

Statement of
THE AMERICAN SOCIETY OF CIVIL ENGINEERS
on the
Environmental and Public Health Impacts
of
Power Plant Emissions
before the
Committee on Environment and Public Works
U.S. Senate
July 26, 2001

Mr. Chairman and Members of the Committee:

The American Society of Civil Engineers (ASCE) appreciates the opportunity to present this statement to the Committee on the environmental and public health effects of power plant emissions.

ASCE is a 501(c)(3) nonprofit organization. It represents more than 123,000 engineers in private practice, academia and government service. Our members practice civil engineering to enhance the welfare of humanity and to provide a better quality of life for all people. A significant number of ASCE members are experts in the technical aspects of environmental and public health, including air-quality engineering.

I. Sources of Air Pollutants

The major pollutants of concern are carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x) and mercury. Emissions of these gases, also known as greenhouse gases for their ability to concentrate in the atmosphere and their tendency to elevate global temperatures, are increasing. U.S. greenhouse gas emissions totaled 6,746 teragrams of carbon dioxide equivalents in 1999, an increase of nearly 12 percent in a decade, according to a recent Environmental Protection Agency (EPA) survey.¹ See Environmental Protection Agency, U . S . E M I S S I O N S I N V E N T O R Y – 2 0 0 1 (2 0 0 1) a t <http://www.epa.gov/globalwarming/publications/emissions/us2001/index.html> (last visited Jul. 23, 2001).

Energy-related activities are the primary sources of U.S. anthropogenic (man-made) greenhouse gases. Domestic energy production accounted for 85 percent of all emissions on a carbon-equivalent basis in 1999. This included 98 percent, 35 percent and 18 percent, respectively, of nation's carbon dioxide (CO₂), methane (CH₄) and nitrous oxide emissions that year. *Id.* a t <http://www.epa.gov/globalwarming/publications/emissions/us2001/energy.pdf> (last visited Jul. 23, 2001).

Most carbon dioxide (98 percent) in the U.S. is emitted as the result of the combustion of fossil fuels; thus, carbon dioxide emissions and energy use are highly correlated, according to the U.S. Energy Information

¹ One teragram is equal to one megaton or one million metric tons.

Administration (EIA).

Although net generation of electricity increased by 2.0 percent in 1999, total carbon dioxide emissions from the electric power sector increased by only 1.0 percent, from 608.5 million metric tons carbon equivalent in 1998 to 614.3 million metric tons carbon equivalent in 1999. The growth rate in emissions was less than the growth rate in net generation in part because 54.5 billion kilowatt hours of the net increase (73.2 billion kilowatt hours) came from nuclear power plants, which produce essentially no carbon dioxide emissions. Nuclear electricity generation was 8.1 percent higher in 1999 than in 1998.

Energy Information Administration, EMISSION OF GREENHOUSE GASES IN THE UNITED STATES 1999 at <http://eia.doe.gov/oiaf/1605/ggrpt/carbon.htm> (last visited Jul. 23, 2001).

The EIA predicts that carbon dioxide (CO₂) emissions alone from energy use in the United States will increase at an average rate of 1.4 percent per year from 1,511 to 2,041 million metric tons carbon equivalent between 1999 and 2020.

Projected emissions in 2020 will be 62 million metric tons carbon equivalent more than was predicted in 2000, due mainly to higher projected economic growth, according to the EIA. See U.S. Energy Information Administration, ANNUAL ENERGY OUTLOOK 2001 (2000) at <http://www.eia.doe.gov/oiaf/aeo/overview.html#electricity> (last visited Jul. 23, 2001).

“Higher projected growth in households, commercial floor space, industrial output, and disposable income leads to higher forecasts for end-use demand and electricity generation. Partly offsetting these trends are more rapid projected declines in industrial energy intensity and higher projected nuclear generation than predicted in 2000.” See *id.*

Additionally, the major contributors to global acidification of the atmosphere are sulfur oxides and nitrogen oxides – also emitted mostly by the burning of fossil fuels.² Declines in the emissions of SO₂ and NO_x have mainly been effective in reducing acidification due to long-range transport. See R. Kikuchi, *Environmental Management of Sulfur Trioxide Emission: Impact of SO₃ on Human Health*, 27 ENVIRON. MANAGE. 837 (2001).

II. The Health Effects of Air Pollutants

The quality of the air we breathe has a direct and material impact upon human health and the environment. Long-term studies have found that nitrogen dioxide (NO₂), for example, has been associated with daily hospital emergency visits for angina, cardiac insufficiency, myocardial infarction, asthma, acute and chronic bronchitis, and

² The acidification returns to Earth in the form of acid rain, which degrades rivers, streams, lakes, estuaries, biota and soils.

pneumonia. Frank Ye et al., *Effects of Temperature and Air Pollutants on Cardiovascular and Respiratory Diseases for Males and Females Older Than 65 Years of Age in Tokyo, July and August 1980-1995*, 109 ENVIRON. HEALTH PERSPECT. 355 (2001). Deaths from respiratory ailments intensify under conditions of increased sulfur dioxide (SO₂) exposure. Evangelia Samoli et al., *Investigating Regional Differences in Short-Term Effects of Air Pollution on Daily Mortality in the APHEA Project: A Sensitivity Analysis for Controlling Long-Term Trends and Seasonality*, *id.* at 349.

Health effects of exposures to carbon monoxide (CO), SO₂, and nitrogen oxides (NO_x) can include reduced work capacity, aggravation of existing cardiovascular diseases, effects on pulmonary function, respiratory illnesses, lung irritation, and alterations in the lung's defense systems. Susan M. Bernard et al., *The Potential Impacts of Climate Variability and Change on Air Pollution-Related Health Effects in the United States*, 109 ENVIRON. HEALTH PERSPECT. SUPPL. 2 at 199 (2001).

Air pollutants are especially hazardous to fetuses and children. Maternal exposures to ambient CO and SO₂ increase the risk for low birth weight at term. This risk escalates whenever there are increases in CO concentrations during the third trimester. Mildred Maisonet, *Relation Between Ambient Air Pollution and Low Birth Weight in the Northeastern United States*, 109 ENVIRON. HEALTH PERSPECT. SUPPL. 3 at 351 (2001). Mercury, a ubiquitous environmental toxin that causes a wide range of adverse health effects in humans, may affect the developing fetus and young children, because many aspects of development, particularly brain maturation, can be disturbed by the presence of mercury. Minimizing mercury exposure is essential to optimal child health. L.R. Goldman and M.W. Shannon, *Technical Report: Mercury in the Environment: Implications for Pediatricians*, 108 PEDIATRICS 197 (2001).

Additionally, elevated concentrations of fine particles – that is, particles less than 2.5 microns – in the air may elevate the risk of a heart attack within a few hours to one day after exposure. A. Peters et al., *Increased Particulate Air Pollution and the Triggering of Myocardial Infarction*, 103 CIRCULATION 2810 (2001).

III. Statutory and Regulatory Background

The Clean Air Act (CAA), 42 U.S.C.A. §§ 7401-7671q (West 2001), requires the EPA to establish minimum national standards for air quality, and assigns primary responsibility to the states to assure compliance. Those areas not meeting the standards, referred to as nonattainment areas, are required to implement specific air pollution control measures. The Act requires federal emission standards for autos and other mobile sources of air pollution, for sources of 188 hazardous air pollutants, and for sources of acid rain. It establishes a comprehensive state-run permit system for all major sources of air pollution. It also addresses the prevention of pollution in areas with clean air, as well as protection of the stratospheric ozone layer.

The Act “establishes a partnership between EPA and the states for the attainment and maintenance of national air quality goals.” *Natural Resources Defense Council v. Browner*, 57 F.3d 1122, 123 (D.C. Cir. 1995). The EPA has promulgated a series of regulations establishing the National Ambient Air Quality Standards (NAAQS). 40 C.F.R. part 50 (2001).

Section 110 of the CAA requires states to develop air pollution regulations and control strategies to ensure that state air quality meets the national ambient air quality standards established by us. The ambient standards are established under section 109 of the CAA, and they currently address six criteria pollutants: Carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), lead, particulate matter, and sulfur dioxide (SO₂). *See, e.g.*, EPA, Approval and Promulgation of Implementation Plans; State of Missouri, 66 Fed. Reg. 37,904 (Jul. 20, 2001).

The Agency also has taken steps to reduce emissions of pollutants from coal-fired electric power plants. The first of these steps, the regulation of SO₂ and some NO_x emissions to reduce acid precipitation, required under Title IV of the CAA, had statutory deadlines in 1995 and 2000. Other regulatory actions include the Ozone Transport Rule (“NO_x SIP call”) requiring power plants in 21 eastern states and the District of Columbia to reduce emissions of nitrogen oxides during the summer ozone season beginning May 31, 2004; various state actions to control emissions of NO_x, sulfur dioxide, mercury, and in at least one case carbon dioxide; and an EPA decision announced in December 2000 to go forward with regulation of mercury from electric utilities. The mercury regulations are expected to be proposed in 2003, with an effective date of 2007 or 2008.

No currently effective federal statute or regulation, however, addresses the emission of carbon dioxide from any sources. In May, the Bush Administration released its energy plan, which would continue to exempt carbon dioxide emissions from all sources from federal regulation.

Rather, the Administration proposed to “direct the Administrator of the Environmental Protection Agency (EPA) to propose multi-pollutant legislation. The NEPD Group recommends that the President direct the EPA Administrator to work with Congress to propose legislation that would establish a flexible, market-based program to significantly reduce and cap emissions of *sulfur dioxide, nitrogen oxides, and mercury* from electric power generators.” White House National Energy Policy Development Group, RELIABLE, AFFORDABLE, AND ENVIRONMENTALLY SOUND ENERGY FOR AMERICA’S FUTURE <http://www.whitehouse.gov/energy/summaries.pdf> (last visited Jul. 24, 2001) (emphasis added).

IV. Clean Air Legislation in the 107th Congress

A number of bills have been introduced in the Congress this year that would target the release of toxic chemicals and greenhouse gases – including CO₂ – from U.S. power plants. Among the most significant are:

S. 556, the Clean Power Act of 2001

A targeted “four-pollutant bill,” this proposal would order stringent reductions of sulfur dioxide, nitrogen oxide, carbon dioxide and mercury. The bill would establish targeted objectives in order to reduce releases from power plants generating at least 15 megawatts of electricity from coal, natural gas or other carbon-based fuels not later than January 1, 2007.

It would require a reduction in (a) aggregate sulfur dioxide emissions from power plants by 75 percent from the levels required at full implementation of the Phase II sulfur dioxide requirements under title IV of the Clean Air Act, (b) aggregate nitrogen oxide emissions from power plants by 75 percent from 1997 levels, (c) aggregate carbon dioxide emissions from power plants to the level of carbon dioxide emissions from those plants in 1990, and

(d) aggregate mercury emissions from power plants by 90 percent from their 1999 levels.

Additionally, S. 556 would require the EPA to adopt regulations within two years that would "allocate required emission reductions equitably, taking into account emission reductions achieved before the date of enactment ... and other relevant factors." The bill contains a "hard hammer" that would require all power plants to meet their reduction targets if the EPA were to fail to adopt regulations in a timely manner.

Finally, the bill would require all older power plants – those in service for 30 years or more – to meet the new emissions standards within five years of enactment.

S. 1008, the Climate Change Strategy and Technology Innovation Act of 2001

This bill would amend the Energy Policy Act of 1992 to develop a U.S. climate change strategy. It would seek (a) to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, (b) to minimize adverse short-term and long-term economic and social impacts, (c) to align the strategy with U.S. energy policy, (d) to promote a sound national environmental policy, and (e) to establish a research and development program that focuses on technological breakthroughs that make significant progress toward the goal of stabilization of greenhouse gas concentrations.

S. 1131, the Clean Power Plant and Modernization Act of 2001

This bill would, among other things, establish combustion heat rate efficiency standards for fossil fuel-fired generating units; establish air emission standards for fossil fuel-fired generating units; establish a "Clean Air Trust Fund" to conduct federal research into renewable and clean-power technologies; provide grants for publicly owned generating units that are in compliance with combustion and air-emissions standards; and provide funding for a clean-coal, advanced-gas-turbine, and combined heat and power demonstration program.

Among the innovations in S. 1131 is a provision that would require the EPA and the Department of Energy to conduct research into the utility of "carbon sequestration," a method of capturing carbon dioxide releases in plants (usually trees), soil and water.

V. Policy Considerations for Congress

A. Flawed Kyoto Protocol Should Not Block U.S. Initiatives to Curtail Greenhouse Gas Emissions

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) of 1997 committed the industrialized nations to specified, legally binding reductions in emissions of six greenhouse gases. The treaty was opened for signature on March 16, 1998; the United States signed the Protocol on November 12, 1998.

The treaty would commit the United States to a target of reducing greenhouse gases by seven percent below 1990 levels between 2008 and 2012. Because of the way sinks, which remove these gases from the

atmosphere, are counted and because of other provisions, the actual reduction of emissions within the United States required to meet the target was estimated to be lower than seven percent. The Clinton Administration did not submit the protocol to the Senate, acknowledging that one condition outlined by S.Res. 98, passed in mid-1997 – a requirement for meaningful participation by developing countries in binding commitments – had not been met. In March, the Bush Administration decided that the United States would not accept the Kyoto treaty’s provisions as a matter of U.S. policy.

On its own, saying “no to Kyoto” is not a viable environmental policy. There is much that can and ought to be done to reduce the emission of greenhouse gases domestically without regard to the flawed Kyoto Protocol. It is important to emphasize that this more active approach is not simply a matter of waiting for better science to guide the policy process. In important respects, there *is* no science available to determine authoritatively the outcome of the debate about the course of events a century or more in the future.³

ASCE believes that the Congress should move quickly to adopt a carbon-allowance-based policy that deals sensibly with the threat of climate change. The policy ought to incorporate policy objectives that put the United States on a path that leads to significant and real reductions in greenhouse gas emissions nationwide. As just one example, Congress could repeal section 123 of the CAA to do away with the provision that allows for the use of certain tall smokestacks to disperse air pollutants from fossil fuel facilities. This methodology, which merely transfers the pollutants downwind, is no emissions reduction technology at all.⁴

Congress must support research into, and the application of, new and less polluting energy-production technologies to ensure that the nation can use its currently abundant coal and natural gas resources in a more energy-efficient and a more environmentally protective manner. For example, under current law, there is no investment tax credit for power plants that generate electricity with coal. Congress could adopt the plan proposed by the House Ways and Means Committee recently that would provide a 10 percent tax credit for investments in advanced clean-coal power plants.

Congress ought to consider other potentially viable carbon dioxide control measures, including the use of carbon permit trading and the forced retirement of older, dirtier fossil-fueled electricity plants.⁵

Although fossil fuels are now the cheapest source of energy (if one entirely discounts the opportunity cost

³ See, e.g., Sylvie Faucheux and Geraldine Froger, *Decision-making Under Environmental Uncertainty*, 15 *ECOL. ECON.* 29 (1995) (arguing for the use of a “precautionary principle” in environmental decision making to safeguard natural resources “against the potentially catastrophic outcomes of some decisions” due to the state of “[n]ear ignorance [that] characterizes many global environmental problems.”)

⁴ See 40 C.F.R. s 52.1475 (describing tall stacks as a “dispersion technique.”)

⁵ For a detailed economic analysis of the cost savings to society to be realized from such a plan, see Jonathan G. Koomey et al., *Technology and Greenhouse Gas Emissions: An Integrated Scenario Analysis Using the LBNL-NEMS Model*, in *THE LONG-TERM ECONOMICS OF CLIMATE CHANGE: BEYOND A DOUBLING OF GREENHOUSE GAS EMISSIONS* 175 (Darwin C. Hall and Richard B. Howarth eds., 2001).

to the environment), ASCE believes that, over the longer term, Congress also should consider an approach that would help “decarbonize” the U.S. economy – that is, help to reduce the ratio of carbon dioxide emissions relative to the gross domestic product (GDP). One of the ways in which to achieve this is to adopt policies that lead the utility industry to substitute fuels, most promisingly through the increased use of nuclear energy, a source of power that releases very little in the way of greenhouse gases.⁶

To reduce NO_x emissions, Congress should enact a summer seasonal cap in the eastern states covered by EPA’s NO_x SIP Call, mandate an annual cap in the same SIP Call region, and a national annual cap. In each case, the law should allow for emissions trading. It has been estimated that an annual cap in the SIP Call region would yield about \$400 million more in net benefits (benefits less costs) than would a seasonal policy, based on particulate-related health effects only. An annual cap in the SIP Call region is also the policy that is most likely to achieve benefits in excess of costs. Consideration of omissions from this accounting, including the potential benefits from reductions in ozone concentrations, strengthens the finding that an annual program offers greater net benefits than a seasonal program.⁷

B. Carbon Sequestration Offers Only Relatively Limited Possibilities To Mitigate CO₂ Emissions

The slogan “Plant a tree ... cool the globe” favored by at least one environmental group is superficially appealing. But the science of “carbon sequestration” is in its infancy, and the idea that forests and oceans, by themselves, can solve most of the nation’s CO₂ problems is simplistic and overlooks obvious problems.

That said, ASCE supports continued federal research into the potential utilization of forests and oceans (and a number of other mitigatory technologies) as carbon “sinks.” Trees and oceans are able to absorb some free carbon dioxide from anthropogenic sources.

Fossil CO₂ is released predominantly at northern latitudes, which should result in a north-to-south decrease of 4 to 5 ppm in the concentration of atmospheric CO₂. A Northern Hemisphere sink is implied because the observed gradient is smaller than this. The original studies disagreed on whether the sink was predominantly oceanic or terrestrial. Recent studies with atmospheric carbon ratios and oxygen concentrations concluded that the sink is caused primarily by terrestrial biosphere uptake.

S. Fan et al., *A Large Terrestrial Carbon Sink in North America Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models*, 282 SCIENCE 442 (1998) (citations omitted).

⁶ See Lee Schipper et al., *International Comparisons of Sectoral Carbon Dioxide Emissions Using a Cross-Country Decomposition Technique*, 22 THE ENERGY JOURNAL 35, 46 (2001).

⁷ For a detailed analysis, see Resources for the Future, COST-EFFECTIVE REDUCTIONS OF NO_x EMISSIONS FROM ELECTRICITY GENERATION (2000) at http://www.rff.org/disc_papers/abstracts/0055.htm (last visited Jul. 24, 2001).

Nevertheless, the use of carbon sinks is not a panacea. Although not all anthropogenic carbon emissions remain in the atmosphere, the size of the terrestrial and oceanic carbon sinks and the mechanisms by which they sequester carbon remain controversial. Christopher B. Field and Inez Y. Fung, *The Not-So-Big U.S. Carbon Sink*, 285 SCIENCE 544 (1999).

Moreover, the terrestrial biosphere and, in particular, the forests that are expected to absorb the excess carbon dioxide are under constant assault themselves.

Assessing the health effects of deforestation is difficult because of the rate at which the world's forests are disappearing. From 1990 to 1995 alone, the world lost a total area of forest cover nearly twice the size of Italy. Deforestation, which is caused by human population growth and encroachment, clearance for agricultural production, and the growing worldwide demand for wood products, has been linked with effects ranging from local changes in climatic and disease patterns to global climate change and biodiversity loss. *Deforestation is responsible for about 25 percent of net annual releases of carbon dioxide into the atmosphere and also lessens the amount of forest available to absorb greenhouse gas emissions.*

David Taylor, *Seeing the Forests for More Than the Trees*, 105 ENVIRON. HEALTH PERSPECT. 1186 (1997) (emphasis added).

Poor agricultural practices also contribute to the loss of carbon-carrying capacity of the soil. Intensive farming can mobilize the carbon dioxide fixed in plants, thus defeating the ecosystem's ability to absorb CO₂. See PAUL HAWKEN ET AL., NATURAL CAPITALISM: CREATING THE NEXT INDUSTRIAL REVOLUTION 204 (1999).

The use of the oceans as a carbon sink also has potential – and potential problems. The natural ocean uptake of the greenhouse gas CO₂ can be accelerated by collecting and liquefying the gas from point sources, and by pumping it into the ocean at appropriate locations and at sufficient depths. See H. Drange et al., *Ocean Release of Fossil Fuel CO₂: a Case Study*, 28 GEOPHYS. RES. LETT. 2637 (Jul. 1, 2001).

Before ... ocean release and storage of fossil fuel CO₂ can be made operational, theoretical results ... require field verifications for both a single source, and for the cumulative effect of many sources, including hydrate formation. Furthermore, *it is of utmost importance that environmental issues including direct and indirect effects on the marine biota and possible dissolution of calcareous sediments are assessed.* These effects should also be viewed in the light of ongoing and future acidification of the world ocean surface waters due to the natural ocean uptake of atmospheric CO₂. Since ocean storage will complicate quantification of the natural ocean sink of human generated CO₂, and consequently the global carbon budget, a global ocean storage monitoring program is needed.

See id. (emphasis added).

Mr. Chairman, that concludes our statement on the health and environmental effects of power plant emissions. If the Committee has any questions, please contact Michael Charles of our Washington Office at (202) 789-2200 or by e-mail at mcharles@asce.org.

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