CLEAN AIR TASK FORCE

Dedicated to restoring clean air and healthy environments through scientific research, public education and legal advocacy.

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Health Impacts of Air Pollution from Washington DC Area Power Plants

SUMMARY

For more than three decades, the nation's oldest and dirtiest power plants have avoided meeting tighter air pollution standards that new plants must meet. Power plants release a number of air pollutants, including soot-like particles known as fine particulate matter. Researchers at the Harvard School of Public Health examined the health impacts of fine particulate matter released by power plants near Washington DC. The study by Jonathan Levy, Susan Greco, and John Spengler examined five power plants: Benning, Chalk Point, Dickerson, Possum Point, and Potomac River. The key findings include:

- Over 250 deaths per year are linked to fine particulate matter from the five plants. Approximately 20 of these deaths are estimated to occur in Washington DC, 40 in Virginia, 60 in Maryland with the remainder occurring in nearby states. The impacts vary based upon the plant's size and proximity to population. Chalk Point was estimated to have the largest impact (about 100 deaths per year).

- If the five plants used readily available pollution control equipment, approximately 75% of the current deaths, asthma attacks, emergency room visits, and hospitalizations could be avoided.

- Disadvantaged groups are especially vulnerable to air pollution. Disadvantaged groups are more impacted from the five plants' emissions and receive more benefits from reducing their pollution than the population as a whole.
  - Although only 25% of the population studied has less than a high school education, this group suffers about half of the mortality impacts attributed to the plants.
  - While 21% of the population of children studied are African-American, they account for more than half of the incidents of pediatric asthma related emergency room visits attributed to the plants' emissions.
  - Diabetics comprised only 13% of the elderly population studied, yet they account for more than half of the incidents in elderly cardiovascular hospital admission reductions attributed to the plants.

Policy Implications

Requiring power plants to reduce air pollution would yield tremendous improvements in air quality and public health. Local impacts of power plants are significant, and vulnerable groups bear a disporpotiante risk. All power plants must meet modern emission standards.

INTRODUCTION

Aging power plants are among the nation's largest sources of air pollution. In 1999, they contributed almost 68% of the sulfur dioxide and 23% of the nitrogen oxide emitted in the United States according to USEPA data.

When Congress amended the Clean Air Act in 1970 and 1977, older power plants-- many built in the 1950's, 1960's, and 1970's, -- were exempted from the most stringent emission standards. It was assumed that these plants would close soon and be replaced with cleaner,

newer plants. But few of these plants closed, and today these older plants produce the bulk of the nation's electricity.

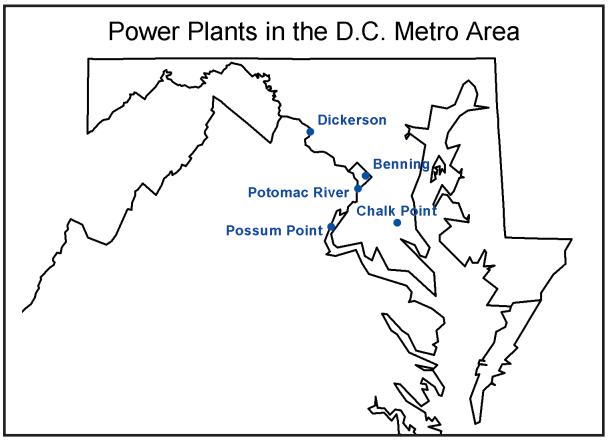
In 1996, researchers at the Harvard School of Public Health began a series of studies aimed at estimating the health impacts of air pollution from specific power plants. The principal authors of these studies, Jonathan Levy and Jack Spengler, examined impacts such as deaths, hospitalizations, asthma attacks, and other serious health outcomes. The Levy and Spengler studies generally focused on only one of many air pollutants from power plants-- fine particulate matter. Fine particulate matter (PM2.5) is composed of small soot-like particles that are a fraction of the width of a human hair. Fine particles can be directly emitted by power plants, but most form downwind as sulfur dioxide and nitrogen oxide gases react with ammonia to form sulfate and nitrate particles.

Levy and Spengler took the results from previous studies of air pollution health effects and combined them with the results of computer models that estimate pollution concentrations due to the emissions from each power plant. From this information, they were able to predict health impacts of each power plant they studied. Their earlier work was supported by Toyko Gas and Owens Corning, and their most recent studies were supported by the Clean Air Task Force with a grant from the Pew Charitable Trusts.

RESULTS

The Harvard researchers examined five fossil-fuel power plants within 50 miles of Washington DC. These plants-- Benning, Chalk Point, Dickerson, Possum Point, and Potomac River-- burn coal as their primary fuel, with some burning oil as well. Possum Point is undergoing modifications to convert some units to burn natural gas, which will lower its emissions. The plants range in size from 480 MW to over 2200 MW. Their location is shown in Figure 1.

FIGURE 1

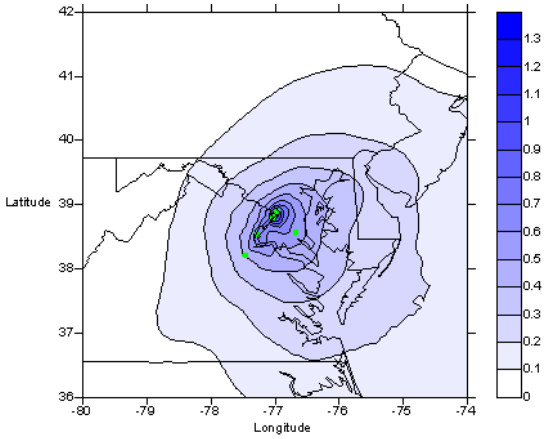


Impacts on the General Population

The five plants together contribute a maximum of 1.4 micrograms per cubic meter of fine particulate matter on an annual basis to the region around the plants. As shown in Figure 2, the concentrations from all plans combined peaked fairly close to the cluster of the plants.

FIGURE 2

Five Power Plants, total PM.5 (primary plus secondary), current impacts (ug/m3, annual average):



Levy, Greco, and Spengler attribute over 250 deaths *per year* to the five plants based on their emissions in 1999. Approximately 20 of these deaths occur in Washington DC, 40 in Virginia, and 60 in Maryland. The Harvard researchers also calculate that each year, these five plants trigger approximately:

- 20,000 asthma attacks,
- 4,000 emergency room visits, and
- 300 hospitalizations.

If the plants were to cut their sulfur dioxide and nitrogen oxide emissions to levels that can be achieved using readily available pollution controls, approximately 75% of the deaths and disease attributed to the five plants could be avoided. Table 1 summarizes the health impacts for each plant for both current conditions and the benefits if the plants emitted less pollution, using the estimates from Levy et al. that do not consider differential effects on disadvantaged populations. These impacts are in a study area covering about 47 million people within a 250 mile radius of the plants.

TABLE 1

Attributed Plant Impacts and Benefits

	Premature Deaths		Hospital Admissions		Emergency Room Visitis		Asthma Attacks	
	Current Impacts	**Lives Saved by Reduced Emissions**	**Current Impacts**	**Hospital Admissions Prevented by Reduced Emissions**	**Current Impacts**	**ER Visits Prevented by Reduced Emissions**	**Current Impacts**	**Asthma Attacks Prevented by Reduced Emissions**
Benning	2	1	3	1	34	19	180	99
Chalk Point	100	79	110	82	1,400	1,100	7,400	5,700
Dickerson	50	41	53	43	700	570	3,700	3,000
Possum Point	50	39	57	44	750	580	3,900	3,000
Potomac River	59	38	66	43	870	560	4,600	3,000

Impacts on Vulnerable Groups

Previous studies have shown that some groups are more vulnerable to air pollution than others. For example, people with lower education may be at higher risk from dying because of air pollution exposure. To better understand how the burden of these impacts are borne by groups who are especially vulnerable to air pollution, the study changed the baseline model's homogeneous population assumption to account for differences in population characteristics. Specifically, the study looked more closely at a several specific health impacts and how they affect three key groups:

- *Mortality and how deaths are distributed by educational level*. Educational attainment is a surrogate measure for a number of factors that influence mortality such as economic status, early childhood health, and supportive networks of family and friends.
- *Pediatric asthma emergency room visits and how these visits are distributed among African-American children.* African-Americans are at higher risk for asthma and for having episodes that require use of the emergency room than the general population as a whole.
- *Cardiovascular hospital admissions among the elderly and how these admissions are distributed among the elderly who have diabetes.* Diabetics are at higher risk for heart disease and hospital admissions when compared to the general population.

Accounting for susceptible groups did not significantly change the total quantity of damage, but did impact the distribution of who was harmed and who benefited if emissions from the plants are reduced.

- Although only 25% of the population studied have less than a high school education, this group suffers about half of the mortality impacts and receives about half the benefits in lives saved when emissions are reduced using readily available pollution controls.
- While 21% of the population of children studied are African-American, they account for about 64% of the pediatric asthma related emergency room visits when emissions are reduced using readily available pollution controls, and about the same percentage of the visits attributed to current power plant emissions.
- While diabetics comprised only 13% of the elderly population studied, they account for about 54% of the cardiovacular hospital admission benefits when emissions are reduced using readily available pollution controls, and about the same percentage of the admissions attributed to current power plant emissions.

Table 2 summarizes the estimates from the Levy et al. study when they used information on vulnerable groups.

TABLE 2

Distribution of Attributed Impacts and Benefits on Vulnerable Groups

	Current Impacts	Benefits from Reduced Emissions	Vulnerable Groups
Mortality	310	230	Although only 25% of the population studied have less than a high school education, this group gets half of the mortality impacts and benefits.
Pediatric Asthma Emergency Room Visits	210	150	While 21% of the population of children are African-American, they receive 64% of the impacts and benefits in pediatric asthma related emergency room visits.
Cardiovascular Hospital Admissions among the elderly	80	60	While diabetics comprised only 13% of the elderly population, they accounted for about 54% of the impacts and benefits in cardiovascular hospital admissions.

STUDY DESIGN

Over the last decade, a growing body of scientific studies has linked current levels of soot in our air to death and disease. These studies tracked thousands of people in cities across the nation who were exposed to different levels of soot in their air. By factoring out differences such as age, smoking, and occupation, these studies establish that people who live in areas with polluted air suffer greater health damage than people who live in areas with cleaner air.

Levy, Greco, and Spengler used these studies to determine how the risk of health damage varies as fine particle concentration changes in the air. Then using state-of-the art computer models, the Harvard researchers estimated the concentration of particulate pollution at ground-level from specific power plants on an annual basis. They calculated the number of deaths, hospitalizations, asthma attacks and other serious health impacts attributable to these plants by combining:

- Fine particulate matter concentration at ground level derived from computer modeling.
- Health risk associated with fine particulate matter concentration
- Census data showing the number people exposed in the region around the plants.

Levy, Greco, and Spengler examined the health impacts attributable to these plants under two emissions scenarios: 1) current emissions (1999), and 2) a hypothetical case assuming the plants were to reduce emissions by applying Best Available Control Technology. This second scenario assumed the plants reduced emissions to sulfur dioxide emissions down to .3 lb/MMBTU, nitrogen oxide emissions down to .15 lb/MMBTU, and .01 lb/MMBTU of PM10. Table 3 summarizes the characteristics of the plants. The Harvard researchers estimated the number of deaths, hospital admissions, emergency room visits and asthma attacks for each plant in each scenario. They considered the impacts of differences among the populations. First, the impacts on the population as a

whole were estimated assuming the population was homogeneous. However, some groups of people within the general population are especially vulnerable to air pollution's effects. These people could bear a greater share of power plant health impacts. Next the study considered heterogeneity by looking at a subset of damages and how they impacted vulnerable groups. The study evaluated three cases: 1) Mortality and how deaths are distributed by educational level, 2) Pediatric asthma emergency room visits and how these visits are distributed among African-American children, and 3) Cardiovascular hospital admissions among the elderly and how these admissions are distributed among the elderly who have diabetes.

TABLE 3
Plant Characteristics

Plant	Current Owner 1.	Capacity (MW) 1.	SO_2 1999 (tons) 2.	SO_2 Rate 1999 (lb/MMBTU) 2.	NOx 1999 (tons) 2.	NOx Rate 1999 (lb/MMBTU) 2.
Benning	Potomac Power Resources	550	1,432	0.87	447	0.27
Chalk Point	Mirant Corp	2283	57,634	1.30	6,084	0.14
Dickerson	Mirant Corp	1178	30,641	1.72	10,956	0.62
Possum Point	Virginia Electric Power	1251	19,497	1.35	5,116	0.35
Potomac River	Mirant Corp	480	17,627	1.10	6,893	0.43

1. United States. Energy Information Administration. Form 767. Spring 2002 <http://www.eia.doe.gov/>
2. United States. Environmental Protection Agency. CEMS data in Acid Raid Scorecard. Spring 2002 <http://epa.gov/airmarkets/emissions/score00/index.html>. Table B1

Sources

Levy, Jonathan I. Briefing on Health Impacts of Power Plants: Case Studies in Massachusetts, Illinois, and Washington DC. United States Senate Environment and Public Works Committee. Senate Office Building. May 17, 2002.

Levy, Jonathan I., Susan L. Greco, and John D. Spengler. "The Influence of Population Heterogeneity on Air Pollution Risk Assessment: A Case Study of Power Plants Near Washington, DC." In press, Environmental Health Perspectives (2003).

United States. Environmental Protection Agency. EPA AIRs Data. <http://www.epa.gov/air/data/net.html>. For SO2 in 1999: 12,738,813 tons out of 18,884,520 or 67.5%. For NOx in 1999: 5,732,256 tons out of 25,394,985 or 22.5%.

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