identify industrial sources that domestically manufacture, import, or use PFAS.
- Reviewed the EPA's 2015 PFOA Stewardship Program annual report to determine if the eight companies that participated in the EPA's PFOA Stewardship Program still manufacture PFOA. The EPA found that by 2015, the eight major manufacturers of PFOA in the United States, Europe, and Japan had stopped producing PFOA, precursor chemicals that can break down to PFOA, and related long-chain compounds (U.S. EPA, 2017a).[18]
- Reviewed federal, state, and foreign government databases, reports, and supporting documentation to identify information relevant to PFAS, including limits and guidelines, sources of PFAS, and the impacts of PFAS on human health and aquatic health.

3.4.3 Findings from the EPA's Current Review of PFAS

This section summarizes the findings from the EPA's PFAS review, including the uses and sources of PFAS, industrial wastewater discharge estimates, environmental fate and transport, wastewater treatment, and government actions to address PFAS.

3.4.3.1 Uses and Sources of PFAS

PFAS have been used in many industries because of their chemical and thermal stability, and unique hydrophilic and hydrophobic properties (Rahman et al., 2014). Because of concerns about persistence and health effects, the principal producer of PFOS in the United States stopped production in 2002. By 2015, the eight major manufacturers of PFOA in the United States had stopped producing PFOA through their participation in the PFOA Stewardship Program. However, facilities may continue the use of PFOA and PFOS from existing stockpiles and companies that did not participate in the PFOA Stewardship Program may still domestically manufacture or import PFOA or related long-chain PFAS

[17] For additional information, see EPA's PFAS Action Plan webpage (https://www.epa.gov/pfas/epas-pfas-action-plan).

[18] For additional information, see EPA's PFOA Stewardship Program webpage (https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-3).

(U.S. EPA, 2017a). The EPA identified three final Significant New Use Rules (SNURs) and one proposed SNUR that cover 24 of the 40 PFAS chemicals within the scope of this review and require manufacturers to notify the EPA through submission of a Significant New Use Notice (SNUN) at least 90 days before manufacturing, importing, or processing listed chemicals (see 67 FR 72854, 72 FR 57222, 78 FR 62443, and 80 FR 2885). Since the comprehensive list of PFAS chemicals is evolving and is dependent on how the grouping is defined, the exact number of PFAS chemicals outside the scope of this review covered by SNURs is difficult to identify. The EPA estimates this number to include hundreds of PFAS chemicals. The SNURs list entities that may potentially be subject to the rule. Whether a particular industry is subject to the SNUR depends on the chemical, use, and any exemptions noted. The SNURs covering the 24 PFAS chemicals in this review note that potentially affected entities may include chemical manufacturers, those with operations consistent with the textiles industry (e.g., carpets, rug, fiber, yarn, and thread mills), petroleum refineries, and those with operations consistent with the metal finishing industry (e.g., electroplating, anodizing).

From review of the literature, the EPA identified airports that use aqueous film forming foams (AFFFs), organic chemical manufacturers, paper and paperboard manufacturers, textiles and carpet manufacturers, and semiconductor manufacturers as potential industrial sources of PFAS discharges. Manufacturers are actively developing short-chain PFAS or non-fluorinated chemicals as replacements for use in textiles, surface treatment of food contact materials, metal plating, firefighting foams, and other commercial and consumer products (Wang et al., 2013), but little is known about the specific compounds used. From the CDR data, the EPA identified 12 facilities that domestically manufacture and/or import PFAS above the reporting threshold as part of their operations. Most of these are identified as organic chemical and plastics manufacturing facilities (U.S. EPA, 2017b).

PFAS have been detected in wastewater discharges from facilities such as POTWs and landfills. The high water solubility of some PFAS allows them to pass through most POTW treatment processes. Some POTWs may have higher PFAS effluent levels than influent levels due to the formation of long-chain PFASs from precursor compounds within POTWs (Loganathana et al., 2007).

The EPA does not currently have an approved Clean Water Act analytical method for monitoring PFAS in wastewater discharges. Consequently, state permitting authorities are using the Method 537 drinking water method, or variations thereof, to establish permit limits or monitoring requirements for NPDES permits. As discussed in *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan,* the EPA plans to develop, validate, and publish reliable sampling and laboratory analytical methods to detect, identify, and quantify PFAS in wastewater, as well as in other environmental media (U.S. EPA, 2019a).[19]

3.4.3.2 Industrial Discharges of PFAS

There were limited data on discharges of PFAS into the environment, in part due to the lack of analytical methods to detect these compounds in wastewater. The EPA evaluated available 2016 DMR wastewater discharge data in the Water Pollutant Loading Tool to assess current sources and industrial discharges of PFAS. The EPA used 2016 data because they were the most recent and complete data available at the time of this review. National ELGs currently do not regulate PFAS, therefore, relatively few facilities have NPDES permit limits or monitoring requirements for PFAS. This review did not assess discharges from facilities that send PFAS-containing wastewater to POTWs (rather than discharge to surface water) because such discharges are not captured in the DMR data.

[19] For additional information, see EPA's PFAS Action Plan webpage (https://www.epa.gov/pfas/epas-pfas-action-plan).

The EPA identified only 13 facilities and five POTWs that reported PFAS discharges on DMRs in 2016. Most of the industrial facilities are organic chemical manufacturers, which fall under the Organic Chemicals Polymers and Synthetic Fibers Point Source Category (40 CFR Part 414). Other point source categories reporting discharges of PFAS included petroleum refining (40 CFR Part 419) and landfills (40 CFR Part 445). The facilities reported discharges of 10 different PFAS. Three facilities (Chemours Company LLC, Washington WV; 3M Specialty Film & Media Products, Cordova, IL; and 3M Company, Decatur, AL) account for 94 percent of the PFAS discharges in the DMR data. Seven of the 13 facilities and all five of the POTWs reported discharges of PFOA.

3.4.4 Next Steps for Review of PFAS

The results of the EPA's review of readily-available information about PFAS surface water discharges are as follows.

- PFAS has been detected in nearly all environmental media and the EPA is developing more refined analytical methods to better characterize the levels.
- The two most common long-chain PFAS, PFOS and PFOA, have been mostly phased out of production in the United States. However, some companies are still using existing PFOS and PFOA stocks or are producing or importing other long-chain PFAS. Manufacturers have commonly been developing and commercializing shorter-chain PFAS as replacement chemicals.
- Industrial facilities that produce or otherwise use PFAS and are discharging wastewater to surface waters or to POTWs may be a source of PFAS to the environment. Little is known about the identity, frequency, or amount of PFAS compounds discharged in industrial wastewater.
- The EPA identified several industries that are likely to discharge PFAS: airports, organic chemical manufacturers, paper and paperboard manufacturers, textiles and carpet manufacturers, and semiconductor manufacturers. Some of the presence of PFAS can be attributed to legacy PFOS and PFOA stockpiles. Shorter-chain chemicals are being substituted for PFOS and PFOA, but little is known about the identity of the compounds being used.
- PFAS are known to pass through POTW treatment works, discharging to surface waters in their effluent and accumulating in the biosolids.
- There are no CWA-approved analytical methods for measuring PFAS in industrial wastewater. However, the EPA is working to address this gap.
- Some treatment processes have been effective at treating PFAS in drinking water including reverse osmosis, nanofiltration, ion exchange, and granular activated carbon filtration, but little data are available on their efficacy on industrial wastewater.

As noted in the *EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan*, the EPA plans to conduct a detailed study, in addition to the information reviewed to date, of PFAS use, treatment, and discharge by the following industries: airports, organic chemical manufacturers, paper and paperboard manufacturers, and textiles and carpet manufacturers (U.S. EPA, 2019a).[20]

[20] For additional information, see EPA's PFAS Action Plan webpage (https://www.epa.gov/pfas/epas-pfas-action-plan).

The presence of PFAS in wastewater discharges associated with semiconductor manufacturing will be evaluated as part of the ongoing detailed study of the Electrical and Electronic Component ELG.

3.5 Industrial Wastewater Treatment Technology Information in IWTT

The EPA continued to collect industrial wastewater treatment performance information to populate the Industrial Wastewater Treatment Technology (IWTT) Database and made the information available to the public through the IWTT web application.[21] The EPA identified and screened additional references across a broad range of industries from key technical conferences on wastewater treatment, including the 2016 Water Environment Federation's Technical Exhibit and Conference. The IWTT Database currently contains performance data for 54 different treatment technologies, some of which may be components of a larger treatment system. The IWTT database contains wastewater treatment technology performance data for 35 industrial point source categories and removal performance for 195 pollutant parameters.

3.6 Industrial Wastewater Treatment Technologies Reviews

The EPA is initiating a more comprehensive review of industrial wastewater treatment technologies that can effectively reduce discharges of pollutants to receiving waters. This type of review responds to the September 2012 Government Accountability Office report entitled *WATER POLLUTION: EPA Has Improved Its Review of Effluent Guidelines but Could Benefit from More Information on Treatment Technologies*, which stated that the EPA does not sufficiently consider advanced treatment technologies in its ELG planning process (GAO, 2012). Reviewing technologies in a systematic way will enable the EPA to gather information earlier in its screening process on new industrial treatment technology capabilities to determine whether there are economically viable wastewater treatment technologies that can reduce pollutant loadings further than the technology upon which the current regulatory requirements are based. The EPA intends to use its IWTT Database (see Section 3.5) as the basis for identifying and prioritizing treatment technologies for further review and study.

The industrial wastewater treatment technology reviews will serve the following purposes.

- Help the EPA identify and prioritize industries for further study based on wastewater treatment technology availability, capabilities, and performance.
- Inform industry studies and rulemakings based on advances/changes in wastewater treatment technologies.
- Consolidate wastewater treatment technology background information for future reference and use.
- Collect preliminary information and data on treatment technology costs.

This section discusses the EPA's proposed methodology for technology reviews and the selection of a subset of nutrient removal technologies as the first to be reviewed using this methodology.

The EPA plans to implement a three-phase approach to identify and prioritize for further review technologies that can inform its ELG planning process as described above. The three phases comprise the following steps: (1) technology screening; (2) preliminary technology review; and (3) technology study. The technology screening includes reviewing and evaluating the latest information in IWTT and identifying technologies for further review. From the technology screening, one or more technologies could be selected for a preliminary technology review. Based on that review, the EPA might decide to

[21] See https://www.epa.gov/eg/industrial-wastewater-treatment-technology-database-iwtt.

launch a technology study, which is a more involved information gathering effort. Figure 3-4 depicts this technology screening, review, and study process. The following subsections describe the key questions, data sources, and approach for each of the three phases of technology review. The final subsection discusses an initial technology screening that the EPA is conducting using the methodology on nutrient removal technologies.

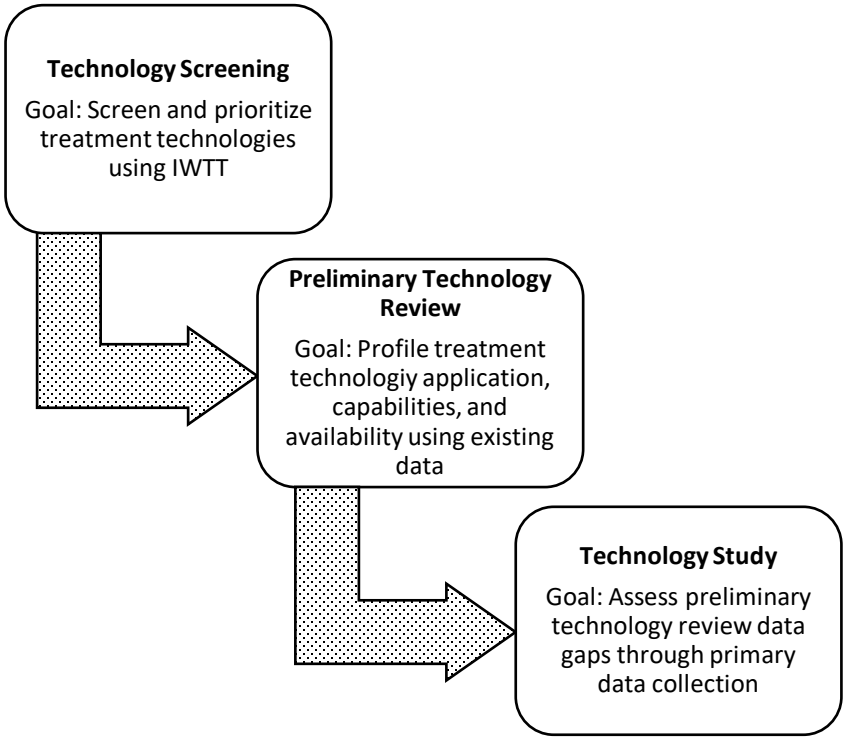

Figure 3-4. Industrial Wastewater Treatment Technology Review Process

3.6.1 Technology Screening

The goal of the technology screening is to screen and prioritize for further review technologies that seem promising for potential application across industries or for controlling specific pollutants (e.g., nutrients) based primarily on information compiled in IWTT (discussed in Section 3.3). The EPA expects to address the following key questions during the technology screening using IWTT.

- How many authors are studying the technology (i.e., how widely used/studied are the technologies by government, academic, or industry researchers)?
- How many and which industries have applied or studied the technology?
- What pollutants are removed by the technology?
- What performance level can be achieved by the technology for specific pollutants?

Based on the information from the IWTT review, the EPA will prioritize technologies for further study. The EPA may also select technologies for further review that were not included in IWTT, based on other ELG planning information, ongoing preliminary and detailed studies, or ongoing regulatory development.

3.6.2 Preliminary Technology Review

For the selected technologies, the EPA will conduct a more in-depth review using readily available data sources. The goals of the preliminary technology review are to (1) profile the capabilities, applications, availability, performance, limitations, and costs (if readily available) of the technologies; (2) compile technology information for future use as part of the EPA studies or rulemakings; and (3) identify for a technology study a specific treatment technology that may be a viable treatment option for one or more industries or wastestreams. During the preliminary technology review, the EPA will attempt to answer the following key questions.

- What is the treatment mechanism for the technology and what is the typical treatment technology system configuration (i.e., what other treatment technologies are typically included in the treatment train)? Included information is on technology background, pollutants targeted, residuals generated, and technology requirements (e.g., electricity).
- What is the application and availability of the treatment technology among identified industries? What was the driver for applying the technology?
- What pollutants are targeted for removal by the technology?
- What is the performance of the treatment technology (percent removal); what treatment effluent concentrations are achieved for specific pollutants of interest?
- How do the performance or effluent concentrations achieved compare to current limits or discharges?
- Does the technology show removals for pollutants that are not currently regulated by the relevant ELGs?
- What cost information is available for the technology?
- Are there any other considerations that would affect widespread or local implementation of the technology?

The EPA will focus on available data and will not collect any primary data for the preliminary technology review. Table 3-7 lists the data sources that the EPA will include in the review and the purpose for each source. The EPA will note any limitations of the data and data gaps that need to be filled for any technologies selected for a technology study.

Table 3-7. Available Data Sources for Preliminary Technology Review

Data Source	Purpose
IWTT	• Develop list of industries to study for the technology. • Develop list of pollutants to study for the technology. • Identify motivations for studying/applying the technology. • Identify treatment configuration requirements. • Obtain treatment performance and technology effluent concentration information. • Obtain cost information (if available). • Identify any implementation considerations (if captured in IWTT). • Identify key words to include in an additional literature search.

Table 3-7. Available Data Sources for Preliminary Technology Review

Data Source	Purpose
Literature Search (peer reviewed articles, government reports, publicly-available industry or vendor information)	• Supplement IWTT information on industries, pollutants, technology performance, and cost, to the extent information is readily available. • Gather publicly-available information to further understand the treatment mechanisms and operation of the technology, design, installation, and operation considerations.
Promulgated ELG and Technical Development Documents	• Provide current limitations for industries of interest for comparison to treatment technology effluent information obtained from IWTT and/or the literature search. • Provide technology basis for current industry regulations.
Water Pollutant Loading Tool	• Provide current discharge information for industries of interest for comparison to treatment technology effluent information obtained from IWTT and/or the literature search.

3.6.3 Technology Study

For a specific technology prioritized by the preliminary technology reviews, the EPA will conduct a detailed technology study focusing on primary data collection. The goals of the technology study are to: (1) fill in data gaps for technologies that were identified during the preliminary technology review; (2) identify if the technology could be a viable treatment option for one or more industries or wastestreams, and (3) collect cost information that could be used to evaluate cost effectiveness of implementing the treatment technology. During the technology study, the EPA will attempt to answer the following key questions.

1. Do the capabilities of the technology exceed Best Available Technology Economically Achievable (BAT) established in the relevant ELGs (e.g., compare performance capability to pollutant long-term averages used to establish BAT limitations)?
2. Could this technology be evaluated as a potential treatment option for an industry not currently covered by national ELGs?
3. Could this technology be used as the basis for any new pretreatment standards?
4. What are the capital and operation and maintenance (O&M) costs of the technology (if available) and how do they compare to the cost of BAT for the relevant industries (if available)?

For the technology study, the EPA will focus on outreach and primary data collection to fill data gaps identified during the preliminary technology review and answer the key questions. Additional existing data may also be collected. Table 3-8 lists the data sources that the EPA will consider in the review and the purpose for each source.

Table 3-8. Data Sources for Technology Study

Data Source	Purpose
Permitting authority contacts, permits and permit applications (if the technology is being studied for a particular industry)	• Understand the range of limits established within an industry (for regulated and unregulated pollutants). • Identify current range and viability of technologies implemented within a specific industry, as they relate to the regulation of specific pollutants. • Identify facilities that have implemented the technology of interest. • Understand capabilities, applications, and considerations for the technology of interest.
Facility/industry trade association contacts	• Understand prevalence of the technology within the industry; if not prevalent, what are the technologies being implemented? • Identify trends or advances in wastewater treatment being studied by the industry. • Identify issues or concerns associated with implementing the technology of interest. • Identify capital and O&M costs for the technology of interest. • Identify specific facilities that have implemented the technology for potential site visits and sampling.
Vendor contacts	• Understand capabilities, applications, considerations, and capital and O&M costs for the technology of interest. • Identify industries or facilities that are implementing or studying the technology. • Identify types of wastestreams the technology is effective in treating.
Facility site visits	• Understand capabilities, configurations, design and O&M considerations, and capital and O&M costs for the technology of interest. • Identify any challenges with technology implementation across and within industries.
Wastewater treatment system characterization sampling	• Understand technology treatment effectiveness for a specific industry/wastestream for regulated and unregulated pollutants of interest.

3.6.4 Technology Screening for Control of Nutrient Discharges

The EPA plans to conduct a technology screening review with a focus on nutrient removal (i.e., ammonia, nitrogen and phosphorous) in industrial wastewaters for the first treatment technology screening. IWTT contains literature from conference proceedings, water-related journals, and industry-specific organizations, which highlight treatment systems, industries implementing the technologies, pollutants removed, percent removal achieved, and specific industry motivations for evaluating and employing new technologies (see Section 3.5 for further details). The EPA will review the data available in IWTT and summarize the articles with treatment technologies for ammonia, nitrogen, and phosphorus removal by the following three criteria.

- Number of treatment systems and their scale (full or pilot).
- Average percent removal.
- Number of industries studied.

These results will also help the EPA to assess the level of development of a technology within an industry (i.e., by number of pilot- and full-scale studies in the database). It is important to note, however, that the number of studies in IWTT is only an indication of how much information the EPA identified through literature reviews conducted to date and included within IWTT. The information in IWTT is not comprehensive, nor does it indicate widespread adoption.

Using the results from the IWTT data review and any comments received on previous effluent guideline plans, the EPA will determine if any wastewater treatment technologies warrant further investigation for the removal of nutrients. The EPA plans to conduct one or two preliminary technology reviews on the technologies selected based on the results of the screening described in this section.

3.7 Economic Screening and Prioritization of Industrial Categories in the Manufacturing, Mining, and Utilities Sectors

The EPA's economic screening analysis is a new tool that is intended to provide an initial screening and prioritization of three industrial sectors: manufacturing, mining, and utilities, as organized under the North American Industry Classification System (NAICS)[22] based on economic factors. These three 2-digit NAICS industrial sectors contain some industries that do not already have ELGs. EPA's use for this tool is to function as a high-level screening to rank potential industries that the EPA may consider for ELG planning efforts. Industries that rank high in the screening are those with the strongest near-term outlook, particularly in relation to other industries' performance. This type of economic screening could provide insight into the relative strength of an industry, its growth potential, and its ability to achieve additional pollution controls. These are all factors for the EPA to consider when prioritizing industries for additional study. This screening looks at relative economic strength across industries and does not assess industry-specific considerations that may be driving economic performance, nor does it assess the economic achievability of technologies to control industrial discharges. The EPA expects to assess both these factors in any additional study of an industry. For a more thorough explanation of the methodology, analyses and findings, see EPA's *Economic Screening of Point-Source Industries for Further Study in the ELG Program* (U.S. EPA, 2019d).

The screening is based on publicly available data that indicate the recent performance and near-term outlook for industries and include metrics that describe core elements of an industry's economic viability, including growth, investment, and financial condition. For the manufacturing sector (NAICS 31-33), the EPA included data elements that capture three key indicators of economic condition.

- Output, quantified in terms of changes in the absolute dollar value of *value added*.
- Investment quantified as changes in the dollar value of *capital expenditures.*
- Financial condition quantified as changes in the industry's *operating margin*.[23]

Due to limited data availability for the mining and utilities sectors (NAICS 21 and 22), the EPA included data elements that capture only two of the three key indicators.

- Output, quantified in terms of changes in absolute dollar value of *domestic industry output*.

[22] NAICS is organized with broader group economic activity, sectors, at the 2-digit level, and becomes more detailed with specific industries, subsectors, at the at the 4-digit and 6-digit levels. The EPA reviewed NAICS data at the 2-digit and 4-digit levels for this screening analysis.

[23] Value added and capital expenditures data come from U.S. Census Bureau's Annual Survey of Manufacturers. Operating margin data come from U.S. Census Bureau's Quarterly Financial Report.

- Investment, quantified as changes in the dollar value of *capital expenditures*.[24]

For each key indicator identified above, the EPA included two metrics for each industry based on (1) deviations from their own-industry performance, and (2) deviations from the average performance of all industries in the manufacturing sector. The purpose of the first metric is to assess the strength of the industry's 2016 performance (the most current complete dataset available publicly when this analysis was developed) relative to recent history. Significant deviations from the industry's previous average annual value can indicate a material change in the industry's economic performance that could also affect the outlook for the industry going forward. The purpose of the second metric is to identify industries that are over- or under-performing relative to their peers, meaning the EPA compared the industry within its sector. To control for differences in the absolute size of industries within a sector, the EPA calculated this metric as the difference between each industry's percentage growth over the most recent three years, and the average percentage growth over the same period within its sector.

For each industry the EPA also included a metric based on Bureau of Labor Statistics' (BLS) 10-year (2016-2026) forecasted average annual percentage growth in output.

To test the Economic Screening Tool, the EPA performed separate screenings for the manufacturing sector, mining sector, and utilities sector, resulting in three sets of industry rankings. For each metric, the EPA calculated each subsector's (4-digit NAICS) result on a percentile basis across all industries in the same subsector. The EPA then assigned the percentile value as a score to each industry and metric. Lastly, the EPA aggregated the scores for each industry and ranked the industries from highest score to lowest score (this results in a total score between 0 and 7 for manufacturing industries and between 0 and 5 for mining and utilities industries).

Table 3-9 presents economic screening scores for the 10 highest-scoring industries in the manufacturing sector, as well as scores for all industries in the mining and utilities sectors. Industries with the highest overall scores are those whose current economic status and near-term economic outlook is strongest according to the screening framework. However, having the highest overall score does not necessarily mean positive economic growth in recent years. Industries may rank at the top despite recent declines in output and capital expenditures. The scores primarily measure performance relative to other industries, to limit the influence of the broader business cycle. During periods of cyclical economic weakness when most or all industries may be performing poorly (e.g., low or negative growth), these metrics can identify the industries that are performing *relatively* better or worse. Industries that are performing relatively better at the low-point in an economic cycle may be poised for a stronger than average rebound when the overall economy recovers. For example, within the mining sector, Metal Ore Mining experienced 2016 output and capital expenditures below its 3-year average. While Metal Ore Mining ranked at the top with a score of 4.00, it has experienced negative economic growth in recent years. The Metal Ore Mining industry has the strongest economic outlook *relative to other industries in the mining sector*. While the industry view below is useful to see overall trends, each subsector also contains several 6-digit industries that could vary in their score.

[24] Domestic industry output data come from Bureau of Labor Statistics' Historical Industry Output, and capital expenditures data come from U.S. Census Bureau's Annual Capital Expenditures Survey.

Table 3-9. Summary of Economic Screening Scores for Manufacturing, Mining, and Utilities Industry Groups

Industry Subsector	Economic Screening Score
Manufacturing – Top 10	
3273 – Cement and concrete product manufacturing	6.07
3272 – Glass and glass product manufacturing	5.98
3115 – Dairy product manufacturing	5.63
3372 – Office furniture (including fixtures) manufacturing	5.62
3111 – Animal food manufacturing	5.51
3261 – Plastics product manufacturing	5.50
3117 – Seafood product preparation and packaging	5.32
3369 – Other transportation equipment manufacturing	5.31
3255 – Paint, coating, and adhesive manufacturing	5.29
3362 – Motor vehicle body and trailer manufacturing	5.17
Mining – All subsectors	
2122 – Metal Ore Mining	4.00
2121 – Coal Mining	3.00
2123 – Nonmetallic Mineral Mining and Quarrying	3.00
2111 – Oil and Gas Extraction	2.00
2131 – Support Activities for Mining	0.75
Utilities – All subsectors	
2211 – Electric Power Generation, Transmission, and Distribution	4.50
2213 – Water, Sewage, and Other Systems	3.00
2212 – Natural Gas Distribution	0.50

3.8 Industrial Discharges to Impaired Waters

The EPA reviewed available information that CWA section 303(d) requires states to submit biennially to the EPA concerning waters that do not meet state water quality standards. The 303(d) database includes information about the location of impaired waterbodies and categories of probable sources and probable causes of their impairment. When this report was written, the available data were not robust enough to be used for ELG planning because few states had relevant data entered into the system.

However, as part of this review, the EPA also considered probable improvements in state data submissions about impaired waterbodies that are anticipated upon implementation of the new 303(d) electronic reporting system known as ATTAINS 2.0. The 303(d) database in the ATTAINS 2.0 framework is expected to yield a more substantial and usable dataset when states identify an industrial or municipal point source as the probable cause of an impairment. This improvement over the previous reporting framework could prove to be useful in future effluent guidelines program planning. The first set of data electronically reported via ATTAINS 2.0 is expected in 2020, at which time the EPA will further evaluate the usefulness of the submitted 303(d) impairment information for identifying point sources of surface water discharges.

3.9 Engineered Nanomaterials

The EPA initiated the study on Engineered Nanomaterials (ENMs) in response to public comments concerning toxicity of ENMs in wastewater. In the Final 2010 ELG Program Plan (76 FR 66286), the EPA requested information from the public on wastewater discharges of nanosilver after the National

Association of Clean Water Agencies (NACWA) submitted a comment requesting that the EPA investigate discharges of nanosilver to POTWs. NACWA was concerned about toxic effects on aquatic organisms and possible impediments to disposal of biosolids containing nanosilver particles. While the resulting public comments did not include data regarding discharges or risks of nanosilver, they did express support for the EPA to investigate nanosilver and other ENMs in industrial discharges.

In the Preliminary 2014 ELG Program Plan, the EPA again requested information and data on discharges associated with the manufacture, formulation, and use of nanomaterials (U.S. EPA, 2014b). The Final 2014 ELG Program Plan summarized the findings and identified the following data gaps: (1) information on potential sources, quantities, and types of ENMs in industrial wastewater discharges, (2) data on fate, transformation, and treatment susceptibility of ENMs in industrial wastewaters, particularly those discharged to POTWs, and (3) lack of analytical methods capable of detecting and quantifying ENMs (U.S. EPA, 2015).

The EPA has not found information to address these data gaps and does not have reason to believe that information to close them is currently available. Therefore, the EPA is proposing to suspend its review of ENMs at this time.

3.10 Pesticide Active Ingredients (PAIs) Without Pesticide Chemicals Manufacturing Effluent Limitations (40 CFR Part 455)

The EPA initiated the study on Pesticide Active Ingredients (PAIs) after conducting a review of Clean Water Act Analytical Methods listed in 40 CFR Part 136. As part of the Final 2012 ELG Program Plan (U.S. EPA, 2014b), the EPA reviewed analytical methods revised in the 2012 Methods Update Rule and identified 30 pesticide active ingredients that had approved analytical methods for wastewater but were not regulated under the Pesticide Chemicals Manufacturing, Formulating, and Packaging ELGs (40 CFR Part 455). Upon further review, the EPA found that five of the 30 are potentially manufactured in the United States (coumaphos, ethoprop, etridiazole, oxamyl, and tokuthion).

The EPA then reviewed the available discharge data (DMR and TRI) for any reported discharges of the five PAIs. No discharges were identified from the available data. The EPA is proposing to suspend its review of PAIs at this time.

4. ONGOING POINT SOURCE CATEGORY STUDIES

This section summarizes the status of the EPA's ongoing ELG industry studies.

4.1 Detailed Study of the Petroleum Refining Category (40 CFR Part 419)

As described in the Preliminary 2014 Effluent Guidelines Program Plan, the EPA initiated the detailed study of petroleum refineries (40 CFR Part 419) due to concerns for increased discharges of metals from petroleum refineries resulting from implementation of wet air-pollution controls, as well as changes in crude feedstock. The Agency also identified a need for further review of dioxin and dioxin-like compound discharges from petroleum refineries to determine whether these pollutants were being discharged at detectible concentrations. The data collection activities conducted as part of this study included: visiting 10 refineries, collecting detailed questionnaire responses for 21 refineries, reviewing 80 NPDES permits, and participating in annual meetings with representatives from the refining industry and petroleum refining trade associations since 2014.

The data gathered during the detailed study is inconclusive and does not demonstrate whether or not the implementation of wet air pollution controls, or the changes in weight of the raw crude processed by the petroleum refining industry, have had an impact on the characteristics of the wastewater generated by the industry. In addition, the EPA determined that dioxin discharges found during the initial review of the petroleum refining industry were primarily from a single refinery that was in upset at the time they reported their effluent data.

The Agency did receive limited information about the potential presence of napthenic acids and alkylated polynuclear aromatic hydrocarbons (alkylated PAHs) in wastewaters from processing heavier crudes, however there is no actual data on discharges of these pollutants to evaluate. As required by statute, the Agency will review the petroleum refining category annually, including any new data related to these pollutants, to determine if revisions to the ELGs may be warranted, and will continue to collaborate with the industry regarding future data assessments and methodologies.

Based on the data gathered during the study, the EPA is concluding the study and not taking further action at this time.

4.2 Detailed Study of E&EC Category (40 CFR Part 469)

As the result of the 2015 Annual Review (U.S. EPA, 2016b), the EPA decided to conduct a detailed study of the Electrical and Electronic Components (E&EC) Point Source Category (40 CFR Part 469). The E&EC ELGs were issued in 1983 and have not been revised. The EPA intends to study if considerable changes and innovations have been implemented that warrant considering revisions of the existing ELGs.

As part of the detailed study of the E&EC industry, the EPA is working to identify the population of facilities subject to the regulation to study further. The EPA is in contact with industry trade groups likely to be associated with regulated facilities to start building a profile of the regulated community. The EPA is also searching permitting databases for facilities that have a discharge permit that contains conditions from the E&EC ELGs. This type of search will only yield partial lists as many facilities discharge their wastewater to a publicly owned treatment works and will not be present in those databases.

The EPA plans to contact some of the facilities on these lists to determine if they are indeed subject to the ELGs, and, if subject, determine if they are candidates for additional site visits to identify and

characterize their current operations, treatment technologies, and treatment performance. When this report was written, the EPA had already conducted two site visits, both of which yielded valuable information regarding manufacturing techniques, chemicals used, and changes to the industry since the rule was issued.

4.3 Study of Oil and Gas Extraction Wastewater Management

In May of 2018 the EPA initiated a study of the management of produced water from the onshore oil and gas extraction industry. During the study the EPA held more than 80 meetings and conference calls with states, tribes and stakeholders and held a public meeting in October 2018 to provide an overview of the input received from these various groups. On May 15, 2019, the EPA released a draft study report for public input. The draft study report describes the outreach activities, what the EPA learned during the study period, and potential next steps. See https://www.epa.gov/eg/study-oil-and-gas-extraction-wastewater-management for more information.

5. ONGOING ELG RULEMAKING

This section summarizes the status of the EPA's ongoing ELG rulemaking efforts.

5.1 Steam Electric Power Generating Point Source Category (40 CFR Part 423)

The EPA is conducting a rulemaking to reconsider the new, more stringent effluent limitations guidelines and standards for flue gas desulfurization wastewater and bottom ash transport water established in 2015 for the Steam Electric Power Generation point source category. The EPA intends to issue a proposed rule in 2019 and after considering public comments and holding a public hearing, promulgate a final rule in 2020.

6. SUMMARY TABLE OF PLANS FOR EXISTING POINT SOURCE CATEGORIES

Table 6-1 summarizes the plans for future activity based on the EPA's review of the effluent guidelines and pretreatment standards of the existing point source categories. The EPA uses the following codes to describe its findings and potential next steps for each industrial category.

A. The EPA recently promulgated or revised effluent guidelines or pretreatment standards for this category.

B. The EPA is undergoing rulemaking for this category.

C. No further action is appropriate for the effluent guidelines and pretreatment standards for this category.

D. The EPA intends to continue the review or study of this category.

E. The EPA intends to initiate a review or study of this category.

Table 6-1. Summary of Plans from the EPA's Review of Existing Industrial Categories

No.	Industry Category (listed alphabetically)	40 CFR Part	Finding(s)
1	Airport Deicing	449	C
2	Aluminum Forming	467	C
3	Asbestos Manufacturing	427	C
4	Battery Manufacturing	461	C
5	Canned and Preserved Fruits and Vegetable Processing	407	C
6	Canned and Preserved Seafood Processing	408	C
7	Carbon Black Manufacturing	458	C
8	Cement Manufacturing	411	C
9	Centralized Waste Treatment	437	D
10	Coal Mining	434	C
11	Coil Coating	465	C
12	Concentrated Animal Feeding Operations (CAFO)	412	C
13	Concentrated Aquatic Animal Production	451	C
14	Construction and Development	450	C
15	Copper Forming	468	C
16	Dairy Products Processing	405	C
17	Dental Offices	441	A
18	Electrical and Electronic Components	469	D
19	Electroplating	413	C
20	Explosives Manufacturing	457	C
21	Ferroalloy Manufacturing	424	C
22	Fertilizer Manufacturing	418	C
23	Glass Manufacturing	426	C
24	Grain Mills	406	C
25	Gum and Wood Chemicals	454	C
26	Hospitals	460	C

Table 6-1. Summary of Plans from the EPA's Review of Existing Industrial Categories

No.	Industry Category (listed alphabetically)	40 CFR Part	Finding(s)
27	Ink Formulating	447	C
28	Inorganic Chemicals	415	C
29	Iron and Steel Manufacturing	420	C
30	Landfills	445	C
31	Leather Tanning and Finishing	425	C
32	Meat and Poultry Products	432	D
33	Metal Finishing	433	C
34	Metal Molding and Casting	464	C
35	Metal Products and Machinery	438	C
36	Mineral Mining and Processing	436	C
37	Nonferrous Metals Forming and Metal Powders	471	C
38	Nonferrous Metals Manufacturing	421	C
39	Oil and Gas Extraction[a]	435	A, D
40	Ore Mining and Dressing	440	C
41	Organic Chemicals, Plastics, and Synthetic Fibers	414	E
42	Paint Formulating	446	C
43	Paving and Roofing Materials (Tars and Asphalt)	443	C
44	Pesticide Chemicals	455	C
45	Petroleum Refining	419	D
46	Pharmaceutical Manufacturing	439	C
47	Phosphate Manufacturing	422	C
48	Photographic	459	C
49	Plastics Molding and Forming	463	C
50	Porcelain Enameling	466	C
51	Pulp, Paper and Paperboard	430	D
52	Rubber Manufacturing	428	C
53	Soap and Detergent Manufacturing	417	C
54	Steam Electric Power Generating	423	A, B
55	Sugar Processing	409	C
56	Textile Mills	410	E
57	Timber Products Processing	429	C
58	Transportation Equipment Cleaning	442	C
59	Waste Combustors	444	C

[a] See Section 4.3 for details concerning Unconventional Oil and Gas Extraction wastewaters.

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