ENVIRONMENTAL LAW & POLICY CENTER

Midwest Generation's "Unpaid Health Bills":
The Hidden Public Costs of Soot and Smog From the Fisk and Crawford Coal Plants in Chicago

Executive Summary

Midwest Generation's very old, highly-polluting Fisk and Crawford coal plants in Chicago are located in more densely populated communities than are any other coal plants in the United States. Using equipment built between 1958 and 1961, they are some of the oldest coal plants operating in the nation. The Federal Clean Air Act allows coal plants constructed before 1976 that have not since been modified to defer achieving the more stringent pollution limits that are imposed on newer plants. This includes emission limits on pollutants such as particulate matter, among others.

Particulate matter (PM) is a complex mixture of diverse solid and liquid particles suspended in the air that cause soot and smog. Chronic exposure to PM can cause serious health problems and premature deaths. PM is directly emitted from coal plants, diesel trucks and locomotives as a by-product of combustion (primary PM) or distally created as other pollutants interact in the atmosphere (secondary PM). Even though pollution from coal plants demonstrably harms human health and the environment, many of the resulting economic costs are "hidden" and externalized to the public. The sound economic "polluter pays principle" calls for coal power owners and other polluters to internalize these costs.

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The U.S. Environmental Protection Agency (U.S. EPA) and other authoritative scientific panels have found PM to be among the most serious and costly public health harms from coal plant pollution.

- On July 6, 2010, the U.S. EPA proposed the Clean Air Act Transport Rule, which would require 31 states and the District of Columbia to significantly improve air quality by reducing power plant emissions that contribute to ozone and fine PM pollution in other states. According to the U.S. EPA: "The proposed rule would yield more than $120 to $290 billion in annual health and welfare benefits in 2014, including the value of avoiding 14,000 to 36,000 premature deaths. This far outweighs the estimated annual costs of $2.8 billion" (emphasis added). Other estimated health benefits include

avoiding 21,000 cases of acute bronchitis, 23,000 nonfatal heart attacks, 26,000 hospital and emergency room (ER) visits, 1.9 million days when people miss work or school, 240,000 cases of aggravated asthma, and 440,000 cases of upper and lower respiratory symptoms.

- In December 2009, the Integrated Science Assessment on PM prepared for the U.S. EPA found sufficient scientific evidence to conclude that fine PM causes premature mortality and cardiovascular effects, is likely to cause respiratory effects, and may cause cancer and reproductive and developmental harms, even at levels far below the U.S. EPA's air quality standards.

- In 2006, the U.S. EPA tightened fine PM air quality standards from 65 to 35 micrograms per cubic meter of ambient air ($\mu g/m^3$) to prevent thousands of premature deaths each year and create health and visibility benefits worth billions of dollars annually. More recent scientific studies and policy assessments by the U.S. EPA point to strengthening the national ambient air quality standards for PM in order to further reduce the related health damages.

The National Research Council's recent study applied an economic model to estimate damages caused by air pollution at 406 coal plants across the nation. Using 2005 pollution emissions from the Fisk and Crawford coal plants, the Council determined that the **health- and environmental-related damages from these coal plants cost the public in excess of $127 million (in 2010 dollars) per year**. These costs primarily result from harms to human health in and around Chicago, up to 200 miles from the plants. The cost estimates do not include individual coal plants' contributions to more widespread environmental problems, such as global climate change. Coal plants are the largest single domestic source of greenhouse gas pollution; however, fully estimating the costs of climate change impacts was beyond that study.

The health- and environmental-related damages from these coal plants cost the public in excess of $127 million per year.

A vast body of scientific research shows that the Fisk and Crawford coal plants' pollution causes serious harm to public health and imposes high economic costs. Beginning in 2002, the Environmental Law & Policy Center and other organizations have drawn public attention to the Harvard School of Public Health's Illinois Power Plant Study and its estimates of premature deaths and illnesses caused by Fisk and Crawford. Yet, these plants have been allowed to continue polluting Chicago's air and, consequently, harming public health. Over the eight years since these harms were modeled and publicized, the continued Fisk and Crawford coal plant pollution may have caused about $750 million to $1 billion (in 2010

dollars) in health and related damages according to the National Research Council model. These mounting costs have not generally been considered in the public debate over pollution from the Fisk and Crawford coal plants. Nor have the costs of this pollution been internalized and incorporated into the cost of the electricity generated and sold by Midwest Generation from these coal plants.

The high health and environmental costs imposed on the public by the Fisk and Crawford coal plants should be more fully considered by policymakers and the general public in making informed decisions about how these coal plants located within the City of Chicago should be operated and regulated. These costs – or measures taken to avoid them – should be the responsibility of the cost-causer, Midwest Generation, which owns and operates these plants.

Introduction

The Fisk and Crawford coal plants operate in the predominantly Latino neighborhoods of Pilsen and Little Village in Chicago. Fisk is a one-unit 326 MW coal plant, which was originally built in 1903 and then rebuilt in 1959. Crawford is a two-unit 532 MW coal plant, which was built in 1958 and 1961. Midwest Generation has largely failed to install modern pollution controls on these coal plants. They emit far more pollution than newer coal plants that meet the federal air quality standards designed to protect public health.

The population within one- and three-mile radii of these coal plants is higher than that for any other coal plant in the U.S. Fisk's and Crawford's pollution affects the health of people across the Chicago area and over 100 miles away.[1] More than 300,000 people live within three miles of each of these coal plants, and more than 12 million people live within 100 miles.[2] Even larger numbers of people are affected when occupational and recreational exposures are considered.

Numerous scientific studies have demonstrated that the PM-forming emissions from coal plants cause significant public health harms – premature deaths as well as cardiovascular, respiratory and neurological problems – and related costs.[3] The increased mortality and

[1] National Research Council, Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use (2010) (Hidden Costs of Energy); Levy, J., et al., "Using CALPUFF to evaluate the impacts of power plant emissions in Illinois: model sensitivity and implications," 36 Atmospheric Environment 1063 (2002) (Harvard School of Public Health Illinois Power Plant Study).

[2] US Census 2000; SourceWatch, "Coal plants near residential areas" (Coal plants near residential areas) http://www.sourcewatch.org/index.php?title=Coal_plants_near_residential_areas

[3] Hidden Costs of Energy, supra; U.S. EPA, "Integrated Science Assessment for Particulate Matter" (Dec. 2009) (Integrated Science Assessment) http://cfpub. EPA.gov/ncea/cfm/recordisplay.cfm?deid=216546; Abt Associates, Power Plant Emissions: Particulate Matter-Related Health Damages and the Benefits of Alternative Emission Reduction Scenarios (2004).

morbidity causes both human suffering and billions in economic costs annually – lives lost, hospital admissions, ER and doctor visits, medications, lost work and school days, restricted activity days, etc.

Since 2002, the Environmental Law & Policy Center and other organizations have drawn attention to the Harvard School of Public Health's Illinois Power Plant Study.[4] The study, published in the peer-reviewed, academic journal Atmospheric Environment, quantified the potential health benefits of reducing air pollution from older coal plants in Illinois. The study applied atmospheric dispersion models to estimate the incremental contributions of coal plants to ambient concentrations of PM, sulfates and nitrates. Together with an earlier study of mortality and morbidity concentration-response functions by Harvard School of Public Health researchers,[5] the models estimated the following annual human health harms caused by pollution from the Fisk and Crawford coal plants: 41 premature deaths, 550 emergency room visits, 2,800 asthma attacks and 36,000 minor restricted activity days.

The increased mortality and morbidity causes both human suffering and billions in economic costs annually.

The scientific evidence on public health harms and costs from coal plant pollution led the U.S. EPA to tighten limits on PM emissions and, under the 1977 Amendments to the Clean Air Act, to impose stricter standards for new coal plants.[6] However, many older coal plants claim to be "grandfathered" or exempted from federal regulations on PM emissions under the Clean Air Act.[7] In 1977, coal plant owners persuaded Congress that the older plants would soon be retired and replaced by new, cleaner facilities, and thus it would not be economically justified to require pollution control retrofits on the soon-to-be-retired old coal plants. However, more than thirty years later, Fisk, Crawford and many other old, highly-

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[4] Harvard School of Public Health Illinois Power Plant Study, supra.

[5] Levy, J., et al., "Development of a new damage function model for power plants: methodology and applications," 33 Environmental Science and Technology 4364 (1999) See also estimates published in September 2010 by the Respiratory Health Association of Metropolitan Chicago, "Health impacts on Chicago region from coal-fired power plant emissions" (annual impacts of Fisk and Crawford combined: 42 deaths, 31 hospital admissions, 66 heart attacks, 720 total asthma attacks, 26 chronic bronchitis cases, and 45 asthma ER visits) (Respiratory Health Association) http://www.lungchicago.org/site/files/487/104182/360615/492996/RHAMC_Quick_Facts_Power_Plants_9_9_10.pdf (citing Clean Air Task Force, The Toll From Coal (Sept. 2010)).

[6] Ackerman, F., et al., "Grandfathering and coal plant emissions: the cost of cleaning up the Clean Air Act," 27 Energy Policy 929 (1999); Hsu, S., "The Real Problem with New Source Review," 36 Environmental Law Reporter 10095 (2006); U.S. EPA, "Implementation of the New Source Review (NSR) Program for Particulate Matter Less than 2.5 Micrometers ($PM_{2.5}$)," 73 Fed. Reg. 28321 (2008).

[7] The federal government brought enforcement actions contending that these plants have been modified, triggering the more stringent Clean Air Act requirements. An enforcement action was brought in 2009 against Midwest Generation, including the Fisk and Crawford coal plants.

polluting coal plants continue to operate, cumulatively causing billions of dollars in health and environmental costs each year. Because of this gap in federal regulations and the high human health and environmental costs, several state and local governments have acted to require that the older coal plants be cleaned up or shut down.

In 2006, as a result of a successful public advocacy campaign led by the Environmental Law & Policy Center and medical, public health, environmental and children's advocacy organizations, the Illinois Pollution Control Board issued an order requiring Midwest Generation to reduce its toxic mercury emissions at Fisk and Crawford (and its other coal plants in Illinois) by installing modern pollution controls for mercury. A related order provides for actions to reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), which form secondary PM. Requirements to reduce SO_2 or close the plant do not go into effect until the end of 2015 for Fisk; Midwest Generation must close or install additional SO_2 control equipment at the Crawford plant (the larger of the two plants) by the end of 2018. The agreement sets January 1, 2019 – over 12 years after it was announced – as the deadline for Midwest Generation to reduce its SO_2 emissions by about 80%. The Orders do not address the coal plants' direct emissions of PM (primary PM) or carbon dioxide.[8]

The Illinois agreement sets January 1, 2019 – over 12 years after it was announced – as the deadline for Midwest Generation to reduce its SO_2 emissions .

Section I below summarizes the scientific and economic findings on the public health benefits of reduced PM-forming emissions from coal plants. Recent authoritative scientific panels and studies have concluded that: (1) reducing PM pollution from coal plants over a wide range of ambient concentrations will benefit public health, and (2) the "hidden" costs of pollution from coal plants are high.

Section II below presents estimates of the damages caused by the Fisk and Crawford coal plants using the model applied by the National Research Council in its 2010 report. That model estimates that the Fisk and Crawford coal plants cause more than $127 million (in 2010 dollars) in health and environmental damages annually, based on 2005 emissions and excluding damages related to climate change.[9] High levels of harmful emissions from

[8] Midwest Generation LLC SEC Form 10-K (filed March 1, 2010) 18; Office of the Illinois Governor News Release, "Gov. Blagojevich announces historic agreement with Midwest Generation to reduce power plant pollutants and deliver dramatic clean air benefits" (Dec. 12, 2006) http://www.illinois.gov/pressreleases/ShowPressRelease.cfm?SubjectID=2&RecNum=5591 .

[9] Hidden Costs of Energy, supra, at 82-99; data provided by National Research Council's Public Access Records Office. Other damages are comprised of certain environmental damages and resulting costs to industry, including agriculture, forestry and other sectors (see Section I.C). Failure to capture many other environmental costs, such

these old coal plants have continued, likely resulting in about $750 million to $1 billion (in 2010 dollars) in health and related damages over the eight years since the release of the Harvard School of Public Health's Illinois Power Plant Study.

Section I: Recent Authoritative Scientific Panels Have Concluded that Particulate-Forming Emissions from Coal Plants Harm Public Health

The findings by the U.S. EPA in 2006 and 2010, the Integrated Science Assessment for the U.S. EPA in 2009 and the National Research Council in 2010 on the health impacts of PM pollution from coal plants demonstrate the need to consider the hidden costs imposed on the public. Coal plants emit both primary PM and pollutants forming secondary PM. Primary PM, which exists as both fine ($PM_{2.5}$, with a diameter of less than 2.5 microns) and coarse (PM_{10}, with a diameter of up to 10 microns) particles, is generated as a combustion by-product and emitted directly from coal plants' smokestacks. Secondary $PM_{2.5}$ is formed when SO_2 and various NO_x molecules undergo chemical transformations in the atmosphere. $PM_{2.5}$ can travel long distances in the air and is of greater health concern than PM_{10}.

Nationally, coal plants are the largest source of SO_2 emissions and among the largest sources of NOx emissions, although other economic sectors also contribute to the pollution problem.[10] The amount of SO_2 emissions from a coal plant depends on the sulfur content in the coal burned and the pollution controls installed at the plant.

A. U.S. EPA's 2010 Proposed Clean Air Act Transport Rule

On July 6, 2010, the U.S. EPA proposed its Clean Air Transport Rule,[11] which would require 31 states and the District of Columbia to improve air quality significantly by reducing emissions that contribute to ozone and fine particle pollution in other states.[12] The proposal would require significant reductions in SO_2 emissions (71 percent below 2005 levels) and NO_x emissions (52 percent below 2005 levels) that cross state lines by 2014, with mandatory reductions starting in 2012.

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as climate change, acid rain, and eutrophication of aquatic ecosystems, is a significant limitation of the models available for this report by underestimating the costs of the coal plants' pollution.

[10] U.S. EPA, Multipollutant Emission Control Technology Options for Coal-fired Power Plants at 1-2, 2-1, 2-2, 2-3 (2005).

[11] The Clean Air Transport Rule responds to a court decision remanding the Clean Air Interstate Rule (CAIR) that was issued by U.S. EPA in 2005. North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008). U.S. EPA estimated that, across 28 eastern states and the District of Columbia, CAIR would reduce SO_2 emissions by over 70 percent and NO_x emissions by over 60 percent from 2003 levels. According to U.S. EPA, this would result in $85 to $100 billion in health benefits and nearly $2 billion in visibility benefits per year by 2015, providing health and environmental benefits valued at more than 25 times the cost of compliance. http://www.epa.gov/CAIR/.

[12] EPA, "Fact Sheet: Proposed Transport Rule Would Reduce Interstate Transport of Ozone and Fine Particle Pollution" (July 6, 2010) http://www.epa.gov/airquality/transport/pdfs/FactsheetTR7-6-10.pdf (EPA 2010 Fact Sheet).

Following extensive analysis of scientific studies and modeling,[13] the U.S. EPA determined that the emissions reductions from the proposed Transport Rule would lead to significant annual health benefits. The U.S. EPA estimates that in 2014 the Transport Rule would protect public health by avoiding:[14]

- 14,000 to 36,000 premature deaths,
- 21,000 cases of acute bronchitis,
- 23,000 nonfatal heart attacks,
- 26,000 hospital and ER visits,
- 1.9 million days when people miss work or school,
- 240,000 cases of aggravated asthma, and
- 440,000 cases of upper and lower respiratory symptoms.

According to the U.S. EPA's estimates based on valuing the mortality and morbidity benefits, the proposed Transport Rule would achieve more than $120 to $290 billion in annual health and welfare benefits in 2014.

The annual health benefits of this rule far outweigh the estimated annual direct costs of $2.8 billion to the power sector to comply with the rule. The U.S. EPA anticipates that power plants may use the following to achieve emission reductions:[15]

- Operate already installed control equipment more frequently,
- Use low sulfur coal, or
- Install control equipment such as low NOx burners, Selective Catalytic Reduction, or scrubbers (Flue Gas Desulfurization).

The proposed Transport Rule is subject to comments by interested parties and final action by the U.S. EPA. The U.S. EPA anticipates adoption of the rule in 2011 with mandatory reductions starting the following year.[16]

[13] EPA, "Regulatory Impact Analysis for the Proposed Federal Transport Rule" (June 2010) http://www.epa.gov/ttn/ecas/regdata/RIAs/proposaltrria_final.pdf (Regulatory Impact Analysis). EPA recognized that there are limitations in its ability to model the health damages from power plant emissions and to quantify the benefits of reducing emissions. As for the implications of these uncertainties, EPA observed: "There are some costs and important benefits that EPA could not monetize. Upon considering these limitations and uncertainties, it remains clear that the benefits of the proposed Transport Rule are substantial and far outweigh the costs." Id. at 1.

[14] EPA 2010 Fact Sheet, supra, at 4.

[15] Id. at 5.

[16] U.S. EPA, "Proposed Air Transport Rule" 22, 28 (July 26, 2010) http://www.epa.gov/airtransport/pdfs/TRPresentationfinal_7-26_webversion.pdf .

B. U.S. EPA's Revised National Standard for Particulate Matter (2006)

In 2006, the U.S. EPA concluded its review of national ambient air quality standards for PM.[17] The Agency noted that thousands of new scientific studies of the health effects of PM were published and peer-reviewed since the Agency last adopted particulate standards in 1997. The U.S. EPA found that exposure to $PM_{2.5}$ caused the following health effects:[18]

Health effects associated with short-term exposure to $PM_{2.5}$:

- Premature death in people with heart and lung disease
- Non-fatal heart attacks
- Increased hospital admissions, ER visits and doctor's visits for respiratory diseases
- Increased hospital admission and ER visits for cardiovascular diseases
- Increased respiratory symptoms such as coughing, wheezing and shortness of breath
- Lung function changes, especially in children and people with lung diseases such as asthma
- Changes in heart rate variability
- Irregular heartbeat

Health effects associated with long-term exposure to $PM_{2.5}$:

- Premature death in people with heart and lung diseases, including death from lung cancer
- Reduced lung function
- Development of chronic respiratory disease in children

The U.S. EPA lowered the 24-hour $PM_{2.5}$ standard from the 1997 level of 65 $\mu g/m^3$ to a more stringent standard of 35 $\mu g/m^3$, a reduction of 46%. The decision retained the 1997 standards for annual $PM_{2.5}$ and 24-hour inhalable PM_{10}.

The U.S. EPA cited strong health benefits from meeting the new 24-hour $PM_{2.5}$ standard, achieving estimated annual reductions of:

- 2,500 premature deaths in people with heart or lung disease
- 2,600 cases of chronic bronchitis
- 5,000 nonfatal heart attacks
- 1,630 hospital admissions for cardiovascular or respiratory symptoms

[17] U.S. EPA, "National Ambient Air Quality Standards for Particulate Matter," 71 Fed. Reg. 61144, 61151-52 (Oct. 17, 2006) (U.S. EPA 2006 Particulate Standards).
[18] U.S. EPA, "Fact Sheet: Final Revisions to the National Ambient Air Quality Standards for Particle Pollution (Particulate Matter)" 4-6 (Sept. 21, 2006) http://www.epa.gov/PM/pdfs/20060921_factsheet.pdf .

- 1,200 ER visits for asthma
- 7,300 cases of acute bronchitis
- 97,000 cases of upper and lower respiratory symptoms
- 51,000 cases of aggravated asthma
- 350,000 days when people miss work or school
- 2 million days when people must restrict their activities because of particle pollution-related symptoms

The U.S. EPA estimated that the revised 24-hour $PM_{2.5}$ standard would most likely yield between $17 and $35 billion of health and visibility benefits each year.

As part of the proceedings leading to its decision, the U.S. EPA organized a Clean Air Scientific Advisory Committee, which recommended $PM_{2.5}$ standards with a maximum daily limit between 30 and 35 $\mu g/m^3$, and an average annual limit between 13 and 14 $\mu g/m^3$ (compared to the annual standard of 15 $\mu g/m^3$ adopted in 1997). The U.S. EPA adopted a daily exposure standard at the top of the recommended range, and retained an annual exposure standard above the recommended range.[19]

In February 2009, the United States Court of Appeals for the D.C. Circuit reversed, in part, several aspects of the U.S. EPA's 2006 rulemaking decision and required further review of the annual standard for $PM_{2.5}$.[20] The Court held that the Agency failed to provide a reasoned explanation for its decision to maintain the annual standard at a level above – i.e., less stringent than – the recommendations of its advisory committee, U.S. EPA staff and many parties to the proceeding. The U.S. EPA's review of its PM air quality standards is now going forward.

C. Integrated Science Assessment for Particulate Matter Performed for the U.S. EPA (2009)

In December 2009, the U.S. EPA issued the Integrated Science Assessment for Particulate Matter. This extensive report by a panel of scientists is "a review, synthesis, and evaluation of the most policy-relevant evidence, and communicates critical science judgments relevant to the National Ambient Air Quality Standards."[21]

[19] U.S. EPA 2006 Particulate Standards, supra, 71 Fed. Reg. at 61169.
[20] American Farm Bureau Federation v. U.S. EPA, 559 F.3d 512, 520-24 (D.C. Cir. 2009).
[21] Integrated Science Assessment, supra, at 1-1.

The Integrated Science Assessment evaluated the collective evidence from epidemiological, controlled human exposure and toxicological studies on the causes of health impacts. The Scientific Panel found sufficient evidence to conclude that a causal relationship:

- Exists between short-term and long-term exposures to $PM_{2.5}$ and mortality as well as cardiovascular effects,
- Is likely to exist between short-term and long-term exposures to $PM_{2.5}$ and respiratory effects
- Is suggestive between long-term exposures to $PM_{2.5}$ and cancer as well as reproductive and developmental outcomes, and
- Is suggestive between short-term exposure to PM_{10} and mortality, cardiovascular effects and respiratory effects. [22]

In particular, the report reviewed scientific studies addressing health effects at levels of PM below the standards adopted by the U.S. EPA in 2006. The Scientific Panel found studies demonstrating adverse health effects from PM at levels substantially below the U.S. EPA standards and below the lower end of the recommendation for daily exposure of the U.S. EPA's 2006 Clean Air Scientific Advisory Committee. For example, from epidemiological studies in locations with ambient concentrations ranging from 7 to 18 $\mu g/m^3$, the Integrated Science Assessment found consistent positive associations between short-term $PM_{2.5}$ and cardiovascular disease (measured in emergency room visits and hospital admissions). The Scientific Panel also reported that multicity studies in locations with mean 24-hour average $PM_{2.5}$ levels above 12.8 $\mu g/m^3$ found consistent increases in cardiovascular mortality associated with greater particulate exposure.[23]

D. National Research Council Report (2010)

The National Research Council is administered by the National Academy of Sciences, the National Academy of Engineering and the Institute of Medicine. In response to a request by Congress in the Energy Policy Act of 2005, the National Research Council formed a committee to study the key external costs and benefits – related to health, environment, security and infrastructure – associated with the production, distribution and use of energy, but that are not reflected in market prices or fully addressed by current government policy. The Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use report was issued in 2010.

Among other topics, the study quantified the impacts on human health, agriculture and visibility of pollution from coal plants. The study applied the Air Pollution Emission

[22] Id. at 2-9 – 2-13, 2-18.
[23] Id. at 2-9.

Experiments and Policy (APEEP) model to estimate the effects of emissions from 406 coal plants on ambient air quality and to calculate the damages associated with emitting a ton of each of four criteria pollutants (SO_2, NO_x, $PM_{2.5}$ and PM_{10}) at each coal plant.[24] The categories of health damages from PM that were modeled by the National Research Council include premature mortality, chronic bronchitis, and respiratory and cardiovascular hospital admissions.[25] Additionally, the APEEP model includes costs associated with visibility impairment; ozone-related crop, timber, and recreation (forest canopy changes) damages; and SO_2-related damages to building materials. The model does not include the damages resulting from climate change. [26] The National Research Council concluded that there are health damages from any level of emissions; there is no threshold of low levels of emissions that cause no damages.[27]

The calculations estimated aggregate annual health and related damages caused by emissions from coal plants in 2005 of approximately $62 billion (in 2007 dollars). The health damages are estimated at 4.4 cents per kWh for the average coal plant, and 3.2 cents per kWh for the plants weighted by net generation of electricity at the plant. By comparison, mean damages for natural gas plants were 0.16 cents per kWh when weighted by the amount of electricity generated.[28] In short, natural gas plants cause 95% less health and related damages than coal plants per kWh generated.

The National Research Council's calculations estimated aggregate annual health and related damages caused by emissions from coal plants

Over 90 percent of the damages associated with the air pollution modeled – more than $56 billion (in 2007 dollars) annually – come from mortality caused by primary and secondary $PM_{2.5}$.[29] The National Research Council explained that primary $PM_{2.5}$ has very high damages per ton emitted. Because there are much greater volumes of SO_2 and NOx emissions than PM emissions from coal plant smokestacks, more health damages come from secondary $PM_{2.5}$.[30]

[24] Hidden Costs of Energy, supra, at 6, 61, 423-29. APEEP can be used to compute the marginal damage of emissions on a source-specific basis for nearly 10,000 distinct sources of air pollution in the United States.
[25] Id. at 86, 428.
[26] Id. at 10. (coal plants are the largest single domestic source of greenhouse gas pollution).
[27] Id. at 87, 424-25. See also Abt Associates, Technical Support Document for the Powerplant Impact Estimator Software Tool 10 (2010); A. Lockwood, et al., Coal's Assault on Human Health (2009) (Physicians for Social Responsibility report); J. Romley, et al., The Impact of Air Quality on Hospital Spending (2010) (Rand Corporation report).
[28] Hidden Costs of Energy, supra, at 6-8, 91. The distribution of damages for gas-fired electricity generation had a large variance.
[29] Id. at 92, 97.
[30] Id. at 88 & n.24.

Section II: Estimating the Economic Damages of Particulate Pollution from the Fisk and Crawford Coal Plants

This section presents estimated health and related damages of PM-forming emissions from the Fisk and Crawford coal plants using the model applied by the National Research Council in its 2010 report. There is uncertainty in the models when used to estimate health and related damages for any one year from any single coal power plant. Nevertheless, there is strong evidence, based on many scientific studies and authoritative review panels, that the health and related damages from these two coal plants are huge – likely $750 million to $1 billion (in 2010 dollars) over the eight years, alone, since release of the Harvard School of Public Health's Illinois Power Plant Study. Moreover, these coal plants continue to operate and produce harmful and costly pollution.

A. National Research Council Estimates Using 2005 Data

The National Research Council's model reflects a wide distribution of pollution intensity (emissions per kWh) across the 406 coal plants. Factors accounting for the variation in the coal plants' health costs and related damages include: the plant size and amount of electricity produced; proximity to population centers; sulfur content of the coal burned; adoption, or not, of scrubbers and other pollution control technologies; and plant vintage (newer plants are subject to more stringent pollution controls).[31]

More people live within one mile and three miles of the Fisk and Crawford coal plants, respectively, than is the case with any other coal plant in the U.S. In addition, more than 12 million people live within 100 miles of the Fisk and Crawford coal plants.[32] Midwest Generation has not installed scrubbers to reduce SO_2 emissions at either of the Fisk or Crawford coal plants.[33]

Table 1 shows the National Research Council's estimates of $120.9 million (2005 data) in health costs and related damages from the Fisk and Crawford coal plants' emissions. These damages are calculated in 2007 U.S. dollars; in 2010 U.S. dollars, the estimated costs exceed $127 million.

[31] Id. at 91-92.
[32] US Census Data 2000; Coal plants near residential areas, supra (population within one mile: Fisk – 47,050; Crawford – 29,009; population within three miles: Crawford – 373,690; Fisk – 314,632)
[33] Midwest Generation LLC SEC Form 10-K (filed March 1, 2010) at 18-19.

Table 1: Estimated Health Costs and Related Damages from Fisk and Crawford Coal Plants (National Research Council estimates using 2005 data and 2007 dollars)

	Crawford			Fisk		
Pollutant	Emissions Amount (tons)	Damages ($ per ton)	Est. Damages ($mil)	Emissions Amount (tons)	Damages ($ per ton)	Est. Damages ($mil)
Sulfur dioxide	9,238	6,400	59.1	4,615	8,360	38.6
Nitrogen oxide	2,237	1,700	3.8	1,123	1,840	2.1
Fine particulates	457	17,500	8.0	203	38,900	7.9
Coarse particulates	841	821	0.7	359	1,890	0.7
	Total Estimated Damages		**$71.6 million**	*Total Estimated Damages*		**$49.3 million**

B. Need for Actions to Reduce Pollution and Health Costs of Midwest Generation's Fisk and Crawford Coal Plants

In addition to the health damages and related costs estimated by the National Research Council for 2005, the impacts of the Fisk and Crawford coal plants in other years call out for actions to reduce the plants' pollution. Midwest Generation bought the Fisk and Crawford plants in 1999. U.S. EPA and National Research Council data make clear that SO_2, NO_x and PM emissions from these plants appear to be on-going, and, in some cases, worsening problems for public health. (see Tables 2 and 3 in the Appendix to this report).[34]

1. Total SO_2 emissions from the Fisk and Crawford coal plants increased from 1999 to 2009, causing high health damages.

Far from reducing SO_2 emissions (by installing scrubbers or other pollution control methods), Midwest Generation allowed the total SO_2 emissions from these plants to increase by 3% from 1999 to 2009. Each year from 2002 through 2009, the total SO_2 emissions from the two plants exceeded the level of 11,000 tons emitted in 1999. In 2006, total SO_2 emissions from these two plants were 33% above the 1999 level.

Total SO_2 emissions equaled or exceeded the 2005 level modeled by the National Research Council annually from 2004 through 2007. From 2008 to 2009, Crawford's SO_2 emissions rose by 7 percent (481 tons). From 2005 to 2006, Fisk's SO_2 emissions rose by 22 percent (1,025 tons).

[34] See Respiratory Health Association, supra (2010 estimates of health impacts of Fisk and Crawford).

While the combined SO_2 emissions of the two plants was down in 2009 from the 2005 level that was modeled by the National Research Council, this decline could be due, in part, to a drop in total electricity produced by these plants. That change in utilization may be only temporary. Unless Midwest Generation installs scrubbers or other pollution control technologies or techniques, these plants' SO_2 emissions may grow or continue at high levels, causing extensive health damages.

2. Total NO_x emissions at these two coal plants averaged in excess of 3,400 tons annually from 2004 through 2009, causing high health damages.

Midwest Generation's Fisk and Crawford coal plants continue to emit large amounts of NO_x. The total NO_x emissions from these plants averaged more than 3,400 tons each year from 2004 through 2009. In the year modeled by the National Research Council, total NO_x emissions were 3,375 tons. Total NO_x emissions rose over 11 percent from 2005 to 2006. From 2007 to 2008, NO_x emissions at Fisk rose by 2 percent (22 tons).

As in the case of SO_2 emissions, in the absence of Midwest Generation implementing NO_x control technologies or techniques, these plants' NO_x emissions may grow or continue at high levels, causing extensive health damages.

3. Direct emissions of PM rose sharply at both Fisk and Crawford from 1999 to 2002 and again from 2002 to 2005, causing increased health damages.

Data on direct emissions of PM are available only for 1999, 2002 and 2005. The tons of direct PM emissions increased sharply at both the Fisk and Crawford coal plants from 1999 to 2002, and, then again, from 2002 to 2005. On a combined basis for the two plants, $PM_{2.5}$ emissions rose 94% from 1999 to 2002, and by an additional 7% from 2002 to 2005; total PM_{10} emissions increased 184% from 1999 to 2002, and by an additional 5% from 2002 to 2005.

The National Research Council found that direct PM emissions cause high health and related damages per ton, as shown in Table 1. However, the Illinois Pollution Control Board's Orders setting up emissions reduction standards and schedules for Midwest Generation's coal plants do not address direct PM emissions.

In summary, the National Research Council's model and the U.S. EPA data do not provide estimated health and related damages for each year of Midwest Generation's operation of the Fisk and Crawford coal plants. There is little doubt that these damages have been large and are continuing at a high level each year. The National Research Council's estimate of more than $127 million (in 2010 dollars) in health costs and related damages in 2005, together with the factors described above, suggest that the total harms to public health and

related damages from Midwest Generation's Fisk and Crawford coal plants have been about $750 million to $1 billion (in 2010 dollars) during the 2002 through 2009 period following release of the Harvard School of Public Health's Illinois Power Plant Study.

Conclusion

Several recent scientific studies have concluded that PM-forming emissions from coal plants cause premature mortality as well as increased respiratory and cardiovascular health problems. The U.S. EPA's cost-benefit analysis for the proposed Transport Rule in 2010, the Integrated Science Assessment of PM performed for the U.S. EPA in 2009, the U.S. EPA's order strengthening the ambient air quality standards for PM in 2006, and the National Research Council report on hidden costs of energy in 2010 evaluated the collective evidence from epidemiological, controlled human exposure and toxicological studies. These analyses found adverse health effects at levels of emissions below the current U.S. EPA standards, and each ton of emissions causes incremental harms and costs.

The public health and environmental costs of coal plants are high. The U.S. EPA estimates that by reducing coal plant emissions of ozone and $PM_{2.5}$, the proposed Transport Rule would achieve more than $120 to $290 billion in annual health and welfare benefits in 2014. These benefits would be 50 - 100 times greater than the estimated annual direct costs. Using a different set of models and 2005 data, the National Research Council estimated aggregate national annual health costs and other damages of $62 billion related to coal plants' emissions of SO_2, NO_x, $PM_{2.5}$ and PM_{10}. Although there are uncertainties in the models used to estimate the health impacts and associated costs of coal plant emissions, there is little doubt, based on thousands of scientific studies and authoritative review panels, that these health costs are very large.

Over the eight years since the premature deaths and illnesses from these plants were highlighted by the Harvard School of Public Health's Illinois Power Plant Study, the cumulative health costs and related damages amount to about $750 million to $1 billion.

The pollution from Midwest Generation's Fisk and Crawford coal plants spreads over adjacent densely-populated Chicago neighborhoods, widely across the Chicago metropolitan area and hundreds of miles from the plants. The model applied by the National Research Council estimates that these coal plants cause substantial health costs: more than $127 million annually using 2005 emissions data and expressed in 2010 dollars. Over the eight years since the premature deaths and illnesses from these plants were highlighted by the Harvard School of Public Health's Illinois Power Plant Study, the cumulative health costs and

related damages amount to about $750 million to $1 billion (in 2010 dollars). These cost estimates do not include environmental and public health damages from climate change. Midwest Generation has failed to install most modern pollution control equipment at these old, highly-polluting coal plants. In particular, Midwest Generation has not taken significant actions to reduce primary PM emissions or to decrease secondary PM emissions from SO_2 and NOx, and Midwest Generation has not committed to such actions for several more years.

The public health costs of pollution from the Fisk and Crawford coal plants are too significant to be overlooked. Public health and related damages should be more strongly considered in the public policy debate in light of the substantial economic costs and human suffering caused by pollution from these old coal plants still operating in Chicago.

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Appendix

Table 2: **Operations and Emissions Data for Midwest Generation's Crawford Coal Plant 1999-2009 (U.S. EPA Clean Air Markets and Air Data)**[35]

year	Heat Input (mmBtu)	Gross Load (MWh)	SO2 tons	NOx tons	PM2.5 tons	PM10 tons
1999	17,750,490	1,603,060	6,707	3,139	205	269
2000	31,145,790	2,941,826	9,332	*NA*	*NA*	*NA*
2001	22,865,797	2,211,986	5,668	*NA*	*NA*	*NA*
2002	28,974,763	2,638,148	7,596	2,863	439	827
2003	31,749,098	2,834,095	7,906	1,688	*NA*	*NA*
2004	35,116,006	3,201,365	9,137	2,259	*NA*	*NA*
2005	32,914,864	3,200,684	9,224	2,249	457	841
2006	32,158,651	3,085,459	9,046	2,495	*NA*	*NA*
2007	31,051,938	2,921,623	8,882	2,226	*NA*	*NA*
2008	28,236,199	2,667,786	6,627	2,201	*NA*	*NA*
2009	27,753,711	2,738,994	7,108	1,908	*NA*	*NA*

Table 3: **Operations and Emissions Data for Midwest Generation's Fisk Coal Plant 1999-2009 (U.S. EPA Clean Air Markets and Air Data)**[36]

year	Heat Input (mmBtu)	Gross Load (MWh)	SO2 tons	NOx tons	PM2.5 tons	PM10 tons
1999	13,358,436	1,232,379	4,306	2,387	113	133
2000	17,527,361	1,610,226	4,848	*NA*	*NA*	*NA*
2001	14,246,772	1,326,190	3,535	*NA*	*NA*	*NA*
2002	14,649,555	1,387,283	3,843	2,465	178	315
2003	17,645,579	1,650,593	4,318	816	*NA*	*NA*
2004	19,988,756	1,915,248	5,137	1,231	*NA*	*NA*
2005	16,791,113	1,602,705	4,616	1,126	203	359
2006	19,762,995	1,872,204	5,641	1,275	*NA*	*NA*
2007	17,394,898	1,754,884	4,954	1,145	*NA*	*NA*
2008	19,304,441	1,993,106	4,486	1,167	*NA*	*NA*
2009	17,095,648	1,783,493	4,217	1,132	*NA*	*NA*

[35] 2005 data on PM from National Research Council.
[36] 2005 data on PM from National Research Council.