Agriculture and EPA's New Air Quality Standards for Ozone and Particulates

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ABSTRACT

This report discusses potential impacts on agriculture of the new air quality standards for ozone and particulates promulgated by EPA on July 18, 1997. Legislation has been introduced in both the House and Senate (H.R. 1984 / S. 1084) to block implementation of the new standards, and the Senate has approved an amendment to the surface transportation bill, S.Amdt. 1687, to address a limited set of implementation issues. At the request of agricultural interests, the amendment includes a requirement that EPA report to Congress on the ability of its sampling and analysis methods to differentiate types of fine particles. This report will not be updated. For current information on implementation of the clean air standards and related legislation, see CRS Issue Brief 97007, *Clean Air Act Issues*.

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Summary

On July 18, 1997, the Environmental Protection Agency promulgated revisions of the National Ambient Air Quality Standards for ground-level ozone and particulates. EPA's action has elevated awareness of possible relationships between agriculture and air quality in the agricultural community. Many in agriculture, including the Department of Agriculture's Agricultural Air Quality Task Force, have questioned the scientific basis for the new standards. The issues raised also have been aired at congressional oversight hearings. This report summarizes these issues.

In assessing the potential impact of the new standards on agriculture, it is important to note that EPA has promulgated new or revised standards for three different pollutants: 1) ozone; 2) the relatively coarse particulate matter already regulated (PM_{10}); and 3) a new category, fine particulates ($PM_{2.5}$). The potential costs and impacts of each of these standards is different.

Agricultural production is adversely affected by ozone in the atmosphere, so agriculture should benefit from a strengthening of the ozone standard. EPA estimates these benefits at $1 billion annually. The agricultural community agrees that lowering ozone concentrations will improve yields, while not necessarily agreeing with the EPA estimate. The vast majority of the emissions that form ozone (nitrogen oxides and volatile organic compounds) originate in urban and industrial areas. Agricultural sources of these emissions would not likely be directly targeted by measures implementing the new rule, although regulation of fuels and motor vehicles might have indirect impacts on the agricultural sector.

The second standard being revised -- that for PM_{10}, a category that includes fugitive dust from construction or tilling the soil -- is effectively relaxed under EPA's proposal. The net effect would be that 31 of the 41 counties currently designated nonattainment (many of them rural) would be reclassified to attainment. This would benefit agriculture, by eliminating the need for additional controls in those areas.

The third standard, for $PM_{2.5,}$ has been the focus of agriculture's concerns. EPA states that fine particulates include five categories of pollutants, two of which can come from agricultural sources. EPA denies any intention to regulate agricultural sources of these emissions, which are not well-characterized, and in the Agency's view are less significant than emissions from power plants and transportation. But agricultural interests have not been satisfied by EPA's response, and, in any event, regulatory decisions will be made by the states, not EPA.

Legislation has been introduced in both the House and Senate (H.R. 1984 / S. 1084) to block implementation of the new standards. Markup of these bills has not been scheduled. On March 4, 1998, however, the Senate approved S.Amdt. 1687, to address a limited set of implementation issues. At the request of agricultural interests, the amendment includes a requirement that EPA report to Congress on the ability of its sampling and analysis methods to differentiate types of $PM_{2.5}$ particles.

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Agriculture and EPA's New Air Quality Standards for Ozone and Particulates

Revisions of the Ozone and Particulate Standards

On July 18, 1997, the Environmental Protection Agency promulgated revisions of the National Ambient Air Quality Standards (NAAQS) for ground-level ozone and particulates. The revisions are the result of a statutory requirement: in Section 109, the Clean Air Act requires that EPA conduct a thorough review of the NAAQS at five year intervals and "make such revisions ... as may be appropriate." In the case of particulates, the standard had been most recently reviewed in 1987. The American Lung Association sued EPA over its failure to act within the required time period; in a consent agreement, EPA has agreed to promulgate standards by July 19, 1997.

The ozone standard was not subject to the court deadline, but was the focus of an earlier suit which EPA settled by reaffirming existing standards in February 1993 and promising to expedite its next review. The Agency subsequently placed its review and promulgation of new standards for ozone on the same schedule as that for particulates, on the grounds that the two standards would require controlling many of the same sources of emissions.

The new ozone standard is 0.08 ppm averaged over an 8-hour period, as opposed to 0.12 ppm averaged over a one-hour period. The particulate standard was changed in several ways: the previous standard for particles smaller than 10 microns (PM_{10}) was relaxed as a result of new averaging methods and additional allowed exceedances; but finer particles, less than 2.5 microns in diameter (referred to as $PM_{2.5}$), are to be separately regulated for the first time.

In setting and revising the National Ambient Air Quality Standards, the Clean Air Act directs the EPA Administrator to protect public health with an adequate margin of safety. This language has been interpreted, both by the Agency and by the courts, as requiring standards based on a review of the health impacts, without consideration of the costs, technological feasibility, or other non-health criteria.[1] In developing these specific proposals, the Agency reviewed more than 270 studies of health effects over a 3-year period before proposing standards.[2]

The net impact of both the ozone and $PM_{2.5}$ standards will be increased stringency. Analyses by interested parties, as well as EPA, indicate that many areas

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[1] *Lead Industries Association* v. *EPA*, 647 F. 2d 1130 (D.C. Cir. 1980).

[2] For a detailed discussion of the studies reviewed, see 61 FR 65641 and 65719, December 13, 1996, or consult EPA's home page for the standards at http://ttnwww.rtpnc.epa.gov/naaqspro/index.htm

considered to be in compliance with the previous NAAQS will not meet the new standards. Under the $PM_{2.5}$ standard, EPA estimated that about 170 U.S. counties would not meet the standard versus 41 under the old PM_{10} requirement.[3] For ozone, the number of counties out of attainment under the proposed standard was estimated to nearly triple, from 106 to about 280.[4]

Such an increase in the number of nonattainment areas and new methods of measuring air quality could have broad implications for EPA, the states, and affected industries, including agriculture. But the effects would not be immediate. A number of steps will be necessary before the new standards can be implemented. In general, EPA concludes that it will be 5-8 years before any regulatory decisions affecting industry or other economic sectors are implemented by the states based on the revised ozone standard, and 10-12 years before regulations are promulgated by states implementing the $PM_{2.5}$ standard. Lawsuits challenging the standards or the measures adopted for implementation could cause further delay. During the interim, new scientific reviews can be anticipated.

The 5-8 year delay for implementing controls under the ozone standard results from the steps mandated by law for implementation of a new standard. Under Section 107 of the Clean Air Act, Governors must submit a list of areas not attaining a National Ambient Air Quality Standard within one year of its promulgation. EPA reviews the information submitted and officially designates nonattainment areas within 2 years of promulgating the standard.

At the time of designation, EPA is required by Section 172(a) of the Act to set a date by which each area shall achieve attainment. The date may be 5 years or 10 years following the date on which an area is officially designated. The 10-year date may also be extended for two additional one-year periods. Thus, areas newly designated as nonattainment under the ozone standard will have 7-14 years after promulgation of the ozone standard (i.e., July 2004 - July 2011) to attain it.

Actual control measures to be implemented in the states are decided by the individual states, using guidance provided by EPA. Following the official designation of nonattainment areas (July 1999), states are given 3 years to develop a State Implementation Plan (SIP) identifying the control measures that will be adopted to bring the areas into attainment. Following submission of these plans, EPA has 6 months to determine whether the submission is complete and an additional 12 months to approve, conditionally approve, partially approve, or disapprove a state's plan. Thus, if all deadlines are met, it would be January 2004 (6 ½ years following promulgation of a new standard) before there is an approved implementation plan outlining the measures a state will take to attain the standard.

The $PM_{2.5}$ standard will take 5 years longer to implement than the ozone standard, for two reasons. First, there is at present no monitoring network in place

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[3]Due to a lack of monitoring data for the specified pollutant, the estimate is necessarily only a rough approximation. See http://134.67.104.12/naaqspro/pmlist.htm, for a list of the counties.

[4]For a list of counties, see http://134.67.104.12/naaqspro/o3list.htm.

to determine which areas are nonattainment. Establishing this network is expected to take at least 2 years. Second, attainment determinations are based on the results of 3 years of monitoring. Thus, 5 years need to be added to the front of the process described for ozone before Governors will submit lists of nonattainment areas to EPA, and the State Implementation Planning process for $PM_{2.5}$ begins. Barring delays, nonattainment areas would be designated by July 2004, with attainment deadlines in 2009-2016. The statutory deadline for SIPs identifying specific control measures would be January 2009, if the earlier deadlines outlined here are met.

These dates will be modified if an amendment to the surface transportation bill (S. 1173), approved by the Senate in March 1998, is enacted. The amendment (S.Amdt. 1687), sponsored by Senator Inhofe, would give Governors until July 1999 to submit designations of ozone nonattainment areas, with final designation by the EPA Administrator in July 2000. This would add one year to the ozone implementation schedule outlined above.

Regarding $PM_{2.5}$, the legislation sets December 31, 1999, as the deadline for EPA to establish a monitoring network, requires Governors to submit lists of nonattainment areas one year after the receipt of three years of monitoring data (presumably December 31, 2004), and sets a December 31, 2005 deadline for EPA to designate nonattainment areas. Under this timetable, the statutory deadline for SIPs outlining control measures would be June 30, 2010, with attainment deadlines stretching to the end of 2017.

This paper looks at the question of agricultural impacts from more stringent ozone and fine particle standards. A subcommittee of USDA's Agricultural Air Quality Task Force, created by the 1996 Farm Bill, drafted comments on the proposed rules during its initial meeting in March, 1997. Excerpts from these comments were widely circulated in the farm press and in other places. Among other things, the Task Force questioned the lack of information on incremental benefits and costs associated with attaining the proposed standard, called for improved monitoring capability for $PM_{2.5}$, requested a more complete assessment of precursors to both ozone and $PM_{2.5}$, suggested that EPA look at key differences between rural areas and urban areas where much of the data have been collected, asked EPA to consider the special needs of smaller and less successful farmers, and recommended that the EPA analysis be based on a fuller understanding of soil erosion problems and solutions.

Agriculture's views on possible effects have been discussed at several hearings. The House Agriculture Committee's Subcommittee on Forestry, Resource Conservation and Research held hearings on April 23 and September 16, 1997. The Senate Agriculture Committee held a hearing July 22, 1997. In addition, at an April 29, 1997 hearing held by the Senate Committee on Environment and Public Works' Subcommittee on Clean, Air, Wetlands, Private Property and Nuclear Waste, three panelists addressed agricultural topics; agricultural topics were also discussed at a July 24, 1997 Environment Committee hearing. The comments offered at these hearings, comments by USDA's Agricultural Air Quality Task Force, and information concerning agriculture provided in EPA's analysis of the proposals were the major sources of information used in preparing this report. We begin, however, with some background concerning the Department of Agriculture and its experience with air quality issues.

Air Quality and the U.S. Department of Agriculture

Air quality emerged only recently as a priority environmental topic in agricultural policy and at USDA. For example, a 1989 national assessment of resource conditions and concerns on the country's privately-owned lands published by USDA included lengthy and detailed discussions of soil and water quality, but only brief treatment of three air quality issues; atmospheric deposition (more commonly called acid rain), ozone, and wind erosion. The focus of the acid rain and ozone discussions was on what is known about relationships between each topic and agriculture, and centered on research. The wind erosion discussion explained why air pollution was one of the resulting problems.

Since then, the importance of relationships between air quality and agriculture has received increased recognition. This recognition culminated in enactment of provisions in Section 391 of the 1996 Federal Agriculture Improvement and Reform Act, better known as the 1996 Farm Bill, requiring USDA to create an Agricultural Air Quality Task Force.[5] One finding in the statute states that studies alleging that agriculture is a source of particulates have been based on erroneous data, and that USDA should lead efforts to determine accurate measures of agriculture's role in air pollution and in the development of cost-effective approaches to reduce pollution. The Task Force, is an advisor to the Secretary, and focuses on research, with emphasis on data quality and interagency coordination.

Members of the Task Force, selected in January 1997, are experts who represent USDA, industry, and basic and applied science. The law specifies that the Chief of the Natural Resources Conservation Service serves as its chair. At its first meeting in early March, 1997, the Task Force decided to pursue developing a Memorandum of Understanding with EPA.[6] Topics the Task Force is addressing include greenhouse gas emissions and climate change, volatile organic compounds and ammonia associated with livestock waste, and odor and visibility questions that arise where agriculture is near residential and other land uses.[7] For example, a subcommittee of the Task Force will make recommendations to the whole group on prescribed burning, to assist EPA as it develops policy proposals on the topic. The Task Force met three times during its first year.

The Ozone and Particulate Issues

The issues raised by revision of the ozone and particulate standards can be grouped in at least three categories: the adequacy of the science underpinning the standards; questions regarding implementation; and regulatory impacts, including the

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[5]P.L. 104-127, enacted April 4, 1996. Prior to the creation of this Task Force, there was no official interagency mechanism within USDA to coordinate air quality topics.

[6]The goal of the MOU, signed in February 1998, is "to provide a thoughtful process for involving the agriculture community and the environmental regulation community relative to agriculture air quality."

[7]The minutes of the meeting are posted on the Internet at http://www.nhq.nrcs.usda.gov.

costs and benefits of the proposals. Only the last of these has any unique agricultural component; nevertheless, because of EPA's mandate under the Clean Air Act, the costs and benefits to agriculture (or any other sector of the economy) did not play a central role in shaping the proposals.

Scientific Underpinnings. Questions concerning the scientific underpinnings of EPA's proposal have assumed a predominant role in the debate. EPA estimates that fine particles cause 40,000 deaths per year, and that the proposed standard will reduce this mortality by 15,000 lives annually. The ozone standards' projected effects are less dramatic: EPA estimates that implementation of the ozone proposal would reduce the risk of significant decrease in children's lung functions by 1.5 million to 2 million incidences per year, reduce the risk of moderate to severe respiratory symptoms in children by 200,000 to 400,000 incidences per year, and prevent 1,600 hospital admissions and 5,000 emergency room visits annually. The standards will have many additional effects, both positive and negative, but under the Clean Air Act and its interpretation by the courts, EPA is prohibited from considering effects other than public health in the setting of air quality standards.

Thus, much of the debate has focused on the quality of the scientific data EPA used to reach its conclusions. Representative Larry Combest, chair of the House Agriculture Committee's Subcommittee on Forestry, Resource Conservation, and Research, which held a hearing on the standards April 23, 1997, reflected the views of many in Congress and in the agricultural community in stating:

> The science employed in developing this rule is not up to par, and I'm concerned that farmers could bear the brunt of a bad policy based on equally bad science.... According to much of the testimony we heard today, it appears the EPA's proposed standards do not reflect the science that is available.[8]

While witnesses at this hearing (including scientific witnesses) offered information to support this conclusion, proponents of the standards have disagreed in other forums. Dr. Morton Lippmann, of New York University's Nelson Institute of Environmental Medicine, a member of every scientific panel that has conducted EPA reviews of the ozone and particulate NAAQS since 1980, concludes that there has never been a proposed standard better supported by the science. He and others note that the particulate panel of the Clean Air Scientific Advisory Committee (CASAC) agreed by a vote of 19-2 that fine particles should be regulated, and that a separate CASAC panel that reviewed the ozone documents reached consensus that "although our understanding of the health effects of ozone is far from complete, the document [EPA's staff paper outlining potential primary standards] provides an adequate scientific basis for making regulatory decisions concerning a primary ozone standard."[9]

There is, however, a consensus among both proponents and opponents that there is a need for additional research, which might lead EPA to further revision of the

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[8]House Committee on Agriculture News Release, April 23, 1997.

[9]Closure letter from Dr. George T. Wolff, Chairman, Clean Air Scientific Advisory Committee, to EPA Administrator Carol Browner, November 30, 1995, p. 1.

standards, especially regarding fine particles. There is virtually no monitoring data for $PM_{2.5}$. Little is known about the biological mechanisms that lead from inhalation of $PM_{2.5}$ to disease or death. And there is controversy concerning whether $PM_{2.5}$ (a broad category that includes many different types of particles) or some *specific* particle type within the broad category is the appropriate pollutant to regulate.

Ultimately, the issue of the adequacy of the science base for EPA's proposed standards could affect agriculture in two ways. First, there is the question of whether EPA has the scientific data to assess correctly the effects of the pollutants. If the standards are too stringent, unnecessary costs of control will be incurred, possibly affecting agriculture adversely. Conversely, if the standards are insufficiently stringent, unnecessary harm from air pollution may result, which for ozone could include adverse effects on agricultural productivity.

Second, there is the question of whether further research would implicate agriculture as a source of air pollutants subject to regulation — for example, as discussed below, whether agricultural sources of ammonia contribute to adverse effects attributed to $PM_{2.5}$ and might be subject to regulation.

The requirement of the Clean Air Act that EPA regularly review the NAAQS makes it clear that EPA must make a decision on the science base available. What is at issue is the level at which the standards should be set given the available science.

Implementation Issues. A number of issues have been raised concerning the consistency of the proposed standards with current provisions of the Clean Air Act and the pace at which air quality improvements would occur under the proposed standards.

The Clean Air Act, as written, specifically references the existing 1-hour, 0.12 ppm ozone standard (Section 181) and the PM_{10} standard (Section 188) in categorizing nonattainment areas: areas with ozone readings of 0.121 to 0.138 are defined as Marginal and given a 3-year deadline to reach attainment; 0.138 to 0.160 as Moderate, with a 6-year deadline; 0.160 to 0.180 as Serious, with a 9-year deadline; etc. Section 182 spells out requirements for each of the five ozone noncompliance categories, and Section 185 contains specific enforcement requirements for the two worst categories (Severe and Extreme) if they fail to attain the standard within the deadlines. Similarly, Section 189 spells out requirements for the PM_{10} noncompliance areas.

When the ozone standard changed from 0.12 ppm to 0.08 ppm, the statutory definition of the 5 nonattainment categories became an anomaly, requiring measured progress toward a standard that no longer exists -- even though virtually all parties concede that the ozone control measures required under the law are the same types of controls one would use to meet the new standard.

Since EPA is proposing to retain the existing PM_{10} standard, the question of references in the CAA specifically to PM_{10} as the PM standard poses less of a problem. Nevertheless, the measures outlined in Sections 188-190 do not address compliance with the $PM_{2.5}$ standard.

EPA has set forth an implementation plan for dealing with the transition to new ozone and PM standards, but the implementation plan itself raises questions. The issue is not whether EPA can implement new ozone and PM standards: the Act provides EPA general authorities to implement air quality standards. The issue is whether EPA can disregard specific statutory requirements relating to the existing standards, as implied by the implementation plan.

A related set of questions concerns what all acknowledge is likely to be a lengthy process for implementing the new standards. As noted earlier, after promulgation of the standards, it is 5-8 years before any regulatory decisions affecting industry or other economic sectors are required to be implemented by the states based on the revised ozone standard, and 10-12 years before any regulations are likely to be promulgated implementing the $PM_{2.5}$ standard. Lawsuits challenging the standards may cause further delay.

With regard to fine particulates, the lengthy schedule for implementation leads some to conclude that conducting further research to obtain greater certainty before regulating would have little impact on public health, particularly as several existing clean air programs, such as Title IV (concerning acid precipitation), will reduce $PM_{2.5}$ in the interim. The same set of facts prompts others to suggest that the standard needed to be promulgated as soon as possible to shorten what is certain to be a lengthy implementation process. There is general agreement that EPA will still have time to revisit the $PM_{2.5}$ standard in 5 years, as required by the Act, before any measures are taken to control emissions.

Proponents of acting now argue that the standards can be revised based on additional research, but that without a commitment to move forward with regulations, there will be little impetus to conduct the additional research. Proponents of delay, on the other hand, argue that huge expenditures of limited resources will be set in motion by the setting of a standard, and that there should be greater certainty about the scientific underpinnings before those resources are committed.[10]

Regulatory Impacts Specific to Agriculture. Even if there were no controversies over the science or implementation issues, there would still be questions about how these proposals would impact the economics of agriculture and other economic sectors. Farmers are less able than many other businesses to pass increased costs along to those who purchase their products because prices are set in commodity markets in which individual producers have negligible influence. That inability, combined with a concern about the potential consequences of these changes, has galvanized the farm community. Critics of the proposals raise the specter of especially severe effects on small farmers with limited incomes. Affected farmers of any size might have any number of controls placed on their actions, according to these critics, from mandating no till days to requiring that the ground be

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[10]Bills seeking delay of the standards include H.R. 1984 (Klink) and S. 1084 (Inhofe). Senator Inhofe's amendment (S.Amdt. 1687), although substantially different from S. 1084, is considered a substitute for the bill. In discussing the amendment during Senate debate, March 4, Senator Inhofe announced that if the amendment were enacted, he did not intend to bring up any other legislation or amendments affecting the NAAQS.

moistened before it is worked. These concerns in some part reflect a situation of uncertainty, as EPA has not stated what guidance it might develop affecting agricultural activities for states to meet the new standards.

Most of the concerns about costs expressed by agricultural stakeholders reflect potential costs, based on assumptions about the implementation of the proposed standards. The uncertainties in the science underlying the standards, as previously noted, and the uncertainties about how the standards would be implemented, since this is a future phase in the process, give considerable range to such assumptions about potential costs. However, it is possible to identify factors concerning each proposed standard that place certain boundaries on potential costs and indicate with some specificity which decisions are key to those costs. These boundaries indicate that, to the extent that agricultural stakeholders are concerned about the costs of EPA's proposals, their focus should be on the $PM_{2.5}$ standard, but that key decisions that could affect those costs will not be made for 10 or more years.

Ozone Issues. Ozone received relatively little attention at any of the Agriculture committee or subcommittee hearings. Agriculture recognizes that it is adversely affected by ozone. Testimony from the National Audubon Society estimated that ozone can be responsible for up to a 10% loss in crop production. Because the proposed standard would lower ozone concentrations in agricultural areas of the South, Midwest, and Northeast, EPA has estimated a $1 billion annual savings for agriculture based on increased crop yields from this proposal. Agricultural interests challenge the magnitude of these projected savings.

Part of this challenge is based on a concern that ozone measurements are generally taken in urban areas, and agricultural representatives believe that ozone levels are much lower in rural areas. If they are lower, the crop losses and the crop benefits are both likely to be less than the estimates above. If ozone is not as significant a problem in rural areas, these critics argue that agriculture should not be required to address it, as the health benefits would be limited. Some of the characteristics of ozone pollution in rural areas were identified in a recent policy forum.[11] The authors concluded that with new regulations in place, large areas of the eastern United States would be in non-attainment and require regional control strategies, with potentially significant costs. The role agriculture might play is unclear.

Proponents of EPA's proposal respond in two ways. First, unlike other pollutants for which there are National Ambient Air Quality Standards, ozone is not emitted directly into the atmosphere, but forms downwind when sunlight and heat catalyze a chemical reaction between nitrogen oxides (NOx) and volatile organic compounds (VOCs). Once formed, ozone can be transported long distances from urban to rural areas. Thus, rural areas are as likely as urban ones to experience high ozone levels, provided that they are downwind of the sources of ozone precursors.[12]

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[11]Chameides, W.L., et. Al., Ozone Pollution in the Rural United States and the New NAAQS. Science. Vol. 276, May 9, 1997. P. 916.

[12]Maine is a good example. With very few sources of pollution, five counties in Maine (continued...)

Second, proponents agree with agricultural interests that farmers do little to generate the nitrogen oxides and volatile organic compounds that cause ozone to form in the atmosphere. As a result, they argue, agriculture is unlikely to be a target of regulation under the ozone proposal. In short, they contend agriculture should benefit from these changes.

The actual measures to be taken to reach attainment would be determined by states through what are called State Implementation Plans. All states model air quality based on current emissions and ambient air quality data, and implement emission control measures sufficient for the models to demonstrate attainment. As EPA notes,

> There are thousands of sources of these gases [ozone precursors]. Some of the more common sources are gasoline vapors, chemical solvents, combustion products of various fuels, and consumer products. These products can be frequently found in large industrial facilities, gas stations, and small businesses such as bakeries and auto body repair shops.[13]

By sector, the major sources of NO_x and VOCs include transportation, electric utilities, petroleum refining and marketing, chemical manufacturing, paints, and architectural coatings. The impacts on agriculture from regulating these sources are most likely to be indirect, primarily the result of engine modifications that could be required of the manufacturers of farm equipment or fuel modifications that might increase the cost of gasoline or diesel fuel.

PM_{10} Issues. The proposed changes in the particulate standards affect both PM_{10}, for which the standards would be less stringent, and $PM_{2.5}$, for which there would be separate standards for the first time. The numeric standard for PM_{10} would remain the same, but EPA would use a different method of calculating attainment that allows additional days above the standard. The net effect would be that 31 of the 41 counties currently designated nonattainment (many of them rural) would be reclassified to attainment.[14]

Agriculture is a major source of PM_{10}, accounting for about 17% of emissions nationally, according to EPA.[15] The mix of emission sources varies in specific air

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(...continued)
(several with as few as 30,000 - 40,000 people) exceeded the ozone standard in 1995, primarily because of pollutants transported downwind from other states.

[13]U.S. EPA, Office of Air Quality Planning and Standards, *National Air Quality and Emissions Trends Report, 1995*, Report No. EPA 454/R-96-005, Research Triangle Park, NC, October 1996, p. 21.

[14]Twenty-six of the 31 counties expected to be redesignated attainment are located west of the Mississippi River, including 5 in California, 5 in Montana, 3 in Oregon, and 2 in Washington..

[15]U.S. EPA, Office of Air Quality Planning and Standards, *Regulatory Impact Analysis for Proposed Particulate Matter National Ambient Air Quality Standard*, Draft Document, Research Triangle Park, N.C., December 1996, p. 6-13.

quality control regions; agriculture may account for a higher or lower percentage of emissions in specific regions.

Despite being a major source of PM_{10}, agricultural activities have not generally been regulated under the current standard. Nevertheless, the weakening of the PM_{10} standard could lower potential costs and regulatory requirements for agriculture in cases where it is a major source of emissions in current PM nonattainment areas.

$PM_{2.5}$ Issues. Data are inconclusive concerning agriculture's role as a source of fine particles ($PM_{2.5}$). In large measure, this is because, in the absence of regulation, there existed fewer than 50 $PM_{2.5}$ monitors in the entire country. Thus, most of EPA's data on the prevalence and sources of $PM_{2.5}$ are estimates subject to potentially large revisions.

In formulating its estimates of areas likely to exceed the proposed $PM_{2.5}$ standard, EPA relied in part on estimated relationships between PM_{10} and $PM_{2.5}$ and in part on monitoring data from representative sites in different regions of the country. As noted, agricultural activities are major sources of PM_{10}, which is essentially dust raised from unpaved roads, construction, and tilling, and particles generated in other mechanical processes; but $PM_{2.5}$ is thought to represent a different class of particles, more the products of evaporation and combustion, for which agriculture is a less likely source, than the result of mechanical processes, such as tilling.

EPA's Regulatory Impact Analysis for the proposed rule identified five potential sources of $PM_{2.5}$: sulfur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH_3), secondary organic aerosols (SOA), and fugitive dust smaller than 2.5 microns. The sources of these pollutants, as estimated by EPA, are summarized in Table 1.

As shown, emissions of SO_2 and NO_x are by far the largest: SO_2 emissions totaled 29.1 million tons in 1990, of which coal-fired utilities accounted for more than half; NO_x emissions totaled 25.6 million tons, with fuel combustion and vehicles accounting for nearly all of the total. Agricultural activities, including farm machinery operating in connection with producing crops, accounted for less than 0.1% of each of these pollutants, according to EPA's estimates. Similarly, agriculture accounted for only 200 tons, less than 0.1% of the total SOA emissions of 221,000 tons.

Agricultural activities do appear to be major sources of the other two categories. According to EPA, "Livestock feed lots are the largest source of anthropogenic ammonia emissions (77 percent), followed by crop production (8 percent)." But the Agency went on to note that "biogenic emissions of ammonia, decomposition of plants and animals, forest fires and human breath and perspiration also contribute to ammonia emissions." As a result, the Agency concluded, "ammonia emissions are not considered for control in this analysis given that ammonia sources are not thoroughly inventoried and ammonia controls are not well developed."[16]

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[16]Ibid., p. 6-8.

Table 1. Sources of $PM_{2.5}$ Emissions, 1990
(thousand tons)

Source Category	SO_2	NO_x	Secondary Organic Aerosols	Ammonia	Fugitive Dust	Total
Coal-Fired Electric Utilities	15,222	6,690	0	0	99	22,011
Highway Vehicles	568	7,446	48	198	291	8,551
Industrial Fuel Combustion	3,106	3,224	2	17	177	6,526
Off-road Vehicles	242	2,836	23	3	293	3,397
Other Fuel Combustion incl. oil and gas-fired utilities	1,229	1,405	1	13	38	2,686
Chemicals, Petroleum and Related Industries	879	397	7	225	63	1,571
Metals Processing	910	82	0	6	96	1,094
Agricultural Production, Livestock	0	0	0	4,186	192	4,378
Agricultural Production, Crops	0	10	0	420	838	1,268
Canada	3,194	2,127	17	233	1,225	6,796
Mexico	3,303	710	7	0	105	4,125
Other	449	656	116	147	3,502	4,870
Total	29,102	25,581	221	5,449	6,920	67,273

Source: U.S. EPA, Particulate Matter Regulatory Impact Analysis, Draft, December 1996, p. 6-7. According to EPA, fugitive dust is $PM_{2.5}$ emitted directly as particles. SO_2, NO_x and ammonia are precursors that transform in the atmosphere to form secondary particulate matter. Secondary organic aerosols are the particulate transformation products of reactive VOCs and atmospheric oxidants.

The fugitive dust "Other" category includes dust from roads and natural sources, and emissions from residential wood combustion, wild fires, and prescribed burning. Prescribed burning, which accounts for 5% of other fugitive dust or 0.5% of the total emissions that become $PM_{2.5}$, includes agricultural burning and prescribed burning for forest and range management.

The remaining category, fugitive dust, is also a source of concern to farm organizations. EPA concludes that agricultural activities account for 837,700 tons of fugitive dust (12% of total emissions) and that production of livestock accounts for an additional 3%. Fugitive dust, in total, is a relatively small component of the $PM_{2.5}$ problem, and EPA argues that one of the major effects of switching from a focus on PM_{10} to $PM_{2.5}$ is to lessen the need to control dust, which in the Agency's view is not as significant a pollutant as emissions from power plants and transportation sources.[17] But agricultural interests have not been completely satisfied by EPA's response regarding ammonia or fugitive dust; and both sides note that, in any event, regulatory decisions will be made by the states, not EPA.

Finally, there are specialized agricultural practices that might be locally important to $PM_{2.5}$ attainment. One of these is agricultural burning. EPA identified agricultural burning as part of a category that also included prescribed burning for forest and range management. Together, these activities are estimated to generate 379,100 tons of $PM_{2.5}$ annually, about 5% of the direct $PM_{2.5}$ emissions, or 0.5% of emissions including precursors. Prescribed burning is unlike other sources of $PM_{2.5}$, because it is not a continuous activity. Rather, it is planned and conducted during confined periods of time. It is unclear from the data whether prescribed burns are common in areas that might be designated nonattainment, and the Regulatory Impact Analysis did not address whether measures controlling agricultural burning might be necessary. Nevertheless, the planned and limited nature of the activity leave open the possibility that management strategies may be able to accommodate burning within the proposed standard, a position the EPA Administrator articulated in a letter to the Secretary of Agriculture, June 5.[18] In addition, as promulgated, the 24-hour $PM_{2.5}$ standard relaxed the proposed standard from 50 $\mu g/m^3$ to 65$\mu g/m^3$. This change is expected to create additional flexibility for episodic sources of fine particles, such as prescribed burning of agricultural fields or range land.

Concerns about the quality of the underlying scientific research on particulate matter are related to the potential agricultural impacts of the standards. As noted previously, at the core of the science issue is the question of whether more research would help to better define either the problem or the solution, or conversely, whether the health threat is such that action is warranted now before better information becomes available. But many other questions have been raised. Examples of the many questions that were raised in hearings were the potential errors in calculating the statistical association between particulate matter and health effects, the inability

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[17]In a June 16 briefing for staff of the House Agriculture Committee, EPA presented data comparing the composition of PM_{10} and $PM_{2.5}$ for three areas. In Washington, D.C., typical of an eastern city, soil represents 31% of PM_{10}, but only 5% of $PM_{2.5}$. In Phoenix, Arizona, representative of an arid western city surrounded by desert and agriculture, soil represents 66% of PM_{10}, but only 16% of $PM_{2.5}$. In the San Joaquin Valley of California, a heavily agricultural area, soil is 53% of PM_{10}, but only 7% of $PM_{2.5}$. The Agency also identified sources of soil in the air, concluding that in both Washington and Phoenix, roads and construction sites were the overwhelming sources, not agriculture. See U.S. EPA, Office of Air Quality Planning and Standards, Emissions, Monitoring and Analysis Division, "PM-2.5 Composition and Sources," June 16, 1997.

[18]Letter from EPA Administrator Carol Browner to Secretary of Agriculture Dan Glickman, June 5, 1997.

to make precise estimates using the agriculture tillage emissions test, basing estimates of the amount of particulates put into the atmosphere by tillage on limited bench research with little or no apparent field testing, and the inability to distinguish the source of the particulates generated by alternative tillage methods. One witness pointed to a research conclusion that a large portion of the very fine particulate matter in the eastern United States originates not in this country, but from North Africa, and a 1996 paper by air quality scientists at the University of California at Davis exploring this dimension of the problem was submitted for the record.[19]

Many of the agricultural changes of the past decade are likely to reduce the volume of airborne particulate matter. The role of the Conservation Reserve Program (CRP), enacted in 1985, was cited several times by witnesses representing agricultural interests. The CRP has retired up to 36.4 million acres (about one tenth of the nation's cropland) under 10 year contracts. It was given credit for reducing particulate matter by planting cover crops, usually perennial grasses, on land that had been cultivated to produce annual crops (air quality benefits may be cited as part of the justification for reauthorizing and extending the program before it expires in 2002). But this land is only retired for 10 years, and should the program end or the land be returned to production, it is likely to become a larger source of PM.

Another basic change in agriculture has been the widespread adoption of conservation tillage techniques, now practiced on about 100 million acres annually. These techniques leave plant residue from the preceding year's crop on the ground to reduce erosion and retain soil moisture. The soil is disturbed less and the farmer may pass over it less frequently in farm machinery, thus generating less particulate matter.

There was less talk by witnesses at these hearings about how farming might change as a result of the requirement to control PM. Examples that were identified, but not discussed extensively, included sweeping machines for harvesting, spraying the soil before working it, and using Best Management Practices (erosion control practices that also provide environmental benefits) for discing.

Aspects of agriculture's concerns will be addressed if an amendment to the surface transportation bill (S. 1173), adopted in the Senate by voice vote, is enacted. The amendment (S.Amdt. 1687), sponsored by Senator Inhofe, sets aspects of EPA's implementation plan in law, providing until December 31, 2005 to designate $PM_{2.5}$ nonattainment areas, and requiring a report to Congress within 2 years of enactment regarding the ability of the Agency's sampling and analysis methods to differentiate types of $PM_{2.5}$ particles. The latter provision, according to Senator Inhofe, was added to accommodate the agricultural community. The Administration has agreed to this amendment. In the immediate aftermath of passage, there has been little public reaction to the amendment by agricultural groups or in the farm press.

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[19]Article attached to the testimony submitted by Mr. Bob Vice, representing the California and American Farm Bureau Federation.

Concluding Observations

Testimony from agricultural interests has focused on questions about data and analysis, including the assessment and characterization of problems and the impacts of taking action. Based on these questions, these interests have sought a delay before EPA acts, so that any action will be based on better information and result in responses by individual farm operators that more precisely resolve problems addressed in the regulatory regime. In seeking delay, many comments were offered about the degree to which current farm practices could be threatened as a result of these new regulations. The accuracy of these predictions can not be verified for the most part, but they have generated attention and headlines, especially in the farm press.

At the heart of this issue are a question and a clash of perspectives. The question is how much does agriculture contribute to the problems that these regulations will address (and how much can it contribute to the solutions). This question has several components, including the diversity of natural conditions and agricultural practices, the quality and age of the available information, the replication of actual and current agricultural practices in the data and analysis, and whether all agriculture should be treated the same in all airsheds. One witness commented that agriculture is not like the large stationary sources that EPA traditionally regulates, and the structure of the environmental regulatory regime is far more difficult to apply to many smaller sources than to few large ones.

The difference of perspectives reflects the different milieus in which the two agencies operate. Some examples help to characterize this clash. First, EPA science centers on human health effects, while USDA science centers on effects on agriculture. At times, scientists with such different foci reportedly encounter difficulty when trying to communicate with each other. Implementing the Memorandum of Understanding between the two agencies may help ameliorate these kinds of problems.

Second, EPA's statutory mandates are segmented by media. Air quality is addressed by a separate entity in EPA from water and land issues. In agriculture, the media are considered together in efforts to help farmers conserve and enhance their resources. This segmentation has been an effective approach for many problems, but it may limit both an understanding of the problems agriculture might face and the range of possible solutions.

Third, the EPA regulatory environment is based on setting national standards that are applied by state agencies in all airsheds. EPA does not have a program delivery system at the local level. USDA, by contrast, works almost exclusively at the local level through direct contact with individual landowners. This approach is based on voluntary participation, and local flexibility and solutions. One source of the strenuous objections from agriculture may be a concern over the EPA regulatory approach as much as the different views on the seriousness of the problem, especially agriculture's role. In part, this concern may reflect a misunderstanding of EPA's regulatory approach (which does allow states and local air quality control regions substantial flexibility in designing control strategies) or the time-frame within which regulations will be implemented, which is likely to be prolonged. Nevertheless, the

different backgrounds or world views that EPA and agriculture bring to the discussion are a major source of potential misunderstandings.

Fourth, EPA views soil as a potential source of pollutants, and is concerned with particle sizes and the ways that soil is transported by air in the case of PM. Agriculture views soil as a basic and valued component for commodity production. Both EPA and agriculture see major benefits in keeping soil in place on the farm. Agriculture measures erosion using a tolerance rate that is based on the gross volume of soil that can be lost while maintaining the long-term production capability. EPA is concerned with particle size that is transported by the processes of erosion. Agriculture believes that appropriate soil conservation measures, properly designed and implemented, should go a long way to solving its definition of the problem, that is, loss of an asset, while the EPA is basically concerned with solving the particulate matter problem. While both strive to keep as much soil in place as possible, the different objectives and possible solutions make common ground on the most appropriate erosion control measures more difficult to find.

A June 5, 1997 letter from Carol Browner to Dan Glickman stated that EPA did not plan to focus on agricultural sources as it implemented the proposed standards. The letter states that agriculture would benefit from the change in the ozone standard, by reducing crop damage. Regarding the PM proposal, EPA states that it plans to issue guidance to states that would direct their control strategies away from farming and tilling activities. The letter also states that burning is a recognized agricultural practice, and that strategies that can accommodate burning will be sought.

The hearings before congressional committees reflect a call to Congress by agricultural interests (and others who might be adversely affected) to hear their concerns and explore these issues, and to consider acting on their behalf. They also represented an attempt to influence EPA's decision-making process.

Continued congressional oversight of these issues is certain. EPA will need a continuing flow of resources to review monitoring data submitted by the states, categorize areas as nonattainment, review new State Implementation Plans, and promulgate regulations affecting specific sources of pollution. The conferees on EPA's FY 1997 appropriation expressed their concerns about the new PM standard even before its proposal. The appropriations committees will continue to monitor these regulations. More broadly, some have suggested free-standing legislation (such as H.R. 1984 / S. 1084) to impose a moratorium on implementation of the new standards. While enactment of such legislation appears less likely as time goes on, the Senate's adoption of S.Amdt. 1687 to the surface transportation bill in early March indicates a continued search for legislative language that can reassure affected interests and narrow Agency discretion in implementing the new standards. (For a discussion of recent congressional actions on clean air issues, see CRS Issue Brief 97007, *Clean Air Act Issues*.)