A Review of National Ozone and Particulate Matter Air Quality Standards in Light of Long-Standing California Air Quality Standards

James M. Lents*

I. INTRODUCTION

On July 18, 1997, the United States Environmental Protection Agency (EPA) announced new air quality standards for ozone and fine particulate matter.[1] The announcement was met with harsh criticism by many industry associations and members of Congress. The Air Quality Standards Coalition, primarily representing business interests, demanded

> Congress must act to halt bad regulations. EPA has issued new air quality regulations that will destroy jobs, hike business costs, and exact painful lifestyle changes while doing little to improve health. . . . Many studies don't support the need for new standards, and those EPA cites as offering strong evidence are ambiguous. . . .[2]

The National Association of Manufacturers (NAM) noted in one of its publications:

> Ignoring the advice of thousands of mayors, governors, state lawmakers, and local governments, EPA on 7/16 issued stringent new rules for particulate matter (PM) and ozone. . . . But many are unconvinced of the

* Director, Environmental Policy Program, Bourns College of Engineering, University of California, Riverside; Former Executive Director of the South Coast Air Quality Management District (SCAQMD), in Diamond Bay, California. Dr. Lents also works on the Environmental Protection Agency's committee to develop air quality control plan guidance for state implementation plans to meet the newly announced federal ozone and particulate standards. B.S. 1966, University of Tennessee; M.S. 1967, University of Tennessee; Ph.D. 1970, Physics, University of Tennessee Space Institute.

1. National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652 (1997) (to be codified at 40 C.F.R. pt. 50).

2. *Congress Must Act to Halt Bad Regulations*, AQSC (Air Quality Standards Coalition, Washington, D.C.).

> need for these new rules . . . Ohio alone estimates the rules would cost their citizens and business $3 billion annually . . . .
>
> . . . .
>
> . . . EPA's decision to tighten the standard was motivated more by politics than scientific concerns. The science behind the health effects of fine particles is even less clear . . . .
>
> . . . .
>
> . . . The impacts of EPA's faulty rush to judgment will be felt by small and large business, utilities and their customers, commuters and consumers.[3]

The NAM leads a national coalition fighting to delay the rules.[4]

Criticism from many members of Congress was equally harsh. Democrat John Dingell (D-MI) and Republican Thomas Bliley (R-VA) pushed for a four-year delay of the standards.[5] In like manner, elements of the scientific and journalistic communities took on the new standards. Dr. Alan Moghissi of the American Council on Science and Health declared that "to date, the agency has failed to offer sufficient proof for its claims. . . . [S]ome charge EPA has rushed the 'peer review' process and not released much of the data."[6] Columnist Charley Reese blasted the standards stating: "It's no surprise that Vice President Al Gore, a junk-science addict, would back the clean air standards demanded by the Environmental Protection Agency. These standards are themselves based on junk science."[7]

Environmental groups and supporters took the opposite position. Gail Ruderman-Feuer of the Natural Resources Defense Council noted in a letter to the *San Gabriel Valley (CA) Tribune*: "Last month the U.S. Environmental Protection Agency announced a long overdue decision to update and tighten Clean Air Act standards for urban smog. . . . This vital public health step was based on more than a decade of scientific data documenting serious health problems from air pollution at levels once thought safe."[8] Columnist Molly Ivins wrote in the *Pasadena (CA) Star News*: "Two things are semi-clear. It has been estimated that the

---

3. National Association of Manufacturers (NAM), Washington, D.C., Aug. 13, 1997, 2-3 (report prepared for NAM members on pending administration and legislative issues).

4. *Id.* at 2.

5. *See* James Gerstenzang, *Foes Press for Delay of New Air Standards*, LOS ANGELES TIMES, July 17, 1997, at A14.

6. Alan A. Moghissi, *The Fuzzy Science Behind New Clean-Air Rules*, ORANGE COUNTY REG., July 14, 1997.

7. Charley Reese, *Clean Air Rules Based on Junk Science*, SAN GABRIEL VALLEY TRIB., July 24, 1997.

8. Gail Ruderman Feuer, *Standing up for Clean Air*, SAN GABRIEL VALLEY TRIB., Sept. 28, 1997.

standards would save between 15,000 and 35,000 lives every year—people who die from diseases either caused or aggravated by air pollution."[9] President Clinton, after approving the new standards, was quoted in the *Torrance (CA) Daily Breeze*: "[T]hey (the standards) were designed to protect children and people with respiratory illnesses from dirty air."[10]

These kinds of disagreements are common in the environmental field, but an independent observer unfamiliar with environmental rhetoric would likely conclude that the two sides must be discussing unrelated standards. The EPA was propelled to address the long-standing standards by a Federal Court decision based on a suit brought by the American Lung Association.[11] Federal law requires the EPA to review air quality standards every five years,[12] but ozone standards were last revised in 1979,[13] when the standard was loosened, and particulate matter standards were last revised in 1987.[14] However, the EPA is not the only group that develops air quality standards—many states and countries set air quality standards to protect public health. California has one of the oldest and most sophisticated air quality standards-setting processes. The California process includes an analysis of the health data by two independent state agencies and a public review by a politically appointed Board.[15] It is insightful to compare the highly criticized 1997 federal air quality standards for particulate matter and ozone with the California air quality standards for similar pollutants in light of critics' accusations that the EPA rushed to judgment using bad science.

II. FEDERAL AIR QUALITY STANDARDS

The initial federal air quality standards for particulate matter and ozone were established in 1971[16] based on criteria documents written in

---

9. Molly Ivins, *Corporate Profit Greater Then Public Health*, PASADENA STAR NEWS, June 17, 1997.

10. H. Josef Herbert, *Clinton OKs Tighter Air Quality Standards*, DAILY BREEZE, June 26, 1997.

11. *See* EPA, REVIEW OF THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER: POLICY ASSESSMENT OF SCIENTIFIC AND TECHNICAL INFORMATION, EPA 452/R-96-013, II-3, II-4 (1996) (OAQPS Staff Paper); *see also* National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652, 38,654 n.3 (1997) (to be codified at 40 C.F.R. pt. 50).

12. *See* Clean Air Act § 109, 42 U.S.C. § 7409 (1994).

13. *See* EPA, REVIEW OF NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE, ASSESSMENT OF SCIENTIFIC AND TECHNICAL INFORMATION, EPA 452/R-96-007, 4-5 (1996) (OAQPS Staff Paper).

14. *See* EPA 452/R-96-013, *supra* note 11.

15. *See* STATE OF CALIFORNIA AIR RESOURCES BOARD (CARB), AMBIENT AIR QUALITY STANDARD FOR OZONE: HEALTH AND WELFARE EFFECTS 2-3 (Sept. 1987).

16. *See* EPA 452/R-96-007, *supra* note 13; *see also* EPA 452/R-96-013, *supra* note 11.

1969 for particulate matter[17] and in 1970 for ozone.[18] The air quality standards for ozone were reviewed and modified in 1979.[19] The air quality standards for particulate matter were not modified until 1987, although the review started at about the same time as the first review of the ozone standards in the late 1970s.[20] These standards stood until the changes announced in 1997. Tables I and II outline the changes to the particulate and ozone air quality standards over the years.

Table I
Comparison of the Federal Primary Air Quality Standards for Ozone as Established over the Years[21]

Standard (ppm)	**1971**	**1979**	**1993**	**1997**
Ozone-One Hour	0.08[1]	0.12[2]	0.12[2]	None
Ozone-Eight Hour	None	None	None	0.10[3]

[1]Not to be exceeded more than once per year. [2]Not to be exceeded on average more than once per year. [3]Three-year average of fourth highest not to exceed this level.

Table II
Comparison of the Federal Primary Air Quality Standards for Particulate Matter As Established Over the Years[22]

	<<<<	**1971**	**>>>>**	**<<<<**	**1987**	**>>>>**	**<<<<**	**1997**	**>>>>**
Standard (µg/m3)	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**
Twenty-Four Hour Standard	None	None	260[1]	None	150[3]	None	65[5]	150[7]	None
Annual Standard	None	None	75[2]	None	50[4]	None	15[6]	None	None

[1]Not to be exceeded more than once per year. [2]Annual geometric mean. [3]No more than one "expected" exceedance per year. [4]Annual arithmetic mean. [5]Three-year average of 98th percentile 24-hour average. [6]Three year average of annual arithmetic mean. [7]99th percentile of 24-hour average.

The changes in averaging periods for the various standards make exact, direct comparisons of the standards difficult and variable from location to location. The increased presence of statistical formats in more recent standards represents the EPA's attempt to take into account unusual meteorological events that could skew a region's attainment plans. For purposes of this Article, the impact of changes in averaging periods will

17. *See* EPA 452/R-96-013, *supra* note 11.
18. *See* EPA 452/R-96-007, *supra* note 13.
19. *See id.*
20. *See* EPA 452/R-96-013, *supra* note 11.
21. *See* EPA 452/R-96-007, *supra* note 13, at 4-7.
22. *See* EPA 452/R-96-013, *supra* note 11, at II-3, II-4.

only be approximated since the purpose here is to take a macro look at the issue.

In the case of ozone, the comparisons are relatively straightforward. Ozone is a single substance, as opposed to particulate matter, which is composed of many sizes and types of material.[23] The only problem in comparing all of the ozone standards is the change from a one-hour, one-exceedance standard used in 1971 and 1979 to an eight-hour, three-year, fourth highest average standard for 1997. The EPA presented data comparing the one-hour/one-exceedance approach with an eight-hour/one-exceedance and an eight-hour/five-exceedance approach for all ninety-eight United States nonattainment areas in the staff analysis of the 1997 ozone standard.[24] The actual 1997-adopted eight-hour standard is not exactly either one of the approaches analyzed by the EPA, but it should lie somewhere close to the eight-hour/five exceedance design value. The comparison of data from the ninety-eight United States nonattainment areas indicates that the eight-hour/fourth highest average value in an area is about forty percent lower than the one-hour/one-exceedance value.[25] This means that the new 0.08 standard approximates a one-hour/one-exceedance standard of about 0.11 ppm. Thus, the actual control impact of the 1997 ozone standard change represents an overall eight percent tightening of the 1979 air quality standard. The new standard is still almost forty percent higher than the original 1971 standard of 0.08 ppm/one-hour average.[26]

As stated earlier, the particulate matter standards are more difficult to compare. Total suspended particulate (TSP) can be heavily influenced by fugitive windblown dust.[27] The ten micron (PM_{10}) standard is less influenced by fugitive dust, and the 2.5 micron ($PM_{2.5}$) contains very little fugitive dust.[28] Thus, a wind storm will heavily influence TSP levels but will have less impact on PM_{10} and even less impact on $PM_{2.5}$.[29] Other than high wind situations or similar occasions with high fugitive dust, the TSP, PM_{10}, and $PM_{2.5}$ track one another in normal urban situations.[30]

---

23. *See generally* EPA 452/R-96-013, *supra* note 11, at IV1-IV8; THAD GODISH, AIR QUALITY 54-59 (2d ed. 1991).

24. *See* EPA 452/R-96-007, *supra* note 13, at Appendix A, tbl. A-13.

25. *See id.*

26. *See* EPA 452/R-96-007, *supra* note 13.

27. *See* EPA 452/R-96-013, *supra* note 11, at IV1-IV8; GODISH, *supra* note 23, at 54-59.

28. EPA 452/R-96-013, *supra* note 11; GODISH, *supra* note 23.

29. EPA 452/R-96-013, *supra* note 11; GODISH, *supra* note 23.

30. *See* EPA, AIR QUALITY CRITERIA FOR PARTICULATE MATTER, 600/P-95-001aF-Cf (PM_{10}), 6-225 to 6-241 (1997).

This is illustrated in the data comparisons presented in the EPA's particulate criteria pollutant document.[31] Data collected in a cross-section of urban areas in both high pollution and average pollution situations resulted in similar weight fractions of different particle size groupings.[32] Based on these studies, PM_{10} is typically sixty-two percent of TSP, and $PM_{2.5}$ is typically thirty-six percent of TSP by weight. $PM_{2.5}$ is typically sixty percent of PM_{10} by weight. It is interesting to compare these ratios with data developed by the California Air Resources Board (CARB) in 1982.[33] CARB concluded that for California, PM_{10} is typically sixty-six percent of TSP, and $PM_{2.5}$ is typically fifty-six percent of PM_{10}.[34] The CARB and EPA estimates are based on data collected a decade apart, yet they are very similar. For this discussion, the more recent EPA data are used. Since $PM_{2.5}$ is the fraction of particulate matter that reaches the lungs, then the original TSP standards and, to a degree, the newer PM_{10} standards are simply surrogates for $PM_{2.5}$. Using this logic, Table III presents the older standards in terms of their estimated PM_{10} and $PM_{2.5}$ fractions.

Table III
National Particulate Standards
Approximated to $PM_{2.5}/PM_{10}$ Fractions[35]

	<<<<	1971	>>>>	<<<<	1987	>>>>	<<<<	1997	>>>>
Standard (ug/m3)	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**
Twenty-four hour Std.	94	156	**260**	90	**150**	-------	**65**	**150**	-------
Annual Standard	27	45	**75**	30	**50**	-------	**15**	-------	-------

As can be seen from Table III, the 1987 particulate matter standards appear to be a substitution of the PM_{10} component of the 1971 standards. The 1997 particulate matter standard, however, appears to represent a significant tightening of the earlier particulate matter standards. The important debate, then, concerning the 1997 ozone and particulate changes resolves down to the need to cut the particulate matter standard by approximately fifty percent. Is this cut a politically motivated misuse of science as some contend or a move to save thousands of lives as others

31. *See id.*
32. *See id.*
33. *See* STATE OF CALIFORNIA AIR RESOURCES BOARD, CALIFORNIA AMBIENT AIR QUALITY STANDARD FOR PARTICULATE MATTER *(PM_{10})* 48 tbl. V-1 (Dec. 1982) [hereinafter CARB PM_{10}].
34. *See id.* at 48.
35. STATE OF CALIFORNIA AIR RESOURCES BOARD, RESOLUTION 82-63 (Dec. 9, 1982).

argue? A comparison with the California ambient air quality standards for ozone and particulate matter can shed some light on this debate.

III. THE CALIFORNIA AIR QUALITY STANDARDS

Like the EPA, the CARB is required to adopt air quality standards "in consideration of the public health, safety, and welfare, including, but not limited to, health, illness, irritation to the senses, aesthetic value, interference with visibility, and effects on the economy."[36] The CARB revised the California ambient particulate standards in 1982[37] and the California ambient ozone standards in 1987.[38]

The original California air quality standard for ozone was set in 1959.[39] It was set in terms of oxidants, which are a group of materials that include ozone along with other reactive molecules.[40] The standard was set at 0.15 ppm/one-hour average.[41] The standard was revised in 1969 to 0.10 ppm/one-hour average—not to be equaled or exceeded.[42] In 1974, the standard was reviewed and maintained at the 0.10 level, but changed from "oxidant" to "oxidant (as ozone)."[43] In 1987, the standard was again reviewed.[44] The level was maintained at 0.10 ppm, but it was designated as "ozone" instead of oxidant.[45] In addition, the CARB pointed out in its analysis that its definition "not to be equaled or exceeded" made its standard equivalent to an EPA standard of 0.09 ppm.[46] A full discussion of the evolution of the California ozone standard can be found in the CARB document *Ambient Air Quality Standard for Ozone: Health and Welfare Effects*.[47] Thus, California, which carries out its own review of air quality health data, concluded twenty-three years before the new 1997 EPA ozone standard that the standard should be 0.09 ppm for one-hour. Using the factors presented earlier for conversion of the one-hour standard to a roughly equivalent eight-hour standard, the 0.09 ppm standard would be in the ballpark of a 0.06 ppm eight-hour average standard. Thus, by implication, California argues that the new federal

---

36. *California Air Pollution Control Laws*, CAL. HEALTH AND SAFETY CODE §§ 60100-60114 (West 1997).
37. STATE OF CALIFORNIA AIR RESOURCES BOARD, RESOLUTION 87-92 (Nov. 12, 1987).
38. *See id.*
39. *See* CARB PM_{10}, *supra* note 33, at 2.
40. *See id.*
41. *See id.*
42. *See id.*
43. *See id.*
44. *See id.* at 2-3.
45. *See id.* at 3.
46. *See id.* at 3-4.
47. STATE OF CALIFORNIA AIR RESOURCES BOARD (CARB), AMBIENT AIR QUALITY STANDARD FOR OZONE: HEALTH AND WELFARE EFFECTS (Sept. 1987); *see also id.* at 2.

standard is too weak. The CARB noted in its 1987 report: "A one hour standard as high as the national standard of 0.12 ppm would not adequately protect public health."[48]

The California particulate matter standards were initially set in 1969 based on TSP.[49] They were revised in 1982 to consider only PM_{10}.[50] The various California particulate matter standards are shown in Table IV.

Table IV
California Particulate Matter Standards
Established Over the Years[51]

	<<<<	**1969**	>>>>	<<<<	**1982**	>>>>
Standard (μg/m3)	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**
Twenty-Four Hour Std.	-------	-------	100	-------	50	-------
Annual Standard	-------	-------	60[1]	-------	30[1]	-------

[1]Annual Geometric Mean.

Table V presents the California standards shown in Table IV along with estimations of equivalent levels of PM_{10} and $PM_{2.5}$ for the designated standards. The estimations are made from the national conversion factors already discussed.

Table V
California Particulate Matter Standards Approximated to
$PM_{2.5}/PM_{10}$ Equivalents

	<<<<	**1969**	>>>>	<<<<	**1982**	>>>>
Standard (μg/m3)	**$PM_{2.5}$**	**PM_{10}**	**TSP**	**$PM_{2.5}$**	**PM_{10}**	**TSP**
Twenty-Four Hour Std.	*36*	*62*	**100**	*30*	**50**	-------
Annual Standard	*22*	*37*	**60[1]**	*18*	**30[1]**	-------

[1]Annual Geometric Mean.

As can be seen in Table V, the actual 1982 CARB standards appear to be an approximation of the 1969 California TSP standards to their PM_{10} fractions. The California Air Resources Board indicated in its 1982 report that the annual PM_{10} standard was derived from the annual TSP standard.[52] It is also interesting to note that the $PM_{2.5}$ fraction of the 1982 California standards is essentially the same as the new national $PM_{2.5}$ air quality standards. However, the national standards use an averaging

48. *Id.* at 9.
49. *See id.* at 1.
50. *See id.* at 1-4.
51. *See id.*
52. *See id.* at 48.

scheme[53] that will in effect make the standards looser than the California standards of the same magnitude.

The CARB again reviewed its standards in 1991, five years ahead of the just announced EPA particulate matter standards.[54] The review concluded that the existing PM_{10} standards were appropriate and noted: "Obviously, the state 24-hour PM_{10} standard is substantially more stringent than the national 24-hour standard. . . . The California Department of Health Services (the DHS) found that these serious health effects occur at PM_{10} levels well below what is now [in 1991] the national 24-hour PM_{10} standard."[55]

IV. CONCLUSIONS

This Article has not attempted to be an exhaustive treatise on the comparison of air quality standards. The review was stimulated by claims of opponents to the recently promulgated EPA standards that they were hastily concocted and based on poor science. California arrived at ozone and particulate matter standards that are equal to or more stringent than the new national standards more than a decade ago. This does not conclusively prove the validity of the new national ozone and particulate matter standards, but it does point out that an independent analysis by two respected California agencies, followed by public debate, resulted in air quality standards in concert with the new national standards. Further, as indicated, this work was completed more than a decade ago. In this light, the EPA's standard setting process seems to be slow and behind the times.

The EPA's adjustment of the ozone standard appears to be more of an attempt to address concerns related to unusual meteorological events than an attempt to actually tighten the standard. The new ozone standard is essentially the same as the old one. It is just recast in the form of a new statistical format. The EPA did significantly tighten the particulate matter standards along with putting them on a more statistical footing. The new EPA standards will now more closely mirror in magnitude the California particulate matter standards that have stood for almost twenty years. It should be expected that as science progresses public health based air quality standards for various states and countries will converge since they

---

53. National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 30,652, 38,668-71 (1997) (to be codified at 40 C.F.R. pt. 50).

54. *See* STATE OF CALIFORNIA AIR RESOURCES BOARD, PROSPECTS FOR ATTAINING THE STATE AMBIENT AIR QUALITY STANDARDS FOR SUSPENDED PARTICULATE MATTER *(PM_{10})*, VISIBILITY REDUCING PARTICLES, SULFATES, LEAD, AND HYDROGEN SULFIDE (Apr. 11, 1991) (Report to the Legislature).

55. *Id.* at 26.

are designed to protect the public, whose needs are fundamentally the same everywhere.