

CRS Report for Congress

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Sulfur in Gasoline

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Summary

President Clinton announced the proposal of so-called "Tier 2" emission standards for cars and light trucks under the Clean Air Act on May 1, 1999. If fully implemented in 2009, the standards would reduce nitrogen oxide emissions 77-95% below current Tier 1 standards. Included in the proposal were requirements that the average concentration of sulfur in gasoline be lowered more than 90%, to 30 parts per million, by 2004. Sulfur in gasoline reduces the effectiveness of catalytic converters and on-board diagnostic equipment in vehicles, thus increasing tailpipe emissions that adversely affect human health and the environment.

Auto manufacturers and most states support setting strict national limits on sulfur, while petroleum refiners seek less stringent and more localized limits. Bills introduced during the 106th Congress (S. 171 and H.R. 888) would provide statutory limits on sulfur similar to those in the proposed regulations. While there is some congressional opposition as well as support for the proposed standard, as of early July, no legislation had been introduced to scale it back. This report will be updated as developments warrant.

Background

The performance of catalysts in vehicle emission control systems is adversely affected by the presence of sulfur in gasoline. Sulfur, a contaminant that is naturally present in crude oil, competes with other pollutants for "space" on the active surface of the catalyst. This limits the ability of catalysts to convert pollutants such as nitrogen oxides, carbon monoxide, and hydrocarbons to less harmful gases.

Nitrogen oxides and hydrocarbons contribute to the formation of ground-level ozone and fine particles that are considered harmful to people and the environment. Mobile

sources of air pollution contribute 49% of the total nitrogen oxides inventory, 40% of volatile organic compounds including hydrocarbons, about one-quarter of particulate matter smaller than 10 microns, and nearly 80% of carbon monoxide.

Sulfur in gasoline in the United States averages about 340 parts per million (ppm) nationally. The average level varies in different parts of the country, from a low of 30 ppm in California to a high of 449 ppm in some other areas of the country. Some gasoline contains as much as 1,000 ppm of sulfur. Reducing the sulfur content of gasoline to 30 ppm, as proposed by the Environmental Protection Agency (EPA) and as required in California,¹ would improve the effectiveness of vehicle catalytic converters enough to cut nitrogen oxide emissions in half in new vehicles, and reduce hydrocarbon emissions by significant amounts as well. The cost of meeting this standard is estimated by refiners at 5-6 cents per gallon of gasoline, and by EPA at less than 2 cents per gallon.² A February 1999 study for the American Petroleum Institute estimated a cost of about 2 ½ cents per gallon to meet a less stringent standard of 40 ppm for a section of the country (east of the Rockies), rather than nationwide as proposed by EPA.³

EPA's Proposed Standards

Building on a 20-year history of progressively more stringent emission standards, the Clean Air Act Amendments of 1990 (in 42 U.S.C. §7521) required EPA to implement tighter emission standards for autos and light trucks in 1994-1996 (Tier 1 standards). Section 202(i) of the Act required that after implementing the standards, EPA was to study the need for further (Tier 2) reductions in emissions, the availability of technology to achieve such reductions, and the cost-effectiveness of such technology. The Agency was required to submit a report to Congress by June 1, 1997, containing the results of the study, and, if stricter standards were needed, to make that determination by December 31, 1999. On August 4, 1998, EPA submitted its report to Congress.⁴ In it, the Agency concluded that further reductions in emissions are needed, that technology exists to make those reductions, and that the technologies can be applied cost-effectively.

EPA states “the presence of sulfur in gasoline has an impact on the performance of catalysts and thus on tailpipe emissions”⁵ and the sensitivity of catalyst efficiency to sulfur

¹The federal Clean Air Act authorizes California to adopt standards to achieve emission reductions from vehicular sources in California, provided that they are at least as stringent as the federal standards. The regulation limiting sulfur in gasoline sold in California, issued by the California Air Resources Board (CARB), took effect March 1, 1996. The regulation can be downloaded from [<http://www.arb.ca.gov/cbg/regs1298.pdf>] and a description of the sulfur limits in gasoline can be downloaded from [<http://www.arb.ca.gov/cbg/pub/cbgbkgr6.htm>].

²Lundberg Letter, Vol. XXV, No. 10, May 27, 1998, p. 1. EPA's estimate can be found at 64 Federal Register 26004, May 13, 1999. For additional detail, EPA's Regulatory Impact Analysis can be found on-line at [<http://www.epa.gov/oms/tr2home.htm>].

³MathPro Inc., Bethesda, Md., *Costs of Meeting 40 ppm Sulfur Content Standard for Gasoline in PADDs 1-3, Via Mobil and CD Tech Desulfurization Processes*, February 26, 1999, p. 2.

⁴The study can be downloaded from [<http://www.epa.gov/oms/tr2study.htm#Documents>].

⁵U.S. EPA, Office of Air and Radiation, *Tier 2 Report to Congress*, July 31, 1998, Report (continued...)

seems to increase with advances in catalyst technology. Because of the impact of gasoline sulfur on emissions, EPA analyzed the issues associated with a gasoline sulfur control program as part of Tier 2 regulation development. Following a series of studies, the Agency concluded that limiting the level of sulfur in gasoline would be desirable in order to protect vehicle catalytic converters and on-board diagnostic systems, and as a way of facilitating lower vehicle emission standards in the future.

President Clinton announced the proposal of Tier 2 standards on May 1, 1999. (The formal proposal appeared in the May 13 Federal Register.⁶) The proposed standards have three major features:

- first, when fully implemented in 2007, they would reduce new auto emission standards for the two major categories of pollutants that cause smog (ozone) by 70 - 88%;
- second, for the first time, they would require that light trucks and sport utility vehicles, which now make up about half of the market for new vehicles, meet the same standards as cars. When fully implemented in 2009, this step will reduce emissions from such vehicles by as much as 95%;
- third, by 2004, the standards would set national limits on sulfur in gasoline, reducing the average sulfur content more than 90%, from 340 ppm to 30 ppm. In addition to setting average sulfur content requirements, the sulfur standard would set a maximum per gallon concentration of 80 ppm.⁷

Like other parts of the Tier 2 proposal, the sulfur proposal contains several provisions designed to provide flexibility to the regulated community. The controls are generally applicable in 2004, but refiners who phase in controls before then could use credits gained in the earlier years to delay full compliance until 2006. Small refiners would be granted a 4-year extension (until 2008) to comply, with the possibility of a further 2-year extension. The program would also allow refiners and importers to trade credits generated by achieving concentrations below the standard, and to use such credits in place of physical compliance.

Legislative Activity in the 106th Congress

The May 13 Federal Register notice begins a public comment period that will run until August 2, 1999. EPA conducted four public hearings in Philadelphia, Atlanta, Denver, and Cleveland between June 9 and June 17. After evaluating public comments, the Agency intends to promulgate final standards before the end of the year.

⁵(...continued)

EPA420-R-98-008, p. 53.

⁶ 64 Federal Register 26004.

⁷The cap amount is phased in, beginning at 300 ppm on October 1, 2003, declining to 180 ppm on January 1, 2005, and finally to 80 ppm on January 1, 2006.

No matter what standards the Agency ultimately promulgates, significant interests are likely to be dissatisfied: environmental groups, auto manufacturers, producers of pollution control equipment, and most states want strict national limits on sulfur in gasoline, while petroleum refiners and some Western and Midwestern states seek more local and seasonal limits. Thus, Congress has begun the process of oversight and, depending on the final form of EPA's regulations, could take action on the issue.

In the 105th Congress, legislation to require strict national standards (S. 2377) was introduced by Senator Moynihan, but not acted on. The bill has been reintroduced in the 106th Congress as S. 171 (Moynihan) and H.R. 888 (Kildee). Beginning 4 years after enactment, the Moynihan and Kildee bills would set a nationwide, year-round standard of 40 ppm of sulfur in gasoline or, alternatively a limit of 80 ppm so long as the average over a year is no higher than 30 ppm. This standard (similar to the EPA proposal) would duplicate the requirement that California has imposed on gasoline sold in that state since 1996. As of early July, no legislative action on these bills had occurred.

In the wake of the President's May 1 announcement, other congressional sources, including the Chairman of the Senate Environment Subcommittee on Clean Air, Senator Inhofe, have expressed displeasure with the proposed rule and have suggested that they might introduce legislation to modify it. Senator Inhofe's subcommittee held two days of hearings on the proposal May 18 and 20, 1999, but as of early July, legislation to block or modify the standards had not been introduced.

Selected Policy Issues

National, year-round standards. Whether sulfur causes permanent damage to catalysts or its effects are reversible once the catalyst is exposed to lower sulfur exhaust is a key question on which differing views have been expressed. The answer depends on a number of factors including the catalyst design and location, the richness of the fuel mixture, engine calibration and load, and the amount of sulfur in the fuel.⁸ If the damage is permanent, national year-round reductions in sulfur would appear more desirable. If not, regional and seasonal controls might achieve the desired effects at lower costs to gasoline producers and consumers. Similarly, if high sulfur levels substantially interfere with on-board diagnostic systems, causing illumination of the malfunction indicator light, then a national sulfur level may be needed to address the problem. If changes in catalyst design and fuel-control technology can offset the effects of sulfur in vehicles that are highly sensitive to sulfur, then a national sulfur standard would be less important.

As noted, environmental groups, auto manufacturers, manufacturers of pollution control equipment, and many states have urged EPA to set strict national limits on sulfur in gasoline to protect vehicle catalytic converters and on-board diagnostic systems, and as a way of facilitating lower vehicle emission standards in the future. In the proposed rule, the Agency agrees with these groups, arguing that damage to emission control systems is not sufficiently reversible to allow regional and seasonal exemptions.

⁸For a discussion of these factors, see Manufacturers of Emission Controls Association, *The Impact of Gasoline Sulfur on Catalytic Emission Control Systems*, September 1998. The report is available on-line at [<http://www.meca.org/>].

Petroleum refiners have sought less stringent and more localized limits in order to hold down costs to consumers, and to minimize the economic hardship on smaller and older petroleum refineries.⁹ The petroleum industry proposal, which calls for an average sulfur content of 150 ppm beginning in 2004 in states east of the Mississippi River plus Missouri, Louisiana, and East Texas, and 300 ppm elsewhere, would cost about half what the EPA proposal would cost. The industry envisions future reductions in the eastern region to a 30 ppm standard in 2010.

Refinery compliance problems. Some refineries would be more adversely affected than others by lower limits on sulfur in gasoline. Some gasoline feedstocks contain more sulfur than others, so that more sulfur must be reduced in order to meet the prescribed standard. In general, smaller, older refineries claim they could not afford to meet significantly lower sulfur standards because more investment would be required per gallon of gasoline produced and because getting the necessary funds would be more difficult than for larger, more profitable refineries.

Industry has raised particular concerns about refineries located in the Rocky Mountain region, an area referred to as PADD IV.¹⁰ According to industry, PADD IV is almost entirely supplied by small refineries, which would face the largest challenge meeting fuel sulfur standards.

For some refiners, EPA's proposed regulation will be the straw that breaks the camel's back. Facilities will close and jobs will be lost. Since the phase-in of identical sulfur-lowering requirements in California's gasoline in 1996, 11 percent of that state's refineries have shut down.¹¹

EPA concedes that the cost of compliance would be double in PADD IV (3.5 cents per gallon vs. the 1.8 cent national average),¹² but believes that exemptions for small refiners provided in the proposed rule and trading and credit provisions would ease compliance. EPA's proposal would allow small refiners — defined as those with no more than 1,500 employees -- an additional 4 years beyond 2004 to come into compliance. Small refiners that can demonstrate a severe economic hardship could apply for an additional extension to 2010. In addition to meeting the standard by investing in sulfur removal technology, refiners would be allowed to comply by purchasing credits from others who reduce sulfur beyond the requirements of the standard.

EPA's definition of small refiner is an area of contention, however. The Agency defines as small any refining company that employed 1,500 or fewer employees as of January 1, 1999. In calculating the number of employees, the business must include all

⁹A summary of the proposal is available at www.api.org/newsroom.cgi.

¹⁰PADD stands for Petroleum Administrative District for Defense. PADD IV includes the states of Wyoming, Idaho, Montana, Colorado, and Utah.

¹¹Statement of J. Louis Frank, President, Marathon Ashland Petroleum, before the Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety, Committee on Environment and Public Works, U.S. Senate, May 18, 1999, p. 4. See also statement of Clint W. Ensign, Vice President, Government Relations, Sinclair Oil Corporation, pp. 4-5.

¹²EPA, Regulatory Impact Analysis, p. V-47.

subsidiaries, including all refining, distribution, and marketing activities worldwide.¹³ Apparently, it is not the size of the specific refinery, but a measure of the corporate resources available to be drawn upon that EPA has chosen. In choosing this definition, EPA relied on the Small Business Administration's definition of what constituted a small petroleum refining business. About 17 refineries, out of a national total of 160, qualify for special treatment under this definition. The Agency notes that 9 of the 17 already produce gasoline with a sulfur content below 90 ppm.¹⁴

Industry representatives want a much larger number of refiners to be exempt, relying on a definition of small diesel refiners that was inserted into the Clean Air Act's acid rain program in the 1990 amendments to the Act (Section 410(h) of the Clean Air Act). In this definition, small refiners are those with a crude oil throughput of less than 18,250,000 barrels per year, provided that they are owned or controlled by a refiner with a total combined throughput of less than 50,187,500 barrels per year. About one-third of U.S. refineries are believed to qualify for exemption under this definition.

Cost-effectiveness of alternatives to reducing sulfur. Whether improved vehicle engines and catalysts would be more cost effective than reducing sulfur in gasoline is not an issue that has received much attention. EPA argues, and to some degree most of the interested parties seem to agree, that reducing emissions will require both better engines and catalysts and lower sulfur gasoline.

Cost-effectiveness of controls is an issue, however, as industry considers how it would comply with EPA's proposed standard: the petroleum industry disagrees strongly with EPA's conclusions regarding the technologies that will be used to remove sulfur from gasoline. The Agency has concluded that new technologies will reduce the cost of removing sulfur to an average of 1.8 cents per gallon. Refiners argue that the technologies touted by EPA have not been demonstrated on anything more than a pilot scale. Given the short time the industry would have to achieve compliance, refiners say they are unlikely to use unproven technologies. Rather, they would install already proven technologies, which would cost substantially more.¹⁵

Conclusion

EPA's proposal to limit sulfur in gasoline is open to public comment until August 2, 1999. EPA appears committed to year-round national standards, with flexibility limited to the provisions for averaging sulfur content and the exemption and trading provisions available to small refiners. The Agency's position is supported by a broad range of interests, including auto manufacturers, environmental groups, and many states. Others, including refiners and some Western and Midwestern states, are opposed. Congressional oversight hearings have occurred, legislation similar to EPA's position has been introduced, and bills opposing or modifying the rule may be introduced.

¹³64 Federal Register 26054.

¹⁴For EPA's discussion of the small business impacts, see Chapter VIII of the Agency's Regulatory Impact Analysis, available on-line at [<http://www.epa.gov/oms/tr2home.htm>].

¹⁵Ensign testimony, pp. 7-8. The same issue was raised in the testimony of J. Louis Frank, previously cited, pp. 4-6, and that of William Nasser, CEO, Energy BioSystems, pp. 2-3.