Air Modeling as a Tool in Environmental Law and Policy:

A Guide for Communities and Environmental Groups

Part I:

Criteria Pollutants
National Ambient Air Quality Standards
State Implementation Plans
Attainment and Nonattainment Areas

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Introduction

Intended as an educational tool for communities and environmental groups, this white paper discusses the role of air modeling in addressing air quality problems. Air modeling plays a predominant role in the implementation of air pollution laws and regulations. Federal, state and local agencies use air modeling to evaluate state implementation plans and develop emissions trading programs. Companies use air modeling to support their applications for air permits. Environmental groups use air modeling to support their public comments on proposed permits and rules, and to support their citizen suit claims against industrial facilities and environmental agencies.

It is important to draw a distinction between air modeling and air monitoring. Air modeling is an attempt to evaluate potential impacts on air quality. In contrast, air monitoring involves the gathering of actual data on air quality. To illustrate, a state might conduct air monitoring to gather real time data to determine whether air quality conforms to national standards. On the other hand, it might use air modeling to forecast whether it will conform to national standards in the future, assuming that a state takes appropriate actions. The tension between air modeling and air monitoring is an important theme in air pollution law and policy.

Part I of this white paper addresses air modeling on a statewide level, in the context of state plans for attaining federal air quality standards. Part II addresses air modeling in the context of air permitting for industrial facilities and legal remedies available to community groups and environmental organizations for addressing air pollution problems.

1. Air Modeling, the National Ambient Air Quality Standards, and State Implementation Plans

The Clean Air Act reflects a "cooperative federalism" approach to the most common air pollutants, known as the "criteria pollutants" (fine particulates ($PM_{2.5}$) and coarse particulates (PM_{10})), ozone, nitrogen oxides, sulfur dioxide, lead, and carbon monoxide), meaning that the states work with the federal government to achieve standards set by the federal government. Under this approach, the U.S. Environmental Protection Agency (EPA) sets national ambient air quality standards ("NAAQS") for the criteria pollutants, and the states develop state implementation plans ("SIPs") as a means to attain and maintain those standards.[1]

There are three important terms to keep in mind when thinking about how EPA and the states work together in order to set and achieve air quality standards: attainment demonstration, attainment determination, and area redesignation. An attainment *demonstration* is prepared by a state permitting agency to show that an area is expected to reach attainment in the future.[2] An attainment *determination* is prepared by EPA to confirm whether an area has reached attainment, as measured by monitoring data. For ozone and fine particulates, an attainment determination suspends the obligation of a state to submit further attainment demonstrations.[3] An attainment area *redesignation* is performed by EPA to legally change the status of a nonattainment area to an attainment area.[4] For this to happen, a state permitting agency must meet additional

[1] 42 U.S.C. §7408 (procedures for EPA to identify criteria pollutants), §7409 (procedures for EPA to set national ambient air quality standards for criteria pollutants), §7410 (procedures for states to develop state implementation plans to attain and maintain the national ambient air quality standards, and submit them to EPA for approval).
[2] 42 U.S.C. §7513a(a)(1)(B), (b)(2) (requiring a "demonstration" for a particulate matter nonattainment area), §7511a(c)(2)(A) (same, for a serious ozone nonattainment area); §51.908 (requiring an "attainment demonstration" for a nonattainment area under the 8-hour ozone standard), 40 C.F.R. §51.1007 (same, for a fine particulate nonattainment area), §51.1108 (same, for a nonattainment area under the 2008 8-hour ozone standard).
[3] 40 C.F.R. §51.918 (8-hour ozone standard); §51.1004(c) (fine particulate standard); §51.1118 (8-hour ozone standard for 2008).
[4] 42 U.S.C. §7407(d)(3).

requirements in the statute, including the requirement that the emissions reductions be "permanent and enforceable."[5]

Under the Clean Air Act, state implementation plans must include air quality modeling for criteria pollutants, as required by EPA.[6] In addition, EPA regulations require a state implementation plan to include a modeling control strategy, which is the combination of measures designated to achieve the reduction of emissions necessary for attainment or maintenance of the standards.[7] A state implementation plan must demonstrate the adequacy of a control strategy to provide for attainment of the standards, through applicable air quality models.[8] A state's attainment demonstration must provide a description of the dispersion models used to project air quality, and evaluate control strategies.[9] In turn, air modeling might be based on information collected during the process of monitoring for air pollutants. Present and past monitoring data might be used as input factors for the model.

2. EPA's Guideline on Air Quality Models (40 C.F.R. part 51, Appendix W)

EPA regulations require a control strategy to meet the requirements of Appendix W, which contains EPA's Guideline on Air Quality Models (the Guideline).[10] A state may modify or substitute another model for a model specified in Appendix W, but only if the use of the specified model is appropriate, and the state obtains written approval from EPA and subjects the model to notice and opportunity for public comment.[11] The Guideline sets forth specific criteria relating to air modeling in general, as well as a series of preferred air modeling programs,

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[5] *Id.*, §7407(d)(3)(E)(iii).
[6] 42 U.S.C. §7410(a)(2)(K).
[7] 40 C.F.R. part 51, Subpart G (Control Strategy); 40 C.F.R. §51.111, 40 C.F.R. §51.100(n) (definition of "control strategy").
[8] 40 C.F.R. §51.112(a)(1).
[9] 40 C.F.R. §51.112(b)(4), §51.115(b)(2).
[10] 40 C.F.R. §51.112(a)(1).
[11] 40 C.F.R. §51.112(a)(2).

tailored to particular circumstances.[12] As the product of a rulemaking, it may only be amended by EPA through another rulemaking under the notice-and-comment procedures of the federal Administrative Procedure Act.[13] The Guideline was most recently revised in 2005.[14]

It is important to understand the limitations of the Guideline. The fact that it is called a "guideline" might suggest that it is not strictly mandatory, even though it is the product of a rulemaking. Indeed, much of the textual language in Appendix W is suggestive, rather than mandatory in nature. This looseness creates a need for environmental organizations and communities to scrutinize air modeling activities by agencies and industrial facilities, to verify whether they accurately forecast actual air quality.

Another shortcoming of the Guideline is that it is expressly limited to the six criteria pollutants.[15] As a result, the Guideline is not expressly intended to apply to hazardous air pollutants (HAPs), a category of pollutants originally defined as those contributing to mortality, serious irreversible illness, or incapacitating reversible illness.[16] Under Section 112 of the Clean Air Act there are currently 187 hazardous air pollutants, including benzene, ethylbenzene, toluene, and xylene, typically emitted by industrial plants such as petroleum refineries and coke oven facilities.[17]

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[12] 40 C.F.R. part 51, Appendix W, §1.0(i) ("Appendix A contains summaries of refined air quality models that are "preferred" for specific applications; both EPA models and models developed by others are included").
[13] *Id.*, §1.0(g) ("All changes to the Guideline must follow rulemaking requirements since the Guideline is codified in Appendix W of Part 51").
[14] Final Rule, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, 70 Fed. Reg. 68,218, 68,228-68,261 (Nov. 9, 2005) (to be codified at 40 C.F.R. part 51, Appendix W).
[15] 40 C.F.R. part 51, Appendix W, §1.0(a) ("Applicable only to criteria air pollutants, it is intended for use by EPA Regional Offices in judging the adequacy of modeling analyses performed by EPA, State and local agencies and by industry.").
[16] Pub. Law 91-604, 84 Stat. 1676, 1685 (to be codified at 42 U.S.C. §7412(a) (1970).
[17] 42 U.S.C. §7412(b); U.S. Environmental Protection Agency, Initial List of Hazardous Air Pollutants with Modifications, http://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications (last visited Feb. 29, 2016).

According to the Guideline, the most preferred air modeling program is known as AERMOD, an acronym for the American Meteorological Society/Environmental Protection Agency Regulatory Model.[18] This is a software program that is available on EPA's website.[19] The program is based on a model that assumes that the concentrations of air pollutants in an exhaust plume are distributed in a pattern that resembles a bell curve.[20] Statisticians refer to such a distribution as a normal or Gaussian distribution.

Of course, air pollutants do not actually travel in such a precise manner in the real world. There are a number of external factors that affect their path. Accordingly, the Guideline addresses factors such as complex winds,[21] turbulence,[22] single and complex terrain,[23] dry and wet deposition,[24] and the presence of buildings.[25] The presence of mobile sources, as well as background levels of a particular air pollutant, may also affect the concentration of an air pollutant at a particular place and time.[26] The Guideline accounts for the nature of land uses and population density by authorizing urban dispersion coefficients and rural dispersion coefficients, in the models.[27] In theory, all these factors should be reflected in the AERMOD program,

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[18] *Id.*, Appendix W, §4.2.2(b) ("For a wide range of regulatory applications in all types of terrain, the recommended model is AERMOD. This recommendation is based on extensive developmental and performance evaluation (Section A.1; subsection n)."); Appendix A to Appendix W, §A.1(a)(1) ("AERMOD is appropriate for the following applications: … Point, volume, and area sources … Surface, near-surface, and elevated releases … Rural or urban areas … Simple and complex terrain … Transport distances over which steady-state assumptions are appropriate, up to 50km … 1–hour to annual averaging times … Continuous toxic air emissions.").

[19] U.S. Environmental Protection Agency, Preferred/Recommended Models, http://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod (last visited Feb. 29, 2016).

[20] 40 C.F.R. part 51, Appendix A to Appendix W, §A.1(d) ("AERMOD is a steady-state plume model, using Gaussian distributions in the vertical and horizontal for stable conditions, and in the horizontal for convective conditions.").

[21] *Id.*, Appendix W, §7.2.8, 8.3.3.2(g).

[22] *Id.*, §8.3.3.2(h).

[23] *Id.*, §4.2.1.1, 4.2.1.2.

[24] *Id.*, §4.1(d).

[25] *Id.*, §4.1(e).

[26] *Id.*, §8.1.2(j) (line source modeling of streets and highways), 8.2 (background concentrations).

[27] *Id.*, §7.2.3.

through software algorithms.[28] Finally, the model must take into account the level of uncertainty, which may arise from the uncertainties associated with data inputs, or from the actual performance of the model.[29] The Guideline does not provide specific guidance on the quantification of model uncertainty.[30] Any one of these considerations could be an area of inquiry in evaluating the performance of AERMOD in a particular situation.

The Guideline points out that AERMOD is intended to address "continuous releases" of "toxic … pollutants," a term that is generally synonymous with the term "hazardous air pollutants."[31] However, hazardous air pollutants present a risk of harm to public health, even where the emissions are intermittent, rather than continuous. The Guideline and AERMOD are not expressly tailored to those emissions.

The Guideline is limited in its use with respect to chemical transformations. There are interrelationships between pollutants that affect their formation and concentration in the atmosphere. For example, while fine particulates are emitted directly from all combustion activities, they are also indirectly formed from sulfur dioxide and nitrogen oxides. These precursors are transformed into sulfates and nitrates, which contribute to the formation of fine

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[28] *See id.*, §4.1(d) ("AERMOD employs best state-of-practice parameterizations for characterizing the meteorological influences and dispersion. The model utilizes a probability density function (pdf) and the superposition of several Gaussian plumes to characterize the distinctly non–Gaussian nature of the vertical pollutant distribution for elevated plumes during convective conditions; otherwise the distribution is Gaussian.").

[29] *Id.*, §9.1.3(a) ("The accuracy of model estimates varies with the model used, the type of application, and site specific characteristics. Thus, it is desirable to quantify the accuracy or uncertainty associated with concentration estimates used in decision-making.").

[30] *Id.*, §9.2 ("No specific guidance on the quantification of model uncertainty for use in decision-making is being given at this time. As procedures for considering uncertainty develop and become implementable, this guidance will be changed and expanded.").

[31] *Id.*, Appendix A to Appendix W, §A.1(e). U.S. Environmental Protection Agency, Pollutants and Sources, https://www3.epa.gov/airtoxics/pollsour.html ("Hazardous air pollutants, also known as toxic air pollutants or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects.") (last visited Mar. 28, 2016).

particulates. The Guideline does not purport to address the full complexity of such chemical transformations.[32]

It is important to recognize the shortcomings of air modeling. Performed by air quality engineers and other technical personnel, air modeling would appear to be an objective process unfettered by subjective human judgment. But even in this highly quantitative world, subjectivity plays a role. For example, human beings make decisions about where to install monitoring stations for the national ambient air quality standards, and the attainment determination is tied to such monitoring stations.[33] People may be exposed to higher levels of air pollution at different locations, away from monitoring stations. In addition, these people may include sensitive populations such as the elderly, the young, and asthmatics.

3. EPA Guidance Documents Relating to Air Modeling

To supplement its regulations and appendices, EPA has developed informal guidance regarding modeling for the attainment demonstration for fine particulates ($PM_{2.5}$) and ozone. (These are the two criteria pollutants that drive much of EPA's work under the Clean Air Act). The most recent guidance was issued in 2007.[34] EPA published a draft revision of this guidance document in 2014.[35] Both documents are available on EPA's website.[36] The 2007 guidance document discusses a number of basic premises for the attainment demonstration for fine

[32] *Id.*, Appendix A to Appendix W, §A.1(e) ("AERMOD is applicable to primary pollutants and continuous releases of toxic and hazardous waste pollutants. Chemical transformation is treated by simple exponential decay."); §A.1(l) ("Chemical transformations are generally not treated by AERMOD. However, AERMOD does contain an option to treat chemical transformation using simple exponential decay, although this option is typically not used in regulatory applications, except for sources of sulfur dioxide in urban areas. Either a decay coefficient or a half life is input by the user.").

[33] 40 C.F.R. part 58, Appendix D, §1.1(b) ("Data from FRM, FEM, and ARM monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS").

[34] U.S. Environmental Protection Agency, Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze (April 2007) ("EPA 2007 Guidance").

[35] U.S. Environmental Protection Agency, Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze (December 2014 draft).

[36] U.S. Environmental Protection Agency, State Implementation Plan (SIP) Attainment Demonstration Guidance, https://www3.epa.gov/scram001/guidance_sip.htm (last visited Feb. 29, 2016).

particulates and ozone (Section 1.3) and discusses how the attainment test is performed for these pollutants (Sections 3.0, 4.0, 5.0).[37] Finally, the guidance document provides a detailed section relating to the process of applying air quality models to produce results needed to help demonstrate attainment (Sections 10.0-18.0).[38]

One potential loophole in the protection of the Clean Air Act is the document's use of the "weight of evidence" approach, discussed in Section 2.3 and Section 7.2 of the document.[39] EPA takes the position that "augmenting a modeled attainment test with supplemental analyses may yield a conclusion differing from that indicated by the modeled attainment test results alone."[40] In other words, "EPA believes that weight of evidence determinations can be used in some cases to demonstrate attainment conclusions that differ from the conclusions of the model attainment test."[41] The premise is that there are uncertainties that result from the use of alternate emissions inputs, chemical mechanisms, and meteorological inputs.[42] Guidance from EPA regarding the sufficiency of evidence for a "weight of evidence" determination is vague, adopting a case-by-case approach based on the circumstances.[43] A "weight of evidence" approach does not involve a quantitative analysis. Rather, it involves a qualitative weighing of factors, dependent upon the capacity of the analysis to address the adequacy of the strategy, and the technical credibility of the analysis.[44] Therefore, such an approach increases the subjectivity

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[37] EPA 2007 Guidance, pp. iv-v (Table of Contents).
[38] *Id.*, pp. vi-vii.
[39] *Id.* at 17-18 (Section 2.3) ("What Does A Recommended Supplemental Analysis/Weight of Evidence Determination Consist Of? – An Overview"), 105-106 (Section 7.2) ("What is Entailed In A Weight Of Evidence Determination").
[40] *Id.* at 105.
[41] *Id.*
[42] *Id.*
[43] *Id.* at 106 ("Each weight of evidence determination will be subject to area-specific conditions and data availability. Area-specific factors may also affect the types of analyses which are feasible for a nonattainment area, as well as the significance of each. Thus, decisions concerning which analyses to perform and how much credence to give each need to be made on a case by case basis by those implementing the modeling/analysis protocol.").
[44] *Id.*

of the attainment demonstration. Accordingly, it is important for communities and environmental groups to be particularly cautious about weight-of-evidence determinations.

Surprisingly, the legal authority for a "weight of evidence" approach to air modeling derives not from the part 51 regulations relating to *air modeling*, but from the part 58 regulations relating to *air monitoring*.[45] In fact, EPA's Guideline on Air Quality Models in part 51, Appendix W does not mention a "weight of evidence" approach at all.[46] In contrast, under part 58, EPA has allowed the use of a "weight of evidence" approach to excuse itself and monitoring agencies from strict compliance with monitoring requirements, depending on the circumstances.[47] Even though there is no legal or regulatory authority supporting the "weight-of-evidence" approach in the *air modeling* context, EPA has endorsed this approach for attainment demonstrations, through informal guidance documents.

4. General Case Law on Challenges to Air Modeling in State Implementation Plans

The Clean Air Act allows parties to challenge state implementation plans in the U.S. Court of Appeals for the appropriate circuit.[48] In legal challenges to state implementation plans, circuit courts have developed a deferential approach to air modeling by air pollution agencies. The premise is that compared with a court, the agency with expertise is better equipped to make complex scientific and technical determinations. This means it is generally quite difficult to challenge air modeling by EPA or an EPA decision approving air modeling by a state agency. However, deference is not unlimited, and courts will strike down decisions that are "arbitrary or

[45] 40 C.F.R. part 58, Appendix A, §1(a).
[46] *See generally*, 40 C.F.R. part 51, Appendix W.
[47] 40 C.F.R. part 58, Appendix A, §1(a) ("Each monitoring organization is required to implement a quality system that provides sufficient information to assess the quality of the monitoring data. The quality system must, at a minimum, include the specific requirements described in this appendix of this subpart. *Failure to conduct or pass a required check or procedure, or a series of required checks or procedures, does not by itself invalidate data for regulatory decision making*. Rather, monitoring agencies and EPA shall use the checks and procedures required in this appendix in combination with other data quality information, reports, and similar documents showing overall compliance with part 58. *Accordingly, EPA and monitoring agencies shall use a "weight of evidence" approach when determining the suitability of data for regulatory decisions*.") (emphasis added).
[48] 42 U.S.C. § 7607(b)(1).

capricious." Legal challenges can still be an effective means of ensuring a state implementation plan is developed properly.

a. Direct Challenges to Particular Air Models

Often petitioners challenge the use of a particular air model because they view the air model as too stringent or too weak. In 1978, the U.S. Court of Appeals for the Sixth Circuit rejected a utility company's challenge to EPA's use of a Real-Time Air-Quality-Simulation Model.[49] This model was a dispersion model that allowed for a determination of the cause and effect relationship between sources of air emissions and ambient air quality.[50] It was an improvement over a previous rollback model which had assumed a linear relationship between source emissions and effects on ambient air quality.[51] Industrial petitioners challenged the use of this model in predicting levels of sulfur dioxide and fixing maximum levels of sulfur dioxide emissions, on the grounds that it made overpredictions.[52] The Court rejected the challenge, reasoning that it was not the responsibility of the Court to determine whether the model was the best approach.[53] Rather, its duty was to determine whether EPA's approach was "arbitrary and capricious."[54] The Court noted that this model was an improvement on the previous model, which had been criticized by the petitioners, who could not point to a better available model.[55] This deferential approach to air modeling by EPA is an important theme in the case law, continuing to the present time.

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[49] *Cleveland Electric Illuminating Co. v. Environmental Protection Agency*, 572 F.2d 1150, 1165 (6th Cir. 1978).
[50] *Id.* at 1160-1161.
[51] *Id.* at 1161.
[52] *Id.* at 1163-1164.
[53] *Id.*
[54] *Id.*
[55] *Id.* at 1161-1163.

In contrast to the decision in that case, the same court decided in favor of another utility company, Cincinnati Gas & Electric Company, in its challenge to the use of a coefficient for another model, the MAXT-24 model.[56] This was a model designed for predicting sulfur dioxide pollution from single sources in rural areas.[57] The coefficient was known as the "Class A" set of assumptions, which conservatively assumed the least stable wind condition and the most direct and quickest impact of a plume on ground level.[58] (In other words, the assumptions were unfavorable to industry). In contrast to *Cleveland Electric Illuminating*, a better solution had been proposed, as separate studies were critical of these assumptions.[59] The company successfully persuaded the Court that the use of these assumptions was not a rational decision, but was arbitrary and capricious, requiring a remand to EPA.[60]

In another case, the U.S. Court of Appeals for the Second Circuit rejected a challenge by a downwind state (Connecticut) to EPA's CRSTER model for air pollution from an upwind state (New York), where the model had estimated the impacts on pollution concentration levels from single individual sources.[61] The Court held it was not arbitrary and capricious for EPA to adjust the model to account for terrain complexities, and to provide a detailed technical rationale for the inadequacy of the petitioner's model, which remained untested over large distances.[62]

There is some authority for the notion that deference can apply even where EPA acts inconsistently. The U.S. Court of Appeals for the Ninth Circuit addressed conflicting petitions by California and Nevada, challenging EPA's approval of each other's state implementation

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[56] *Cincinnati Gas & Electric Co. v. Environmental Protection Agency*, 578 F.2d 660, 661-664 (6th Cir. 1978).
[57] *Id.* at 661.
[58] *Id.* at 662-663.
[59] *Id.* at 663-64.
[60] *Id.*
[61] *State of Connecticut v. Environmental Protection Agency*, 696 F.2d 147, 157-59 (2nd Cir. 1982).
[62] *Id.* at 158-59.

plan, with California predicting nonattainment for the Tahoe Basin in Nevada, and Nevada predicting attainment for the same area.[63] EPA explained that the discrepancy was due to California's use of conservative estimates, and explained why it considered Nevada's assumptions adequate.[64] The Court upheld the approval of both state implementation plans and denied the petitions, even though the plans reached opposite conclusions.[65] The Court reasoned that EPA provided a reasonable explanation for the discrepancy between the different modeling approaches.[66] Notwithstanding this precedent, at a certain point inconsistent action by EPA could become "arbitrary and capricious action," and therefore unlawful.

In a legal challenge to a nonattainment designation for the municipality of Guaynabo, Puerto Rico, the U.S. Court of Appeals for the First Circuit rejected a grain manufacturer's claim that EPA's modeling of its processing operations was arbitrary and capricious, where EPA presented reasoned explanations for approving the revised state implementation plan, and the objections involved the expertise of the agency.[67] The Court provided little analysis of EPA's substantive decision.[68]

Given the general pattern of judicial deference to air modeling decisions by EPA, the best strategy for challenging agency modeling is to demonstrate that the modeling is unreliable, based on a particular reason. To illustrate, the U.S. Court of Appeals for the Sixth Circuit held that EPA acted arbitrarily when it failed to validate its CRSTER model against ambient air quality data and against monitored emissions from industrial plants.[69] (This was a single source model

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[63] *State of California v. Environmental Protection Agency*, 774 F.2d 1437, 1439, 1441 (9th Cir. 1985).
[64] *Id.* at 1441.
[65] *Id.* at 1441 (upholding approval of Nevada plan), 1442-1443 (upholding approval of California plan).
[66] *Id.*
[67] *Pan American Grain Mfg. Co. v. Environmental Protection Agency*, 95 F.3d 101, 105 (1st Cir. 1996).
[68] *See id.*
[69] *State of Ohio v. Environmental Protection Agency*, 784 F.2d 224, 230-231 (6th Cir. 1986).

for hot, buoyant stack effluents of the kind emitted by power plant and furnace chimneys).[70] This decision is consistent with a more recent line of cases requiring that scientific and technical evidence be reliable, in order for it to be admissible in federal court under the Federal Rules of Evidence.[71] However, the *Daubert* decision and related case law concern the admissibility of evidence, while the *State of Ohio* decision concerns whether EPA's rulemaking was arbitrary and capricious on the merits, pursuant to the judicial review section of the Clean Air Act.[72] Therefore, the reliability of air modeling can be relevant to both questions of admissibility of evidence and proof of the merits of a claim.

b. Revisions of Air Models

From time to time, EPA revises a particular air model, and the question arises how it should phase in the revision. While there may be some leeway to continue using an old model during a transition period, EPA's conduct is ultimately governed by a standard of reasonableness.

In 2012, the U.S. Court of Appeals for the Ninth Circuit rejected a sulfur manufacturer's challenge to an EPA determination that a Montana state implementation plan was "substantially inadequate" to attain the national ambient air quality standard for sulfur dioxide, even though the manufacturer cited monitoring data showing no actual monitored sulfur dioxide violations.[73] In addition, the Court held that the use of an old Industrial Source Complex (ISC) model in EPA's

[70] *Id.* at 228.
[71] *See* discussion in Part II of this white paper, relating to *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 (1993) (interpreting the Federal Rules of Evidence to require that expert evidence be reliable, in order for it to be admissible).
[72] *State of Ohio*, 784 F.2d at 227, 230.
[73] *See Montana Sulphur & Chemical Company v. Environmental Protection Agency*, 666 F.3d 1174, 1184-85 (9th Cir. 2012) (noting the limited number of monitoring sites in the Billings and Laurel area, and the fact that monitoring cannot predict concentrations that may occur in the future).

2008 Federal Implementation Plan was not arbitrary and capricious.[74] The ISC model was the preferred point source model for a wide range of regulatory applications, before EPA introduced the AERMOD model.[75] Even though EPA had revised the Guideline in 2005 to recommend the use of the new AERMOD model, EPA had proposed its Federal Implementation Plan within the one-year transition period for the new model.[76] While the Guideline stated that AERMOD "should be used" after the one-year transition period, it also stated that the Industrial Source Complex model "may be accepted."[77] The result was that the Court allowed EPA to use an outdated model, three years after the introduction of the new AERMOD model.

The following day, the same court reached a contrary result in a similar case, requiring the use of a new model instead of an old one.[78] It held that EPA's 2010 approval of a 2004 California state implementation plan was arbitrary and capricious, where the plan was based on an old computer model (EMFAC 2002 Motor Vehicle Emissions Factor Model), which had been superseded by a newer model approved by EPA in 2008 (EMFAC 2007).[79] The distinguishing factor appears to be that "EPA knew that a new computer modeling tool was available and had access to data compiled through the use of the more current tool."[80] In contrast, the *Montana Sulphur* decision does not indicate that the agency had generated data pursuant to the revised

[74] *Id.* at 1196-97.
[75] *Id.* at 1196; 40 C.F.R. part 51, Appendix W, §4.1(c)
[76] *Id.* at 1196-97. The statute requires EPA to impose a federal implementation plan within two years of a finding that a state implementation plan does not meet minimal requirements, or within two years of disapproving a state implementation plan. 42 U.S.C. §7410(c)(1).
[77] *Montana Sulphur*, 666 F.3d 1196-1197; 70 Fed. Reg. 68,218, 68,226, column 1 ("Beginning one year after promulgation of today's notice, (1) applications of ISC3 with approved protocols may be accepted (see DATES section) and (2) AERMOD *should be* used for appropriate applications as a replacement for ISC3") (emphasis in original).
[78] *See Sierra Club v. Environmental Protection Agency*, 671 F.3d 955, 963-968 (9th Cir. 2012).
[79] *See id.*
[80] *Id.* at 965.

computer model.[81] What was important in the *Sierra Club* case was that EPA failed to even *consider* the new data, let alone explain its preference for the old data.[82]

c. Air Modeling v. Air Monitoring

Generally, it is difficult to challenge air modeling based merely on the existence of contrary air monitoring data. The fact that monitoring data contradict a modeled demonstration of attainment or nonattainment does not necessarily undermine the model.[83] One court has reasoned that modeled data and monitored data do not necessarily conflict, because modeling is used to predict violations, while monitoring is used to record historical concentrations at discrete locations.[84]

Sometimes a court may defer to EPA without providing much substantive analysis of the air modeling or air monitoring developed by the agency. For example, the U.S. Court of Appeals for the Second Circuit rejected an environmental group's challenge to EPA's approval of a state implementation plan for New York State, despite the alleged failure to effectively relate actual measurement of air quality to models and predictions.[85] It was not clear to the Court whether the petitioners were faulting the air modeling or the air monitoring.[86] In any event, the Court based its decision on the fact that modeling is appropriate for an attainment demonstration, that the

[81] *Montana Sulphur,* 666 F.3d at 1196-1197.
[82] *Sierra Club,* 671 F.3d at 968 ("We hold that EPA's failure to even consider the new data and to provide an explanation for its choice rooted in the data presented was arbitrary and capricious.").
[83] *See Columbus and Southern Ohio Electric Co. v. Costle*, 638 F.2d 910, 912-913 (6th Cir. 1980) (rejecting utility company's challenge to a nonattainment designation, where agency's refusal to redesignate a sulfur dioxide nonattainment area to attainment was not arbitrary and capricious, because data evidencing attainment did not unequivocally call into question EPA's computer modeling).
[84] *See Wisconsin Electric Power Company v. Gorsuch*, 715 F.2d 323, 330-331 (7th Cir. 1983) (rejecting utility company's challenge to a nonattainment designation despite eight quarters of monitoring data indicating attainment, as EPA was not required to prefer monitoring over modeling).
[85] *Council of Commuter Organizations v. Thomas,* 799 F.2d 879, 888 (2nd Cir. 1986).
[86] *Id.*

state had committed to adequate monitoring of air quality and reporting to EPA, and that there was an assurance of necessary funding and personnel to carry out the programs.[87]

d. Air Modeling and the Interstate Transport of Air Pollutants

One early line of cases involved the State of New York's effort to address the interstate transport of total suspended particulates (TSP), due in part to the release of emissions of sulfur dioxide from utility plants in upwind states.[88] The first case involved New York's challenge to an EPA rule approving a revision of a Tennessee state implementation plan, which had allowed for an increase in emissions of sulfur dioxide from a Tennessee Valley Authority plant in Kingston, Tennessee.[89] New York argued that EPA was required to consider the effects of multiple sources other than the Kingston plant, and that it should also consider the impact of the proposed revision on levels of total suspended particulates in the ambient air, in addition to the impacts on levels of sulfur dioxide.[90] (Sulfur dioxide is a precursor to the formation of particulates). The U.S. Court of Appeals for the Sixth Circuit rejected the argument.[91] It was important that EPA had not yet developed models for measuring the impact on neighboring states from the secondary formation of sulfate particulates.[92] It was also important that New York had filed seven other petitions to disapprove state implementation plans, based on the interstate transport of pollutants.[93] The Court noted that the appropriate procedure for relief for

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[87] *Id.*
[88] In 1971, EPA identified total suspended particulates (TSP) as a criteria pollutant. Final Rule, National Primary and Secondary Ambient Air Quality Standards, 36 Fed. Reg. 8,186, 8,187, column 2 (Apr. 30, 1971) (to be codified at 42 C.F.R. §§410.6-410.7). Only in 1997 did it identify fine particulates ($PM_{2.5}$) and coarse particulates (PM_{10}) as distinct criteria pollutants, by rule. Final Rule, National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652, 38,711-38,712 (Jul. 18, 1997) (to be codified at 40 C.F.R. §§50.6-50.7).
[89] *State of New York v. Environmental Protection Agency*, 710 F.2d 1200, 1201 (6th Cir. 1983).
[90] *Id.* at 1203-1204.
[91] *Id.*
[92] *Id.*
[93] *Id.* at 1205.

New York would be the filing of a Section 126 petition directly with EPA.[94] (Although New York had filed such a petition with EPA, this petition was not a part of this decision).

The U.S. Court of Appeals for the Seventh Circuit reached a similar result in New York's challenge to a revision of an Illinois state implementation plan to allow for increased sulfur dioxide emissions from a power station in Illinois.[95] New York objected to a short-range, in-state model that could only assess impacts of sulfur dioxide within a 50-mile radius.[96] The Court held that EPA did not act arbitrarily and capriciously by analyzing the impact of the increased emissions only on immediate ambient air quality.[97] It did this because EPA explained its inability to measure long-term impacts, and supplied an analysis that suggested that long-term impacts would be insignificant.[98]

To evaluate the problem of interstate transport of air pollutants today, one must follow EPA's modeling under a comprehensive interstate transport program. In 2012, EPA promulgated the Cross-State Air Pollution Rule.[99] In support of that rule, EPA performed complex interstate air modeling to identify downwind nonattainment and maintenance

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[94] *Id.* Under Section 126 of the Clean Air Act, a state may file a petition with EPA to seek a finding that a major source or group of stationary sources would emit pollutants in violation of the "good neighbor" provision. 42 U.S.C. §7426(b). The "good neighbor" provision requires that state implementation plans prohibit emissions activity that will "contribute significantly to nonattainment in, or interfere with maintenance by, any other State with respect to any such national primary or secondary ambient air quality standard …." 42 U.S.C. §7410(a)(2)(D)(i)(I). If EPA grants such a petition, the statute imposes restrictions on the construction and operation of major sources within the state where the facilities are located. *Id.*, §7426(c).

[95] *State of New York v. Environmental Protection Agency,* 716 F.2d 440, 442-444 (7th Cir. 1983).

[96] *Id.* at 443-444.

[97] *Id.* at 444.

[98] *Id.*

[99] Final Rule, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208 (Aug. 8, 2011) ("Transport Rule") (to be codified at amended 40 C.F.R. parts 51, 52, and 97). The rule was vacated by the U.S. Court of Appeals for the District of Columbia, not because the air modeling was deemed arbitrary and capricious (this was not an issue in that decision), but because its use to address interstate air pollution violated the "good neighbor" provision of the Clean Air Act. *EME Homer City Generation, L.P. v. Environmental Protection Agency*, 696 F.3d 7, 19-28 (2012). The Supreme Court reversed that decision, upholding the rule. *Environmental Protection Agency v. EME Homer City Generation, L.P.*, 134 S.Ct. 1584, 1603-1610 (2014).

receptors,[100] evaluate the pollution transport from the upwind states,[101] and quantify the state emissions reductions required.[102] EPA prepared a detailed Technical Support Document for the air modeling used to support the rule.[103] That document forms the starting point for understanding the modern interstate air pollution problem of ozone and fine particulates. Additional technical support documents relating to revisions of the rule are also available on EPA's website.[104]

In 2015, EPA proposed a revision to the Cross-State Air Pollution Rule, following the revision of the national ambient air quality standard for ozone in 2008.[105] The revision is based on complex interstate modeling that involves an analysis of downwind air quality and upwind state contributions.[106] The principal model is known as the Comprehensive Air Quality Model with Extensions (CAMx), a multipollutant photochemical grid model for ozone and fine particulates.[107] This model is supplemented by the use of a number of other models, including a Sparse Matrix Operator Kernel Emissions (SMOKE) Modeling System for emissions inventories, an Integrated Planning Model (IPM) for calculating baseline emissions from electric generating units, a Motor Vehicle Emissions Simulator (MOVES) for mobile source emissions, and a National Mobile Inventory Model (NMIM) for nonroad mobile sources.[108]

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[100] 76 Fed. Reg. 48,224-48,236. A nonattainment receptor is a receptor in a downwind state which is in nonattainment with a national ambient air quality standard, due to sources in a particular upwind state. *Id.* at 48,211, column 3. A maintenance receptor is a receptor in a downwind state which has difficulty maintaining attainment with a national ambient air quality standard, due to sources in a particular upwind state. *Id.*

[101] *Id.* at 48,236-48,246.

[102] *Id.* at 48,246-48,271.

[103] *Id.* at 48,233; U.S. Environmental Protection Agency, Air Quality Modeling Final Rule Technical Support Document (Jun. 2011), http://www3.epa.gov/crossstaterule/pdfs/AQModeling.pdf (last visited Mar. 30, 2016).

[104] U.S. Environmental Protection Agency, Technical Information and Support Documents, http://www3.epa.gov/crossstaterule/techinfo.html (last visited Mar. 29, 2016).

[105] Proposed Rule, Cross-State Air Pollution Rule Update for the 2008 Ozone NAAQS, 80 Fed. Reg. 75,706 (Dec. 3, 2015) (noting that the original rule was adopted to address the 1997 ozone national ambient air quality standard).

[106] *Id.* at 75,720-75,730.

[107] *Id.* at 75,721, column 1.

[108] *Id.* at 75,721-75,723.

EPA uses these models to calculate the contribution of upwind states to downwind nonattainment and maintenance receptors.[109] Ultimately, EPA identifies those states making a contribution of more than one percent to the concentration of ozone at a downwind receptor, where the downwind receptor is either in nonattainment or has difficulty maintaining attainment with the national ambient air quality standard.[110] For example, as an upwind state, Pennsylvania is linked to downwind nonattainment receptors in Connecticut, as well as maintenance-only receptors in Connecticut, Maryland, New Jersey, and New York.[111] As a downwind state, Pennsylvania does not have nonattainment receptors linked to upwind states, but it does have maintenance-only receptors linked to Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, Ohio, Tennessee, Texas, Virginia, and West Virginia.[112]

While states may have an interest in challenging such modeling by EPA, such challenges may require substantial expertise and resources beyond the capabilities of the states themselves, and not just beyond the capabilities of environmental groups and communities.

5. Specific Case Law on the "Weight of Evidence" Approach to Air Modeling

Because of the potential loophole for the protection of public health, environmental groups have challenged "weight of evidence" determinations in the federal courts. The reported cases have addressed the use of the "weight of evidence" approach in connection with states' attainment demonstrations for the 1-hour ozone national ambient air quality standard. In these cases, the federal courts have upheld EPA's approval of "weight of evidence" approaches to air modeling, rejecting data showing nonattainment.

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[109] *Id.* at 75,727-75,728 (Table V.D-1).
[110] *Id.* at 75,728-75,730 (Tables V.D-2, V.D-3).
[111] *See id.* (entries for Pennsylvania as an upwind state).
[112] *See id.*

With respect to the Houston-Galveston-Brazoria (HGB) area, the U.S. Court of Appeals for the Fifth Circuit held that EPA offered a rational explanation for its reliance on an attainment model for the 1-hour ozone standard, even though comparisons between model predictions and monitor observations did not exactly match, due to the area's unique land-sea breeze phenomenon.[113] When the model did not demonstrate attainment by 2007, Texas developed a quadratic equation to calculate the emissions reduction gap, and revised its final control strategy to eliminate that gap and provide for attainment.[114] The Court held that EPA's approval of the "weight of evidence" approach was reasonable, because the state and EPA followed the EPA guidance document, and because EPA's approval of the model itself was reasonable.[115]

In a subsequent case several years later, the Court held that where Texas' photochemical grid modeling for the Houston-Galveston-Brazoria area did not demonstrate attainment for the 1-hour ozone standard on a particular date (August 31), EPA was not unreasonable in excluding that exceedance through a "weight of evidence" approach, due to unusual heat, wind, and wildfire activity, as well as additional reductions that were not modeled.[116]

With respect to the New York City area, the U.S. Court of Appeals for the Second Circuit held that EPA's approval of the State of New York's "weight of evidence" analysis for an attainment demonstration for the 1-hour ozone standard did not contradict the statute and EPA guidelines.[117] EPA considered it anomalous that the model predicted ozone peaks as high as 171 parts per billion (ppb) in 2007, in excess of the 0.12 parts per million (ppm) standard (numerically equivalent to 120 parts per billion).[118] The forecasted peaks were as high as

[113] *BCCA Appeal Group v. Environmental Protection Agency*, 355 F.3d 817, 830-834 (2004).
[114] *Id.* at 834-835.
[115] *Id.* at 834-836.
[116] *Galveston-Houston Association for Smog Prevention (GHASP) v. Environmental Protection Agency*, 289 Fed.Appx. 745, 753 (5th Cir. 2008) (unpublished opinion).
[117] *Environmental Defense v. Environmental Protection Agency*, 369 F.3d 193, 203-207 (2nd Cir. 2004).
[118] *Id.* at 198.

exceedances in the past, before emissions control strategies had been implemented, and such strategies had not been incorporated into the model.[119] Applying the "weight of evidence" approach, the state was able to reduce the forecasted ozone peaks of 171 ppb and 169 ppb, to a range of 118 ppb to 122 ppb.[120] This range constituted attainment with the 120 ppb standard, under applicable rounding conventions.[121] With its own model, EPA was able to reduce the peak to 129 ppb, in excess of the standard.[122] To reduce the peak level, the state made commitments to adopt a number of emissions reduction measures.[123] The Court rejected the environmental group's challenge to the "weight of evidence," finding it was consistent with the statutory and regulatory requirements for photochemical grid modeling,[124]

With respect to the Baltimore area, the U.S. Court of Appeals for the Fourth Circuit upheld EPA's conclusion that additional photochemical grid modeling for the 1-hour ozone standard was not necessary following EPA's rejection of Maryland's motor vehicle emissions budget, even though modeling had shown that ozone concentrations would be in excess of attainment levels in 2005.[125] After EPA concluded that the modeling over-predicted ozone levels for Baltimore, it applied a "weight of evidence" approach by considering the effect of a number of additional control measures that the state had committed to make.[126] Based on EPA's representation that it was likely that the Baltimore area would attain the 1-hour ozone standard by 2005, the Court held that EPA's conclusion was not arbitrary or capricious.[127]

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[119] *Id.* at 198-200.
[120] *Id.* at 199.
[121] With rounding, there would be an exceedance only if the concentration was greater than 0.124 parts per million, or 124 ppb. *Id.* at 198.
[122] *Id.* at 199.
[123] *Id.* at 200.
[124] *Id.* at 200-207.
[125] *1000 Friends of Maryland v. Browner*, 265 F.3d 216, 223-224, 233-235 (4th Cir. 2001).
[126] *Id*. at 234.
[127] *See id.* at 234-235.

With respect to the Washington, D.C. area, the U.S. Court of Appeals for the District of Columbia Circuit reached a result similar to that in *Environmental Defense*, discussed above.[128] It upheld a "weight of evidence" analysis as consistent with the statutory and regulatory requirements for photochemical grid modeling.[129] The states' modeling predicted peak ozone concentrations of 139, 150, and 178 ppb on three days in 2005, exceeding the standard.[130] Because the model over-predicted known ozone concentrations during the 1991 base year, EPA adjusted the model's predictions of future data.[131] (EPA ran the model for the base year of 1991, to validate it against data that were already known). When the adjustments still did not result in a conclusion of attainment in 2005, EPA determined that the base-year data were too anomalous to demonstrate nonattainment.[132] Ruling out such exceedances as not likely to occur in the future, EPA concluded that "attainment of the 1-hour ozone standard has been successfully demonstrated for the Washington area by no later than 2005."[133] Reasoning that there was no evidence to dispute EPA's findings, the Court held that EPA's judgment was reasonable.[134]

Despite EPA's approval of the attainment demonstrations for the 1-hour ozone standard in these cases, the subsequent history of most of these areas indicates that the "weight of evidence" approach is indeed a loophole that undermines the protection of public health. The Houston-Galveston-Brazoria area did not attain the 1-hour ozone standard by its attainment date of November 15, 2007.[135] It was not until 2013 that the area monitored attainment with a design

[128] *Sierra Club v. Environmental Protection Agency*, 356 F.3d 296, 304-307 (D.C. Cir. 2004).
[129] *See id.*
[130] *Id.* at 305. The relevant states were Virginia and Maryland, together with the District of Columbia, treated like a state in this context. *Id.* at 299.
[131] *Id.* at 305.
[132] *Id.*
[133] *Id.*
[134] *Id.* at 306-307.
[135] Final Rule, Approval and Promulgation of Air Quality Implementation Plans; Texas; Determination of Failure to Attain the 1-Hour Ozone Standard, 77 Fed. Reg. 36,400, 36,403 (Jun. 19, 2012) (to be codified at 40 C.F.R. §52.2275(d)).

value of 0.12 ppm (121 ppb), attaining the standard.[136] Accordingly, the result was a delay of six years in coming into attainment with the standard.[137]

The New York City area did not attain the 1-hour ozone standard by its attainment date of November 15, 2007, although EPA determined that as of June 18, 2012 the standard had been met based on 2008-2010 ozone monitoring data.[138] Accordingly, the result was a delay of three years in coming into attainment with the standard.

The Baltimore area did not attain the 1-hour ozone standard by its attainment date of November 15, 2005, although EPA determined that as of June 12, 2012 the standard had been met based on 2009-2011 ozone monitoring data.[139] Accordingly, the result was a delay of six years in coming into attainment with the standard.

Of the areas involved in the foregoing cases, only the Washington, D.C. area actually attained the 1-hour ozone standard by its attainment date (November 15, 2005).[140] The poor track record of the state permitting agencies and EPA in forecasting attainment in these cases

[136] Texas Commission on Environmental Quality, Redesignation Substitute Report for the Houston-Galveston-Brazoria One-Hour Ozone Standard Nonattainment Area (Jul. 22, 2014), page 5, https://www.tceq.texas.gov/assets/public/implementation/air/sip/hgb/HGB_1Hr_Ozone_RS_Report.pdf (last visited Mar. 2, 2016). EPA approved this report pursuant to a regulation authorizing a relaxation of anti-backsliding provisions, where an area has attained the relevant standard due to permanent and enforceable emissions reductions, and the area will maintain the standard for a period of ten years. Final Rule, Clean Air Act Redesignation Substitute for the Houston-Galveston-Brazoria 1-Hour Ozone Nonattainment Area; Texas, 80 Fed. Reg. 63,429, 63,430, 63,431 (Oct. 20, 2015) (to be codified at 40 C.F.R. §52.2275): 40 C.F.R. §51.1105(b)(1)).

[137] Even before the attainment demonstration, the Houston-Galveston-Brazoria area had a history of nonattainment with the 1-hour ozone standard. The Fifth Circuit noted that "[t]he HGB area has not complied with the federal one-hour health standard for ground-level ozone since the inception of the CAA [Clean Air Act] in 1970." *Galveston-Houston Association for Smog Prevention*, 289 Fed.Appx. at 749. Therefore, the total period of nonattainment with the 1-hour standard was 42 years.

[138] Final Rule, Determinations of Failure To Attain the One-Hour Ozone Standard by 2007, Current Attainment of the One-Hour Ozone Standard, and Attainment of the 1997 Eight-Hour Ozone Standards for the New York-Northern New Jersey-Long Island Nonattainment Area in Connecticut, New Jersey and New York, 77 Fed. Reg. 36,163, 36,169-36,170 (Jun. 18, 2012) (to be codified at 40 C.F.R. §52.1679(a)).

[139] Final Rule, Determination of Failure To Attain by 2005 and Determination of Current Attainment of the 1-Hour Ozone National Ambient Air Quality Standards in the Baltimore Nonattainment Area in Maryland, 77 Fed. Reg. 34,810, 34,819 (Jun. 12, 2012) (to be codified at 40 C.F.R. §52.1076(y), 40 C.F.R. §52.1082(f),(g)).

[140] Final Rule, Determination of Attainment for the Ozone National Ambient Air Quality Standards for Nonattainment Areas in Delaware, District of Columbia, Maryland, Pennsylvania, and Virginia, 73 Fed. Reg. 43,360, 43,361 (Jul. 25, 2008) (to be codified at 40 C.F.R. §52.476(d)); 40 C.F.R. §52.1076(o).

undermines their claim to scientific and technical expertise that forms the premise for judicial deference to the "weight of evidence" approach.

EPA might defend its "weight of evidence" approach by arguing that it is very difficult to conform modeling practices that forecast attainment in the future, with regulatory requirements that rely on complex averaging formulas for the attainment determination. Indeed, EPA and New York made a similar argument in the *Environmental Defense* case, discussed above.[141] But this is a difficulty created by EPA itself, through its adoption of informal guidance documents which are not entirely compatible with its own regulations.

EPA's 1-hour ozone standard illustrates this tension. It required a state to calculate the maximum 1-hour average concentration each day, then determine the number of days of the year where this average exceeded the standard, and then calculate the average number of such exceedances in each of the past three years, to determine the "design value" that is used for making the attainment determination.[142] The tension was not always apparent. In a guidance document in 1991, EPA conservatively stated that "there should be no predicted daily maximum ozone concentration greater than 0.12 ppm anywhere in the modeling domain."[143] That statement was consistent with EPA's regulatory formula for an attainment determination. In theory, the absence of any forecast exceedances would ensure that an area would reach attainment. (Of course, this assumes the modeling would otherwise accurately and completely predict future air quality). However, in a subsequent guidance document EPA allowed states more flexibility to track the limited number of exceedances that are allowed by the regulatory

[141] *Environmental Defense*, 369 F.3d 193, 199 ("Because the computer model only predicts peak readings, it does not ascertain what is the area's all-important design value.").
[142] 40 C.F.R. §50.9(a) ("The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 parts per million (235 μg/m^3) is equal to or less than 1, as determined by appendix H to this part"), Appendix H, §1.0 ("In its simplest form, the number of exceedances at a monitoring site would be recorded for each calendar year and then averaged over the past 3 calendar years to determine if this average is less than or equal to 1.").
[143] *Environmental Defense*, 369 F.3d at 205.

formula.[144] By developing a more flexible approach, EPA made it more likely that its methods would make inaccurate forecasts of attainment in the future.

6. Citizen Science and Crowdsourcing Projects

On December 16, 2015, EPA published in the Federal Register a notice requesting that the Office of Management and Budget approve an Information Collection Request relating to citizen science and crowdsourcing projects.[145] According to EPA, citizen science and crowdsourcing techniques will allow EPA to collect data to help inform scientific research, assessments, and environmental screening, to validate environmental models and tools, and to enhance data collected across the diverse communities and ecosystems of the nation, in support of EPA's mission.[146] On the regulatory docket for this notice, EPA included a Supporting Statement setting forth in detail the circumstances making the collection of such information necessary, along with the intended purpose and use of this information collection.[147] This effort responded to a call by President Obama for increased citizen science and crowdsourcing projects, in an Open Government National Action Plan.[148]

During the comment period the Chamber of Commerce opposed the request, asserting that citizen science does not meet the rigorous requirements of federal regulatory standards.[149] In its letter, the business federation asserted that crowdsourced data relating to a perceived

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[144] *Id.* at 205-206.
[145] Notice, Information Collection Request Submitted to OMB for Review and Approval; Comment Request; Generic Clearance for Citizen Science and Crowdsourcing Projects (New), 80 Fed. Reg. 78,227 (Dec. 16, 2015).
[146] *Id.*, column 2.
[147] U.S. Environmental Protection Agency, ICR Number 2521.01, Generic Clearance for Citizen Science and Crowdsourcing Projects (New), https://www.regulations.gov/document?D=EPA-HQ-ORD-2015-0659-0004 (last visited Sep. 15, 2016).
[148] The Open Government Partnership, Second Open Government National Action Plan for the United States of America (Dec. 5, 2013), https://www.whitehouse.gov/sites/default/files/docs/us_national_action_plan_6p.pdf (last visited Mar. 30, 2016).
[149] Letter of William L. Kovacs, Senior Vice President, Environment, Technology & Regulatory Affairs, Chamber of Commerce of the United States of America, Jan. 15, 2016, https://www.regulations.gov/document?D=EPA-HQ-ORD-2015-0659-0005 (last visited Sep. 15, 2016).

violation of a national ambient air quality standard might be used to support an argument that an area is not in attainment with a standard.[150] It asserted that "States should not be required to spend their scarce resources disproving sensational claims of nonattainment based entirely on samples from sensors worn by crowds of activists."[151]

However, there is precedent for the notion that communities can play a role in gathering scientific and technical data regarding air quality, even under existing law. Current part 50 regulations relating to the national ambient air quality standards authorize EPA to consider citizen science in attainment monitoring. The fact that ambient air quality data happens to have been gathered by citizens (including activists) does not preclude them from being considered by EPA or a state permitting agency, provided the data are otherwise valid.[152]

The nature and scope of "citizen science" is very important for environmental organizations and community groups. The concept of "citizen science" is potentially broad. It encompasses not only an individual with a sensor, but also sophisticated monitoring equipment operated by a university. From the notice published in December 2015, it appears that EPA has

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[150] *Id.* at 5.
[151] *Id.*
[152] 40 C.F.R. part 50, Appendix N, §3.0(a) (for fine particulates, "*all valid FRM/FEM/ARM* $PM_{2.5}$ *mass concentration data* produced by suitable monitors that are required to be submitted to AQS, *or otherwise available to EPA*, meeting the requirements of part 58 of this chapter including appendices A, C, and E *shall be used in the DV calculations*") (emphasis added); 40 C.F.R. part 50, Appendix U, §2(a) (for ozone, "*All valid hourly* O_3 *concentration data* collected using a federal reference method specified in Appendix D to this part, or an equivalent method designated in accordance with part 53 of this chapter, meeting all applicable requirements in part 58 of this chapter, and submitted to EPA's Air Quality System (AQS) database *or otherwise available to EPA*, *shall be used in design value calculations*.") (emphasis added); 40 C.F.R. part 50, Appendix T, §2(a) (for sulfur dioxide, "*All valid FRM/FEM* SO_2 *hourly data* required to be submitted to EPA's Air Quality System (AQS), *or otherwise available to EPA*, meeting the requirements of part 58 of this chapter including appendices A, C, and E *shall be used in design value calculations*.") (emphasis added); 40 C.F.R. part 50, Appendix S, §2(a) (for nitrogen dioxide, "*All valid FRM/FEM* NO_2 *hourly data* required to be submitted to EPA's Air Quality System (AQS), *or otherwise available to EPA*, meeting the requirements of part 58 of this chapter including appendices A, C, and E *shall be used in design value calculations*.") (emphasis added); 40 C.F.R. part 50, Appendix R, §3(a) (for lead, "*All valid FRM/FEM Pb–TSP data* and all valid FRM/FEM Pb–PM_{10} data submitted to EPA's Air Quality System (AQS), *or otherwise available to EPA*, meeting the requirements of part 58 of this chapter including appendices A, C, and E *shall be used in design value calculations*.") (emphasis added).

the will to explore potential opportunities for developing science and technology in this area of law and policy. Communities and environmental groups should pursue these opportunities.

Conclusions

It is important for environmental organizations and communities to understand the role of air modeling in the evaluation of state implementation plans for attainment and maintenance of the national ambient air quality standards. This is primarily how states address air quality problems within their borders. While the process is driven largely by engineers and technical personnel, the general principles and even the technical protocols can be understood by laypersons.

The complexity of air pollution law and policy has contributed to the development of a judicial doctrine of deference to the scientific and technical decisions of EPA, including those relating to air modeling. In the context of ozone, environmental groups have been largely unsuccessful in federal court challenges to the "weight of evidence" approach used by air pollution agencies to reject quantitative data demonstrating future nonattainment with the national ambient air quality standards. However, judicial deference is not unlimited. Challenges may still be made to approvals of state implementation plans, when the actions are "arbitrary or capricious." Moreover, ongoing ozone nonattainment following most of these deferential federal court decisions calls into question the very agency expertise upon which deference is premised.

Citizen science and crowdsourcing data represent an aspect of the future of air modeling for environmental organizations and communities. Citizen science may extend beyond one individual wearing a sensor. Rather, it may encompass sophisticated modeling and monitoring by large universities, supplementing the work of federal and state air pollution agencies.