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Preliminary Engineering Report: Steam Electric Detailed Study

U.S. Environmental Protection Agency
Engineering and Analysis Division
Office of Water
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1.0 INTRODUCTION

Every other year, Section 304(m) of the Clean Water Act requires EPA to publish a plan establishing a schedule for the annual review and revision of effluent guidelines required by Section 304(b). Section 304(m) also requires EPA to take public comment on its plan prior to issuing a final plan. EPA published the latest biennial plan, the 2004 effluent guidelines program plan ("2004 Plan"), on September 2, 2004 (69 FR 53705). EPA selected the Steam Electric Point Source Category (40 CFR 423) for detailed investigation because it ranked second in terms of toxic and non-conventional toxic-weighted discharges in the 2005 annual review.

During the development of the 2004 Plan, EPA identified data gaps and issues that may affect the Agency's estimate of the potential hazards caused by discharges from steam electric facilities. To fill these gaps, EPA is currently collecting information on the wastewater characteristics and treatment technologies used at facilities in the steam electric point source category, including electric utilities and nonutilities that use fossil fuels or nuclear fuel to generate electricity for distribution in commerce. As part of the detailed study, EPA will also investigate data on facilities that are not currently regulated under Part 423 but that use a steam cycle to generate electricity. EPA will evaluate whether the point source category should be revised to include these facilities.

This report presents the preliminary results of EPA's evaluation and outlines the additional data collection that will be conducted for the development of the next biennial plan ("2006 Plan"). The report is organized into the following sections:

- Section 2.0 summarizes the existing regulations for this industry;
- Section 3.0 discusses the data sources used in this profile;
- Section 4.0 presents a profile of the industry;
- Section 5.0 discusses wastewater characteristics;

- Section 6.0 discusses the additional information needs and next steps in the detailed review; and
- Section 7.0 presents the references used to date for the detailed study.

2.0 EXISTING EFFLUENT GUIDELINES AND OTHER REGULATIONS

This section presents a brief overview of existing regulations for steam electric facilities and is divided into the following sections:

- Section 2.1 discusses the current effluent guidelines for the steam electric point source category;
- Section 2.2 discusses the Cooling Water Intake Structure regulations;
- Section 2.3 discusses Clean Air Act requirements; and
- Section 2.4 discusses Resource Conservation and Recovery Act requirements (RCRA).

2.1 <u>Steam Electric Effluent Guidelines</u>

The steam electric point source category is currently regulated under 40 CFR 423. EPA first published effluent guidelines for this category in 1974 with subsequent revisions in 1977 and 1982. The timeline below describes the history of the effluent guideline:

October 8, 1974 (39 FR 36186):

EPA promulgated effluent limitations based on:

- — Best practicable control technology currently available (BPT),
- — Best available control technology economically achievable (BAT),
- — New Source performance standards (NSPS), and
- — Pretreatment standards for new sources (PSNS).

The promulgated regulations addressed thermal and chemical pollution. Amendments were issued February 19, 1975 (40 FR 23987) and June 4, 1978 (40 FR 23987). The chemical limitations covered the following wastestreams:

- — Once-through cooling water,
- — Cooling tower blowdown,
- — Bottom ash transport water,
- — Fly ash transport water,
- — Boiler blowdown,
- — Low volume wastes,
- — Metal cleaning wastes, and

— Material storage and construction runoff (including coal pile runoff).

July 16, 1976:

The U.S. Court of Appeals in the Fourth Circuit remanded (1) thermal limitations;[1] (2) NSPS for fly ash transport water; (3) rainfall run off limitations; and (4) BPT variance clause.

March 23, 1977 (42 FR 15695):

EPA promulgated pretreatment standards for existing sources (PSES). PSES covered copper in metal cleaning wastes, polychlorinated biphenyls (PCBs), and oil and grease.

November 19, 1982 (47 FR 52290):

EPA revised existing BAT, NSPS, PSES, and PSNS effluent limitations guidelines and standards for the steam electric point source category, codified at 40 CFR 423. The regulations modified the existing subcategorization scheme and reserved effluent limitations for four types of wastestreams for future rulemaking:

— Non-chemical metal cleaning,
— Flue gas desulfurization waters,
— Thermal discharges, and
— Run off from materials storage and construction areas (other than coal storage).

The 1982 guidelines are summarized in Table 2-1 and are applicable to:

> discharges resulting from the operation of a generating unit by an establishment primarily engaged in the generation of electricity for distribution and sale which results primarily from a process utilizing fossil-type fuel (coal, oil, or gas) or nuclear fuel in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium.

[1]Thermal dischargers may still apply for a variance from stated water quality standards under section 316(a) of the Clean Water Act.

Table 2-1. Pollutants Regulated by Existing Effluent Limitations Guidelines and Standards

Wastestream	BPT	BAT	NSPS	PSES & PSNS
All Wastestreams	pH 6-9 PCBs: Zero discharge	PCBs: Zero discharge	pH 6-9 PCBs: Zero discharge	PCBs: Zero discharge
Low Volume Wastes	TSS 100/30 Oil and Grease 20/15	No Limitation	= BPT	No Limitation
Fly Ash Handling	TSS 100/30 Oil and Grease 20/15	No Limitation	Zero Discharge	Zero Discharge (PSNS only) No limitation in PSES
Bottom Ash Handling	TSS 100/30 Oil and Grease 20/15	No Limitation	TSS 100/30 Oil and Grease 20/15	No Limitation
Chemical Metal Cleaning	TSS 100/30 Oil and Grease 20/15 Cu 1.0/1.0 Fe 1.0/1.0	Cu 1.0/1.0 Fe 1.0/1.0	TSS 100/30 Oil and Grease 20/15 Cu 1.0/1.0 Fe 1.0/1.0	Cu 1.0 max
Once Through Cooling	FAC 0.5/0.2	TRC 0.20 max or = BPT if <25 MW	TRC 0.20 max or = BPT if <25 MW	No Limitation
Cooling Tower Blowdown	FAC 0.5/0.2	FAC 0.5/0.2 126 Pr. Pol. No. Detect Cr 0.2/0.2 ZN 1.0/1.0	FAC 0.5/0.2 126 Pr. Pol. No. Detect Cr 0.2/0.2 ZN 1.0/1.0	126 Pr. Pol. No Detect Cr 0.2 max Zn 1.0 max
Coal Pile Runoff	TSS 50 max	No Limitation	TSS 50 max	No Limitation

Source: Code of Federal Regulations <http://www.epa.gov/epahome/cfr40.htm>.
Notes:
- Concentrations are in mg/l. If daily maximum and 30-day average concentrations apply, they are given as "maximum/average".
- Total Residual Chlorine (TRC) = Free Available Chlorine (FAC) + Combined Residual Chlorine (CRC).
- BCT is reserved for all wastestreams.
- Low Volume Wastes include: clarifier blowdown, makeup water filter backwash, lime softener blowdown, ion exchange softener regeneration, demineralizer regeneration, powdered resin demineralizer back flush, reverse osmosis brine, boiler blowdown, evaporator blowdown, laboratory drains, sanitary wastes, and diesel engine cooling system discharge.

Region IV issued a policy guidance letter on December 19, 1989 stating that the steam electric unit of a facility employing combined-cycle technology is subject to the applicability of the steam electric effluent guidelines in 40 CFR 423. Region IV made the determination during a review of proposed new facilities at a Florida Power & Light plant. Because the steam electric portion of a facility employing combined-cycle technology uses fossil-type fuel in conjunction with a thermal cycle, Region IV declared that Part 423 applies to the steam electric portion of these facilities. The Region IV letter also states that no operational, technological, economic, or cost factors distinguish the steam electric portion of a combined cycle plant from a stand-alone steam electric unit. EPA has been following this guidance. (1)

The current applicability of Part 423 does not include facilities that may be using a renewable fuel source, such as biomass or wood wastes, to generate steam to produce electricity, nor does it cover facilities whose primary activity is not the distribution and sale of electricity. According to information provided in the 1996 *Preliminary Data Summary for the Steam Electric Point Source Category*, permits for the effluent wastestreams of an electric power generating unit which exists as an ancillary unit of a plant not subject to Part 423 are normally written by best professional judgement (BPJ) using Part 423 regulations for similar wastestreams (U.S. EPA, 1996). EPA does not have information regarding the application of Part 423 limits to facilities using renewable fuel sources.

2.2 Cooling Water Intake Structures

Section 316(b) of the Clean Water Act requires EPA to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impacts. Such impacts include death or injury to aquatic organisms by impingement (being pinned against screens or other parts of a cooling water intake structure) or entrainment (being drawn into cooling water systems and subjected to thermal, physical, or chemical stresses). In response to section 316(b), EPA developed the regulation in three phases:

- Phase I, promulgated on December 18, 2001 (66 FR 65256), covers new facilities that use cooling water intake structures to withdraw water from waters of the U.S.

and that have or require a National Pollutant Discharge Elimination System (NPDES) permit. New facilities subject to the Phase I regulations include those that have a design intake flow of greater than two million gallons per day and that use at least 25% of the water withdrawn for cooling purposes;

- Phase II, promulgated on July 9, 2004 (69 FR 41576), covers large existing electric generating plants that use at least 50 million gallons of water a day from waters of the U.S., including existing utilities and nonindustrial nonutilities; and

- Phase III, proposed on November 24, 2004 (69 FR 68444), would cover certain existing facilities not covered under Phase II that withdraw cooling water above a certain threshold, and new offshore and coastal oil and gas extraction facilities.

Phase II establishes performance standards and other requirements for cooling water intake structures at large utility and nonutility power plants. Phase III proposes similar requirements that would be applicable to power generating facilities co-located with manufacturing facilities (industrial nonutilities). The Phase II regulation applies to facilities that:

- Meet the definition of an existing steam electric power generating facility;

- Use a cooling water intake structure or structures, or obtain cooling water by a contract or arrangement with an independent supplier who has a cooling water intake structure;

- Withdraw cooling water from waters of the U.S. and use at least 25% for contact or non-contact cooling purposes;

- Have a National Pollutant Discharge Elimination System (NPDES) permit or are required to obtain one; and

- Have a design intake flow of 50 MGD or greater.

The section 316(b) rulemaking focuses on reducing impingement, mortality, and entrainment. According to the Phase II rule, facilities must choose one of five alternatives for establishing the best technology available (BTA) to minimize adverse environmental impact. The impacts of the section 316(b) regulations on wastewater characteristics from steam electric facilities are not yet known. (U.S. EPA, section 316(b) Web site)

2.3 Air Regulations

Electric utility boilers that fire fossil fuels are subject to numerous regulations under the Clean Air Act. These regulations include the Clean Air Interstate Rule (CAIR), Clean Air Visibility Rule (CAVR), Clean Air Mercury Rule (CAMR), Acid Rain Program, New Source Performance Standards (NSPS), and National Emissions Standards for Hazardous Air Pollutants (NESHAP). The only regulations with the potential to create new wastewater streams at electric utilities are those with SO_2 emission limits. Over time, new and revised SO_2 regulations are leading to the greater use of flue gas desulfurization systems (FGD). Wet FGD systems create a sludge byproduct that must be de-watered for disposal. Each regulation is summarized briefly below.

- CAIR. Published in 2005, CAIR will regulate SO_2 and NOx emissions to help states achieve the national ambient air quality standards (NAAQS) for ozone and fine particulate matter. The rule permanently caps emissions (tons per year) across 28 eastern states and the District of Columbia. The cap for SO_2 will take effect in 2010 with a lower cap in 2015. States must meet the caps by establishing emission limits or participating in a regional cap and trade program.

- CAVR. On June 15, 2005, EPA finalized amendments to the July 1999 regional haze rule. These amendments apply to the provisions of the regional haze rule that require emission controls known as best available retrofit technology, or BART, for industrial facilities emitting air pollutants that reduce visibility by causing or contributing to regional haze. The pollutants that reduce visibility include fine particulate matter, and compounds which contribute to its formation, including SO_2 and others. The amendments include final guidelines, known as BART guidelines, for states to use in determining which facilities must install controls and the type of controls the facilities must use. States which adopt the CAIR cap and trade program for SO_2 and NOx are allowed to apply CAIR controls as a substitute for controls required under BART because the analysis concluded that CAIR controls are "better than BART" for electric generating units in the states subject to CAIR.

- CAMR. Published in 2005, this rule established a national cap and trade program for mercury emissions from power plants. Plants will be able to meet the first phase cap in 2010 using the SO_2 and NOx controls required to comply with CAIR. The second phase cap in 2018 is expected to require the use of mercury-specific control technologies.

- Acid Rain. The acid rain program established a national cap and trade program for SO_2 emissions from fossil fuel-fired power plants. Phase I began in 1995 and affected 445, mostly coal-fired electric utility plants located in 21 eastern and midwestern states. Phase II, which began in the year 2000, lowered the emission caps on the Phase I plants and also capped emissions on all units nation-wide that serve generating units > 25 MW fired by coal, oil, or gas. The program also established emission limits for NOx.

- NSPS. The NSPS limit SO_2, particulate matter, NOx, and mercury from new, modified, or reconstructed electric utility boilers. EPA proposed amendments to the NSPS in February. The proposed SO_2 standard sets a single limit that all fuels must achieve regardless of the fuel sulfur content. The SO_2 standard for units burning high sulfur coals requires approximately a 95% reduction of emissions, which requires FGD. Units burning low sulfur coals can achieve the standard with approximately 80% reduction, which can be achieved with a spray dryer. Spray dryers do not generate a wastewater stream. The NOx emission limits require the use of selective catalytic reduction or selective non-catalytic reduction. The mercury NSPS emission limits can be met using the same technologies used to meet SO_2 and NOx NSPS emission limits. The particulate matter NSPS can be met using an electrostatic precipitator or bag house.

- NESHAP. The NESHAP regulates hazardous air pollutant emissions from stationary gas turbines and reciprocating internal combustion engines. The controls to meet these standards will not create wastewater streams.

2.4 Resource Conservation and Recovery Act (RCRA)

In 1993, EPA issued a regulatory determination addressing large volume wastes (fly ash, bottom ash, boiler ash, boiler slag, and flue gas emission control wastes) generated by coal-fired utility power plants, including independent power producers. This determination stated that these wastes should not be regulated as Subtitle C wastes. Therefore, no Federal regulations exist for solid wastes from steam electric facilities; instead, they are managed by state solid waste programs or specific programs for fossil fuel combustion wastes (U.S. EPA, 1997).

3.0 DATA SOURCES

This section describes the data sources EPA used, to date, for its detailed study of the Steam Electric Point Source Category. EPA used calendar year 2002 data from three primary data sources: the Department of Energy's Energy Information Administration (EIA), the Permit Compliance System (PCS), and the Toxic Release Inventory (TRI).[1] EPA also reviewed data from other regulations impacting steam electric sources, and data provided by trade associations.

The remainder of this section presents information on the following sources as they pertain to the steam electric industry detailed study:

- Section 3.1 discusses EIA data;
- Section 3.2 discusses PCS data;
- Section 3.3 discusses TRI data;
- Section 3.4 discusses data obtained from the 2002 Economic Census;
- Section 3.5 discusses data obtained from records supporting EPA's section 316(b) Cooling Water Intake Structure Guidelines;
- Section 3.6 discusses data provided by the Utilities Water Act Group (UWAG);
- Section 3.7 discusses information obtained from the 1996 Preliminary Data Summary for the Steam Electric Point Source Category; and
- Section 3.8 discusses information obtained from EPA's Office of Enforcement and Compliance Assurance (OECA) *Profile of the Fossil Fuel Electric Power Generation Industry* (Sector Notebook).

[1]Note that the most recent TRI data available when EPA began this study was for calendar year 2002.

3.1 Energy Information Administration

The EIA is a statistical agency of the Department of Energy that collects information on existing electrical generating plants and associated equipment to evaluate the current status and potential trends in the electric power industry. EPA used information from two of EIA's data collection forms:

- Form EIA-860, Annual Electric Generator Report (discussed in Section 3.1.1); and
- Form EIA-767, Steam Electric Plant Operation and Design Report (discussed in Section 3.1.2).

3.1.1 Form EIA-860

Form EIA-860 collects data for all electric generating plants that have or will have a nameplate rating of one megawatt or more, and are operating or plan to be operating within five years of the filing of the report. The data collected in Form EIA-860 are associated only with the design and operation of the generators at facilities. EPA used the following information from Form EIA-860 to characterize the steam electric industry:

- Company Name;
- Facility Name;
- Plant ID (Assigned by EIA);
- North American Industry Classification System (NAICS) code;
- Generator ID;
- Nameplate Capacity - The maximum rated output of a generator;
- Prime Mover - The engine, turbine, water wheel, or similar machine that drives an electric generator;
- Energy Source - The primary source providing the power that is converted to electricity through chemical, mechanical, or other means;

- Month and year of initial operation; and
- Type - A code identifying whether the parent company is a regulated or unregulated company.

3.1.2 Form EIA-767

Form EIA-767 collects information annually from all U.S. plants with a total existing or planned organic-fueled or combustible renewable steam-electric unit that has a generator nameplate rating of ten megawatts or larger. The data collected in Form EIA-767 is associated with the operation and design of the entire facility. EPA used Form EIA-767 primarily for information on the type of cooling system including the following data fields:

- Type of system;
- Type of towers;
- Flow rates; and
- Source water.

One of the limitations of using data from Form EIA-767 is that the cooling system information is required to be completed only by facilities that have a nameplate capacity larger than 100 megawatts. Therefore, some of the facilities that report to EIA-767 do not report any information about cooling systems.

EPA will review any additional or updated data from Form EIA-767 during the development of the final 2006 ELG Plan.

3.2 Permit Compliance System

OECA maintains PCS which is a computerized management information system, containing information from Discharge Monitoring Reports (DMR) that facilities provide to their permitting authority (e.g., states, regions) in accordance with their permit requirements. The information stored in PCS consists of the concentration and/or quantity of the parameter discharged, as well as the flows associated with the various discharge pipes. Using this information, EPA estimated the annual pounds released for each of the reported parameters. PCS provides information only for wastewaters discharged directly to receiving streams. The PCS database contains information for both major and minor sources. EPA only used information from the major sources because permitting authorities are not required to provide DMR data to PCS for minor sources. Consequently, data available for minor sources are limited. To compute a Toxic-Weighted Pound Equivalent (TWPE) for each parameter reported, the estimated mass (in pounds) of the chemical discharged is multiplied by its toxic weighting factor (TWF). Additional information on the calculation of TWPE and the PCS loading calculations can be found in the *2005 Screening-Level Analysis Report*.

Chlorine, used by steam electric facilities to control the growth of microorganisms in cooling water systems (i.e., condenser tubes, cooling towers, etc), is reported to PCS as either free available chlorine or total residual chlorine (TRC). Per 40 CFR 423, neither free available chlorine nor TRC may be discharged from once-through cooling or cooling tower blowdown for more than two hours in any one day. However, PCS may report pollutant concentrations as either a daily maximum or average or as a 2-hour maximum or average. In computing chlorine releases for the detailed study, EPA assumed chlorine is discharged only 2 hours per day, and calculated loads using this discharge period rather than the standard 24 hours per day. UWAG stated that the amount of time a facility discharges chlorine varies from plant to plant and could only be determined through an industry survey (see DCN 01738 in section 13.2 of the record).

EPA determined that eight facilities discharged 93% of the TWPE for the steam electric industry. EPA contacted these facilities to verify their discharges and revised the PCS data to include the newly collected information. Table 3-2 shows the facilities contacted and the explanation of their discharges. Based on these explanations, EPA determined it was appropriate to revise the 2002 PCS data for these facilities. After making the revisions, the TWPE for steam electric facilities decreased from 22.7 million to 1.6 million. EPA used the revised loadings for all analyses discussed in this report. For additional information, see the *2005 Screening-Level Analysis Report*.

Table 3-2. Steam Electric Facilities Contacted to Verify PCS 2002 Data.

Facility	NPID	Pollutant	2002 Estimated Load (lbs/yr)	2002 Revised Load (lbs/yr)	Explanation for Re-estimated Discharge Loads[1]
AL Power Co. (EC Gaston Plant) Wilsonville, AL	AL0003140	Arsenic	2,016,604	2,016	PCS incorrectly reported the units as mg/L rather than µg/L.
Gulf Power Co. Pensacola, FL	FL0002275	Iron	1,010,409,425	1,010,409	PCS incorrectly reported the units as mg/L rather than µg/L.
Duke Energy South Bay Chula Vista, CA	CA0001368	Chlorine	4,578,499	4,578	PCS incorrectly reported the units as mg/L rather than µg/L.
FPL Energy Wyman Station Yarmouth, ME	ME0000272	Mercury	18,028	0.018	PCS incorrectly reported the units as mg/L rather than ng/L.
Progress Energy Asheville Arden, NC	NC0000396	Copper	1,552,866	1,553	PCS incorrectly reported the units as mg/L rather than µg/L.
Duke Energy Marshall Terrell, NC	NC0004987	Arsenic	16,880	244	Two of the four concentrations were reported correctly as mg/L, while the other two were incorrectly reported as mg/L rather than µg/L.
Duke Energy Marshall Terrell, NC	NC0004987	Selenium	84,526	115	One of the four concentrations were reported correctly as mg/L, while the other three were incorrectly reported as mg/L rather than µg/L.
Gulf Power Co (Scholz Plant) Chattahoochee, FL	FL0002283	Iron	109,028,494	109,028	PCS incorrectly reported the units as mg/L rather than µg/L.
Duke Energy (Allen) Belmont, NC	NC0004979	Cadmium	19,498	43	One of the two concentrations was reported correctly as mg/L, while the other one was incorrectly reported as mg/L rather than µg/L.
Duke Energy (Allen) Belmont, NC	NC0004979	Zinc	557,712	1,208	One of the two concentrations was reported correctly as mg/L, while the other one was incorrectly reported as mg/L rather than µg/L.
Duke Energy (Allen) Belmont, NC	NC0004979	Barium	8,925,808	16,607	One of the two concentrations was reported correctly as mg/L, while the other one was incorrectly reported as mg/L rather than µg/L.

[1] Discharge loads were re-estimated for use in this detailed study.

3.3 Toxic Release Inventory (TRI)

Steam electric facilities are required to complete a TRI Form R or A if the facility meets the following criteria:

- Facility Identification: The facility is in SIC code 4911, 4931, or 4939 and it combusts coal and/or oil for the purpose of generating electric power.
- Number of Employees: Facilities must have 10 or more full-time employees or their equivalent. EPA defines a "full-time equivalent" as a person who works 2,000 hours in the reporting year.
- Activity Thresholds: Facilities must conduct an activity threshold analysis for every chemical and chemical category on the current TRI list to determine whether it manufactures, processes, or otherwise uses each chemical at or above the appropriate activity threshold.

Facilities provide an estimate of toxic chemical[2] releases in pounds per year. Note that TRI does not collect data for natural gas or nuclear powered steam electric facilities. However, if the facility combusts any coal or oil for the purpose of distributing electricity in commerce, the entire facility (including the non-coal/oil combustion operations) is subject to TRI reporting requirements. TRI considers kerosene and petroleum coke as "oil" for reporting purposes. EPA used the reported releases to compute a TWPE for each chemical reported for reporting year 2002. (U.S. EPA, 2000)

Unlike PCS, chlorine is reported to TRI as chlorine (Cl_2), not as TRC. The *EPCRA Section 313 Industry Guidance for Electricity Generating Facilities* states that no releases to water of chlorine are typically expected. At a pH above four, chlorine reacts almost completely with water to form HOCl, Cl^-, and H^+; therefore, no releases of Cl_2 are expected during normal discharge situations. However, 13 steam electric facilities reported releases of chlorine in TRI. EPA provided information on the 13 facilities to an industry trade group, UWAG. UWAG believes the facilities reported incorrectly and will be submitting Form R corrections to TRI (See DCN 01738 in section 13.2 of the record).

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[2]Over 600 specific chemicals and chemical categories are associated with TRI reporting.

3.4 Economic Census

The Economic Census provides a detailed portrait of the U.S. economy once every five years. The 2002 Economic Census covers nearly all of the U.S. economy in its basic collection of establishment statistics, and provides the following information by NAICS code:

- Number of companies;
- Number of establishments;
- Number of establishments by size range, based on number of employees; and
- Number of employees.

The Economic Census provides an upper limit of the number of facilities performing operations that fall under the steam electric category, as the census may overstate the number by including nonproduction facilities, such as distribution locations. Also, some of the facilities included in the census may not use a steam turbine. For these reasons, EPA used the census data only as a point of reference in this detailed study.

3.5 Section 316(b) Cooling Water Intake Structures

For the section 316(b) Cooling Water Intake Structures Rulemaking, EPA conducted a survey of steam electric utilities, steam electric nonutilities, and other manufacturing facilities that use cooling water in the following four major manufacturing sectors: Paper and Allied Products (SIC 26), Chemical and Allied Products (SIC 28), Petroleum and Coal Products (SIC 29), and Primary Metals (SIC 33). The survey requested the following type of information:

- General plant information, such as plant name, location, and SIC codes;
- Cooling water source and uses;
- Design and operational data on cooling water intake structures and cooling water systems;

- Studies of potential impacts from cooling water intake structures that the facility had performed; and

- Financial and economic information about the facility.

Although the section 316(b) survey was used to create guidelines for cooling water intake structures, the cooling water system information collected is useful for this review of the steam electric industry. EPA used the information provided by the section 316(b) survey in the following analyses:

- Linking EIA facility information to the TRI and PCS discharges;
- Identifying the type of cooling systems used by facilities; and
- Identifying industrial nonutilities.

EPA will continue to evaluate section 316(b) information as it completes the detailed study.

3.6 <u>Utility Water Act Group</u>

UWAG is a trade association that represents the utility electricity producers. On February 22, 2005, EPA staff met with representatives of UWAG to discuss the detailed study and certain data inconsistencies and gaps. UWAG indicated that they would try to provide EPA additional information on the steam electric industry such as the following aggregated data:

- Information regarding reported chlorine and boron releases;
- Information on wastewater characteristics; and
- Information regarding current technologies used by the industry.

Information provided by UWAG to EPA as of June 27, 2005 has been included in this report, where appropriate. For more information regarding specific information that has been provided to EPA, see Docket ID No. OW-2004-0032.

3.7 1996 Preliminary Data Summary for the Steam Electric Point Source Category (PDS)

The 1996 Preliminary Data Summary (PDS) was conducted to provide technical support for possible revision of the 1982 steam electric effluent limitations guidelines and standards. The 1996 PDS contained information about the process descriptions and the pollutants released in each of the different types of waste streams. EPA used the 1996 PDS as a guide for the type of information that would be useful to collect for the industry profile and wastewater characteristic sections of the detailed study report. Because the 1996 PDS noted changes that were starting to occur in the industry, it can be used as a point of comparison to the results of this detailed study.

3.8 OECA Sector Notebook

The OECA Sector Notebook, *Profile of the Fossil Fuel Electric Power Generation Industry*, contains the following information:

- Industry profile using 1995 data;
- Industrial process descriptions;
- Chemical releases and transfers;
- Pollution prevention opportunities; and
- Regulatory summary.

EPA supplemented data from EIA, PCS, and TRI with background information from the Sector Notebook (U.S. EPA, 1997).

4.0 INDUSTRY PROFILE

This section describes the steam electric industry in greater detail and is divided into the following sections:

- Section 4.1 discusses the different types of steam electric facilities;
- Section 4.2 presents an overview of the steam cycle for electricity generation and discusses the waste streams generated; and
- Section 4.3 discusses the demographics of the industry using data from EIA.

4.1 Facility Types

Electric power plants may use various prime movers to generate electricity. DOE's EIA defines prime mover as the engine, turbine, water wheel, or similar machine that drives an electric generator; or, a device that converts energy to electricity directly (e.g., photovoltaic solar and fuel cell(s)) (U.S. DOE EIA Web site). The primary types of prime movers are steam turbines, gas turbines, internal combustion engines, combined-cycle turbines, hydraulic turbines, and others.

Steam electric facilities use a steam/water system as the thermodynamic medium to drive a turbine. An energy source is required to produce heat for the boiler which generates the steam. The current applicability of Part 423 covers facilities that use fossil-type fuel (coal, oil, or gas) or nuclear fuel to produce the steam. However, other fuel sources such as municipal solid wastes or wood wastes (biomass) may also be used to produce the steam. For this preliminary report, EPA focused on facilities that meet the definition of steam electric under Part 423. A brief discussion of steam facilities using alternate fuel sources is included in Section 4.3.5. EPA will investigate these facilities further during the development of the 2006 Effluent Guidelines Program Plan.

Some electricity generators use combined-cycle units to produce electricity. These units use steam turbine technology to increase the efficiency of the primary gas turbine. Hot gases from the turbines are transported to a waste heat recovery boiler to generate steam for a second turbine.

For the purposes of this detailed study, EPA divided the steam electric industry into the three facility types:

1. Utility: A corporation, person, agency, authority, or other legal entity or instrumentality that owns and/or operates facilities for the generation, transmission, distribution, or sale of electric energy for use primarily by the public. Utilities provide electricity within a designated franchised service area and file forms listed in 18 CFR Part 141. Per EIA, facilities that qualify as cogenerators or small power producers under the Public Utility Regulatory Policies Act are not considered electric utilities.

2. Nonindustrial nonutility: A corporation, person, agency, authority, or other legal entity or instrumentality that owns electric generating capacity and is not an electric utility. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other nonutility generators (including independent power producers) without a designated franchised service area, and which do not file forms listed in 18 CFR Part 141.

3. Industrial nonutility: Industrial nonutilities are similar to nonindustrial nonutilities except their primary purpose is not the distribution and sale of electricity. This category includes electric generators that are co-located with other manufacturing activities such as chemical manufacturing or pulp making.

In general, utilities and nonindustrial nonutilities are categorized by three SIC codes:

- 4911: Electric Services - Establishments engaged in the generation, transmission, and/or distribution of energy for sale.

- 4931: Electric and other services combined - Establishments primarily engaged in providing electric services in combination with other services when the electric services are the major part of the services, but are less than 95% of the total services.

- 4939: Combination utilities, not elsewhere classified - Establishments primarily engaged in providing combinations of electric, gas, and other services, not elsewhere classified.

NAICS codes have replaced SIC codes. The U.S. Census Bureau provides tables showing the correspondence between NAICS and SIC codes. SIC codes 4911, 4931, and 4939 all fall under NAICS code 22, Utilities. The NAICS definition of utilities includes establishments providing the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the utility services provided vary by establishment. Services that electric power establishments may provide include generation, transmission, and distribution. NAICS code 22 is further subdivided into the following codes that apply to steam electric facilities:

- 221112 - Fossil Fuel Electric Power Generation;
- 221113 - Nuclear Electric Power Generation; and
- 221119 - Other Electric Power Generation.

Utilities and nonindustrial nonutilities typically report to EIA under NAICS code 22. The 2002 Economic Census data uses the more detailed six-digit NAICS code.

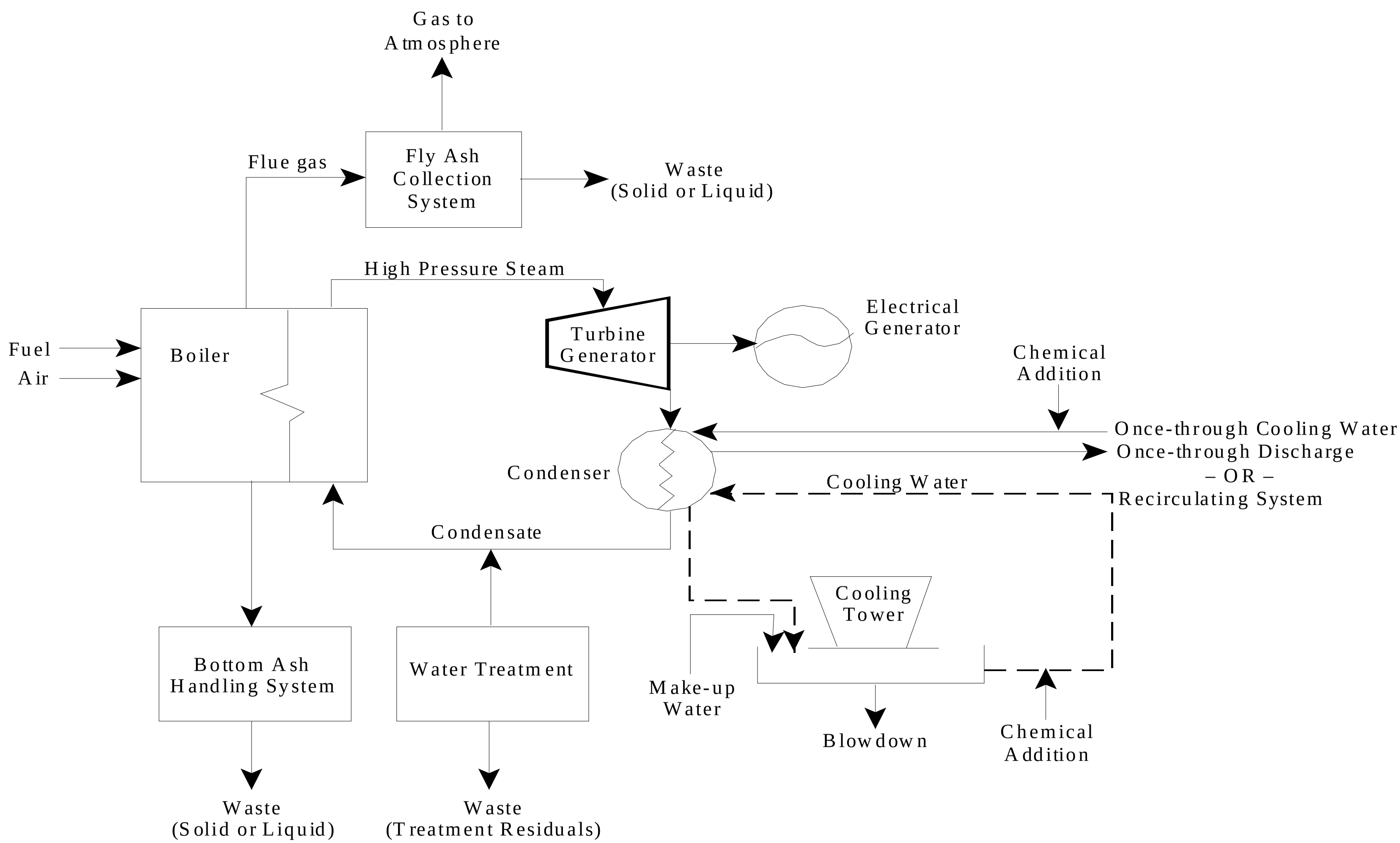
Industrial nonutilities are not categorized in the above SIC and NAICS codes since their primary purpose is not the distribution and sale of electricity. EPA used the reported SIC and NAICS codes to identify industrial nonutilities. Section 4.3 discusses the identification of steam electric facilities in greater detail.

4.2 Process Description and Wastewater Sources

Steam electric facilities consist of a steam generator (boiler), a steam turbine, and a condenser. The following description of the steam process reflects facilities using fossil fuel. Fossil fuels are conveyed into a boiler where they are combusted to generate steam. Boilers may have superheaters, reheaters, economizers, and air heaters to improve efficiency. The high temperature, high pressure steam leaves the boiler and enters the turbine generator. As it moves from the high pressure boiler to the low pressure condenser the steam drives the turbine blades. During the process, the steam expands, and the now low pressure steam enters the condenser, where it is condensed by the cooling water flowing through condenser tubes. The condensate travels back to the boiler where it is reheated for use in the turbine. Figure 4-1 shows a diagram of the steam electric cycle. Table 4-1 lists the wastewater streams produced by the steam electric cycle.

A constant flow of cooling water is required to keep the condenser shell at the proper pressure. The cooling water is warmed during the condensation process. Facilities use either a once-through or recirculating cooling water system. In once-through cooling water systems, the cooling water is withdrawn from the source water, flows through the condenser, and is discharged back to the source water. In a recirculating system, the warmed cooling water is cooled in cooling towers or cooling ponds and then recirculated to the condenser. Recirculating systems require only about 5% of the water that once-through systems use. In recirculating systems, a small amount of water must be discharged periodically to control the build-up of solids; then make-up water is added to the system.

In both once-through and recirculating systems, chemicals may be added to prevent scaling and biofouling. Chlorination is the most widely used method of biofouling control, although some facilities use bromine. EPA does not have information on the types and amounts of chemicals used at steam electric facilities. According to information from UWAG, if facilities report discharges of total residual oxidants, rather than total residual chlorine, the facility is likely using bromine. Facilities using bromine must still use some chlorine to activate the bromine. UWAG also stated that the steam electric industry is trying to optimize the amount of chemicals added and the timing of the addition to reduce costs (see DCN 01738 in section 13.2 of the record).



Source: U.S. EPA 1996 and 1997

Figure 4-1. Steam Electric Process Flow Diagram

Two types of ash are produced during the combustion of fossil fuels, bottom ash and fly ash. Bottom ash collects at the bottom of the boiler. Fly ash, which is finer than bottom ash, is transferred by the flue gas to the end of the boiler where it is collected in the economizer, air heater, or particulate control equipment. Fly ash and bottom ash may be managed separately or together in landfills or in wet surface impoundments. While natural gas plants generally do not require ash handling facilities, coal-fired facilities generate the largest quantities of ash and usually require ash handling facilities. The ash content will depend on the type of coal burned, how it was prepared before burning, and the operating conditions of the boiler. According to the OECA Sector Notebook (U.S. EPA, 1997), more than 95% of the ash consists of silicon, aluminum, iron, calcium, magnesium, potassium, sodium, and titanium. Trace constituents include antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, strontium, zinc, and other metals.

Another source of wastewater from steam electric facilities is coal pile runoff. Rainwater can dissolve inorganic salts in coal and carry the pollutants into the runoff. Other sources of wastewater include water treatment discharges, boiler blowdown, maintenance cleaning, and wet air pollution control devices (flue gas desulfurization) (U.S. EPA, 1997).

Table 4-1. Wastewater Streams from Steam Electric Facilities

Process	Wastewater
Cooling Water	Chlorine, iron, copper, nickel, chlorinated organic compounds, temperature, suspended solids
Ash Handling	*Generally:* SiO_2, Al_2O_3, Fe_3O_3, CaO, MgO, TiO_2, SO_3, P_2O_3, and carbon residuals *Possibly:* TDS, TSS, sulfate, calcium, chloride, magnesium, nitrate, antimony, arsenic, cadmium, chromium, copper, cyanide, iron, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc (may cause turbidity)
Coal Pile Runoff	*Generally:* Acidity, COD, calcium, magnesium, iron, aluminum, manganese, silica, chloride, sulfate, TD, TSS, arsenic, chromium, copper, nickel, vanadium, and zinc *Possibly:* antimony, cadmium, beryllium, lead, selenium, thallium, mercury, and silver

Table 4-1 (Continued)

Process	Wastewater
Water Treatment	**Clarification:** aluminum sulfate, sodium aluminate, ferrous sulfate, ferrous chloride, and calcium carbonate
	Filtration: suspended solids
	Ion Exchange: calcium and magnesium salts, iron, copper, zinc, aluminum, manganese, potassium, soluble sodium, chlorides, sulfates, organics, sulfuric acid, and sodium hydroxide
	Evaporation: salts (type depends on intake water characteristics)
	Softening: calcium carbonate, magnesium hydroxide, and sodium salts
Boiler Blowdown	Chlorides, sulfates, metals, precipitated solids containing calcium and magnesium salts, soluble and insoluble corrosion products, and chemical additives
Flue Gas Desulfurization Waste from Wet Scrubbers	A slurry of ash, unreacted lime, calcium sulfate, and calcium sulfite.
Maintenance Cleaning	Oil, grease, phosphates, nitrites, suspended solids, dissolved solids, iron, nickel, chromium, vanadium, zinc, magnesium salts, polynuclear hydrocarbons, acidity, alkalinity, and oil
Miscellaneous Wastestreams	Suspended solids, dissolved solids, oil and grease, phosphates, surfactants, acidity, methylene chloride, phthalates, BOD_5, COD, fecal coliform, and nitrates

Source: Preliminary Study of the Steam Electric Point Source Category, 1996 and OECA Sector Notebook, 1997.

4.3 Industry Demographics

EPA performed a preliminary analysis of the demographic information for the year 2002 collected by EIA.

This section is divided into the following subsections:

- Section 4.3.1 discusses the overall industry;
- Section 4.3.2 discusses utilities;
- Section 4.3.3 discusses nonindustrial nonutilities;
- Section 4.3.4 discusses industrial nonutilities; and
- Section 4.3.5 discusses additional fuel types.

4.3.1 Overall Steam Electric Industry

As stated previously, the steam electric industry comprises facilities that generate electricity using a steam cycle. Part 423 regulates steam facilities that use fossil fuel or nuclear fuel as their energy source. For the purpose of this preliminary report, EPA refers to facilities using fossil or nuclear fuel to produce electricity through a steam-cycle as ‘steam electric’ facilities. Facilities may be using other sources of energy to generate steam. Section 4.3.5 provides a brief discussion of these facilities. EPA will investigate these facilities further during the development of the 2006 Effluent Guidelines Program Plan.

EPA reviewed data from PCS, TRI, and EIA to characterize the steam electric industry. This section describes the facilities included in each data source. EIA provided information on facility type, capacity, and fuel type while PCS and TRI provided information on wastewater characteristics.

EPA extracted all PCS data from major sources in SIC 4911, SIC 4931, and SIC 4939 for the preliminary detailed study. In the PCS database, 882 facilities report one of these SIC codes. Of the 882 facilities, 554 are major dischargers and 328 are minor dischargers. The analyses in this report use PCS data from the 554 major facilities. Table 4-2 shows the distribution of the PCS facilities by SIC code.

Table 4-2. Distribution of PCS Facilities by SIC Code

SIC Code	Major Dischargers	Minor Dischargers	Total
4911	545	266	811
4931	9	42	51
4939	0	20	20
Total	**554**	**328**	**882**

EPA also extracted TRI data from all facilities in SIC 4911, 4931, and 4939. Of the 692 facilities that report one of these SIC codes in the TRI database, only 376 report wastewater discharges of reportable toxic chemicals, and one facility reports wastewater discharge in SIC Code 4939. Because this facility has only one discharge of 1.7 pounds of barium, resulting in a TWPE of 0.003, EPA did not use this facility's data in this analysis. Table 4-3 shows the distribution of the TRI facilities by SIC code. EPA linked the PCS and TRI data to information from EIA to classify each facility type. Section 5.0 discusses the use of the PCS and TRI data in greater detail.

Table 4-3. Distribution of TRI Facilities by SIC Code

SIC	Total	No Reported Water Discharge	Direct Discharge	Indirect Discharge	Both Direct and Indirect Discharge
4911	639	289	320	12	18
4931	45	20	19	3	3
4939	8	7	1	0	0
Total	**692**	**316**	**340**	**15**	**21**

Since Form EIA-860 contained the most detailed information on facility type, energy source, and capacity, EPA used data from EIA to develop a preliminary demographic profile of the industry. Form EIA-860 contains records for 16,413 generators from 5,137 facilities for calendar year 2002. However, these records include data from all facilities that produce electricity, not specifically steam electric facilities. EPA included just the facilities that used a steam turbine as the prime mover in the steam electric detailed study. For this preliminary report, EPA included the following prime movers from Form EIA-860:

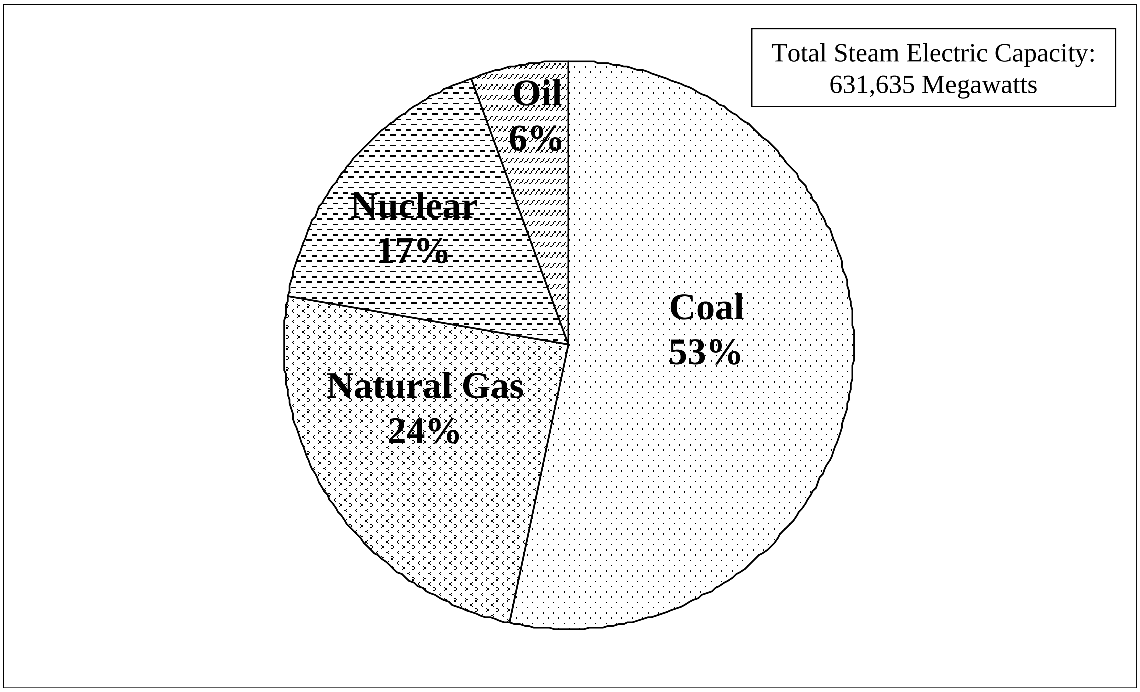
- ST - Steam Turbine;
- CA - Combined Cycle Steam Part; and
- CS - Combined Cycle Single Shaft (combustion turbine and steam turbine share a single generator).

As mentioned in Section 2.1, Region IV determined that the steam electric effluent guidelines in 40 CFR 423 are applicable to the steam electric unit of a combined cycle generating plant because the steam electric portion of the combined cycle uses fossil-type fuel in conjunction with a thermal cycle. Therefore, EPA included data for the prime movers reported as “combined cycle steam part” in this study.

Based on the current applicability of 40 CFR 423, EPA included facilities using only fossil or nuclear fuel in this initial analysis:

- BIT - Anthracite Coal, Bituminous Coal;
- LIG - Lignite Coal;
- SUB - Subbituminous Coal;
- WC - Waste/Other Coal;
- DFO - Distillate Fuel Oil;
- JF - Jet Fuel;
- KER - Kerosene;
- RFO - Residual Fuel Oil;
- WO - Oil-Other and Waste Oil, Crude Oil, Liquid Byproducts, Oil Waste, Propane (Liquid), Re-Refined Motor Oil, Sludge Oil, Tar Oil);
- NG - Natural Gas; and
- NUC - Nuclear (Uranium, Plutonium, Thorium).

Figure 4-2 shows the distribution of the energy sources used in the steam electric industry. The figure shows that most of the electricity produced by the steam electric facilities is provided by coal and natural gas. For 2002, Form EIA-860 reporting shows 1,450 steam electric facilities with a total electric capacity of 631,635 Megawatts.



Source: EIA, 2002

Figure 4-2. Distribution of Electricity Production in the Steam Electric Industry, 2002

EIA uses the terms “regulated” and “unregulated” entities to correspond to utilities and nonutilities. Regulated entities sell electricity to the public while unregulated entities do not have a designated franchised service area. According to information obtained from EIA, the “type” field reported on Form EIA-860 can be used to separate utilities (regulated) from nonutilities (unregulated). However, some unregulated facilities may be run by regulated utilities, and vice-versa.

EIA reports facilities by NAICS code rather than SIC code. Utilities and nonindustrial nonutilities are reported under NAICS code 22, while industrial nonutilities are reported under the NAICS code for their primary industry. EPA used the NAICS code along with the regulated status to determine the number of facilities, number of generating units, and total capacity for each type of facility, shown in Table 4-4.

Table 4-4. Number of Steam Electric Facilities, Generating Units, and Capacity, by Facility Type Reported to EIA

Facility Type	Number of Facilities	Number of Generating Units	Total Capacity (MW)
Utilities	662	1,721	416,361
Nonindustrial nonutilities	480	857	204,614
Industrial nonutilities	308	676	10,660
Total	**1,450**	**3,254**	**631,635**

4.3.2 Utilities

Utilities provide approximately 66 percent (416,361 Megawatts) of the electricity produced by steam electric facilities. Table 4-5 presents the capacity, number of steam electric facilities, and number of steam electric generating units according to plant capacity. Note that facilities may have multiple generating units.

Table 4-5. Distribution of Steam Electric Utilities by Size

Plant Capacity	0-50 MW	50-100 MW	100-200 MW	200-300 MW	300-400 MW	400-500 MW	>500 MW	Total
Total Utility Capacity (MW)	2,887	5,249	12,511	12,826	14,527	18,855	349,506	416,361
Percent of Utility Capacity	1%	1%	3%	3%	3%	5%	84%	100%
Number of Utility Facilities	109	70	85	52	41	42	263	662
Percent of Utility Facilities	16%	11%	13%	8%	6%	6%	40%	100%
Number of Utility Generating Units	203	153	203	129	124	112	797	1,721
Percent of Utility Generating Units	12%	9%	12%	7%	7%	7%	46%	100%

The data in Table 4-5 show that the majority of the utilities, generating units, and capacity is from the largest size group (>500 megawatts). EPA also divided the utility group by primary energy source as shown in Figure 4-3. The majority of utility capacity is provided by coal.

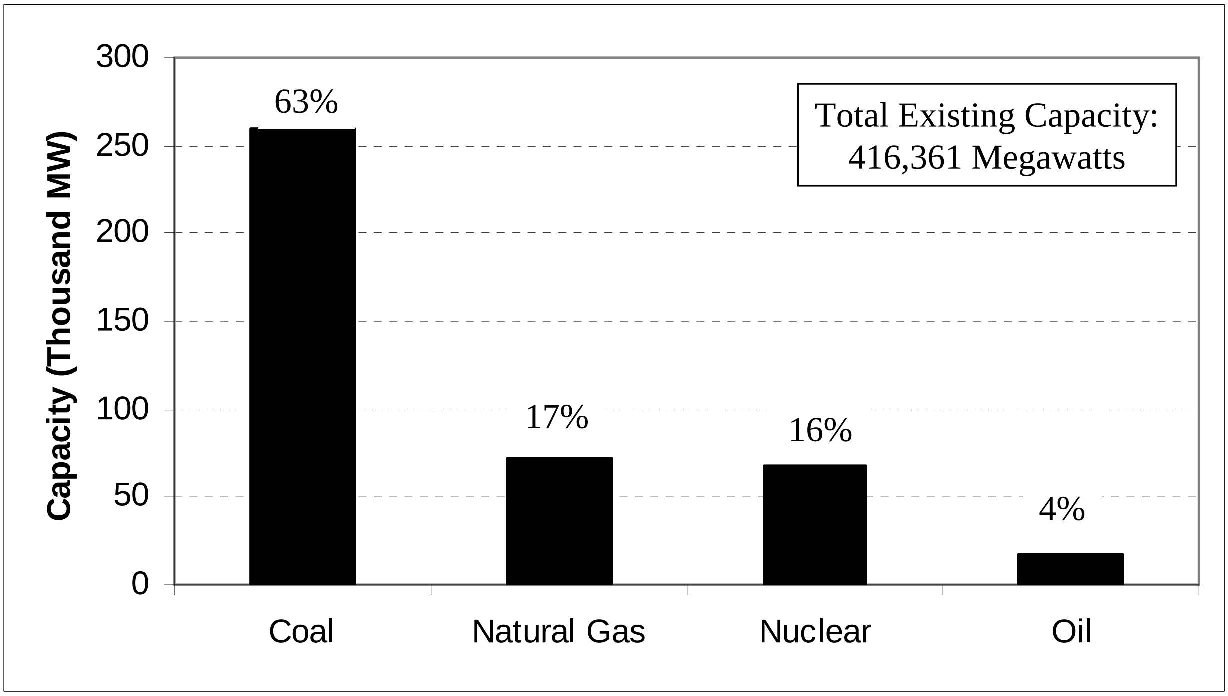


Figure 4-3. Distribution of Utility Capacity by Energy Source

Figure 4-4 presents a timeline of cumulative capacity for the utilities reported on the 2002 EIA forms. The graph shows the cumulative steam electric capacity based on initial year of operation. While the coal-fired capacity increased rapidly in the 1970s, the utility capacity has leveled off in recent years.

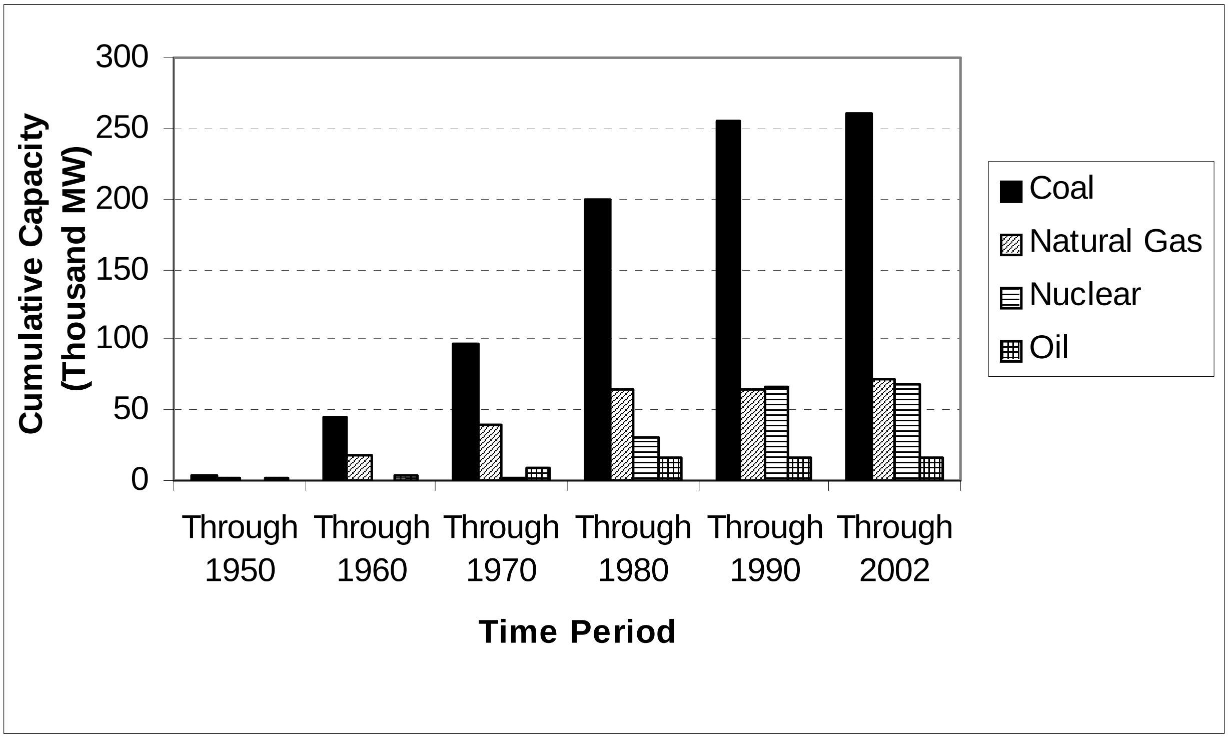


Figure 4-4. Capacity of Utilities by Fuel Type

4.3.3 Nonindustrial Nonutilities

Nonindustrial nonutilities provide 32% of the total steam electric capacity. Table 4-6 and Figures 4-5 and 4-6 present the nonindustrial nonutility distributions in the same manner as the utilities. Like utilities, most of the capacity is from large (>500 MW) facilities; however, nonindustrial nonutilities have a greater percentage of facilities and generating units in the smaller size ranges than utilities.

Table 4-6. Distribution of Steam Electric Nonindustrial Nonutilities by Size

Plant Capacity	0-50 MW	50-100 MW	100-200 MW	200-300 MW	300-400 MW	400-500 MW	>500 MW	Total
Total Nonindustrial Nonutility Capacity (MW)	2,835	4,210	9,868	12,655	12,532	8,332	154,181	204,613
Percent of Nonindustrial Nonutility Capacity	1%	2%	5%	6%	6%	4%	75%	100%
Number of Nonindustrial Nonutility Facilities	118	57	68	52	36	19	130	480
Percent of Nonindustrial Nonutility Facilities	25%	12%	14%	11%	8%	4%	27%	100%
Number of Nonindustrial Nonutility Generating Units	144	64	98	76	67	45	363	857
Percent of Nonindustrial Nonutility Generating Units	17%	7%	11%	9%	8%	5%	42%	100%

Nonindustrial nonutilities also have a larger percentage of capacity than natural gas-fired generating units. The overall capacity from natural gas for utilities and nonutilities is similar (70,800 megawatts for utilities and 75,700 megawatts for nonindustrial nonutilities).

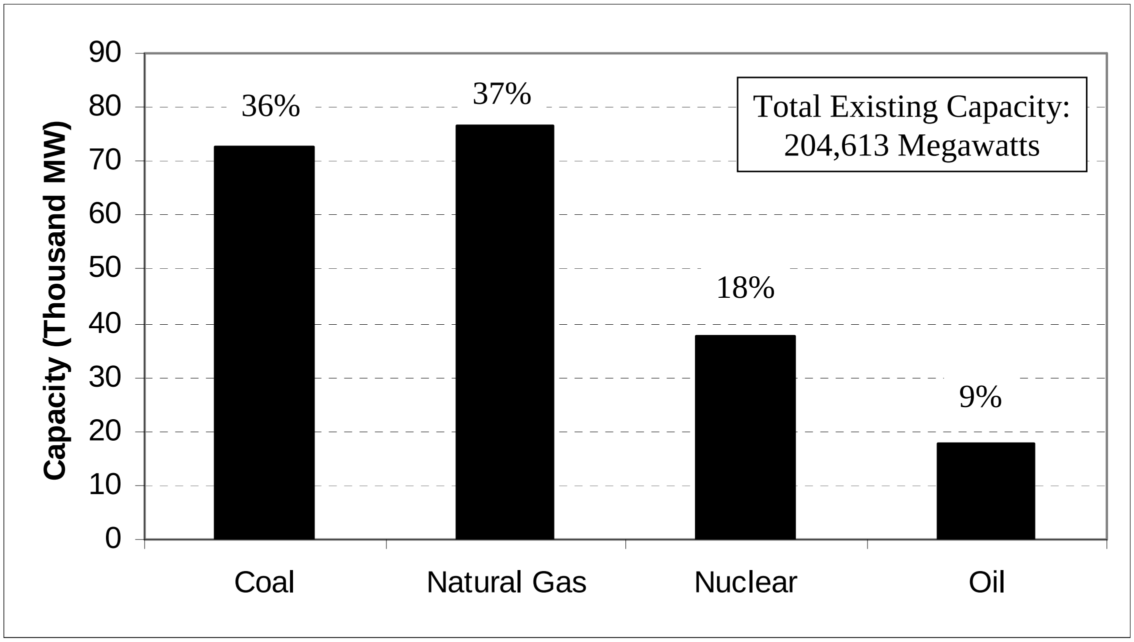


Figure 4-5. Distribution of Nonindustrial Nonutility Capacity by Energy Source

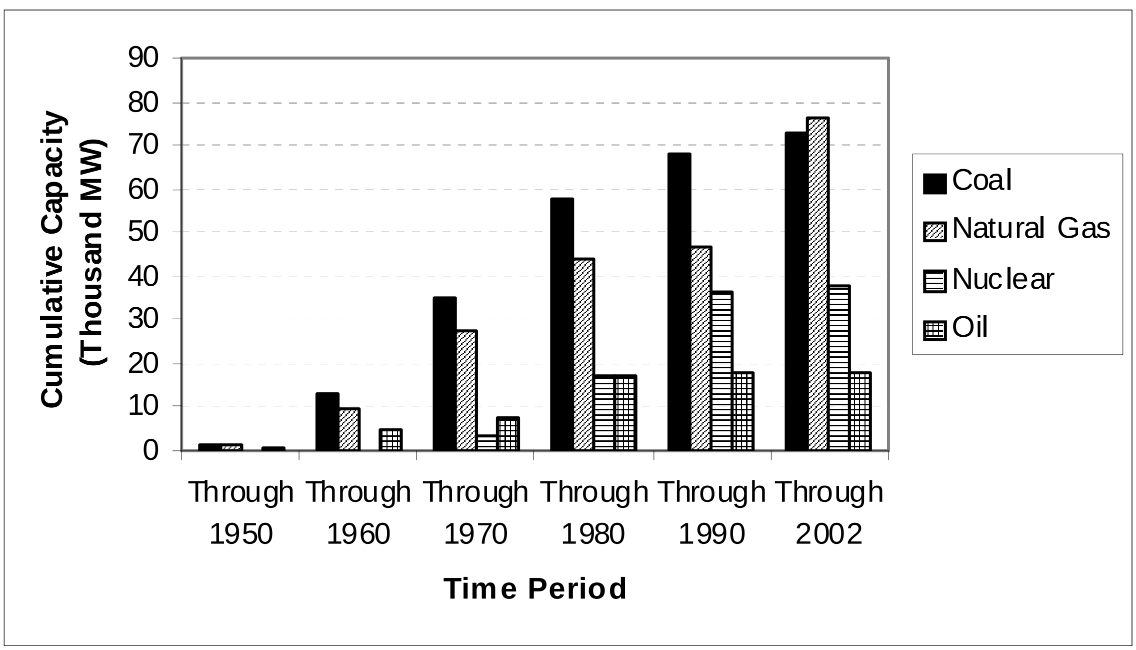


Figure 4-6. Capacity of Nonindustrial Nonutilities by Fuel Type

Figure 4-5 shows that coal-fired nonindustrial nonutility capacity increased through the 1960s and 1970s. Nonindustrial nonutilities also saw a large increase in natural gas capacity during the 1990s.

4.3.4 Industrial Nonutilities

The industrial nonutility group contains facilities reporting NAICS codes other than 22, Utilities. These facilities are not currently regulated under 40 CFR 423. According to information provided in the 1996 *Preliminary Data Summary for the Steam Electric Point Source Category*, permits for the effluent wastestreams of an electric power generating unit which exists as an ancillary unit of a plant falling under an effluent guideline other than Part 423 are normally written by best professional judgement (BPJ) using Part 423 regulations for similar wastestreams. Table 4-7 lists the industries, the number of facilities represented, and the total capacity for steam electric industrial nonutilities using fossil or nuclear fuel as reported to EIA.

Table 4-7. Distribution of Industrial Nonutilities by NAICS Code

NAICS Code	NAICS Title	Number of Facilities	Total Capacity (MW)
322	Paper Manufacturing	82	2,968
325	Chemical Manufacturing	58	3,147
311	Food Manufacturing	44	1,001
611	Educational Services	33	456
324	Petroleum and Coal Products Manufacturing	20	743
331	Primary Metal Manufacturing	12	1,158
211	Oil and Gas Extraction	10	34
622	Hospitals	9	60
92	Public Administration	5	57
314	Textile Product Mills	5	84
327	Nonmetallic Mineral Product Manufacturing	2	77
336	Transportation Equipment Manufacturing	3	93
3122	Tobacco Manufacturing	3	101

Table 4-7 (Continued)

NAICS Code	NAICS Title	Number of Facilities	Total Capacity (MW)
321	Wood Product Manufacturing	2	9
333	Machinery Manufacturing	2	24
22132	Sewage Treatment Facilities	2	112
326	Plastics and Rubber Products Manufacturing	1	40
332	Fabricated Metal Product Manufacturing	1	10
481	Air Transportation	1	8
482	Rail Transportation	1	4
514	Information Services and Data Processing	1	0.7
521	Monetary Authorities	1	12
561	Administrative and Support Services	1	2
624	Social Assistance	1	2
814	Private Households	1	6
212	Mining	2	66
2212	Natural Gas Distribution	1	3
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1	205
4911	Postal Service	1	178
562212	Solid Waste Landfill	1	1
Total		**308**	**10,660**

Table 4-8 and Figures 4-7 and 4-8 present the distribution information for industrial nonutilities. Table 4-8 shows that industrial nonutilities are much smaller in size than utilities and nonindustrial nonutilities, which is expected since the steam electric generator is ancillary to other manufacturing activities. Industrial nonutilities have a fairly small overall capacity (10,660 MW). The capacity is fairly equally distributed between coal and natural gas fired generating units.

Table 4-8. Distribution of Steam Electric Industrial Nonutilities by Size

Plant Capacity	0-50 MW	50-100 MW	100-200 MW	200-300 MW	300-400 MW	400-500 MW	>500 MW	Total
Total Industrial Nonutility Capacity (MW)	3,257	2,950	2,145	1,195	688	425	0	10,660
Percent of Industrial Nonutility Capacity	31%	28%	20%	11%	6%	4%	0%	100%
Number of Industrial Nonutility Facilities	242	42	16	5	2	1	0	308
Percent of Industrial Nonutility Facilities	79%	14%	5%	2%	1%	0%	0%	100%
Number of Industrial Nonutility Generating Units	453	124	59	29	4	7	0	676
Percent of Industrial Nonutility Generating Units	67%	18%	9%	4%	1%	1%	0%	100%

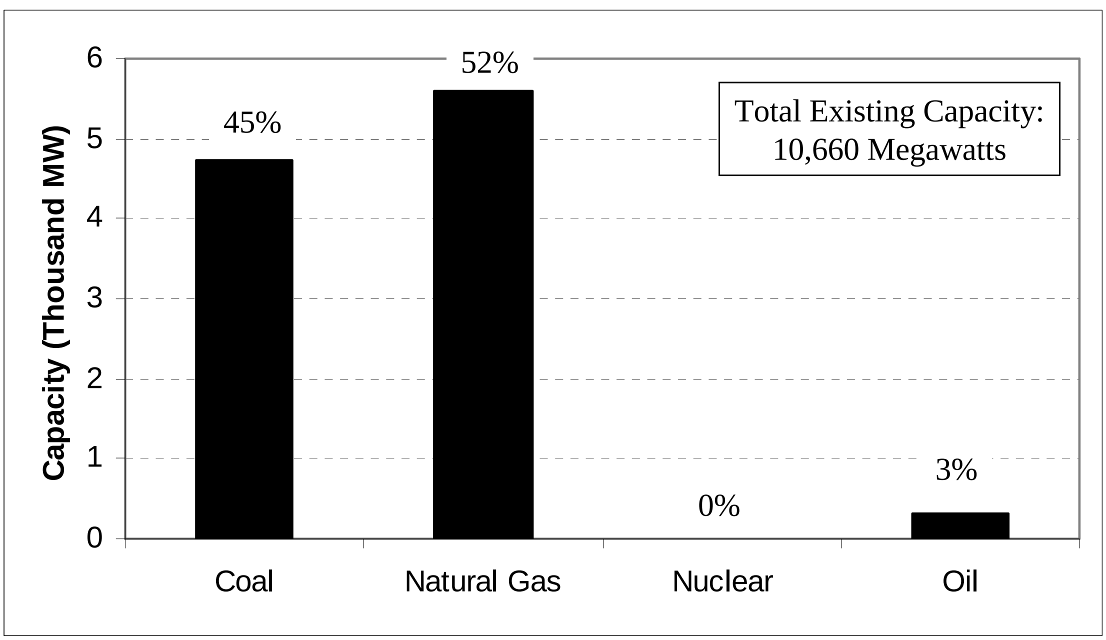


Figure 4-7. Distribution of Industrial Nonutility Capacity by Energy Source

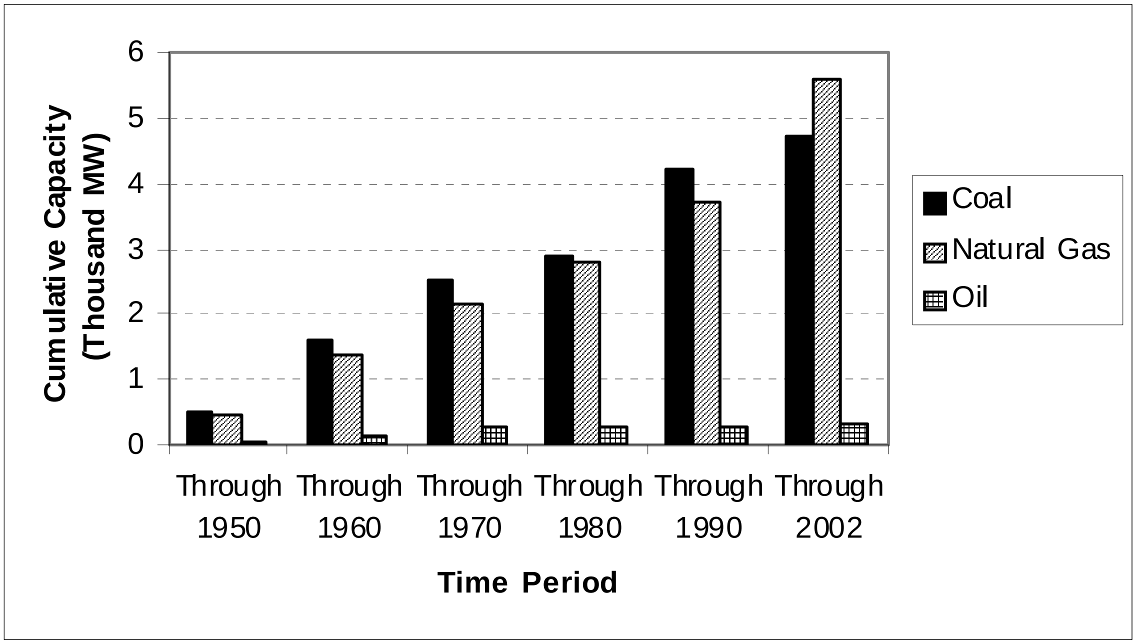


Figure 4-8. Capacity of Industrial Nonutilities by Fuel Source

4.3.5 Other Fuel Sources

Some facilities that produce electricity using a steam cycle may be using a renewable fuel rather than fossil or nuclear fuel. EPA has not reviewed wastewater characteristics for these facilities, to date. This section provides demographic information for these facilities.

Facilities reported using the following fuel types with steam cycles in EIA:

- AB - Agricultural Crop;
- MSW - Municipal Solid Waste;
- OBS - Other Biomass Solid;
- TDF - Tire-derived Fuels;
- WDS - Wood/Wood Waste Solids;
- BLQ - Black Liquor;
- WDL - Wood Waste Liquids;
- LFG - Landfill Gas;
- GEO - Geothermal;

- PC - Petroleum Coke;
- OG - Other Gas;
- BFG - Blast Furnace Gas;
- PUR - Purchased Steam;
- OBG - Other Biomass Gas;
- SUN - Solar; and
- OTH - Other.

Table 4-9 lists the number of facilities, number of generating units, and total capacity for the renewable fuels.

Table 4-9. Summary of EIA Data for Other Fuel Sources for All Steam Electric Facilities Reporting to EIA 2002

Facility Type	Number of Facilities	Number of Generating Units	Total Capacity (MW)
Steam Cycle - BLQ	66	157	3,688
Steam Cycle - GEO	45	200	2,987
Steam Cycle - MSW	81	105	2,900
Steam Cycle - WDS	117	161	2,701
Steam Cycle - PC	16	19	1,043
Steam Cycle - OG	24	54	837
Steam Cycle - BFG	9	29	826
Steam Cycle - OTH	20	29	673
Steam Cycle - SUN	9	9	410
Steam Cycle - AB	13	27	345
Steam Cycle - LFG	11	12	212
Steam Cycle - PUR	4	9	58
Steam Cycle - TDF	2	2	57
Steam Cycle - WDL	2	3	35
Steam Cycle - OBS	2	2	25
Steam Cycle - OBG	1	1	18

5.0 WASTEWATER CHARACTERIZATION

EPA analyzed the wastewater discharges by the type of facility reporting (utility, nonindustrial nonutility, or industrial nonutility). In order to classify the PCS and TRI data by facility type, EPA linked the PCS and TRI databases to the EIA database. Each of these primary data sources uses unique identification numbers for facilities. EPA linked the PCS and TRI data for each facility using EPA's Facility Registration System (FRS). FRS provides a unique identification number for facilities and contains relevant information about the facility such as name, address, owners, and permits held. Both PCS and TRI identification numbers are included in the FRS system. EPA linked the PCS and TRI information to the EIA data using information from EPA's section 316(b) cooling water intake structure regulation development, and also by matching zip codes and other facility identification information. EPA created a master table that lists the FRS ID, TRI ID, NDPES number, and EIA ID. This master table allowed information from each data source to be consolidated by facility. See Docket ID No. OW-2004-0032 for additional information.

Table 5-1 shows the number of facilities that are in the TRI and PCS databases that report to the SIC codes applicable to the steam electric industry, the number of facilities linked to the EIA database, and the percent of the TWPE that is represented by the linked facilities. EPA was not able to categorize all the facilities listed in the table below as utilities or nonutilities due to incomplete information in EIA. For example, EIA does not contain information for facilities in Puerto Rico and the Virgin Islands and some facility information was incomplete. However, the analysis of wastewater characteristics presented in this section represents 96% of the PCS TWPE and 95% of the TRI TWPE.

Table 5-1. Number of Facilities in the PCS and TRI Databases Matched to the EIA Database

Database	Number of Facilities Reporting	Number of Matched Utilities	Number of Matched Nonindustrial Nonutilities	Total Number of Matched Facilities	Percent of TWPE Represented
PCS	554 (major dischargers)	327	163	490	96
TRI	375	235	103	338	95

The remainder of this section presents the wastewater characteristics for the following types of steam electric facilities:

- Section 5.1 discusses utilities;
- Section 5.2 discusses non-industrial nonutilities; and
- Section 5.3 discusses industrial nonutilities.

5.1 Utilities

This section summarizes the wastewater characteristics for utilities. Section 5.1.1 discusses the PCS data and 5.1.2 discusses the TRI data.

5.1.1 PCS

EPA analyzed data from PCS to identify pollutants discharged from steam electric utilities. Of the 554 major facilities reporting to PCS, 327 are utilities. Table 5-2 presents the top pollutants discharged based on TWPE, along with the number of facilities reporting the pollutant. The top five pollutants reported are:

1. Copper: Copper may be present in cooling water biocides or coal pile runoff.

2. Arsenic: Coal pile runoff and ash handling wastes are the most likely source of arsenic since arsenic is naturally occurring in coal. All but 1 of the 44 facilities that report arsenic discharges are coal facilities. Arsenic discharges are reported by facilities in only 14 states, and 29 of the 44 facilities reporting arsenic

discharges are in Region IV. Facilities in North Carolina account for 12% of the arsenic TWPE.

3. Chlorine: Chlorine is used as a biocide and is most likely discharged from cooling water streams. Chlorine is a constituent of coal and therefore may also be present in other wastestreams such as coal pile runoff, ash handling streams, and scrubber wastes. Chlorine reported in PCS refers to TRC and not Cl_2.

4. Boron: Boron is not regulated by 40 CFR 423 so few facilities report boron discharges. Of the 11 facilities that reported boron discharges, 6 use coal as an energy source and 5 use nuclear as an energy source. One facility accounts for 67% of the boron discharged, and the top five boron dischargers account for 98%. EPA does not currently have information on potential sources of boron in the wastewater; however, UWAG has performed an initial investigation regarding the release of boron and will be submitting a summary memorandum to EPA on the sources of this pollutant (see DCN 01739 in section 13.2 of the record).

5. Aluminum: Aluminum is typically used as a treatment chemical in chemical precipitation/clarification systems although the potential source in steam electric discharges is not apparent from the PCS data.

Table 5-2. The Top Pollutants Released From 327 Utilities in the PCS Database

Pollutant	Number of Facilities Reporting Pollutant	Total Pounds Estimated to be Discharged	Total TWPE	Percent of Total TWPE
Copper	121	318,312	202,071	19%
Arsenic	44	47,443	191,732	18%
Chlorine (based on discharging 2 hrs/day)	136	364,978	185,833	17%
Boron	11	920,836	163,186	15%
Aluminum	21	1,609,747	104,136	10%
Silver	6	5,090	83,836	7.9%
Selenium	50	28,229	31,655	3.0%
Iron	88	4,442,293	24,877	2.3%
Cadmium	22	744	17,209	1.6%
Fluoride	7	412,707	14,445	1.4%
Lead	26	6,216	13,923	1.3%
Mercury	25	97	11,360	1.1%
Zinc	69	159,696	7,488	0.7%
Nitrogen, Nitrate Total (as N)	5	807,041	4,519	0.42%
Nickel	25	23,422	2,551	0.24%
Nitrite plus Nitrate Total 1 Det. (as N)	11	342,762	1,919	0.18%

Table 5-2 (Continued)

Pollutant	Number of Facilities Reporting Pollutant	Total Pounds Estimated to be Discharged	Total TWPE	Percent of Total TWPE
Manganese	15	76,926	1,110	0.10%
Chromium, Hexavalent	6	2,051	1,060	0.10%
Total	**327**	**9,568,590**	**1,067,569**	**99.6%**

Note: Includes only pollutants that have a TWF. Does not include conventional pollutants like BOD_5 and TSS.

In addition to the pollutants listed in Table 5-2, steam electric plants discharge other pollutants, such as the conventional pollutants, that do not have a toxic weighting factor (TWF). EPA could not calculate TWPE for these pollutants. As shown in Table 5-3, utilities discharge large masses of these pollutants.

Table 5-3. Pollutants Without TWFs Discharged From 327 Utilities in the PCS Database

Pollutant	Number of Facilities Reporting Pollutant	Total Pounds Estimated to be Discharged
Total Suspended Solids	294	375,870,357
BOD_5	94	7,611,588
Oil & Grease	280	4,886,983
Total Residual Oxidants*	49	729,338

*According to UWAG, total residual oxidants indicates use of bromine biocides (see DCN 01738 in section 13.2 of the record).

Analysis of Pollutants Discharged by Energy Source

EPA further investigated the pollutant discharges reported in PCS by the energy source reported in the EIA database. Table 5-4 shows the number of facilities, the combined capacity, and the TWPE associated with the reported discharges by energy source. Table 5-4 was created using information from the 327 PCS steam electric utilities. Since facilities may report two or more energy sources, the total number of facilities reported in Table 5-4 is greater than 327.

Table 5-4. PCS Discharges From 327 Utilities Distributed by Energy Source

Category	Number of Facilities	Energy Source Capacity (MW)	MW/Facility	TWPE (tox-lb/yr)	TWPE/Facility	TWPE/MW
Coal	231	200,650	869	853,828	3,696	4.26
Natural Gas	71	45,324	638	72,864	1,026	1.61
Nuclear	38	56,993	1,500	120,125	3,161	2.11
Oil	30	13,262	442	20,753	692	1.56

For facilities that reported using two or more energy sources, EPA distributed the TWPE to each energy source based on the percentage of capacity from each energy source. For example, if 25% of a facility's capacity is from coal and 75% is from natural gas, and the facility reported releasing 4,000 pounds of chlorine, then EPA assumed 1,000 pounds are associated with coal and 3,000 pounds are associated with natural gas operations. Although some pollutants, especially metals, are more likely to result from the use of certain fuels (e.g., coal), this approximation allowed EPA to evaluate whether certain energy sources contributed the bulk of the pollutant loads. Table 5-4 shows that the majority of the utility TWPE is discharged by coal facilities. Coal facilities account for 65% of the steam electric utility capacity, but 80% of the TWPE discharged. Compared to the other fuel types, coal facilities have additional waste streams from coal pile runoff and ash handling that add to the loadings for this energy source.

Table 5-4 also shows TWPE per megawatt, TWPE per facility, and megawatt per facility calculated by EPA. The table shows that coal facilities have the highest TWPE per megawatt, discharging more than 2.5 times as much as natural gas and oil facilities, and twice as much as nuclear facilities per megawatt.

Table 5-5 shows the top five pollutants and their TWPE released from each energy source and the total TWPE. Similar pollutants are ranked in the top five for each energy source. Coal has the highest levels of arsenic compounds, likely due to coal pile runoff or ash handling since arsenic is naturally occurring in coal. As mentioned previously, cooling water is a potential source of chlorine. Copper may be found in cooling water, ash handling, coal pile runoff, or the low volume wastestreams.

Table 5-5. Top Five Pollutants From 327 Utilities by Fuel Source

Rank	Coal		Natural Gas		Nuclear		Oil	
	Pollutant	TWPE	Pollutant	TWPE	Pollutant	TWPE	Pollutant	TWPE
1	Arsenic	177,205	Copper	30,439	Copper	37,824	Chlorine	11,649
2	Chlorine	137,480	Chlorine	24,204	Boron	34,492	Copper	3,451
3	Copper	130,357	Arsenic	11,866	Aluminum	19,507	Arsenic	2,661
4	Boron	128,690	Lead	1,610	Iron	13,202	Nitrite Plus Nitrate Total (as N)	1,028
5	Aluminum	84,630	Mercury	1,529	Chlorine	12,499	Iron	640
	Total	**853,828**	**Total**	**72,864**	**Total**	**120,125**	**Total**	**20,753**

According to Tables 5-4 and 5-5, nuclear facilities have a TWPE of 120,125 lb-eq, which accounts for 11% of the total utility TWPE. However, 60% of this discharge is released from one facility, RE Ginna Nuclear Power Plant in Ontario, NY. The top five pollutant discharges from this facility based on TWPE are copper, boron, iron, chlorine, and zinc. The facility accounts for 80% of the copper TWPE, 66% of the boron TWPE, and 99.9% of the iron TWPE released from utility facilities using nuclear as an energy source. Table 5-6 compares the releases from the RE Ginna facility to the releases for all nuclear facilities. The high TWPE per facility and TWPE per MW for nuclear facilities are driven by the results from this facility.

Table 5-6. Pollutant Releases From RE Ginna Nuclear Plant in Ontario, NY

Pollutant	RE Ginna Nuclear Plant	All Nuclear Facilities
Copper	30,071	37,824
Boron	22,721	34,492
Iron	13,198	13,202
All Releases	**71,690**	**120,125**

Analysis of Pollutants Discharged by Flow Rate

PCS does not provide adequate information to determine the process stream (e.g., fly ash handling) for each reported discharge. Therefore, EPA divided waste streams into four categories based on flow, shown in Table 5-7, to help determine the type of streams driving loads. Although the flows for these streams varies largely by plant size, EPA is using these categories only as a screening-level tool to determine the source of the majority of the TWPE.

Table 5-7. Flow Categories

Flow Rate (MGD)	Potential Streams
> 50	Once-Through Cooling Water
10 - 50	Recirculating Cooling Water
1-10	Ash Handling
< 1	Miscellaneous, Metal Cleaning Waste

EPA separated the discharges for each of the top pollutants released by flow category. EPA did not have concentration and flow information for all 327 facilities in the utility segment. Some facilities report releases by a mass quantity (rather than concentration and flow), and therefore, the TWPE from these facilities could not be distributed to one of the flow categories. However, these facilities account for only 1% of the total TWPE reported by utilities. Table 5-8 lists the total TWPE for each of the four flow categories. The table shows that the majority (52%) of the TWPE released is from streams that are greater than 50 MGD.

Table 5-8. TWPE From Utilities by Flow Range

Flow Range (MGD)	Total Flow (MGD)	TWPE	Percent of Total TWPE
>50	167,375	549,009	52%
10-50	7,111	224,908	21%
1-10	2,703	246,801	23%
<1	301	36,618	4%
TOTALS	**177,490**	**1,057,336**	

Note: Approximately 1 percent of the total TWPE is not included in the flow analysis since some facilities do not report a flow rate, but do report a discharge by quantity.

Table 5-9 shows the distribution among the four flow categories for the top five pollutants. Arsenic is the only pollutant that does not have the majority of its TWPE associated with flows that are greater than 50 MGD. The majority of the arsenic TWPE falls in the flow range of 10 - 50 MGD. Arsenic is a constituent of coal, and is likely to be released from ash ponds. Although ash handling streams are likely to have a lower flowrate, coalpile runoff may also be contributing to the arsenic loads and may be a higher flow stream.

Table 5-9. Flow Distribution for the Top Five Pollutants Released by Utilities

Flow Range (MGD)	Copper TWPE	Arsenic TWPE	Chlorine TWPE	Boron TWPE	Aluminum TWPE
>50	**123,630**	14,518	**181,061**	**117,858**	**51,932**
10-50	35,832	**115,885**	3,715	6,150	29,945
1-10	38,316	56,805	382	37,507	10,176
<1	4,293	4,354	211	1,670	2,703
Total	**202,071**	**191,562**	**185,369**	**163,186**	**94,755**

Note: Approximately 1% of the total TWPE is not included in the flow analysis since some facilities do not report a flow rate, but do report a discharge by quantity.

Analysis of Pollutants Discharged by Type of Cooling System

Steam electric power plants use two types of cooling systems: once-through and recirculating. EPA used information from EIA and the section 316(b) cooling water intake structure regulation development to categorize cooling system type. Form EIA-767 and section 316(b) contain information about the type of cooling system in use at 305 of the 327 steam electric utilities in PCS. Table 5-10 shows the number of utilities that use each type of cooling system. Table 5-11 shows the total TWPE released for all utilities, once-through facilities, recirculating facilities, and facilities using a combination of once-through and recirculating cooling systems. Forty facilities reported both a once-through and a recirculating cooling system. Table 5-11 shows that, for each of the pollutants, once-through facilities release a greater amount of pollutant than recirculating facilities.

Table 5-10. Distribution of Cooling Systems Used by Utilities

Type of Cooling System	Number of Facilities
Once Through	195
Recirculating	70
Combination	40
Total	**305**

Analysis of Effluent Pollutant Concentrations

EPA used concentration data available in PCS to compute the minimum, average, and maximum concentration of detected concentrations reported for each of the top pollutants. EPA also determined the number of non-detects reported. Table 5-12 shows the distribution of concentrations for each of the top pollutants along with the method detection limit. Concentration data were available for 309 of the 327 PCS utilities, which accounts for 97% of the total PCS TWPE.

Table 5-11. Distribution of PCS TWPE From 305 Utilities by Type of Cooling System[1]

Pollutant	Number of Facilities Reporting Pollutant	Total TWPE for the 327 Steam Electric Utilities	Once Through			Recirculating			Combination		
			Number of Facilities Reporting	TWPE	TWPE/Facility	Number of Facilities Reporting	TWPE	TWPE/Facility	Number of Facilities Reporting	TWPE	TWPE/ Facility
Copper	121	202,071	68	164,006	2,412	31	34,181	1,103	18	3,460	192
Arsenic	44	191,732	27	141,643	5,246	11	13,585	1,235	6	36,505	6,084
Chlorine	136	185,833	72	151,676	2,107	42	10,727	255	16	23,303	1,456
Oxidants, Total Residual		-	13	-	-	7	-	-	6	-	-
Boron	11	163,186	8	51,228	6,404	1	3,119	3,119	2	108,839	54,420
Aluminum	21	104,136	14	77,749	5,554	7	26,387	3,770	0	0	-
Silver	6	83,836	5	83,835	16,767	1	1.5	1	0	0	-
Selenium	50	31,655	29	17,474	603	17	3,611	212	4	10,570	2,642
Iron	88	24,877	53	16,471	311	21	2,676	127	12	5,728	477
Cadmium	22	17,209	15	9,931	662	5	1,088	218	2	6,190	3,095
Fluoride	7	14,445	6	13,822	2,304	1	623	623	0	0	-
Lead	26	13,923	16	11,532	721	4	605	151	6	1,785	298
Mercury	25	11,360	15	2,608	174	4	48	12	6	8,704	1,451

[1]EPA used information from EIA and section 316(b) to identify cooling system type.

Table 5-12. PCS Concentration Information From 309 Utilities for Top Pollutants in PCS

Pollutant	Number of Facilities	Number of Records	Number of Non-Detects	Number of Detects	Summary of Detected Concentrations				Units
					Avg Conc.	Min Conc.	Max Conc.	Method Detection Limit	
Copper, Total (As Cu)	49	347	72	275	272	0.12	35820	6	ug/L
Arsenic, Total (As As)	12	76	14	62	27	0.01	243	1	ug/L
Chlorine, Total Residual	100	1131	226	905	1713	0.05	790000		ug/L
Boron, Total (As B)	9	164	9	155	5.21	0.002	426	0.005	mg/L
Aluminum, Total (As Al)	8			91	0.97	0.003	15	0.045	mg/L
Silver, Total (As Ag)	8	19	13	6	0.05	0.0005	0.19	0.007	mg/L
Selenium, Total (As Se)	18	99	24	75	6.1	0.0010	456	0.002	mg/L
Iron, Total (As Fe)	43	310	12	298	777	0.10	30100	7	ug/L
Cadmium, Total (As Cd)	11	59	14	45	1.9	0.009	51	4	ug/L
Fluoride, Total (As F)	6			79	0.67	0.10	4.1	0.1	mg/L
Lead, Total (As Pb)	13	55	20	35	20	0.08	405	1	ug/L
Mercury, Total (As Hg)	17	64	11	53	28	0.00	300	0.2	ug/L

Note: This table presents only total metals and not dissolved metals or total recoverable metals. All three types of metals analyses contribute to the total TWPE.

5.1.2 TRI

EPA developed analyses similar to the PCS data analyses using information from TRI. However, the two data sets have differences, such as:

- Not all pollutants are reported to both databases - for example, TRO is reported to PCS but not TRI;
- Chlorine is reported to TRI as Cl_2 rather than residual chlorine;
- TRI data contains only facilities using coal or oil as energy, as other fuel sources aren't required to report unless the facility also uses coal or oil; and
- TRI contains data for both direct and indirect discharges, while PCS contains only direct discharges.

The numbers presented in this section of the report for pounds released and TWPE represents the quantity discharged to receiving streams and accounts for POTW treatment (for indirect discharges).

As in the PCS analysis, EPA was not able to link all TRI facilities to information in EIA to obtain facility information. Of the 375 facilities reporting to TRI, 235 are utilities. Table 5-13 shows the pollutant discharges reported from the 235 utilities in TRI. Arsenic is the top pollutant discharged, followed by copper, mercury, lead, and selenium. Arsenic is reported by 84 out of 235 facilities and accounts for 49% of the total TWPE reported by steam electric utilities in TRI. All 84 facilities that reported arsenic discharges are coal facilities. Arsenic discharges are reported by only 17 states, of which 45 of the 84 releases are from Region IV.

Table 5-13. Pollutants Released From 235 Utilities in the TRI Database

Chemical Name	Number of Facilities Reporting Chemical	Total Pounds Released Accounting for POTW Removals	Total TWPE	Percent of Total TWPE
Arsenic and Arsenic Compounds	84	73,224	295,923	49%
Copper and Copper Compounds	143	258,030	163,803	27%
Mercury and Mercury Compounds	96	313	36,654	6%
Lead and Lead Compounds	148	16,272	36,449	6%
Selenium and Selenium Compounds	21	26,858	30,117	5%
Chlorine	9	22,929	11,675	2%
Zinc and Zinc Compounds	148	212,630	9,969	1.6%
Nickel and Nickel Compounds	119	60,598	6,600	1.1%
Manganese and Manganese Compounds	126	379,967	5,484	0.9%
Chromium and Chromium Compounds	111	31,561	2,389	0.4%
Polycyclic Aromatic Compounds	3	24	2,382	0.4%
Vanadium and Vanadium Compounds	66	62,811	2,198	0.4%
Thallium and Thallium Compounds	11	1,832	1,882	0.3%
Beryllium and Beryllium Compounds	15	1,279	1,351	0.2%
Cobalt and Cobalt Compounds	38	10,389	1,187	0.2%
Barium and Barium Compounds	167	543,754	1,082	0.18%
Ammonia	18	48,006	72	0.01%
Antimony and Antimony Compounds	7	4,111	50	0.01%
Nitrate Compounds	3	516,350	32	0.01%
Benzo(g,h,i)perylene	4	18	5	<0.01%
Methanol	1	6,604	0.10	<0.01%
Sulfuric Acid (1994 and after "Acid Aerosols" Only)	1	5	0.007	<0.01%
Hydrochloric Acid (1995 and after "Acid Aerosols" Only)	1	5	0.00012	<0.01%
Hydrogen Fluoride	1	10	0.00006	<0.01%
Total	**235**		**609,307**	**100%**

Analysis of Pollutants Discharged by Energy Source

EPA segmented the TRI discharges by the energy source as in the PCS analysis. Table 5-14 shows a summary of the total TWPE for each energy source. Since facilities may report using two or more energy sources, the total number of facilities reported in Table 5-14 is greater than 235. For facilities that reported using two or more energy sources in the EIA database, EPA distributed the TWPE to each energy source based on the percentage of capacity from each energy source as in the PCS data analysis. As with the PCS data, the majority of the utility TWPE is released by coal facilities. EPA also computed the TWPE per megawatt (MW), TWPE per facility, and megawatt per facility. Table 5-14 shows that coal facilities again have the highest TWPE per MW. Coal facilities account for most of the capacity, but they also account for most of the TWPE, and on a TWPE per MW basis, coal facilities are discharging just slightly more than natural gas facilities, four times as much as oil facilities, and more than eight times as much as nuclear facilities. As mentioned previously, natural gas and nuclear facilities are not required to report under TRI. Facilities report to TRI if any portion of their capacity is generated from coal or oil. Not enough information is available to determine why the natural gas and nuclear facilities may be reporting to TRI.

Table 5-14. TRI Discharges From 235 Utilities Distributed by Energy Source

Category	Number of Facilities	Energy Source Capacity (MW)	MW/Facility	TWPE (Tox-lb/yr)	TWPE/Facility	TWPE/MW
Coal	220	192,560	875	567,360	2,579	2.95
Natural Gas	25	12,296	492	32,849	1,314	2.67
Nuclear	4	7,974	1,994	2,792	698	0.35
Oil	18	8,578	477	6,305	350	0.74

Table 5-15 shows the top five pollutants, based on TWPE, released from each energy source and the total TWPE for the energy source. The top pollutants are mainly metals which are a constituent of coal and may be released to water in the fly ash handling system or through coal pile runoff.

Table 5-15. Top Five Pollutants From 235 Utilities for Each Fuel Source in the TRI Database

	Coal		Natural Gas		Nuclear		Oil	
Rank	**Pollutant**	**TWPE**	**Pollutant**	**TWPE**	**Pollutant**	**TWPE**	**Pollutant**	**TWPE**
1	Arsenic	282,479	Arsenic	13,168	Copper	1,696	Mercury	1,734
2	Copper	155,335	Chlorine	8,381	Zinc	952	Copper	1,552
3	Lead	35,351	Copper	5,220	Lead	110	Polycyclic Aromatic Compounds	1,468
4	Mercury	30,560	Mercury	4,359	Nickel	35	Chlorine	458
5	Selenium	29,998	Lead	674			Lead	314
	Total	**567,360**	**Total**	**32,849**	**Total**	**2,792**	**Total**	**6,305**

Summary

The PCS and TRI analysis shows that copper, arsenic, chlorine, boron, aluminum, mercury, lead, and selenium rank highest in terms of TWPE released to wastewater for utilities. The majority of the pollutant loads are from coal facilities. This result is expected since coal facilities have additional wastestreams due to coal-pile runoff and ash handling systems. The initial evaluation of cooling system information shows that utilities using a once-through cooling water system discharge higher levels of pollutants.

5.2 <u>Nonindustrial Nonutilities</u>

This section summarizes the wastewater characteristics for nonindustrial nonutilities. Section 5.2.1 discusses the PCS data and 5.2.2 discusses the TRI data.

5.2.1 PCS

EPA analyzed data from PCS to identify pollutants discharged from steam electric nonindustrial nonutilities. Of the 554 facilities reporting to PCS, 163 are nonindustrial nonutilities. Table 5-16 presents the top pollutants discharged based on TWPE, along with the number of facilities reporting the pollutant.

Table 5-16. The Top Pollutants Released From 163 Steam Electric Nonindustrial Nonutilities in the PCS Database

Pollutant	Number of Facilities Reporting Pollutant	Total Pounds Estimated to be Discharged	Total TWPE	Percent of Total TWPE
Boron	14	703,404	124,654	26%
Aluminum	24	1,858,482	120,227	25%
Chlorine	79	184,974	94,182	20%
Copper	55	71,321	45,276	10%
Iron	62	4,578,911	25,642	5%
Lead	19	8,809	19,733	4%
Silver	5	1,016	16,733	4%
Zinc	49	267,254	12,530	3%
Selenium	11	5,723	6,417	1.4%
Chromium, Hexavalent	5	6,009	3,104	0.7%
Cadmium	9	99	2,295	0.5%
Mercury	6	4	521	0.11%
Hydrazine	7	7,409	465	0.10%
Nickel	27	3,636	396	0.08%
Manganese	20	23,405	338	0.07%
Nitrogen, Ammonia	20	223,024	336	0.07%
Boric Acid	1	519,734	312	0.07%
Arsenic	8	74	298	0.06%
Sulfate	13	48,887,354	274	0.06%
Nitrogen, Nitrate Total (As N)	6	35,868	201	0.04%
Chloride	5	6,511,436	159	0.03%
Chromium	12	1,918	145	0.03%
Pcb-1260 (Arochlor 1260)	2	0	81	0.02%
Nitrogen, Nitrite Total (As N)	4	209	78	0.02%
Magnesium	2	75,839	66	0.01%
Vanadium	7	1,349	47	0.01%
Cobalt	1	235	27	0.01%
Molybdenum	2	121	24	0.01%
Sodium	1	2,318,659	13	<0.01%
Fluoride	4	339	12	<0.01%
Titanium	2	109	3	<0.01%
Beryllium	4	1	1	<0.01%
Barium	2	408	1	<0.01%
Total			**474,591**	

As in the analyses of utilities, boron, aluminum, chlorine, and copper ranked in the top five pollutants discharged based on TWPE. Iron also ranked in the top five for nonindustrial nonutilities. Arsenic is the only pollutant that was in the top five for utilities, but not for nonindustrial nonutilities. The capacity of coal-fired plants is over three times higher for utilities than nonindustrial nonutilities which may also account for the higher arsenic loads.

Table 5-17 shows the comparison of capacity between the utility and the nonindustrial nonutility facilities.

Table 5-17. Comparison of Capacity Between Utilities and Nonindustrial Nonutilities Reporting in the PCS Database

Energy Source	Utility Capacity (MW)	Percent of Total Utility Capacity	Nonindustrial Nonutility Capacity (MW)	Percent of Total Non-industrial Nonutility Capacity
Coal	200,650	64	59,426	40
Natural Gas	45,324	14	37,609	25
Nuclear	56,993	18	35,245	24
Oil	13,262	4	16,428	11
Total	**316,229**	**100**	**148,708**	**100**

As with the utilities, some of the pollutants discharged, such as conventional pollutants, do not have TWFs. Some of these pollutants can have significant discharges, as shown in Table 5-18.

Table 5-18. Pollutants Without TWFs Released From 163 Nonindustrial Nonutilities in the PCS Database

Pollutant	Number of Facilities Reporting Pollutant	Total Pounds Estimated to be Discharged
Total Suspended Solids	139	88,278,176
Oil & Grease	131	11,621,147
Total Residual Oxidants	26	669,239
BOD_5	65	21,359

Analysis of Pollutants Discharged by Energy Source

EPA further investigated the pollutant discharges reported in PCS by the energy source reported in the EIA database. Table 5-19 shows the number of facilities, the combined capacity, and the TWPE associated with the reported discharges by energy source. Table 5-19 was created using information from the 163 PCS steam electric nonindustrial nonutilities. Since facilities may report two or more energy sources, the total number of facilities reported in Table 5-19 is greater than 163.

Table 5-19. PCS Discharges From 163 Nonindustrial Nonutilities Distributed by Energy Source

Category	Number of Facilities	Energy Source Capacity (MW)	MW/Facility	TWPE (tox-lb/yr)	TWPE/Facility	TWPE/MW
Coal	80	59,426	743	184,089	2,301	3.10
Natural Gas	53	37,609	710	190,001	3,585	5.05
Nuclear	22	35,245	1,602	64,868	2,949	1.84
Oil	33	16,428	498	35,633	1,080	2.17

For facilities that reported using two or more energy sources, EPA distributed the TWPE to each energy source based on the percentage of capacity from each energy source. For example, if 25% of a facility's capacity is from coal and 75% is from natural gas, and the facility reported releasing 4,000 pounds of chlorine, then EPA assumed 1,000 pounds are associated with coal and 3,000 pounds are associated with natural gas operations. Although some pollutants, especially metals, are more likely to result from the use of certain fuels (e.g., coal), this approximation allowed EPA to evaluate whether certain energy sources contributed the bulk of the pollutant loads. Table 5-19 shows that the natural gas facilities report the highest TWPE.

Table 5-19 also shows TWPE per megawatt, TWPE per facility, and megawatt per facility calculated by EPA. The table shows that natural gas facilities have the highest TWPE per megawatt, discharging more than twice as much as nuclear and oil facilities, and more than 1.5 times as much as coal facilities per megawatt.

Table 5-20 shows the comparison of TWPE per facility between the utilities and nonutilities. Table 5-20 shows that the natural gas TWPE for nonindustrial nonutilities is 2.5 times larger than for utilities while the number of facilities is lower. The overall TWPE per facility for nonindustrial nonutilities is more than three times larger than for utilities. The difference is driven by one facility, West Texas Utilities Company in Abilene, TX. This facility reports a discharge of 1,226,638 pounds of aluminum which is equal to 79,353 lb-eq. EPA will contact this facility to verify the reported discharge.

Table 5-20. Comparison of TWPE/Facility Between Utilities and Nonindustrial Nonutilities Reporting in the PCS Database

Category	Number of Utility Facilities	Utility TWPE	Utility TWPE/Facility	Number of Nonindustrial Nonutility Facilities	Nonindustrial Nonutility TWPE	Nonindustrial Nonutility TWPE/Facility
Coal	231	853,828	3,696	80	184,089	2,301
Natural Gas	71	72,864	1,026	53	190,001	3,585
Nuclear	38	120,125	3,161	22	64,868	2,949
Oil	30	20,753	692	33	35,633	1,080

Due to the greater TWPE and the lower capacity for nonindustrial nonutility natural gas facilities compared to utility natural gas facilities, the TWPE per megawatt is greater. Part of this difference may be attributable to West Texas Utilities; however, even if the TWPE from that facility was set to zero, the TWPE would still be larger for nonindustrial nonutilities than for natural gas utilities. Table 5-21 shows the TWPE per megawatt for each of the energy sources for utility facilities and nonindustrial nonutility facilities.

Table 5-21. Comparison of TWPE/MW Between Utilities and Nonindustrial Nonutilities Reporting in the PCS Database

Energy Source	Utility TWPE/MW	Non-industrial Nonutility TWPE/MW
Coal	4.26	3.10
Natural Gas	1.61	5.05
Nuclear	2.11	1.84
Oil	1.56	2.17

Analysis of Pollutants Discharged by Cooling System

Using the section 316(b) and Form EIA-767 information, EPA determined the cooling system used by 144 of the 163 nonindustrial nonutilities. As with the utilities, the majority of the TWPE is released by facilities using once-through cooling systems. However, for the nonindustrial nonutilities, greater quantities of some pollutants (boron, selenium, and cadmium) are released from recirculating systems rather than once-through systems. Table 5-22 shows the distribution of the 144 facilities by cooling system type. Table 5-22 shows that the majority of the nonindustrial nonutilities use once-through cooling systems.

Table 5-22. Distribution of Cooling Systems Used by Nonindustrial Nonutilities

Type of Cooling System	Number of Facilities
Once-Through	102
Recirculating	31
Combination	11

5.2.2 TRI

EPA analyzed data from TRI to identify pollutants discharged from steam electric nonindustrial nonutilities. Of the 375 facilities reporting to TRI, 103 are nonindustrial nonutilities. Table 5-23 presents the top pollutants discharged based on TWPE, along with the number of facilities reporting the pollutant.

Table 5-23. The Top Pollutants Released From 103 Steam Electric Nonindustrial Nonutilities in the TRI Database

Chemical Name	Number of Facilities Reporting Chemical	Total Pounds Released	Total TWPE	Percent of Total TWPE
Arsenic and Arsenic Compounds	29	15,395	62,216	41%
Lead and Lead Compounds	76	20,742	46,462	30%
Copper and Copper Compounds	43	30,978	19,665	13%
Mercury and Mercury Compounds	41	44	5,099	3%
Nickel and Nickel Compounds	41	44,984	4,899	3%
Chromium and Chromium Compounds	40	54,413	4,119	3%
Zinc and Zinc Compounds	52	46,593	2,185	1.4%
Vanadium and Vanadium Compounds	28	59,998	2,100	1.4%
Selenium and Selenium Compounds	7	1,862	2,088	1.4%
Manganese and Manganese Compounds	55	107,621	1,553	1.0%
Chlorine	2	1,945	990	0.6%
Barium and Barium Compounds	63	286,663	571	0.4%
Thallium and Thallium Compounds	4	530	544	0.4%
Ammonia	22	46,871	71	0.05%
Polychlorinated Biphenyls	1	0.0012	41	0.03%
Hexachlorobenzene	1	0.02	39	0.03%
Toluene	2	4,200	24	0.02%
Cobalt and Cobalt Compounds	6	132	15	0.01%
Antimony and Antimony Compounds	4	763	9	0.01%
Beryllium and Beryllium Compounds	1	4	4	<0.01%
Polycyclic Aromatic Compounds	2	0.03	3	<0.01%
Molybdenum Trioxide	2	253	0.2	<0.01%
Formic Acid	1	13	0.005	<0.01%
Benzo(g,h,i)perylene	1	0.0005	0.00014	<0.01%
Hydrogen Fluoride	1	10	0.00006	<0.01%
Total			152,697	

Four of the top five pollutants (arsenic, lead, copper, and mercury) released from nonindustrial nonutilities were among the top five pollutant released from utility facilities. Nickel replaced selenium in the top five pollutants list for nonindustrial nonutilities.

Analysis of Pollutants Discharged by Energy Source

EPA segmented the TRI discharges by the energy source as in the PCS analysis. Table 5-24 shows a summary of the total TWPE for each energy source. Since facilities may report two or more energy sources, the total number of facilities reported in Table 5-24 is greater than 103. For facilities that reported using two or more energy sources in the EIA database, EPA distributed the TWPE to each energy source based on the percentage of capacity from each energy source as discussed in the PCS data analysis. Unlike the PCS data, the majority of the nonindustrial nonutility TWPE is released by coal facilities, 91%, not natural gas. EPA also computed the TWPE per megawatt, TWPE per facility, and megawatt per facility. Table 5-24 shows that coal facilities have the highest TWPE per megawatt. Coal facilities account for most of the capacity, but they also account for most of the TWPE, and on a TWPE per megawatt basis, coal facilities are discharging almost twice as much as natural gas facilities and four times as much as oil facilities. Four utility facilities reported a nuclear fuel source, but no nonindustrial nonutilities reported a nuclear fuel source. This discrepancy is not surprising, since nuclear facilities are not required to report to TRI.

Table 5-24. TRI Discharges From 103 Nonindustrial Nonutilities Distributed by Energy Source

Category	Number of Facilities	Energy Source Capacity	MW/Facility	Energy Source TWPE	TWPE/Facility	TWPE/MW
Coal	90	56,939	633	139,615	1,551	2.45
Natural Gas	14	5,484	392	6,939	496	1.27
Oil	16	10,004	625	6,143	384	0.61

Table 5-25 shows the comparison of TWPE between the two types of facilities. The TWPE percentage by fuel source is fairly consistent between the utilities and the nonindustrial nonutilities.

Table 5-25. Comparison of TWPE Between Utility and Nonindustrial Nonutility Facilities Reporting in the TRI Database

Category	Utility TWPE	Percent of Utility TWPE	Nonindustrial Nonutility TWPE	Percent of Nonindustrial Nonutility TWPE
Coal	567,360	93.1	139,615	91.4
Natural Gas	32,849	5.4	6,939	4.6
Nuclear	2,792	0.5	-	-
Oil	6,305	1.0	6,143	4.0

While the TWPE percentages were consistent, the TWPE per megawatt for each of the fuel sources was lower for utility facilities as compared to nonindustrial nonutility facilities. For example, the TWPE per megawatt was 52% lower for utilities than nonindustrial nonutilities using natural gas as the fuel source. Table 5-26 shows the comparison of TWPE per megawatt for the two types of facilities.

Table 5-26. Comparison of TWPE/MW Between Utility and Nonindustrial Nonutility Facilities Reporting in the TRI Database

Category	Utility TWPE/MW	Nonindustrial Nonutility TWPE/MW
Coal	2.95	2.45
Natural Gas	2.67	1.27
Nuclear	0.35	-
Oil	0.74	0.61

Summary

The PCS and TRI analysis shows that boron, aluminum, chlorine, copper, iron, arsenic, mercury, lead, and nickel rank highest in terms of TWPE released to wastewater for nonindustrial nonutilities. Arsenic loadings reported to PCS are significantly lower for nonindustrial nonutilities than for utilities, because the megawatts generated by coal (the major source of arsenic) is over three times higher for utilities. The PCS data show that the TWPE per facility is highest for natural gas facilities, while the TRI data show coal facilities have the highest TWPE per facility. As discussed previously, the high TWPE reported for natural gas facilities may be due to a single anomalous facility. EPA will discuss the reported discharge with the facility, and, if necessary, investigate the source of their high discharge. The preliminary results show that utilities and nonutilities have similar wastewater characteristics.

5.3 Industrial Nonutilities

EPA was able to match 60 of the 308 steam electric industrial nonutilities listed in EIA to data included in the PCS database. The industries that these facilities represent are presented in Table 5-27.

Table 5-27. Industries Represented in the Analysis of 60 Industrial Nonutilities

Industry	Number of Facilities
Pulp, Paper, and Paperboard	17
Sugar Processing	8
Petroleum Refining	8
Organic Chemicals, Plastics, and Synthetic Fibers	5
Iron and Steel Manufacturing	5
Vinyl Chloride and Chlor-Alkali	4
Grain Mills Manufacturing	2
Nonferrous Metals Manufacturing	2
Pharmaceutical Manufacturing	2
Pesticide Chemicals Manufacturing	2
Fruits and Vegetable Processing	1
Cement Manufacturing	1
Inorganic Chemicals	1
Metal Finishing	1
Ore Mining and Dressing	1
Explosives	1
Sewerage Systems	1

Since the industrial nonutilities' primary purpose of operation is something other than electricity production, many of the chemicals released may not be associated with electricity production. Table 5-28 shows the top pollutants, based on TWPE, released from the steam electric industrial nonutilities. Of the 60 industrial nonutilities, 21 reported releasing chlorine, which is one of the most frequently reported chemicals from steam electric facilities in the PCS database.

Table 5-28. Top Pollutants Released From 60 Industrial Nonutility Facilities Reporting in the PCS Database

Pollutant	Number of Facilities	Pounds Released	TWPE
Silver	3	9,990	164,548
Chlorine	21	295,368	150,390
Molybdenum	1	717,011	144,434
Sulfide	7	42,674	119,550
Nitrogen, Ammonia	38	32,564,941	49,022
Lead	15	13,085	29,310
Copper	19	44,006	27,936
Nitrogen, Nitrite Total (As N)	2	74,432	27,788
Cyanide	11	18,422	20,576
Fluoride	3	358,547	12,549
Selenium	4	11,136	12,487
Aluminum	5	168,466	10,898
Arsenic	4	2,467	9,970
Nickel	13	72,970	7,947
Zinc	19	134,045	6,285
Phenol & Phenolics	12	187,285	5,245
Mercury	5	45	5,238
Cadmium	4	216	4,986
Chloride	6	126,159,200	3,072
Tributyltin	1	25	2,242
Nitrogen, Nitrate Total (As N)	3	143,050	801
Boron	1	3,837	680
Chromium, Hexavalent	5	1,307	675

Using the section 316(b) and Form EIA-767 information, EPA determined the type of cooling system used by 22 of the 60 industrial nonutilities. Table 5-29 shows the distribution of the 22 facilities by cooling system type. The majority of the industrial nonutilities use recirculating cooling systems; however, with such a small data set, it is difficult to determine if these results are representative of all industrial nonutilities.

Table 5-29. Distribution of Cooling Systems Used by 60 Industrial Nonutility Facilities

Type of Cooling System	Number of Facilities
Once-Through	6
Recirculating	15
Combination	1
Total	**22**

Table 5-30 shows the distribution of the 60 facilities by energy source using EIA information. Five of the facilities reported using two or more energy sources; therefore, the total number of facilities reported in Table 5-30 is greater than 60.

Table 5-30. Distribution of Energy Sources Used by Industrial Nonutility Facilities

Energy Source	Number of Facilities
Coal	32
Natural Gas	35
Nuclear	0
Oil	5

Due to the limited information on industrial nonutilities, EPA will continue to investigate this type of facility as it completes the detailed study.

6.0 ADDITIONAL INFORMATION NEEDS AND NEXT STEPS

EPA will continue to evaluate steam electric facilities for the development of the 2006 Plan. EPA will respond to comments on this preliminary report and continue to evaluate the topics discussed in this report. Topics requiring further study include:

- Arsenic - Arsenic discharges are reported by facilities in 14 states, and 29 of the 44 facilities reporting are in Region IV. EPA will investigate the reason for the increased discharge in this area;
- Boron - Boron ranks in the top five pollutants discharged from steam electric utilities and nonindustrial nonutilities. EPA will investigate possible sources of boron;
- Mercury - Mercury ranks in the top five pollutants discharged from natural gas-fired utilities and coal- and natural gas-fired nonindustrial nonutilities. EPA will investigate the wastestreams that contribute to the mercury load; and
- Total Suspended Solids - Steam electric facilities discharge high quantities of TSS. EPA will investigate the sources of TSS.

In addition, EPA will conduct a focused review of topics that were not evaluated as part of the preliminary study. The additional areas to be investigated are discussed in the following sections:

- Section 6.1 discusses the evaluation of pollution prevention and wastewater treatment technologies;
- Section 6.2 discusses the review of information provided by UWAG;
- Section 6.3 discusses the additional questions on industrial nonutilities;
- Section 6.4 discusses the additional questions on generators using renewable or recycled fuel; and
- Section 6.5 discusses emerging issues.

EPA will review any additional information provided on these topics for the development of the 2006 Plan.

6.1 Pollution Prevention and Wastewater Treatment Technologies

EPA will review pollution prevention and wastewater treatment technologies available to reduce pollutant loadings. When evaluating potential treatment options, EPA will take into account the preliminary concentration analysis (Table 5-12), which shows that, on average, the pollutants are present in steam electric wastewaters. EPA will consider the reported concentration levels when evaluating treatment options.

In the OECA Sector Notebook (U.S. EPA, 1997), EPA suggested several methods for reducing pollution from steam electric facilities (summarized in Table 6-1). EPA will investigate these and other options further during the development of the final detailed study.

Table 6-1. Potential Pollution Prevention Options for Steam Electric Facilities

Pollution Prevention Option	Description/Notes
Cooling Water	
Optimize chemical use	Facilities should minimize the amount of chemicals added to the system.
Chemical substitution	Bromine is more toxic than chlorine. Ozone treatment could be considered to replace both bromine and chlorine.
Use inert construction materials	Nonreactive construction materials will reduce scale and corrosion.
Reduce water use	Recirculating systems should be used instead of once-through systems. Installing automatic bleed/feed controllers and bypass feeders may also reduce volumes of chemicals and water required.
Boiler Cleaning (Fire side)	
Use cleaner fuels	Natural gas is the cleanest burning fuel. Cleaner coals and oils will reduce amount of cleaning required.
Use alternate cleaning methods	Soot blowers, sonic horns, brushing, sweeping, or vacuuming used to replace or augment waster washing will reduce wastewater generated.
Boiler Cleaning (Water side)	
Optimize cleaning frequency	Maintain operating records including normal cycle chemistry to help determine when cleaning is needed
Control boiler chemistry	Controlling chemistry will help reduce scaling

Source: OECA Sector Notebook (U.S. EPA, 1997)

Steam electric facilities are currently recycling fly ash and bottom ash to minimize the amount of ash requiring treatment. UWAG provided information on the use of coal combustion product wastes (see DCN 01728 in section 13.2 of the record). Information for 2003 shows that fly ash and bottom ash are used in the following applications:

- Concrete/Concrete Products/Grout;
- Cement/Raw Feed for Clinker;
- Flowable Fill;
- Structural Fills/Embankments;
- Road Base/Sub-base/Pavement;
- Soil Modification/Stabilization;
- Mineral Filler in Asphalt;
- Snow and Ice Control;
- Blasting Grit/Roofing Granules;
- Mining Applications;
- Waste Stabilization/Agriculture; and
- Agriculture.

EPA will continue to collect information on potential pollution prevention and wastewater treatment options for this industry.

6.2 UWAG Information

As mentioned in Section 3.6, UWAG is currently collecting data from their members for use in EPA's evaluation of this industry. EPA will review the information as it is received from UWAG and incorporate it into analyses where appropriate. Since UWAG represents only utilities, the information collected will only be applicable to this facility type (see DCN 01738 in section 13.2 of the record).

6.3 Industrial Nonutilities

Industrial nonutilities are not currently regulated under Part 423 since their primary purpose is not the generation or distribution of electricity. EPA will investigate these facilities further to estimate the potential hazard posed by discharges from the steam electric portion of these facilities. Additional questions to address include:

- What are the current permit limits for these generating units? Are permit writers applying Part 423 limits to the steam electric portion of these plants?
- Is wastewater from the steam electric plant commingled with other facility wastewater before treatment and discharge? Does it affect the pollutant loads and potential treatment?
- What type of cooling systems are used by these facilities? What chemicals are they using to control biofouling?
- Does the fact that these facilities are co-located with other manufacturing operations affect pollution prevention and treatment options?

EPA may answer these questions through a targeted permit review and/or through facility site visits.

6.4 Renewable/Recycled Fuel Sources

Part 423 currently only applies to facilities using fossil-based or nuclear fuel. As mentioned in Section 4.3.5 steam electric facilities may use fuels such as agricultural waste and biomass to produce steam. EPA will investigate these facilities to determine if they should be included in the applicability of Part 423. Additional questions to address include:

- How are these facilities similar to facilities currently covered by Part 423 in terms of pollutant discharge, water use, wastewater flow rates, and plant capacity?
- Do these facilities have any additional sources of wastewater?
- How are these facilities currently permitted? What pollutants are regulated and what limits apply?

EPA may answer these questions through a targeted permit review and/or through facility site visits.

6.5 Emerging Issues

EPA will also review information on emerging technologies that may impact pollutant loadings, such as Integrated Gasification Combined-Cycle (IGCC). This technology, which may become used more frequently, involves converting coal into a gaseous fuel which is then purified and combusted in a gas turbine generator to produce electricity. Heat from the exhaust gas is recovered and used to generate steam to produce additional electricity. IGCC plants are more efficient than traditional steam electric plants. Most of the environmental benefits for this technology will be related to reducing air emissions. (U.S. EPA, 1997)

EPA will collect additional information on the prevalence of these types of facilities. Currently, EPA only has information on one IGCC plant located at the Polk Power Station in Florida. The 260 MW IGCC plant is considered a zero-discharge facility. A brine concentration unit handles all of the liquid wastes and the effluent is reused in the process. EPA will investigate topics related to IGCC plants during the development of the 2006 Plan. (www.tampaelectric.com/TEEVPowerPlantsIGCC.cfm)]

7.0 REFERENCES

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5. U.S. EPA, EPCRA Section 313 Industry Guidance Electricity Generating Facilities, EPA 745-B-00-004, Office of Pollution Prevention and Toxics, February 2000.

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9. U.S. EPA, Screening-Level Analysis Report. Washington, DC, 2005.

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