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# Utilities

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# *and* TRI

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*A Primer on  
Electric Utility Companies  
and EPA's  
Toxics Release Inventory*

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January 2006



## Foreword

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This primer has been prepared to inform the media, legislators, state and local officials, and the public about electric utility right-to-know reports. A typical coal-based power plant is used to illustrate how such plant operations result in releases of reportable substances under EPA's Toxics Release Inventory (TRI) program.

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Funding for this project was provided by the Edison Electric Institute®.

*This booklet was updated and revised in April 2001 and January 2006.  
It was published in its original format in March 1999.*



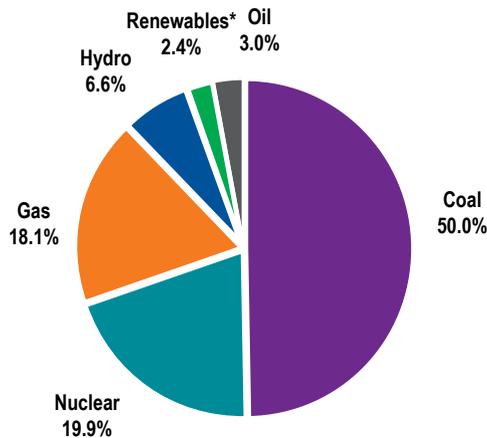
# Introduction

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Reliability is the hallmark of America’s electric power system. With very few exceptions, customers only need to flip a switch and the lights come on. It all seems very simple.

However, the generation of electricity is an industrial process involving large power plants and millions of tons of raw materials. The electric utility industry in the United States is a \$268-billion-a-year business — more than the chemical and steel industries combined.

Utilities produce most of the electricity in the United States by burning fossil fuels such as coal, natural gas, and oil. The combustion of fossil fuels results in releases of certain chemicals to the air, water, and land. A typical coal-based power plant burns millions of tons of coal each year and produces millions of pounds of releases.



*Half of our nation's electricity is generated from coal, an inexpensive fuel that exists in great quantities in the United States. Electric utilities burned nearly 1 billion tons of coal and over 209 million barrels of oil in 2004.*

\*Includes wind, solar, biomass, geothermal, and other non-hydropower renewable energy sources

Source: Energy Information Administration (EIA), 2004 preliminary data

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Since July 1998, most manufacturing industries have reported their air, water, and land releases under a federal program known as the Toxics Release Inventory (TRI). TRI is often referred to as the “right-to-know” program. Passed as part of the Emergency Planning and Community Right-to-Know Act of 1986, the right-to-know program requires industries to file annual reports on their releases of any of approximately 650 chemicals to the air, water, and land.

EPCRA, as the law is known, was intended to provide information to the pub-

lic on releases from industrial sources such as chemical plants. Congress did not include electric utilities in the original TRI program.

However, as part of the Clinton administration's attempt to broaden the scope of the right-to-know program, the U.S. Environmental Protection Agency (EPA) in May 1997 brought electric utilities and several other industries into the program and required them to report for the first time in July 1999.

Since then, additional changes to the TRI program include a final rule published by EPA in October 1999 that added seven chemicals and two chemical compound categories to the list of TRI chemicals. These chemicals are part of

### **The Right-to-Know Program in Brief**

The federal government established the Toxics Release Inventory or "right-to-know" program under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) in 1986. EPCRA was largely a response to a 1984 accident involving the release of a toxic chemical in Bhopal, India, and was meant to help communities in the United States avoid similar disasters and better prepare states and local communities in the event one did occur.

Under the right-to-know program, designated facilities must report annually on the amounts of any of approximately 650 "toxic" chemicals they release to the air, water, and land. A facility is required to report if it "manufactures" or "processes" 25,000 pounds or more of any listed chemical, or "otherwise uses" 10,000 pounds or more of any listed chemical. Lower thresholds exist for certain PBTs like mercury and dioxin.

According to the law, the term "manufacture" means to produce, prepare, import, or compound a toxic chemical. "Process" means to prepare a toxic chemical, after

it has been manufactured, for distribution in commerce. EPA rules define "otherwise use" to mean the use of a toxic chemical — including one contained in a mixture, a trade name product, or waste — that is not covered by the terms "manufacture" or "process." Congress originally required traditional manufacturing facilities — identified as those with Standard Industrial Classification (SIC) codes of 20 to 39, which include heavy industries like chemicals, petroleum refining, primary metals, fabricated metals, paper, plastic and transportation equipment — to report under the right-to-know program. It did not include electric utilities. In May 1997, EPA added seven new industries — including electric utilities that burn coal or oil — to begin reporting 1998 releases in 1999.

Of the approximately 650 chemicals listed under the right-to-know program, electric utilities will report on up to 70 that are released by coal- and oil-based power plants. In reporting year 2001, electric utilities and other industries began reporting PBTs. One reporting form is required for each listed chemical per facility.

a group of chemicals called persistent, bioaccumulative toxics, or PBTs. The rule also lowered reporting thresholds for 18 PBT chemicals in the TRI program, including a 10-pound threshold for mercury and a 0.1-gram threshold for dioxin and dioxin-like compounds. The lower mercury threshold meant that electric utilities began submitting mercury emissions data to the TRI program for the first time in 2001. In prior years, the industry fell far below the reporting thresholds for mercury, although some companies made their mercury data publicly available on a voluntary basis.

Industries covered by TRI must report releases of any substance that a facility “manufactures” or “processes” in quantities of at least 25,000 pounds or “otherwise uses” in quantities of at least 10,000 pounds. Lower thresholds exist for PBTs—100 pounds for PBTs, 10 pounds for “highly” PBTs, and 0.1 gram for dioxin and dioxin-like compounds.

Although the program is straightforward, right-to-know reports provide only raw data. Without any context or perspective, critics say the reports can be misleading — especially for power plant operations — because they do not:

- Explain that most reportable substances at concentrations released by coal- and oil-based power plants are not hazardous to public health. Federal and state operating permits require utilities to meet health-based standards.
- Allow readers to compare the costs associated with the potential further control of air, water, or land releases with the benefits of electricity.
- Provide information on the progress electric utilities have made in reducing releases from coal- and oil-based power plants.

## **Inside a Fossil Fuel Power Plant**

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Air, water, and land releases are the byproduct of the important mission of providing safe, reliable and inexpensive electricity to the nation’s homes and businesses. With today’s technology, it is impossible to meet the country’s enormous appetite for electricity without burning the fossil fuels that release some chemicals to the environment. To understand why, let’s step inside a typical 800-megawatt coal-fired power plant.

At any coal plant, the process of generating electricity begins outside the plant in the coal pile. An 800-megawatt power plant operating about 85 percent of the time – with the other 15 percent due to downtime and/or maintenance – can serve the needs of approximately 600,000 homes annually. To do so, it must burn

nearly three million tons of coal every year. Our plant burns bituminous coal from a mine that produces a soft coal characterized by high energy content, moderate levels of impurities such as sulfur and ash, and low moisture content. This bituminous coal is the most common form of coal used to generate electricity in the United States.

Coal, like other fossil fuels, burns because it contains carbon which has a high heating value. Coal also contains a small percentage of all the elements that were part of the world when it was created. These same materials — including things like hydrogen, oxygen, nitrogen, and chlorine as well as moisture and various minerals — are also present in rocks and soil.

When a pound of coal is burned, most of it turns into energy in the form of heat, but small amounts of natural chemicals like chlorine, fluorine, and sulfur turn into gas. Multiply even small amounts of these chemicals in the coal by three million tons burned, and it becomes clear why one coal plant can produce millions of pounds of releases in a year.

Although scientists have developed ways to make coal cleaner before it is shipped to a power plant, most of the materials that turn into air, water, and land releases remain in the fuel as it enters the plant because they occur naturally in the coal.

To make it burn more efficiently, coal is usually pulverized into a fine powder. The powder is sprayed into a boiler or furnace through vents in the wall, where it mixes with air and burns at temperatures exceeding 2,500 degrees Fahrenheit. Tubes filled with water surround the furnace, and the heat turns the water into steam.

In addition to turning most of the coal into heat, the combustion process also releases the other materials present in the coal. Once inside the furnace, these materials must leave through one of two exits: as a gas or fine particulate matter in “flue gas,” or as a solid in “bottom ash” that accumulates at the bottom of the furnace.

At most power plants, pollution control equipment removes particulate matter and other chemicals from the flue gas. After passing through the pollution control equipment, flue gas leaves the plant through its stacks. All coal-burning power plants have stacks, which can be as high as 1,000 feet. The stacks are designed to disperse air releases and consequently they reduce exposure to the general public and to the environment.

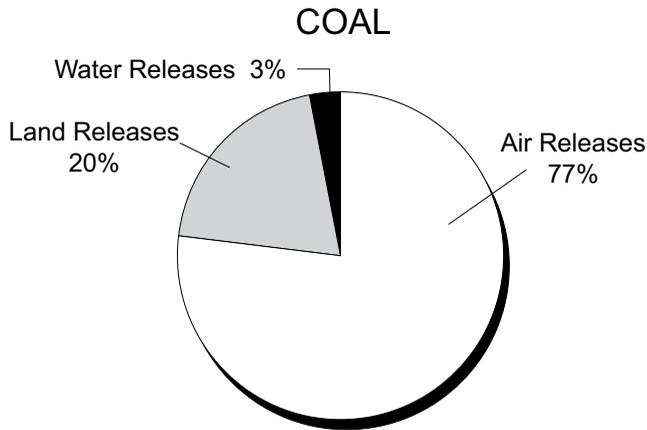
Similarly, releases to the water and land undergo various pollution control activities.

## Air Releases

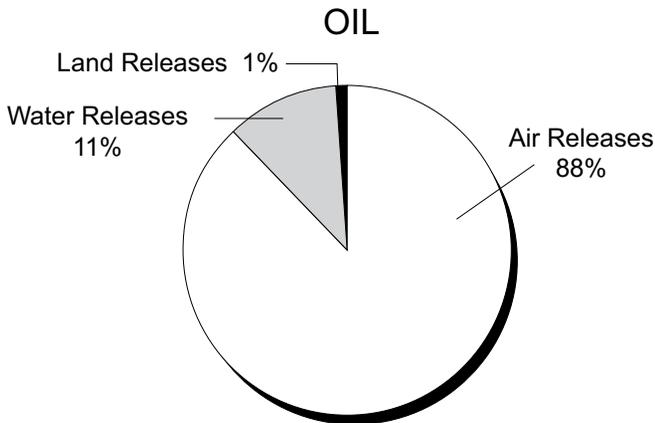
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Of the chemicals that leave a typical plant through its stacks, and therefore must be reported under the right-to-know program, by far the largest are diluted hydrochloric acid, hydrogen fluoride, and sulfuric acid. These substances do not exist naturally in coal. Instead, they are formed when chlorine, fluorine, and sulfur in

### Electric Utility TRI Releases



*For both coal- and oil-based power plants, air releases represent most of the reportable substances under the right-to-know program.*



the burning coal react chemically with other chemicals inside the furnace. Trace amounts of other reportable chemicals that are not captured by pollution control equipment may also leave the plant through the stacks.

EPA defines a “release” as any amount of a reportable chemical that leaves a facility. Power plant stacks are designed to disperse these gases in order to reduce human exposure. Right-to-know reports do not explain this, nor do they explain that the gases are released in very low concentrations that comply with plant operating permit requirements. These health-based permit requirements are designed to protect people and the environment.

Overall, air releases account for 77 percent of our coal plant’s reportable releases and 88 percent of a typical oil-based power plant’s reportable releases.

## **Water Releases**

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Water releases account for a small percentage of the substances a coal plant reports under the right-to-know law.

Although most substances that electric utilities must report are “manufactured” (as EPA defines the term) during the combustion process, such as hydrochloric acid, some are “otherwise used” to remove other releases or to clean and maintain equipment. These substances are responsible for many reportable water releases and may include ammonia, bromine, and chlorine.

Our coal plant is located on the bank of a river, from which it draws water used to produce steam and cool the steam after it passes through the plant’s turbine and generator. The plant also discharges water into the river on a regular basis to maintain proper water and pressure levels. Discharge water may contain small amounts of reportable chemicals. Our plant, like all fossil fuel power plants, has permits issued by the state and/or federal government to ensure that these “effluents” are discharged at levels that protect the health of the river and the public.

Overall, water releases account for three percent of our coal plant’s reportable releases. Water releases typically account for 11 percent of an oil-based power plant’s reportable releases.

## **Land Releases**

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Most reportable right-to-know substances released to land are present in the coal when it enters the furnace. These chemicals either settle in the ash at the bottom

of the furnace or are removed from flue gas by pollution control equipment.

Of the TRI substances that electric utilities are likely to report as land releases in bottom ash, fly ash, slag, and flue gas emission-control waste, most are metal compounds. They include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc.

Land releases, which account for 20 percent of our coal plant's reportable releases and one percent of a typical oil-based power plant's reportable releases, are maintained in landfills or other disposal facilities. They are designed to contain the discarded materials on-site, in compliance with federal and state standards, and to ensure that the right-to-know chemicals do not reach people or sensitive environments.

## **Electric Utility Releases in Perspective**

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The public has a right to accurate and meaningful information on the release of chemicals to the environment, and the utility industry is on record in support of reporting information that has technical and scientific merit.

Experts have pointed out that the TRI right-to-know program was originally created with manufacturing industries in mind, not electric utilities. The program also fails to put releases into proper perspective.

In interpreting right-to-know reports, it is useful to keep the following in mind:

*The industry's right-to-know reports should be placed into context of real health and environmental concerns.* Although certain electric utility releases will likely be very high, two things that are not included in TRI reports affect human health: exposure levels and toxicity. It is the purpose of this primer to provide context and to help the reader understand the information presented in right-to-know reports.

*Electric utilities have made significant progress in reducing all power plant releases.* In compliance with federal, state, and local laws, and through voluntary measures, the electric utility industry has made steady and significant progress in reducing power plant releases of all kinds. For example, electric utility releases of particulate matter, which may contain small amounts of metals included in the right-to-know program, declined significantly between 1970 and 1998. During the same period, the generation of electricity using coal and oil increased by 116 percent. These reductions have contributed to the general improvement in air quality that EPA reports each year.

*Electric utilities have reduced or eliminated the use of several listed chemicals.* EPA's efforts during the early 1990s to expand the right-to-know program prompted many electric utilities to develop pollution prevention programs that would eliminate listed chemicals from their facilities. For example, most plants have stopped using hydrazine as a boiler treatment, and many are using less ammonia. Plants also commonly recycle the antifreeze ethylene glycol as a way of reducing total usage.

*Right-to-know reports do not reflect human exposure or health risks.* They simply provide raw data on the total releases of certain substances from coal- and oil-based power plants. In its public information kit on the right-to-know program, EPA notes that there are several complex and important steps that must be taken before health risks can be estimated using data provided in right-to-know reports.

*Electric utilities have permits that control the release of any substance that may be harmful to human health.* These permits, which are issued either by state environmental agencies or the U.S. Environmental Protection Agency, allow releases only in amounts that protect human health and the environment. Electric utilities report on compliance with those permits and regulatory agencies conduct inspections to verify those reports. The information in the reports has always been publicly available.

*Coal- and oil-based power plant releases are regulated and managed by dozens of laws.* Because they provide only raw data, right-to-know reports do not reflect the positive benefits obtained under the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, and other federal, state, and local environmental laws. These laws are in place to ensure that electric utility releases of all kinds remain at levels that protect human health and the environment.

*Reportable releases reflect the country's economic health.* The use of inexpensive coal to generate most of the country's electricity has helped drive economic growth since early this century. Assuming that our nation's economic growth will continue to grow in tandem with electricity growth, utilities will burn more coal in existing plants and may need to build new plants as well. Therefore, total releases reported by electric utilities under the right-to-know program may increase in the future.

*Electric utility mercury emissions have decreased steadily since 1960.* Though overall electricity generation has increased dramatically over the years, utility mercury emissions have decreased. The latest data reveal that existing pollution control devices installed at power plants are removing, on average, about 40 percent of the mercury present in coal. The requirements of new regulations passed in 2005 to reduce acid rain, ozone and mercury emissions from coal-based power plants will further reduce mercury emissions from electric utilities.

# Appendix A

## Chemicals Utilities May Report Under TRI

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Of the nearly 650 chemicals included in the Toxics Release Inventory, electric utilities will likely report on one or more of the chemicals listed below. The number will depend on several factors, including whether their plants burn coal or oil, the characteristics of the fuel, and the type of pollution control equipment in place.

For most of the following chemicals, the primary release medium (air, water, land) is indicated.

**Ammonia** is not naturally present in coal or oil. Utilities use it to reduce emissions such as sulfur dioxide from flue gas leaving coal- and oil-based power plants through their stacks, to control the release of nitrogen oxides, and to protect against corrosion in power plant furnaces and cooling towers.

**Antimony and antimony compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Antimony releases will be primarily to the land.

**Arsenic and arsenic compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Arsenic releases will be primarily to the land.

**Barium and barium compounds** are naturally present in coal, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Barium releases will be primarily to the land. Barium compounds represent the largest single land release from most coal-based power plants.

**Beryllium and beryllium compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Beryllium releases will be primarily to the land.

**Bromine** is not naturally present in coal or oil. It is used to guard against the build-up of “biofouling agents” such as bacteria in power plant furnaces and cooling towers. Electric utilities may report bromine as a water release.

**Cadmium and cadmium compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Cadmium releases will be primarily to the land.

**Chlorine** is naturally present in coal but it is turned into hydrochloric acid in the furnace and reported as an air release (see “hydrochloric acid” below). Both coal- and oil-based power plants may use chlorine and chlorine dioxide to guard against

the build-up of “biofouling agents” such as bacteria in power plant furnaces and cooling towers. While electric utilities may have to file a report on chlorine and chlorine dioxide, releases are unlikely.

**Chromium and chromium compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Chromium releases will be primarily to the land.

**Cobalt and cobalt compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Cobalt releases will be primarily to the land.

**Copper and copper compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Copper releases will be primarily to the land.

**Dioxin and dioxin-like compounds** are generally believed to form during the combustion process. Dioxin also occurs naturally in the environment as a result of forest fires or volcanic eruptions. Dioxin is classified, in the TRI program, as a persistent, bioaccumulative toxic, or PBT.

**Ethylene glycol and glycol ethers** are sprayed on coal in outdoor storage yards to prevent it from freezing in winter weather.

**Hydrazine** is used to protect against corrosion in power plant furnaces and cooling towers.

**Hydrochloric acid** is created in gaseous form when inorganic chlorides that occur naturally in coal and oil are burned during the combustion process. Many utilities will release a large amount of hydrochloric acid aerosols. Hydrochloric acid releases will be primarily to the air.

**Hydrogen fluoride** is created in gaseous form when inorganic fluorides that occur naturally in coal are burned during the combustion process. Approximately 90 percent of the fluorides in coal are released as hydrogen fluoride through power plant stacks. Hydrogen fluoride releases will be primarily to the air.

**Lead** is naturally present in coal and oil, and collects in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Lead releases will be primarily to the land.

**Manganese and manganese compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste

during and after the combustion process. Manganese releases will be primarily to the land.

**Mercury** is a silver-colored metal that is liquid at room temperature. Small amounts of mercury are naturally present in soil and water, and collect in bottom ash, fly ash, slag, and flue gas during and after the combustion process. Mercury is classified, in the TRI program, as a persistent, bioaccumulative toxic, or PBT. Mercury releases will be primarily to the air.

**Nickel and nickel compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Nickel releases will be primarily to the land.

**Polycyclic aromatic compounds (PACs)** form during the incomplete burning of fossil fuels, garbage, and organic materials. PACs are classified, in the TRI program, as a persistent, bioaccumulative toxic, or PBT.

**Selenium and selenium compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Selenium releases will be primarily to the land.

**Silver and silver compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Silver releases will be primarily to the land.

**Sulfuric acid** is created in gaseous form when sulfur that occurs naturally in coal and oil is burned during the combustion process. Sulfuric acid releases will be primarily to the air.

**Thallium** is naturally present in coal, and collects in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Thallium releases will be primarily to the land.

**Vanadium and vanadium compounds** are naturally present in coal and oil, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Vanadium releases will be primarily to the land.

**Zinc and zinc compounds** are naturally present in coal, and collect in bottom ash, fly ash, slag, and flue gas emission-control waste during and after the combustion process. Zinc releases will be primarily to the land.



## Appendix B

### Major Federal Laws Governing Coal- and Oil-Based Power Plant Emissions

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Coal- and oil-based power plants are monitored and regulated by more than a dozen federal environmental laws, and by hundreds of state and local laws. This section briefly describes the relevant provisions of the major federal environmental laws that directly impact releases from coal-based power plants. State and local laws may not be less stringent than these federal laws, but they may be more stringent. For more information on state and local statutes, contact your state's environmental regulatory agency.

#### *Clean Air Act*

The original Clean Air Act of 1970 placed controls on, and created standards and regulations for, emissions from mobile (vehicle) and stationary (power plant, industrial facility) sources. Congress has amended the Act many times, including major amendments in 1977 and 1990. In general terms, the Act:

- Requires EPA to establish National Ambient Air Quality Standards (NAAQS) for “criteria” pollutants like sulfur dioxide, ozone (nitrogen oxides), and lead. These NAAQS are set at levels to protect people as they breathe “ambient” air — the air around them.
- Requires EPA to establish standards for industries that release any of 188 Hazardous Air Pollutants (HAPs), and to conduct a study of HAPs releases from electric utility steam generating plants. That study, completed in 1998, shows that HAPs releases from electric utilities generally are not a public health concern. Additionally, the requirements of new regulations passed in 2005 to reduce acid rain, ozone and mercury emissions from coal-based power plants will further reduce mercury emissions from electric utilities.
- Requires EPA to set more stringent rules — known as New Source Performance Standards (NSPS) — for power plants and other stationary sources that are built or modified after publication of those standards.

#### *Clean Water Act*

Originally known as the Federal Water Pollution Control Act of 1948, Congress totally revised this law in 1972 and again in 1987, giving it the name by which it is known today. The law directs the EPA to establish limits on the amounts of specific “effluents” (releases to water) that may be discharged from industrial facilities. The Act addresses most water pollution issues, with a special emphasis on surface water.

The EPA has authorized approximately 40 states to issue discharge permits to industrial facilities based on limits contained in the Act. EPA issues permits for facilities in other states directly. Individual facilities, including coal- and oil-based power plants, are responsible for monitoring and reporting on their effluents, and they are subject to inspection at any time by state or federal regulators. In essence, any discharge not specifically allowed by a permit is considered unlawful, and the Act sets penalties for facilities that are found to be out of compliance.

The effluents covered by the law and discharged by coal- and oil-based power plants include: nutrients, sediment, oil and grease, chlorine, and metals such as arsenic, cadmium, nickel, and mercury. Electric utilities will report the amount of some of these effluents under the right-to-know program, although reportable substances emitted to water represent a small fraction of overall coal- and oil-based power plant releases.

### ***Emergency Planning and Community Right-to-Know Act***

Section 313 of this law, enacted in 1986, requires certain industrial facilities to report to the EPA annually on the amounts of approximately 650 substances they release to the air, water, and land, as well as off-site transfers. A facility must report under Section 313 if it “manufactures” or “processes” 25,000 pounds or more of any designated substance, or “otherwise uses” 10,000 pounds or more of any designated substance. Under EPA’s PBT reporting requirements, which took effect in 2001, the reporting threshold is 100 pounds for a PBT, 10 pounds for a “highly” PBT, and 0.1 gram for dioxin and dioxin-like compounds.

The original law did not include electric utilities. In May 1997, EPA issued a new rule requiring electric utilities and six other previously excluded industries to begin reporting in 1999. One form is required for each “reportable substance,” of which most coal- and oil-fired power plants will have between 10 and 20.

### ***Resource Conservation and Recovery Act***

RCRA, the federal waste management law, covers nearly all types of solid waste. RCRA’s primary function is to manage the generation, handling, transportation, and disposal of hazardous waste. RCRA assigns EPA the responsibility for determining if a waste qualifies as hazardous.

EPA has studied solid wastes created by the combustion of coal, and classifies it as non-hazardous. Power plant solid waste is therefore not subject to the hazardous waste provisions of RCRA. Instead, utilities dispose of it in permitted facilities that must comply with the non-hazardous waste provisions of RCRA or comparable state programs. This solid waste contains some substances that are reportable under the right-to-know program.



