$PM_{2.5}$: Federal and California Regulation of Fine Particulate Air Pollution

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Particulate matter (PM) is comprised of all sorts of particles – pollen, dust, sulfates, nitrates, acid aerosols, ammonium, elemental carbon, carbon compounds and metals – that exist as solids or liquid droplets in the atmosphere over a wide range of sizes. $PM_{2.5}$ refers to those particles, known as "fine particulates," that have a diameter smaller than 2.5 microns. (A micron is one millionth of a meter.) This article is devoted to analyzing the law of $PM_{2.5}$ regulation, with a particular focus on its development in California.

I. $PM_{2.5}$ EMISSION SOURCES

$PM_{2.5}$ is emitted directly by combustion sources such as open burning, trucks, automobiles, boilers and wood stoves and by a variety of non-combustion sources. According to the U.S. Environmental Protection Agency (EPA), among the sources of directly emitted $PM_{2.5}$ are: fugitive dust from roads (30.6% of U.S. direct $PM_{2.5}$ emissions), fugitive dust from construction (11.6%), miscellaneous non-fuel combustion (10.5%), agricultural crops (10.4%), wind erosion (9.5%), residential wood combustion (4.2%), on-road vehicles (2.4%), open burning (2.3%), fuel combustion at industrial facilities (1.9%), construction vehicles (1.6%), coal-fired power plants (1.6%), metals processing (1.3%), miscellaneous fuel combustion (1.3%), mineral products (1.1%), farm vehicles (0.8%), and pulp and paper (0.7%).[1] Oil and natural gas fired power plants contribute 0.2% and 0.01%, respectively, to $PM_{2.5}$ emissions in the United States.[2]

The mix of $PM_{2.5}$ sources in any single geographic area may depart from these national statistics. For example, according to an EPA database that provides county-specific emissions information,[3] the principal sources of $PM_{2.5}$ emissions in Los Angeles are miscellaneous sources (38% of in-County $PM_{2.5}$ emissions), highway and off-road vehicles (33%) waste disposal and recycling (11%), industrial sources (11%), and fuel combustion at stationary sources such as apartment buildings, hospitals and office buildings (9%).[4]

Direct $PM_{2.5}$ emissions, however, constitute only a portion of the $PM_{2.5}$ found in ambient air. "Secondary" fine particulates (in contrast to particulates emitted directly from combustion and other sources) can comprise as much as half the $PM_{2.5}$ measured in the United States.[5] Secondary $PM_{2.5}$ is formed from the emission of non-particulates (*i.e.*, gases) – such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC) and ammonia (NH_3) – that turn into fine particulates in the atmosphere through chemical reactions or condensation. SO_2, which can form particulates such as sulfates and sulfuric acid in the atmosphere, is emitted principally by coal-fired electric utilities (63% of U.S. SO_2 emissions), fuel combustion in industrial sources (15%), on-road and non-road engines and vehicles (7%), oil-fired electric utilities (4%) and other sources.[6] NO_x, which can form particulates such as nitrates and nitric acid in the atmosphere, is emitted principally by on-road and non-road engines and vehicles (53% of U.S. NO_x emissions), coal-fired electric utilities (22%), other electric utilities (3%), fuel combustion in industrial sources (12%) and other fuel combustion (5%).[7] VOC can form organic particulates in the atmosphere and is emitted principally by on-road and non-road engines and vehicles (43% of U.S. VOC emissions), solvent utilization (29%) and storage and transport (7%).[8] Finally, NH_3, which combines with SO_2, NO_x and other chemicals in the atmosphere to form ammonium, ammonium sulfate, ammonium bisulfate, ammonium nitrate and other compounds, is emitted principally by livestock and fertilizer (86% of U.S. NH_3 emissions) and on-road vehicles (5%).[9]

Since most of the chemical transformations in the atmosphere occur slowly (over hours or even days, depending on atmospheric conditions and other variables), secondary formation $PM_{2.5}$ generally occurs at some distance from the source of its gaseous emissions precursors,[10] greatly complicating the development of mathematical models that can adequately describe the relationship between $PM_{2.5}$ concentrations in the ambient air and their gaseous precursors.[11]

Another source of $PM_{2.5}$ in the air that people breathe is indoor air pollution. Most people in industrialized nations spend more than 80 percent of their time indoors.[12] For potentially sensitive individuals such as infants, the elderly and those with chronic diseases, the proportion of time spent indoors is even higher. A principal indoor source of particulates is environmental tobacco smoke.[13] Other important indoor sources of $PM_{2.5}$ are cooking, cleaning, aerosol sprays, pets, indoor plants, and indoor combustion sources such as wood stoves, fireplaces, furnaces, and natural gas stoves and clothing dryers.[14] The design and operation of a building's ventilation system affects both the attenuation of contributions from indoor $PM_{2.5}$ sources and the extent to which ambient $PM_{2.5}$ penetrates indoors.[15]

II. EXISTING REGULATION OF PARTICULATE MATTER

EPA and the California Air Resources Board (CARB) have regulated particulate matter, including $PM_{2.5}$, since the dawn of the modern era of environmental regulation. In 1971, EPA promulgated a National Ambient Air Quality Standard (NAAQS) for total suspended particulate (TSP), which includes particles ranging from the smallest measurable size up to 45 microns in diameter.[16] CARB adopted its own TSP standard in 1969 and developed regulatory requirements limiting TSP emissions.

In 1987, EPA revised its NAAQS for particulate matter by replacing the TSP standard with a new standard for particles up to 10 microns in diameter (PM_{10}).[17] Since $PM_{2.5}$ is a component or subset of PM_{10}, this new standard, and the regulations that were put into place to implement it, actually limit $PM_{2.5}$ as well as larger particles. The PM_{10} NAAQS is set in units of micrograms of PM_{10} per cubic meter of air ($\mu g/m^3$), for each of two averaging periods. The current 24-hour PM_{10} standard (for which concentration levels are averaged over one day) is 150 $\mu g/m^3$, with no more than one exceedance per year.[18] The current annual PM_{10} standard (for which concentration levels are generally averaged over three years pursuant to an EPA protocol[19]) is 50 $\mu g/m^3$.[20]

EPA has also promulgated significant impact levels (SILs) for PM_{10}. The 24-hour PM_{10} SIL of 5 $\mu g/m^3$ is 3% of the 24-hour PM_{10} NAAQS; the annual PM_{10} SIL of 1 $\mu g/m^3$ is 2% of the annual PM_{10} NAAQS.[21] The SILs are safe harbors: if they are not exceeded, there is a conclusive regulatory presumption that a proposed source will not cause or contribute to the contravention of a NAAQS.[22]

Numerous regulations have been enacted to limit PM_{10} emissions. The Prevention of Significant Deterioration (PSD) program regulates new or modified major sources of TSP and PM_{10} in those areas that are in attainment with the PM_{10} NAAQS.[23] The currently effective PSD requirements relating to particulates establish significance thresholds of 25 and 15 tons per year for TSP and PM_{10}, respectively,[24] and require new or modified sources whose emissions exceed these thresholds to install Best Available Control Technology and meet other requirements. Similarly, in PM_{10} nonattainment areas, such as within the South Coast Air Quality Management District (SCAQMD), new source review (NSR) regulations[25] establish a significance threshold of 15 tons of PM_{10} per year for new emission units and modifications to existing units.[26]

Other existing potentially applicable California regulations that control the emission of particulates and their precursors include the regulation of internal combustion engines[27]; cement kilns[28]; commercial bakery ovens[29]; the sulfur content of fuels[30]; woodworking operations[31]; and agricultural operations.[32]

III. $PM_{2.5}$ HEALTH EFFECTS

The health effects of ambient $PM_{2.5}$ have been analyzed and debated in a vast body of epidemiological and toxicological literature, and substantial research in this area is underway. EPA's bottom line conclusion after a review of these studies, in a judgment that has now been upheld by the federal courts,[33] is that exposure to $PM_{2.5}$ at the ambient concentrations that presently exist in some areas of the country, including those in compliance with the PM_{10} NAAQS, can result in serious health consequences, including premature mortality, exacerbation of respiratory and cardiovascular disease, decreased lung function, increased respiratory symptoms from pre-existing pulmonary disease, and aggravation of symptoms associated with asthma.[34]

At the same time, EPA has candidly admitted that it has based its conclusions almost entirely on the epidemiological literature, which reveals more or less consistent statistical "associations" between significant increases in ambient $PM_{2.5}$ concentrations and the foregoing adverse health effects. EPA acknowledges that

"the relevant toxicological and controlled human studies published to date have not identified any accepted mechanism(s) that would explain how [the] relatively low concentrations of ambient PM [regulated by the $PM_{2.5}$ NAAQS] might cause the health effects reported in the epidemiological literature."[35] Thus, as EPA itself has acknowledged, significant questions remain as to how $PM_{2.5}$, or perhaps certain of its constituents, may result in the adverse health "associations" reported in the epidemiological studies.

Moreover, even the statistical "associations" cited by EPA are not so robust as to put all controversy to rest as to whether the generic category of compounds that comprise $PM_{2.5}$ should, as a group, be deemed a toxic agent subject to a new regulatory regime that does not distinguish among such disparate pollutants as acid aerosols, sulfates, ash, soot, metals and dust. The Office of Management and Budget recently requested that EPA focus its research on identifying "those [$PM_{2.5}$] particles most responsible for health risks" to make it "possible to design controls that do more for public health and cost the economy less than would occur through policies that assume all [$PM_{2.5}$] particles are equally toxic."[36]

According to the preamble that accompanied EPA's proposed $PM_{2.5}$ rulemaking in 1996,[37] the two most critical studies EPA relied upon to assess the statistical associations between ambient $PM_{2.5}$ concentrations and adverse health effects are the so-called Harvard Six Cities[38] and American Cancer Society[39] studies. Yet, when these same data were re-analyzed by the Health Effects Institute (HEI),[40] it was concluded that, with respect to the Harvard Six Cities data, there was no statistically significant association between $PM_{2.5}$ and mortality among high school graduates (in fact, for the 34% of the study population whose education continued beyond high school, the positive association ceased altogether, as their mortality was *inversely* proportional to higher $PM_{2.5}$ concentrations)[41]; there was no statistically significant association between $PM_{2.5}$ and mortality in the data set if one of the six cities (Steubenville, Ohio) were removed from the data[42]; and the same "associations" that existed between all causes of mortality and $PM_{2.5}$ also existed, and to approximately the same degree of statistical significance, with respect to other pollutants, such as sulfates, TSP, PM_{15}, SO_2 and NO_2, whose concentration levels tend to co-vary with $PM_{2.5}$, making it difficult to assign blame among these pollutants for the observed variations in mortality.[43] With respect to the American Cancer Society study, the HEI re-analysis concluded that there was no statistically significant association between $PM_{2.5}$ levels and mortality for the 59% of the study population that had more than a high school education[44] and that when SO_2 was included in a multi-pollutant model, it displaced $PM_{2.5}$ as the pollutant of concern, since the relative risk for SO_2 was statistically significant, while the relative risk for $PM_{2.5}$ with the inclusion of SO_2 in the model was not statistically significant.[45] The ultimate conclusion drawn by HEI upon its review of the data was that "urban air pollution [that is, the type of air pollution found in cities, regardless of its origin] is associated with increased mortality."[46] HEI observed that "mortality may be associated with more than one component of the complex mix of ambient air pollutants in urban areas of the United States" and that the data were "insufficient to identify causal relations" between any single pollutant, such as $PM_{2.5}$, and mortality.[47]

Of the dozens of epidemiological studies on $PM_{2.5}$ published since EPA's NAAQS rulemaking in 1997, one of the most important is a recent article extending the analysis of the American Cancer Society cohort of approximately 1.2 million adults with an additional eight years of follow-up.[48] The article concludes that long-term exposure to combustion-related $PM_{2.5}$ air pollution is an important environmental risk factor for cardiopulmonary mortality and lung cancer. Using statistical techniques that seek to adjust for age, gender, race, smoking, education, martial status, body weight, alcohol consumption, occupational dust exposure and diet, the study concludes that a 10 $\mu g/m^3$ increase in long-term average ambient $PM_{2.5}$ concentrations results in a 9% increase in the cardiopulmonary mortality rate and a 14% increase in the lung cancer mortality rate.

The foregoing synopsis, of course, hardly does justice to the massive body of epidemiological research on the human health effects of $PM_{2.5}$. The most recent effort by EPA to summarize the epidemiological literature is 300 pages long (not counting appendices) and cites more than 400 published studies.[49] The basic conclusion of many of these studies is that significant increases in the concentrations of ambient $PM_{2.5}$ and other pollutants have been statistically associated with mortality, hospital admissions and emergency room visits.

IV. THE $PM_{2.5}$ NAAQS

The Clean Air Act establishes an extraordinarily detailed program for the control of air pollution through a system of shared federal and state responsibility. The NAAQS are the central feature of that program. The Act requires EPA to establish, review and revise nationally applicable permissible concentration levels for the ambient air for a small class of common air pollutants, including particulate matter.[50] Upon the establishment of such standards, the Act then calls on states, acting through an EPA-approved State Implementation Plan (SIP), to impose controls on individual sources of air pollution as necessary to attain and maintain the standards.[51] The $PM_{2.5}$ NAAQS set in 1997 and related regulations are discussed below.

A. The Federal Statutory Framework

The Clean Air Act establishes the general process by which EPA must set and revise a NAAQS. EPA must develop "air quality criteria" reflecting the "latest scientific knowledge" on "all identifiable effects on public health or welfare" that may result from the presence of a criteria pollutant in ambient air.[52] In promulgating a NAAQS, EPA consolidates the scientific assessments into a "Criteria Document" that provides an analysis of the pertinent scientific information. EPA also develops a "Staff Paper" to "bridge the gap" between the scientific review and the judgments its Administrator must make to set standards.[53] Both documents undergo public notice and comment, and scientific peer-review by the Clean Air Act Scientific Advisory Committee (CASAC), an independent committee established under the Act to advise the EPA Administrator on air quality criteria and NAAQS.[54]

Relying on the "air quality criteria," EPA promulgates "primary" and "secondary" NAAQS to protect against the adverse health and welfare effects of the criteria pollutant.[55] EPA must set "primary" standards at levels that, "in the judgment of the Administrator," are "requisite to protect the public health" with "an adequate margin of safety."[56] EPA must set "secondary" standards at levels that are "requisite to protect the public welfare" from any "known or anticipated adverse effects."[57] The adverse effects to be protected by the secondary standards include impacts on vegetation, crops, ecosystems, visibility, climate and building facades. To ensure that the standards reflect the latest advances in scientific knowledge, EPA must review the air quality criteria and standards every five years (although EPA typically takes much longer) and revise them as "appropriate in accordance with [the foregoing standards]."[58]

B. Development of the $PM_{2.5}$ NAAQS

In April 1994, EPA initiated its review of the PM_{10} standard that it had promulgated in 1987 by announcing its intention to develop a revised Criteria Document for particulate matter. Thereafter, a series of drafts were developed, as well as drafts of a Staff Paper that discussed the options for revising the NAAQS, based on detailed reviews of the published literature, and subjected to technical scrutiny and public comment at workshops and meetings.[59] Upon completing its review of the revised Criteria Document and new Staff Paper, CASAC concluded that "although our understanding of the health effects of PM is far from complete," the revised Criteria Document and Staff Paper, if modified to incorporate CASAC's recommendations, would be adequate to make regulatory decisions concerning the PM NAAQS. EPA thereafter finalized the Criteria Document[60] and Staff Paper[61] and proposed to revise the NAAQS for particulate matter.[62]

C. The Revised NAAQS

On July 18, 1997, EPA promulgated a new NAAQS for particulate matter that set a new standard for $PM_{2.5}$ and made modest revisions to the PM_{10} standard that had been set in 1987.[63] In a related rulemaking, EPA later promulgated a regional haze rule to protect visibility in certain scenic areas from $PM_{2.5}$-related impairment.[64]

1. The $PM_{2.5}$ NAAQS

The NAAQS promulgated in 1997 set forth numeric $PM_{2.5}$ standards of 65 $\mu g/m^3$ for average 24-hour $PM_{2.5}$ concentrations and 15 $\mu g/m^3$ for average annual $PM_{2.5}$ concentrations.[65] EPA also established statistical protocols for comparing ambient air quality data to these numeric standards to determine NAAQS compliance.

EPA requires three years of $PM_{2.5}$ monitoring data to determine compliance with the 24-hour standard. To determine compliance one must first calculate a separate 98th percentile value of 24-hour concentrations for each of the three years.[66] For example, if there are 365 days of $PM_{2.5}$ data for the first year,

the 98th percentile for that year would be the average concentration on the day that had the eighth highest average $PM_{2.5}$ concentration, since the dirtiest seven days represent the top two percentile of days that are not considered in determining compliance with the standard (.02 x 365 ≈ 7). To determine compliance with the 24-hour standard, one then computes the arithmetic mean of each year's 98th percentile value.[67] Each monitor within an area must comply with the 65 $\mu g/m^3$ standard.

Three years of $PM_{2.5}$ monitoring data are also required to determine compliance with the annual standard of 15 $\mu g/m^3$. The annual standard applies to a three-year average at either a single location or, in the case of a highly populated area where there are several monitors and in which the State has elected to use such an approach, to a spatial region that represents area-wide exposure.[68] EPA's logic in allowing states to elect to use spatial averaging is that "the health-effects data base that served as the basis for selecting the new $PM_{2.5}$ standard relied on a spatial average approach that reflects average community-oriented area-wide exposure levels."[69] Thus, such an "averaging approach is directly related to [the] epidemiological studies used as the basis for the $PM_{2.5}$ NAAQS."[70] The decision to use spatial averaging, in effect, relaxes the stringency of the $PM_{2.5}$ standard because it allows monitoring sites whose average concentrations exceed the annual standard to be offset by nearby monitoring sites whose average concentrations are sufficiently below the annual standard as to bring the average of the sites within the standard.

2. The Revised PM_{10} NAAQS

In connection with its revision of the $PM_{2.5}$ NAAQS, EPA left the 1987 24-hour PM_{10} numeric standard in place, but revised the statistical form of the standard. The 1987 24-hour PM_{10} standard was 150 $\mu g/m^3$, which was required to be met on all but one day per year.[71] EPA did not alter the 150 $\mu g/m^3$ number but changed the form of the standard so that compliance is now determined by averaging the 99th percentile 24-hour concentrations of each of three consecutive years.[72] EPA also retained the 1987 annual PM_{10} standard of 50 $\mu g/m^3$.[73]

3. The Regional Haze Rule

EPA's regional haze rule, enacted in 1999,[74] is potentially the most restrictive air quality rule ever promulgated, obligating major reductions in particulates and their precursor gas emissions to return visibility in many U.S. national parks and wilderness areas to natural levels by the year 2064. Since the rule will be implemented in lockstep with the $PM_{2.5}$ NAAQS, a brief discussion of the rule is appropriate to understand what EPA and the state agencies will be doing over the next several years to regulate $PM_{2.5}$.

Congress adopted the Clean Air Act's visibility provisions[75] in 1977 because of concern that the NAAQS might not provide adequate visibility protection for "areas of great scenic importance."[76] The major anthropogenic contributions to the haze that can reduce visibility in natural areas are: secondary particulate associated with SO_2 emissions (*e.g.*, sulfates); secondary particulate associated with NO_x emissions (*e.g.*, nitrates); and, to a lesser extent, primary particulate such as elemental carbon (soot).

The areas protected by these regulations are the so-called Class I federal areas which are, basically, national parks exceeding 6,000 acres and national memorial parks and wilderness areas exceeding 5,000 acres.[77] Protected areas located in California include the Joshua Tree Wilderness, Yosemite National Park and Sequoia National Park.[78] Since the ultimate objective of the EPA regulations is to restore visibility in protected areas to their background condition by 2064,[79] and, since the pollutants at issue are capable of staying suspended in the atmosphere over long periods and do not respect state boundaries, sources in California may be subject to regulation under the regional haze rule with respect to out-of-state protected areas, such as the Grand Canyon.

EPA's original visibility rule, enacted in 1980, applied only in states in which protected areas are located and required them to address haze caused by a reasonably attributable source or a small group of sources.[80] EPA's new regional haze rule expands the original rule to all states, even those without Class I federal areas, to participate in regional haze reduction efforts.[81] The new rule now requires all states to develop implementation plans and meet reasonable progress goals towards meeting the visibility standard.[82] This requirement is likely to result in control strategies for sources that have emissions that "may reasonably be anticipated to cause or contribute to any impairment of visibility" in protected areas.[83]

D. The $PM_{2.5}$ Standard Setting Process Underway in California

1. California Air Quality Regulation

California has long been known for "doing its own" thing in the environmental protection realm, including with respect to air pollution control. Regulation of particulate pollution is no exception to this trend, and California first began regulating PM_{10} in 1982. As indicated in the table below, the current California PM_{10} standard is significantly lower than the federal standard:[84]

Comparison of EPA and California PM_{10} Standards		
Jurisdiction	**24-Hour Average PM_{10}**	**Annual Average PM_{10}**
National	150 $\mu g/m^3$	50 $\mu g/m^3$ (arithmetic mean)
California	50 $\mu g/m^3$	30 $\mu g/m^3$ (geometric mean)[85]

The California Air Resources Board, a state agency, does not directly enforce the state's clean air laws with regard to stationary sources. Instead, each air quality management district implements rules and regulations to ensure compliance with the statewide and federal standards.[86]

2. The Current Standard Setting Process

In 1997, the legislature ordered the California Air Resources Board to monitor $PM_{2.5}$ and to make annual reports regarding the status and results of the monitoring program.

In 1999, the Children's Environmental Health Protection Act required the evaluation of all health based ambient air quality standards by December 2000, to determine if they were adequately protective of human health, especially for children.[87] The initial report from the Air Resources Board concluded that significant health effects could occur at or near the existing PM_{10} standards.[88] As a result, another more detailed review of PM_{10} standards, as well as the possible adoption of a new $PM_{2.5}$ standard was undertaken by the staff of the Air Resources Board in conjunction with the California Office of Environmental Health Hazard Assessment (OEHHA). The final Staff Report released on May 3, 2002, made several recommendations, set forth below:[89]

OEHHA Staff's Recommended California Particulate Standards				
Particulate	24-Hour Average		Annual Average	
	Numeric Standard	Form	Numeric Standard	Form
PM_{10}	50 μg/m³	Not to be exceeded	20 μg/m³	Not to be exceeded; annual arithmetic mean
PM2.5	25 μg/m³ [Withdrawn]	N/A	12 μg/m³	Not to be exceeded; annual arithmetic mean

These recommendations are based on what the Air Resources Board and OEHHA staff believe are epidemiological and toxicological studies showing significant toxicity related to exposure to fine particles.[90] The Staff Report proposes using the Federal Reference Method for data collection to ensure compatibility with information collected by monitors using that method.[91]

In mid-June of 2002, prior to the public hearing on the Report, the Air Resources Board withdrew its proposal to establish a 24-hour average $PM_{2.5}$ standard because one of the software statistics packages used to support the analysis was determined to be flawed. Once the Board re-reviews the data supporting the 24-hour average $PM_{2.5}$ standard, it will proceed as appropriate with respect to this standard, and most likely propose the same standard of 25 μg/m³.

The California Air Resources Board approved the proposed new standards at its June 20, 2002 meeting, and the process of incorporating them into the California regulations has now begun.[92]

V. THE JUDICIAL CHALLENGE TO THE $PM_{2.5}$ AND PM_{10} NAAQS AND HAZE RULE

Shortly after EPA promulgated its NAAQS for particulate matter in 1997, more than fifty petitions for review were filed by industry groups, states, environmental organizations and others in the U.S. Court of

Appeals for the D.C. Circuit. The surprising outcome of these cases is that EPA's new $PM_{2.5}$ NAAQS has been upheld in all respects, but its relatively minor revisions to the PM_{10} NAAQS have been vacated.

In its initial decision in the case, the D.C. Circuit held that the statutory provision, discussed above, requiring that NAAQS be established "requisite to protect the public health" with "an adequate margin of safety" was unconstitutional because, as construed by EPA, it "effects an unconstitutional delegation of legislative power."[93] Subsequently, however, the U.S. Supreme Court unanimously overturned this holding and upheld the constitutionality of the statute,[94] remanding the case to the D.C. Circuit for it to rule upon contentions that EPA's rulemaking was "arbitrary and capricious."

On remand, the D.C. Circuit, on March 26, 2002, gave short shrift to industry's arguments and upheld the $PM_{2.5}$ NAAQS. The court held that "[t]he Act requires EPA to promulgate protective primary NAAQS even where, as here, the pollutant's risks cannot be quantified or 'precisely identified as to nature or degree.'"[95] Nor did the Act require EPA to identify a biological mechanism for the statistical association between PM and adverse health effects.[96] Thus, according to the court, "EPA's inability to guarantee the accuracy or increase the precision of the $PM_{2.5}$ NAAQS in no way undermines the standards' validity"; rather, such "limitations indicate only that significant scientific uncertainty remains about the health effects of fine particulate matter at low atmospheric concentrations."[97] Since the court ruled that the Act requires that EPA set the primary NAAQS "notwithstanding that uncertainty," it upheld the $PM_{2.5}$ NAAQS after concluding that EPA's rulemaking for $PM_{2.5}$ was "'rational and supported by the record.'"[98]

By contrast, in a portion of its earlier 1999 decision as to which no party sought subsequent review, the court held that EPA had acted arbitrarily in promulgating the revised PM_{10} NAAQS in 1997.[99] The court noted, correctly, that PM_{10} includes a fine particulate fraction ($PM_{2.5}$) and a coarse particulate fraction (that portion of PM_{10} that is not $PM_{2.5}$, abbreviated $PM_{10-2.5}$). The court held that, in light of the $PM_{2.5}$ standard, the PM_{10} standard was arbitrary and capricious because: (i) hazards associated with the fine fraction of PM_{10} are addressed by the $PM_{2.5}$ NAAQS; (ii) thus, the only residual risks associated with PM_{10} are those due to the coarse fraction, $PM_{10-2.5}$; and (iii) EPA had not provided an adequate justification for "using PM_{10} (which includes both coarse and fine PM) as a 'surrogate for coarse fraction particles.'"[100] In light of its holding, the court "vacate[d] the challenged coarse particulate matter [*i.e.*, PM_{10}] standards because EPA will have to develop different standards when it corrects the arbitrarily chosen PM_{10} indicator" for $PM_{10-2.5}$.[101]

The court's repudiation of the 1997 PM_{10} NAAQS is oddly at variance with its decision-making with respect to the $PM_{2.5}$ standard. If, as the D.C. Circuit held in upholding the $PM_{2.5}$ standard, a statistical association between a pollutant and adverse health outcomes is, without more, sufficient to promulgate a NAAQS, then the association between PM_{10} and adverse health outcomes should have been sufficient to justify the PM_{10} NAAQS, irrespective of what "fraction" of PM_{10} may have contributed to those associations. Moreover, if $PM_{2.5}$ and $PM_{10-2.5}$ have synergistic effects – that is, $PM_{2.5}$ concentrations contribute to the adverse health affects associated with $PM_{10-2.5}$ – it would be rational to regulate the pollutants with a PM_{10} standard that includes them both.

Regardless of the merits of the court's decision, it is clear that the 1997 PM_{10} NAAQS –although it continues to be printed in the Code of Federal Regulations – is no longer valid. EPA's position on the matter is that, since the D.C. Circuit struck down the 1997 revisions to the 1987 PM_{10} NAAQS, those "1987 PM_{10} standards remain in effect."[102]

On May 24, 2002, the U.S. Court of Appeals for the D.C. Circuit struck again, vacating the Best Available Retrofit Technology (BART) provisions of the Regional Haze Rule and remanding other challenged provisions of the rule to EPA for further review.[103] Among the remanded issues were those raised by the Sierra Club that the Regional Haze Rule impermissibly extends the States' deadline for submitting haze SIPs. At the same time, the court rejected industry's contention that EPA exceeded its authority in establishing "natural visibility" as the goal of the haze program. The court also rejected industry's related contention that the Regional Haze Rule's "no degradation" requirement is inconsistent with the prevention of significant deterioration requirements of the Act.

VI. TOWARDS A $PM_{2.5}$ SIP FOR CALIFORNIA

Title VI of the Transportation Equity Act for the 21st Century (TEA-21) establishes a specific schedule for joint implementation of the $PM_{2.5}$ NAAQS and EPA's regional haze rule.[104] This schedule is discussed below, together with a discussion of the ambient air monitoring data that have been collected to date and the planning that is underway to implement the EPA and California regulations.[105]

A. $PM_{2.5}$ Monitoring

Nationwide monitoring of ambient air for $PM_{2.5}$ has been the initial focal point of efforts by EPA and state agencies to implement the new $PM_{2.5}$ standards. Pursuant to EPA's $PM_{2.5}$ monitoring regulations[106] and California state law,[107] California has installed more than 80 Federal Reference Method (FRM) monitors in the State, to generate the $PM_{2.5}$ data (in $\mu g/m^3$) that are necessary for attainment designations under the $PM_{2.5}$ NAAQS. The $PM_{2.5}$ FRM is a filter based method; one 24-hour sample is collected every third day, except at a few daily monitoring locations. The California Air Resources Board website provides summaries and a map of the monitoring sites in the State.[108] EPA's web site contains only a summary of the $PM_{2.5}$ data, but includes all EPA-approved monitors, nationwide.[109]

In order to have the requisite three calendar years of FRM data to make attainment designations under the $PM_{2.5}$ NAAQS, data through the end of calendar year 2002 will be needed, making it impossible, at this time, to determine which areas of the State will be designated $PM_{2.5}$ nonattainment areas. A look at the data collected to date, however, shows that average concentrations at selected monitoring stations in the South Coast and San Joaquin Valley Air Quality Management Districts have consistently exceeded the annual $PM_{2.5}$ standard of 15 $\mu g/m^3$.

In addition to the FRM monitors, the Air Resources Board or local air quality management districts operate over 20 speciation monitors (in EPA jargon, "trends" monitors) in the State to determine the ambient

particulate concentration of 58 compounds in the atmosphere and to characterize the physical and chemical composition of ambient $PM_{2.5}$. Speciation information can help to determine the possible sources of $PM_{2.5}$ emissions (since different sources emit different types of $PM_{2.5}$) and assist in the development of a regulatory program to control those sources that are contributing to ambient $PM_{2.5}$ concentrations in excess of the NAAQS.

The Air Resources Board and the local air quality management districts also operate 21 continuous monitors that collect mass data regarding $PM_{2.5}$. Other continuous monitors are used to report ambient hourly pollutant concentrations, more or less in real time, on some of the local air quality management district websites. One prominent use of the data, which are also collected for pollutants such as ozone and carbon monoxide, is to calculate an area's Air Quality Index (AQI) rating, which can result in cautionary announcements on television and radio stations.[110] In promulgating its revised AQI regulations to incorporate $PM_{2.5}$, EPA deemed 24-hour $PM_{2.5}$ concentrations between 40 and 65 $\mu g/m^3$ as "unhealthy for sensitive groups"[111] even though such concentrations comply with the 24-hour $PM_{2.5}$ NAAQS. EPA's rationale for this seeming anomaly is that "for $PM_{2.5}$, . . . the annual standard is the principal vehicle for protecting against short-term concentrations."[112] The EPA approved public service announcements for days in which $PM_{2.5}$ concentrations result in an AQI score in the "unhealthy for sensitive groups" range is that "people with respiratory or heart disease, the elderly, and children should limit prolonged exertion."[113]

Finally, in connection with EPA's regional haze rule, there are 18 Interagency Monitoring of Protected Visual Environments (IMPROVE) sites operating within California.[114]

B. Development of a $PM_{2.5}$ SIP

The Air Resources Board is required to submit proposed $PM_{2.5}$ NAAQS attainment/nonattainment designations to EPA under section 107(d) of the Clean Air Act[115] within one year after receipt of three years of FRM data.[116] Under this schedule, the Board is likely to make its submission to EPA sometime in 2003 or early 2004. EPA is then required to promulgate official attainment/nonattainment designations under section 107(d)(1) of the Act by the earlier of one year after the Board's initial designation or December 31, 2005.[117] Once EPA makes those designations, states will be allowed three years to develop and submit to the EPA pollution control plans showing how they will meet the new standards,[118] and states will have up to 10 years from the designation of nonattainment to attain the $PM_{2.5}$ standards, with the possibility of two 1-year extensions. [119] Accordingly, the timeline to achieve nationwide compliance with the $PM_{2.5}$ NAAQS could extend to 2017, 20 years after EPA promulgated the standard in 1997.

C. Implementation of the Regional Haze Rule

On May 9, 2000, California joined the Western Regional Air Partnership (WRAP), a group of western states, tribes, and federal agencies collaborating in an effort to comply with the regional haze rule.[120] WRAP is a voluntary organization of western states, tribes and federal agencies, formed in 1997 as the

successor to the Grand Canyon Visibility Transport Commission, which made over 70 recommendations in June 1996 for improving visibility in 16 national parks and wilderness areas on the Colorado Plateau. WRAP promotes, supports and monitors the implementation of those recommendations throughout the West, and is also implementing regional planning processes to improve visibility in all Western Class I areas by providing the technical and policy tools needed by states and tribes to implement the federal regional haze rule. WRAP is administered jointly by the Western Governors' Association and the National Tribal Environmental Council.[121]

Under EPA's regional haze rule, participation in this regional planning effort sets December 31, 2008 as the latest date for the participating states' first regional haze control strategy SIPs.[122] WRAP's "Work Plan for Regional Haze" is posted on its web site,[123] and contains numerous intermediate milestones for the development of these SIPs.

D. Exemption of $PM_{2.5}$ from PSD Regulation

The PSD regulations, by their terms, apply to any major stationary source or major modification of a stationary source "with respect to each pollutant subject to regulation under the Act that it would emit."[124] If $PM_{2.5}$ were considered a "pollutant subject to regulation under the Act," a question would be raised as to whether new or modified sources that emit $PM_{2.5}$ would thereby be required to obtain PSD permits.

EPA addressed this issue in a memorandum issued by John S. Seitz, Director, Office of Air Quality Planning and Standards, dated October 21, 1997,[125] advising how the review of new sources should proceed with respect to implementation of the newly-adopted $PM_{2.5}$ standard. The memorandum notes "the lack of necessary tools to calculate emissions of $PM_{2.5}$ and related precursors and project ambient air quality impacts." In light of such considerations, EPA concluded that it "is administratively impracticable" for states to consider $PM_{2.5}$ in their review of new sources and that "until these deficiencies are corrected . . . sources should continue to meet PSD and NSR requirements for controlling PM_{10} emissions and for analyzing impacts on PM_{10} air quality." According to EPA's memorandum, this approach will "serve as a surrogate . . . for reducing $PM_{2.5}$ emissions and protecting air quality."

VII. AD HOC REGULATION OF $PM_{2.5}$ THROUGH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

Since promulgation of the PM_{10} NAAQS in 1987, it has been (and continues to be) routine to scrutinize proposed actions under the California Environmental Quality Act (CEQA)[126] to determine whether the proposed governmental action may have an adverse affect on ambient air quality with respect to PM_{10}.[127] CEQA requires California's public agencies to identify the significant environmental effects of their actions and either avoid such effects altogether or mitigate them to the extent feasible.[128] CEQA applies to "projects" proposed to be undertaken or requiring approval by State and local government agencies, which are defined as "activities which have the potential to have a physical impact on the environment and may include the enactment of zoning ordinances, the issuance of conditional use permits and the approval of

tentative subdivision maps."[129] Where a project requires approvals from more than one public agency, CEQA requires one of the agencies to serve as the "lead agency" for the environmental review process.[130]

For any non-exempt "project" subject to the statute, the lead agency must perform an Initial Study to identify the potential environmental impacts of the project.[131] The lead agency then prepares one of the following environmental review documents: (i) a Negative Declaration, if it finds no "significant" impacts; (ii) a Mitigated Negative Declaration, if it finds "significant" impacts but revises the project to avoid or mitigate them; or (iii) an Environmental Impact Report (EIR), if it finds "significant" impacts. While there is no ironclad definition of "significance," the State CEQA Guidelines provide criteria to lead agencies in determining whether a project may have significant effects. If an EIR is required, it must provide detailed information on a proposed project's potentially significant environmental effects, list ways to minimize them, and provide alternatives to the project.[132]

In the air quality context, an analysis under CEQA generally requires consideration of impacts from stationary sources (such as boilers) that are part of a proposed facility, as well as impacts from vehicular traffic affected by the proposed project. Compliance with NAAQS or the California PM_{10} standards, like any regulatory standard, creates a presumption that there would be no "significant impact on the environment."[133] The lead agency can, however, override that presumption if it "determines on the basis of substantial evidence in light of the whole record that a standard is inappropriate to determine the significance of an effect for a particular project."[134]

Not content to wait through years of $PM_{2.5}$ SIP development and implementation, opponents of projects subject to CEQA have already started to demand that such reviews also include an analysis of the health or other environmental impacts associated with project-related changes to $PM_{2.5}$ concentrations. To date, however, there have not been any determinations whether compliance with the proposed $PM_{2.5}$ standards is sufficient to demonstrate CEQA compliance. Caselaw interpreting New York's analogous State Environmental Quality Review Act has required that $PM_{2.5}$ impacts be assessed under that statute.[135]

Issues that may eventually need to be resolved in this context by lead agencies, and eventually the courts, include: (i) in what circumstances secondary formation $PM_{2.5}$ should be assessed and how such potential impacts should be modeled in the absence of any EPA-approved model for this purpose; (ii) whether particular attention should be paid to any one component of $PM_{2.5}$ (*e.g.*, acid aerosols) or, alternatively, whether all $PM_{2.5}$ should be presumed to be of equal potential toxicity; (iii) whether any heed should be paid to EPA's determination that, for purposes of calculating the Air Quality Index, certain 24-hour concentrations below the 24-hour $PM_{2.5}$ NAAQS may be "unhealthy for sensitive groups"; and (iv) what weight should be given to the expectation that new regulations will be put in place to limit emissions of $PM_{2.5}$ and its precursors to put California on the path to achieving and maintaining compliance with the $PM_{2.5}$ NAAQS and California's ambient air quality standards for $PM_{2.5}$.

Although many of these issues relating to $PM_{2.5}$ have yet to be resolved, it is clear that federal and state regulators, the regulated community, and environmental lawyers and other professionals working in this area are likely to spend a good portion of the next decade and beyond grappling with complexities of $PM_{2.5}$.

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1 U.S. Environmental Protection Agency, "National Air Pollutant Emission Trends, 1900-1998," EPA-454/R-00-002, Tables A-6 & 3-6 (March 2000) (1998 data).

2 *Id.*

3 The data can be accessed in AIRData (www.epa.gov/air/data) using the "NET Tier" query.

4 Data are for 1999 and were calculated by entering a query in AIRData (*supra* n.3) for the county.

5 *Supra* n.1, Table 3-6 (notes).

6 *Supra* n.1, Figure 2-4 & Table A-4 (1998 data). Natural gas fired power plants account for 0.01% of nationwide SO_2 emissions. *Id.*

7 *Id.*, Figure 2-2 & Table A-2 (1998 data).

8 *Id.*, Figure 2-3 (1998 data).

9 *Id.*, Table 3-8 (1998 data).

10 *E.g.*, Luria, *et al.*, "Rates of Conversion of Sulfur Dioxide to Sulfate in a Scrubbed Power Plant Plume," J. Air & Waste Manage Assoc., 51:1408-1413 (Oct. 2001).

11 Seigneur, "Current Status of Air Quality Models for Particulate Matter," J. Air & Waste Management Assoc., 51:1508-1521 (Nov. 2001).

12 National Research Council, Research Priorities for Airborne Particulate Matter: III. Early Research Progress at 49 (National Academy Press 2001).

13 *Id.* (environmental tobacco smoke produces "long-term increases in PM exposures of around 30 $\mu g/m^3$"); s*ee also* U.S. Environmental Protection Agency, Introduction to Indoor Air Quality: A Reference Manual, EPA/400/3-91/003, at 52-53 (July 1991). California has advanced further in prohibiting smoking in indoor work locations, such as restaurants, office buildings and bars, than many other states. Cal. Labor Code § 6405.5.

14 *Supra* nn.12-13.

15 Abt, *et al.*, "Relative Contribution of Outdoor and Indoor Particle Sources to Indoor Concentrations," Environ. Sci. Technol., 34:3579-3587 (2000); Riley, *et al.*, "Indoor Particulate Matter of Outdoor Origin: Importance of Size-Dependent Removal Mechanisms," Environ. Sci. Technol., 36:200-207 (2002); Long, "Using Time- and Size-Resolved Particulate Data to Quantify Indoor Penetration and Deposition Behavior," Environ. Sci. Technol., 35:2089-2099 (2001).

[16] "Revisions to the National Ambient Air Quality Standards for Particulate Matter," 52 Fed. Reg. 24634, 24635 (July 1, 1987).
[17] *Supra* n.16.
[18] 40 C.F.R. § 50.6(a) & App. K.
[19] 40 C.F.R. Part 50, App. K.
[20] 40 C.F.R. § 50.6(b).
[21] 40 C.F.R. §§ 50.6, 51.165(b)(2).
[22] 44 Fed. Reg. 3274, 3277 (Jan. 16, 1979) ("A new or modified source will not be considered to cause or contribute to a violation of a NAAQS if the air quality impact of the source is less than the specified significance levels."); *In re:* Tondu Energy Co., Permit No. 519-87F, Order Denying Review at 13-14 (USEPA Environmental Appeals Board March 28, 2001).
[23] 40 C.F.R. § 52.21; 6 N.Y.C.R.R. § 200.10.
[24] 40 CFR § 52.21(b)(23).
[25] South Coast Air Quality Management District ("SCAQMD") Regulation XIII, Rules 1300-13.
[26] SCAQMD Regulation XIII, Rule 1303.
[27] SCAQMD Regulation XI, Rule 1110.
[28] SCAQMD Regulation XI, Rule 1112.
[29] SCAQMD Regulation XI, Rule 1153.
[30] SCAQMD Regulation IV, Rule 431.
[31] SCAQMD Regulation XI, Rule 1137.
[32] SCAQMD Regulation XI, Rule 1186.
[33] *American Trucking Associations, Inc. v. EPA*, 283 F.3d 355 (D.C. Cir. 2002) (*"American Trucking II"*).
[34] National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38652, 38656 (July 18, 1997).
[35] *Id.*
[36] Letter from John D. Graham, OMB Office of Information and Regulatory Affairs, Dec. 4, 2001, www.whitehouse.gov/omb/inforeg/epa_pm_research_prompt120401.html.
[37] "National Ambient Air Quality Standards for Particulate Matter: Proposed Decision," 61 Fed. Reg. 65638, 65642 (Dec. 13, 1996).
[38] Dockery, *et al.*, "An association between air pollution and mortality in six U.S. cities," New England J. Med. 329:1753-1759 (1993).
[39] Pope, "Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults," Am. J. Respir. Crit. Care Med. 151:669-674 (1995).
[40] Krewski, *et al.*, Reanalysis of the Harvard Six Cities Study and American Cancer Society Study of Particulate Air Pollution and Mortality (HEI 2000). This peer-reviewed report is published on the HEI web site, www.healtheffects.org.
[41] *Id.,* Part II, page 139, Table 4.
[42] *Id.*
[43] *Id.*, Part II, page 150, Table 16.
[44] *Id.*, Part II, page 220, Table 52.
[45] *Id.*, Part II, page 213, Table 50.
[46] *Id.*, Part II, page 234.
[47] *Id.*
[48] Pope, *et al.*, Lung Cancer, "Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution," J. Am. Med. Assoc. 287:1132-41 (March 6, 2002).
[49] U.S. Environmental Protection Agency, Third External Review Draft of Air Quality Criteria for Particulate Matter, vol. II, ch. 8 (April 2002).
[50] 42 U.S.C. §§ 7408-7409.
[51] 42 U.S.C. § 7410.
[52] 42 U.S.C. § 7408(a)(2).
[53] *Natural Resources Defense Council v. EPA*, 902 F.2d 962, 967 (1990), *vacated in part*, 921 F.2d 326 (D.C. Cir. 1991).
[54] 42 U.S.C. § 7409(d)(2)(B); 62 Fed. Reg. 38652, 38654 (July 18, 1997).
[55] 42 U.S.C. § 7409(a)(1) & (b)(1)-(2).
[56] 42 U.S.C. § 7409(b)(1).
[57] 42 U.S.C. § 7409(b)(2).
[58] 42 U.S.C. § 7409(d)(1).
[59] 62 Fed. Reg. 38652, 38655 (July 18, 1997).

[60] U.S. Environmental Protection Agency, "Air Quality Criteria for Particulate Matter," EPA/600/P-95/001aF, bF & cF (April 1996).
[61] U.S. Environmental Protection Agency, "Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information – OAQPS Staff Paper," EPA-452/R-96-013 (July 1996).
[62] 61 Fed. Reg. 65638 (Dec. 13, 1996).
[63] 62 Fed. Reg. 38652 (July 18, 1997).
[64] 64 Fed. Reg. 35714 (July 1, 1999).
[65] 40 C.F.R. § 50.7(a)(1).
[66] 40 C.F.R. § 50.7(c) & Part 50, Appendix N.
[67] 40 C.F.R. § 50.7(c) & Part 50, Appendix N.
[68] 40 C.F.R. § 50.7(b) & Part 50, Appendix N.
[69] 40 C.F.R. Part 58, Appendix D 2.8.1.2.3.
[70] 40 C.F.R. Part 58, Appendix D 2.8.1.6.1.
[71] 40 C.F.R. § 50.6(a).
[72] 40 C.F.R. § 50.7(a)(2) & (e).
[73] *Compare* 42 U.S.C. § 50.6(b) & App. K *with* 40 C.F.R. § 50.7(a)(2), (d) & App. N.
[74] 64 Fed. Reg. 35714 (July 1, 1999).
[75] 42 U.S.C. §§ 7491 to 7492.
[76] H.R. Rep. No. 95-294 at 203-205 (1977).
[77] 40 C.F.R. §§ 81.400-81.437.
[78] *See* www.epa.gov/ttn/oarpg/t1/fr_notices/classimp.gif.
[79] 40 C.F.R. § 51.308(d).
[80] 40 C.F.R. § 51.300(b)(2).
[81] 40 C.F.R. § 51.300(b)(3).
[82] 40 C.F.R. § 51.308.
[83] 42 U.S.C. § 7491(b)(2).
[84] 17 California Code of Regulations § 70100 *et seq.*; 17 California Code of Regulations § 70200 *et seq.*
[85] *See* www.arb.ca.gov/aqs/aaqs2.pdf.
[86] *See generally* Cal. Health & Safety Code §§ 39606, 40001 (2002); *see also* Cal. Health & Safety Code § 40471 (2002)(requiring the SCAQMD to make an assessment regarding compliance with the federal $PM_{2.5}$ standard).
[87] The Children's Environmental Health Protection Act (Senate Bill 25, Senator Martha Escutia; Stats. 1999, Ch. 731, Sec. 3) requires the Air Resources Board, in consultation with the California Office of Environmental Health Hazard Assessment, to "review all existing health-based ambient air quality standards to determine whether, based on public health, scientific literature, and exposure pattern data, these standards adequately protect the health of the public, including infants and children, with an adequate margin of safety." Cal. Health & Safety Code § 39606(d)(1).
[88] These reviews were not exhaustive, but were narrowly targeted to determine whether the existing ambient air quality standards adequately protect the health of the public, including infants and children, with an adequate margin of safety, and to prioritize for full review those standards determined not to adequately protect public health. Cal. Health & Safety Code § 39606(d)(1) and (2).
[89] California Air Resources Board & California Office of Environmental Health Hazard Assessment, Staff Report: Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates (May 3, 2002). *See* http://www.arb.ca.gov/research/aaqs/std-rs/pm-final/pm-final.htm.
[90] *Id.*
[91] *Id.*
[92] *See* California Air Resources Board News Release, June 20, 2002, *located at* www.arb.ca.gov/newsrel/nr062002.htm.
[93] *American Trucking Associations, Inc. v. EPA*, 175 F.3d 1027, 1033 (D.C. Cir. 1999) (*"American Trucking I"*).
[94] *Whitman v. American Trucking Associations, Inc.*, 531 U.S. 457 (2001).
[95] *American Trucking II*, 283 F.3d at 369 (quoting Particulate Matter NAAQS, 62 Fed. Reg. at 38653).
[96] *American Trucking I*, 175 F.3d at 1055-56.
[97] *American Trucking II*, 283 F.3d at 370.
[98] *American Trucking II,* 283 F.3d at 370 (quoting *Lead Indus. Ass'n v. EPA*, 647 F.2d 1130, 1160 (D.C. Cir. 1980)).
[99] *American Trucking I*, 175 F.3d at 1054.
[100] *American Trucking I,* 175 F.3d at 1054 (citation omitted).
[101] *American Trucking I,* 175 F.3d at 1057.

[102] U.S. Environmental Protection Agency, "Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information – OAQPS Staff Paper" at 1-5 n.3 (Preliminary Draft June 2001).

[103] *American Corn Growers Assoc. v. EPA*, No. 99-1348 (D.C. Cir. May 24, 2002).

[104] Pub. L. No. 105-178, Title VI, June 9, 1998, 112 Stat. 463 (reprinted in the "note" to 42 U.S.C. § 7407).

[105] Elements included in the California State Implementation Plan are located in the Code of Federal Regulations at Title 40, Chapter I, Part 52, Subpart F, Section 52.220.

[106] 40 C.F.R. Parts 50, 53 and 58.

[107] Cal. Health & Safety Code § 39619.5 (2002).

[108] *See* www.arb.ca.gov/aqd/pm25/pmfdsign.htm.

[109] *See* www.epa.gov/aqspubl1/annual_summary.html.

[110] *See* www.arb.ca.gov/html/aqi.htm.

[111] 40 C.F.R. Part 58, App. G, Table 2.

[112] 40 C.F.R. Part 58, App. G, ¶ 9. *See also* Air Quality Index Reporting; Final Rule, 64 Fed. Reg. 42547 (Aug. 4, 1999).

[113] U.S. Environmental Protection Agency, Air Quality Index: A Guide to Air Quality and Your Health, EPA-454/R-00-005 at page 10 (June 2000).

[114] *See* www.arb.ca.gov/aqd/pm25/pmfmon.htm.

[115] 42 U.S.C. § 7407(d).

[116] TEA-21, Pub. Law 105-178 § 6102(c)(1).

[117] TEA-21, Pub. Law 105-178 § 6102(d).

[118] Implementation of Revised Air Quality Standards for Ozone and Particulate Matter, 62 Fed. Reg. 38421 (July 18, 1997).

[119] *Id.*

[120] 40 C.F.R. § 51.309.

[121] *See* www.wrapair.org for more information about WRAP.

[122] 40 C.F.R. § 51.308(c)(2).

[123] *See* www.wrapair.org/WRAP/Reports/wpatt99.pdf.

[124] 40 C.F.R. § 52.21(i)(2).

[125] The document is posted at www.epa.gov/ttncaaa1/t1/memoranda/pm25.pdf.

[126] Cal. Public Resources Code § 21000 *et seq.*

[127] 14 California Code of Regulations § 15064(i) (2002), *see e.g. City of Hanford v. GWF Power Systems Co.*, 221 Cal.App.3d 692 (5th Dist. 1990) *rev. denied* (1990).

[128] *See* Cal. Pub. Res. Code §§ 21000 *et seq.*

[129] Cal. Pub. Res. Code § 21065.

[130] Cal. Pub. Res. Code § 21067.

[131] Cal. Pub. Res. Code § 21068.

[132] Cal. Pub. Res. Code §§ 21002, 21002.1.

[133] 14 California Code of Regulations § 15064(i) (2002).

[134] *Id.* at (i)(1)(C).

[135] *Uprose v. Power Authority of the State of the New York*, 285 A.D.2d 603, 729 N.Y.S.2d 42 (2d Dep't), *leave to appeal denied*, 97 N.Y.2d 605 (2001); *Spitzer v. Farrell*, 2002 N.Y. Div. LEXIS 5536 (App. Div. 1st Dept. May 28, 2002).