No. 12-1182, -1183

In the Supreme Court of the United States

ENVIRONMENTAL PROTECTION AGENCY, ET AL.,
Petitioners,
v.
EME HOMER CITY GENERATION, L.P., ET AL.,
Respondents.

AMERICAN LUNG ASSOCIATION, ET AL.,
Petitioners,
v.
EME HOMER CITY GENERATION, L.P., ET AL.,
Respondents.

On Writs of Certiorari to the United States Court of Appeals for the District of Columbia Circuit

BRIEF OF *AMICI CURIAE* ATMOSPHERIC SCIENTISTS AND AIR QUALITY MODELING EXPERTS IN SUPPORT OF PETITIONERS

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INTEREST OF THE *AMICI CURIAE*[1]

Amici Curiae atmospheric scientists and air quality modeling experts are Gregory Carmichael, William Chameides, Russell Dickerson, Arlene Fiore, Tracey Holloway, Mark Jacobson, Paul Miller, Mehmet Odman, Noelle Eckley Selin, Sanford Sillman, Scott Spak, and Jason West. The *Amici* wish to supply the Court with an understanding of the complexity of interstate air transport and air quality modeling, and explain why the approach EPA used to quantify upwind states' significant contributions to nonattainment and maintenance problems in downwind states and determine upwind states' emissions reduction obligations under the Transport Rule is a scientifically reasonable way to meet the requirements of the good neighbor provision of the Clean Air Act. The *Amici* also wish to explain why it would be difficult (if not impossible) to design a rule that meets the lower court's "red lines" or constraints on EPA's authority to regulate the interstate transport of air pollutants and why there is no scientifically justified reason for the lower court to substitute its preferred approach for the one EPA used.

Amicus Dr. Gregory Carmichael is the Karl Kammermeyer Professor of Chemical and Biochemical Engineering at the University of Iowa and co-director of Iowa's Center for Global and

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[1] No counsel for any party in this case has authored this brief in whole or in part, and no persons other than the *amici curiae* and their counsel made any monetary contribution to its preparation or submission. Written consents from the parties to the filing of this brief are on file with the Clerk.

Regional Environmental Research. He has M.S. and Ph.D. degrees in Chemical Engineering from the University of Kentucky. Dr. Carmichael has done extensive research related to air quality and its environmental impacts and is a leader in the development and application of chemical transport models at scales ranging from local to global. His research has involved the development of innovative modeling tools, including techniques to optimally integrate measurements and models via formal chemical data assimilation. He serves as chair of the Scientific Advisory Group for the World Meteorological Organization Global Atmospheric Watch Urban Meteorology and Environment project, which is focused on building capacity worldwide to improve air quality forecasts and related services. He is also a fellow of the American Institute of Chemical Engineering and a recent recipient of the Lawrence K. Cecil Award in Environmental Chemical Engineering, which recognizes an individual's outstanding chemical engineering contribution and achievement in the preservation or improvement of the environment.

Amicus Dr. William L. Chameides is Dean of the Nicholas School of the Environment at Duke University. He has a Ph.D. from Yale University and has combined more than 30 years in academia as a professor, researcher, teacher, and mentor with a 3-year stint in the NGO world as the chief scientist of the Environmental Defense Fund. Dr. Chameides' research focuses on the atmospheric sciences, elucidating the causes of and remedies for global, regional, and urban environmental change and identifying pathways towards a more sustainable future. His research helped lay the groundwork for our understanding of the chemistry of the lower atmosphere, elucidating pathways for the mitigation of urban and regional photochemical smog, and identifying the impact of regional environmental change on global food production. He is a member of the National Academy of Sciences and a fellow of the American Geophysical Union. He has also served on numerous national and international committees and task forces, including being appointed Vice Chair of the Committee on America's Climate Choices, commissioned by Congress to develop a multi-decadal roadmap for America's response to climate change.

Amicus Dr. Russell Dickerson is a professor in the Department of Atmospheric and Oceanic Science at the University of Maryland and Director of the Regional Atmospheric Measurement, Modeling, and Prediction Program (RAMMPP), the research arm of the Maryland Department of the Environment. He earned his A.B. at the University of Chicago, Ph.D. (Chemistry) at the University of Michigan, and did postdoctoral studies at the Max Planck Institute (Air Chemistry Division) in Mainz, Germany. He has more than 30 years experience in atmospheric chemistry and air quality research including measurements and models of pollutant transport on international and interstate scales. He is a member of NASA's Air Quality Applied Science Team and AURA Science Team, as well as a fellow of the American Geophysical Union and the American Association for the Advancement of Science.

Amica Dr. Arlene M. Fiore is an Associate Professor in the Department of Earth and

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Amica Dr. Tracey Holloway is an Associate Professor in the Nelson Institute for Environmental Studies at the University of Wisconsin-Madison and leads an air quality research program in the Nelson Institute Center for Sustainability and the Global Environment. She is also deputy director of the NASA Air Quality Applied Sciences Team and a 2011 Leopold Fellow, with research supported by NASA, the National Renewable Energy Laboratory, the National Institute of Health, and the U.S. Department of Transportation. She earned her Ph.D. in Atmospheric and Oceanic Sciences from Princeton University. Dr. Holloway's research employs mathematical models of the atmosphere to evaluate how emissions in one area can affect atmospheric chemistry downwind, how alternative energy strategies could improve air quality, and to evaluate connections between climate and chemistry.

Amicus Dr. Mark Z. Jacobson is a Professor of Civil and Environmental Engineering at Stanford University and a Senior Fellow of both the Woods

Institute for the Environment and the Precourt Institute for Energy. He has M.S. and Ph.D. degrees in Atmospheric Science from the University of California at Los Angeles as well as B.S. and M.S. degrees in Civil and Environmental Engineering from Stanford University. Dr. Jacobson's research focuses on better understanding severe atmospheric problems, such as air pollution and global warming, and developing and analyzing large-scale clean-renewable energy solutions to them. He has developed numerous computer models to simulate air pollution, weather, and climate, testified three times before the U.S. Congress, and served on the Energy Efficiency and Renewables advisory committee to the U.S. Secretary of Energy. In 2005, Dr. Jacobson received the American Meteorological Society Henry G. Houghton Award for significant contributions to modeling aerosol chemistry.

Amicus Dr. Paul Miller is the Deputy Director and Chief Scientist of Northeast States for Coordinated Air Use Management (NESCAUM), a nonprofit association providing scientific, technical, analytical, and policy support to the air quality and climate programs of the eight Northeast states. Dr. Miller provides the organization with legal, technical, and policy support for all NESCAUM initiatives. He plays a leading role in supporting state efforts to address ozone transport, acid deposition, regional haze, and other air and climate issues. Dr. Miller has been a Senior Fellow at Princeton University's Center for Energy and Environmental Studies, and a National Research Council Associate at the Joint Institute for Laboratory Astrophysics, University of Colorado, Boulder. He has a Ph.D. in Chemical

Physics from Yale University and a J.D. from Stanford University.

Amicus Dr. Mehmet T. Odman is Principal Research Engineer in the School of Civil and Environmental Engineering at the Georgia Institute of Technology. He received his Ph.D. in Mechanical Engineering from Carnegie Mellon University. Dr. Odman's research interests include air pollution meteorology and atmospheric chemistry, air quality modeling at local, urban, regional, and global scales, computational fluid dynamics in environmental applications, numerical methods and algorithms, and high performance computing. Dr. Odman has also developed simulation models that are widely used in the field of air pollution management.

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Amicus Dr. Sanford Sillman is a Research Professor in the Department of Atmospheric, Oceanic and Space Sciences at the University of Michigan. He has also worked at EPFL, Lausanne, Switzerland and at the Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Gif-sur-Yvette, France. He has an M.S. degree in Applied Math and a Ph.D. in Applied Physics from Harvard University and an M.S. in Technology and Policy from M.I.T. Dr. Sillman has 25 years of research experience focused on the formation, transport and photochemistry of ozone in the atmosphere, and also on the transport of atmospheric mercury. He developed one of the first model-based analyses of regional (100-1000 mile) transport of ozone and precursors in the eastern U.S. and has worked in particular on uncertainties in model predictions for the relation between ozone and precursor emissions. Dr. Sillman is a member of the American Geophysical Union and has three times received awards for excellence in refereeing articles for AGU journals.

Amicus Dr. Scott Spak is an Assistant Professor holding joint appointments with Urban and Regional Planning, Civil and Environmental Engineering, and the Environmental Policy Program at the Public Policy Center at the University of Iowa. He teaches courses on U.S. and international environmental policy, dynamic systems modeling, and urban growth. Dr. Spak develops and applies numerical models to study the intersection between human activities and environmental change. His research informs decision-making by identifying tipping points in linked Earth systems, including atmospheric aerosols, chemical pollution, and regional climate, understanding the roles of technology, policy, and societal change in projecting future human impacts on the environment, and developing new ways to embed Earth System modeling in environmental policies and urban planning. He has a Ph.D. in Atmospheric and Oceanic Sciences from the University of Wisconsin.

Amicus Dr. Jason West is an Assistant Professor in the Department of Environmental Sciences and Engineering at the University of North Carolina at Chapel Hill, where he performs interdisciplinary research addressing air pollution and climate change, using models of atmospheric chemistry and transport. Dr. West's research has included computer modeling of the international transport of ozone and particulate matter, and modeling of air pollution formation and transport in Mexico City and the Middle East. He has likewise conducted global scale modeling of the effects of air pollution on global climate change. Dr. West has worked at Princeton University, the Massachusetts Institute of Technology, and at the Environmental Protection Agency under a fellowship from the American Association for the Advancement of Science. He has a Ph.D. and M. S. from Carnegie Mellon University, an M.Phil. from the University of Cambridge, and a B.S. from Duke University.

All *Amici* file this brief solely as individuals and not on behalf of the institutions with which they are affiliated.

SUMMARY OF THE ARGUMENT

In passing the Clean Air Act, Congress recognized that the interstate transport of air pollutants like sulfur dioxide and nitrogen oxides from upwind states has contributed significantly to the inability of downwind states to meet the Act's science-based air quality standards. The Act thus requires the regulation of air pollution emitted by upwind states through the good neighbor provision.

EPA, fulfilling its duties under the Act, promulgated the Cross-State Air Pollution Rule — also known as the Transport Rule — after careful consideration of the realities of this complex phenomenon. The Transport Rule is a reasonable scientific interpretation of the statutory mandate.

In its opinion setting aside the Transport Rule, the lower court imposed three "red lines" or constraints on the EPA's administrative authority which it purported to find in the language of the Clean Air Act itself. However, these constraints do not take into account the complexity of the interstate transport of air pollutants and as a result, it would be difficult, if not impossible, to design a rule that both recognizes the physical realities of air transport and meets these constraints. The lower court erred in doing so, and this Court should reverse its decision.

ARGUMENT

The Clean Air Act, 42 U.S.C. § 7401 *et seq.*, regulates air pollution across the United States. Under the Act, EPA is required to set science-based National Ambient Air Quality Standards (NAAQS) which limit the amount of specific pollutants in the air to protect public health and the environment. Once EPA has established NAAQS for a pollutant, each state must adopt a State Implementation Plan or SIP designed to insure that NAAQS will be met within state borders.

The Act also places limits on interstate air pollution through the good neighbor provision, 42 U.S.C. § 7410(a)(2)(D)(i)(I). This section requires all SIPs to contain provisions that prohibit emissions within state borders that "contribute significantly" to nonattainment or interference with maintenance of the NAAQS by another state. *Id.*

The Cross-State Air Pollution Rule, also known as the Transport Rule, is EPA's latest attempt to implement the good neighbor provision of the Act. Adopted in August 2011, the Transport Rule limits emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) by coal- and natural gas-fired power plants in 27 upwind states that contribute significantly to NAAQS[2] nonattainment and maintenance problems in one or more downwind states.

A coalition of power companies, coal companies, and other industry participants, along with various state and local governments filed suit in the U.S. Court of Appeals for the D.C. Circuit, challenging the Transport Rule. According to the challengers, EPA exceeded its statutory authority to regulate the interstate transport of air pollutants when it adopted

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[2] The relevant NAAQS are the 1997 $PM_{2.5}$ annual NAAQS, the 2006 $PM_{2.5}$ daily NAAQS and the 1997 8-hour ozone NAAQS. C.A. App. 278.

the Transport Rule. The lower court agreed, and in August 2012, vacated the rule.

The lower court held that EPA's administrative authority under the Act is restricted by several "red lines" or constraints. Pet. App. 22a-29a. First, EPA may not force any state to reduce its emissions below EPA's initial threshold for inclusion in the Transport Rule (the Threshold Constraint). *Id.* at 23a. Second, EPA may not force any upwind state to "share the burden of reducing other upwind states' emissions" and must allocate necessary emissions reductions among upwind states in proportion to the size of their contributions to the downwind state's nonattainment or maintenance problems (the Proportionality Constraint). *Id.* at 24a-27a. Third, EPA may not require emissions reductions in upwind states that, when aggregated, go beyond what is necessary for the downwind states to achieve the NAAQS (the Over-control Constraint). *Id.* at 29a.

These constraints have a certain intuitive appeal. They promise no unnecessary emissions reductions and invoke notions of fairness and equity in the allocation of reductions among upwind states. However, the complexity of interstate air transport makes it difficult (if not impossible) to design a rule that meets these constraints. Furthermore, emissions at the source are not directly proportional to pollutant concentrations downwind, which the lower court did not account for, and even if they were directly proportional, air pollution controls do not allow the precise emissions reductions that would be necessary to achieve the perfect allocation the lower court desires. Most pollution controls are blunt instruments that eliminate pollution in bulk, not scalpels capable of cutting out specific amounts.[3] Power plants, also known as electric generating units (EGUs), cannot easily be controlled for specific amounts of SO_2 and NO_x that EPA or the states determine they can emit. Rather, they are fitted with control devices designed to capture SO_2 and NO_x emissions in amounts dictated primarily by the design of the equipment and not subject to much, if any, manipulation when operated[4].

We believe that the lower court's decision fails to recognize these physical realities. The approach EPA used to quantify upwind states' significant contributions to nonattainment and maintenance problems in downwind states and determine upwind states emissions reductions obligations to meet the requirements of the good neighbor provision is scientifically reasonable. The approach recognizes that any control strategy must involve trade-offs due to the complexity of air transport, the various uncertainties involved, and the challenges that arise when dealing with multiple emitting and receiving states.

Hence, the lower court's goal of reducing upwind emissions just enough for downwind states to achieve the NAAQS while allocating the necessary reductions

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[3] Common pollution controls include electrostatic precipitators, baghouses, scrubbers, and selective catalytic reduction.

[4] Operators can, however, manipulate the emissions captured by control devices by not operating them all of the time. EPA specifically addressed this possibility in its rulemaking. C.A. App. 325-26.

in such a way that no upwind state is responsible for more than what the court refers to as its "fair share of the mess in downwind states" is all but unattainable due to the complexities of interstate air transport. The lower court's rigid requirements would not have their intended effect and would only needlessly delay the public health benefits that reduced exposure to air pollution would bring to millions of citizens.

I. INTERSTATE AIR TRANSPORT, AND THE MODELS USED TO SIMULATE IT, ARE COMPLEX.

A. Interstate Air Transport Is A Complex Phenomenon.

Regulating interstate air transport of pollutants is complex because transport, which brings pollutants from distant sources to places that may already be impacted by local sources, occurs on multiple scales. The movements of large high-pressure systems, generally (but not always) from west to east across the United States, cause large-scale transport over many days, their circulation patterns giving rise to more complex transport behavior than their mean movements suggest. Regional phenomena, such as the nocturnal low-level jet over the Atlantic Coastal Plain, cause moderate-scale transport over shorter time frames, often inducing transport in directions at odds with the prevailing wind direction. Land, sea, mountain, and valley breezes cause small-scale, short-term transport in other directions still, selectively affecting local areas. Northeastern States for Coordinated Air Use Management, *The Nature of the Ozone Air Quality Problem in the Ozone Transport Region: A Conceptual Description* (2006).

Further complicating matters is the fact that the atmospheric processes and variables that influence the formation and air transport of pollutants, including (but not limited to) wind speed and direction, temperature, pressure, relative humidity, the presence of liquid water (i.e., clouds), precipitation, solar energy, and atmospheric turbulence, vary considerably over space and time and can change by the hour, by the day, and by the season, as can the emissions of EGUs and other combustion sources. In addition, the compounds directly emitted by EGUs and subject to removal by control devices, *i.e.*, SO_2 and NO_x, are, in the context of the Transport Rule, just precursors (causal elements) to the pollutants that are actually subject to the NAAQS, *i.e.*, fine particles ($PM_{2.5}$) and ozone. The chemical reactions governing the formation and destruction of these pollutants in the atmosphere are influenced by many of the same varying atmospheric processes and variables that influence air transport.

In short, interstate air transport of pollutants is dependent upon weather phenomena that cause transport on different time and spatial scales. Atmospheric processes and source emissions vary considerably over space and time and can change rapidly. Together, the available precursor emissions and weather conditions initiate complex chemical reactions that produce and destroy pollutants in the atmosphere.

B. The Models Used To Simulate Interstate Air Transport Are Also Complex.

The models developed to simulate transport and identify linkages between upwind sources and downwind receptors take into account our basic understanding of these processes and thus themselves are complex. The accuracy of their predictions depends upon the physical and chemical processes simulated, the mathematical treatment of those processes, and the accuracy of meteorological data, emissions data, and other inputs.

Models are essential tools and provide information that is hard to obtain any other way. Models can identify general patterns of regional transport and can help identify the relative impact of local versus upwind sources. They can also identify upwind states' impacts on downwind states in rough proportion to the size of their emissions reasonably well.

Still, it is important to recognize that models, including those used by EPA to estimate interstate transport, are not perfect. Observations from field experiments add powerful, additional evidence. For example, aircraft observations show that ozone concentrations in air crossing the upwind (western) borders of smaller Eastern states such as Maryland and Delaware often already exceed the NAAQS, demonstrating that the only practical way for certain downwind states to be in attainment is stricter controls on emissions from upwind states. L.C. Brent et al., *Evaluation of the Use of a Commercially Available Cavity Ringdown Absorption Spectrometer* *for Measuring NO_2 in Flight, and Observations over the Mid-Atlantic States, during DISCOVER-AQ*, Atmos. Chem., DOI 10.1007/s10874-013-9265-6 (2013). Therefore, model simulations must be evaluated against direct measurements of air pollutants such as ozone and its precursors, especially NO_x. When such comparisons are made for the eastern U.S., regional models generally *underestimate* both the spatial scale of pollution episodes, and the range of transport. J.M. Godowitch, G.A. Pouliot, and S.T. Rao, *Assessing Multi-Year Changes In Modeled And Observed Urban NOx Concentrations From A Dynamic Model Evaluation Perspective*, 44 Atmos. Environ., 44, 2894–2901 (2010).

II. EPA'S APPROACH TO THE QUANTIFICATION OF UPWIND STATES' SIGNIFICANT CONTRIBUTIONS AND THE DETERMINATION OF UPWIND STATES' EMISSIONS REDUCTIONS OBLIGATIONS IS SCIENTIFICALLY REASONABLE.

In designing the Transport Rule, EPA made substantial use of air quality modeling. As the technical support documents demonstrate, EPA's use of modeling was a scientifically appropriate use of this important tool.

EPA first used an air quality modeling platform known as the Comprehensive Air Quality Model with Extensions (CAMx) version 5.3 to determine which states to include in the Transport Rule. CAMx is a photochemical model that simulates the emission, transport, chemical transformation, and removal of pollutants in the troposphere, where most of these processes take place. It has been employed extensively by local, state, regional, and federal government agencies, academic and research institutions, and private consultants for regulatory assessments and general research throughout the U.S. since 1996. Council for Regulatory Environmental Modeling, *Model Report: Comprehensive Air Quality Modeling with Extensions* (2009), available at http://cfpub.epa.gov/crem/Knowledge_base/crem_report.cfm?deid=75888.[5]

EPA used CAMx modeling for its initial screening analysis, wherein it determined which upwind states contribute at or above a threshold level (1% of the relevant NAAQS) to one or more downwind nonattainment or maintenance receptors. The 1% threshold was used to screen out states with relatively small contributions to pollution in downwind states. It was not used to quantify upwind states' significant contributions to nonattainment and maintenance problems in downwind states.

For its subsequent control analysis, in which it quantified the emissions that it defines as each upwind state's significant contribution to nonattainment or maintenance problems in

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[5] The *Model Report* gives several examples of state government use of CAMx in the "Case Studies" section. *Id.* Additional information is available at the regulatory sites. *See, e.g.,* Texas Commission on Environmental Quality (TCEQ). Houston-Galveston-Brazoria 8-Hour Ozone SIP Modeling (2005/2006 Episodes): CAMx Modeling Domain, available at http://www.tceq.texas.gov/airquality/airmod/data/hgb8h2/hgb8h2_camx_domain.html (showing CAMx modeling domain used by TCEQ in SIP development extending over eastern U.S.).

downwind states, EPA identified each upwind state's emission reductions available at ascending costs per ton, assessed those upwind emission reductions' downwind air quality impacts, identified upwind "cost thresholds" that deliver the most cost-effective emission reductions and downwind air quality improvements, and wrote the emissions reductions available at those cost thresholds into state emissions budgets.[6] *See* C.A. App. 317 (summary of method).

In its technical support documents, EPA explained its inclusion of cost factors in the Transport Rule, offering, among other reasons, the following example. Suppose a downwind state exceeds the NAAQS by 1.2 $\mu g/m^3$. It receives 4.8 $\mu g/m^3$ of the pollutant from four upwind states. For the downwind state to meet the NAAQS, all upwind states would have to reduce their cumulative contribution by 1.2 $\mu g/m^3$. C.A. App. 2311. If the reductions are made in proportion to state contributions to downwind nonattainment, the absolute reductions required would vary from state to state, but the relative reductions would stay the same. In this example, each state would have to reduce its contribution by 25%.

States that had already implemented stringent control programs would have a much harder time achieving the required reductions whereas the states

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[6] The Transport Rule's state emissions budgets represent the quantity of pollutants that may be emitted in each upwind state after it eliminates its significant contribution to nonattainment by, or interference with maintenance in, downwind states. C.A. App. 281.

that had done little to control air pollution would find it easy to achieve the same percentage. C.A. App. 2312. Suppose State A, which does not require much in the way of air pollution controls, contributes 2.4 $\mu g/m^3$ of the 4.8 $\mu g/m^3$. Its power plants would have to reduce their emissions by a relatively large 0.6 $\mu g/m^3$, but the reductions might be accomplished through the use of first-line, low-cost pollution controls, such as switching to lower-sulfur coal. On the other hand, State B, which contributes only 0.4 $\mu g/m^3$ of the 4.8 $\mu g/m^3$ but which already requires its power plants to use lower-sulfur coal, precipitators and baghouses, might have difficulty reducing its contribution by even the relatively small amount of 0.1 $\mu g/m^3$. Since State B already requires higher-level, cost-effective controls, its power plants would likely be subject to considerable expense while achieving little in absolute numeric emissions reductions. C.A. App. 2311-12. States would thus have little incentive to require stringent controls on their power plants on their own, *i.e.,* absent any legal requirement to do so.

For these reasons, we believe that the consideration of cost factors to define "significant contribution" and assign transport-related emissions reductions obligations is reasonable. It is consistent with a scientific understanding of the complexities of air pollution transport, the appropriate use of air quality modeling and its limitations, and available emissions-control technologies and how they work.

III. THE COMPLEXITY OF INTERSTATE TRANSPORT AMONG MULTIPLE STATES MAKES IT DIFFICULT (IF NOT IMPOSSIBLE) TO DESIGN A RULE THAT MEETS THE LOWER COURT'S CONSTRAINTS.

As mentioned above, the lower court imposed three constraints on EPA's authority to regulate interstate air pollution, based on its interpretation of the statutory text. Pet. App. 22a-23a. We believe these constraints have their basis in an overly simplified understanding of how interstate air pollution transport really works.

This understanding can be illustrated by the example of proportionality found in the lower court's opinion. *See* Pet. App. 26a. Suppose, the lower court says, that the NAAQS for a pollutant is 100 units and the nonattainment area in that state contains 150 units of that pollutant, 60 units of which originated in upwind states. *Id.* According to the lower court, EPA cannot lawfully require the upwind states, when their contributions are combined, to reduce the level of the pollutant by more than the 50 units by which the downwind state exceeds the 100-unit NAAQS. *Id.* Therefore, if three upwind states each contribute equally to the downwind state's air quality exceedance, EPA can only require the upwind states to lower the level of the pollutant emitted by no more than 1/3 of the 50-unit, out-of-state contribution, or 16 2/3 units. *Id.*

Downwind nonattainment in this example (and in the lower court's understanding) is caused by contributions from a small number of isolated upwind states contributing a readily measurable amount of a specified pollutant to one (and only one) nonattainment area in one downwind state. This is not realistic. This example also assumes, incorrectly, that the amount of a pollutant that leaves an EGU's stack in an upwind state is consistently proportional to the ambient concentration of that pollutant in affected downwind states.

The reality, however, is much more complicated. First, most upwind states contribute, in varying degrees, to nonattainment and maintenance problems in many downwind areas. For example, according to EPA's modeling, Kentucky contributes to 12 annual $PM_{2.5}$ nonattainment receptors in six states, four annual $PM_{2.5}$ maintenance receptors in two states, 20 24-hour $PM_{2.5}$ nonattainment receptors in eight states, 21 24-hour $PM_{2.5}$ maintenance receptors in seven states, four 8-hour ozone nonattainment receptors in two states, and six 8-hour ozone maintenance receptors in four states. C.A. App. 2706; 2708, 2710; 2712; 2702; 2704.

Second, many states that are upwind contributors to pollution problems in other states also have NAAQS nonattainment and maintenance problems of their own, i.e., they are both "upwind" and "downwind." For example, according to EPA's modeling, Ohio is an upwind state contributing to six annual $PM_{2.5}$ nonattainment receptors in five states, two annual $PM_{2.5}$ maintenance receptors in one state, 18 24-hour $PM_{2.5}$ nonattainment receptors in seven states, 15 24-hour $PM_{2.5}$ maintenance receptors in six states, four 8-hour ozone nonattainment receptors in two states, and six 8-hour ozone maintenance receptors in four states. *Id.* at 2707; 2709; 2711; 2713; 2705. Ohio is also a downwind state with six annual $PM_{2.5}$ nonattainment receptors and two annual $PM_{2.5}$ maintenance receptors affected by 28 upwind states each as well as two 24-hour $PM_{2.5}$ nonattainment receptors and six 24-hour $PM_{2.5}$ maintenance receptors affected by 26 to 29 states each. *Id.* at 2706-07; 2708-09; 2710-11; 2712-13.

In short, as EPA notes on page six of its opening brief, "the interstate pollution problem is thus best understood as a dense, spaghetti-like matrix of overlapping upwind/downwind 'linkages' among many states, rather than a neater and more limited set of linkages among just a few." The lower court's overly simplistic view of a small number of upwind states contributing to a single downwind state, and the far more complicated set of overlapping upwind/downwind contribution linkages that EPA identified through its air quality modeling for the Transport Rule, are shown in Figures 1 and 2.[7]

This complexity makes it difficult (if not impossible) to develop a rule that meets the lower court's constraints.

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[7] It is worth noting that even the more complicated set of linkages shown in Figure 2 is a vast simplification relative to the real atmosphere, with linkages that change from day to day and year to year.

Figure 1. Interstate air transport as conceived by the lower court. Paul Miller, *Transport Science and the Law* 9 (2013), *available at* http://acmg.seas.harvard.edu/presentations/aqast/jun2013/day2_am_1/7_AQAST_PMiller_NESCAUM_20130605.pdf.

A. The Threshold Constraint.

In the event an upwind state contributes to downwind nonattainment or maintenance problems in more than one area, as is very often the case, the emissions reductions necessary to address that state's significant contribution to one nonattainment area are likely to result in its contribution to other nonattainment area(s) falling below the 1% threshold used in EPA's initial screening analysis, in violation of the lower court's Threshold Constraint[8]. This is

[8] The lower court's description of the "Threshold Constraint" is less than clear. Pet. App. 36a-37a. It may have meant that an upwind state's *maximum* contribution to the

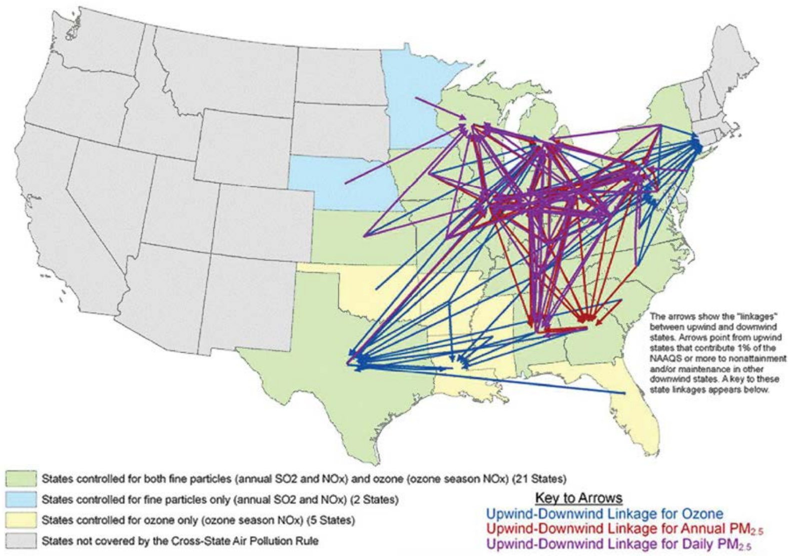

Figure 2. Interstate air transport as modeled by EPA. Paul Miller, *Transport Science and the Law* 8 (2013), available at http://acmg.seas.harvard.edu/presentations/aqast/jun2013/day2_am_1/7_AQAST_PMiller_NESCAUM_20130605.pdf.

particularly true when the amount of pollution the upwind state contributes to one downwind area is significantly more than the amount it contributes to the other(s).

Consider Illinois, which according to EPA's modeling contributes 0.8 ppb — exactly 1% of the

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downwind states cannot be reduced below the threshold or that the upwind state's contribution to *any* downwind state cannot fall below the 1% threshold. If the first interpretation is correct, there is nothing in the administrative record to indicate that the Transport Rule falls short. The second interpretation leads to the scenarios described below.

1997 8-hour ozone NAAQS — to maintenance receptors in Fairfield County, Connecticut and Harris County, Texas, while simultaneously contributing 26.8 ppb — over 33% of the NAAQS — to a maintenance receptor in Allegan County, Michigan. C.A. App. 2704. If EPA required Illinois to reduce its emissions enough to eliminate its significant contribution to Allegan County, Illinois' contributions to Fairfield and Harris Counties would most likely fall below the 1% significance threshold, in violation of the lower court's Threshold Constraint.

Consider also Missouri, which according to EPA's modeling contributes between 0.36 and 0.46 μg/m^3 — roughly 1% of the 2006 24-hour $PM_{2.5}$ NAAQS — to five nonattainment receptors in Michigan and Pennsylvania, between 0.86 and 0.88 μg/m^3 — roughly 2% of the NAAQS — to four nonattainment receptors in Indiana and Wisconsin, and 3.73 μg/m^3 — nearly 11% of the NAAQS — to a nonattainment receptor in Illinois. C.A. App. 2704. If EPA required Missouri to reduce its emissions enough to halve its 2% contribution to Indiana and Wisconsin, its contributions to Michigan and Pennsylvania might fall below the 1% significance threshold, in violation of the lower court's Threshold Constraint, and it would still contribute significantly to Illinois. On the other hand, if EPA required Missouri to eliminate all of its significant contribution to Illinois, Missouri's contributions to Michigan, Pennsylvania, Indiana *and* Wisconsin would most likely fall below the 1% significance threshold.

In instances such as these, EPA might theoretically be able to meet the Threshold

Constraint by imposing tailored emissions reductions on specific EGUs in upwind states, provided that different plants contributed to different nonattainment and maintenance receptors in downwind states. However, just as upwind states typically contribute to downwind nonattainment or maintenance problems in more than one area, individual sources, particularly large, high-emitting EGUs, are likely to contribute to downwind nonattainment or maintenance problems in more than one area too. In that case, even EGU-specific emissions reductions wouldn't allow EPA to design a rule that meets the Threshold Constraint.

B. The Proportionality Constraint.

The lower court's view of interstate air pollution, where a small number of upwind states contribute to a single downwind state as shown in Figure 2, assumes each upwind state's contribution to the downwind state is easy to calculate. However, in reality, many upwind states contribute significantly to nonattainment and maintenance problems in numerous downwind states and contribute in differing proportions to each one. Where that is the case, it is impossible for the upwind state to reduce its emissions in proportion to its contribution to one downwind state without necessarily over- or under-controlling for its contribution to every other downwind state. The reductions required to meet the Proportionality Constraint are different in each instance, and cannot be met simultaneously.

For example, according to EPA's modeling, a nonattainment receptor in Marion County, Indiana receives contributions from 28 upwind states, with eight of these states exceeding the 1% threshold for the 24-hour $PM_{2.5}$ NAAQS. C.A. App. 2710-11. Similarly, a nonattainment receptor in Allegheny County, Pennsylvania receives contributions from 28 states, seven of which contribute more than 1% of the same NAAQS. *Id.* West Virginia (9%) and Tennessee (11%) each contribute roughly similar amounts to the Marion County receptor while Kentucky contributes significantly more, with 32% of all contributions over the 1% threshold for that receptor. So, in order to meet the Proportionality Constraint for their contributions to Marion County, West Virginia and Tennessee's emissions would have to be reduced by about the same amount while Kentucky's emissions would have to be reduced by approximately three times as much to account for its larger contribution to the Marion County receptor.

However, the Proportionality Constraint simultaneously requires these same states to make a completely different set of emissions reductions for their contributions to the Allegheny County receptor. West Virginia contributes 30% of all contributions over the 1% threshold to the Allegheny County receptor, while Kentucky's contribution is 11%, and Tennessee's only 3%. In this case, the Proportionality Constraint would require West Virginia to reduce its emissions more than twice as much as Kentucky and ten times as much as Tennessee. This trio of states would be subject to emissions reduction in ratios of 3:4:11 and 10:1:4 concurrently. This is simply not possible.

C. The Over-control Constraint.

According to the lower court, EPA may only require the precise level of emissions reductions in upwind states necessary for downwind states to achieve the NAAQS. In the lower court's view, impermissible over-control occurs when upwind emissions reductions cause pollutant levels in downwind nonattainment areas to drop below the NAAQS. However, given the complex and varied web of interstate pollution transfers, compliance with the Threshold and/or Proportionality Constraints is certain to result in non-compliance with the Over-control Constraint.

If an upwind state is required by the Transport Rule to make a large reduction in a pollutant, based on its large contribution to one downwind state's nonattainment of the NAAQS, that same large reduction may reduce the level of that pollutant in another downwind state so that the second downwind state achieves air quality better than the NAAQS. That is, eliminating upwind states' significant contributions to heavily polluted downwind states is likely to cause unavoidable over-control in less polluted states.

In reality, the net effect of EPA's Transport Rule *is under*-control, not over-control. Even after the Transport Rule is fully implemented, not all downwind nonattainment and maintenance problems will be resolved. C.A. App. 316. Furthermore, the NO_x controls EPA's Transport Rule would require during the ozone season are already in place in most states under the Clean Air Interstate Rule (CAIR).

Yet despite these controls, many ozone monitors in the eastern U.S. are still recording concentrations at or above the NAAQS. Table 1 summarizes NO_x emissions reported to the EPA CAIR program in recent years and the number of monitors recording at least one exceedance of the 0.08 part per million (ppm) ozone NAAQS.

Year	NO_x emissions (tons/ozone season)	No. monitors above 0.08 ppm NAAQS
2008	689,000	21
2009	495,000	0
2012	514,000	70

Table 1. Annual ozone season NO_x emissions reported to the CAIR program and corresponding number of ozone air monitors recording a 4th maximum 8-hour ozone average above the NAAQS within states affected by the CAIR program. Data available at EPA, *Air Markets Program Data* (June 19, 2013), http://ampd.epa.gov/ampd; EPA, *Monitor Reports* (Sep. 9, 2013), http://www.epa.gov/airquality/airdata/ad_rep_mon.html.

In sum, the constraints imposed by the lower court's opinion are not based on a realistic scientific understanding of the complexity of interstate air transport. EPA's Transport Rule is a reasonable implementation of the good neighbor provision of the Clean Air Act that does take these realities into account. Therefore, the rule should be allowed to stand.

CONCLUSION

For the foregoing reasons, this Court should reverse the lower court's decision.

Respectfully submitted,

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